

A47/A11 Thickthorn Junction

Scheme Number: TR010037

Volume 7 **7.1 Case for the Scheme**

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

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Infrastructure Planning

Planning Act 2008

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

The A47/A11 Thickthorn Junction
Development Consent Order 202[x]

CASE FOR SCHEME

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1 INTRODUCTION

1.1 Purpose of this Document

- 1.1.1 This Case for the Scheme (this “Case”) relates to an application for a Development Consent Order (DCO) made by Highways England (the “Applicant”) to the Secretary of State for Transport (SoS) via the Planning Inspectorate (the “Inspectorate”) under section 37 of the Planning Act 2008 (PA 2008). If made the DCO would grant consent for the A47/A11 Thickthorn Junction scheme (the “Scheme”). A detailed description of the Scheme can be found in Chapter 2: The Proposed Scheme of the Environmental Statement (ES) (**TR010037/APP/6.1**).
- 1.1.2 Under Section 104(2) of the PA 2008 the SoS must have regard to (among other matters) any ‘relevant national policy statement’ (NPS) when deciding an application for a DCO. The relevant NPS for the Scheme is the National Policy Statement for National Networks (NPS NN) which sets out the need, and Government’s policies, for delivering the development of Nationally Significant Infrastructure Projects (NSIPs) on the national road and rail networks in England.
- 1.1.3 The NPS NN has a particular weight in the deciding this DCO application as, under Section 104(3) of the PA 2008, the SoS is required to decide the application in accordance with the relevant NPS, subject to the exceptions set out in section 104 (4) to (8). The Scheme’s compliance with the NPS NN is assessed in the NPS NN Accordance Tables (**TR010037/APP/7.2**).
- 1.1.4 This Case supplements the assessment of the Scheme’s compliance with the NPS NN in the Accordance Tables and also identifies ‘any other matters’ that are considered ‘important and relevant’ to the determination of the application in accordance with Section 104(2) of the PA 2008.

1.2 The Applicant

- 1.2.1 The Applicant is Highways England, the strategic highway company responsible for operating, maintaining and improving the strategic road network (SRN) in England. Highways England became a Government owned company in April 2015 succeeding to the functions of the Highways Agency.
- 1.2.2 The SRN is made up of the motorway and major A roads network. The A47 is part of the SRN.

1.3 Requirement for a Development Consent Order

- 1.3.1 The Scheme is a nationally significant infrastructure project (NSIP) within sections 14(1)(h) and 22(1)(b) of the PA 2008. The Scheme comprises the alteration of a highway:
- the highway to be altered is wholly in England – 22(3)(a)
 - Highways England Company Limited is the strategic authority for the highway; and - (22(3)(b)
 - the speed limit is 50mph or greater and the Order Limits at 66.4 hectares exceed the threshold of 12.5 hectares - (22(3)(c) and (22(4)(b).
- 1.3.2 To comply with the PA 2008, the Applicant is required to secure a DCO in order to

construct the Scheme.

- 1.3.3 An application for a DCO has been submitted to the Inspectorate, who will appoint an Examining Authority or Panel (ExA) to examine it and make a recommendation to the SoS on whether development consent should be granted. The SoS will make the final decision on whether development consent should be granted.

1.4 Requirement for an EIA

- 1.4.1 The Scheme is an Environmental Impact Assessment (EIA) development, as defined by the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (EIA Regulations).
- 1.4.2 An EIA Scoping Report was prepared in February 2018 to comply with Section 10 of the EIA Regulations, the purpose of which was to establish the scope of the EIA and the level of detail required. A Scoping Opinion was then adopted by the Secretary of State in March 2018 (**TR010037/APP/6.6**).
- 1.4.3 An ES (**TR010037/APP/6.1**) has been submitted as part of the DCO application. The ES provides an assessment of the potential impacts of the Scheme and sets out proposals for mitigation.
- 1.4.4 Chapters 5 to 15 of the ES (**TR010037/APP/6.1**) provide details of the assessments that have been undertaken. They also set out any impacts, a description of the likely significant effects on the environment and identify the measures that are proposed to reduce and, if possible, offset any significant adverse effects on the environment.

1.5 Planning Policy Context

- 1.5.1 Section 104 of the PA 2008 states that, where a relevant NPS has been designated, decisions about applications for a DCO must be taken in accordance with it.
- 1.5.2 The NPS NN was designated on 14 January 2015. It sets out the Government's vision and policies to deliver road networks that meet the country's long-term needs, support a prosperous and competitive economy and improve the quality of life for all.
- 1.5.3 Further details can be found in Section 6 of this document and the NPS NN Accordance Tables (**TR010037/APP/7.2**).
- 1.5.4 The aims of the Scheme are fully in line with the Government's policies and illustrate the need for the Scheme on a national level. The Government has highlighted the express need for further growth and improvements to the national networks within the NPS NN. The Road Investment Strategy (both RIS1¹ and RIS2²), which explore these needs in further detail, supports the Scheme as a required improvement to the SRN.
- 1.5.5 The Scheme will reduce congestion-related delay, improve journey time reliability and increase the overall capacity of the junction while improving road safety and traffic flow. There will be improved connectivity for local people and improved amenities for walkers, cyclists and horse-riders (WCH).
- 1.5.6 The Scheme accords with the Joint Core Strategy for Broadland, Norwich and South

¹ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/408514/ris-for-2015-16-road-period-web-version.pdf

² https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/872252/road-investment-strategy-2-2020-2025.pdf

Norfolk which highlights current problems of congestion and safety and the strategic importance of the A11 and A47. Improvements to the transportation system sit within the Core Strategy's policies which specifically refer to junction improvements at Thickthorn. The Scheme accords with other policies of the Strategy in relation to sustainability, incorporation of green infrastructure networks and inclusion of good design.

- 1.5.7 The Scheme is also located within the designated Norwich Policy Area (NPA) which is the focus for major growth and development. Future residential developments of over 4,800 dwellings are expected within the NPA with related service provision, meaning the Scheme is a strategic necessity underpinning growth and investment.
- 1.5.8 The Scheme is within the Southern Bypass protection Zone defined in the Development Management Development Plan Document for South Norfolk.
- 1.5.9 Policy in the Cringleford Neighbourhood Development Plan requires the improvements to the Thickthorn interchange to be brought forward with some urgency to support the residential growth in the area.
- 1.5.10 The Scheme is mentioned within, and also supports the priorities of, the current and emerging Norfolk County Council Local Transport Plans and Norwich Area Transport Strategy (NATS4) as well as the Greater Norwich Infrastructure Plan in supporting growth, upgrading a strategic connection to improve safety and access for current users while providing capacity for future proposed and committed residential and business developments in the area.
- 1.5.11 By increasing capacity and removing many of the constraints associated with the Thickthorn junction, the Scheme meets the objectives contained in the transport and economic strategies for the area as well as policies within the Joint Core Strategy, the development plan for South Norfolk and the Cringleford Neighbourhood Development Plan.
- 1.5.12 The Scheme is therefore strongly supported at a sub-regional level, as being essential and integral to the Region's drive for economic success articulated in the objectives of the various sub regional policy documents. Improvements to the SRN are considered to be key priorities for the delivery of economic growth in Norfolk and the East of England as a whole.
- 1.5.13 The Scheme has also been assessed in the context of the environment. Where any unavoidable impacts occur, suitable mitigation is proposed and overall, the benefits of the Scheme are considered to outweigh any unavoidable adverse effects.
- 1.5.14 Following public consultation and feedback, the Scheme is considered by the Applicant to be the best available option for the needed junction improvements. It is an opportunity to secure a deliverable and fully funded A47 Thickthorn Junction Scheme in accordance with the RIS, and current and emerging planning and transport policies.
- 1.5.15 A full planning and transport policy overview is in Section 6 of this Case.

1.6 Structure of the Report

- 1.6.1 This document comprises seven Sections as follows:

-
- Section 1 – sets out the details of the application, confirms the details of the Applicant, and explains why the Scheme is a NSIP which requires the submission of a DCO application.
 - Section 2 – describes the Scheme and the surrounding area and sets out how the Scheme has developed over time. It sets out the junction configuration options that have been considered and how the preferred option was selected.
 - Section 3 – sets out the need for the Scheme, describes the existing environment and describes the Scheme itself.
 - Section 4 – summarises the transport case for the Scheme.
 - Section 5 – summarises the economic case for the Scheme and describes its monetised and non-monetised benefits.
 - Section 6 – assesses the Scheme against national, sub-regional and local planning and transport policy, and considers the policy justification for the Scheme.
 - Section 7 – provides a summary, bringing together the case for the Scheme and setting out its overall compliance with the NPS NN and relevant planning policy and other important considerations.

2 SCHEME DEVELOPMENT AND OPTIONS CONSIDERED

2.1 Development History and Alternative Options

2.1.1 During 2014 the A47/A12 Corridor Feasibility Study (Feasibility Study) was undertaken the then Highways Agency and the Department for Transport (DfT), to identify issues on the SRN on the A47/A12 Corridor between the A1 west of Peterborough and Lowestoft (south of the A47 junction with the A12).

2.1.2 Twenty-two locations were identified that were considered to have current or imminent problems. These were then considered further at a high-level using criteria from the DfT's Early Assessment and Sifting Tool (EAST). An Options Assessment Report (OAR) was developed for each scheme and from this recommended a solution for which Strategic Outline Business Cases (SOBC) were produced.

2.1.3 The studies informed the Government's RIS and an initial case was made to carry out the following improvements, which includes this Scheme:

- A47 Wansford to Sutton Dualling
- A47 Guyhirn Junction Improvements
- A47 North Tuddenham to Easton Dualling
- A47 Thickthorn Junction Improvements
- A47 Blofield to North Burlingham Dualling

2.1.4 A47 Great Yarmouth Junction In December 2014 the DfT published the RIS for 2015 to 2020³. The RIS includes a package of six schemes (identified in paragraph 2.1.3 above) to be developed and constructed by the Applicant during Roads Period 1 (2015 to 2020) and Roads Period 2 (2020 to 2025). These will improve journeys on the 115-mile section of the A47 between Peterborough and Great Yarmouth. These schemes have been branded as the A47 Improvement Programme.

2.1.5 Following the publication of the RIS, a high-level appraisal of benefits for the identified scheme was produced. This work was summarised in the A47 and A12 Corridor Feasibility Study (dated February 2015) published on the DfT website in March 2015; see: <https://www.gov.uk/government/publications/a47-and-a12-corridor-feasibility-study-technical-report>.

2.1.6 Stage 1 of the Feasibility Study⁴ reviewed the existing evidence to identify any problems along the corridor, with the report's summary stating:

"Current Situation: The standards and level of service on the A47 vary considerably over its length with part of the network which are single and dual carriageways. It is understood that the widely held opinion by local authorities and the business community, is that the corridor in its current form is a significant constraint to growth.

Future Situation: The area is expected to continue to grow with over 50,000 new jobs and 100,000 new homes planned for the area over the next 15 years. There are growth hotspots at several locations along the corridor, including Peterborough, Kings

³ <https://www.gov.uk/government/collections/road-investment-strategy>

⁴ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/411142/a47-stage-1.pdf

Lynn, Norwich and Great Yarmouth and Lowestoft. There are several major proposed housing developments close to the A47, including a Rackheath and Wisbech, Norwich and on the fringes of Great Yarmouth and Lowestoft.

Growth is forecast to result in increased traffic levels on sections of the route and therefore add to congestion and other problems. At the same time, proposed developments could be constrained by the capacity limitations on the highway network to accommodate additional trip.

Need for intervention: There are a wide range of traffic issues along this route due to the varying nature of the corridor in terms of local environment, travel patterns and requirements. The main issues for the route relate to capacity; some of the links and junctions are currently over capacity and/or will be over capacity. The limited capacity impacts on the route reliability and creates journey time delays. It also can cause traffic to divert onto the highway network and generate further issues. There are safety issues in certain locations where there are currently high collision and incident rates that could be addressed.

A summary of the challenges was considered within the study which identified 32 challenges along the route with the majority being capacity issues along the full extent. Other challenges raised relate to asset condition, network operation, safety and social and environmental issues and also lack of realistic alternatives to support planned growth, hence the need for interventions to address such problems.”

- 2.1.7 The feasibility study identified the A47/A11 Thickthorn Junction as operating over capacity on a number of approaches and that the situation will get worse with traffic growth.
- 2.1.8 In April 2015 the Applicant assumed responsibility for the SRN and for delivering the Government’s vision for that network as set out in the RIS. As a result, the Applicant took ownership of the previously DfT led ‘Strategy, Shaping and Prioritisation’ phase of Scheme development.

2.2 Options Selection

- 2.2.1 Each of the six schemes were progressed separately but collaboratively.
- 2.2.2 A Scheme Assessment Report (SAR)⁵ produced in January 2018 confirmed the unsuitability and poor safety record of the current junction layout to accommodate both the dominant movement between the A11 south and A47 east (in both directions), and the strong tidal movement through the junction on the A11, during both peak hours. This is predicted to worsen in future years due to the future growth in strategic traffic, and growth from the large local residential developments across the Greater Norwich Area, including Hethersett, Cringleford and Wymondham. In addition, this junction forms a critical part of the Cambridge Norwich Tech Corridor⁶ that aims to build a top-tier tech destination for the talented people, high growth companies and long-term investment that create jobs, transform lives and drive economic growth.
- 2.2.3 Twenty-six potential route options were identified and initially assessed comparatively in terms of their engineering, environmental, transportation and economic suitability.

⁵ <https://highwaysengland.citizenspace.com/he/a47-a11-thickthorn-junction-improvement/results/schemeassessmentreport2018.pdf>

⁶ [What is the Tech Corridor | Cambridge Norwich Tech Corridor](#)

These assessments were undertaken based on data gathered from desk-based information supplemented by initial walk over environmental surveys undertaken in 2016.

2.2.4 Each of the assessments qualitatively and comparatively rated each option as either red, amber or green. The options rated red having the least favourable outcome for the assessment, the options rated green the more favourable outcome from the assessment. Amber ratings were given where assessments were considered to be in-between the red and green ratings.

2.2.5 **Environmental Assessment:** A qualitative environmental assessment, based on available environmental data, was undertaken and the following environmental topics considered:

- noise
- air quality
- greenhouse gases
- landscape
- townscape
- historic environment
- biodiversity
- water environment.

2.2.6 **Transport assessment:** each of the options offered a solution to the transportation problem and each provided additional capacity on the network, so the transportation assessment was therefore predominantly based on route length. The shorter the route, the lower likely journey times and the more favourable the option was rated in the assessment.

2.2.7 **Engineering:** a qualitative engineering assessment, based on the data available, was made taking the following engineering criteria into consideration:

- buildability
- land take requirements
- general alignment
- accommodation works
- geotechnical
- structures
- impact on statutory undertakers.

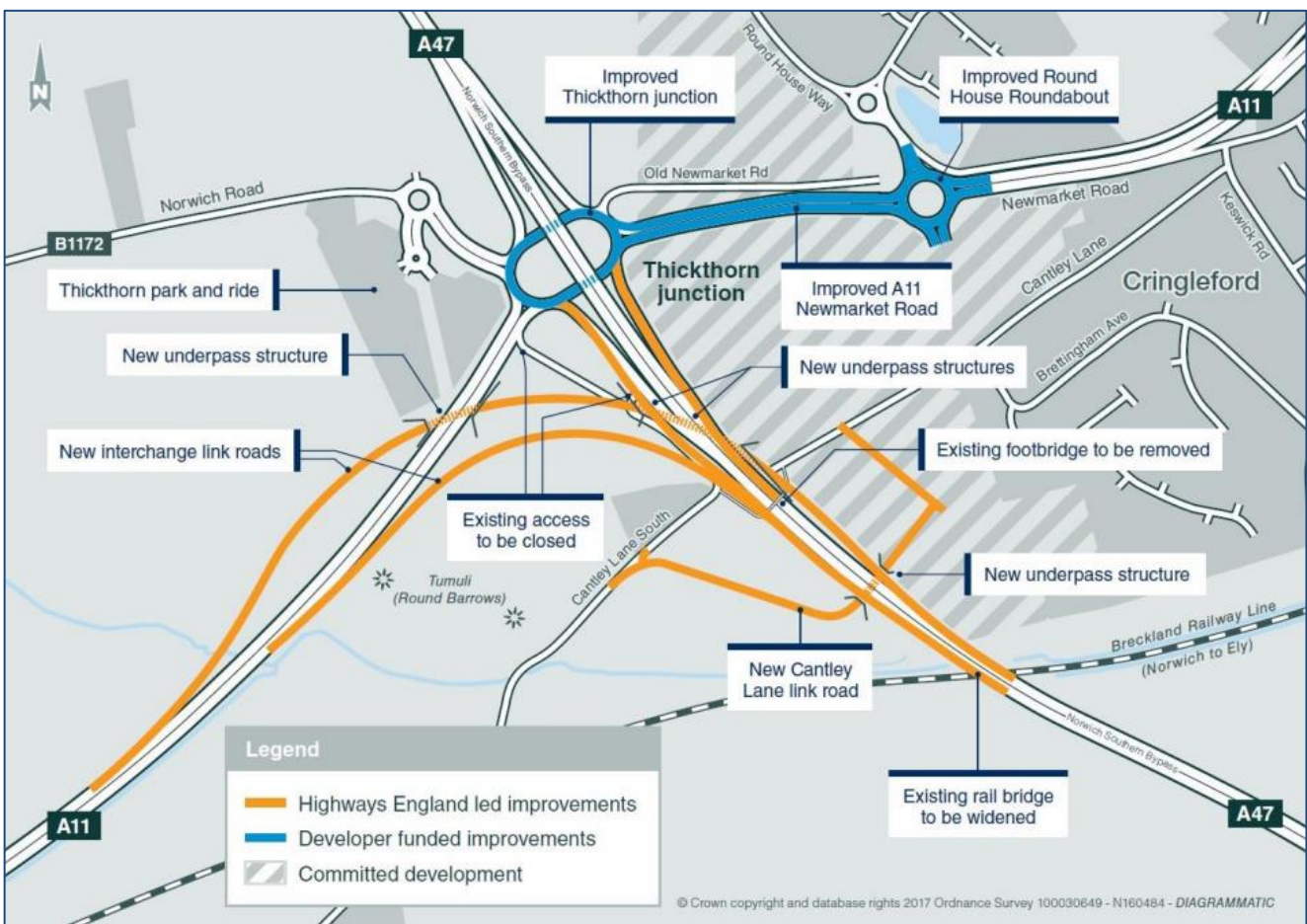
2.2.8 **Economic Assessment:** A comparative economic assessment of each option was made based on high level comparative estimates of scheme costs and potential benefits.

2.2.9 An updated local transportation model was developed based on the Norwich Area Transportation Strategy model which was used to further assess the Options and to provide transportation information to inform the economic analysis of each of the

Options.

- 2.2.10 **Assessment Results:** The SAR summarises the findings of the technical, operational, safety, traffic, economic and environmental assessments. This formed the basis for recommendations for which option should be taken forward for public consultation on the Options.
- 2.2.11 On completion of the initial assessments, one potential option (the single option) was considered for further review which comprised free flow link roads connecting the A11 and A47 and bypassing the Thickthorn Junction. This option performed well against the Scheme objectives and was considered to be the only feasible solution for further development.
- 2.2.12 The single option was taken for more detailed assessment to identify its performance against safety, environmental, engineering, transportation and economic criteria.
- 2.2.13 The original proposed Single Option presented for public consultation incorporates the A11 south to A47 east bi-directional interchange link roads, as shown on Figure 2.1 below. This Single Option provides relief to the Thickthorn Junction gyratory (hereafter referred to as a roundabout) by the provision of bi-directional free flowing interchange links between the A11 south and the A47 east.

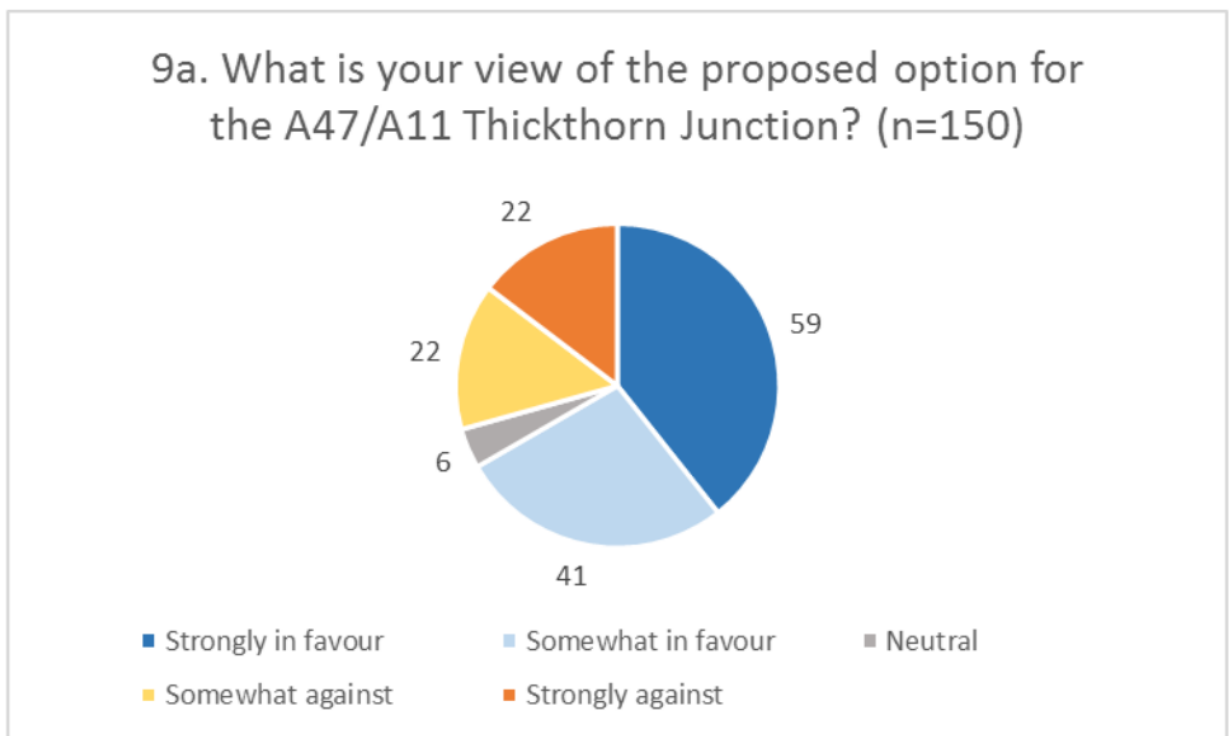
Figure 2.1 – Single Option with the A11 south to A47 east bi-directional link roads, as presented at the PIE



2.3 Options Consultation

- 2.3.1 The proposed Single Option was presented for public consultation between March and April 2017. The purpose of the consultation was to seek views on the outline proposals from the general public, statutory consultees, including local authorities, and other interested bodies.
- 2.3.2 The total number of respondents to the consultation was 185 which included responses from stakeholders and members of the public. Further details are provided in the Consultation Report (TR010037/APP/5.1). A summary of the level of support for the A47/A11 Thickthorn Junction Scheme is provided in Figure 2.2.
- 2.3.3 Common themes among respondents included the belief that improvements to the Thickthorn Junction are necessary due to concerns regarding the current level of traffic and congestion. The respondents supporting the proposed Single Option believed it would alleviate congestion problems around the Thickthorn Junction, improve the local environment and socio-economic climate, protect the safety of users and represents the best design and construction process. However, as a result of concerns raised about the Cantley Lane Link Road and underpass, the Applicant refined the design of the Cantley Lane Link Road.

Figure 2.2 – Summary of level of support for the proposed option at consultation



2.4 Preferred Route Announcement

2.4.1 Key findings from the non-statutory consultation were:

- generally good support for the Scheme from local residents, stakeholders and the travelling public
- disapproval of Cantley Lane South being reconnected to Cantley Lane, north of the A47
- concerns about the impact during construction period in terms of noise pollution and traffic disruption

- requests for provision for walkers, cyclists and horse riders

2.4.2 Therefore, the preferred route was announced on the 14 August 2017, but preferred route option was then subject to further assessment by the Applicant. This included traffic analysis and the following considerations:

- drainage and flooding assessments
- geotechnical considerations
- mining assessments
- assessment of structures
- assessment of public utilities
- topography
- buildability
- operational, technology and maintenance
- safety assessments
- environmental assessments
- cost assessments.

2.4.3 The SAR included a summary of the previous assessments, public consultation on the Single Option and the further surveys, investigations and assessment work undertaken.

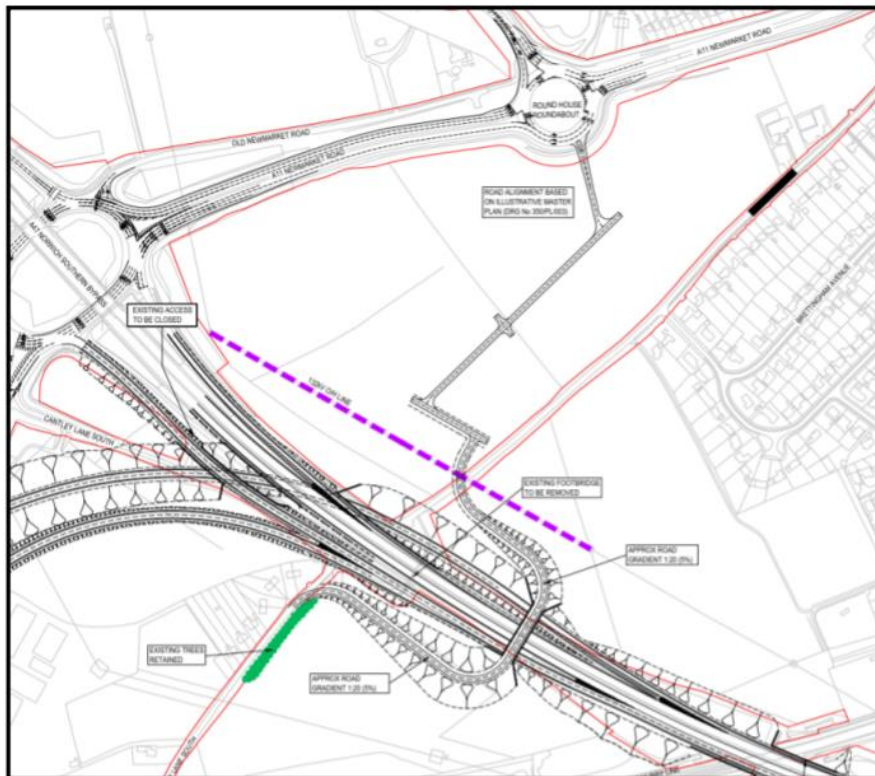
2.4.4 Subsequently, modifications were proposed to the preferred single option to improve the Cantley Lane South link road to the B1172 Norwich Road. During this process, seven alternatives to compensate for the severance of Cantley Lane South were reviewed, as follows; full details are provided in the A47 Thickthorn Junction - Highways England Side Road Strategy Options Report (2018).

Proposed reconnection of Cantley Lane South to Cantley Lane

Option 1 - Connection of Cantley Lane South to Round House Way roundabout via an Overbridge across the A47

- 2.4.5 The alignment of Option 1 follows the A47 southern boundary as closely as possible in order to reduce severance of the land between Cantley Lane South, the A47, and the Breckland Railway Line; as shown in figure 2.3.
- 2.4.6 The local road link is then routed through the development west of Cringleford, via the estate roads, before connecting to Round House Way roundabout. This route avoids the need to route vehicles along Cantley Lane (north).

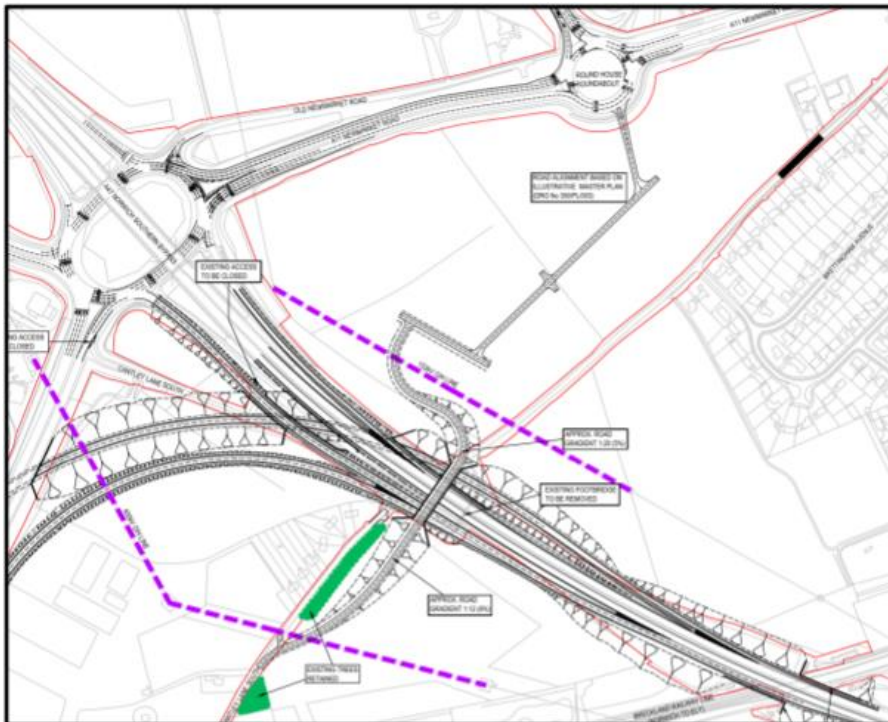
Figure 2.3: Option 1 - Connection of Cantley Lane South to Round House Way roundabout via an A47 overbridge



Option 2 - Connection of Cantley Lane South to Round House Way roundabout via an Overbridge across the A47

- 2.4.7 The horizontal alignment of Option 2 to the south of the A47 passes through an existing thinning in the vegetation adjacent to Cantley Lane South, beneath the overhead high voltage electricity cables, and is therefore screened to some extent from the properties along Cantley Lane South by an established row of mature trees and shrubs. Option 2 is shown in figure 2.4.
- 2.4.8 The alignment, which is close to the tree screen, minimises the severance to the land between Cantley Lane South, the A47, and the Breckland Railway Line.
- 2.4.9 The local link road is then routed through the West of Cringleford development land via the estate roads before connecting with Round House Way roundabout. This route avoids the need to route vehicles along Cantley Lane (north).
- 2.4.10 The overbridge for Option 2 is similar to Option 1.

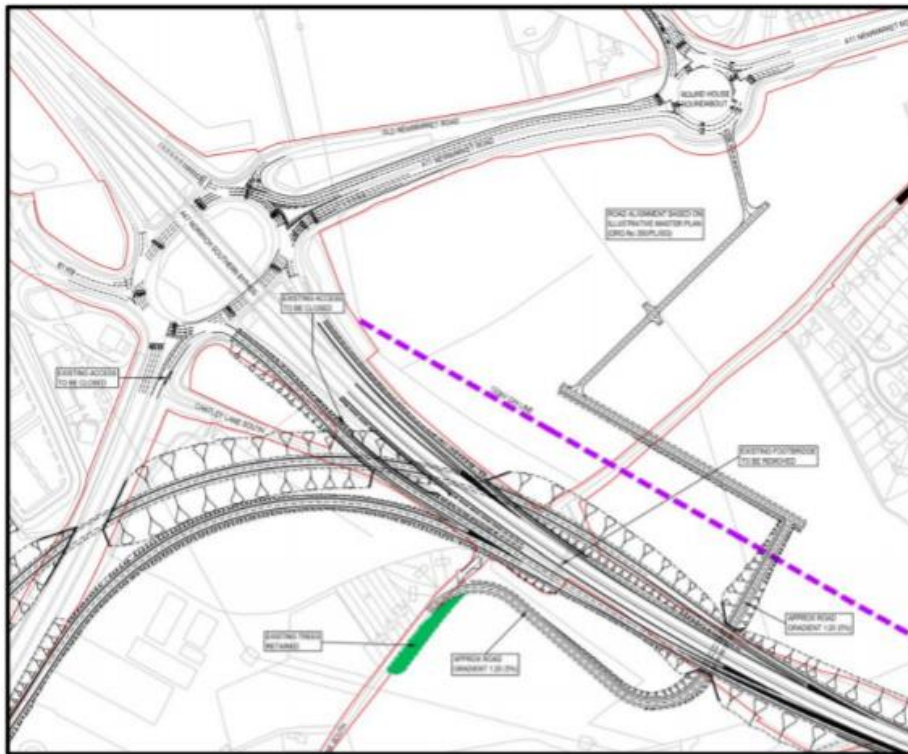
Figure 2.4: Option 2: Connection of Cantley Lane South to Round House Way roundabout via an A47 overbridge



Option 3 - Connection of Cantley Lane South to Round House Way roundabout via an A47 underbridge

- 2.4.11 Option 3 connects Cantley Lane South to Round House Way roundabout beneath the A47 via an underbridge, as shown in figure 2.5. It is similar to the originally proposed option, except that the local road to the South of the A47 has been diverted along the edge of the existing trees in order to reduce the severance of the land between Cantley Lane South, the A47, and the Breckland Railway Line.
- 2.4.12 The local link road is then routed through the West of Cringleford development land via the estate roads before connecting with Round House Way roundabout.
- 2.4.13 A structure is required under the A47 mainline in order to accommodate the proposed local road link reconnecting Cantley Lane South and Round House Way roundabout.

Figure 2.5: Option 3: Connection of Cantley Lane South to Round House Way roundabout via an A47 underbridge



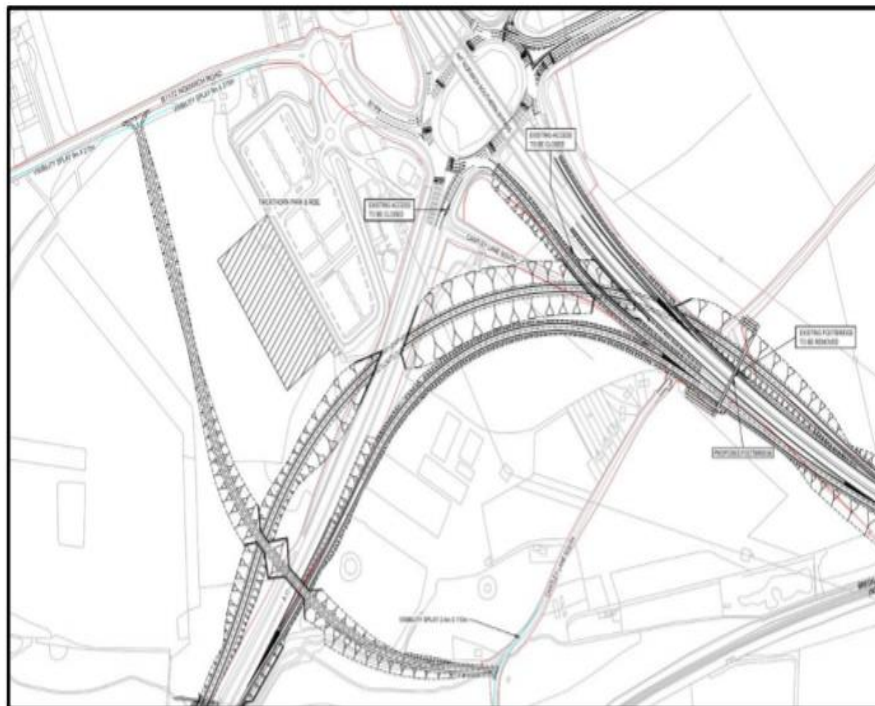
Option 4 - Connection of Cantley Lane South to B1172 Norwich Road

- 2.4.14 Option 4 connects Cantley Lane South with the B1172 to the west of the Thickthorn Junction, to restore access to the main highway network for the properties along Cantley Lane South, who otherwise would have their access restricted by the low bridge, when the Cantley Lane (South) links to Thickthorn Junction are removed to implement the scheme. The proposed link passes over the A11 mainline and the A11 south to A47 east bi-directional interchange links, as shown in figure 2.6.
- 2.4.15 There will be a replacement for the existing footbridge across the A47 between Cantley Lane South and Cantley Lane, which has to be removed to accommodate the proposed A11 south to A47 east bi-directional Interchange links.

2.4.16 The proposed local road link crosses over:

- The existing A11
- The proposed A11 to A47 connector road

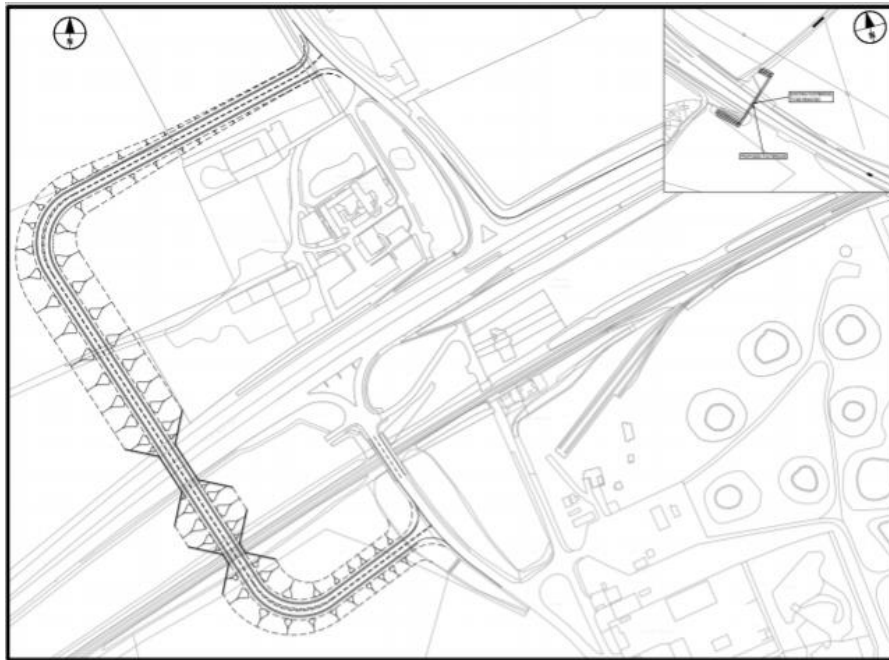
Figure 2.6: Option 4: Connection of Cantley Lane South to B1172 Norwich Road



Option 5 - A11 and Station Lane Compact Grade Separated Junction

- 2.4.17 Options 5, 6 and 7 were designed to improve the Station Lane junction to facilitate a right turn from Station Lane (south) to A11 northbound.
- 2.4.18 Option 5 is a compact grade separated junction, which is created by providing a link between Station Lane north and south, which crosses the Breckland Railway Line, and the A11 mainline, as shown in figure 2.7. This junction provides full turning movements.
- 2.4.19 There will be a replacement for the existing footbridge across the A47 between Cantley Lane South and Cantley Lane, which has to be removed to accommodate the proposed A11 south to A47 east interchange links.
- 2.4.20 Both overbridges (one spanning over the A11 and one spanning over the Breckland Railway Line) are roughly square to the abutments.

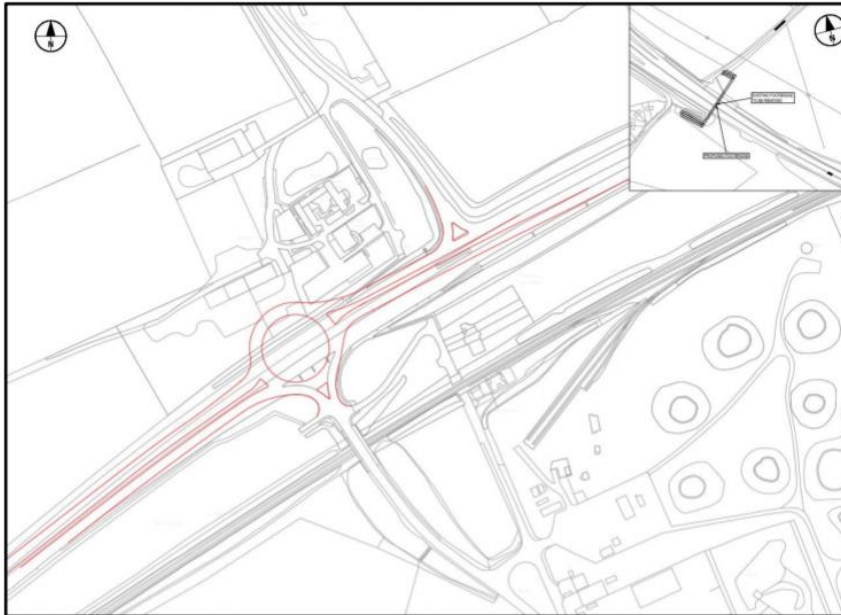
Figure 2.7: Option 5: A11 and Station Lane compact grade separated junction



Option 6 - A11 and Station Lane roundabout

- 2.4.21 Option 6 is an 'at grade' roundabout, which provides full turning movements between Station Lane (south) and the A11. This will enable traffic returning from the recycling centre to turn right onto the A11 towards Thickthorn Junction, as shown in figure 2.8. The Station Lane (north) junction remains left-in, left out.
- 2.4.22 The new roundabout entry for Station Lane (south) is constrained by the existing access to Station Cottages and the existing railway bridge.
- 2.4.23 There will be a replacement for the existing footbridge across the A47 between Cantley Lane South and Cantley Lane, which has to be removed to accommodate the proposed A11 south to A47 east bi-directional interchange links.

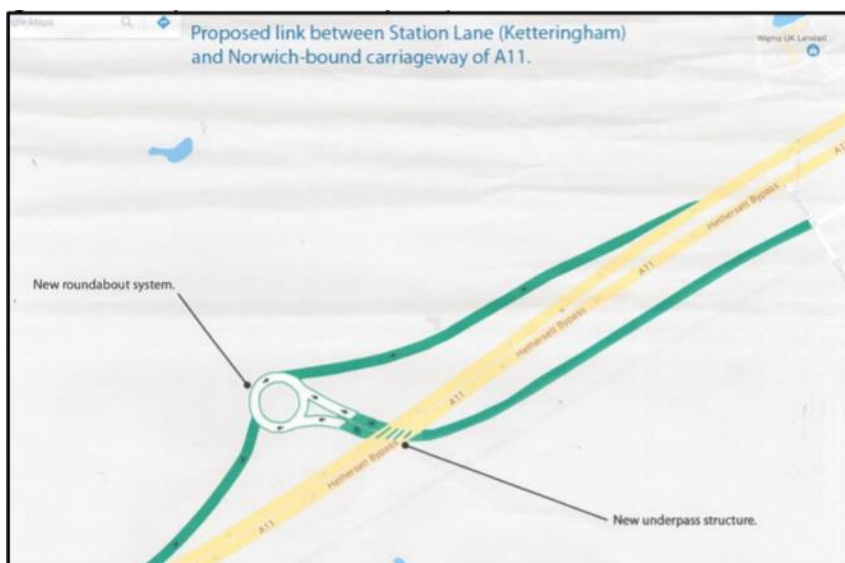
Figure 2.8: Option 6: A11 and Station Lane roundabout



Option 7 - A11 underpass

- 2.4.24 Option 7 consisted of a new three arm roundabout proposed to the north of the A11, which connects to the proposed A11 northbound off-slip, and A11 northbound on-slip. This roundabout is located approximately 350m to the west of Station Lane (south), as shown in figure 2.9.
- 2.4.25 The roundabout connects to Station Lane (south) via a two-way link, which passes beneath the A11 mainline.
- 2.4.26 The existing A11 southbound off-slip and on-slip for Station Lane (south) remain unchanged.
- 2.4.27 Cantley Lane footbridge is as discussed for Option 4.

Figure 2.9: Option 7: A11 underpass southwest of Station Lane



Justification for chosen option

2.4.28 Options 1 and 2 were not considered further due to:

- the overbridge and its high embankments being considered as visually intrusive to the residents of Cantley Lane South
- proximity of overhead power lines
- potential for greater propagation of traffic noise
- potential for an increase in through traffic along Cantley Lane South and the Cringleford Residential Extension Development

2.4.29 Options 5, 6 and 7 detailing improvements to the Station Lane junction were not considered further due to:

- properties on Cantley Lane South requiring additional detours of between 4.7km and 5.3km, depending on the options chosen in order to access the existing A11/A47 Thickthorn Junction.
- the detour noted above leading to adverse response times for emergency services, accessing Cantley Lane South.
- access to properties on Cantley Lane South being restricted by the low railway bridge. With a headroom of 13 feet 6 inches, access would be restricted for agricultural equipment

2.4.30 Options 3 and 4 were considered suitable for further progression. Detailed assessments for engineering design and environmental aspects, including a Designers Risk Assessment, were undertaken and presented in the Side Roads Options Strategy Options Report⁷ prepared for the 2019 statutory consultation.

2.4.31 The Side Road Options Strategy Report concluded that, although the environmental impacts of Option 4 were considered to be higher than Option 3, the preferred was Option 4 (see figure 2.10) as it solves the existing traffic and safety problems, plus:

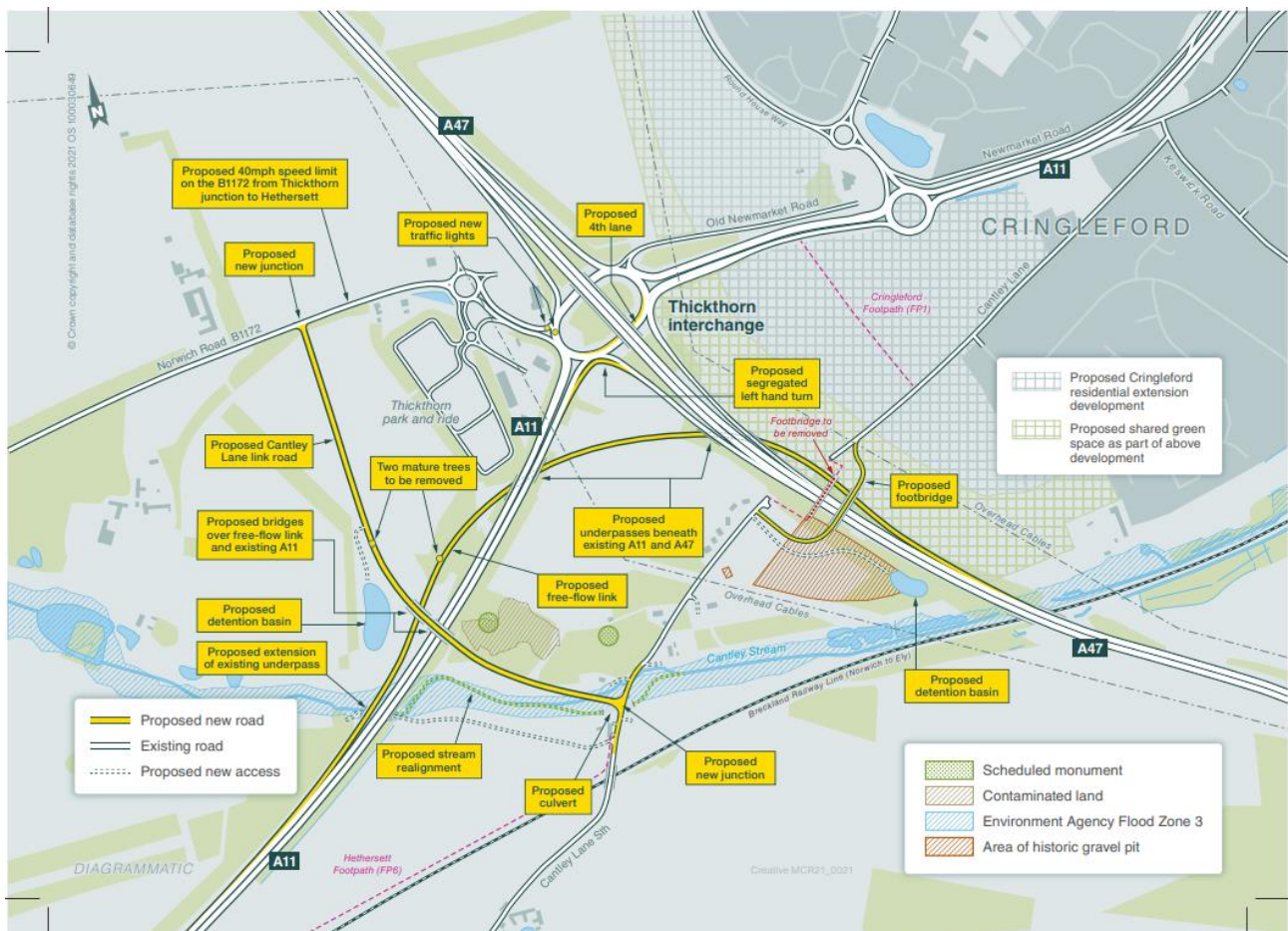
- Minimises disruption to road users as the majority is offline reducing traffic management to existing highways. The existing road can remain in use for local traffic during construction.
- Reduces the risk of the route being used as a rat run.
- Removes impacts upon Cringleford Residential Extension Development.
- Avoids lengthy diversions for residents along Cantley Road.
- Provides an attractive and continuous route for non-motorised users between Cantley Lane and Cantley Lane South via the new non-motorised user bridge across the A47.
- Generates less excavated materials and reduces the export of surplus excavated material.

⁷ Available at: https://highwaysengland.citizenspace.com/he/a47-a11-thickthorn-junction-improvement-scheme/supporting_documents/Side%20Road%20Strategy%20Options%20Report%20Part%201%20pages%201%20to%2057.pdf

- Reduces the effects from noise, air pollution and vibration as the option is further from Cringleford properties and impacts fewer properties.
- Reduces the amount of works directly adjacent to overhead cables.
- Considers the potential to expand the Thickthorn Park and Ride site in the future.

2.4.32 Through the increased capacity and improved journey time reliability, the Scheme would also assist in making the region more attractive for businesses and provide the required infrastructure for development including housing and employment.

Figure 2.10: Side Road Options Strategy Report's proposed scheme design



2.5 Statutory Consultation

2.5.1 Statutory consultation on the Scheme was held between 3 June and 11 July 2019. Full details of this consultation are provided in the Consultation Report (TR010037/APP/5.1).

2.5.2 A total of 237 responses were received during the statutory consultation period and answers informed decision-making on the Scheme design and mitigation measures.

2.6 Design Development

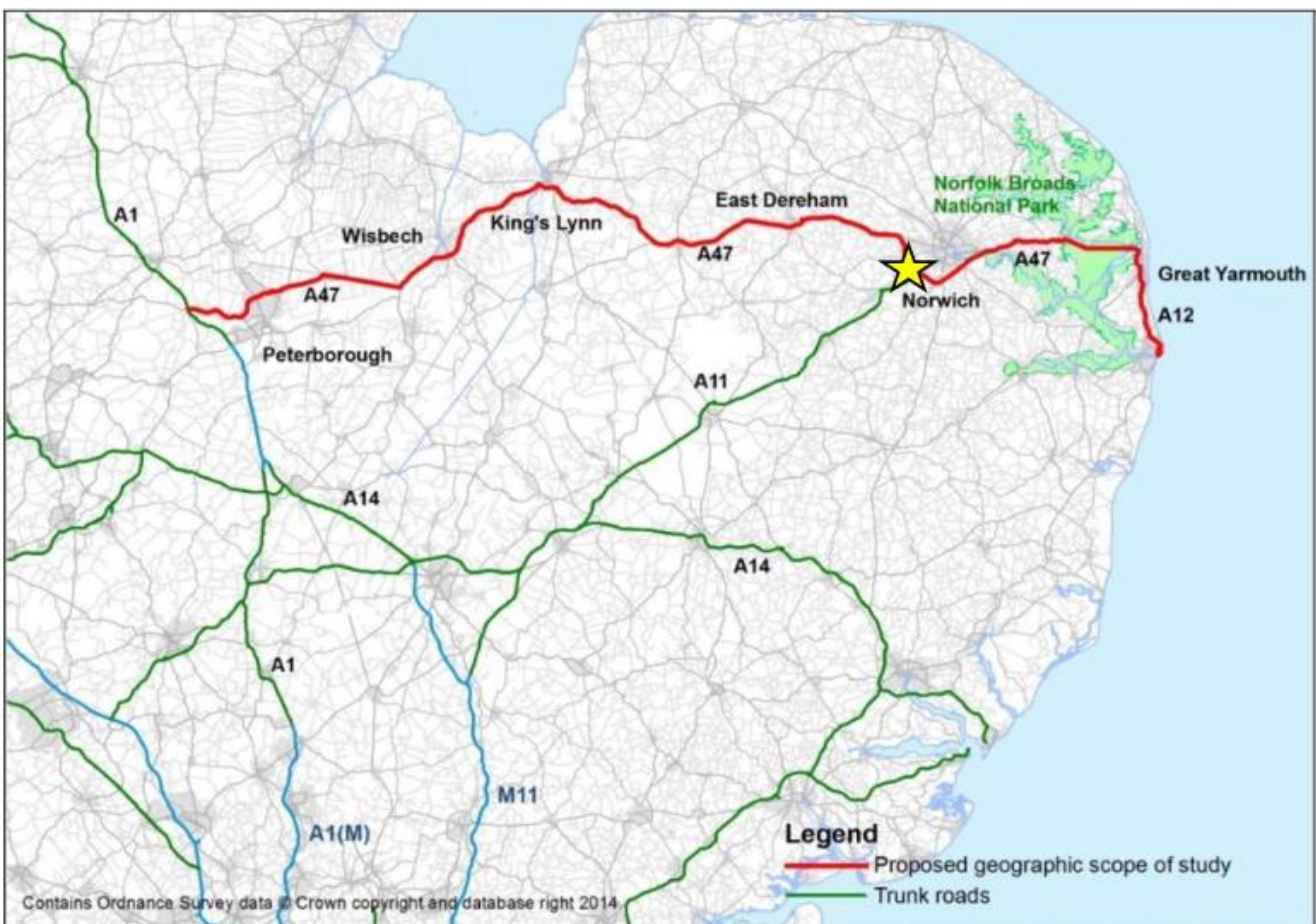
- 2.6.1 Following consideration of the responses to the statutory consultation and further design work, the Scheme was refined. This has included consideration of the land required for the utilities diversions and resulted in minor changes to the DCO boundary presented at the statutory consultation. The following key design changes have also occurred following the alignment presented at statutory consultation:
- removal of the A47 westbound to A11 southbound link road
 - repositioning of the proposed drainage detention basins
 - shortening of the realignment of Cantley Stream
 - repositioning of the replacement footbridge across the A47, shortening the previously proposed detour.
 - removing the requirement to widen the Breckland railway bridge
 - removal of proposed works between the existing A47/A11 Thickthorn Junction and the Round House Way roundabout.
 - addition of a segregated left hand turn from the A47 westbound onto the A11 southbound
 - repositioning of the Cantley Lane Link Road and Cantley Lane South junction
- 2.6.2 As the statutory consultation had taken place in 2018, a 'Project Update' was produced (autumn 2020) and circulated within the 2018 consultation zone and to stakeholders. A focused statutory consultation was also undertaken between 11 September and 9 October 2020 to advise newly affected parties of the Scheme. Further details can be found in the Consultation Report (**TR010037/APP/5.1**).
- 2.6.3 Stakeholder engagement post the statutory consultation included a number of meetings with Norfolk County Council, the District Councils and Environmental Bodies such as the Environment Agency, Natural England and Historic England.
- 2.6.4 The feedback received from both consultations, together with that from stakeholder engagement on the design, proposed mitigation measures or issues raised during statutory consultation, has informed the Scheme as presented within the application documents.
- 2.6.5 Full details of engagement and consultation are set out in the Consultation Report (**TR010037/APP/5.1**).
- 2.6.6 The Scheme development is further detailed within Chapters 2 and 3 of the ES (**TR010037/APP/6.1**) and the Scheme Design Report (**TR010038/APP/7.3**), including the key features of the design presented at consultation and the Scheme which forms this application.

3 THE NEED FOR THE SCHEME

3.1 Overview

- 3.1.1 The A11/A47 Thickthorn Junction is located south-west of Norwich and forms part of the main arterial highway route connecting Norwich Peterborough, Kings Lynn, Cambridge, London the Midlands and the north of England.
- 3.1.2 In the wider context, the A47 and A12 trunk roads form part of the SRN and provide for a variety of local, medium and long-distance trips between the A1 and the eastern coastline. The corridor connects the cities of Norwich (population over 141,000⁸) and Peterborough (population over 201,000), the towns of Wisbech, Kings Lynn, Dereham, Great Yarmouth and Lowestoft and a succession of villages in what is largely a rural area. Thickthorn Junction also links the A47 with the A11 Cambridge Norwich Tech Corridor – an initiative, supported by four District Councils, to attract up to 15,000 new jobs, £900 million private sector investment in construction and 20,000 new homes along the corridor⁹. The locations the A47 and A11 are shown in Figure 3.1 below, with the location of the Scheme indicated with a yellow star.

Figure 3.1: Scheme Context¹⁰

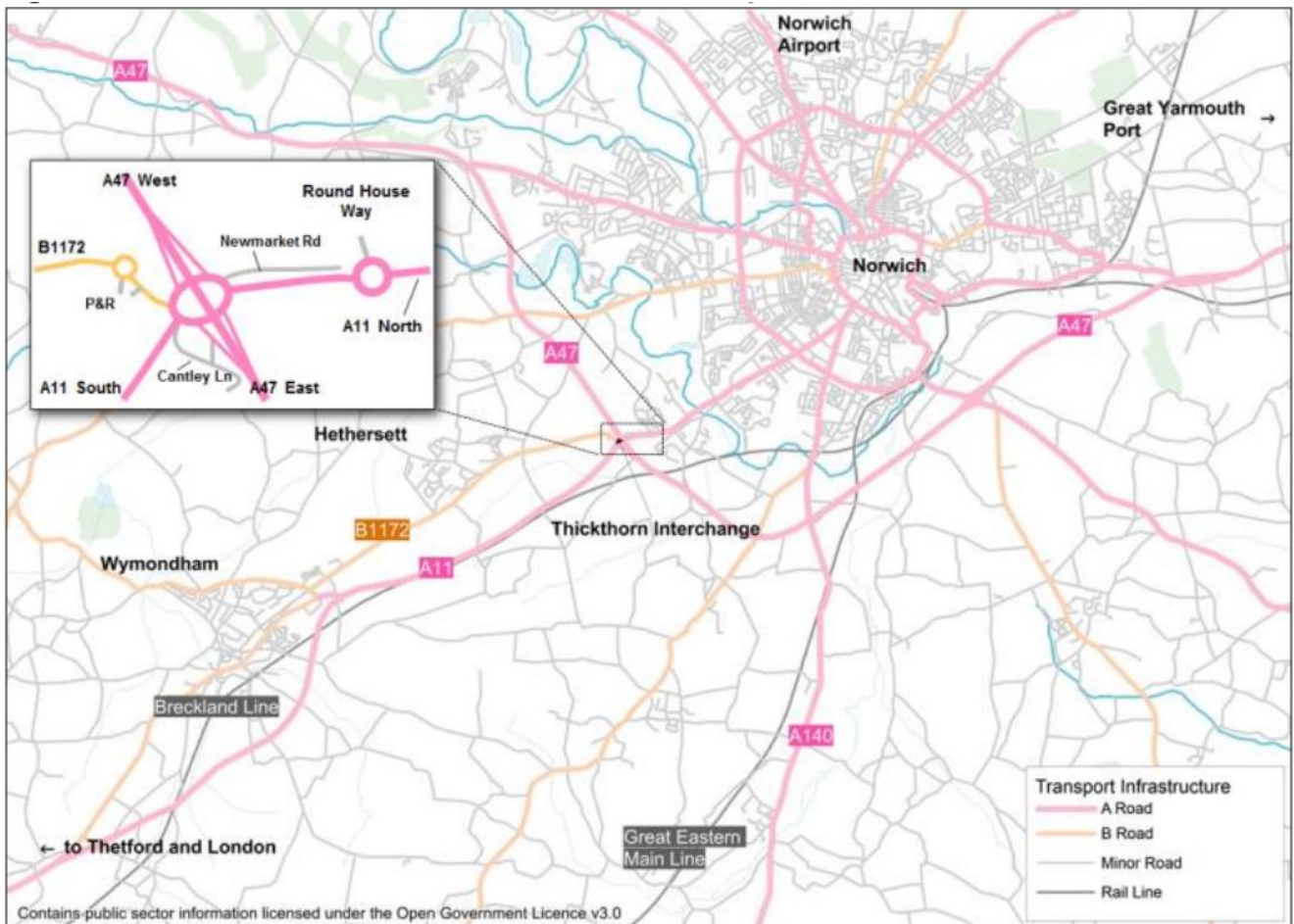


⁸ ONS 2018 Population estimates for Norwich and Peterborough

⁹ Cambridge Norwich Tech Corridor: Vision and Spatial Strategy Report 2020, Perkins & Will

¹⁰ Extracted from the A47/A11 Thickthorn Junction Improvements Scheme Assessment Report (2018): <https://highwaysengland.citizenspace.com/he/a47-a11-thickthorn-junction-improvement/results/schemeassessmentreport2018.pdf>

Figure 3.2: Location of the Scheme¹¹



3.1.3 Thickthorn Junction is located on the south-western edge of Norwich (see Figure 3.2) and provides access to the A47 via the A11 and B1172 Norwich Road for Eaton, Cringleford, Hethersett and Wymondham.

3.1.4 It is an integral junction for communities and commuters travelling in and out of Norwich, with the A47 connecting Norwich with Great Yarmouth to the east, and Peterborough via King's Lynn and Wisbech to the west. The A11 is the main route connecting Norwich with Thetford, Cambridge and London (via the M11 and A14). The junction is therefore important for commuter, business, and commercial traffic, and for both short and long distance trips. The junction has three key roles within the wider network:

- To allow traffic on the A11 between Norwich, Cambridge, Suffolk and Hertfordshire to cross the A47.
- To provide Cringleford, Hethersett, and areas in south Norfolk with access to the strategic road network.

¹¹ Extracted from the A47/A11 Thickthorn Junction Improvements Scheme Assessment Report (2018): <https://highwaysengland.citizenspace.com/he/a47-a11-thickthorn-junction-improvement/results/schemeassessmentreport2018.pdf>

- To carry long distance traffic between the eastern section of the A47 and the A11.
- 3.1.5 Norwich and Peterborough have developed service-based economies, while the potential for economic growth (esp. in the offshore energy sector) on the east coast was recognised in 2011 with the establishment of the Great Yarmouth and Lowestoft Enterprise Zone. In December 2013 the Government announced a Greater Norwich City Deal to enable knowledge-based industries to develop.
- 3.1.6 In addition, Thickthorn Junction forms a critical part of the Cambridge Norwich Tech Corridor¹² along the A11 between Cambridge and Norwich. This partnership aims to build a top-tier tech destination for the talented people, high growth companies and long-term investment that create jobs, transform lives and drive economic growth.
- 3.1.7 There has been a rapid growth in the economy along the A47 and A11 corridors over the past decade which is expected to continue to grow. The cities of Peterborough, Cambridge and Norwich are attracting additional traffic along these routes, particularly during the morning and evening peak periods¹³.
- 3.1.8 Traffic is forecast to grow across the county and, as set out in section 2.1 above and the A47 and A12 Corridor Feasibility Study (Stage 1, Page 3), this area is expected to continue to grow with over 50,000 new jobs and 100,000 new homes planned over the next 15 years. This growth along the A47 and A11 corridors is supported by large residential developments, such as near Thickthorn Junction at Hethersett, Cringleford, Attleborough and Wymondham as well as within the Greater Norwich Area.
- 3.1.9 The A47 Alliance, comprising of local MPs, local government, businesses and other stakeholders, have been campaigning for comprehensive improvement of the A47. Their aim is to capitalise on the potential economic benefits of improved accessibility to the Midlands and the north of England as well as addressing safety issues.
- 3.1.10 The A47/A11 Thickthorn Junction experiences high levels of congestion during peak hours, acting as a bottleneck and leading to longer and more unreliable journey times. Details of these delays can be found under section 4.5 of this document.
- 3.1.11 The SAR reported collision data for Thickthorn Junction, obtained between 1 April 2012 to 31 March 2017, showing 39 collisions in total recorded in this period, of which none were fatal, three serious and 36 slight. These 39 collisions resulted in 54 casualties and involved a total of 72 vehicles.
- 3.1.12 The high rate of accidents in the area is a key safety challenge for the Scheme, since the A47 is currently ranked second nationally for fatalities on A roads and the accident severity ratio is above average.
- 3.1.13 Improving this junction would address the current levels of congestion experienced; would reduce the number of accidents and will allow economic growth in the area.

3.2 Description of Existing Junction and Surrounding Roads

- 3.2.1 The location of the junction in relation to surrounding settlement and transport networks is shown in Figure 3.2.

¹² [What is the Tech Corridor | Cambridge Norwich Tech Corridor](#)

¹³ Extracted from A47 & A12 Corridor Stage 3: The Case for Investment, AECOM

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/411144/a47-stage-3.pdf

3.2.2 The A47, the A11 to the west of the junction, and the junction roundabout and slip roads are maintained by the Applicant. The A11 Newmarket Road and Old Newmarket Road to the east of the junction, and the B1172 Norwich Road to the north-west are maintained by Norfolk County Council. The location of the junction in relation to the local area is shown in Figure 3.3.

Figure 3.3: Local Highway Network¹⁴



3.2.3 Thickthorn Junction is a six arm, signal controlled and grade separated junction at the intersection of the A47 and A11. The A11 approaching the junction from the south-west is a trunk road, which becomes a local road to the east of the junction, which is under the jurisdiction of Norfolk County Council. The A47, which is carried over the junction, is the main trunk road, which has Type A merge and diverge tapers (DMRB CD 122 requirements for the geometric design of grade separated junctions.) at the junction.

3.2.4 The main carriageway of the A47 at this location is a rural dual two-lane all-purpose (D2AP) cross section with 7.3m wide carriageways, 1m wide hard strips and a central reserve strip of 2.5m wide. The A11 to the south of the junction has the same cross section as the A47. The A47 is subject to the national speed limit of 70mph for dual carriageway and the roundabout and A11 approaches in both the eastbound and westbound directions are restricted to 40mph. Additional lanes are developed on each approach to the junction.

3.2.5 The junction is a standard roundabout with traffic signal controls on all the approaches, except for the B1172 Norwich Road and Old Newmarket Road, which have normal

¹⁴ Extracted from RIS East Area 6, A47/A11 Thickthorn Junction Improvements Scheme Assessment Report, January 2018 [on-line] Available at: <https://highwaysengland.citizenspace.com/he/a47-a11-thickthorn-junction-improvement/results/schemeassessmentreport2018.pdf>.

priority give way approaches. The circulatory island of the Thickthorn Junction roundabout has an elliptical geometrical layout with a width of 100m at its narrowest and 165m at its widest point. The circulatory carriageway has a width varying between 12m to 15m. The northern part of the roundabout has four lanes, whilst there are only three lanes provided on the southern part. The roundabout has a connection to the B1172, which also serves a park and ride facility, a trunk road service area as well as the villages of Hethersett and Wymondham. There is also a connection to a little used section of Old Newmarket Road, which is a stopped up old section of the A11.

3.2.6 The junction's approach roads are described from the east going clockwise:

- The A11 Newmarket Road is signalised and joins the roundabout from the east. This flares to three lanes approximately 70m prior to the stop line, and increases to four lanes at the stop line.
- The A47 westbound off-slip is signalised and joins the roundabout from the south-east. The slip road gradually flares to provide three lanes at the stop line. The nearside lane is marked with a left turn arrow, the middle lane with left turn and straight-ahead arrows, whilst the outside lane is marked with a straight-ahead arrow.
- The A11 approaches the roundabout from the south-west and is signalised. This widens from two lanes to four lanes approximately 130m before the stop line.
- The B1172 approach road is located to the north-west of the roundabout and is not signalised. The road connects the roundabout to the B1172 Norwich Road. A bus lane occupies 100m of the nearside lane, which ends approximately 27m prior to the roundabout.
- The A47 eastbound off-slip road is signalised and is located to the north-west of the roundabout. The slip road widens to three lanes approximately 40m from the roundabout.
- Old Newmarket Road runs parallel with the A11 Newmarket Road. The road serves as a private access to agricultural land and private properties along its northern side. The approach road is not included in the existing traffic signal arrangement. This also provides cycling connectivity to the city pedalway network and the long-distance cycleway from Wymondham.

3.2.7 An egress from Cantley Lane South feeds directly onto the A47 westbound off slip. Access to Cantley Lane South is via a short de-acceleration lane on the A11 south exit from the junction. A number of residential properties and farmsteads are located on Cantley Lane South which connects with a much wider network of small country lanes.

3.2.8 The A11 Newmarket Road to the east of Thickthorn Junction is a local authority road maintained by Norfolk County Council. The A11 Round House Way roundabout is located approximately 450m to the east of Thickthorn Junction. This roundabout serves as an access to the existing conurbations to the north of the A11. In the future years a planned residential development is located on both the northern and southern sides of the junction, this is discussed further in section 4.3 of this Case.

3.2.9 The B1172 Norwich Road is a non-signalised minor road arm of the Thickthorn Junction roundabout. This road provides access to the Thickthorn service area, which includes a hotel, restaurant and filling station, and the Thickthorn Park and Ride

facility. The road is also a route to the settlements of Hethersett and Wymondham. As discussed in section 4.3 of this report there are plans for the future expansion of the Park and Ride facility.

3.3 Walking, Cycling and Horse-riding

- 3.3.1 There are no National Cycle Network routes or national walkways within the study area of the Scheme though there are two local cycle routes and Pedalways. There are also two local walking routes, one equestrian bridleway and seven Public Right of Way (PRoW) including Cringleford FP4a which runs from Cantley Lane to a footbridge over the A47, providing a link to Cantley Lane South.
- 3.3.2 There is a shared-use footway on the northern side of the Thickthorn Junction roundabout from the B1172 (Thickthorn Park and Ride) arm to the old Newmarket Road arm. There are several toucan crossings on the A47 and A11.

3.4 Existing Land Uses & Character

- 3.4.1 The Scheme is located within the South Norfolk District Council area and within the administrative boundary of Norfolk County Council.
- 3.4.2 This section summarises the geographical, environmental, socio-economic and health receptors that have the potential to be affected by the Scheme, in accordance with the criteria set out in the Design Manual for Roads and Bridges (Highways England, 2020)¹⁵.
- 3.4.3 The study areas for each topic are described in the respective chapters of the **ES (TR010037/APP/6.1)**.

Air quality

- 3.4.4 There are currently no Air Quality Management Areas (AQMAs) declared by South Norfolk Council. The nearest AQMA to the Scheme is the Central Norwich AQMA over 3km to the north-east, within Norwich City Centre, declared by Norwich City Council.
- 3.4.5 Further details can be found in ES Chapter 5 Air Quality (**TR010037/APP/6.1**).

Cultural heritage

- 3.4.6 Cultural heritage assets have been identified as either located within the DCO boundary, within the zone of theoretical influence or potentially affected by noise.
- 3.4.7 There is a Scheduled Monument, which is Two Tumuli in Big Wood, located outside of but surrounded by the Scheme DCO boundary between the A11, Cantley Lane South Link, Cantley Lane South and the A47/A11 connector road. The Milestone No.4 Grade II listed structure lies within the DCO boundary. There are six additional Grade II listed buildings and one Grade II* listed building within the zone of theoretical visibility (as defined in ES Chapter 6 Cultural Heritage (**TR010037/APP/6.1**)). The assessment also considers 13 non-designated historic buildings.
- 3.4.8 There are no World Heritage Sites or Registered Battlefields recorded within the study area. Further details can be found in ES Chapter 6 Cultural Heritage (**TR010037/APP/6.1**).

¹⁵ The Design Manual for Roads and Bridge can be viewed at: <https://highwaysengland.co.uk/industry/design-manual-for-roads-and-bridges-dmrb/>

Landscape and visual

- 3.4.9 The DCO boundary lies adjacent to and encompasses the existing A47 near the settlements of Cringleford and Hethersett, west of Norwich. This is a lowland agricultural area, characterised by medium scale rectilinear fields bound by hedgerows and linear belts of trees.
- 3.4.10 The Scheme is in a mainly rural location with the village of Cringleford (forming the south western fringes of Norwich) approximately 500m to the east; although there is an on-going housing development to extend the urban footprint closer to the Scheme. The Norfolk and Norwich Hospitals are approximately 1km to the north and the village of Hethersett lies approximately 2km to the west. A more extensive area of sparsely populated open countryside lies to the south. Thickthorn Hall and its parkland lie between the Scheme and Hethersett.
- 3.4.11 Thickthorn Hall is a Registered Park and Garden (RPG) at County level and extends eastwards towards the Thickthorn Park and Ride site.
- 3.4.12 Further details can be found in ES Chapter 7 Landscape and visual **(TR010037/APP/6.1)**.

Biodiversity

- 3.4.13 Within 2km of the Scheme DCO boundary are seven statutory designated nature conservation sites:
- The Broads Special Area of Conservation (SAC)
 - Broadland Special Protection Area (SPA)
 - Broadland Ramsar
 - Eaton Chalk Pit Site of Special Scientific Interest (SSSI)
 - Eaton Common Local Nature Reserve (LNR)
 - Earlham Park Woods LNR
 - Marston Marshes LNR
- 3.4.14 There are 19 Country Wildlife Sites (CWS) located within 2km, but no internationally protected SACs designated for bats within 30km of the Scheme.
- 3.4.15 Further details can be found in ES Chapter 8 Biodiversity **(TR010037/APP/6.1)**.

Geology and soils

- 3.4.16 No designated or sensitive geological assets were identified within the DCO boundary.
- 3.4.17 Further details can be found in ES Chapter 9 Geology and Soils **(TR010037/APP/6.1)**.

Materials and waste

- 3.4.18 The Scheme intersects part of a known sand and gravel reserve (mineral safeguarding area) designated as a mineral safeguarding area by Norfolk County Council.
- 3.4.19 Further detail is provided in ES Chapter 10 Material Assets and Waste and in Appendix 10.4 Mineral Impact Assessment **(TR010037/APP/6.2)**, which also concludes it is not anticipated that any mineral safeguarding sites will be sterilised.

Noise and vibration

- 3.4.20 Sensitive receptors, such as residential properties, in proximity to the Scheme have been identified. Human receptors reside in small groups of residential properties located at East Lodge and Thickthorn Cottages on the B1172. On Cantley Lane South there is one group of 12 properties, whilst there are an additional five properties further south-west of the A47. A single residential property (the Round House) is located east of Thickthorn junction and approximately 50m north of the A11.
- 3.4.21 There are residential properties concentrated in Cringleford to the east of the A47, both to the north and south of the A11. An ongoing development of 1,200 additional residential units lies close to the junction. There are also a number of non-residential sensitive receptors in Cringleford, including a primary school. There are two Noise Important Areas¹⁶ east of the Round House Way roundabout on the A11.
- 3.4.22 Further details can be found in ES Chapter 11 Noise and Vibration **(TR010037/APP/6.1)**

Population and human health

- 3.4.23 In 2011, across the South Norfolk district the population was estimated to be 124,012 (Census, 2011).
- 3.4.24 The area is of relative affluence and high employment. There are proportionally more economically active people in South Norfolk (85%) and Norfolk (78%) than in England (77%). It also shows that employment is higher in South Norfolk (84%) and Norfolk (78%), compared to across England (77%).
- 3.4.25 Broadland is primarily an agricultural area with interspersed residential housing, community and commercial facilities. Cringleford and Hethersett are the main population centres within 500m of the Scheme and are connected by the existing A47 and A11. Norwich is the nearest city to the east, connected by the existing A47.
- 3.4.26 There are several community facilities within the 500m of the Scheme area, including: a service station, veterinarian surgery, doctor's surgery, 90m south of A11 Newmarket Road, two fast food restaurants, a hotel, Thickthorn Park and Ride, a community centre, Intwood Hall RPG, a Church hall, and a primary school.
- 3.4.27 The planned Cringleford Residential Development is located adjacent to the north east of the Proposed Scheme and proposes the development of 890 new dwellings. The Greater Norwich Local Plan (GNLP) will also support the growth of employment and residential housing.
- 3.4.28 There are no national cycle network routes or national walkways crossing through the DCO area, though there are two local cycle routes and Pedalways.
- 3.4.29 There are also two local walking routes, one equestrian bridleway and seven public rights of way (PRoW), including Cringleford FP4a which runs from Cantley Lane to a footbridge over the A47 to provide a link to Cantley Lane South. There is a shared-use footway on the northern side of the Thickthorn junction roundabout from the B1172 (Thickthorn Park and Ride) arm to the old Newmarket Road arm. There are several Toucan crossings on the A47 and A11.

¹⁶ Areas identified by the Government in the below DEFRA website for action to control noise levels:
<https://data.gov.uk/dataset/fc786717-3756-4fd1-9c7d-c082331e40e4/noise-action-planning-important-areas-round-2-england>

3.4.30 Further details can be found in ES Chapter 12 Population and Human Health **(TR010037/APP/6.1)**.

Road drainage and the water environment

3.4.31 The Scheme is located within two main river catchment areas and the Scheme lies predominantly in the Environment Agency defined Flood Zone 1 (low risk) for these rivers. However, some areas lie within Flood Zones 2 (medium risk) and 3 (high risk) that are associated with the Cantley Stream where it passes under the A11, west of Thickthorn junction, and joins the River Yare downstream.

3.4.32 The area is underlain with by a Groundwater Source Protection Zone 3 due to the presence of a secondary A superficial aquifer (Sheringham Cliffs Formation) and a principal aquifer.

3.4.33 Further details can be found in ES Chapter 13 Road Drainage and the Water Environment **(TR010037/APP/6.1)**.

Climate

3.4.34 The Climate Change Act 2008 is central to the UK Government's plan to reduce carbon emissions, committing the UK to a reduction of 80% against 1990 levels by 2050. On 01 May 2019, the UK Government declared a climate emergency, leading to updating the commitments in the 2008 Act to target net zero carbon emissions by 2050 under the Climate Change Act (2050 Target Amendment) Order 2019.

3.4.35 Climate change adaptation requires more than just managing carbon emissions. Therefore, ES Chapter 14 Climate **(TR010037/APP/6.1)** assesses the various impacts on climate change and associated mitigation measures by the Scheme. This chapter also assesses the potential impacts by the Scheme and measures to adapt in response to climate change.

3.5 Description of the Scheme

3.5.1 The layout extents are shown on the **Location Plan (TR010037/APP/2.1)** with further detail provided on the **General Arrangement Plans (TR010037/APP/2.2)**. A detailed description of the Scheme is provided in ES Chapter 2 The Proposed Scheme **(TR010037/APP/6.1)**. The summary of the Scheme is as follows:

- a single-lane free-flowing road connecting the A11 northbound to the A47 eastbound via two underpasses (under the A11 and A47 respectively)
- improvements to the junction:
 - widening the existing slip road on the A47 westbound and building a dedicated left-hand free flow lane to the A11 southbound
 - widening the southern section of the roundabout from three lanes to four
 - new traffic lights on the approach to / from the junction with the B1172 Norwich Road
 - new road surface on the circulatory, plus new road signs and road markings throughout the junction
- removal of the Cantley Lane South direct connections between the A11 and A47 exit slip roads

- new link road connecting Cantley Lane South with the B1172 Norwich Road to the north and construction of two new bridges
- new junction connecting the B1172 Norwich Road to Cantley Lane Link Road
- new junction connecting Cantley Lane South to Cantley Lane Link Road
- existing Cantley Lane stream and access track realigned and one new stream culvert constructed
- new Cantley Lane Footbridge over the A47 for walkers, cyclists and horse riders (WCH) approximately 45m south-east of the existing footbridge, which will be demolished; the footbridge will have higher railings to improve safety for horse riders
- paths for walking and cycling proposed along the new Cantley Lane Link Road giving access to local amenities and links to other recreational routes
- access to the Park and Ride from the Cantley Lane Link Road for walkers and cyclists

3.5.2 A full description of the Scheme is provided in Section 2, 'The Proposed Scheme', of the ES (TR010037/APP/6.1).

3.6 Key Objectives of the Scheme

Scheme objectives

3.6.1 The objectives of the Scheme are:

- **Supporting economic growth:** the Scheme aims to reduce congestion related delay, improve journey time reliability and increase the overall capacity of the A47. This will help contribute to sustainable economic growth by supporting regional housing and economic growth in Norwich and the surrounding areas.
- **A safer and reliable network:** make the network safer for motorists and for those living near the junction by improving operational safety issues at the junction.
- **A more free-flowing network:** increase the resilience of the junction to cope with incidents such as collisions, breakdowns, maintenance and extreme weather. Reduce vehicular delay and improve journey time reliability, making journey times more predictable and movement at the junction more free-flowing
- **Improved environment:** protect the environment by minimizing adverse impacts and, where possible, deliver benefits.
- **An accessible and integrated network:** consider local communities and their access to the roads. Provide a safer route between communities for cyclists, walkers, horse riders and other vulnerable users of the network.
- **Value for money:** to ensure that the Scheme is affordable and delivers good value for money.

3.6.2 Table 3.1 below sets out how the Scheme will meet the Scheme Objectives.

Table 3.1 How the Scheme meets the Scheme objectives

Objectives	How the Scheme Meets the Objectives
Supporting economic growth	<p>The Scheme will provide additional capacity and improved journey times to encourage economic growth in the local area as well as across the A47 and A11 corridors between Norwich and Peterborough and Cambridge. This will help contribute to sustainable economic growth by supporting employment and residential development opportunities.</p> <p>The Economic Case, in section 5 of this Case, provides more details of the economic benefits of the Scheme. The monetised value for the total wider economic impacts is about £33.1 million, with the majority of these benefits being derived from the agglomeration assessment. This suggests that business users are the main beneficiaries from the enhanced connectivity and congestion reductions brought about by the Scheme and that there will be an overall, long-term positive impact.</p>
Making a safer network	<p>The Scheme will improve safety and operational issues by upgrading Thickthorn Junction and creating a new A11-A47 connector road.</p> <p>The Scheme improves road safety by reducing the numbers of accidents and consequently the number of casualties. In total, over a 60-year timeframe the Scheme will save a total of 242 accidents and 26 killed or seriously injured (Table 4.19 in this Case).</p> <p>Section 4 Transport Assessment of this report Case, provides more detail on the safety benefits.</p>
A more free-flowing network	<p>Operational traffic modelling shows the Scheme would reduce traffic congestion and journey times even with the increased growth of traffic by 2040.</p> <p>The results of the modelling assessment show that the Scheme improves the overall operation of the network (Table 4.11 of this Case) as well as improving A47 and A11 peak hour journey times (by up to approximately 35% depending on direction and time period, see Table 4.10 of this Case. In terms of overall AADT, with the new A11/A47 connector road and dedicated left turn in place, forecasts on the A11 slip roads are reduced by approximately 20-37% (Figure 4.13 of this Case).</p> <p>Section 4 Transport Assessment of this Case, provides more detail on traffic movements.</p>
Protected environment	<p>The Scheme provides an improved junction with a design that supports mitigation of environmental impacts.</p> <p>In this regard there will be improvements in the environmental effects for some receptors. An ES (TR010037/APP/6.1) has been</p>

Objectives	How the Scheme Meets the Objectives
	<p>undertaken which assesses and proposes mitigation to minimise any impacts on biodiversity, heritage, climate, air quality, flooding, and geology, and from any cumulative effects. Mitigation measures are detailed on the Environmental Masterplan (TR010037/APP/6.8) and in the Environmental Management Plan (EMP) (TR010037/APP/7.4).</p> <p>Table 6.1, in Section 6.2 of this Case for the Scheme, presents an overview of the impacts and benefits of the Scheme on the environment, while a summary of the ES is presented in the ES Non-technical Summary (TR010038/APP/6.4).</p>
<p>An accessible and integrated network</p>	<p>The A47/A11 Thickthorn Junction provides strategic road access to Peterborough, Cambridge, London, the Midlands and the north of England. It plays a vital role in supporting the economy which relies on strong transport links along the A47 and A11.</p> <p>The Scheme design has considered local community access to the road network, providing safer routes between villages for WCH and vulnerable users where a need is identified. For example, the Scheme would require the stopping up and diversion of Cringleford FP4a to a new WCH overbridge spanning the A47 to link Cantley Lane and Cantley Lane South. The new overbridge will be suitable for all WCH users and will replace the existing footbridge which is to be demolished.</p> <p>Details of all the new facilities to be provided and the facilities to be replaced are detailed in Section 4.13 of this Case. The benefits and impacts are set out in Section 12.10 of ES Chapter 12 Population and Human Health (TR010037/APP/6.1).</p>
<p>Value for money</p>	<p>The economic benefits of the Scheme include travel time savings and thus vehicle operating costs, accident savings and indirect savings relating to the reduction in greenhouse gases and improvement in air and noise quality. The increased road capacity will encourage investment in housing and will support employment growth.</p> <p>Overall, the Scheme is forecast to produce user benefits of £119.8 million (present value (PV)) over the 60-year appraisal period. Overall, taking into account a balance of benefits and disbenefits, the Scheme would provide benefit-cost ratio 2.4, whereby the economy gains £2.40 for every £1 spent on the scheme. As per the DfT Value for Money Framework, this is categorised as high value for money.</p> <p>An overview of the economic benefits of the Scheme is provided in section 5 of this Case.</p>

National Policy Statement for National Networks

- 3.6.3 The National Policy Statement for National Networks (NPS NN) (designated on 14 January 2015) sets out the need for, and Government's policies for delivering NSIP developments on the national road network. The compliance of the Scheme with the environmental requirements of the NPS NN is considered in detail in the NPS NN Accordance Tables (**TR010037/APP/7.2**). This section sets out how the Scheme is consistent with the aims of the NPS NN at a strategic level.
- 3.6.4 Paragraph 2.2 of the NPS NN recognises that there is a '*critical need*' to improve the national road and rail networks to address road congestion and crowding on railways; to provide safe, expeditious and resilient networks that better support social and economic activity; and to provide a transport network that is capable of stimulating and supporting economic growth.
- 3.6.5 Paragraph 2.6 of the NPS NN confirms that the development of the national networks helps to support national and local economic growth, and that "*improved and new transport links can facilitate economic growth by bringing businesses closer to their workers, their markets and each other*".
- 3.6.6 The Government has concluded that at a strategic level there is a '*compelling need*' for development on the national networks, as confirmed in paragraph 2.10 of the NPS NN. The same paragraph confirms that "*The Examining Authority and the SoS should therefore start their assessment of applications for infrastructure covered by this NPS on that basis*".
- 3.6.7 Identifying the need for development on the national road network, paragraph 2.13 of the NPS NN, confirms that the SRN provides critical links between cities and joins up communities. It plays a vital role in people's journeys and drives prosperity by supporting new and existing development, encouraging trade and attracting investment. Paragraph 2.13 also confirms that a well-functioning SRN is "*critical in enabling safe and reliable journeys and the movement of goods in support of national and regional economies*."
- 3.6.8 Paragraph 2.22 of the NPS NN confirms the importance of improving the road network as without doing so "*it will be difficult to support further economic development, employment and housing and this will impede economic growth and reduce people's quality of life. The Government has therefore concluded that at a strategic level there is a compelling need for development of all national road networks*."
- 3.6.9 The Government's policy for making enhancements to the existing national road network is set out in paragraph 2.23 of the NPS NN as including:
- i. junction improvements, new slip roads and upgraded technology to address congestion and improve performance and resilience at junctions which are a major source of congestion
 - ii. implementing 'smart motorways' to increase capacity and improve performance
 - iii. improvements to trunk roads in particular dualling of single carriageway strategic trunk roads and additional lanes on existing dual carriageways to increase capacity and to improve performance and resilience.
- 3.6.10 The NPS NN sets out that, subject to the detailed policies and protections contained in the NPS and the legal constraints set out in the PA 2008, there is a '*presumption in*

favour of granting development consent for national network NSIPs that fall within the need for infrastructure established in the NPS NN.

3.6.11 Paragraph 4.3 of the NPS NN states: “...in considering any proposed development, and in particular, when weighing its adverse impacts against its benefits, the ExA and SoS should consider:

- Its potential benefits including the facilitation of economic development, including job creation, housing and environmental improvements and any long-term or wider benefits; and
- Its potential adverse effects, including any longer-term and cumulative adverse impacts, as well as measures to avoid, reduce or compensate for any adverse impact.”

3.6.12 Table 3.2 illustrates how the Scheme will respond to this identified need by fulfilling the strategic objectives of the NPS NN.

Table 3.2 – Response to the NPS NN Strategic Objectives

NPS NN Vision and Strategic Objectives (NPS NN Page 9)	Conformity of the Scheme
<p>The Government will deliver national networks that meet the country’s long-term needs; supporting a prosperous and competitive economy and improving overall quality of life, as part of a wider transport system.</p>	<p>Norwich is amongst the fastest growing cities in the country and further growth is planned¹⁷. Section 3.1 of this Case demonstrates the need to increase capacity on the A47/A11 Thickthorn Junction to support local economic and housing growth. It also explains the wider SRN role of this junction and its critical role in providing an important link between the A47 and A11 that are corridors of future economic growth between Norwich and Peterborough and Cambridge, respectively.</p> <p>Section 4 of this Case demonstrates how traffic flows will be improved to provide more reliable journey times. This in turn has informed the appraisal of net economic benefits of the Scheme presented in section 5 in this Case.</p> <p>The Scheme also contributes to improving overall quality of life, as part of a wider transport system, by upgrading or creating new and safer WCH infrastructure. For example, the Scheme would stop up and divert Cringleford FP4a to a new WCH overbridge spanning the A47 to link Cantley Lane and Cantley Lane South. The new overbridge will be suitable for all WCH users and will replace the existing footbridge which is to be demolished.</p>
<p>Networks with the capacity, connectivity and resilience to support national and local economic activity and facilitate growth and create jobs</p>	<p>Section 4.12 of Chapter 4 of this Case summarises the overall benefits of the Scheme. It will improve traffic flows; provide more reliable journey times and improve the safety of the route. These improvements will contribute towards the attractiveness of areas along the A47 and A11 corridors for business and will help in promoting a competitive regional economy.</p>

¹⁷ Norwich Economic Analysis, Norwich City Council, June 2017

NPS NN Vision and Strategic Objectives (NPS NN Page 9)	Conformity of the Scheme
<p>Networks which support and improve journey time quality, reliability and safety</p>	<p>The forecast local and regional traffic growth will cause a significant increase in delays at Thickthorn Junction and along the A11, B1172 and A47. Section 4 Transport Assessment of this Case demonstrates the Scheme relieves congestion (in particular along the B1172 and A11 corridors) and improves journey times by increasing capacity. Section 4.10 of this Case also shows the Scheme improves road safety by saving a total of 242 accidents and 26 killed or seriously injured over a 60-year period which as set in Section 5 Economic Case Overview of this Case represents a predicted monetised benefit of £ 84.1 million.</p>
<p>Networks which support the delivery of environmental goals and move to a low carbon economy</p>	<p>Chapters 5 to 15 of ES (TR010037/APP/6.1) assess the impacts and benefits of the Scheme on the environment</p> <p>Chapter 14 Climate of the ES (TR010038/APP/6.1) assesses the impact of the Scheme on climate change and set out mitigation to minimise carbon through design and construction. In accordance with the DMRB (LA 114-Climate), the Scheme has sought to minimise carbon emissions as far as possible in all cases in order to contribute to the UK's net reduction in carbon emissions. Mitigation of effects on climate (i.e. carbon emissions associated with the Scheme) take place throughout the design process in accordance with the principles of Publicly Available Standard (PAS) 2080: Carbon Management in Infrastructure (i.e. baselining, target setting and monitoring).</p>
<p>Networks which join up our communities and link effectively to each other</p>	<p>Section 4.12 of this Case concludes that the Scheme improves accessibility for local communities by reducing congestion along the B1172 and A11 corridors. The Scheme improves accessibility for local communities by reducing congestion along the B1172 and A11 corridors. The Scheme also provides an overbridge increasing the accessibility for north to south local trips crossing the A11.</p> <p>Chapter 12 Population and Human Health of the ES (TR010037/APP/6.1) has considered impacts on local communities and access to the road network, plus provision of safer routes between communities for cyclists, pedestrians, equestrians and vulnerable users.</p> <p>Cringleford footpath 4A would experience adverse effects due to journey increases associated with the diversion of the footpath via the new WCH overbridge. There would also be a permanent increase in journey time to access the A47 from private properties and businesses on the severed Cantley Lane South and Cantley Lane.</p>

NPS NN Vision and Strategic Objectives (NPS NN Page 9)	Conformity of the Scheme
	<p>However, most users of the Scheme accessing properties, businesses and community assets would benefit from journey time savings and improved safety.</p> <p>The inclusion of new WCH routes align to sustainable and integrated transport objectives, as well as improve safety for these users:</p> <ul style="list-style-type: none"> • The existing Cantley Lane footbridge that carries Cringleford footpath 4A over the A47 between Cantley Lane South and Cantley Lane will be demolished by Scheme and replaced with a new overbridge approximately 50m south-east of the existing footbridge location. The new replacement bridge will be suitable for WCH users, with approach ramps constructed on earthwork embankments. • Walkers and cyclists would benefit from travelling along a new shared footway and cycleway to be provided on the eastern frontage of the new Cantley Lane Link Road. A refuge island would also be incorporated into its junction with the B1172 Norwich Road to facilitate the safe crossing between the shared footway and cycleway and the existing facility provided on the northern frontage of Norwich Road, which comprises part of the Wymondham to Sprowston Blue Pedalway cycle route. The provision of this infrastructure would provide a safer and pleasant route for users avoiding the need to pass through Thickthorn Junction.

4 TRANSPORT CASE FOR THE SCHEME

4.1 Introduction

4.1.1 This section summarises the findings of the Transport Assessment in the context of the national, regional and local transport policies that are relevant to the Scheme. The Case supplements the assessment of the Scheme's compliance with the NPS NN in the Accordance Tables and reviews the matters of importance to the determination of the application. The transport issues are key to this process.

4.1.2 Full details of the Scheme's accordence with all relevant national and local policies, local transport plans and associated supplementary plans, particularly the National Policy Statement for National Networks (NPS NN), is provided in Section 6 of this document and in the NPS NN Accordance Tables (**TR010037/APP/7.2**).

National policy

The National Policy Statement for National Networks (NPS NN)

4.1.3 The NPS NN sets out the need for, and the Government's policies to deliver NSIPs on the national road network in England and also sets out the primary basis for making decisions of development consent for NSIPs in England. The Government recognises in the Appraisal of Sustainability accompanying the NPS NN that some developments may have adverse local impacts on noise, emissions, landscape and visual amenity, biodiversity, cultural heritage and water resources. The significance of these effects and the effectiveness of mitigation is uncertain at the strategic and non-locational specific level of the NPS NN. Therefore, while applicants should deliver developments in accordance with government policy and in an environmentally sensitive way, including considering opportunities to deliver environmental benefits, some adverse local effects of development may remain.

4.1.4 Outside the NSIP regime, government policy is to bring forward targeted works to address existing environmental problems on the SRN and improve the performance of the network. This includes:

- reconnecting habitats and ecosystems
- enhancing the settings of historic and cultural heritage features
- respecting and enhancing landscape character
- improving water quality and reducing flood risk
- avoiding significant adverse impacts from noise and vibration
- addressing areas of poor air quality.

4.1.5 Where appropriate, mitigation of any unavoidable impacts on the environment will be undertaken as set out in the ES (**TR010037/APP/6.1**) and where possible enhancements will be made.

The National Planning Policy Framework (NPPF)

4.1.6 While the overall strategic aims of the National Planning Policy Framework (NPPF) and the NPS are consistent, the NPPF is an important and relevant consideration in decisions on nationally significant infrastructure projects, but only to the extent relevant to that project. The NPS NN provides transport policy which will guide individual development brought under it. It also provides guidance on good scheme

design, as well as the treatment of environmental impacts. Both documents seek to achieve sustainable development and recognise that different approaches and measures will be necessary to achieve this.

- 4.1.7 The NPPF states that the purpose of the planning system is to contribute to the achievement of sustainable development. In this regard there are three interdependent overarching objectives; economic, social and environmental which need to be pursued in mutually supportive ways with the aim of securing net gains across each. Accordingly, the NPPF states a “*presumption in favour of sustainable development*” (NPPF Paragraph 10).

Road Investment Strategy

- 4.1.8 In April 2020, the Department of Transport (DfT) published the second Road Investment Strategy (RIS2). RIS2 sets out a list of schemes that are to be developed by the Applicant in the period 2020 to 2025.

- 4.1.9 The Applicant, as the strategic highways company and appointed by the SoS must, in exercising its functions and complying with its legal duties and other obligations, act in a manner which it considers best calculated to, among others:

- minimise the environmental impacts of operating, maintaining and improving its network and seek to protect and enhance the quality of the surrounding environment
- conform to the principles of sustainable development.

- 4.1.10 RIS 2 (pg100¹⁸) introduces the committed schemes in the East of England committed to in Road Programme 2. RIS 2 (page 101) includes the “*A47 Thickthorn Junction - improvement of the interchange between the A47 and A11, improving access into Norwich.*”

The Strategic Road Network and the Delivery of Sustainable Development (DfT Circular 02/2013)

- 4.1.11 This Circular explains how the Highways Agency (Highways England) will engage with the planning system, communities and the development industry to deliver sustainable development and, thus, economic growth, whilst safeguarding the primary function and purpose of the SRN.

- 4.1.12 The document states that Highways England will work with local authorities to influence Local Plan decisions that may affect the SRN.

Highways England policy

The Highways England Licence (2015)

- 4.1.13 The Highways England Licence sets out key requirements which must be complied with by the licence holder as well as statutory guidance. In exercising its functions and complying with its legal duties and obligations, the licence holder must act in such a manner which it considers best calculated to:

- ensure the effective operation of the network

¹⁸ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/872252/road-investment-strategy-2-2020-2025.pdf

- ensure the maintenance, resilience, renewal, and replacement of the network
- ensure the improvement, enhancement and long-term development of the network
- ensure efficiency and value for money
- protect and improve the safety of the network
- co-operate with other persons or organisations for the purposes of coordinating day-to-day operations and long-term planning
- minimise the environmental impacts of operating, maintaining and improving its network and seek to protect and enhance the quality of the surrounding environment
- conform to the principles of sustainable development
- comply with section 4.2(g) and its general duty under section 5(2) of the Infrastructure Act 2015 in having regard for the environment
- ensure that protecting and enhancing the environment is embedded into its business decision-making processes and is considered at all levels of operations
- ensure the best practicable environmental outcomes across its activities, while working in the context of sustainable development and delivering value for money
- consider the cumulative environmental impact of its activities across its network and identify holistic approaches to mitigate such impacts and improve environmental performance
- develop solutions that can provide increased environmental benefits over those that the licence holder can achieve alone, where this delivers value for money
- consider the carbon impact of road projects and factor carbon into design decisions and seek to minimise carbon emissions and other greenhouse gases from its operations
- adapt its network to operate in a changing climate, including assessing, managing and mitigating the potential risks posed by climate change to the operation, maintenance and improvement of the network
- develop approaches to the construction, maintenance and operation of the licence holder's network that are consistent with the government's plans for a low carbon future
- take opportunities to influence road users to reduce the greenhouse gas emissions from their journey choices.

Highways England Delivery Plan, 2020 to 2025

- 4.1.14 The Highways England Delivery Plan sets out the Applicant's long-term plans for the modernisation and renewal of the road network over the five-year period from 2020 to 2025. It provides a brief outline of what Highways England have delivered during the previous five years and sets out a clear programme of activity for 2020 to 2021, as well as a proposed pipeline of future schemes.

- 4.1.15 In year one, work will be finalised across four schemes to provide dualling and junction upgrades on the A47 between Peterborough and Norwich.
- 4.1.16 Annex B of the Plan sets out the six key performance outcomes agreed with the DfT for this second road period including:
- improving safety for all
 - providing fast and reliable journeys
 - a well-maintained and resilient network
 - delivering better environmental outcomes
 - meeting the needs of all users
 - achieving efficient delivery.
- 4.1.17 Annex B lists the A47 Thickthorn junction as an enhancement Scheme.
- 4.1.18 In relation to funding, the Plan details a series of designated ring-fenced funds for actions beyond 'business as usual' which are available across environmental disciplines including:
- safety and congestion fund - to address safety, congestion and economic development (jobs and housing) issues,
 - users and communities fund - to help Highways England understand customers' evolving expectations and improve the service provided to all, supporting engagement with stakeholders to deliver improvements on and off the network
 - environment and wellbeing fund - to support environmental and community wellbeing outcomes across the SRN working in harmony with communities, and the built, natural and historic environments
 - innovation and modernisation fund - to exploit the potential that innovation holds to transform roads by supporting the development of new technologies and working practices and enabling wider rollout once concepts are proven.

Local transport policy

- 4.1.19 There are a number of local transport plans which are applicable to the Scheme:
- Norfolk County Council Local Transport Plan, 2011-2026: describes the Council's strategy and policy framework for transport and is used as a guide for investment priorities as well as being considered by other agencies when determining their planning or delivery decisions. The Council is currently refreshing the Local Transport Plan so that it covers the period 2020 to 2036. A consultation of the key priorities was held in early 2020. However there has been no update since this consultation.
 - Norwich Area Transport Strategy, 2004, updated 2013: the current transport strategy has been in place since 2004 through significant changes to the city. These included transformation of the Westlegate area into a new public space and changes to St Stephens Street and Chapel Field North that improved journey times for buses. The strategy also included creating the Norwich Northern Distributor Road, now officially named the Broadland Northway.

Norfolk County Council is looking to the future of investment in the network, and want to update the strategy to match the changing needs of the city and Greater Norwich as it continues to grow.

- Greater Norwich Infrastructure Plan, adopted in 2020: covers the districts of Broadland, Norwich and South Norfolk and helps coordinate and manage the delivery of strategic infrastructure to support growth.

Policy summary

- 4.1.20 The objectives of the Scheme are directly in line with the Government's policies and illustrate the need for the Scheme on a national level. The Government has highlighted the express need for further growth and improvements to the national networks within the NPS NN. The Road Investment Strategies (both 'RIS1 and 'RIS2'), which explore these needs in further detail, support the A47 Scheme as a required improvement to the SRN. The Scheme also supports RIS2 economic objectives and strategic policies in providing transport infrastructure which also facilitates sustainable means of travel through the provision of new and improved WCH routes.
- 4.1.21 The conformity of the Scheme with national, regional and local development and transport planning policies is set out in further detail in Section 6 of this Case.
- 4.1.22 The Scheme complies with national planning policy within the NPS NN and NPPF. It will reduce congestion-related delay, improve journey time reliability, increase the overall capacity of the A47 and improve road safety and traffic flow. These improvements mean that the Scheme will contribute towards making the eastern region more attractive for business and will help in promoting a competitive regional economy.
- 4.1.23 The Scheme supports the objectives of the various sub regional policy documents in delivering the required and supported improvements to the A47. Local planning policies support the implementation of enhancements to the A47/A11 Thickthorn Junction to accommodate future planned growth, housing development, tackle congestion and improve road safety, which are consistent with the Scheme objectives.

4.2 Baseline Data and Development of Model

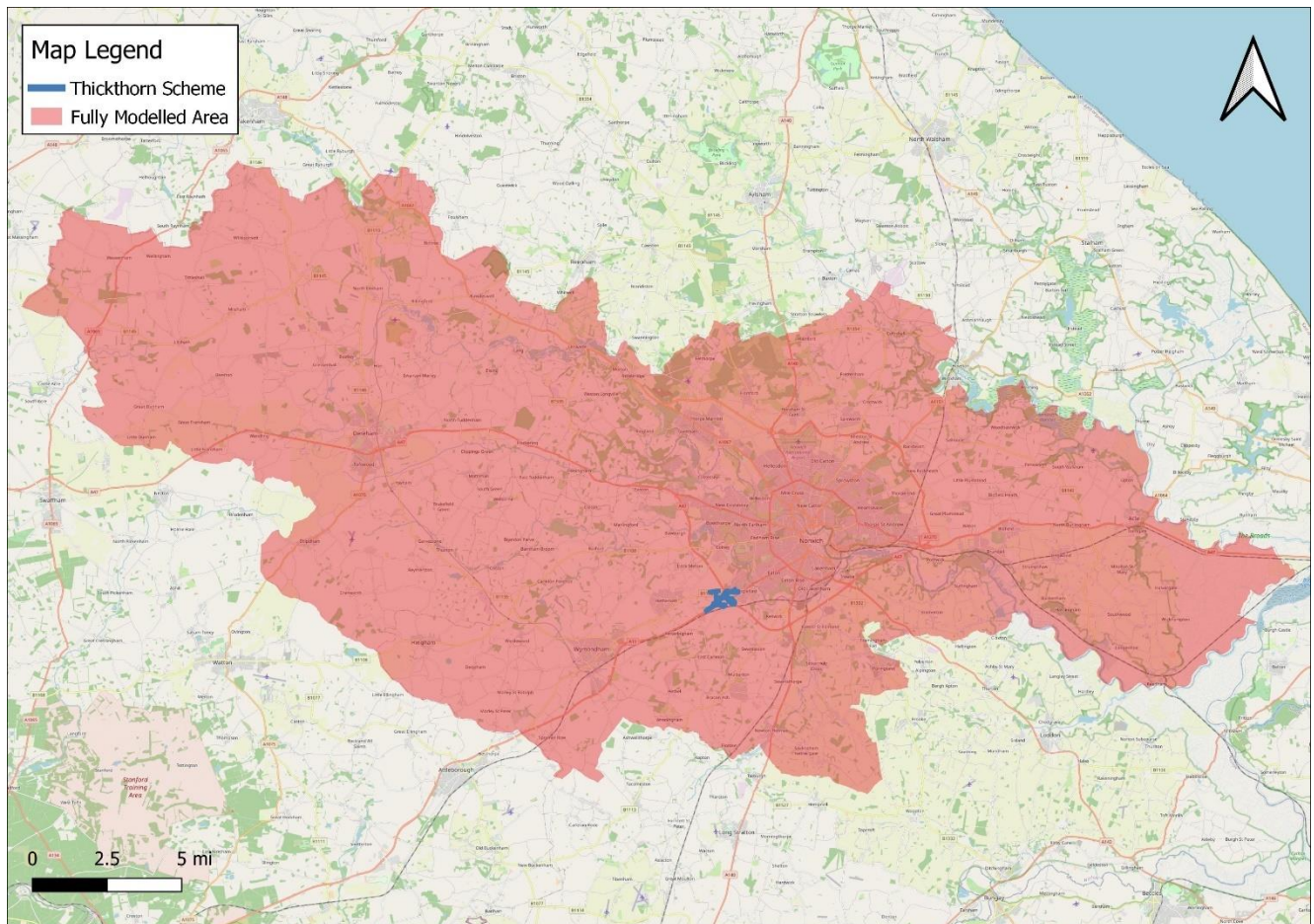
Introduction

- 4.2.1 This section provides a summary of the A47/A11 Thickthorn Junction modelling assessment as well as the supporting baseline data collection. The baseline dataset includes the collection of volumetric traffic count, network and vehicle journey time data sources. This information is used in the model development process to calibrate and validate the baseline model. The fully calibrated and validated base year model then provides a stable basis to undertake the future year assessment of the Scheme.
- 4.2.2 The framework of the modelling assessment has been developed to enable the comparative analysis of the existing Thickthorn junction layout's operation against the Scheme design. The comparative assessment is used to evaluate the A47/A11 Thickthorn Junction improvements performance against the Scheme objectives.
- 4.2.3 The modelling assessment comprises a strategic multi-modal model. The model utilised for the assessment of the Scheme is called the Norwich Area Transport Strategy Model (referred to as the NATS Model). The NATS model, utilised for the

preliminary design work has been developed in line with the DfT's Transport Appraisal Guidance (TAG).

4.2.4 Figure 4.1 shows the extent of the NATS model and the location of the Scheme. The NATS model covers all strategic traffic movements across Norwich as well as the wider Broadland and South Norfolk area. The model contains a detailed zoning system, a refined network resolution and has been calibrated to a high level of accuracy closer to the Scheme.

Figure 4.1: Extent of the 2015 NATS model



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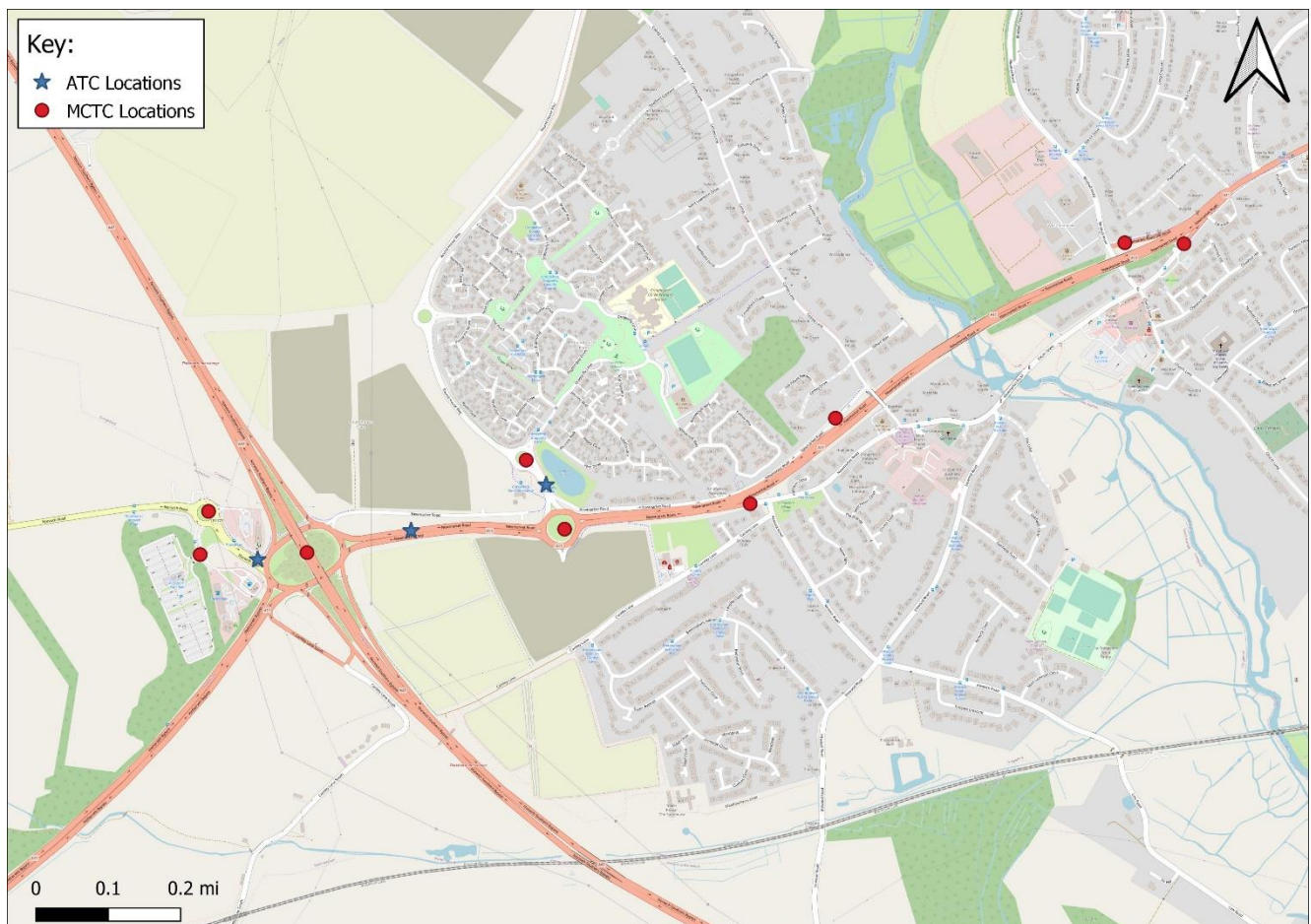
Baseline data collection

Traffic flows

4.2.5 A range of traffic surveys have been undertaken in the vicinity of the Scheme and across the surrounding network in 2015, 2016 and 2019. The traffic surveys in 2015 and 2016 provide the input traffic flow data for the development of the base year strategic highway model whereas the 2019 provides the input traffic data for the microsimulation model.

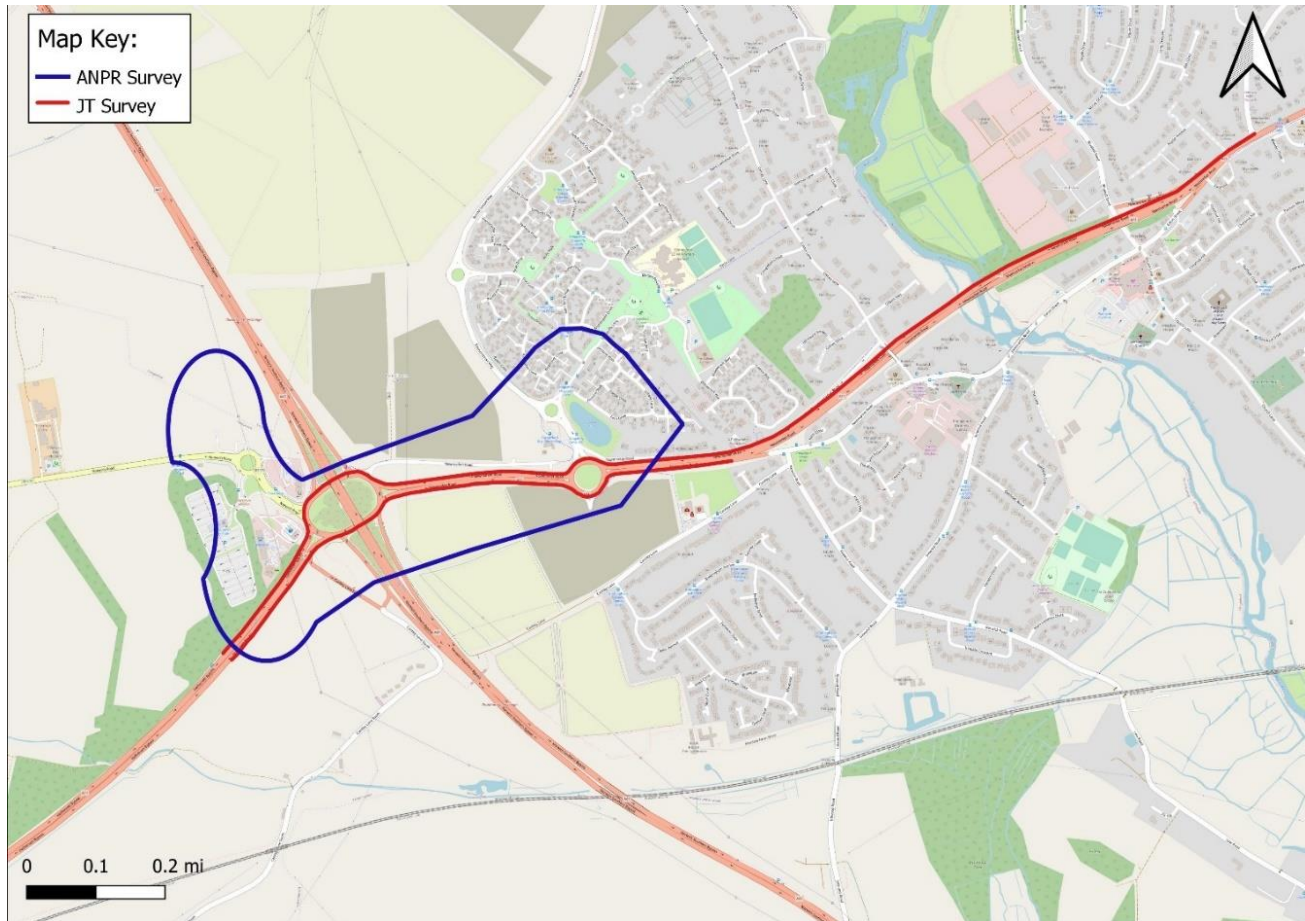
4.2.6 In June 2015 12-hour Manual Classified Turning Counts (MCTC) were undertaken to observe traffic movements on the local network around Thickthorn junction, this is shown in Figure 4.2. The MCTC surveys recorded the number of vehicles and their classifications by turning movement. Automatic Number Plate Recognition (ANPR) surveys were also carried out in the Thickthorn junction cordon shown in Figure 4.3. The ANPRs surveys were used to record vehicles entrance and exit points from the cordon, providing a dataset of through junction traffic movements.

Figure 4.2: Location of 2015 traffic survey sites



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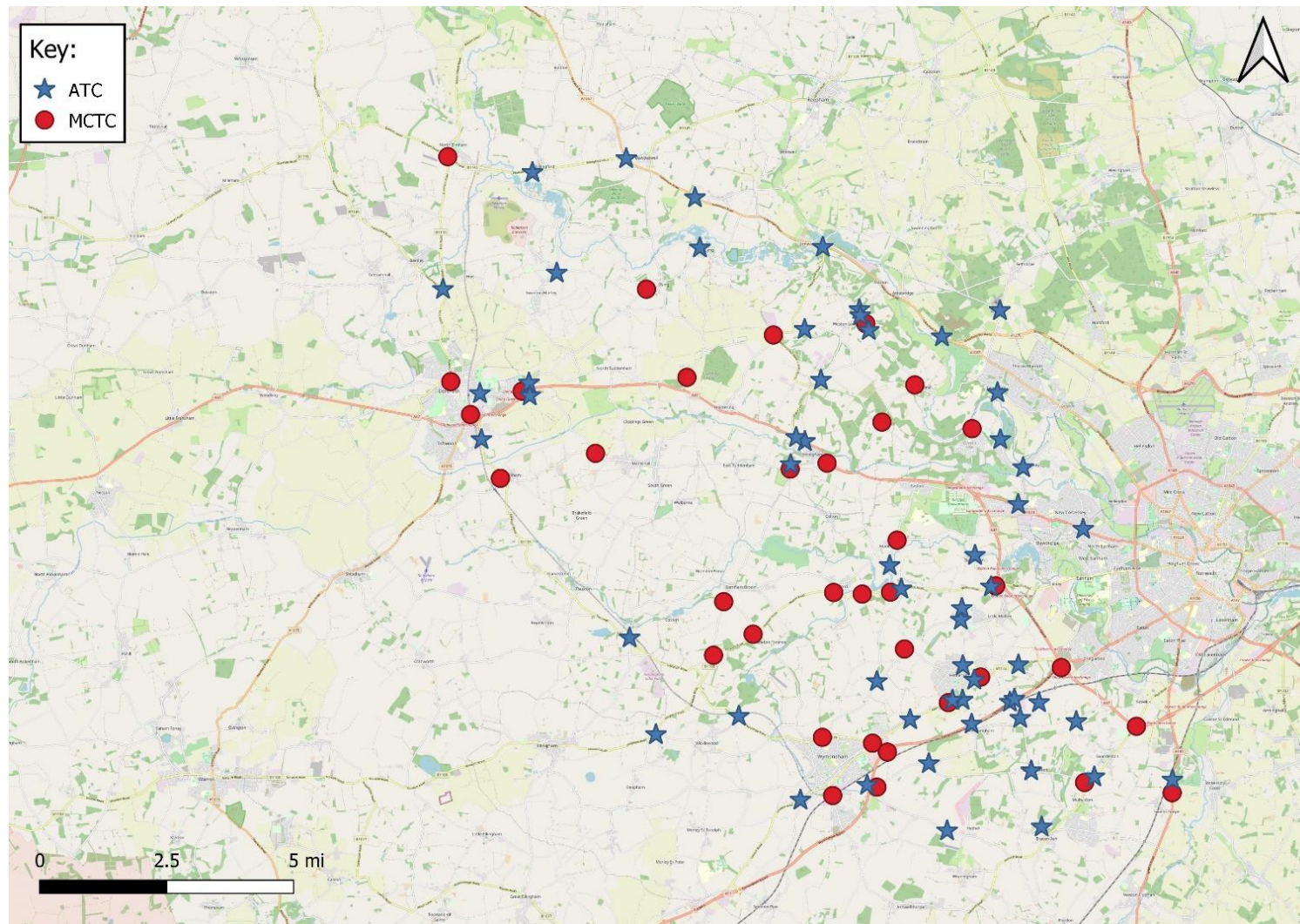
Figure 4.3: Location of 2015 ANPR traffic survey sites



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4.2.7 In addition to the MCTCs, as shown in Figure 4.2 Automated Traffic Counts (ATCs) were undertaken on the A11, B1172 and Round House Way in 2015. The ATC surveys were undertaken over a 14-day period, for 12 hours a day collecting traffic flow data in 15 minutes intervals. To supplement the 2015 data additional MCTC and ATCs were undertaken during the months of May, June and July 2016. Figure 4.4 below shows the extent of the 2016 traffic flow data collection. In summary, the 2015 data collection study was focused primarily in the local vicinity of the Thickthorn Junction, whereas the 2016 data collection covered the wider surrounding area.

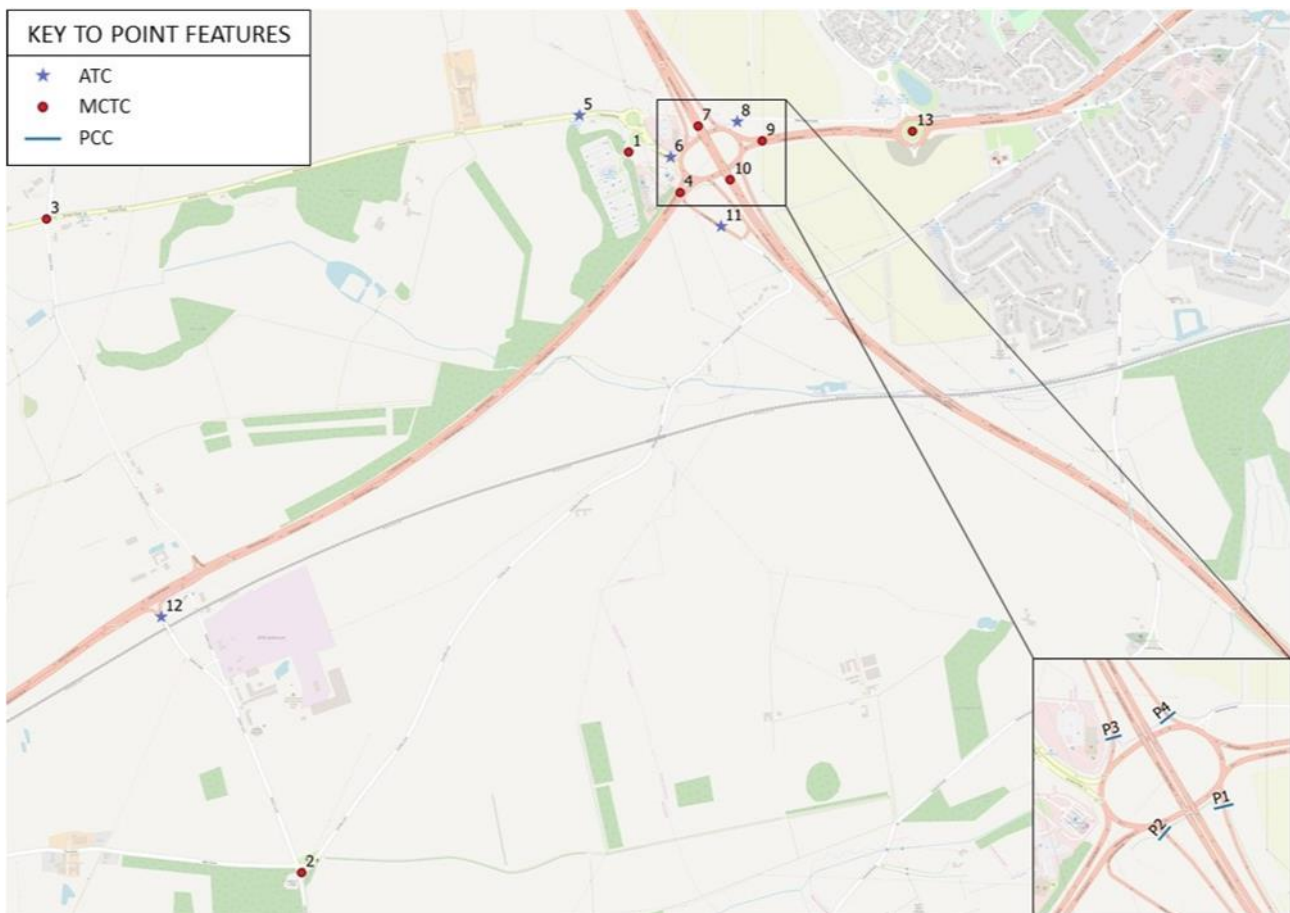
Figure 4.4: Location of 2016 traffic survey sites



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4.2.8 In addition, in October 2019, further traffic surveys were undertaken to inform the local microsimulation modelling. Figure 4.5 shows the location of the 2019 survey sites, this data exercise involved collecting traffic data on the local roads as well as recollecting data on a number of sites included in 2015 and 2016. Therefore, the 2019 survey information was used to update the microsimulation model.

Figure 4.5: Location of 2019 survey sites



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Congestion and queuing

4.2.9 Queuing data was collected as part of the 2015 traffic surveys. During the 2015 data collection exercise queue length surveys were undertaken concurrently with the MCTCs surveys.

Road network and traffic movement data

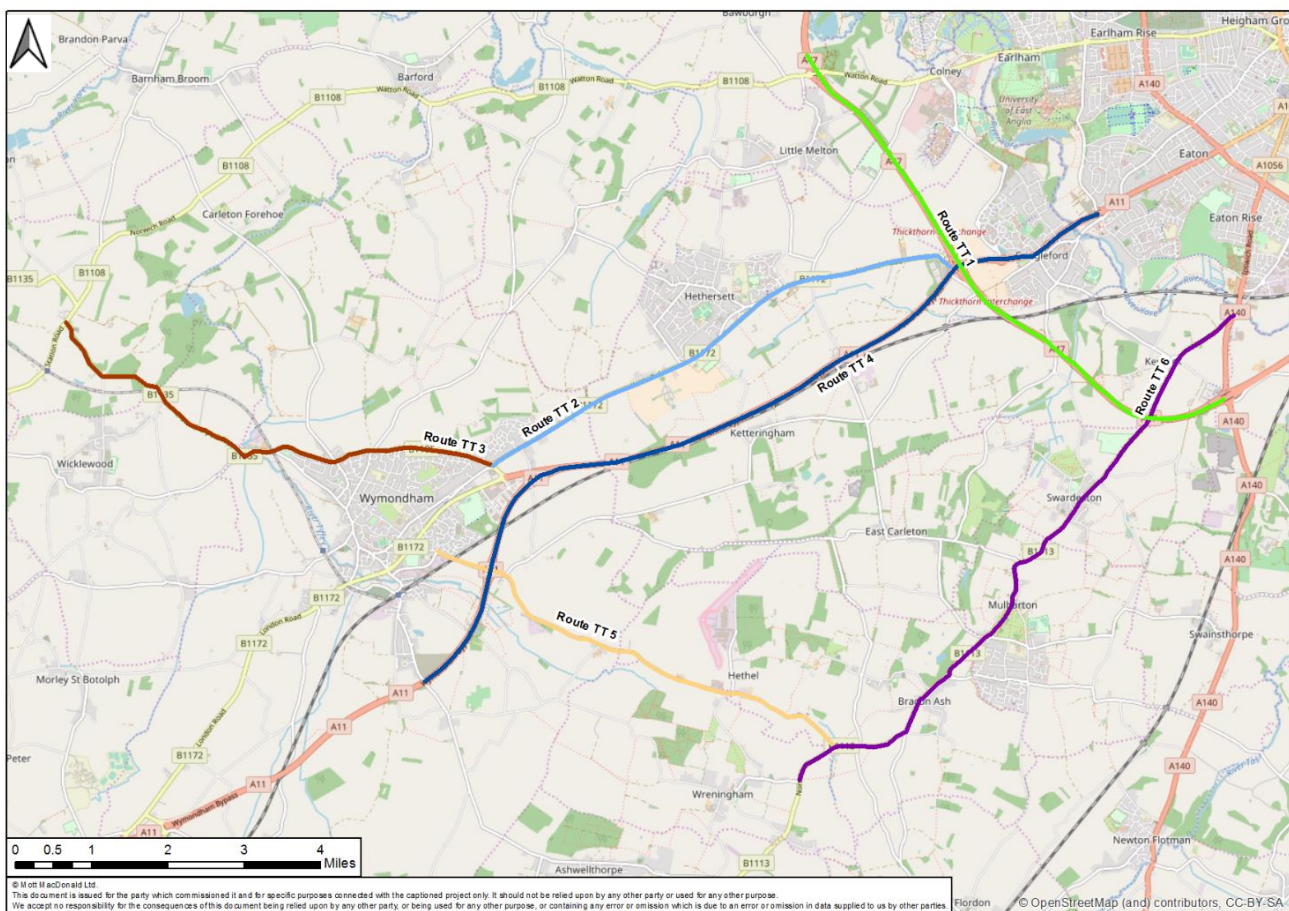
4.2.10 The Applicant has developed a series of regional traffic models under a consistent framework to support the delivery of the schemes identified in the RIS. The entire SRN and major associated links in England are represented in five strategic models representing the north, the trans-Pennine south or “Northern Powerhouse” area, the Midlands, the south-west and the south-east, known as South East Regional Transport Model (SERTM).

- 4.2.11 Provisional trip matrices were constructed using mobile phone data. The SERTM models network and mobile phone prior matrix traffic movement data were therefore adopted in the study to inform the development of the Scheme assessment 2015 base year model.
- 4.2.12 In addition to SERTM data, Google and TrafficMaster data have been used as data sources for traffic highway network development. Traffic signal data has been sourced from Norfolk County Council.

Journey times

- 4.2.13 TrafficMaster¹⁹ data was obtained for the period October 2014 to September 2015. From this dataset a neutral month was extracted to inform the traffic modelling assessment. WebTRIS²⁰ journey times were also utilised in the traffic modelling validation assessment to supplement the TrafficMaster data. WebTRIS data was available along the A47 and A11 corridors for neutral months in 2015. Figure 4.6 below shows the journey time routes.

Figure 4.6: TrafficMaster journey time data



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¹⁹ Trafficmaster data contains vehicle GPS information sourced and centrally purchased by the Department for Transport <https://www.teletracnavman.co.uk/support/customer-resource/trafficmaster-customer-support>

²⁰ WebTRIS is an open data source of traffic flow information provided by Highways England at <https://webtris.highwaysengland.co.uk/>

Accidents

- 4.2.14 Department for Transport Stats19 accident data records have been analysed, over the 2014 to 2018 period, to identify all reported accidents which have occurred across the Scheme assessment area. The data set includes details of all recorded slight, serious and fatal accidents across the five-year time period. This information has been adopted to provide total observed accident rates as an input to the COBA-LT (Cost-Benefit of Accidents - Light Touch) modelling assessment.

The transport network

- 4.2.15 The A47/A11 Thickthorn Junction is a large grade-separated junction comprising a three to four lane roundabout with both on and off slip road connections to the A47. The junction has six approach arms, of which four are signal controlled. See section 3.2 of this Case for a more detailed description of the existing junction.
- 4.2.16 The A47 and the A11 to the west are part of the trunk road network managed by the Applicant. The A11 to the east and the B1172 are managed by Norfolk County Council. The A47, which passes over the junction via an overbridge, is the main trunk road.

4.3 Overview of the Strategic Modelling

Base year model

- 4.3.1 The NATS model base year has been calibrated to represent a 2015 base year, utilising the data collected as part of the Scheme assessment as well as South East Regional Transport Model (SERTM) network and mobile phone data. Key features of the NATS model include:
- The model contains AM and PM peak hours (08:00 to 09:00 and 17:00 to 18:00) and an Inter-Peak (IP) average hour (10:00 to 16:00) time segments.
 - The highway trip purposes represented in the model comprise of five user groups: car employer business, car commute, car other, light goods vehicles (LGVs) and heavy goods vehicles (HGVs).
- 4.3.2 The NATS model's highways component adopts the SATURN²¹ software package which calculates converged assignment impacts of the Scheme. This is supplemented by a public transport component constructed in VISUM²² software and a variable demand model in DIADEM²³ software packages.
- 4.3.3 Mobile phone data, from SERTM, is the primary source used for deriving the distribution of trips in the base year prior demand matrices in the Schemes impact area. Traffic count data is used to calibrate the model based on a matrix estimation (ME) procedure. The SATURN ME process adjusts the prior trip matrix based on the strategic traffic assignment and the observed count data. This process utilises the data referred to in the above baseline data collection section, and traffic data collect across the wider NATS model study area. A variety of checks were undertaken to ascertain that ME has not altered the integrity and profile of the trip matrix. These

²¹ Simulation and Assignment of Traffic in Urban Road Network (SATURN): <https://saturnsoftware2.co.uk/>

²² VISUM is a Transport Demand modelling software provided by PTV:
<https://www.ptvgroup.com/en/solutions/products/ptv-visum/>

²³ Dynamic Integrated Assignment and Demand Modelling is a (DIADEM):
<https://www.gov.uk/government/publications/diadem-software>

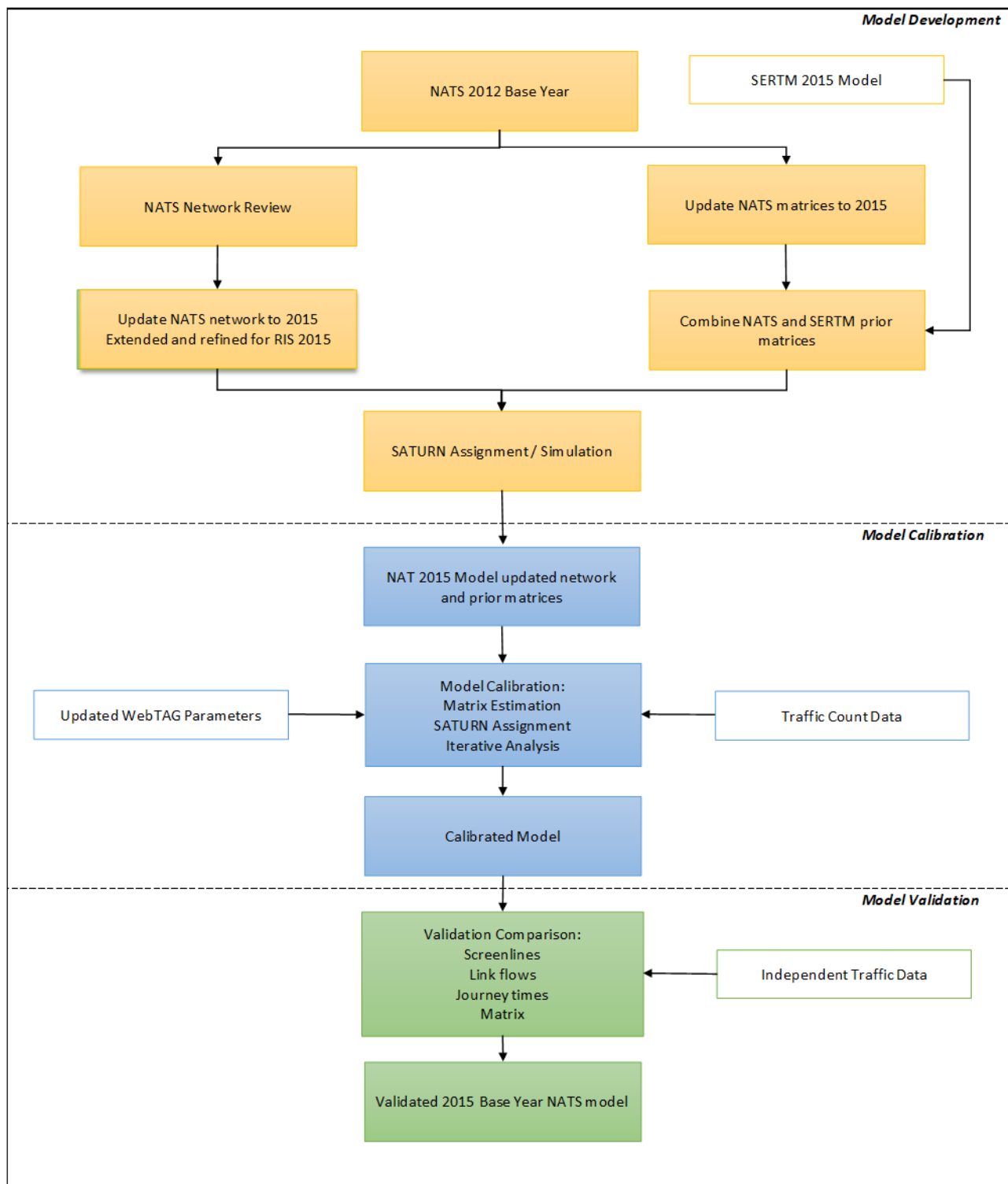
checks include comparing the prior and post ME matrices trip length distributions as well as their matrix cell values and zonal trip end totals. Subsequent to the ME process, the model has been validated against independent data sets based on the following criteria:

- Flows across screenlines²⁴
- Individual link flows
- Journey time comparison
- Model convergence.

4.3.4 The base model was developed in accordance with the DfT's TAG Unit M3.1: Highway Assignment Modelling (2020). The strategic base year model development process is outlined in Figure 4.7.

²⁴ A screenline is an arbitrary line on a map which could follow rivers, railway lines or natural boundaries which crosses a number of parallel roads. Screenline analysis provides a means of comparing the results of a traffic model with traffic count data along the section of the roads which are crossed by the screenline. The combination of traffic counts on the screenline is used to compare the model and observed data and if all the traffic is captured in the model.

Figure 4.7: Strategic base year model development process - overview



4.3.5 In order to complete a fully TAG compliant assessment of the Scheme, the existing NATS model was updated and recalibrated based on up to date survey data. The results of the calibration indicated that the TAG criteria were achieved for link flow calibration and validation. In addition, TAG criteria were also achieved for the journey time validation assessment.

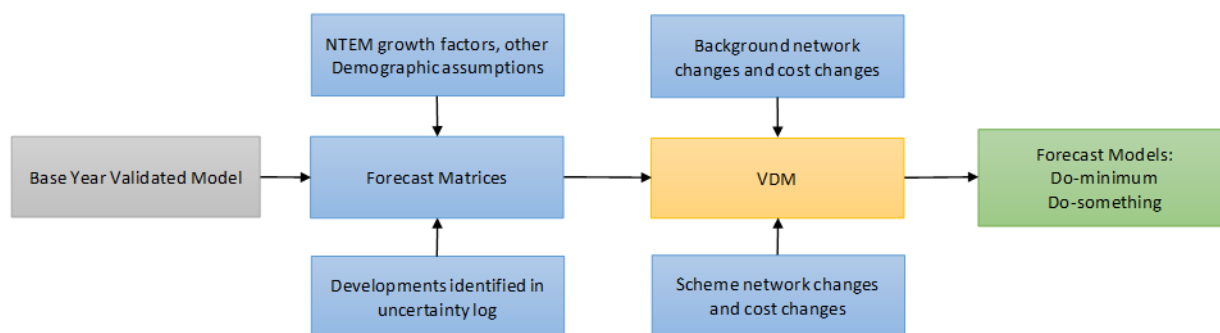
4.3.6 Overall, it is considered that the updated NATS base year model demonstrates a good

representation of traffic behaviour in the Scheme study area as well as Norwich and the surrounding wider area. Therefore, the model forms a robust basis for the future year forecast assessment of the Scheme.

Forecast modelling approach

- 4.3.7 The forecasting approach involves creating initial reference case travel demand forecasts which reflect changes in car ownership, population, employment and other demographic and economic factors. However, traffic growth resulting from other sources, such as changes in generalised costs due to traffic conditions, are not included in the reference case forecasts. These impacts are evaluated through the variable demand model (VDM).
- 4.3.8 The VDM calculates the increment in demand applied to the reference case forecasts generated by changes in road network congestion. To calculate this increment, the VDM alternates between demand matrix calculations and highway assignment model runs to achieve an appropriate equilibrium between demand and supply.
- 4.3.9 In this iterative process, the VDM calculates the growth in traffic demand across the network, between origin and destination pairs. Based on the origin-destination demand and the available highway network supply capacity, the NATS SATURN assignment model's algorithm calculates the equilibrium traffic flows on individual road links. The underlying principle of this equilibrium, or steady state, is outlined in DfT's WebTAG Unit M3.1 highway assignment modelling guidance:
- Traffic arranges itself on networks such that the cost of travel on all routes used between each OD (Origin-Destination) pair is equal to the minimum cost of travel and all unused routes have equal or greater cost.
- 4.3.10 Based on this approach VDM is applied to derive the demand impacts of both the without-Scheme scenario (Do Minimum) as well as the with-Scheme scenario (Do Something).
- 4.3.11 The overall forecasting approach is summarised in the flowchart in Figure 4.8.

Figure 4.8: Forecasting approach



Forecast years

4.3.12 The base year and forecast years are listed as follows:

- 2015 Base Year
- 2025 Opening Year
- 2040 Design Year (15 years after opening).

4.3.13 In the future year scenarios, 2025 and 2040, both Do Minimum (DM) and Do Something (DS) network scenarios were modelled. Hence the comparison of the DM and a DS provides the assessment of the Scheme's impacts in a given forecast year.

Traffic growth forecasts

4.3.14 The traffic forecasts are dependent on household and employment growth, which were derived from both local and national growth forecasts. The local growth forecasts consider the local authority growth projections and the national growth forecasts take wider anticipated growth into account.

4.3.15 The wider area national growth in car trips is derived from the DfT National Trip End Model (NTEM 7.2). This provides demographic projections in employment and population throughout the UK. The change in freight traffic (light and heavy goods vehicles) was derived from the DfT 2018 road traffic forecasts.

4.3.16 The local authority forecasts on development growth are derived from the uncertainty log. The uncertainty log details the local authority development schemes in regions which are both nearby and significant to the model. This includes assumptions on local uncertainty, which is dependent on whether developments or other planned transport schemes close to the Scheme are proposed. In addition to identifying each source of uncertainty in the local area, the uncertainty log lists the following information for each source:

- The core assumptions – describing the assumptions that have been made for the core scenario.
- The likelihood that the scheme or development will go ahead.
- The range of assumptions around each input or parameter and, if possible, information about the distribution.

4.3.17 The core scenario represents the most unbiased and realistic set of assumptions. It is intended to provide a sound basis for decision-making given current evidence. It must be robust and evidence-based taking on board various factors and noting uncertainties affecting travel demand in the future. In accordance with TAG guidance, the uncertainty log includes the management of the uncertainties required for formulating the core scenario.

4.3.18 The definition of each classification of likelihood is summarised in Table 4.1. Where a scheme or land use change is considered 'near certain' or 'more than likely', it will be included in the core scenario.

Table 4.1: Uncertainty log – classification of future inputs

Probability of the Input	Local Authority/Development Scheme	Core Scenario Assumption
<p>Near Certain</p> <p>The outcome will happen or there is a high probability that it will happen</p>	<ul style="list-style-type: none"> • Intent announced by the proponent to regulatory agencies • Approved development proposals • Projects under construction 	<p>This should form part of the core scenario</p>
<p>More than likely</p> <p>The outcome is likely to happen but there is some uncertainty</p>	<ul style="list-style-type: none"> • Submission of planning or consent application imminent • Development application within the consent process • Projects under construction 	<p>This could form part of the core scenario</p>
<p>Reasonably Foreseeable</p> <p>The outcome may happen, but there is significant uncertainty</p>	<ul style="list-style-type: none"> • Identified within a development plan • Not directly associated with the transport strategy/Scheme, but may occur if the strategy or scheme is implemented • Development conditional upon the transport strategy and scheme proceeding • Or, a committed policy goal, subject to tests (e.g. of deliverability) whose outcomes are subject to significant uncertainty 	<p>These should be excluded from the core scenario but may form part of the alternative scenarios</p>
<p>Hypothetical</p> <p>There is considerable uncertainty whether the outcome will ever happen</p>	<ul style="list-style-type: none"> • Conjecture based upon currently available information • Discussed on a conceptual basis • One of a number of possible inputs in an initial consultation process • Or a policy aspiration 	<p>These should be excluded from the core scenario but may form part of the alternative scenarios</p>

4.3.19 The categorisation and schedule for the potential developments included in the uncertainty log for the Thickthorn traffic forecasting was agreed in correspondence with Norfolk County Council.

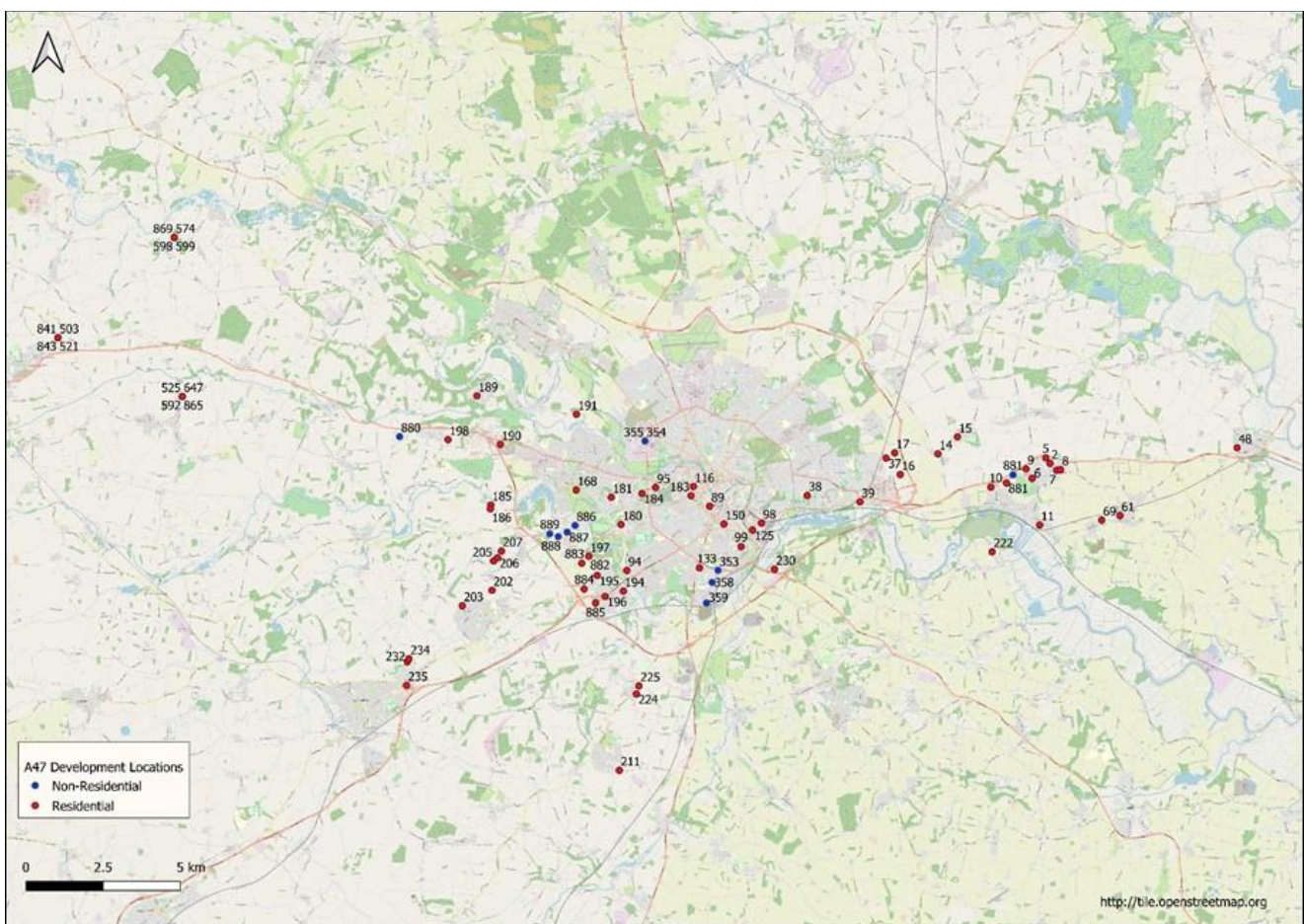
4.3.20 The ‘core’ scenario traffic growth forecast matrices representing car growth are calculated by spatially allocating development trips from the uncertainty log using trip

rates derived from the NTEM 7.2 data. Public Transport (PT) growth was fully based on NTEM 7.2 growth factors and LGV and HGV growth was derived using DfT RTF 2018 growth factors. A constraining process is then carried out to control the development growth in accordance with the overall growth forecast from the DfT.

Local developments

4.3.21 Following the TAG guidance, developments with the likelihood of at least ‘near certain’ or ‘more than likely’ were included in the forecast estimates. The locations of each development included within the uncertainty log can be seen in Figure 4.9.

Figure 4.9: NATS DM Development locations (wider area)



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4.3.22 Table 4.2 provides details of the local planned developments which have been included in the forecast modelling assessment. As per Table 4.1, all developments are attributed a status regarding their likelihood in the uncertainty log. The local planned developments included in Table 4.2 below are all regarded as ‘near certain’ or ‘more than likely’.

4.3.23 Figure 4.10 shows the location of the developments in the local area based on the uncertainty logs included in the NATS forecast. These developments are primarily located in Hethersett and Wymondham along the B1172 or in Cringleford along the

A11. In total eleven identified development sites are situated in the local area, with six in Cringleford, two in Hethersett and three in Wymondham. As discussed above in the Traffic Growth Forecasts section, the DfT National Trip End Model (NTEM 7.2) is used to accommodate for development growth in the wider area not defined in the uncertainty log.

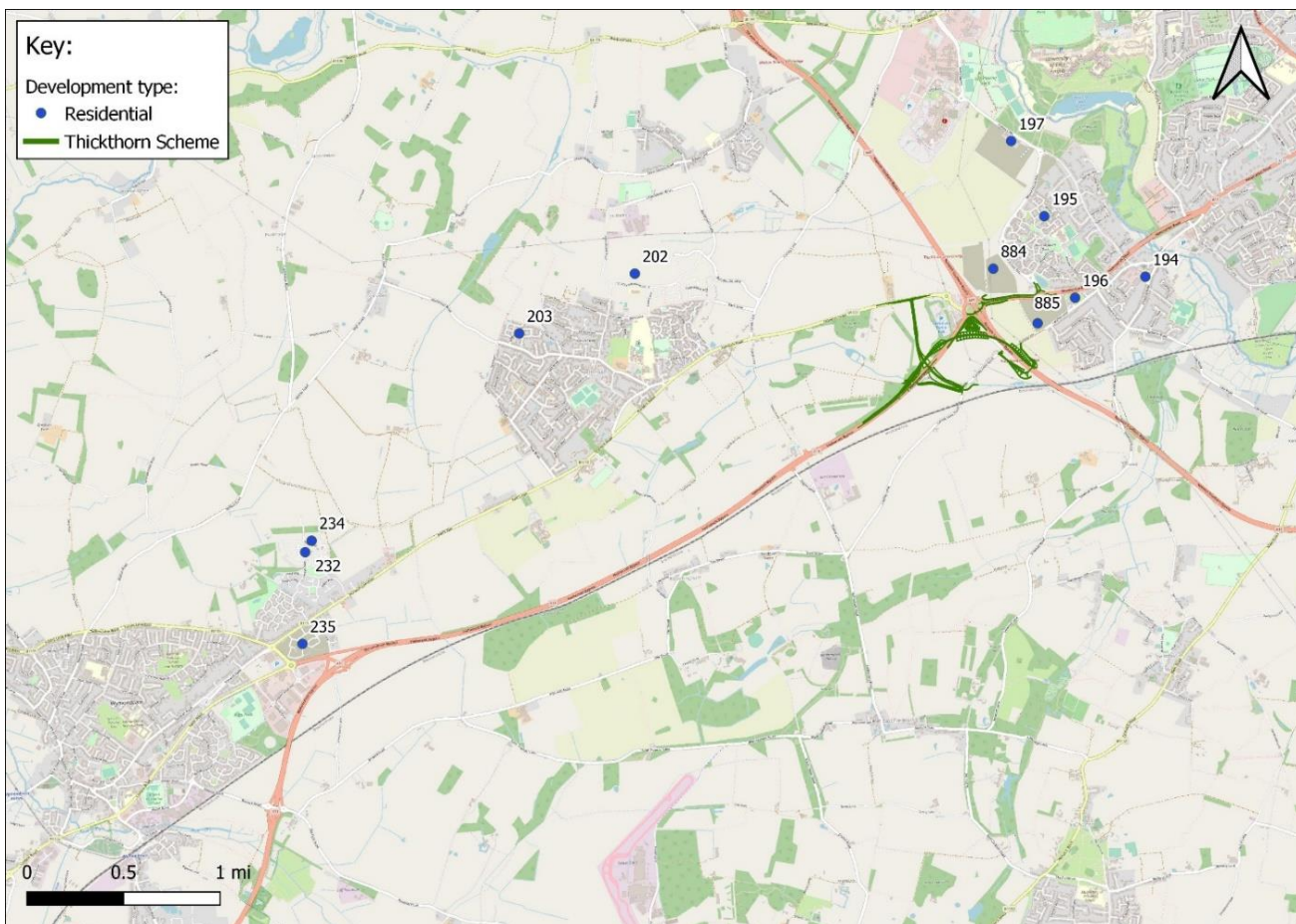
- 4.3.24 Included in the list of planned developments is a residential development located on land to the north of Hethersett village centre. The “Hethersett: North village” development includes plans for the delivery of over 1,000 new dwellings. The access junctions to the development site include new highway intersections along Colney Lane, Little Melton Road and Great Melton Road.
- 4.3.25 To the west of Hethersett, a number of residential developments are situated in the nearby village of Wymondham. In total, an allocation of approximately 1,000 dwellings in Wymondham have been included in the uncertainty log.
- 4.3.26 The West of Cringleford development, including 650 dwellings, is situated directly to the east of the A47/A11 Thickthorn Junction. The site is separated into two locations, north and south sections of the A11. Trips accessing the site will use the northern and southern arms of the Round House Way roundabout.
- 4.3.27 The current layout of the Round House Way Roundabout comprises three approach arms, including the A11 eastbound and westbound approach arms and the Round House Way side arm situated on the northern side of the junction. In the future year 2025 and 2040 scenarios a southern arm is included to allow access to the ‘West of Cringleford’ development. In addition, a dedicated left turn link is added to the roundabout to allow a free flow turning movement for A11 westbound to Round House Way northbound traffic.
- 4.3.28 In addition to the local residential developments, outlined in Table 4.2 below, the following local transport developments have been included:
- Improvements to Thickthorn Junction, including:
 - the signalisation of the B1172 Norwich Road approach arm
 - an additional lane for circulatory traffic on the roundabout.
 - Thickthorn Park and Ride expansion including an increase in parking capacity from 725 to 1,625 spaces.

Table 4.2: Local planned residential developments

Site Reference	Site name	District	Certainty	Type	Dwellings
194	Cringleford: Business Centre, Intwood Road	Cringleford	Near Certain	Residential	35
195	Cringleford: North of the A11/Round House Park (Polygons missing - multiple permissions)	Cringleford	Near Certain	Residential	286
196	Cringleford: Former Primary School site	Cringleford	Near Certain	Residential	10
197	Cringleford: Newfound Farm	Cringleford	Near Certain	Residential	5

Site Reference	Site name	District	Certainty	Type	Dwellings
202	Hetherset: North Village	Hetherset	Near Certain	Residential	1196
203	Hetherset: Great Melton Road	Hetherset	Near Certain	Residential	111
232	Wymondham: Carpenter's Barn	Wymondham	Near Certain	Residential	350
234	Wymondham: Rugby Club and land West of Elm Farm, Norwich Common Approved since April 2016	Wymondham	Near Certain	Residential	390
235	Wymondham: Norwich Road/Spinks Lane (Polygon missing)	Wymondham	Near Certain	Residential	259
884	West of Cringleford development (north of A11)	Cringleford	Near Certain	Residential	325
885	West of Cringleford development (south of A11)	Cringleford	Near Certain	Residential	325

Figure 4.10: Local planned developments



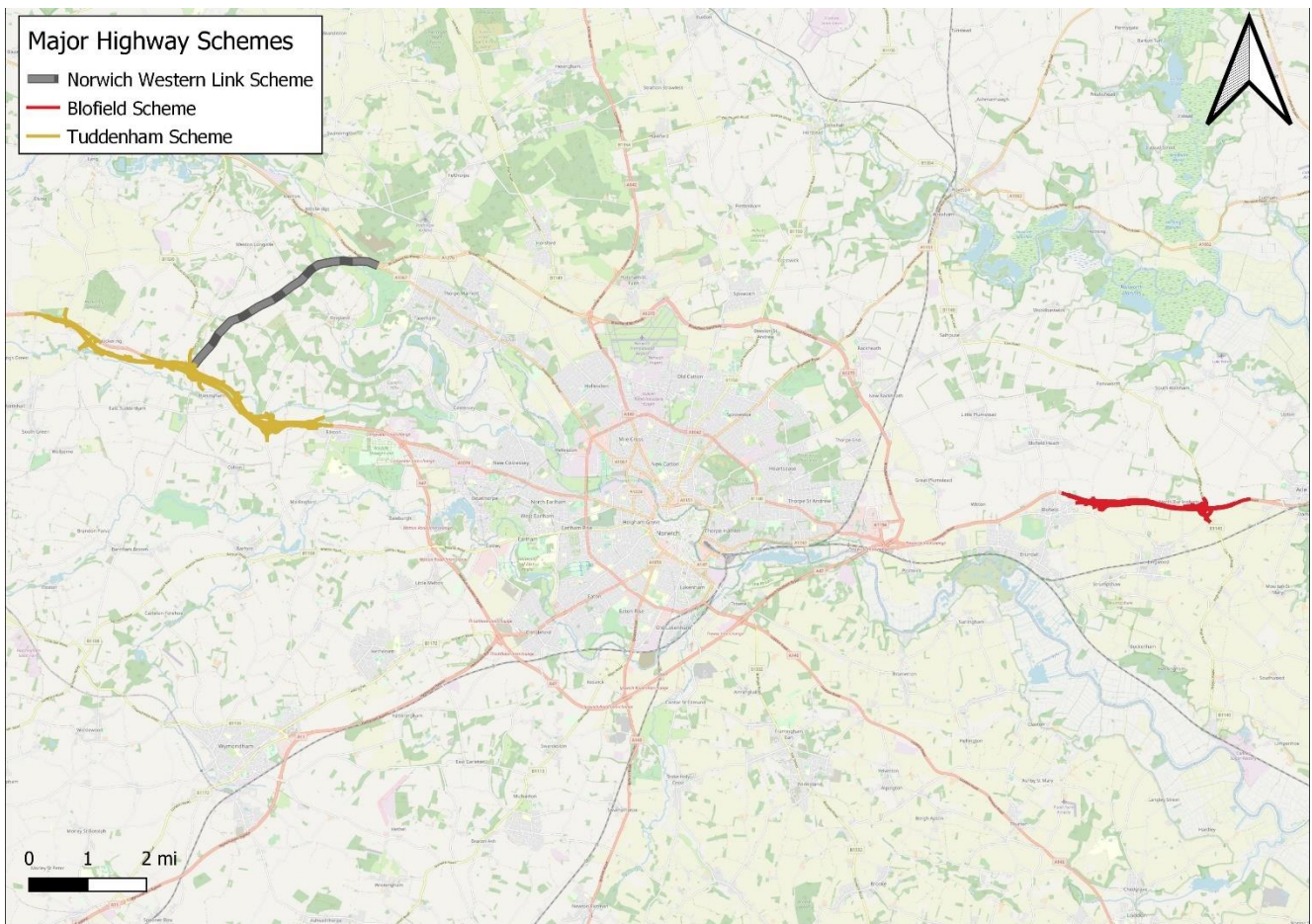
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4.4 Major Highway Schemes and Model Scenarios

- 4.4.1 The uncertainty log contains the significant local authority and the Applicant's schemes. Based on TAG guidance, the schemes included in the DM scenario have a likelihood of at least 'near certain' or 'more than likely'.
- 4.4.2 The uncertainty log contains the significant local authority and Highways England network Schemes. Based on TAG guidance, the schemes included in the DM scenario have a likelihood of at least 'near certain' or 'more than likely'.
- 4.4.3 The major highway schemes listed in the uncertainty log as 'near certain' or 'more than likely' include the Norwich Western Link (NWL) as well two RIS schemes: A47 North Tuddenham to Easton and the A47 Blofield to North Burlingham. Figure 4.11 shows the location of all the identified major highway schemes.

Figure 4.11: NATS DM network alterations (wider area)



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Core scenarios

- 4.4.4 The DM is defined as the core highway network scenario without the Scheme intervention, against which the Scheme is compared to create the do something (DS) scenario. As discussed, in the wider area network the Blofield and North Tuddenham schemes improvements are included.
- 4.4.5 In July 2019 the preferred route was announced for the NWL with the estimated start of construction in late 2022 and estimated opening year in 2025. The NWL is classified as ‘near certain’ and therefore was included in the DM scenario.
- 4.4.6 The Scheme included in the DS scenario is described in Section 3.5 of this report. Table 4.3 summarises the Scheme assumptions adopted in the DM and DS scenarios.

Table 4.3: DM/DS network assumptions

Scenario	Schemes Included			
	Thickthorn	Blofield	North Tuddenham	Other DM Schemes including NWL
DM	N	Y	Y	Y
DS	Y	Y	Y	Y

Overview of the operational modelling

- 4.4.7 A local area VISSIM²⁵ micro-simulation model has been constructed to aid the development of the Scheme design. The principal purpose of the micro-simulation model is to undertake a detailed operational assessment of the Scheme designs. This assessment is then used to inform and refine the Scheme layout. Micro-simulation models include a representation of the time-continuous movement of individual vehicles travelling across a highway network. This individual representation of driver behaviour provides a suitable tool to assess the detailed operation of the Scheme design.
- 4.4.8 The road network layout of the VISSIM model’s representation of the Thickthorn Junction is shown below in Figure 4.12. Further details of the Thickthorn Junction existing layout can be found in section 3.2 of this Case.

²⁵ VISSIM is a micro-simulation modelling software developed by the PTV Group, Germany:
<https://www.ptvgroup.com/en/solutions/products/ptv-vissim/>

Figure 4.12: Thickthorn VISSIM Model Junction Layout



- 4.4.9 The simulation periods are defined as:
- AM model 07:00 – 09:00 (peak hour 07:30 to 08:30)
 - PM model 16:15 – 18:15 (peak hour 16:45 to 17:45).
- 4.4.10 The simulation period is two hours which comprises a 30-minute ‘warm-up’ period to populate the network, followed by a modelled peak hour where evaluation results are extracted, followed by a 30-minute ‘cool-down’ period where evaluation traffic can complete their journeys. Figure 4.21: Thickthorn VISSIM model junction layout – Do Something 2040 illustrates the future year model layout.
- 4.4.11 The definitions of the VISSIM operational model time periods differ from the strategic NATS model (See Section 4.3), as the micro-simulation model considers individual vehicle movements and thus ‘warm-up’ and ‘cool-down’ periods are included to allow for queues to build up at the beginning of the peak hour and for all vehicles to finish their journey at the end of the peak hour. In addition to this, the NATS model represents the traffic peak hour (08:00-09:00, 17:00-18:00) for the wider area as shown in Figure 4.1, whereas the VISSIM model is specific to the Thickthorn Junction local traffic peak hour (07:30-08:30, 16:45-17:45).
- 4.4.12 The signals of Thickthorn Junction are controlled by MOVA (Microprocessor Optimised Vehicle Actuation). MOVA is a strategy for the control of traffic light signals at isolated junctions.
- 4.4.13 MOVA is designed to cater for the full range of traffic conditions, from very low flows through to a junction that is overloaded. Before congestion occurs, MOVA operates in a delay minimising mode; if any approach becomes overloaded, the system switches to a capacity maximising procedure. The system can vary stage timings every cycle according to demand at each approach using detectors on every approach lane. This

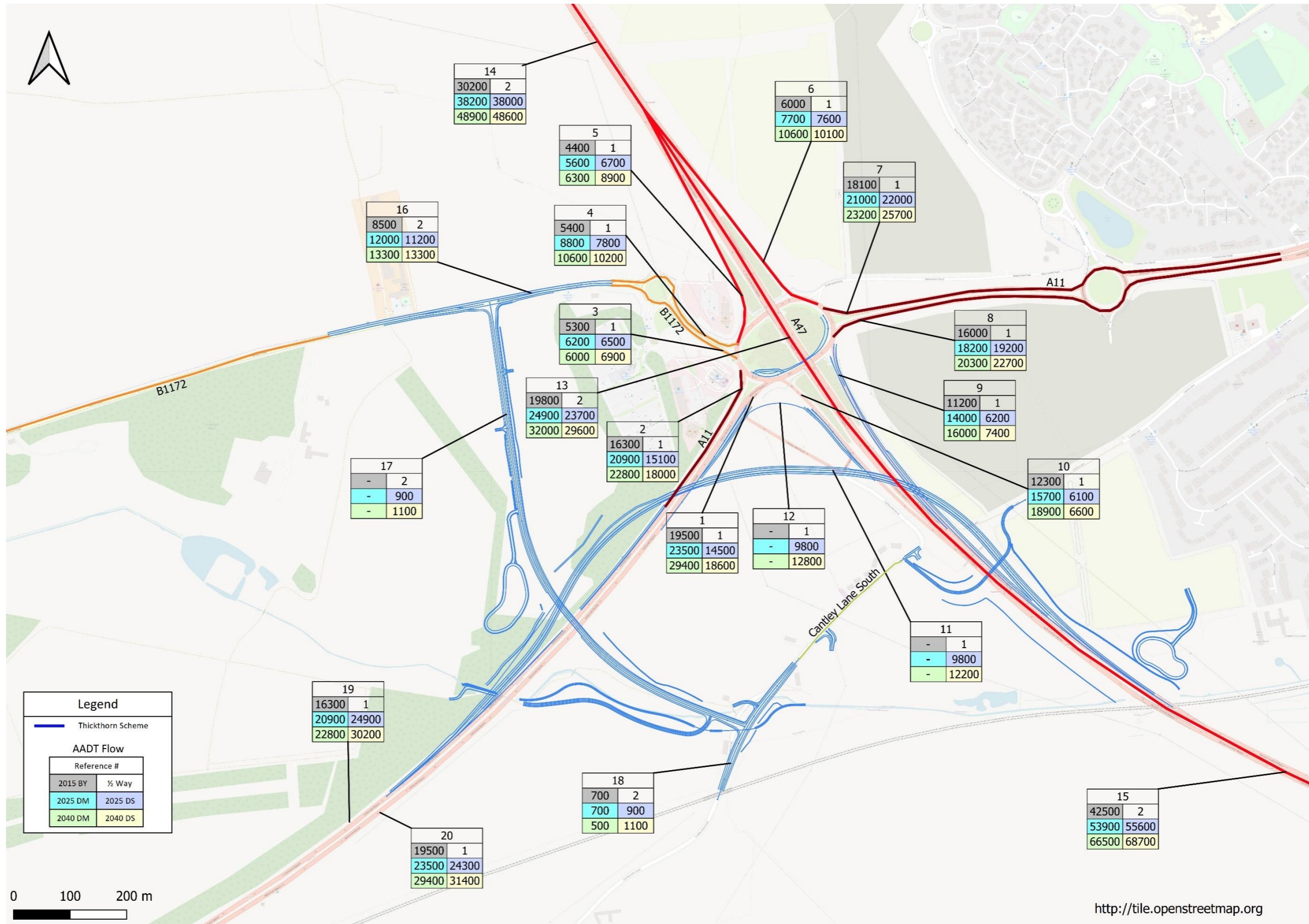
combination of operational modes allows the signal settings to optimise the traffic flows or minimise the delays across the junction.

- 4.4.14 PCMOVA is the implementation of MOVA within a computer (PC) environment that allows connection to microscopic simulation models. PCMOVA has been run as an external signal controller for VISSIM, to simulate the detailed operation of the junction. Current MOVA datasets have been produced by the Applicant.
- 4.4.15 The traffic demand used in the VISSIM model has been derived from the wider area NATS model via an interface which considers the local observed 2019 traffic count data. To assess the model's robustness and ensure it provides a suitable platform for evaluating the Schemes forecast year impacts, a separate VISSIM base year model validation exercise has been undertaken.
- 4.4.16 The Thickthorn VISSIM base year model achieved the DfT required validation criteria and is therefore considered fit for the purpose of assessing the operational performance of the Scheme.

4.5 Annual Average Daily Traffic (AADT) Flows

- 4.5.1 The core scenario forecast traffic flows for the Thickthorn Scheme area are shown in Figure 4.13 at an annual average daily traffic (AADT) level to the nearest 100 vehicles for each forecast scenario.
- 4.5.2 The AADT flows on the A11 west on-slip road (Location 1) and off-slip road (Location 2) are forecast to increase from 19,500 and 16,300 in the base scenario (2015) to 23,500 and 20,900 in the opening year (2025) respectively. In the design year (2040) in the DM scenario the A11 west on-slip and off-slip roads AADT flows have increased by 29,400 and 22,800 respectively; this represents an approximate increase of around 40% to 50% from 2015 to 2040.
- 4.5.3 In the DS scenarios, with the new A11/A47 connector road (eastbound direction) and dedicated left turn (westbound direction) in place forecasts on the two A11 slip roads (locations 1 and 2) are reduced by approximately 37% and 21% from the 2040 DM scenario respectively. This reduction in 2040 AADT flow, between DM and DS scenarios, is primarily due to eastbound traffic and westbound A11/A47 traffic rerouting on to the new Scheme links.

Figure 4.13: AADTs in Scheme area – Base and Do Minimum and Do Something



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4.6 Current Network Performance

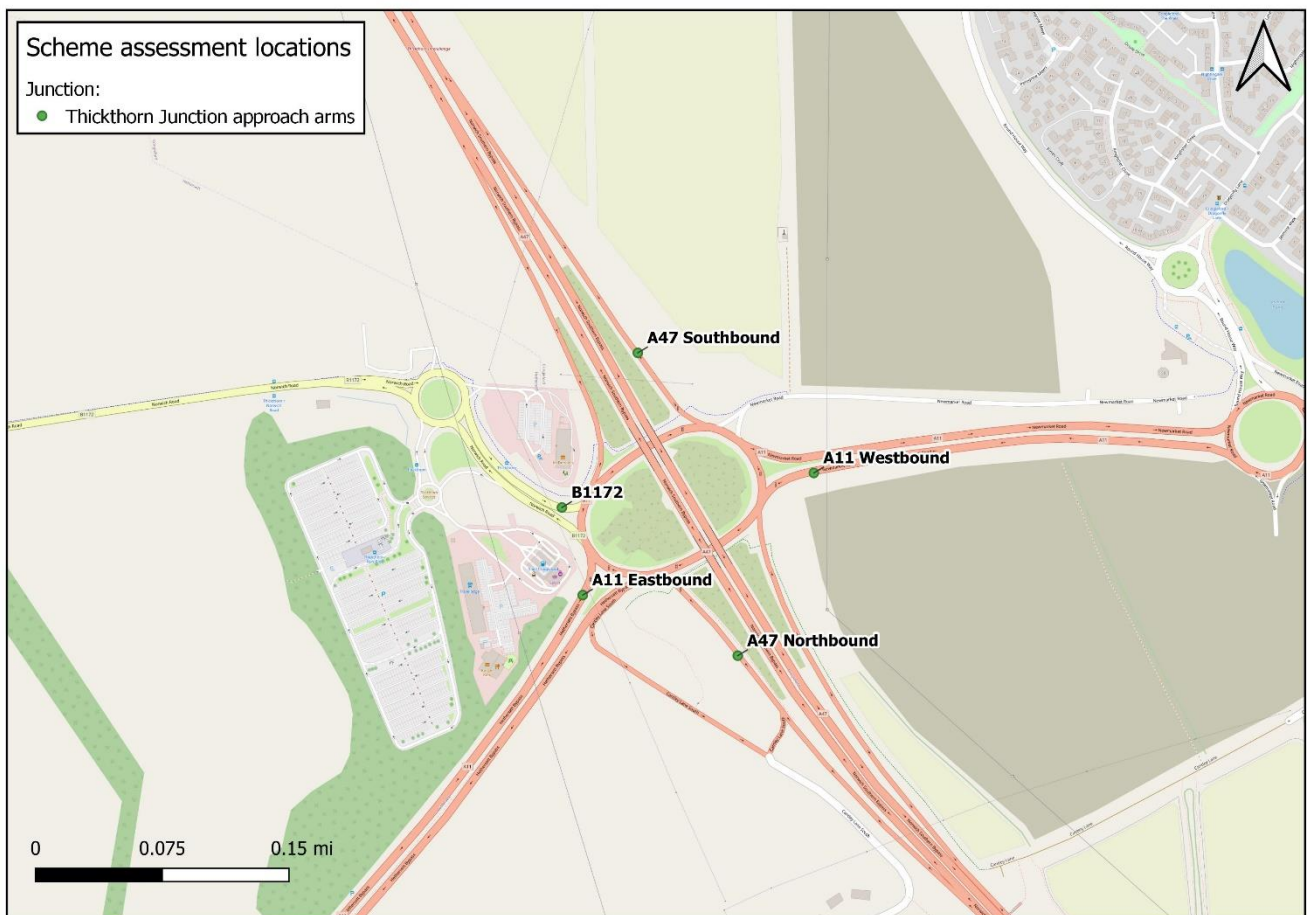
Introduction

- 4.6.1 This section provides an overview of the current operation of the road network. This assessment has been undertaken using the NATS SATURN highway network assignment base year model (2015).
- 4.6.2 This section also establishes the key links, junctions and journey time routes used for the assessment of the Scheme's impacts.

Overview of base year traffic flows and delays

- 4.6.3 The traffic flows shown are peak hour flows, in passenger car units (PCUs), for the AM and PM peaks. Figure 4.14 shows the locations of the base year traffic flow and delay assessment included in Tables 4.4 and 4.5.

Figure 4.14: Scheme assessment locations



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4.6.4 The Thickthorn Junction traffic flows range between 500 to 2,100 PCUs. The highest flows in both the AM peak and PM peaks are on the A11 eastbound arm approach in the eastbound direction. A47 northbound and A11 westbound traffic flows range between 1300 to 1800 PCUs. Traffic flows on the B1172 eastbound approach arm, from the B1172 park and ride roundabout located just to the north of the junction, approximately range between 700 to 500 PCUs. Therefore, the A47 and A11 approach arms are the primary movements at the Thickthorn Junction.

Table 4.4: 2015 Base year traffic flows

Link	Peak Hour Flow (PCUs)	
	AM Peak	PM Peak
A47 Northbound	1,662	1,311
A11 Eastbound	1,988	2,105
B1172	711	506
A47 Southbound	747	780
A11 Westbound	1,430	1,805

4.6.5 The base year modelled traffic delays at the Thickthorn junction are shown in Table 4.5. Volume over capacity ratios (V/C) are also shown in this table. The ratio of (volume of traffic) flow to capacity, is an indicator of the likely performance of a road link. According to DMRB guidance, a V/C ratio of 85% is acceptable.

4.6.6 The A11/A47 Thickthorn Junction is operating above or just below the available capacity on the A11 westbound and eastbound approach arms in both the AM and PM peaks (AM:112%, 87% PM: 91%, 92%). On average vehicles experience around 4.0 minutes of delay due to the traffic congestion on the A11 eastbound approach arm in the AM peak and 0.3 minutes in the PM peak. In addition to this, average traffic delays of 1.3 minutes are experienced on the B1172 approach arms (V/C ratio of 102%) in the AM peak and 92% in the PM peak.

Table 4.5: 2015 Base year traffic delay and V/C results

Link	Volume Over Capacity Ratio		Delay (Min)	
	AM Peak	PM Peak	AM Peak	PM Peak
A47 Northbound	81%	74%	0.4	0.3
A11 Eastbound	112%	91%	4.0	0.3
B1172	102%	92%	1.3	0.6
A47 Southbound	52%	63%	0.3	0.3
A11 Westbound	87%	92%	0.5	0.4

Summary

- 4.6.7 Traffic modelling analysis indicates that the A11 eastbound approach to Thickthorn Junction is operating above the desired capacity in particular during the AM peak with a V/C ratio of 112%. On average vehicles travelling eastbound along the A11 experience around 4 minutes of delay due to the traffic congestion in the AM peak and 0.3 minutes in the PM peak. In addition to this, average traffic delays of 1.3 minutes are experienced on the B1172 approach arms (V/C ratio of 102%).
- 4.6.8 In summary in the existing situation large traffic flows are accessing the Thickthorn Junction on the A47 eastbound, A11 westbound and A11 eastbound approach arms. Delays are present on the A11 eastbound and B1172 approach arms, particularly in the AM peak, due to the traffic demand exceeding the available junction capacity.

4.7 Future Year Network Performance

Introduction

- 4.7.1 This section provides an overview of the forecasted future year network performance as well the impacts of the Scheme based on the NATS traffic model. Traffic forecasts for 2025 and 2040 have been prepared using the modelling approach outlined in section 4.2 above. Using these models and assumptions DM and DS scenarios have been prepared. The comparison of these two scenarios enables the impacts of the Scheme to be evaluated.
- 4.7.2 The DM represents a without Scheme scenario, it includes all the changes unrelated to the Scheme that are considered more than likely to be in place prior to the respective future year.
- 4.7.3 The DS scenario includes the Scheme. The local development and transport infrastructure assumptions for both scenarios are detailed in section 4.2 above.

Do Minimum - traffic flow

- 4.7.4 Table 4.6 shows the forecasted change in traffic flows at Thickthorn Junction in the base year and 2025, 2040 DM for the AM and PM peak periods.
- 4.7.5 Overall, there is expected to be an increase in traffic throughout the network across the Norwich and wider Norfolk area. This traffic growth is derived from the modelling approach detailed in section 4.2 above. In summary, the growth in traffic at an individual link level is calculated by the NATS SATURN highway assignment model based on the available road capacity and the total network wide demand.

Table 4.6: 2025 and 2040 Do Minimum and Base Year (2015) traffic flows – Thickthorn Junction

Link	Base Year (2015) Peak Hour Flow (PCUs)		DM 2025/2040 Peak Hour Flow (PCUs)		% Change vs BY	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
2015 Vs 2025						
A47 Northbound	1,662	1,311	1,890	1,508	14%	15%
A11 Eastbound	1,988	2,105	1,956	1,921	-2%	-9%
B1172	711	506	1,216	1,069	71%	111%
A47 Southbound	747	780	874	904	17%	16%
A11 Westbound	1,430	1,805	1,526	1,995	7%	11%
Total	6,538	6,507	7,463	7,398	14%	14%
2015 Vs 2040						
A47 Northbound	1,662	1,311	2,030	1,724	22%	32%
A11 Eastbound	1,988	2,105	2,047	1,962	3%	-7%
B1172	711	506	1,210	1,315	70%	160%
A47 Southbound	747	780	1,184	1,053	58%	35%
A11 Westbound	1,430	1,805	1,691	2,044	18%	13%
Total	6,538	6,507	8,162	8,098	25%	24%

- 4.7.6 Along the A47 approach arms to the Thickthorn Junction 2025 traffic flows increase by around 14% to 17% in the AM peak and 15% to 16% in the PM peak. In the 2040 DM traffic increases by around 22% to 32%. Larger levels of growth are forecasted on the A47 southbound approach arm which starts from a lower baseline level of traffic.
- 4.7.7 On the A11 eastbound approach arm traffic levels stay approximately the same or decrease slightly in both 2025 and 2040 AM and PM peaks. This is due to the capacity constraints of the roundabout, present in the base year scenario, limiting the potential for growth in this direction. In the opposite directions on the A11 westbound approach traffic growth ranges from 7% to 11% in 2025 and 18% to 13% in 2040. As discussed in section 4.3 above, traffic growth along this arm will in part be driven by the West of Cringleford development.
- 4.7.8 The highest percentage growth levels in traffic are displayed on the B1172 approach arm (71% to 111% 2025, 70% to 160% 2040). Due to congestion along the A11 eastbound approach arm, in the DM scenario traffic growth from the Hethersett and Wymondham developments will be focused along the B1172.
- 4.7.9 Table 4.6 also shows the total approach arm traffic at the junction. Overall, the Thickthorn junction experiences a total traffic growth of around 14% in 2025 and 25% in 2040.

Do Minimum - traffic delays

4.7.10 The increase in traffic flows approaching the junction corresponds with the increase in delays and V/C ratios shown in Table 4.7.

Table 4.7: 2025 and 2040 Do Minimum and Base Year (2015) traffic delay and V/C results – Thickthorn Junction

Link	BY 2015				DM 2025/2040			
	Volume Over Capacity Ratio		Delay (Min)		Volume Over Capacity Ratio		Delay (Min)	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
2015 Vs 2025								
A47 Northbound	81%	74%	0.4	0.3	69%	64%	0.3	0.3
A11 Eastbound	112%	91%	4.0	0.3	110%	106%	3.4	2.1
B1172	102%	92%	1.3	0.6	87%	83%	0.4	0.4
A47 Southbound	52%	63%	0.3	0.3	61%	74%	0.3	0.3
A11 Westbound	87%	92%	0.5	0.4	92%	102%	1.1	0.8
2015 Vs 2040								
A47 Northbound	81%	74%	0.4	0.3	74%	73%	0.4	0.5
A11 Eastbound	112%	91%	4.0	0.3	115%	111%	5.0	3.6
B1172	102%	92%	1.3	0.6	86%	102%	0.4	1.1
A47 Southbound	52%	63%	0.3	0.3	83%	86%	0.4	0.3
A11 Westbound	87%	92%	0.5	0.4	102%	104%	2.1	1.6

- 4.7.11 Delays along the A11 eastbound approach arm are forecast to increase by approximately 1.8 minutes in 2025 during the PM peak (PM Peak: BY 0.3, 2025 DM 2.1) and 1.0 to 3.3 minutes in 2040 (AM Peak: BY 4.0, 2040 DM 5.0. PM peak: BY 0.3, 2040 DM 3.6). The largest increases in delay occur in the PM peak, along with V/C ratios increasing to greater than 100% (106%, 111%). It should be noted that the A11 eastbound approach arm has a V/C greater than 85% during both AM and PM in all of the base year, 2025 and 2040 scenarios.
- 4.7.12 Along the A11 westbound arm traffic delays are forecasted to increase in all scenarios (0.5 to 0.7 minutes in 2025 and 1.2 to 1.7 minutes in 2040) along with V/C ratios increasing above 100% in the 2040 scenario.
- 4.7.13 On the B1172 approach arm, despite an increase in traffic flows delays remain approximately in-line with, or reduce from, the base year. This is due to the signalisation of the B1172 approach arm in the DM. The introduction of the signals on the approach arm regulates the traffic flow accessing the roundabout and hence improves the junction capacity. Whereas, to access the junction in the existing situation vehicles at the priority stop line have to find a gap in the roundabout circulatory traffic flow.
- 4.7.14 In summary, in the DM scenario traffic growth between 2015 and 2025 will put additional pressure on the A7/A11 Thickthorn Junction. This will result in vehicles experiencing increased delay on key approach arms, particularly in the PM peak. Further traffic growth is forecasted between 2025 and 2040. This additional growth will exacerbate the existing congestion issues at the A47/A11 Thickthorn Junction.

4.8 Impact of the Scheme

Do Something - traffic flows

4.8.1 Table 4.8 shows the projected change in traffic flows between the DM and DS scenarios for the AM and PM peak periods in 2025 and 2040. The comparison of these two forecast scenarios shows the impact of the Scheme on traffic flows. Figure 4.15 and Figure 4.16 show the Thickthorn Junction approach arm peak hour traffic flows (PCU) to the nearest 10 for each forecast scenario and the 2015 base year.

Figure 4.15: Traffic flows at Thickthorn Junction – base and core scenario – AM peak (PCU)

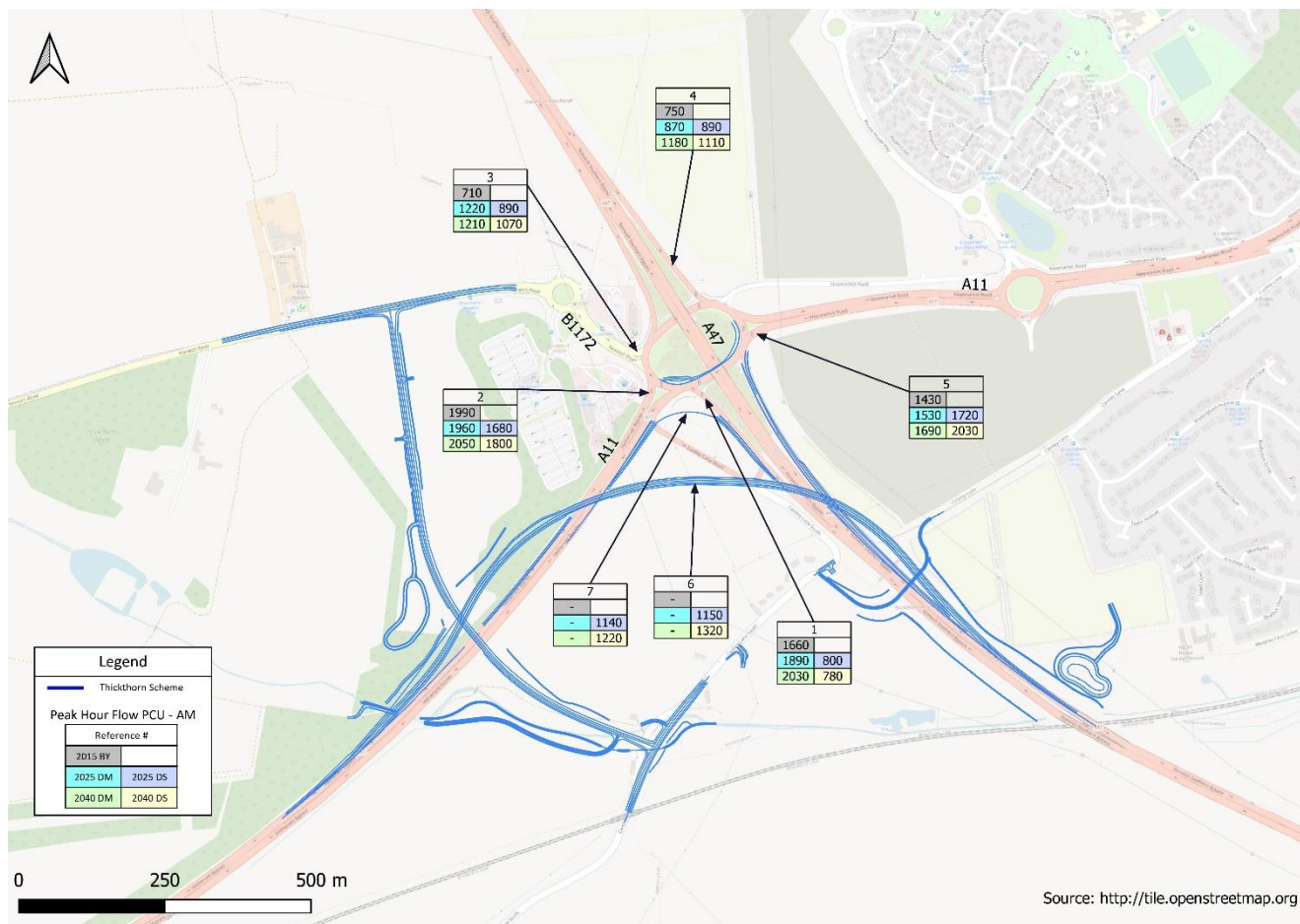


Figure 4.16: Traffic flows at Thickthorn Junction – base and core scenario – PM peak (PCU)

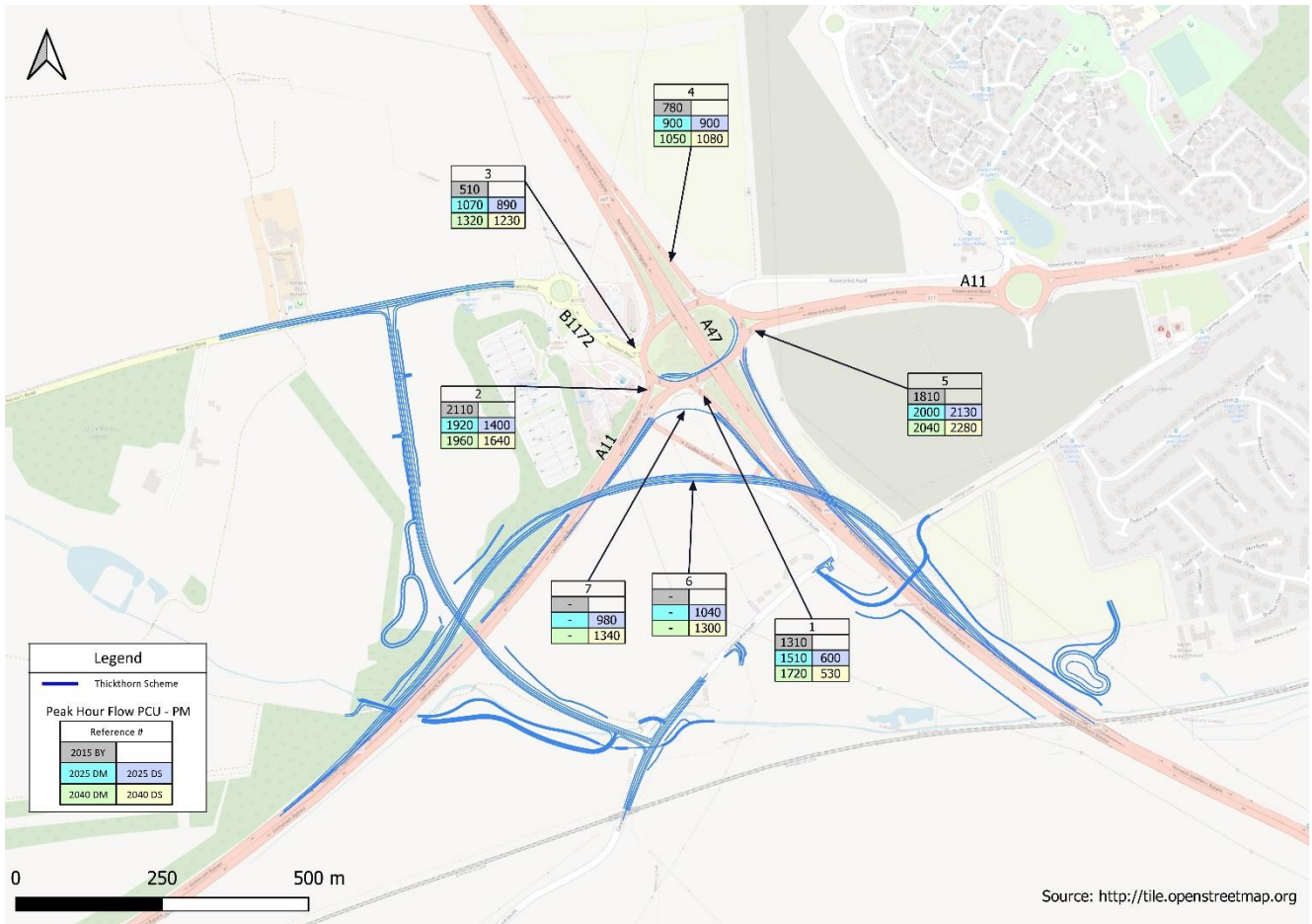


Table 4.8: 2025 and 2040 Do Something and Do Minimum traffic flows – Thickthorn Junction

Link	DM Peak Hour Flow (PCUs)		DS 2025/2040 Peak Hour Flow (PCUs)		% Change vs DM	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
DM Vs DS - 2025						
A47 Northbound	1,890	1,508	797	598	-58%	-60%
A11 Eastbound	1,956	1,921	1,683	1,402	-14%	-27%
B1172	1,216	1,069	885	888	-27%	-17%
A47 Southbound	874	904	892	899	2%	-1%
A11 Westbound	1,526	1,995	1,718	2,133	13%	7%
A11 to A47 EB connector road			1,150	1,043		
A47 to A11 WB dedicated left turn			1,138	980		
Total	7,463	7,398	8,262	7,943	11%	7%
DM Vs DS - 2040						
A47 Northbound	2,030	1,724	777	532	-62%	-69%
A11 Eastbound	2,047	1,962	1,795	1,636	-12%	-17%
B1172	1,210	1,315	1,066	1,231	-12%	-6%

Link	DM Peak Hour Flow (PCUs)		DS 2025/2040 Peak Hour Flow (PCUs)		% Change vs DM	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
A47 Southbound	1,184	1,053	1,113	1,080	-6%	3%
A11 Westbound	1,691	2,044	2,032	2,279	20%	12%
A11 to A47 EB connector road			1,323	1,296		
A47 to A11 WB dedicated left turn			1,223	1,342		
Total	8,162	8,098	9,329	9,395	14%	16%

4.8.2 The Scheme is forecast to cause a decrease in traffic flows approaching Thickthorn Junction. The A11 eastbound approach flow decreases by around 14% to 27% in 2025 and 12% to 17% in 2040. On the A47 northbound approach arm, traffic flows decrease by around 58% to 60% in 2025 and 62% to 69% 2040. This is due to traffic diverting to the proposed A11 to A47 eastbound connector road and the westbound dedicated left turn, which reduce the level of traffic approaching the roundabout. It is forecast that around 1,000 to 1,150 PCUs and 1,200 to 1,350 PCUs will use the Scheme's A11 to A47 links in 2025 and 2040, respectively.

4.8.3 The total traffic through the junction, based on the sum of all the approach arm flows including the eastbound connector road and the westbound dedicated left turn, is forecast to increase by 7% to 11% in 2025 and 14% to 16% in 2040.

Do Something - traffic delays

4.8.4 Table 4.9 shows the delays and volume over capacity ratios of the DS and DM 2025 and 2040 scenarios.

Table 4.9: 2025 and 2040 Do Something and Do Minimum traffic delay and V/C results – Thickthorn Junction

Link	DM				DS 2025/2040			
	Volume Over Capacity Ratio		Delay (Min)		Volume Over Capacity Ratio		Delay (Min)	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
DM Vs DS - 2025								
A47 Northbound	69%	64%	0.3	0.3	39%	29%	0.3	0.3
A11 Eastbound	110%	106%	3.4	2.1	95%	61%	0.4	0.3
B1172	87%	83%	0.4	0.4	63%	69%	0.4	0.4
A47 Southbound	61%	74%	0.3	0.3	62%	54%	0.3	0.3
A11 Westbound	92%	102%	1.1	0.8	56%	72%	0.3	0.3
A11 to A47 EB connector road					70%	64%	0.3	0.2
A47 to A11 WB dedicated left turn					57%	49%	0.0	0.0
DM Vs DS - 2040								
A47 Northbound	74%	73%	0.4	0.5	38%	26%	0.3	0.3
A11 Eastbound	115%	111%	5.0	3.6	101%	71%	0.7	0.3

Link	DM				DS 2025/2040			
	Volume Over Capacity Ratio		Delay (Min)		Volume Over Capacity Ratio		Delay (Min)	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
B1172	86%	102%	0.4	1.1	76%	96%	0.4	0.4
A47 Southbound	83%	86%	0.4	0.3	78%	65%	0.3	0.3
A11 Westbound	102%	104%	2.1	1.6	67%	77%	0.3	0.3
A11 to A47 EB connector road					81%	79%	0.4	0.4
A47 to A11 WB dedicated left turn					61%	67%	0.0	0.0

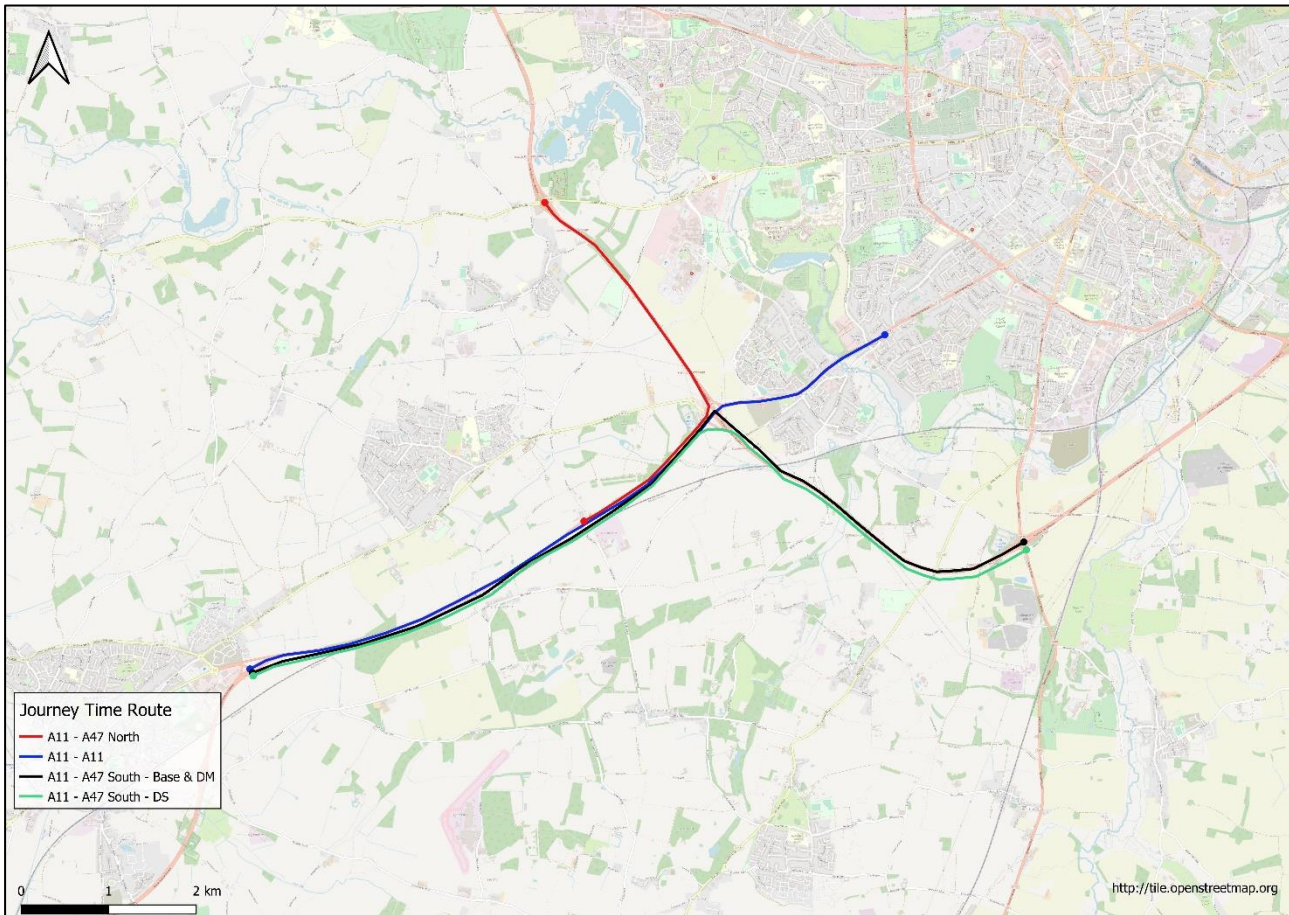
4.8.5 In the DS scenario delays on the A11 and A47 approach arms reduce to around 0.3 to 0.4 minutes in 2025 and 0.3 to 0.7 minutes in 2040. In particular, along the A11 eastbound approach arm this equates to a substantial reduction in delay of around 2 to 3 minutes in 2025 and 3 to 4 minutes in 2040. Furthermore, apart from the A11 eastbound approach in the AM peak and the B1172 approach in the PM peak, V/C ratios decrease to well within the acceptable range of less than 85%. This indicates that the introduction of the Scheme would reduce traffic approaching the roundabout to an extent where the traffic signal-controlled approach arms operate without any significant over capacity delays.

Overview of journey time routes

4.8.6 Analysis of journey time routes across the junction capture the change in congestion related delays across the A47 and A11 corridors. Thus, the comparison of DM and DS journey times across these sections highlight the positive benefits of the Scheme in terms of relieving congestion. The following journey time routes, shown in Figure 4.17, have been selected for this assessment:

- A11 to A47 via Thickthorn Junction: between the A47/A140 and A11/B1135 junctions
- A11 to A11 across Thickthorn Junction: between the A11/Poplar Avenue and the A11/B1135 junctions
- A11 to A47 via Thickthorn Junction: between the A47/B1108 and A11/Station Road junctions

Figure 4.17: A11 and A47 Journey time routes



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Journey times

- 4.8.7 To assess the impact of the Scheme on the A47 and A11 journey times, analysis has been carried out between the DS, DM and base year scenarios for the two key journey time routes identified in Figure 4.17. The results are reported in Table 4.10.
- 4.8.8 Table 4.10 shows that the largest journey time savings are derived from the eastbound A11 to A47 routes (A11/B1135 - A47/A140 (EB) & A11/Station Rd - A47/B1108 (NB)
- 4.8.9 in the AM and PM peaks, with approximately 3 minutes saving in 2025 and 4 minutes saving in 2040. This represents a reduction of approximately 30%-50% in the total journey time across the route.
- 4.8.10 Along the A11, the through junction route has similar journey time savings of 2 to 3 minutes (23% to 30%), derived from the AM and PM 2025 and 2040 comparisons. In the inter peak period, eastbound journey time savings range from 0.1 to 2 minutes.
- 4.8.11 The results clearly show the Scheme will provide substantial journey time savings for eastbound traffic movements in both the AM and PM peaks. These savings are due to the capacity enhancements provided by the new connector road (eastbound direction). This connector road will reduce journey times for A47 to A11 traffic as they

will be able to travel across a free flow separated link. In turn this will also improve A11 cross junction journey times, as a reduced volume of traffic will approach the Thickthorn Junction because A11 to A47 movements will divert to the new connector road.

4.8.12 In the westbound direction, moderate journey time savings of 0.1 to 1.8 minutes are achieved from the Scheme. The largest journey time savings, of 11% to 20%, are provided by the AM peak along the A11 cross junction route. These journey time savings are due to the dedicated left turn introduced in the DS scenario.

Table 4.10: 2025 and 2040 Do Something and Do Minimum journey time comparison (minutes)

Route/Direction	Scenario	2025			2040		
		AM	IP	PM	AM	IP	PM
A11/B1135 - A47/A140 (EB)	2015 Base	11.6	7.3	7.9	11.6	7.3	7.9
	DM	12	7.6	10.5	13.7	8.8	12.6
	DS	8.2	6.5	7.3	9.7	6.9	8.3
	DS - DM	-3.8	-1.1	-3.2	-4	-2	-4.3
	DS - DM % difference	-32%	-14%	-30%	-29%	-23%	-34%
A47/A140 - A11/B1135 (WB)	2015 Base	7.1	6.5	7	7.1	6.5	7
	DM	7.5	6.6	7.3	9.2	7	8.6
	DS	7.3	6.4	7.2	8.7	6.8	8.3
	DS - DM	-0.2	-0.1	-0.1	-0.4	-0.2	-0.3
	DS - DM % difference	-3%	-2%	-1%	-4%	-3%	-3%
A11/B1135 - A11/Poplar Ave (NB)	2015 Base	10.5	6.4	6.7	10.5	6.4	6.7
	DM	10.5	6.5	9	12.1	7.6	10.6
	DS	7.5	6.4	6.9	8.7	6.6	7.4
	DS - DM	-3	-0.1	-2.1	-3.3	-1	-3.2
	DS - DM % difference	-29%	-2%	-23%	-27%	-13%	-30%
A11/Poplar Ave - A11/B1135 (SB)	2015 Base	6.7	6.2	6.7	6.7	6.2	6.7
	DM	7.5	6.1	7.3	9	6.8	8.7
	DS	6.7	6.2	6.8	7.3	6.5	7.7
	DS - DM	-0.8	0.1	-0.5	-1.8	-0.3	-1
	DS - DM % difference	-11%	2%	-7%	-20%	-4%	-11%
A11/Station Rd - A47/B1108 (NB)	2015 Base	7.0	3.3	3.4	7.0	3.3	3.4
	DM	7.2	3.4	5.9	8.6	4.5	7.6
	DS	3.8	3.3	3.6	4.6	3.4	4.1
	DS - DM	-3.4	-0.1	-2.3	-4	-1.1	-3.6
	DS - DM % difference	-47%	-3%	-39%	-47%	-24%	-47%
A11/Station Rd - A47/B1108 (SB)	2015 Base	4.1	3.9	4.1	4.1	3.9	4.1
	DM	4.2	3.9	4.2	4.6	4.1	4.7
	DS	4.4	4.1	4.4	4.8	4.3	5
	DS - DM	0.2	0.2	0.2	0.3	0.2	0.3
	DS - DM % difference	5%	5%	5%	7%	5%	6%

Wider network statistics

- 4.8.13 Network wide average speeds have been extracted from the NATS model for the wider area. The average speed statistics represent a weighted average of all trips travelling across the wider network within the specified time periods.
- 4.8.14 The overall average speeds are displayed in Table 4.11. In both 2025 and 2040, there is a relative improvement in network speeds in the DS scenario in the order of 0.6% to 1.1% in the AM and PM peak periods. Overall, this indicates that the Scheme will have a positive impact in terms of improving the operation of the wider network. The global statistics are calculated over the entire NATS study area (see Figure 4.1), which contains all of Norwich as well as the wider Broadland and South Norfolk area. Therefore, deriving a network wide increase in average speeds of 0.6% to 1.1%, from the implementation of the Scheme, is considered to represent a considerable improvement in the overall operation of the network.

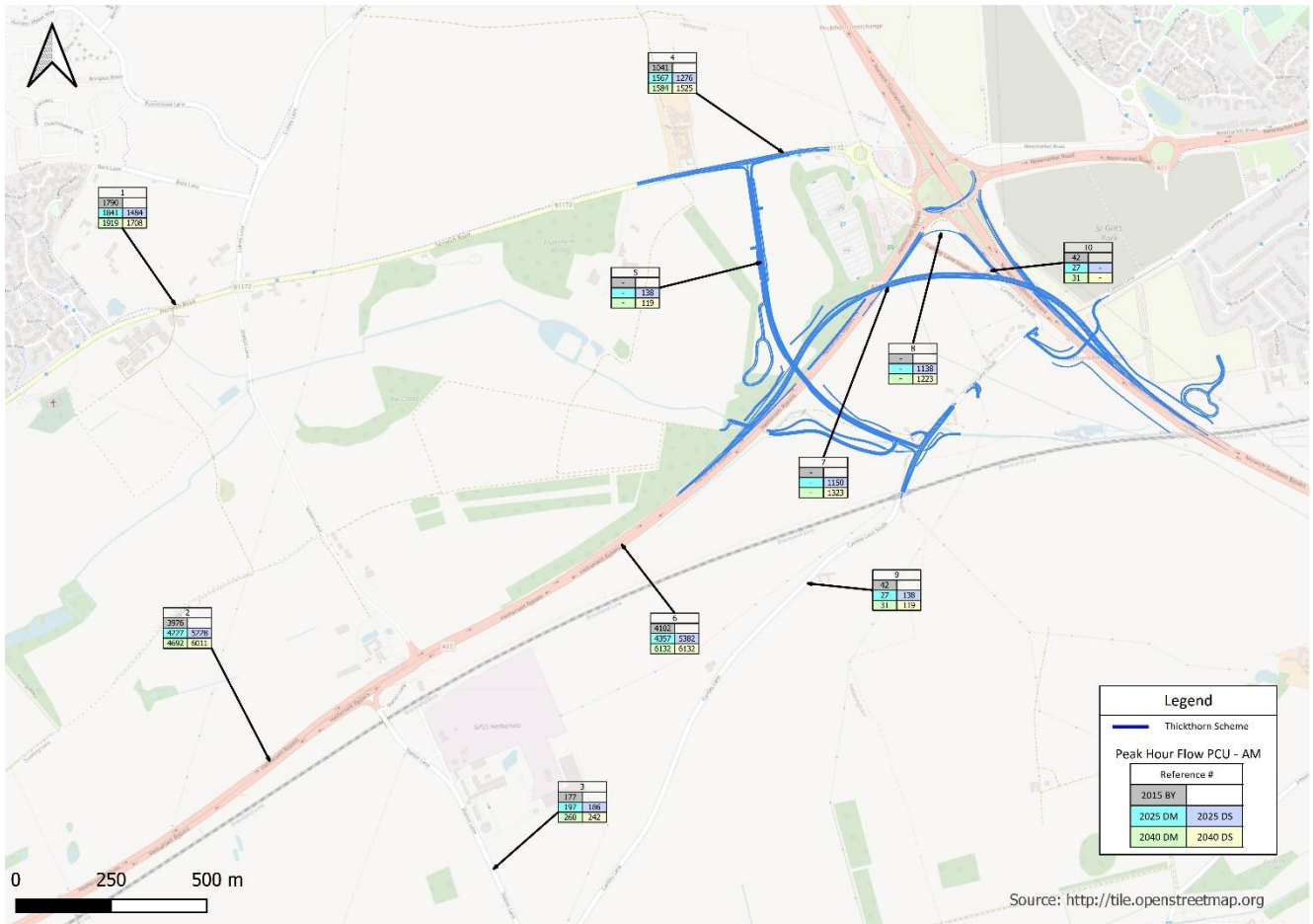
Table 4.11: SATURN simulation network overall average speed (km/hr)

Scenario	AM	IP	PM
2025 DM	48.2	51.9	47.9
2025 DS	48.6	51.9	48.2
2025 DS- DM	0.4	0	0.3
2025 DS- DM % difference	0.8%	0.0%	0.6%
2040 DM	45.5	51.6	45.4
2040 DS	46	51.8	45.8
2040 DS- DM	0.5	0.2	0.4
2040 DS- DM % difference	1.1%	0.4%	0.9%

Impact of the Scheme on the local road network

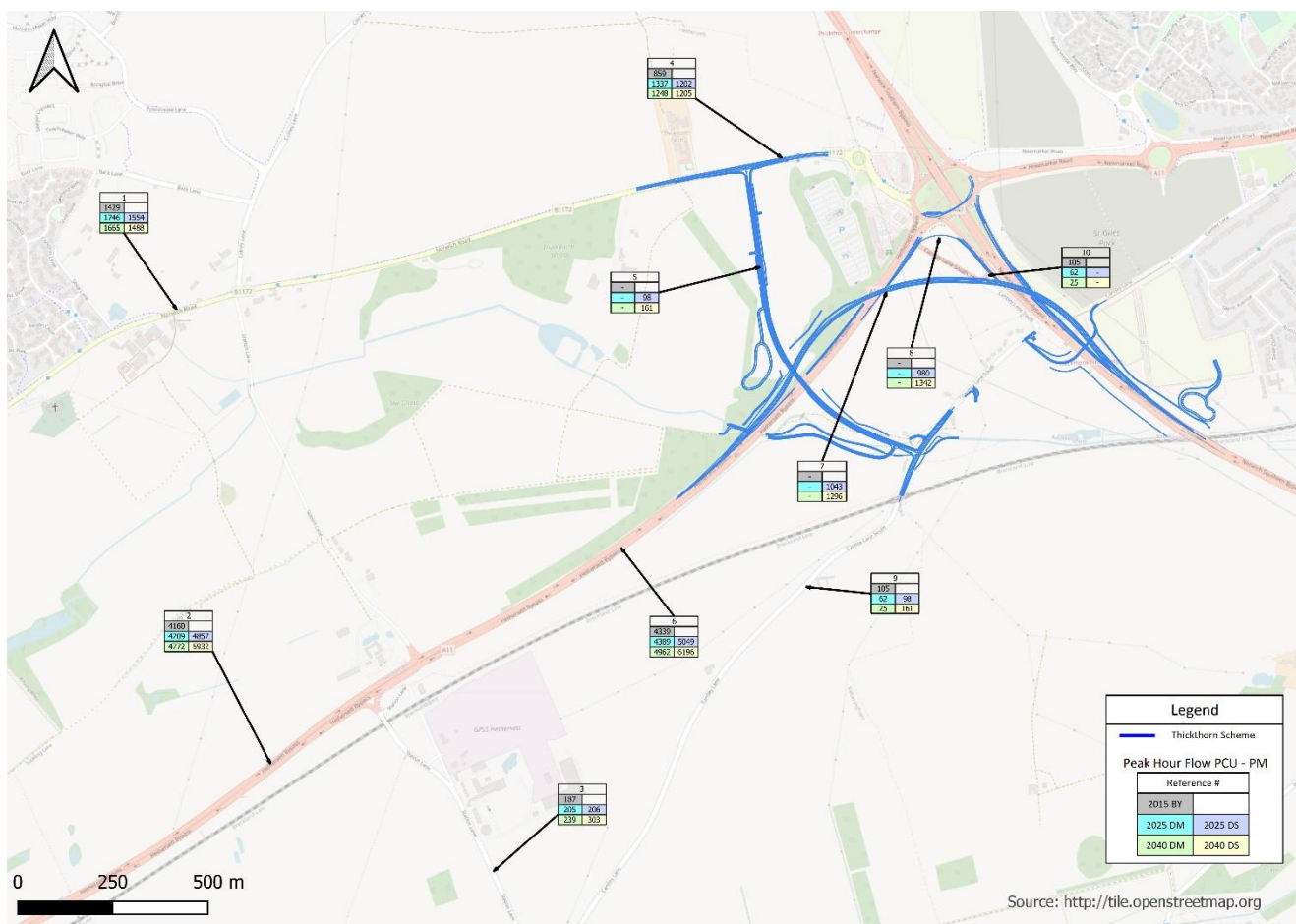
- 4.8.15 Figures 4.18 and 4.19 show the local road network two-way peak hour traffic flows (PCUs) to the nearest 10 for each forecast scenario. The sites identified in this figure represent the local road network included in the NATS model.
- 4.8.16 The results of the NATs model indicate that the Scheme has a relatively minor impact on traffic flows on Cantley Lane South and Station Lane. In general terms, the Scheme will result in a traffic flow increase in the range of 10 to 300 PCUs. Cantley Lane South (Location 9) experiences a minor traffic flow increase of around 40 to 140 PCUs in the AM and PM peaks. Along Station Road south of the A11 (Location 3) the Scheme will result in an increase in traffic of approximately 60 PCUs in the 2040 PM peak scenario. Traffic flows along the B1172 (Location 1 and 4) are forecasted to decrease by around 40-350 PCUs, this is due to traffic diverting on to the A11 in the DS scenario.

Figure 4.18: AM Peak Local Traffic Flows (PCU 2-way) – Base and Do Minimum and Do Something



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Figure 4.19: PM Peak Local Traffic Flows (PCU 2-way) – Base and Do Minimum and Do Something



Park and ride expansion

- 4.8.17 The NATS model includes the Thickthorn Park and Ride in its SATURN highway assignment component. Within the SATURN model park and ride trips into Norwich city centre are modelled using pseudo links representing the public transport part of the journey. These park and ride pseudo links are calibrated in the base year to ensure the that the NATS model provides an accurate representation of the 2015 existing situation.
- 4.8.18 Figure 4.20 shows the location of the Thickthorn Park and Ride as well as the parking capacity for the existing situation and the proposed expansion. Table 4.12 shows the forecasted park and ride traffic flow growth, between, the Base Year and DS 2040 scenario. The traffic flows are focused in the inbound direction in the AM peak and outbound direction in the PM peak to represent trips entering the park and ride in the morning and leaving in the evening. In the inter peak park and ride traffic flows are evenly balanced between the inbound and outbound directions and are relatively lower than the AM and PM peak hours.

4.8.19 The traffic flows forecasted by the NATS model have been used in the ARCADY²⁶ junction modelling assessment discussed in section 4.9 below. The ARCADY modelling assessment evaluates the operation of the junction, with respect to queuing and delays, in the 2040 DS scenario.

Figure 4.20: Existing Thickthorn Park and Ride location

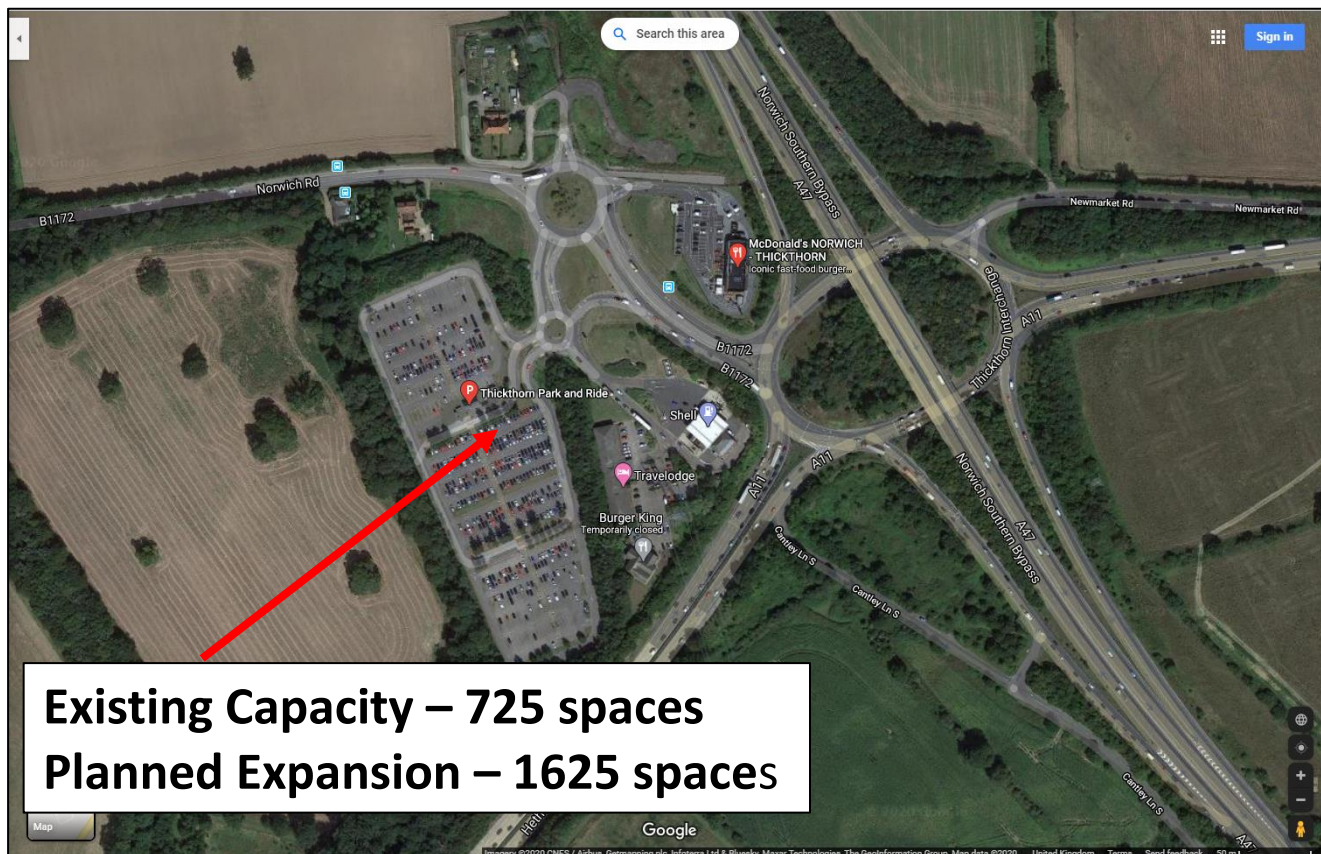


Table 4.12: 2040 Do Something and Base Year traffic flows – P&R (vehicles)

Scenario	Capacity	AM		IP		PM	
		Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
2015 Base Year	725	165	-	36	40	-	177
2040 DS	1625	329	-	91	73	-	732
Traffic Growth		164		55	33		555

4.9 Operational Modelling Assessment

Introduction

4.9.1 The VISSIM operational model has been adopted to undertake a detailed assessment of the Scheme’s performance at Thickthorn Junction and the immediate local network. This assessment is used to inform and refine the Scheme layout. Iterative test runs are undertaken to ensure the detailed aspects of the design, such as lane allocations

²⁶ ARCADY (Assessment of Roundabout Capacity And Delay) is software, produced by the Transport Research Laboratory (UK), for modelling traffic capacity, queues and delays at roundabouts.

and signal timings, are suitable to accommodate the NATS models DS demand forecasts.

- 4.9.2 The road network layout of the VISSIM model's representation in the DS scenario is shown below in Figure 4.21. This section outlines design refinements resulting from the initial rounds of operational modelling. These early iterations highlighted queueing on the B1172 approach in the 2040 design year. Design refinements were made to improve the operation of Thickthorn Junction to increase vehicle throughput and reduce predicted queueing, particularly on the B1172.
- 4.9.3 Based on the VISSIM analysis, a four-lane section on the north-western side of the roundabout and three lanes on the A11 eastbound exit arm have been included. In addition to this the VISSIM model has been used to evaluate the B1172/Cantley Lane junction, the additional successive southbound A47 merge slip and sensitivity tests to assess the effect of removing the B1172 bus lane. These aspects of the Scheme design are discussed in more detail within this section.

Figure 4.21: Thickthorn VISSIM model junction layout – Do Something 2040



B1172 bus lane

- 4.9.4 The existing layout of the Thickthorn Junction includes a bus lane, approximately 100m in length, along the B1172. The B1172 bus lane is primarily used by buses exiting the Thickthorn Park and Ride facilities. The park and ride operates with an exit frequency of approximately one bus every ten minutes.
- 4.9.5 Initial model results highlighted queueing on the B1172 in the 2040 design year, with queues extending to the B1172/McDonald's roundabout. A sensitivity test was undertaken to assess the effect of removing the existing 100m bus lane on the B1172 between B1172/McDonald's roundabout and the Thickthorn Junction and opening the lane to general traffic. This sensitivity test was undertaken to evaluate the requirement for the allocation of a bus lane in the future year 2025 and 2040 scenarios, when the B1172 approach to the Thickthorn Junction is signalised. This assessment involved evaluating any potential benefits, to both general traffic and buses, derived from reallocating the bus lane to increase the approach arms stacking capacity.

- 4.9.6 Journey time benefits are predicted for both general traffic and buses when the bus lane is removed. Journey time benefits are limited in 2025 year of opening, but increase in 2040 to savings of up to 20% for general traffic. Buses also benefit with journey time savings of up to 14% in 2040. Removing the bus lane improves the capacity of the signalised B1172 approach, providing additional stacking capacity to general traffic. This helps to prevent queues extending beyond the B1172/McDonald's roundabout which can impact buses.
- 4.9.7 Figure 4.22 shows the VISSIM model's queue length results for the base year scenario as well as the proposed four lane B1172 layout with and without the bus lane. Table 4.13 shows the journey time results for both buses and general traffic along the route shown in Figure 4.23 VISSIM journey time analysis route.
- 4.9.8 The queue length results indicate that, despite the increase in 2040 traffic, the 'without bus lane scenario' queue lengths will be roughly in line with the base year situation.
- 4.9.9 In summary, the results indicate that removing the bus lane reduces the queue lengths and any associated delay in the 2040 DS scenario. However, the results show limited benefit in removing the bus lane in 2025. Therefore, the proposal to remove the B1172 bus lane will be revisited after the Scheme's opening year (2025)

Figure 4.22: 2040 Do Something VISSIM queue length analysis (07:30-08:30, meters)

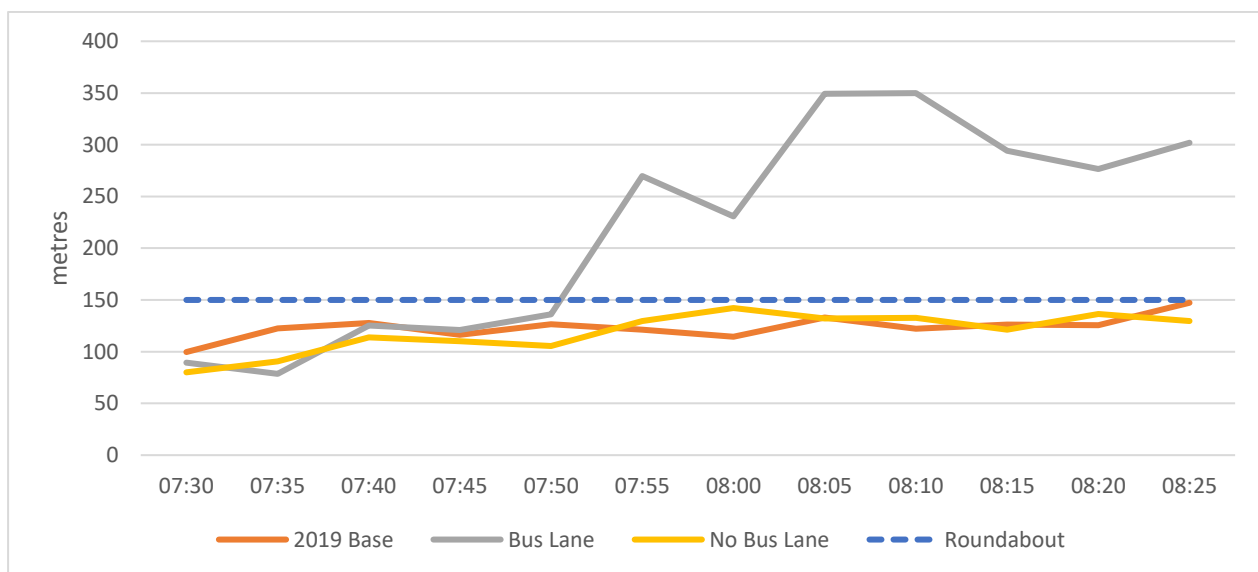


Figure 4.23: VISSIM journey time analysis route

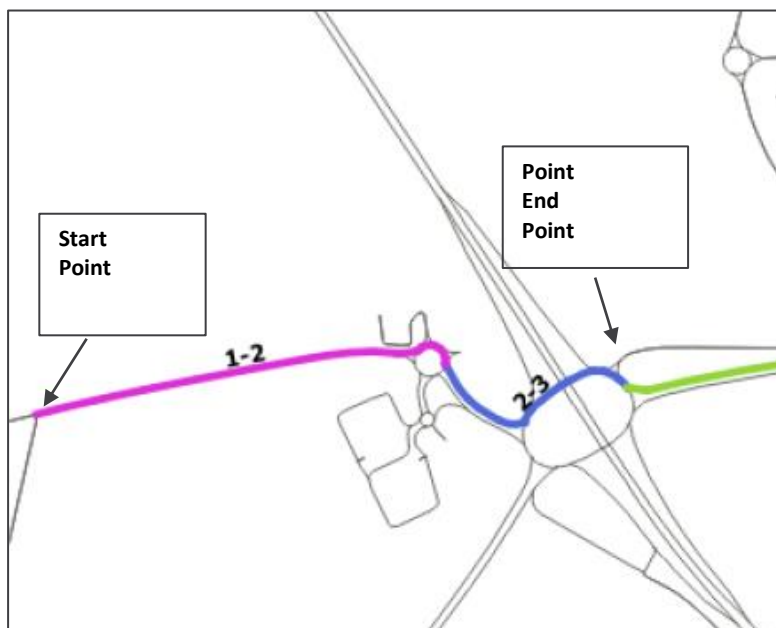


Table 4.13: 2040 Do Something VISSIM journey time analysis (07:30-08:30, seconds)

Vehicle Type	2019 Base	2025	2025 no bus lane	2040	2040 no bus lane
All Vehicles Journey Times	117	126	123	173	139
Bus Journey Times	122	169	152	193	167

Cantley Lane/B1172 junction

- 4.9.10 The DS scenario includes an overbridge across the A11, linking Cantley Lane South to the B1172. This overbridge improves accessibility for the north-south local trips to the west of the A47 corridor and ensures Cantley Lane South is connected on to the primary road network.
- 4.9.11 The VISSIM model was used to assess operation of the proposal ghost island junction at Cantley Lane/B1172 in the 2040 design year. Maximum queue results and vehicle delays were extracted from the model at the Cantley Lane approach to the junction. Queue results predict that maximum queues do not exceed 25m through the AM peak hour, indicating queues do not exceed six vehicles. Predicted average delay per vehicle for right-turners on the Cantley Lane approach is 12 seconds. These results indicate that the proposed junction is operating satisfactorily without significant queues or delay in the 2040 design scenario.

B1172/McDonald's roundabout

- 4.9.12 In order to assess the operational performance of the B1172/McDonald's roundabout junction, ARCADY analysis was undertaken for the 2040 DS scenario. Table 4.14 presents the delay, queue and ratio of flow to capacity (RFC) results from the ARCADY assessment. As outlined in section 4.7 above, the forecast flows used the ARCADY assessment include the proposed expansion of the Thickthorn Park and Ride capacity.

4.9.13 The model results show that all arms will remain well within capacity for both the AM and PM peak hours, with the B1172 westbound being the only exception during the AM peak with an RFC of 0.91. While this exceeds the 0.85 threshold, the arm remains within capacity, recording queues of less than 10 vehicles.

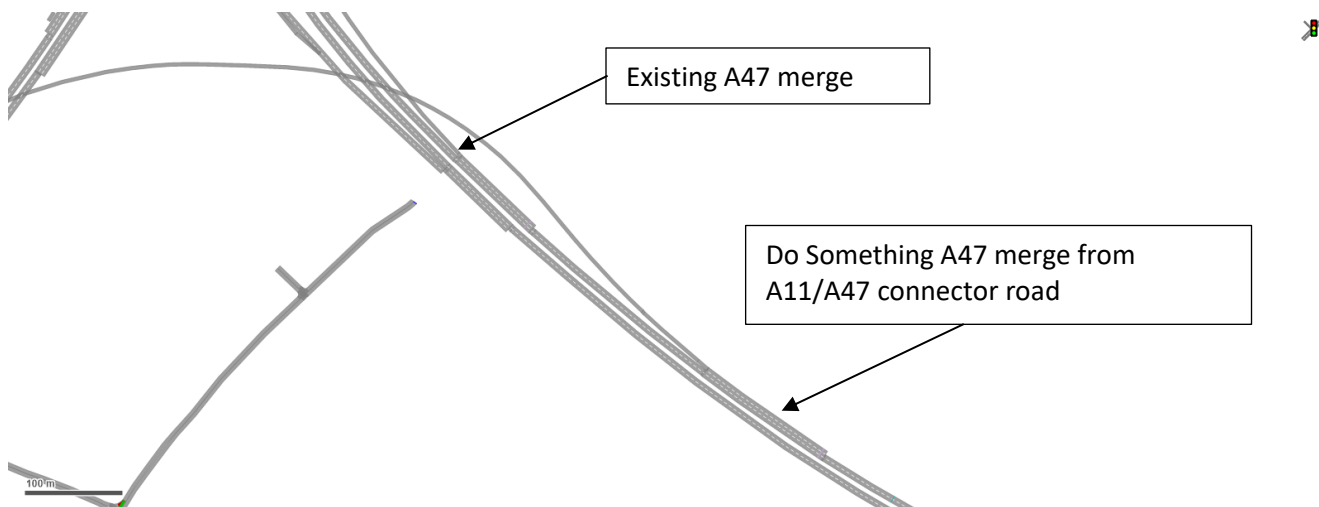
Table 4.14: ARCADY summary of junction performance – 2040 Do Something

Side Arm	AM			PM		
	Queue (Veh)	Delay (s)	RFC	Queue (Veh)	Delay (s)	RFC
1 – McDonalds	0.4	18.55	0.27	0.8	16.88	0.45
2 – B1172 east	0.4	2.6	0.28	0.4	2.43	0.29
3 – Park and ride	0.1	2.6	0.09	0.6	3.69	0.37
4 – B1172 west	8.3	27.85	0.91	1.5	8.53	0.6
5 - Local access	0	9.38	0.02	0	7.53	0.02

A47 southbound merge

4.9.14 The road network layout of the VISSIM model’s representation of the DS’s A47 southbound successive merge arrangement is shown below in Figure 4.24.

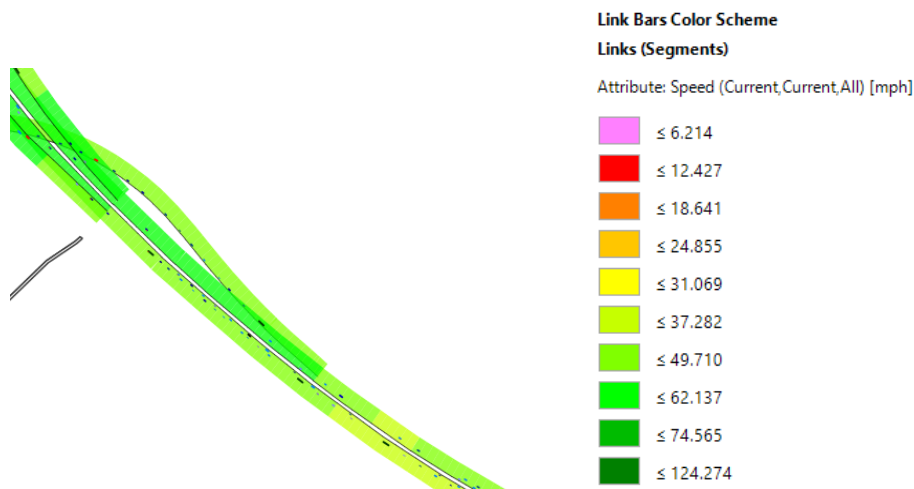
Figure 4.24: A47 southbound successive merges – Do Something 2040



4.9.15 Both the strategic modelling and the VISSIM modelling have not highlighted any issues operationally at the successive merges in the 2040 DS scenario. Furthermore, the VISSIM modelling has not highlighted any issues related to weaving between successive merges. As would be expected, occasionally a transient queue is predicted as vehicles must sometimes wait for gaps when merging with the A47 from the new link road. The A47 mainline operates satisfactorily without any significant delays predicted in the 2040 DS scenario.

4.9.16 Figure 4.25 below shows the VISSIM average speeds on the A47 southbound merge section. From this figure it can be seen that the model is operating in free flow conditions with ‘green’ speed categories.

Figure 4.25: VISSIM speed results (08:30) – A47 Southbound successive merges



4.10 Journey Time Reliability

- 4.10.1 The term reliability refers to variation in journey times that are unable to be predicted (journey time variability, or JTV). Such variation could come from recurring congestion at the same period each day (day-to-day variability, or DTDV) or from non-recurring events, such as incidents. It excludes predictable variation relating to varying levels of demand by time of day, day of week, and seasonal effects which travellers are assumed to be aware of.
- 4.10.2 The implementation of the Scheme will generate reliability benefits as road capacity is increased, delays are shortened and accidents (and their impacts) are reduced, all of which contribute to improved reliability.
- 4.10.3 Journey time reliability analysis has been undertaken to assess the economic impacts of the Scheme. The economic assessment of the Scheme is outlined in Section 5 of this Case. This analysis shows that the Scheme will generate a positive journey time reliability improvement benefit predicted to be approximately **£2.7m**.

4.11 Summary of Scheme Impacts

- 4.11.1 Implementation of the Scheme will improve the capacity of the Thickthorn Junction by allowing free flowing traffic movements between the A11 eastbound and A47 northbound approach arms. Analysis of the existing situation base year traffic model (2015) showed that the A11 eastbound and B1172 approach arms are over capacity (Table 4.5).
- 4.11.2 The NATS traffic model analysis shows that strategic traffic growth across the A47 and A11 corridors, as well as local traffic from the villages of Cringleford, Wymondham and Hethersett, will cause an approximate increase in total peak hour traffic flows of approximately 14% in 2025 and 25% in 2040 (Table 4.6). This traffic growth will further exacerbate the existing capacity issues at the junction, particularly in the PM peak, resulting in increased delays and longer journey times.
- 4.11.3 The results of the modelling assessment show that the Scheme improves the overall

operation of the network (Table 4.11) as well as improving A47 and A11 peak hour journey times (by up to approximately 35% depending on direction and time period, see Table 4.10). In terms of overall AADT, with the new connector road and dedicated left turn in place, forecasts on the A11 slip roads are reduced by approximately 20-37% (Figure 4.13). This reduction in AADT flow, between DM and DS, is primarily due to the eastbound and westbound A11-A47 traffic rerouting on to the new links.

- 4.11.4 The Scheme therefore provides additional capacity to the highway network, improves travel times and supports housing and economic growth across the region. In the villages of Wymondham and Hethersett a number of residential developments are identified in the Scheme's uncertainty log. The improvements to the capacity of the A11 eastbound Thickthorn Junction approach arm will support these developments. Furthermore, the Scheme will provide additional capacity to support strategic traffic growth across the A47 and A11 corridors linking Norwich to Peterborough and Cambridge.
- 4.11.5 In terms of operational traffic impacts on the highway network, the VISSIM model has been adopted to undertake a detailed assessment of the Scheme's performance. This assessment shows that the Scheme is operating without any large excess queues building on the roundabout or its approach arms.
- 4.11.6 In addition to this the NATS and VISSIM models have been used to assess the Scheme's A47 southbound successive merge arrangement. Both the strategic modelling and the VISSIM modelling have not highlighted any issues operationally at the successive merges in the 2040 DS scenario. Furthermore, the VISSIM modelling has not highlighted any issues related to weaving between successive merges.

4.12 Road Safety

Introduction

- 4.12.1 This section outlines the existing situation based on the recorded accident data in the vicinity of the Scheme, as well as the forecasted impact of the Scheme. The DfT's COBA-LT²⁷ modelling tool has been used to the forecasted impact of the Scheme on accidents.
- 4.12.2 The DfT COBA-LT software is used to calculate the impact of the Scheme, in terms of the number of accidents and the number of casualties, by comparing the DM and DS scenarios. This section details the underlying STATS-19 accident data used in the development of the model as well as the results of the assessment.

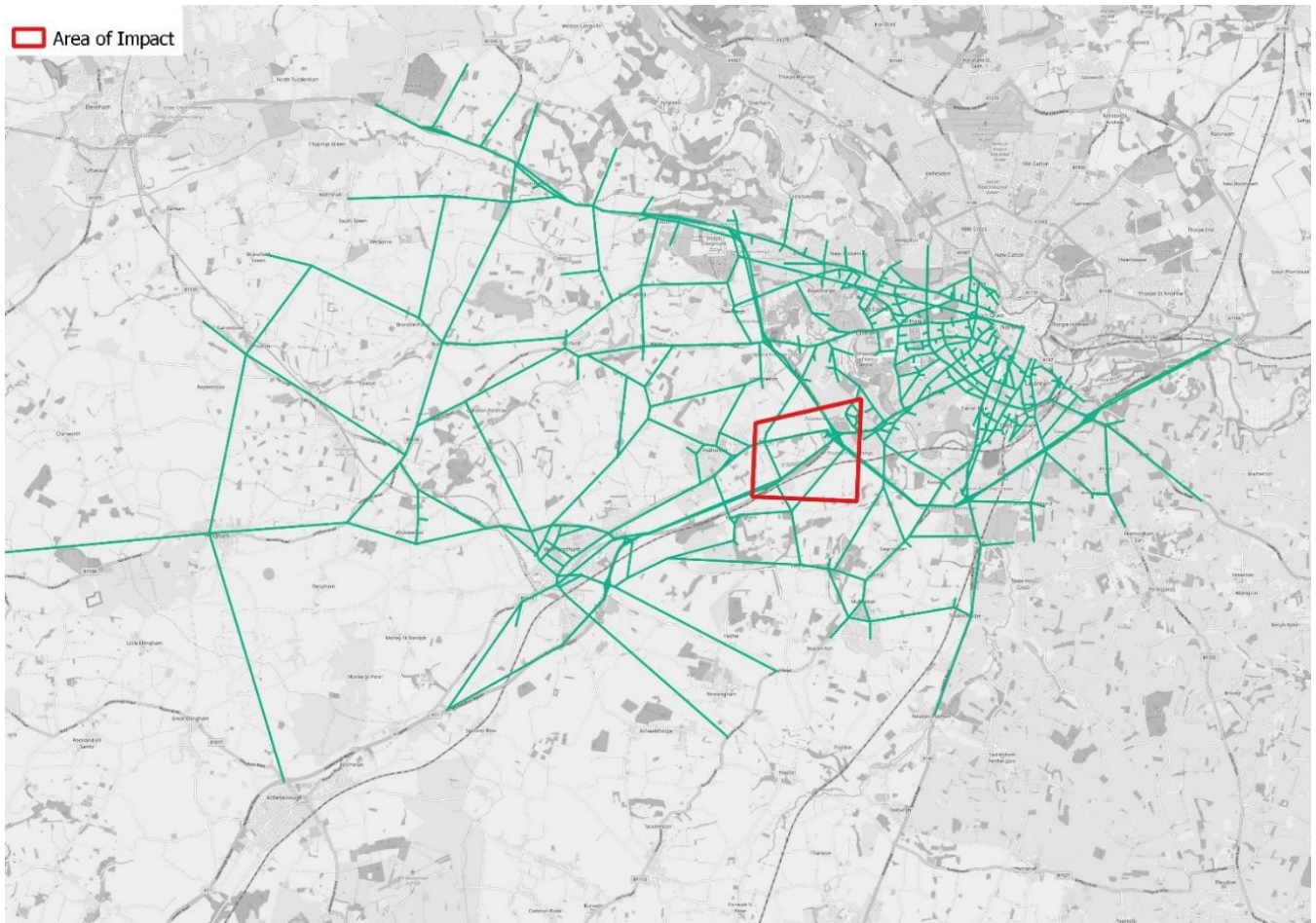
Scheme impact area

- 4.12.3 The COBA-LT model study area is shown in Figure 4.26. The model study area is based on a sub area, or cordon, of the NATS model. The cordoned network used within the assessment contains all of the principle roads in the wider highway network in the vicinity the Scheme.
- 4.12.4 In addition to the study area, a Scheme impact area of approximately 1km either side of the Thickthorn Junction between Round House Way roundabout and the A11/Station Lane junction was formalised (represented by the red box in Figure 4.26).

²⁷ COBALT (COst and Benefit to Accidents – Light Touch) is a computer program developed by the DfT to undertake the analysis of the impact on accidents as part of economic appraisal for a road scheme: <https://www.gov.uk/government/publications/cobalt-software-and-user-manuals>

Within this Scheme impact area observed data was analysed to assess the accidents records on the local road network. The observed data analysis was used to inform the accident Scheme impact area baseline accidents in the COBA-LT model. Outside of the Scheme impact area, default DfT COBA-LT accident rates were adopted.

Figure 4.26: COBA-LT road network



Observed accident data

- 4.12.5 The 5-year 2014 to 2018 collision data, derived from STATS-19 accident records, was analysed to derive the total number of accidents on the links in the Scheme impact area.
- 4.12.6 The severity of casualties was based on the default COBA-LT values for each link type. The observed accidents by accident type are summarised in Table 4.15. The locations and years of the observed accidents, within the impact area, are shown in Figure 4.27.

Figure 4.27: Impact area/Scheme links and junction observed accidents between 2014 and 2018

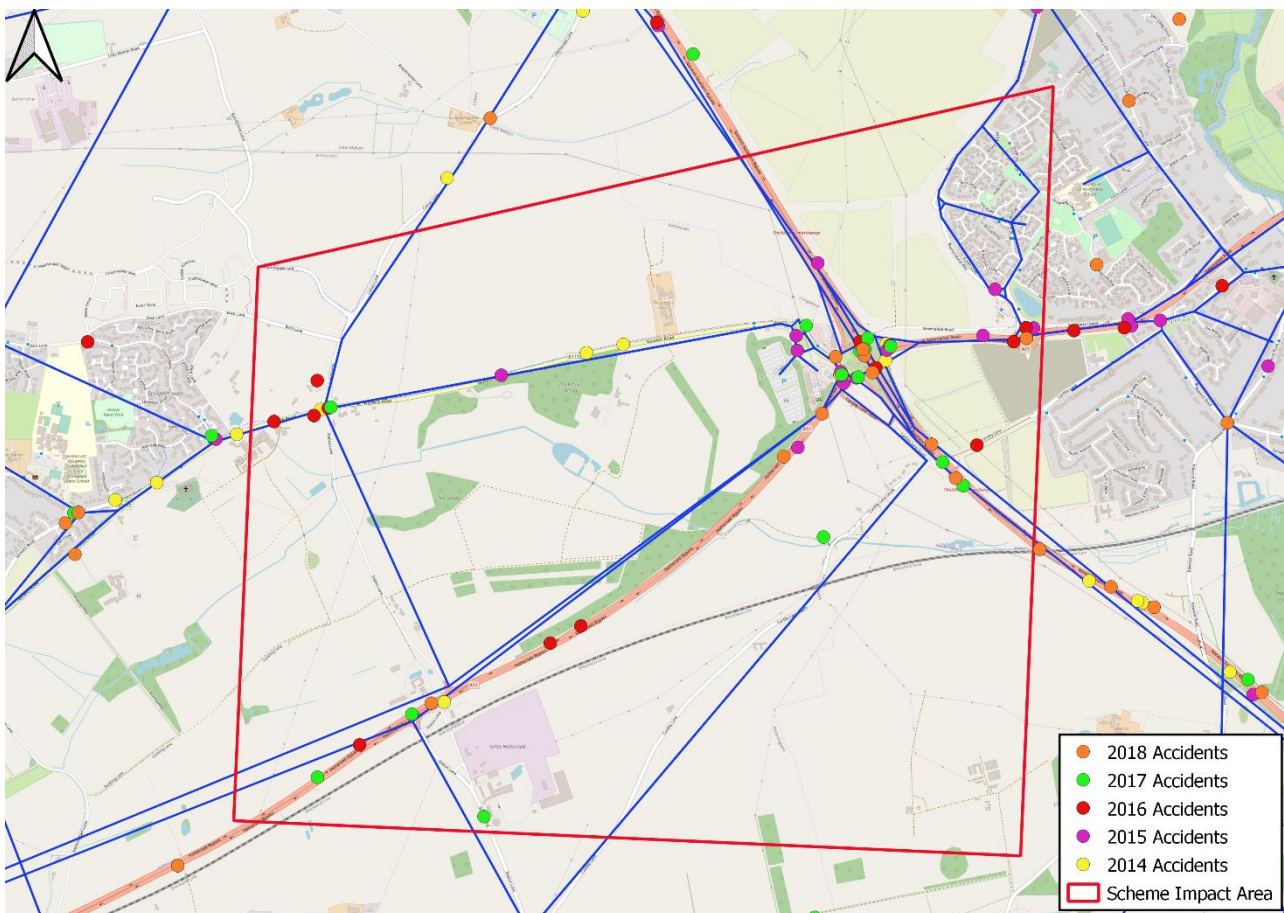


Table 4.15: Locally observed accidents

Year	2014	2015	2016	2017	2018	Total
Fatal	0	0	0	0	1	1
Serious	2	3	2	2	2	11
Slight	11	20	14	15	10	70
Total	13	23	16	18	12	82

Accident analysis

- 4.12.7 The Scheme is designed to result in a reduction of accidents through introducing several operational improvements. These include upgrading the Thickthorn Junction to a high quality interchange with free-flowing movements in both directions between the A11 west and the A47 south as well as a new overbridge connecting Cantley Lane South and the B1172 Norwich Road.
- 4.12.8 The economic appraisal of the Scheme's accident benefits, derived from the COBAL-T modelling assessment, is outlined in Section 5 of this Case. A summary of the accident savings and economic benefits is presented in Tables 4.16 and 4.17.

Table 4.16: Predicted accident reductions over 60 year design life

Scenario	Do Minimum	Do Something	Savings
Fatal	164	164	0
Serious	2,305	2,279	26
Slight	21,197	20,981	216
Total	23,666	23,424	242
KSI	2,469	2,443	26

Table 4.17: Predicted casualty reductions and benefits over 60 year design life

Accident Results	Without Scheme	With Scheme	Total Savings
Accident cost, £m	£737.20	£730.04	£7.16

4.12.9 The results of the COBA-LT analysis, in Table 4.17, indicate in total 242 accidents, including one predicted to be fatal and 26 predicted serious accidents, are saved by the Scheme over the analysis period. Total accident benefits generated by the Scheme over the same period is predicted to be approximately **£7.16m** of economic benefits.

Summary

4.12.10 In summary, the COBA-LT analysis demonstrates that the Scheme improves road safety by reducing the numbers of accidents and consequently the number of casualties. In total, over a 60-year timeframe the Scheme will save a total of 242 accidents and 26 killed or seriously injured (KSIs) (Table 4.19).

4.13 Walking, Cycling and Horse-riding Assessment

Introduction

4.13.1 Minimising the impacts of the Scheme on WCH is an integral part of Scheme design and this has been achieved by maintaining connectivity and incorporating both new and improved facilities to enhance existing networks. The WCH strategy aligns with the wider objectives of the Scheme and with local transport policy objectives in respect of the development of an accessible and integrated network which provides safer routes between local communities and promotes the use of active travel modes.

4.13.2 In developing the WCH strategy, consultation was undertaken with relevant officers at Norfolk County Council and with local user groups to ensure that accessibility issues local to the Scheme were clearly understood. The existing WCH facilities to be removed by the Scheme are to be replaced with enhanced facilities that better reflect the accessibility needs of the area.

4.13.3 This section provides an overview of the existing WCH facilities in the vicinity of the Scheme and accessibility issues in the area. It also provides an overview of the WCH facilities to be provided as part of the Scheme.

Baseline data

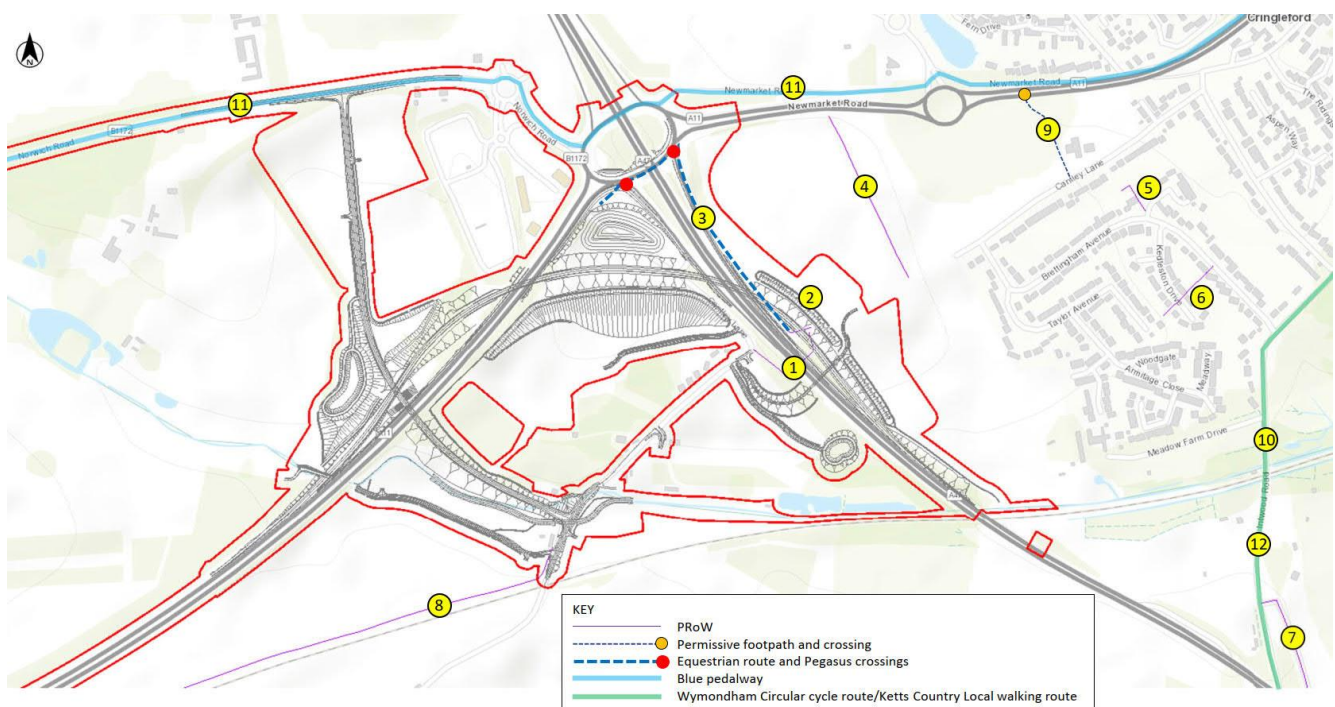
4.13.4 A number of WCH routes are present in the vicinity of the Scheme. These routes

provide an important means of access to community assets and connectivity to destinations in the local area. These routes are summarised in Table 4.18 and shown in Figure 4.29.

Table 4.18: Existing WCH routes

Reference	Description
1	Cringleford footpath FP4a runs from Cantley Lane to a footbridge over the A47, providing a link to Cantley Lane South
2	Cringleford bridleway BR5 which runs from Cantley Lane to Norwich A47 Southern Bypass
3	Equestrian route leading between Cantley Lane and Cantley Lane south, immediately south its junction with the A11, via two Pegasus crossings on Thickthorn Junction
4	Cringleford footpath FP1 runs from Cantley Lane to Newmarket Road
5	Cringleford footpath FP2 runs south from Cantley Lane to Langley Close
6	Cringleford footpath FP3 runs south west from Brettingham Avenue to Kedleston Drive
7	Keswick bridleway BR 5 runs to the east of the A47 at Intwood
8	Hethersett footpath FP6 which runs parallel to Cantley Lane South before heading west adjacent to the railway line and parallel to the Hethersett Bypass
9	Permissive footpath and cycleway between Cantley Lane and Toucan crossing on A11 Newmarket Road
10	Wymondham Circular cycle route, which follows Intwood Road
11	Wymondham to Sprowston Pedalway (Blue Pedalway)
12	Kett's Country Local walking route from Cringleford to Wymondham which follows Intwood Road

Figure 4.29: Existing WCH routes



- 4.13.5 Surveys of usage were undertaken for a number of the WCH routes identified, including those routes in the immediate vicinity of the Scheme, at the A11/Round House Way roundabout, on Cantley Lane and on Cantley Lane South. The surveys were undertaken during both school term time and during school summer holidays periods in 2017. As such, the surveys provided representative information on weekday and weekend day WCH activity.
- 4.13.6 The surveys confirmed the most important routes for cyclists and walkers demands at key crossing points in the area. Key points worthy of note are that both walkers and cyclists use the signalised crossings at the slip roads on the northern side of the Thickthorn Junction. This is as expected since these facilities form part of the Blue Pedalways cycle route. Although only having footpath status, both walkers and cyclists make use of the Cantley Lane footbridge. No users of the existing equestrian route and associated Pegasus crossing facilities at the Thickthorn roundabout were recorded during the survey periods. The lack of usage of these facilities confirms the view expressed by Norfolk County Council officers that these facilities are no longer required.
- 4.13.7 As indicated, consultation was undertaken with relevant officers from Norfolk County Council, namely the active travel officer and highways manager. The key issues raised as part of these discussions have been investigated as part of the design process and, where deemed practicable, WCH facilities have been incorporated into the Scheme to improve connectivity for WCH users.
- 4.13.8 Local stakeholders and user groups were consulted on the emerging WCH strategy. Those invited included representatives from local cycling groups, the Norwich Cycling Campaign, the British Horse Society, the Ramblers and the Local Access Forum. In general, the WCH strategy and the improved facilities to be provided as part of the Scheme were favourably received.

Impact of the Scheme

- 4.13.9 The Scheme would result in the permanent diversion of one WCH route and the permanent closure of others.
- 4.13.10 The Scheme would require the stopping up and diversion of Cringleford FP4a to a new WCH overbridge spanning the A47 to link Cantley Lane and Cantley Lane South. The new overbridge will be suitable for all WCH users and will replace the existing footbridge which is to be demolished. The footpath to be diverted will be upgraded to bridleway status as part of the proposals. The location of the new overbridge would slightly increase journey length for users. However, the overall impact of providing this new infrastructure would be beneficial as it would result in a large reduction in journey length for cyclists and horse-riders and provide a grade separated crossing of the A47 for all users when travelling between Cantley Lane and Cantley Lane South.
- 4.13.11 The Scheme would permanently remove the section of bridleway Cringleford BR5 and the tracks leading to the Pegasus crossing facilities at Thickthorn Junction. In the future, equestrians will be able to make use of the new overbridge to travel between Cantley Lane and Cantley Lane South.
- 4.13.12 The Scheme would not impact on any of the other WCH routes in the vicinity of Thickthorn Junction, as identified in 4.18. Although these WCH routes have varying sensitivities, the effects of the Scheme are assessed as being neutral.
- 4.13.13 The Scheme includes the provision of a cycle track on the eastern frontage of the Cantley Lane Link Road. In conjunction with the new overbridge, this new infrastructure will provide an alternative route between Cantley Lane and the Blue Pedalways cycle route and will be signed as such. An uncontrolled crossing facility, incorporating a refuge island and dropped kerbs, will be provided on B1172 Norwich Road to the east of its junction with the Cantley Lane Link Road. This will facilitate the safe crossing between the new shared footway and cycleway and the existing provision on the northern frontage of Norwich Road
- 4.13.14 In addition to the WCH facilities outlined above, the speed limit on the section of Cantley Lane South that will become a cul-de-sac as part of Scheme will be reduced to 20mph to promote road safety and improve conditions for WCH users.

Summary

- 4.13.15 In summary, the Scheme will provide new WCHR facilities to mitigate the impacts of the Scheme and improve accessibility for users in the local area generally, thereby supporting the promotion of active travel modes. As such, the Scheme would have a positive impact on WCHR provision.

4.14 Transport Assessment Conclusions

- 4.14.1 In conclusion, the Scheme fulfils its objectives by providing capacity, relieving congestion, improving journey times and increasing accessibility for the local communities.
- 4.14.2 The modelling analysis indicates that the forecast local and regional traffic growth will cause a significant increase in delays at Thickthorn Junction and along the A11, B1172 and A47. The Scheme, however, provides the required capacity improvements to allow for the forecasted traffic growth.
- 4.14.3 In terms of operational traffic impacts on the highway network, the VISSIM modelling

assessments show the Scheme is operating successfully with 2040 forecasted demand. The Scheme would generate benefits with respect to congestion relief as well as road safety. Further information on the Scheme's journey time reliability, environmental and economic impacts can be found in Sections 5 and 6 of this Case

4.14.4 In summary it is considered that the Scheme achieves the following objectives:

- Provides additional capacity and improved journey times to encourage housing and economic growth in the local area as well as across the A47 and A11 corridors linking Norwich to Peterborough and Cambridge.
- Provides additional capacity along the A11 and reduces delays along the parallel B1172. This encourages growth in the local area from the Wymondham and Hethersett residential developments, as well as providing capacity for future regional traffic growth up to 2040.
- The Scheme improves accessibility for local communities by reducing congestion along the B1172 and A11 corridors. The Scheme also provides an overbridge increasing the accessibility for north to south local trips crossing the A11.
- Improve safety operational issues by reducing congestion at the Thickthorn Junction, along the A47 and the B1172.
- VISSIM modelling shows the Thickthorn roundabout operating satisfactorily without any significant excess queuing.
- Road traffic congestion is significantly reduced by the Scheme, with journey times reducing in the 2040 DS scenario to be approximately equivalent or better than 2015.

5 ECONOMIC CASE OVERVIEW

5.1 Introduction

5.1.1 This Section outlines the economic assessment of the Scheme. It presents the expected benefits and disbenefits associated with the Scheme and sets out overall value for money. It estimates the economic worth of the Scheme, by comparing the benefits to users against the costs of procuring the Scheme. It does this by comparing economic costs and benefits of the Scheme against the equivalent costs and benefits without the Scheme.

5.2 Overview of Economic Assessment and Methodology Used

5.2.1 The economic assessment of the Scheme has been based on a 60-year appraisal period in accordance with DfT guidelines. A benefit to cost ratio (BCR) is calculated from the economic assessment by comparing the Scheme cost to the benefits of the Scheme over this period.

5.2.2 As stated in the DfT's Value for Money Framework, the benefits appraised for the Scheme have been categorised as:

- established monetised impacts
- evolving monetised impacts
- indicative monetised impacts
- non-monetised impacts

5.2.3 The benefits of the Scheme are calculated from a number of sources, including:

- user benefits during normal operation (savings relating to travel times and vehicle operating costs) have been assessed using Transport User Benefit Appraisal (TUBA)
- user disbenefits during construction have also been assessed using TUBA
- accident savings have been forecast using Cost and Benefit to Accidents – Light Touch (COBA-LT)

5.2.4 In addition, monetised estimates have been made of the greenhouse gas (GHG), air quality and noise impacts and supplementary assessments have been undertaken to quantify benefits due to journey time reliability (JTR) and wider economic impacts.

5.2.5 Qualitative and quantitative assessments on the social and distributional impacts resulting from the Scheme have also been carried out in full.

5.2.6 The costs of the Scheme used in the assessment comprise the Scheme construction costs.

5.2.7 Maintenance costs were taken from the July 2019 Cost and Benefit Analysis (COBA) manual default values.

5.2.8 The main economic assumptions are based on the May 2019 Transport Appraisal Guidance (TAG) Databook, which at the time of writing was the latest version.

5.2.9 In line with DfT recommendations and uncertainty of forecasting the future, scenario analysis has been undertaken supplemented with sensitivity tests. The economic appraisal has been undertaken for the core scenario as this is viewed as the 'most

likely' future scenario.

- 5.2.10 Two sensitivity tests have therefore been undertaken, considering changes to traffic growth and uncertainty of assumptions, as agreed with Highways England.
- 5.2.11 All benefits and costs were calculated in monetary terms and expressed as present values (PV) in discounted 2010 prices. This enables direct economic comparison with other schemes which may have very different timescales.

5.1 Value for Money

- 5.1.1 As can be seen in Table 5.1 the Scheme generates an initial present value of benefits of £84.1 million.
- 5.1.2 The total Scheme costs are £49.8 million (PV) with an assumption that none of the costs will be funded from developer contributions. The construction cost figure was correct at the time of compiling this report and may be refined as the detailed design progresses. Any significant changes in cost may require the BCR calculations to be reviewed.
- 5.1.3 With consideration of the effects of delays during construction, accident benefits, indirect taxation benefits and monetised environmental impacts, **the initial BCR is 1.7, which represents 'medium' value for money (VfM).**
- 5.1.4 The Scheme is also forecast to generate wider economic impacts and journey time reliability benefits. Inclusion of journey time reliability benefits and wider economic impacts gives **an adjusted BCR of 2.4, which represents 'high' VfM.**
- 5.1.5 The Scheme will also generate additional, non-monetised benefits such as social and distributional impacts. These will generate additional benefits thus maximising public value.

Table 5.1: Value for Money Summary

	Cost / Benefits
Initial Present Value of Benefits	£84.08
Adjusted Present Value of Benefits	£119.84
Total Present Value Cost	£49.76
Initial BCR	1.7
Adjusted BCR	2.4

5.1 Monetised Benefits

- 5.1.1 Overall, the Scheme is forecast to produce benefits of **£119.8 million (PV)** over the 60-year appraisal period. The results of the economic appraisal for the Scheme are summarised in Table 5.1. The table includes the results of the appraisal of the core scenario.

Table 5.2: Summary of economic assessment results – Core scenario, £ millions

		Cost / Benefits	
Benefits	Consumer Commuting User Benefits	Travel Time	£28.79
		Vehicle Operating Costs	-£1.82
		Construction Delays	-£4.74
		Net Consumer User Benefits	£22.24
	Consumer Other User Benefits	Travel Time	£35.46
		Vehicle Operating Costs	-£13.75
		Construction Delays	-£3.87
		Net Consumer User Benefits	£17.84
	Consumer Business User Benefits	Travel Time	£36.64
		Vehicle Operating Costs	£1.99
		Construction Delays	-£4.17
		Net Business User Benefits	£34.47
	Accidents Benefits		£7.16
	Indirect Tax Revenues		£9.07
	Noise		£0.11
	Air Quality		-£0.98
Greenhouse Gases (Carbon)		-£5.82	
Initial (Level 1) Present Value of Benefits		£84.08	
Costs	Operating and Maintenance Costs		£0.65
	Investment Costs (including capital costs of Maintenance)		£49.11
	Total Present Value Cost		£49.76
Level 1 Net Present Value (NPV)		£34.32	
Level 1 Benefit Cost Ratio (BCR)		1.7	
Benefits Level 2	Journey Time Reliability (JTR)		£2.65
	Wider Economic Impacts		£33.12
	Level 2 Present Value of Benefits		£35.76
Adjusted Present Value Benefit (Level 1 + Level 2)		£119.84	
Costs	Total Present Value Cost		£49.76

		Cost / Benefits
Adjusted Net Present Value (NPV) (Level 1 + Level 2)		£70.08
Adjusted BCR (Level 1 + Level 2)		2.4

Economic Benefits

- 5.1.2 The Scheme would increase capacity, relieve congestion and improving journey times along this section of the A47 and A11 Strategic Road Network. These improvements will in turn reduce lost productive time and subsequently increase business user and transport service provider benefits. Further details can be found in Section 4 Transport Assessment of this case.
- 5.1.3 There would also be associated reductions in vehicle operating costs, such as fuel, vehicle maintenance and mileage related depreciation. The monetised economic benefits include travel time savings of £100.9 million and vehicle operating cost disbenefits of -£13.6 million. As the Scheme generates reductions in congestion, greater time benefits are experienced but at the expense of higher fuel consumption due to increased vehicle speeds.
- 5.1.4 The Scheme will also improve safety with an overall reduction of fatal, serious and slight accidents and casualties. The monetary savings in terms of accidents is approximately £7.2 million over the 60-year appraisal period.
- 5.1.5 Construction of the Scheme generates disbenefits from journey delays. The estimated impact amounts to approximately -£12.8 million, but temporary traffic management solutions presented are expected to keep disruption to a minimum.

Environmental Benefits

- 5.1.6 The ES (TR010037/APP/6.1) contains a detailed assessment and appraisal of the full environmental impacts associated with the Scheme. A summary of the findings are presented in Table 6.1 of this Case, whilst the monetised value of the predicted changes in greenhouse gases, air quality and noise is as follows.
- 5.1.7 Greenhouse gases over the 60-year appraisal period have been calculated to generate a total disbenefit of -£5.8 million.
- 5.1.8 Air quality has also been calculated over the 60-year appraisal period and amount to a total disbenefit of -£1.0 million.
- 5.1.9 The impact on noise as a result of the Scheme is anticipated to provide a positive benefit. The PV of noise benefits over 60 years is £0.1 million.
- 5.1.10 The monetary calculation is based on absolute quantities of emissions across all receptors that doesn't take into account whether or not there are significant effects but places a monetary value based on the absolute changes from current levels. It gives a numerical figure to include in the cost-benefit analysis, but one which is often more pessimistic (or sometimes more optimistic) than the picture emerging from the environmental assessment in the ES.

Additional Economic Benefits

- 5.1.11 JTR impacts for the Scheme were calculated to generate JTR benefits of £2.7 million. It should be noted that these benefits are only incorporated in the Adjusted BCR.

5.1.12 The monetised value for the total wider economic impacts is about £33.1 million, with the majority of these benefits being derived from the agglomeration assessment. This suggests that business users are the main beneficiaries from the enhanced connectivity and congestion reductions brought about by the Scheme and that there will be an overall, long-term positive impact. Similar to JTR these benefits are only incorporated in the Adjusted BCR.

5.2 Non-Monetised Benefits

Social and Distributional Impacts

5.2.1 Social impacts (SIs) cover the human experience of the transport system and its impact on social factors that are not considered as part of economic or environmental impacts. SIs have been assessed in accordance with Transport Analysis Guidance (TAG) unit A4.1 – Social Impact Appraisal (May 2020).

5.2.2 The social impacts (SI)²⁸ of the Scheme have been assessed, either quantitatively or qualitatively, for accidents, physical activity, security, severance, journey quality, option and non-use values, accessibility and personal affordability.

5.2.3 Table 5.2 provides a concise summary of the findings and results of the Social Impacts Appraisal undertaken for each indicator.

Table 5.3: Social Impacts Summary

Indicator	Assessment	Conclusion
Accidents	£7.2m in benefits are generated through accident savings.	Moderate beneficial
Security	All security indicators are of medium to high importance. All indicators, with the exception of emergency call facilities, have a neutral assessment as a result of the Scheme. There will be improved provision of emergency call facilities upon Scheme implementation.	Slight beneficial
Journey quality	The majority of journey quality impacts are related to public transport and so have been assessed as neutral. Traveller's frustration and traveller's fear of potential accidents have been assessed as moderate beneficial due to their impact on car users.	Slight beneficial
Physical activity	The Scheme is an inter-urban road Scheme and so is not anticipated to impact active mode provision, nor discourage the use of active modes. Therefore, the impact on physical activity will be negligible.	Neutral
Option and non-use values	Public transport is not affected by the Scheme, therefore no significant impact on option and non-use values.	Neutral

²⁸ Social impacts (SIs) cover the human experience of the transport system and its impact on social factors that are not considered as part of economic or environmental impacts.

Indicator	Assessment	Conclusion
Accessibility	Changes in the cost or provision of public transport will not result from the Scheme. However, the implementation of an additional lane is anticipated to improve access to the Newfound Farm development, Norwich Research Park and the Hospital.	Slight beneficial
Severance	There is a large positive impact on a significant proportion of the population's ability to access places of worship and a slight positive impact for groups accessing leisure facilities. Only a smaller proportion of the population will be negatively impacted in terms of severance when accessing medical and education facilities.	Moderate beneficial
Personal affordability	80% of the sectors within the study area generate disbenefits in personal affordability in relation to their population proportion. The only sector to note benefits is one of the least deprived sectors.	Moderate adverse

5.2.4 Distributional impacts (Dis) consider how the impacts of a Scheme vary across different social groups and has been assessed in accordance with TAG unit A4.2 Distributional Impact Appraisal (May 2020). DIs of the Scheme have been assessed, either quantitatively or qualitatively for their impact on users in terms of:

- **Noise and air quality** – noise and air quality impacts are likely to occur where a Scheme results in changes to traffic flows or speeds or where the physical gap between people and traffic is altered.
- **Accidents** - any change to the road network can affect the number of accidents that occur. Groups that are particularly vulnerable to increases in risk of accidents include children, the elderly, young males and motorcyclists. There is also a strong link between deprivation and road accidents.
- **Security** – there are potential impacts (in personal security terms) from making changes to the transport system and these can raise specific concerns for women, young people, older people, people with disabilities and black and minority ethnic communities.
- **Severance** – consideration is given to how groups such as children, people without access to a car, older people, people with disabilities and parents with pushchairs are impacted by severance. These groups often experience longer journey times or are often required to use pedestrian routes that are inappropriate and difficult to use.
- **Accessibility** - public transport accessibility for different groups to access employment, services and social networks.
- **Personal affordability** - changes in transport costs could have disproportionate impacts on vulnerable groups due to their reliance on available, accessible and affordable transport options.

5.2.5 Table 5.3 provides a summary of the Distributional Impacts Appraisal undertaken for each indicator.

Table 5.4: Distributional Impacts Summary

Indicator	Assessment	Conclusion
User Benefits	The least deprived Indices of Multiple Deprivation (IMDs) in the study area experience the majority of the benefits whilst a proportion of disbenefits are experienced by the most deprived deciles 1 and 2 as well as deciles 5 and 6.	Neutral
Noise	Income deciles 4 and 5 will experience long term deterioration in noise levels. However, in the short-term receptors will experience improvements in the noise levels due to the Scheme. Some sensitive receptors (such as schools, care homes and nurseys) will experience both improvements and deterioration of noise levels as a result of the Scheme, but the overall net result is a deterioration in noise levels for these sensitive receptors.	Moderate adverse
Air Quality	Receptors in income domain 3 have the largest net winners as a percentage of the total receptors within the study area, experiencing the most benefit in air quality as a result of the Scheme. Receptors in income domain 4 and 5 have a lower proportion of receptors within the impact area but also experience improving air quality. Schools in the study area also experience air quality benefits, where many are located within affluent income deciles.	Moderate beneficial
Accidents	All vulnerable groups and users considered see no significant change in the expected number of accidents. Cyclists and young male drivers are anticipated to experience some increase in accidents or casualties, but this is still only a small proportion of the total links that have been assessed.	Neutral
Security	All security indicators, except emergency call facilities, do not note any change in facilities. The spread of benefits is relatively equal across all vulnerable goods.	Neutral
Severance	The overall number of amenities that note a positive change in severance marginally outweigh those that note a negative change. No-car households disproportionately disbenefit in terms of severance as a result of the Scheme, whilst the other vulnerable groups assessed see slight to moderate benefits.	Slight beneficial

Indicator	Assessment	Conclusion
Accessibility	<p>No assessment undertaken.</p> <p>The Scheme itself is not expected to have any significant impacts on public transport accessibility so this was scoped out of the assessment.</p>	n/a
Affordability	<p>80% of the sectors within the study area generate disbenefits in personal affordability in relation to their population proportion. The only sector to note benefits is one of the least deprived sectors.</p>	Moderate adverse

6 CONFORMITY WITH PLANNING POLICY AND TRANSPORT PLANS

6.1 Policy Context

6.1.1 This Section provides an overview of the Scheme's compliance with national planning policy and infrastructure delivery strategies and plans, relevant sub-regional and local planning policies.

6.1.2 As set out by the PA 2008, the primary policy consideration for highway NSIPs is the NPS NN. Section 104 of the PA 2008 requires the SoS to determine an application for an NSIP in accordance with a relevant national policy statement (NPS) except in a limited number of specified circumstances.

6.1.3 In addition to the NPS NN, there are other key policy documents that may also be important and relevant matters to which the SoS will have regard. These are set out in this Section, as they demonstrate the Government's continued commitment to invest in the SRN and include:

- National Planning Policy Framework 2019
- Road Investment Strategy 2015 to 2020 (RIS1) and 2020 to 2025 (RIS2)
- The Strategic Road Network and the Delivery of Sustainable Development (DfT Circular 02/2013).

6.2 National Policy Statement for National Networks (January 2015)

6.2.1 National Policy Statements are produced by the relevant government body and provide policy on specific aspects of national infrastructure. They clarify how the infrastructure:

- contributes to sustainable development
- takes account of the mitigation of, and adaptation to, climate change
- demonstrates how objectives have been integrated with other government policies
- details how actual and projected capacity and demand have been taken into account
- considers relevant issues in relation to safety or technology
- looks at circumstances where it would be particularly important to address the adverse impacts of development.

6.2.2 On 14 January 2015, the government designated the NPS NN. This statement sets out the Government's vision and policy specifically regarding the strategic road and rail network.

6.2.3 As the Scheme meets the criteria for an NSIP (see section 1.3 of this Case) and will be subject to a DCO application, the application will be judged primarily against the NPS NN according to the decision-making framework set out in the PA 2008.

6.2.4 The NPS NN sets out the need for NSIPs on the national road and rail networks in England, and the Government's policy to deliver these projects.

6.2.5 Paragraph 1.2 of the NPS NN states that:

“The Secretary of State will use this NPS as the primary basis for making decisions on development consent applications for national networks nationally significant infrastructure projects in England. Under section 104 of the Planning Act the Secretary of State must decide an application for a national networks nationally significant infrastructure project in accordance with this NPS unless he/she is satisfied that to do so would:

- *Lead to the UK being in breach of its international obligations;*
- *Be unlawful;*
- *Lead to the Secretary of State being in breach of any duty imposed by or under any legislation;*
- *Result in adverse impacts of the development outweighing its benefits; or*
- *Be contrary to legislation about how the decisions are to be taken”.*

- 6.2.6 The NPS NN is not scheme specific and does not set out a programme of road schemes, but instead deals with road and rail networks and strategic rail freight interchanges. It also sets out the principles by which applications for road and rail schemes should be assessed.
- 6.2.7 Section 2 of the NPS NN sets out the need for development of the national networks, the Government's policy and strategic vision and objectives.
- 6.2.8 Paragraph 2.2 of the NPS NN states that: *“There is a critical need to improve the national networks to address road congestion and crowding on railways to provide safe, expeditious and resilient networks that better support social and economic activity; and to provide a transport network that is capable of stimulating and supporting economic growth”.*
- 6.2.9 Paragraph 2.10 of the NPS NN states that the Government has concluded that, at a strategic level there is a compelling need for development of the national networks. It further states that the ExA and the SoS should start their assessment of applications for infrastructure covered by the NPS NN on that basis.
- 6.2.10 There is an assumption within the NPS NN that significant improvements to the road network will be necessary in order to support the Government's vision for the national networks. Paragraph 2.21 of the NPS NN sets out a range of alternatives to major improvements to the network including Maintenance and Asset Management, Demand Management and Modal Shift. However, it is concluded that, at a strategic level, there is a compelling need for development of the national road network.
- 6.2.11 Paragraph 2.22 of the NPS NN states that without improving the road network, including its performance, it will be difficult to support further economic development and this will impede economic growth and reduce people's quality of life. The Government has therefore concluded that, at a strategic level, there is a compelling need for development of the national road network.
- 6.2.12 The Scheme comprises an essential part of a wider package of proposals for the A47 corridor to transform connectivity to and from the East of England, as described in the Roads Investment Strategy, the Transport Investment Strategy, the National Infrastructure Delivery Plan and the Applicant's Delivery Plan. The Scheme therefore helps address the compelling and strategic need for development identified in the NPS NN.

- 6.2.13 Compliance of the Scheme's objectives with the vision and strategic objectives, contained within Chapter 2 (page 9) of the NPS NN is set out in Table 3.2 within Section 3 of this Case.
- 6.2.14 Paragraph 3.1 of the NPS NN states that the need for development of the national networks, and the Government's policy for addressing that need, must be seen in the context of the Government's wider policies on economic performance, environment, safety, technology, sustainable transport and accessibility, as well as journey reliability and the experience of road users.
- 6.2.15 The Scheme directly addresses the Government's wider strategic policy objectives, whilst specifically addressing the historic problems in connectivity to the east. A description of these issues and the need for the Scheme is provided in Section 3 of this Case. The Scheme fulfils this long-established need, and delivers benefits in terms of resolving local transport, economic, environmental and heritage concerns and the Government's recognised national commitment to improving the SRN.
- 6.2.16 The NPS NN states that the assessment of the Scheme should consider the balance of potential benefits and adverse impacts (paragraph 4.3). Benefits to be considered include the facilitation of economic development, job creation, housing and environmental improvement, and any longer-term or wider benefits. Assessment of adverse impacts should include longer-term and cumulative adverse impacts, as well as planned mitigation of these impacts.
- 6.2.17 The NPS NN requires that environmental, safety, economic and social impacts should be considered at a national, regional and local level. The information provided will be proportionate to the development (paragraph 4.4). The Scheme has been subject to a transport assessment (see Section 4 of this Case), Economic Assessment (see Section 5 of this Case) and an EIA as reported in the ES (**TR010037/APP/6.1**).
- 6.2.18 The Scheme has been subject to a rigorous options appraisal process. A summary of the options considered and the appraisal process has been provided in Section 2 of this Case. Further detail is provided in the Scheme Assessment Report²⁹.
- 6.2.19 Section 5 of NPS NN gives guidance for decision making relating to impacts on environment, habitat, landscape, accessibility and existing infrastructure. The assessment of effects on environment, habitat, landscape, accessibility and existing infrastructure is provided in the ES (**TR010037/APP/6.1 to 6.4**). The ES provides the detail to demonstrate compliance with many of the requirements of the NPS NN, as follows:
- ES Chapter 5 Air Quality - NPS NN paragraphs 5.6 to 5.15, plus 5.82 to 5.89
 - ES Chapter 6 Cultural Heritage - NPS NN paragraphs 5.124 to 5.138
 - ES Chapter 7 Landscape and Visual - NPS NN paragraphs 5.144 to 5.184, plus 5.82 to 5.89
 - ES Chapter 8 Biodiversity - NPS NN paragraphs 5.20 to 5.38
 - ES Chapter 9 Geology and Soils - NPS NN paragraphs 5.117 to 5.118
 - ES Chapter 10 Material Assets and Waste - NPS NN paragraphs 5.42 to 5.44

²⁹ <https://highwaysengland.citizenspace.com/he/a47-a11-thickthorn-junction-improvement/results/schemeassessmentreport2018.pdf>

- ES Chapter 11 Noise and Vibration - NPS NN paragraphs 5.186 to 5.200
- ES Chapter 12 Population and Human Health - NPS NN paragraphs 4.81 to 4.82, plus 5.82 to 5.89
- ES Chapter 13 Road Drainage and the Water Environment - NPS NN paragraphs 5.90 to 5.115, 5.203 to 5.205, 5.220 to 5.231 and 5.165 to 5.184
- ES Chapter 14 Climate - NPS NN paragraphs 5.17 to 5.19
- ES Chapter 15 Cumulative Effects Assessment - NPS NN paragraphs 4.15 to 4.17

6.2.20 Table 6.1 below summarises the significant environmental effects during construction and operation as presented in Chapters 5 to 15 of the ES (**TR010037/APP/6.1**). The NPS NN Accordance Tables (**TR010037/APP/7.2**) provide an analysis of these effects and the wide-ranging benefits for compliance with the requirements of the NPS NN. Several NPS NN paragraphs recommend that the Secretary of State does not grant development without reasonable justification. Those associated with significant residual effects in Table 6.1 are considered in Section 7.4 of this Case for the Scheme.

Table 6.1: Summary of significant environmental effects

Topic	Assessment of Significant Environmental Effects	
	Construction	Operation
Air Quality (ES Chapter 5)	No significant air quality effects have been identified nor will the Scheme affect the UK's ability to comply with the Air Quality Directive. With the recommendation of best practice construction mitigation measures, the impact of construction dust, no significant effects on sensitive receptors have been identified.	The air quality assessment has concluded there would be no significant adverse effects from the Scheme for human health and ecological receptors. For half the 155 potential receptors there is expected to be an improvement in air quality with the Scheme in place. Furthermore, the operation of the Scheme is not predicted to affect compliance with the European Union (EU) Air Quality Directive. With no significant effects predicted, no mitigation is required.
Cultural Heritage (ES Chapter 6)	All temporary construction phase effects on heritage assets are not considered significant as they are either short term (less than four years) and reversible or can effectively be mitigated through preservation by record (archaeological recording).	Adverse residual operational effects have been identified for two grade II listed buildings, six undesignated heritage assets and a Historic Landscape Character. However, these effects are not significant. The impact assessment identified one significant residual adverse effect on a scheduled monument consisting of two Prehistoric burial mounds known as 'barrows', located outside the site boundary, named 'Two Tumuli in Big

Topic	Assessment of Significant Environmental Effects	
	Construction	Operation
		<p>Wood' (NHLE1003977). This was due to the permanent alteration of its setting from construction of the Cantley Lane Link Road. The new road permanently severs a significant aspect of the asset's setting, in which the barrows historically could be viewed prominently from downslope to the south.</p> <p>A planting plan incorporated into the Environmental Masterplan (TR010037/APP/6.8) will screen and enhance the setting of several cultural heritage sites.</p> <p>A heritage information board relating to the Two Tumuli in Big Wood to bring public value back to a historic landscape that has been almost entirely permanently altered in character by the road network and modern developments.</p>
Landscape and Visual (ES Chapter 7)	<p><u>Landscape</u></p> <p>A moderate adverse (significant) effect on landscape character principally associated with the removal of areas of woodland and individual trees has been identified.</p> <p><u>Visual</u></p> <p>Some receptors would be subject to large to moderate adverse (significant) visual effects, associated with views of construction activities and haul routes. This would particularly be the case in the vicinity of the proposed junction of the new Cantley Lane Link Road and the realigned section of Cantley Lane South near Cantley Stream for receptors at 15 properties and users of the railside footpath (Hethersett FP6), the footbridge over the A47 (Cringleford FP4),</p>	<p><u>Landscape</u></p> <p>There are no statutory landscape designations within the study area. The landscape at Thickthorn Hall is a County level designated historic park and garden, while the parkland at Intwood Hall on the southern fringes of the study area is a nationally registered Grade II Historic Park and Garden.</p> <p>At the year of opening there would be a moderate adverse (significant) effect on landscape character arising from the residual loss of vegetation, the relative prominence of Scheme infrastructure and changes in character at the junction with Cantley Lane South.</p> <p>By year 15 of operation, with the establishment of Scheme landscape mitigation, effects on landscape character would be not significant.</p>

Topic	Assessment of Significant Environmental Effects	
	Construction	Operation
	and vehicular users of Cantley Lane South.	<p><u>Visual</u></p> <p>At the year of opening, moderate to large adverse (significant) effects would remain, especially near the proposed junction of the new Cantley Lane Link Road and the realigned section of Cantley Lane South near Cantley Stream. However, following the establishment of the Scheme planting contributing to screening and landscape integration, by year 15 of operation only three residential properties close to the proposed new junction at Cantley Lane South would continue to experience significant residual adverse visual effects.</p> <p>In accordance with DMRB LA107, significant long term residual visual effects are localised on only three residential properties. Combining both landscape and visual effects and focusing on the longer-term outcome, it is determined that the Scheme would not result in a significant long term residual effect on landscape and visual amenity as a single combined consideration.</p>
Biodiversity (ES Chapter 8)	<p>Mitigation measures will avoid or reduce adverse construction effects through measures such as: replacing lost habitat; timing of construction works to avoid the most sensitive times of year; and landscape planting and pollution control measures to prevent damage and degradation to habitats.</p> <p>The EMP (TR010037/APP/7.4) details the good practice environmental measures that would be implemented to protect biodiversity during construction, why they are required, who is responsible for delivering them</p>	<p>There would be no impact, either directly or indirectly, on internationally or nationally designated sites. For most other receptors, there would be no significant residual effects after mitigation.</p> <p>Although the design has sought to avoid trees where possible and minimise habitat loss, areas of trees will need to be lost due to the Scheme. Deciduous woodland and hedgerows will experience a significant adverse residual effect due to the long-time lag to achieve their former maturity. The loss of two veteran trees would be a significant adverse residual effect as they are irreplaceable.</p>

Topic	Assessment of Significant Environmental Effects	
	Construction	Operation
	<p>and details any ongoing maintenance and monitoring arrangements. The EMP is secured through Requirement 4 in Schedule 2 of the draft DCO (TR010037/APP/3.1).</p> <p>There would be no significant impacts on statutory or non-statutory designated sites after mitigation, including Eaton Chalk Pit SSSI and Eaton Common, Earlham Park Woods and Marston Marshes LNRs.</p> <p>Protected species licences and mitigation will be agreed with Natural England to manage: disturbance and destruction of bat roosts; translocating water voles along Cantley Stream; and, potentially, affecting an otter holt.</p>	<p>However, there will be beneficial effects from: a net gain of more biodiverse grasslands with the introduction of species-rich and marshy, wet grassland; riparian planting along Cantley Stream increasing beneficial habitat for aquatic invertebrates.</p>
Geology and Soils (ES Chapter 9)	<p>The Scheme will result in the permanent loss of approximately 12.64 hectares (ha) of Grade 3a (good quality) and 2.24ha of 3b (moderate quality) agricultural land; areas of Grade 3a agricultural land are considered to be best and most versatile (BMV) agricultural land (i.e. land that can best deliver future crops for food and non-food uses). temporary land take of 13.02 hectares of Grade 3a agricultural land and 3.54 hectares of temporary land take.</p> <p>A Soils Management Plan, within the EMP (TR010038/APP/7.4), will be developed to help preserve land quality on the temporary land take areas and to make effective reuse of the soils taken from the areas of permanent land take.</p> <p>With the Scheme located near Cantley Lane landfill and an infilled gravel pit, existing contaminated land poses a risk of residual adverse effect of moderate significance during construction and operation of the Scheme. Mitigation measures are proposed on the assumption that contamination is present, but the contamination risk sources will be investigated prior to construction of the Scheme to confirm the mitigation measures required to manage risks of pollution and har to workers from contaminated land.</p> <p>With effective mitigation measures and restoration of temporary land take areas to their former condition, the long-term residual effects on agricultural soils would be limited to the permanent loss of agricultural land.</p>	

Topic	Assessment of Significant Environmental Effects	
	Construction	Operation
	Mitigation measures in the EMP (TR010037/APP/7.4) would be secured through Requirement 4 of Schedule 2 in the draft DCO (TR010037/APP/3.1).	
Materials, Assets and Waste (ES Chapter 10)	<p>An Outline Site Waste Management Plan (TR010037/APP/6.2) has been prepared to demonstrate how waste generated during the construction phase will be minimised and controlled to reduce impacts. Preliminary information included in the Outline SWMP will be updated and used to develop the detailed SWMP for use during construction; this is a commitment in the EMP (TR010037/APP/7.4) that would be secured through Requirement 4 of the draft DCO (TR010037/APP/3.1).</p> <p>Design, mitigation and enhancement measures will be implemented during construction and controlled through the EMP. The residual effects during construction will not be significant.</p>	<p>The Scheme intersects part of a known sand and gravel reserve (mineral safeguarding area) as shown in Norfolk County Council's mineral safeguarding area mapping. Further detail is provided in ES Appendix 10.4 Mineral Impact Assessment (TR010037/APP/6.2), which concludes it is not anticipated that any mineral safeguarding sites will be sterilised. Therefore, the effects on mineral resources are assessed as not significant.</p> <p>Significant environmental effects from the use of material assets and generation of waste during the first year of operation (opening year) are not predicted due to limited material use and waste generation from infrequent maintenance activities.</p>
Noise and Vibration (ES Chapter 11)	The assessment of construction and operational noise and vibration impacts concluded that with appropriate mitigation measures, where necessary, the Scheme is unlikely to give rise to any potential significant effects. The mitigation measures are set out in the EMP (TR010037/APP/7.4) and secured by Requirement 4 of Schedule 2 in the Draft DCO (TR010040/APP/3.1).	
Population and Human Health (ES Chapter 12)	<p>During construction the Scheme would result in changes to access for private properties along Cantley Lane and Cantley Lane South, but these changes are not considered to be significant.</p> <p>Construction activities could result in some adverse amenity effects for human health, specifically in terms of noise, dust</p>	There will be a permanent change to access from the Scheme to private properties and businesses on Cantley Lane South and Cantley Lane. However, most people using the Scheme to access properties, businesses and community assets would also benefit from journey time savings and safety for road users.

Topic	Assessment of Significant Environmental Effects	
	Construction	Operation
	<p>and visual intrusion. Mitigation measures are set out in the EMP (TR010037/APP/7.4) and secured by Requirement 4 of Schedule 2 in the Draft DCO (TR010037/APP/3.1).</p> <p>During construction, the Scheme would result in the temporary loss of agricultural holdings and some disruption to farming operations in particular with regards to access of adjacent agricultural blocks farmed by holding 2.</p>	<p>Overall, impacts on population and human health would be not significant once the Scheme is operational. The exception to this is users of Cringleford footpath 4A where a moderate adverse effect is anticipated due to journey increases associated with the diversion of the footpath via the new Cantley Lane Footbridge (Cringleford).</p> <p>Beneficial effects would be experienced by horse-riders and cyclists travelling between Cantley Lane and Cantley Lane South via the new Cantley Lane footbridge (Cringleford) and by pedestrians and cyclists travelling along the shared cycle track to be provided on the eastern frontage of the Cantley Lane Link Road.</p> <p>For those travelling to access properties, businesses and community assets using the Scheme, benefits would be experienced in terms of journey time savings and safety for road users.</p> <p>The loss of 1.8Ha of proposed on-site public open space (reducing the total area from 10.9Ha to 9.1Ha) secured by a planning obligation and to be provided as part of the Cringleford residential development would result in a Large adverse effect should an alternative solution not be agreed with the developer and local planning authority.</p> <p>The Scheme is unlikely to have an impact on the long term viability of the majority of the agricultural holdings identified as part of this assessment. However, the permanent land take required from holding 2 will result in a Moderate adverse effect for both the construction and operation of the Scheme.</p>
Road Drainage and the Water	No significant adverse effects are predicted during construction,	No significant adverse effects associated with surface, sewer and

Topic	Assessment of Significant Environmental Effects	
	Construction	Operation
Environment (ES Chapter 13)	<p>subject to best practice measures for pollution prevention and water management implemented as part of the EMP (TR010037/APP/7.4), secured by a requirement of the draft DCO (TR010037/APP/3.1).</p>	<p>groundwater flooding, subject to the mitigation measures included in the Environmental Management Plan.</p> <p>The Scheme shall discharge to Cantley Stream. Runoff will be attenuated to a 1 in 100 year event (including an allowance for climate change) using oversized pipes and attenuation ponds. The drainage has been designed for an extreme pluvial event (1 in 100 year plus 20% climate change with a sensitivity check at 40% climate change) so there would be no increased flood risk to others. Flood flow pathways intercepted by the Scheme will be maintained to allow natural overland drainage through the construction of 'dry culverts' or cross-drains designed to 1 in 100-year plus 65% climate change allowance.</p> <p>The Scheme design incorporates treatment of road drainage prior to discharging to ground. This includes filter drains and vegetated attenuation ponds. The realignment and restoration of Cantley Stream has been designed to ensure there is no loss of habitat or biodiversity.</p> <p>Below ground structures, including underpasses and foundations, shall be designed so as not to impede groundwater flow.</p> <p>Activities affecting the Intwood Stream and indirectly Yare (Tiffey to Wensum) will be compliant with the requirements of the Water Framework Directive (WFD), and are considered to not cause deterioration nor prevent future attainment of good ecological status under the WFD.</p>
Climate (ES Chapter 14)	<p>In accordance with DMRB LA 114, carbon emissions associated with the Proposed Scheme have been provided in the context of published UK carbon budgets. These budgets currently extend until 2032 and can be compared with 23% of the emissions increase associated with the Proposed</p>	

Topic	Assessment of Significant Environmental Effects	
	Construction	Operation
	<p>Scheme. The remaining 77% of the increase in carbon emissions will occur after 2032 (the end of the last currently published UK carbon budget).</p> <p>Efforts to minimise carbon emissions throughout the design and construction of the Proposed Scheme at this stage are outlined in accordance with requirements set out in DMRB LA 114. Recommendations to further reduce carbon emissions through design considerations and recalculation of carbon emissions at later stages of the design process have also been made.</p> <p>The vulnerability of Scheme assets to projected changes in climate during operation has been assessed, and the Scheme has been deemed resilient.</p> <p>Therefore, no significant effects as a result of climate change are anticipated; however, this would be reviewed when updated projections become available.</p>	
Cumulative Effects (ES Chapter 15)	<p>Significant single project cumulative effects are not expected as a result of the Scheme. Slight adverse cumulative effects are expected on residential properties on Cantley Lane notably 128 Cantley Lane, and properties on Cantley Lane South due to temporary visual intrusion, construction noise, and temporary increased journey length to access Thickthorn junction.</p> <p>Large adverse different project cumulative effects are expected at the Two Tumuli scheduled monument, which may experience significant temporary cumulative effects due to the alteration of its cultural heritage setting, visual effects, noise and vibration increase and light intrusion during construction of the Scheme.</p> <p>Best standard practice construction approaches in combination with community liaison would help to mitigate the cumulative impact of the effects. A planting design to mitigate visual impacts by screening the property views is presented in the Environmental Masterplan (TR010037/APP/6.8).</p> <p>The residual cumulative effects during the construction and operational phases of the Scheme with all of the other developments are not anticipated to contribute beyond that of the effects identified in the preceding environmental chapters.</p>	

6.3 National Planning Policy Framework 2019

- 6.3.1 The National Planning Policy Framework (NPPF) sets out the government’s national planning policies for England and how it expects these to be applied strategically in the development plan system and in the management of development. The revised NPPF, published on 19 February 2019, replaces the second Framework published on 24 July 2018.
- 6.3.2 The NPPF is explicit about the role of NPS being the primary decision-making document for NSIP under the PA 2008. Paragraph 5 of the NPPF states: “*The Framework does not contain specific policies for nationally significant infrastructure projects. These are determined in accordance with the decision-making framework in the Planning Act 2008 (as amended) and relevant national policy statements for major*

infrastructure, as well as any other matters that are relevant (which may include the National Planning Policy Framework)."

- 6.3.3 Paragraph 1.17 of the NPS NN states that the overall strategic aims of the NPS NN and NPPF are consistent. Paragraph 1.18 goes on to say that the NPPF will be an important and relevant consideration "*but only to the extent relevant to [the] project*". Therefore, it is necessary to consider the extent of any such relevance and compliance with the policies that it contains.
- 6.3.4 The NPPF confirms that the purpose of the planning system is to contribute to the achievement of sustainable development (paragraph 7), and that a presumption in favour of sustainable development lies at the heart of the NPPF (paragraph 10).
- 6.3.5 Paragraph 8 of the NPPF confirms that sustainable development is to be achieved by three overarching objectives: economic, social and environmental. These objectives are interdependent and need to be pursued in mutually supportive ways.
- 6.3.6 With regards to promoting sustainable transport, Chapter 9 of the NPPF states that transport issues should be considered from the earliest stages of plan-making and development proposals, so that opportunities from existing or proposed transport infrastructure, and changing transport technology and usage, are realised and the environmental impacts of traffic and transport infrastructure can be identified, assessed and taken into account. This should include appropriate opportunities for avoiding and mitigating any adverse effects, and for net environmental gains (paragraph 102).
- 6.3.7 Paragraph 104 states that planning policies should: "*Be prepared with the active involvement of local highways authorities, other transport infrastructure providers and operators and neighbouring councils, so that strategies and investments for supporting sustainable transport and development patterns are aligned; and identify and protect, where there is robust evidence, sites and routes which could be critical in developing infrastructure to widen transport choice and realise opportunities for large scale development;*" they should also provide for any large scale transport facilities that need to be located in the area, and the infrastructure and wider development required to support their operation, expansion and contribution to the wider economy. In doing so they should take into account whether such development is likely to be a nationally significant infrastructure project and any relevant national policy statements."
- 6.3.8 Paragraph 148 states that the planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.
- 6.3.9 Paragraph 150 states that new development should be planned for in ways that:
- a) "*avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and*
 - b) *can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings*

should reflect the Government's policy for national technical standards."

- 6.3.10 With regards to the need to adapt to climate change, the environmental effects of the Scheme have been robustly assessed. One of the objectives of the Scheme is to protect the environment by minimising adverse impacts and where possible, improve the environmental effects of transport on those living close to the route of the new Cantley Lane Link Road and on the existing Cantley Lane South. This will be achieved through design, reducing any impacts on the natural and built environment. Chapter 14 Climate of the ES (**TR010037/APP/6.1**) considers the Scheme's effect on climate (i.e. increases in carbon emissions) as well as the vulnerability of the Scheme assets to projected changes in climate during operation. The latest UK Climate Projections have been used and the Scheme has been deemed resilient. Therefore, no significant effects as a result of the Scheme on climate change are anticipated.
- 6.3.11 The Scheme would improve the quality of the SRN in the east by improving connectivity, reliability and safety at the A47/A11 Thickthorn Junction which accords with the social objective of the NPPF. The Scheme supports the NPPF economic objective and strategic policy in making adequate provision for transport infrastructure and supporting future economic growth. The Scheme therefore accords with the key aims of the NPPF by providing improved infrastructure to support economic growth.

6.4 Road Investment Strategy RIS1 and RIS2

- 6.4.1 The RIS define a national programme of improvements to the SRN.
- 6.4.2 **The Road Investment Strategy 1: 2015 to 2020 (RIS1)** introduces long-term strategic planning and funding for the SRN, underpinned by a significant increase in investment in the SRN. It is the ambition of the Applicant to substantially modernise the SRN within 25 years. This vision for improvement is outlined in more detail through the Performance Specification and Key Performance Indicators (KPIs) related to: the environment; WCH and other vulnerable users; efficiency; network condition; road safety; user satisfaction; traffic flow; and economic growth.
- 6.4.3 The RIS1 stated that 127 major schemes would be undertaken over the course of the first Road Period (2015 to 2020), in order to deliver benefits quickly. The Scheme was listed as a committed scheme in the Strategy, detailed as *"improvement of the interchange between the A47 and A11, improving access into Norwich"*.
- 6.4.4 In the longer term, up to 2040, the Applicant looks to achieve an upgraded network which makes use of the latest technology in line with KPIs and in order to fulfil the Performance Specification (February 2015).
- 6.4.5 **Road Investment Strategy 2: 2020 to 2025 (RIS2)** sets out: a long-term strategic vision for the network and specifies the performance standards Highways England must meet; planned enhancement schemes that are expected to be built; and the funding that will be made available during the Second Road Period (RP2), covering the financial years 2020-21 to 2024-25.
- 6.4.6 The Scheme is committed for RP2 within the list of schemes to be developed by the Applicant over the period covered by RIS2. This categorisation means that construction of the Scheme is expected to start by 1 April 2025. Funding to deliver the schemes named in RIS2 is committed on the assumption that they continue to demonstrate a strong business case and secure the necessary planning consents.
- 6.4.7 The Applicant, as the strategic highways company appointed by the SoS must, in

exercising its functions and complying with its legal duties and other obligations, act in a manner which it considers best calculated to, among others:

- minimise the environmental impacts of operating, maintaining and improving its network and seek to protect and enhance the quality of the surrounding environment
- conform to the principles of sustainable development.

6.5 The Strategic Road Network and the Delivery of Sustainable Development (DfT Circular 02/2013)

- 6.5.1 This Circular explains how the Highways Agency (Highways England) will engage with the planning system, communities and the development industry to deliver sustainable development and, thus, economic growth, whilst safeguarding the primary function and purpose of the SRN.
- 6.5.2 The document states that the Applicant will work with local authorities to influence Local Plan decisions that may affect the SRN.

6.6 Highways England Delivery Plan and Strategic Business Plans

Highways England Strategic Business Plan 2020 to 2025

- 6.6.1 The Applicant is responsible for planning the long-term future and development of the SRN including its maintenance, operation and improvement.
- 6.6.2 The Strategic Business Plan (SBP) 2020 to 2025 was published in March 2020 and responds to and aligns with the Government's RIS2. It provides the high-level direction for every part of Highways England for the second road period (2020 to 2025), setting the outcomes the Applicant will work to deliver and the strategic priorities for the business. This SBP includes similar KPIs as agreed with the DfT, Transport Focus and the Office of Rail and Road. The framework reflects how the following six outcomes will be delivered:
- improving safety for all
 - providing fast and reliable journeys
 - a well-maintained and resilient network
 - delivering better environmental outcomes
 - meeting the needs of all users
 - achieving efficient delivery.
- 6.6.3 These outcomes respond to and align with government's priorities, as set out in RIS2: a network that supports the economy; a greener network; a safer and more reliable network; a more integrated network; and a smarter network.

Highways England Delivery Plan, 2020 to 2025

- 6.6.4 The Highways England Delivery Plan 2020 to 2025 responds to RIS2 and provides details of how investment will be delivered over the five years. It also discusses the Applicant's approach efficiency and risk management. The delivery plan includes a performance framework, which brings together all the delivery aims for the second road period. The A47 Thickthorn Scheme is listed as an enhancement scheme for which works are anticipated to start in 2022/23.

National Infrastructure Strategy, November 2020

- 6.6.5 HM Treasury, advised by the National Infrastructure Commission, presented the National Infrastructure Strategy to Parliament in November 2020. It sets out the government's plans to deliver a radical improvement to the UK's infrastructure system delivering projects better, greener and faster, underpinned by high levels of government investment. It aims to:

- boost growth and productivity across the whole of the UK, levelling up and strengthening the Union
- put the UK on the path to meeting its net zero emissions target by 2050
- support private investment
- accelerate and improve delivery.

6.6.6 The foundational role of high quality infrastructure in relation to economic growth is emphasised, particularly in current times in the UK's recovery from the COVID-19 pandemic. The 2020 Spending Review pledges £27 billion over Roads Period 2 (2020-2025) to develop the economic infrastructure sectors, including transport. Further, it states, "*continuing to progress the UK's ambitious infrastructure plans in all parts of the country is vital to the recovery of the construction sector, and the economy as a whole*".

Summary

- 6.6.7 The Scheme complies with national planning policy identified above in that the Government has highlighted the express need for further growth and improvements to the national networks within the NPS NN and the recently published National Infrastructure Strategy.
- 6.6.8 The criteria identified within NPS NN are met with mitigation measures incorporated into the Scheme to reduce unavoidable impacts on the surrounding environment. Any residual impacts are not without sufficient justification. Further details are provided in the ES **(TR010037/APP/6.1)**.
- 6.6.9 The DfT's RIS2 supports the Scheme as a required improvement to the network. The Highways England Delivery Plan, built on the HE Strategic Business Plan, lists the Scheme as a committed enhancement within the second road period.
- 6.6.10 The Scheme meets the environmental and sustainable objectives of the NPPF. The Scheme as submitted will improve safety and journey times at this junction. Measures taken to minimise potential significant adverse effects and maximise benefits on the environment and local communities to comply with the NPS NN are discussed, with justification provided for any unavoidable residual significant effects.
- 6.6.11 The Applicant has engaged with the planning system, communities and the development industry to ensure the delivery of sustainable development and, thus, economic growth, whilst safeguarding the primary function and purpose of the SRN in line with the requirements of Circular 2/2013.

6.7 Sub-regional Policy

New Anglia Local Enterprise Partnership (LEP) Norfolk and Suffolk Unlimited Economic Strategy, 2017

- 6.7.1 The Economic Strategy produced by the New Anglia LEP in November 2017 is based on the Strategic Economic Plan 2014 and provides a plan for growth in Norfolk and Suffolk³⁰. This is a shared endeavour between businesses, education providers, local councils, the voluntary and community sector and is led by New Anglia LEP. It outlines

³⁰ https://newanglia.co.uk/wp-content/uploads/2020/03/New-Anglia_Norfolk-Suffolk-Unlimited_Economic-Strategy-Brochure-1-1.pdf

ambitious plans for future growth across Norfolk and Suffolk

- 6.7.2 The Strategy sets out to address the regions' shortfalls and growth opportunities, demonstrating housing and employment commitments and potential growth locations with reference to specific improvements on the SRN.
- 6.7.3 Improvements to the A47 are identified as key to improve the region's internal connectivity and links to wider markets.
- 6.7.4 In May 2019, a Norfolk and Suffolk Economic Strategy Progress Report was produced by the LEP which provides an overview of progress being made since the Norfolk and Suffolk Economic Strategy was published in November 2017.
- 6.7.5 It sets indicators for the area to deliver and measure progress towards the LEP's goals and ambitions using eight economic indicators, Gross Value Added (GVA), jobs, businesses, housing, median wage, employment rate and skills.
- 6.7.6 The results show that there has been low to moderate GVA growth, and the growth in GVA per hour worked in Norfolk and Suffolk was strong against both the national average and comparator LEP areas. However, Norfolk and Suffolk have seen depressed wage growth, in real terms, over the past two years.
- 6.7.7 Norfolk and Suffolk have however seen particularly strong levels of growth in the employment rate over the past decade. The Economic Strategy sets a qualitative target of maintaining a consistently higher employment rate than the national average. Though this exceeds the indicator target of 0.5% growth in both 2016 (2.03%) and 2017 (0.52%) there was a net slowing of business growth and rate of housing completions. Norfolk and Suffolk improved the skills base at a faster rate in 2017 than the national average and all of the comparator LEP area.

New Anglia LEP Integrated Transport Strategy, 2018

- 6.7.8 In May 2018, the New Anglia LEP produced an Integrated Transport Strategy (ITS) for Norfolk and Suffolk which highlighted the congestion in, amongst others, the critical east-west growth corridor along the A47 from Lowestoft and Great Yarmouth to King's Lynn. The ITS aims to "*Ensure a resilient SRN that is agile to future opportunities, the timely delivery of already committed Schemes and certainty that the ... A47 amongst others would feature prominently in future Roads Investment Strategies by strengthening relationships with Highways England*".
- 6.7.9 The ITS discusses the A47 Alliance, a "*successful lobbying group which is pushing for full dualling of the A47 between Peterborough and Lowestoft. The dualling of the A47 has cross-party, cross-county support and in 2014, the government awarded a £300m funding package for dualling and junction improvement Schemes along the A47. The A47 Alliance brings together the Chambers of Commerce, local authorities, LEPs and MPs along the route and is also supported by other stakeholders including the RAC, Eastern Daily Press and local businesses. The Eastern Daily Press, Norfolk Chamber of Commerce and Norfolk County Council are currently spearheading the 'Just Dual It' campaign to push government to invest further in the A47 and get a commitment for full dualling of the A47 by 2030.*"
- 6.7.10 The Scheme is therefore supported by the LEP which see the improvements to the A47 as a key to economic prosperity.

New Anglia Norfolk and Suffolk Limited, Draft Local Industrial Strategy, 2020

- 6.7.11 The Draft Local Industrial Strategy has been adopted by local partners. It has been submitted to Government and awaits approval. It reflects the opportunities and needs of Norfolk and Suffolk's growing economy and how it will respond in a fast-changing world. It has a strong local partnership with a track record of delivery and shows how Norfolk and Suffolk will continue to collaborate across disciplines and boundaries to provide new solutions and the infrastructure that its communities and businesses need.
- 6.7.12 Norfolk and Suffolk are at the forefront of tackling the challenges and opportunities of climate change and the document identifies that 'Clean Growth' sits at the heart of the Local Industrial Strategy. The area's major strengths in energy generation and usage, and high-tech sustainable agri-food, present major opportunities. The Strategy sets out specific actions that will drive productivity and growth across the economy as a whole. Improvements to the A47 are mentioned and it is stated that committed improvements to date through the RIS will deliver significant benefits, but additional investment on the A47 could further drive growth opportunities for Norfolk and Suffolk.

The A47 Alliance

- 6.7.13 The A47 Alliance brings together the business community, local authorities, MPs and stakeholders along the whole of the trunk road route between Peterborough and Lowestoft. The Alliance states that they are working together to make the case for improvements and to secure the investment required to make it happen.
- 6.7.14 The A47 Alliance is calling on the Government to commit funding to fully dual the A47 by 2030 and specifically to prioritise upgrading sections from single to dual carriageway by 2025.
- 6.7.15 A number of technical papers supporting the case for improvements are on the A47 Alliance website. In 2019 the Alliance produced its latest brochure: *The A47 Investing in East-West Success*. This details why in their opinion getting the A47 fully dualled is vital to the East of England's businesses and economic growth.

Summary

- 6.7.16 There is a strong drive in the Norfolk and Suffolk Regions for sustained economic transformation and growth to build upon the area's strong employment rate and its specific strengths in energy generation and usage, and hi-tech sustainable agri food. The development of the trunk road network is seen as key to economic delivery – jobs, business and housing, including access to enterprise zones, particularly along the critical east-west growth corridor of the region. The New Anglia LEP Integrated Transport Strategy highlights the cross-party, cross-county support for the A47 dualling and improvement while the A47 Alliance in particular brings together the Chamber of Commerce, Local Authorities, LEPs, MPs and other stakeholders who support dualling of the A47 in its entirety. The Scheme is therefore an essential and integral part of the region's drive for economic success articulated in the objectives of the various sub regional policy documents.

6.8 Conformity of the Scheme with Local Development Plans and Local Transport Plans

Local Development Plans

6.8.1 The Scheme is located within South Norfolk local planning authority area. South Norfolk Council shares a Core Strategy, the Greater Norwich Joint Core Strategy (JCS) (part of its Local Development Plan), with two other local authorities: Norwich City Council and Broadland District Council. South Norfolk Council also maintains its own Local Development Framework, which includes Site Specific Allocations and Development Management Policies specific to South Norfolk. Cringleford Parish Council, which spans part of the Thickthorn Junction, has an adopted Neighbourhood Development Plan (NDP). There are also Supplementary Planning Documents (SPD), including a Landscape Character Assessment SPD September 2013.

Joint Core Strategy for Broadland, Norwich and South Norfolk, 2011, amended 2014

6.8.2 The Joint Core Strategy (JCS) for Broadland, Norwich and South Norfolk, 2011 was adopted in March 2011, and amended in January 2014. It is the key planning policy document for the Greater Norwich area and forms part of the local plan for the districts of Broadland, Norwich and South Norfolk, setting out the broad vision for the growth of the area and containing strategic policies for the period 2008 to 2026.

6.8.3 Section 3 of the JCS acknowledges the increase in trip generation in and around Norwich, the impact on road capacity and resultant significant delays to traffic. As the economy in Norwich grows, so will traffic levels, exacerbating the problem. The strategic importance of both the A11 and the A47, which provide access to London, Cambridge, the south Midlands, and the Midlands and the North respectively, is highlighted as are the safety and congestion issues.

6.8.4 The Spatial Vision outlines the potential for economic growth in the region and the importance of access to and across the area as a prerequisite for development. Objective 7 of the JCS is *“to enhance transport provision to meet the needs of existing and future populations while reducing travel need and impact”*. Objective 11 outlines the need for people to be offered the best opportunities to make healthy travel choices as part of their daily lives. The Scheme offers improvements to connectivity along the A47 corridor, including new walker and cyclist links that support this vision.

6.8.5 A number of the policies are applicable to aspects of the Scheme:

- Policy 1: Addressing climate change and protecting environment assets promotes sustainable practices in the design of development. This is addressed in Chapter 13: Road Drainage and the Water Environment and Chapter 14: Climate of the ES (**TR010037/APP/6.1**) and Chapter 3 of the Scheme Design Report (**TR010037/APP/7.3**). The importance of ensuring priority is given to low impact modes of travel and the need to develop and maintain green infrastructure networks is also key. The Scheme incorporates: a new, safer footbridge over the A47 for walkers, cyclists and horse-riders; paths for walking and cycling along the new Cantley Lane Link Road; and access to the park and ride from the Cantley Lane Link Road.
- Policy 2: Promoting good design is also relevant in promoting the highest standards of design while respecting local distinctiveness in relation to the

landscape, historic environment, provision of routes for walking and cycling, use of sustainable materials where possible and avoidance of harm to key environmental assets. The compliance of the Scheme will all of these issues is addressed in Chapters 5 to 15 of the ES (**TR010037/APP/6.1**) and Chapter 3 of the Scheme Design Report (**TR010037/APP/7.3**).

- Policy 5: The policy promotes development of the local economy in a sustainable way to support jobs and economic growth both in urban and rural locations. The supporting narrative to the policy states *“achieving the full economic potential of the area is dependent on improved connectivity, including the implementation of the priorities set out in the sustainable transport policy and maintaining and enhancing the environment and quality of life in the area.”*
- Policy 6 of the JCS seeks to improve the transportation system to develop the role of Norwich as a Regional Transport Node, particularly through the implementation of the Norwich Area Transportation Strategy and will improve access to rural areas. One of the ways this will be achieved is *“by promoting improvements to the A11 and A47”*. The narrative states that strategic improvements required to deliver growth and facilitate modal shift include *“junction improvements, including public transport priority, on the A47 Norwich Southern bypass, in particular at Longwater, Thickthorn and Postwick”*.
- Policy 9: Strategy for growth in the Norwich Policy Area (NPA). Confirms the Scheme is located within an area which is the focus for major growth and development in all sectors, supported by safe and efficient transport infrastructure. Junction improvements on the A47 Norwich Southern bypass are listed as a necessity in this regard.
- Policy 10: Locations for major new or expanded communities in the Norwich Policy Area. States that most of the growth within the plan will be located in the NPA, where it can be best served by greatly enhanced public transport, walking and cycling. The future expansion of Wymondham, Cringleford and Hethersett is dependent on the expanded capacity of the A11/A47 Thickthorn junction to enable overall growth of 4,800 dwellings and related service expansion. The Scheme is a strategic necessity underpinning growth and investment in the NPA.

South Norfolk Local Plan

6.8.6 The following Development Plan Documents were adopted by the Council in October 2015 and now form part of the development plan for South Norfolk:

- Site Specific Allocations and Policies Document³¹
- Development Management Policies Document³²
- Wymondham Area Action Plan – south-west of Norwich, so not considered further
- Long Stratton Area Action Plan – south of Norwich, so not considered further

³¹ <https://www.south-norfolk.gov.uk/residents/planning/planning-policy/adopted-south-norfolk-local-plan/site-specific-allocations-and>

³² <https://www.south-norfolk.gov.uk/residents/planning/planning-policy/adopted-south-norfolk-local-plan/development-management-policies>

- Neighbourhood Plans – there is a plan for Cringleford
- Supplementary Planning Documents (SPD), including the Open Space SPD³³.

Site Specific Allocations and Policies Document, adopted October 2015

6.8.7 This document sets out those sites across the district that are suitable for certain forms of development such as housing, employment, community facilities etc. The scale of development reflects the requirements set out in the JCS. It also includes the definition of development boundaries or “settlement limits” for those places where some growth may take place.

6.8.8 There are sites identified within the site Allocations DPD for residential development of approximately 1,200 dwellings in Hethersett.

Development Plan and Policies Document, adopted October 2015

6.8.9 The Development Management Development Plan Document (DPD), adopted August 2015, sets out the generic policies that are to be applied throughout the South Norfolk planning authority area. It should be read alongside the JCS. The policies set out within the Development Management DPD do not repeat but seek to further the aims and objectives set out within the NPPF and JCS. It therefore includes more detailed local policies for the management of development. The majority of the Scheme is within the Southern Bypass Protection Zone and in a Strategic Gap where under Policy DM 4.7 development is permitted providing it would not undermine the openness of the Strategic Gap and complies with other Development Plan policies.

Supplementary Planning Documents (SPD), including Open Space SPD September 2018

6.8.10 The Landscape Character Assessment SPD is supplementary to the Development Management Policy DM3.15: ‘Outdoor play facilities and recreational space’ and provides a tool to calculate the open space requirement a development will generate.

6.8.11 As detailed in ES Chapter 7 (**TR010037/APP/6.1**), part of the Scheme overlaps with the Cringleford Housing development’s provision of public open space, which is discussed in Table 6.1 and Section 7 of this Case.

Cringleford Neighbourhood Development Plan (NDP) 2013 - 2026

6.8.12 1,200 dwellings are allocated to Cringleford in addition to a new primary school. Policy TRA1 of the NDP states “*the Improvements to the Thickthorn interchange have long been recognised as essential to further development in Cringleford and neighbouring parishes (Joint Core Strategy T4 and T17). Plans must be brought forward as a matter of urgency*”.

Greater Norwich Local Plan (not yet adopted)

6.8.13 Broadland District Council, Norwich City Council, South Norfolk Council and Norfolk County Council are working together to prepare the Greater Norwich Local Plan (‘GNLP’). The GNLP is therefore emerging policy. Consultation on the publication draft ended on 22 March 2021.

6.8.14 The GNLP builds on the joint working arrangements for Greater Norwich, which have delivered the current JCS for the area. The JCS plans for the housing and job needs

³³ <https://www.south-norfolk.gov.uk/residents/planning-and-building/planning-policy/supplementary-planning-documents-and-advice-notes>

of the area to 2026 and the GNLP will ensure that these needs continue to be met to 2036.

- 6.8.15 The GNLP will include strategic planning policies to guide future development and plans to protect the environment. It will look to ensure that delivery of development is done in a way which promotes sustainability and the effective functioning of the whole area. The Plan will also allocate land for development.
- 6.8.16 The draft states that the transport system will be enhanced by a combination of infrastructure improvements including, amongst others, road improvements to the A47. Policy 4 Strategic Infrastructure states that trunk road improvements are planned by HE, in particular £300 million of A47 improvements including Thickthorn junction with a planned start date of 2022-23.

Green Belt Policy

- 6.8.17 The Scheme is not located within adopted Green Belt.

Local Transport Policy

Norfolk County Council Local Transport Plan, 2011-2026

- 6.8.18 Norfolk County Council's third Local Transport Plan (LTP3) was adopted in 2011. It describes the county's strategy and policy framework for delivery up to 2026 with an Implementation Plan covering the period 2015-2021 including a number of objectives which seek to address transport issues. These are: managing and maintaining the transport network; sustainable growth; strategic connections; transport emissions; road safety; and accessibility. Policy 7: Strategic Connections supports the improvement to Norfolk's strategic connections including the A11 and A47.

- 6.8.19 The Council is currently refreshing LTP3. LTP4 will cover the period 2021 to 2036. A consultation on the key priorities was held during January and February 2020. Proposed Policy 8 prioritises the improvement of major road and rail connections between larger places in the county. It notes the government commitment to over £300m of investment for the A47 works including the Scheme.

Norwich Area Transport Strategy, 2004, updated 2013

- 6.8.20 The Norwich Area Transport Strategy (NATS4) was adopted in 2004, with an updated Implementation Plan published in 2013 by Norfolk County Council.
- 6.8.21 The Norwich Area Transportation Strategy (NATS) summarises the characteristics of the Norwich Area, existing and predicted future travel patterns, and transport problems and issues in the Norwich area.
- 6.8.22 The update refers to post 2015 schemes including major junction enhancements at the Thickthorn Interchange.
- 6.8.23 Norfolk County Council are looking to update NATS4 to match the changing needs of the city and Greater Norwich as it continues to grow. The next phase of the strategy review project will involve working with the Greater Norwich authorities and local stakeholders to develop a revised strategy and implementation plan which addresses the issues and priorities identified from the initial consultation.

Greater Norwich Infrastructure Plan, 2020

- 6.8.24 The Greater Norwich Infrastructure Plan (GNIP), adopted May 2020, which covers the districts of Broadland, Norwich and South Norfolk, has been prepared to help

coordinate and manage the delivery of strategic infrastructure to support growth. The purpose of the document is to inform prioritisation of investment and delivery and support the JCS.

- 6.8.25 The GNIP sets out the major growth locations in South Norfolk which include the aforementioned housing allocations at Wymondham, Heathersett and Cringleford. It states that collectively the growth at these locations and the Norwich Research Park (25ha of land available for expansion of B1(b) uses including a designated Enterprise Zone and multi-storey car park), is “*partly dependent on improvements at the A11/A47 Thickthorn 28 junction and public transport corridor enhancements. Major improvement at Thickthorn is included as a commitment in the Government’s Road Investment Strategy Investment Plan with construction currently timetabled for a 2021 start.*”

Conformity of the Scheme

- 6.8.26 The Joint Core Strategy for Broadland, Norwich and South Norfolk highlights current problems of congestion and safety in and around Norwich and the strategic importance of the A11 and A47. The strategic importance of the A47, the potential for future economic growth in the region and the inextricably linked need for fluid and safe access is highlighted. Improvements to the transportation system sit within the Core Strategy’s policies which specifically refer to junction improvements at Thickthorn.
- 6.8.27 The Scheme accords with other policies of the Strategy in relation to sustainability, incorporation of green infrastructure networks and inclusion of good design. The plans highlight the importance of creating attractive communities where healthy travel choices are available, noting the commitment to climate change and green infrastructure, including public rights of way.
- 6.8.28 The Scheme is also located within the designated Norwich Policy Area (NPA) which is the focus for major growth and development. Future residential developments of over 4,800 dwellings are expected within the NPA with related service provision, meaning the Scheme is a strategic necessity underpinning growth and investment.
- 6.8.29 The Scheme is within the Southern Bypass Protection Zone defined in the Development Management DPD for South Norfolk. Also, policy in the Cringleford NDP requires the improvements to the Thickthorn interchange to be brought forward with some urgency to support the residential growth in the area.
- 6.8.30 The Scheme will therefore accord with Development Plan policy and objectives in relieving congestion for the benefit of existing users, in light of new residential developments and to assist the region’s attractiveness to potential commercial investors. It will result in safer connections and a reduction in accidents and provides for improved footpath and cycle way connections to support the provision of sustainable travel.
- 6.8.31 The Scheme is mentioned within and also supports the priorities of the current and emerging NCC Local Transport Plans and NATS4 as well as the Greater Norwich Infrastructure Plan in supporting growth, improving a strategic connection and improving safety and access for current users while providing capacity for future proposed and committed residential and business developments in the area.

6.9 Planning Balance

- 6.9.1 Section 104(7) of the PA 2008 requires that the application should be determined in accordance with the relevant National Policy Statement unless the adverse impact of the proposed development would outweigh its benefits. This Case for the Scheme document provides an overview of the economic, social and environmental benefits of the Scheme. The potential impacts of the Scheme have also been comprehensively considered and addressed through the management and mitigation measures described in the ES (**TR010037/APP/6.1**). The balance of benefits and adverse impacts is also considered through the Scheme's compliance with the NPS NN, set out in the NPS NN Accordance Tables (**TR010037/APP/7.2**) and in section 7.4 below.
- 6.9.2 The ES (**TR010037/APP/6.1**) has considered each impact assessment topic according to whether there are likely to be significant environmental effects, in line with the EIA Regulations. The conclusions from the ES have been reviewed in order to consider the conformity of the Scheme with the NPS NN, the NPPF, the development plan, plus other infrastructure and transport plans and strategies, as set out in this document.
- 6.9.3 In terms of adherence to national policy requirements, the Scheme demonstrates compliance with the Government's strategic vision for the development of the national road network. The benefits of the Scheme are demonstrated by its inclusion within the RIS and within national, regional and local transport and planning policy. Section 3(6) of the Infrastructure Act 2015 places a duty on the SoS to comply with the provisions of the RIS.
- 6.9.4 By creating the A11/A47 Connector Road and undertaking improvements to the A47/A11 Thickthorn Junction, removing many of its existing constraints, the Scheme meets the objectives contained in the transport and economic strategies for the area as well as policies within the Joint Core Strategy for Broadland, Norwich and South Norfolk, in the Development Management DPD for South Norfolk and in the Cringleford NDP.
- 6.9.5 The Scheme is strongly supported at a sub-regional level as being essential and integral to the region's drive for economic success articulated in the objectives of the various sub regional policy documents. Improvements to the SRN are considered to be key priorities for the delivery of economic growth in Norfolk and the East of England as a whole.
- 6.9.6 The Scheme, in providing safe and fluid road capacity to accommodate increased trip generation, will help support economic growth by encouraging inward investment in business and residential development and will tackle a range of identified capacity and safety issues at the Thickthorn Junction. It also provides for the improvement of green infrastructure for sustainable transport modes. Table 3.2 of this Case for the Scheme sets out how the Scheme has been designed to meet the objectives of the NPS NN in the above regard, as well as protecting the environment and ensuring a more accessible and integrated network which represents value for money.
- 6.9.7 The Scheme's benefits have been assessed in the context of unavoidable impacts that are identified in the ES (**TR010037/APP/6.1**). It is acknowledged that, for example, the Scheme will result in impacts in certain areas, including a Scheduled Monument and veteran trees. Suitable mitigation is proposed to manage these impacts where they occur and overall the benefits of the Scheme are considered to

outweigh any unavoidable adverse effects.

- 6.9.8 Following public consultation and feedback the Scheme is considered by the Applicant to be the best available option for improving the Thickthorn Junction. It is fully funded as illustrated in the Funding Statement (**TR010037/APP/4.2**) and, if granted, the DCO will include the compulsory acquisition powers required to deliver the Scheme.
- 6.9.9 The Scheme therefore comprises an opportunity to secure a deliverable and fully funded Scheme in accordance with the RIS, and current and emerging planning and transport policies.

7 CONCLUSIONS

7.1 Introduction

- 7.1.1 This Case and accompanying NPS NN Accordance Tables (**TR010037/APP/7.2**) set out the policy context against which the Scheme should be viewed. Together, they demonstrate a clear justification for the Scheme grounded in national, regional and local planning and transport policy.
- 7.1.2 The NPS NN, NIDP and RIS set out a strong position of support in delivering national networks that meet the country's long-term needs, whilst supporting a prosperous and competitive economy and improving the quality of life for all.

7.2 Need and Scheme Objectives

- 7.2.1 Thickthorn Junction already exceeds the recommended traffic flows leading to longer and unreliable journey times. By the 2040 Design Year its slip roads are predicted to exceed capacity by over 70% for the case of the westbound diverge, and by over 50% for the case of the eastbound merge. These levels of saturation could result in an increased collision risk and affect the performance of the A47 mainline. Residential and commercial growth in Norwich and the immediate local area will exacerbate this condition. In addition, Norwich, Cambridge and Peterborough are amongst the fastest growing cities in the country.
- 7.2.2 Safety is also currently compromised. The high rate of accidents in the area is a key safety challenge for the Scheme, since the A47 is currently ranked second nationally for fatalities on A-roads and the accident severity ratio is above average. The rate of accidents is likely to increase owing to the increase in traffic flow and need for increased capacity due to future growth in area.
- 7.2.3 The proposed solution to the traffic and safety issue which is defined in the RIS as "*improvement of the interchange between the A47 and A11, improving access into Norwich*".
- 7.2.4 Improving the Thickthorn Junction offers a solution to its capacity limitations and improve its safety record in accordance with the DfT proposals. It will support residential and economic growth and development in the area, which is considered essential at a regional level and is promoted strongly by the A47 Alliance.

7.3 Alternatives, the Scheme and its Benefits

- 7.3.1 A wide ranging and detailed optioneering process, involving extensive study and consultation, has considered reasonable alternatives, ultimately resulting in the announcement of the preferred junction arrangement in August 2017.
- 7.3.2 The Scheme has been further developed since the preferred route announcement. Taking on board feedback from stakeholder engagement, the design of the Scheme was developed to that now set out within the DCO application. It is the best option to meet the defined need and objectives, including the delivery of a comprehensive set of benefits including reduced congestion and journey times, improved safety and journey time reliability consistent with national and local planning objectives for transport, economy and the environment.
- 7.3.3 Economic benefits include increased road capacity to support regional and local housing and employment growth. Reduced congestion, reduced transport costs and

more reliable journey times will also support businesses accessing Peterborough, Kings Lynn, London, Cambridge, the Midlands and the North.

- 7.3.4 The Scheme is supported by an EIA, reported in the ES (**TR010037/APP/6.1**). The ES establishes the impacts and mitigation measures needed to meet the Scheme objective of avoiding unacceptable impacts on the surrounding natural and historic environment and landscape and optimising opportunities for enhancement.

7.4 Compatibility with NPS NN

- 7.4.1 The Scheme is compliant with the NPS NN. It meets the Government's strategic vision for the development of the national road network and wider policies for economic performance, environment, safety, technology, sustainable transport and accessibility, as well as journey reliability and the experience of road users. Where impacts are generated by the construction or operation of the Scheme, it has been demonstrated, through careful and comprehensive assessment, that substantial and long-lasting transportation, economic and community benefits will outweigh the limited impacts identified.

- 7.4.2 The detailed NPS NN Accordance Tables (**TR010037/APP/7.2**) demonstrate the conformity of the Scheme with the NPS NN. Several NPS NN paragraphs recommend The Secretary of State does not grant development without reasonable justification. Those relevant to this Scheme are considered below:

- 7.4.3 **Paragraph 4.66** (*"The Secretary of State should not grant development consent unless satisfied that all reasonable steps have been taken and will be taken to: minimise the risk of road casualties arising from the Scheme; and contribute to an overall improvement in the safety of the Strategic Road Network."*):

- The Scheme has been designed in accordance with current national design standards as set out in the DMRB. In addition, as discussed in Section 4.12 of this Case for the Scheme, the transport modelling for this Scheme has demonstrated that over a 60-year timeframe it will reduce the risk of road casualties by saving a total of 242 accidents and 26 killed or seriously injured (KSI). It is therefore considered that reasonable steps have been taken in the design and will be effective in the operation to ensure that the Scheme will contribute to an overall improvement in the safety of the SRN.

- 7.4.4 **Paragraph 5.174** (*"The Secretary of State should not grant consent for development on existing open space, sports and recreational buildings and land, including playing fields, unless an assessment has been undertaken either by the local authority or independently, which has shown the open space or the buildings and land to be surplus to requirements, or the Secretary of State determines that the benefits of the project (including need) outweigh the potential loss of such facilities, taking into account any positive proposals made by the applicant to provide new, improved or compensatory land or facilities."*):

- There are no areas of community land within the study area, but there is proposed public open space provision as part of the Cringleford Residential Development on land immediately adjacent to the north-east and south-east of Thickthorn Junction. Round House Park has planning permission to provide 1,000 dwellings and is currently on course for construction as part of the Greater Norwich Development Partnership's Joint Core Strategy (Cringleford

Neighbourhood Development Plan, 2014). The residential development is subject to planning obligations requiring the provision of onsite public open space, both informal recreational space and formal space in the form of several football pitches. The Section 106 Agreement outlines areas required for both formal and informal public open space.

- An area of the proposed Cringleford Residential Development public open space is unavoidably required permanently by the Scheme due to its position adjacent to the south-east side of Thickthorn junction. The area of open space required for the Scheme was to be a football pitch (0.49ha) and informal open space (1.31ha). As the informal open space is a surplus requirement of the planning obligations, the loss as a result of the Scheme is not considered to impede the planning obligations set for the Cringleford Development. As the loss of land would result in half of the proposed pitch area to be lost it is considered the facility as a whole is removed. The sensitivity of this area of public open space would be medium as there would be alternative facilities available at a local level with other football pitches proposed as part of the development.
- Discussions are ongoing during the DCO process with the developer to determine the mitigation for the loss of approximately half of the proposed area of formal public open space (whole area is an approximately 0.49ha football pitch). However, confirmation of mitigation to either compensate this loss or relocate the football pitch will be determined during the DCO examination stage. Therefore the effect has been assessed as the worst case scenario that the football pitch would not be relocated resulting in a **Large adverse** effect.
- As the informal open space has been identified as surplus to requirements and in light of wider benefits of the Scheme in environmental, safety, social and economic terms, the Scheme is deemed to meet the requirements of this NPS paragraph.

7.4.5 **Paragraph 5.26** (*"In taking decisions, the Secretary of State should ensure that appropriate weight is attached to designated sites of international, national and local importance, protected species, habitats and other species of principal importance for the conservation of biodiversity, and to biodiversity and geological interests within the wider environment."*) and **Paragraph 5.32** (*"The Secretary of State should not grant development consent for any development that would result in the loss or deterioration of irreplaceable habitats including ancient woodland and the loss of aged or veteran trees found outside ancient woodland, unless the national need for and benefits of the development, in that location, clearly outweigh the loss"*).

- There would be no impact, either directly or indirectly, on sites internationally or nationally designated for their biodiversity or geological conservation interests. For most other biodiversity receptors, there would be no significant residual effects after mitigation. However, areas of deciduous woodland and hedgerows would experience a significant adverse residual effect due to the long-time lag to achieve their former maturity. The loss of two veteran trees would be a significant adverse residual effect as they are irreplaceable.
- Removal of some areas of woodland, two veteran trees (T13 and T14 north of the A11) and some notable individual mature trees at Cantley Lane South (for example, T32) has been determined as unavoidable. Delivery of modern

highway standards has necessitated realignment of a section of Cantley Stream and the creation of a wider, standard highway junction (with segregated pedestrian and cycle lanes) at Cantley Lane South which is currently a very narrow rural lane.

- At year 15 of operation the establishment of Scheme woodland, individual tree and hedgerow planting would notably contribute to the replacement of these habitats. The redirected section of Cantley Stream would also have matured to more closely reflect baseline conditions. Adverse residual effects after 15 years would be associated with the irreplaceable loss (within a fifteen year time horizon) of the two veteran trees north of the A11 and of several mature roadside trees at Cantley Lane South (most notably T32).
- The Scheme will bring beneficial effects to the biodiversity interests within the wider environment: a net gain of more biodiverse grassland habitats with the introduction of species-rich and marshy, wet grassland; and riparian planting along Cantley Stream increasing beneficial habitat for aquatic invertebrates.
- Overall, although there are significant residual effects for habitats of principal importance and loss of two irreplaceable veteran trees, these need to be considered against the wider economic and transport benefits of the Scheme as set out in this document. It is therefore considered that on balance the wider benefits of the Scheme outweigh the potential harm to biodiversity within the wider environment, the extent of which on woodland and hedgerow habitats should decrease over time as new habitats mature.

7.4.6 Paragraphs 5.131 (*“When considering the impact of a proposed development on the significance of a designated heritage asset, the Secretary of State should give great weight to the asset’s conservation. The more important the asset, the greater the weight should be. Once lost, heritage assets cannot be replaced and their loss has a cultural, environmental, economic and social impact. Significance can be harmed or lost through alteration or destruction of the heritage asset or development within its setting. Given that heritage assets are irreplaceable, harm or loss affecting any designated heritage asset should require clear and convincing justification. Substantial harm to or loss of a grade II Listed Building or a grade II Registered Park or Garden should be exceptional. Substantial harm to or loss of designated assets of the highest significance, including World Heritage Sites, Scheduled Monuments, grade I and II* Listed Buildings, Registered Battlefields, and grade I and II* Registered Parks and Gardens should be wholly exceptional.”*) and **Paragraph 5.132** (*“Any harmful impact on the significance of a designated heritage asset should be weighed against the public benefit of development, recognising that the greater the harm to the significance of the heritage asset, the greater the justification that will be needed for any loss”*):

- There would be significant residual adverse effect (that is, after application of proposed mitigation measures) upon one heritage asset as a result of the operation of the Scheme: a scheduled monument consisting of two Prehistoric burial mounds known as ‘barrows’, located outside the site boundary, named ‘Two Tumuli in Big Wood’ (NHLE1003977).
- Construction of the proposed embanked Cantley Lane Link Road immediately adjacent to the western barrow would cause severance from the monument’s associated landscape to the south, from where the barrows are currently viewed

prominently. The effect would be to remove the last remaining preserved part of the setting permanently. The same effects will occur but be of reduced magnitude for the eastern barrow due to the thicker vegetation present providing improved screening.

- Without mitigation the effect on the western barrow is assessed as Large. Following application of mitigation proposals including focused planting and screening of new infrastructure, an improved understanding of the context of the barrows through excavation, and introduction of a heritage information board, the residual effect on the scheduled monument is assessed as Moderate.
- Whilst there are no mitigation measures available to fully ameliorate the permanent impact upon the scheduled monument, opportunities to enhance appreciation of cultural heritage in the area have been proposed in the form of a new viewpoint and information board. These measures will enhance everyday public awareness and appreciation of a scheduled monument which is inaccessible to the public.
- Overall, in response to these NPS paragraphs, although significant effects remain for this asset the effects need to be considered against its existing position immediately adjacent to the A47 and A11, plus the wider environmental, safety, social and economic benefits of the Scheme as set out in this document. It is therefore considered that on balance the wider benefits outweigh the harm.

7.4.7 In conclusion, it is considered that the public benefits provided by the Scheme are clear, founded in factual evidence and outweigh any unavoidable impacts. This Case has shown that, where the NPS NN requires a balanced judgement between harm and benefits, the evidence demonstrates that the Scheme fully complies with the NPS and that the Scheme benefits significantly outweigh any adverse impacts.

7.5 Delivery of Government Policy and Programmes

7.5.1 The Scheme forms part of the Government's vision and strategic objectives for improving the UK's transport infrastructure as detailed in Section 3 of this Case. It will meet the identified need to provide safe, expeditious and resilient networks that better support and stimulate social and economic growth as set out in the NPS NN.

7.5.2 The Scheme is both a committed scheme in the DfT's RIS and also fulfils the aims of the NIDP and the Highways England Delivery Plan.

7.6 Delivery of Local Planning and Transport Policy

7.6.1 The Scheme accords with, and will deliver, the policy and aims of the Joint Core Strategy for Broadland, Norwich and South Norfolk and local transport plans within which there is specific support for the Scheme.

7.7 Planning Act 2008

7.7.1 The PA 2008 requires that, in determining DCO applications, the SoS must have regard to the relevant NPS, the Local Impact Report, any prescribed matters and any other matters the SoS thinks are important and relevant. Paragraph 4.2 of the NPS NN confirms that there is a presumption in favour of granting development consent for national networks.

7.7.2 The PA 2008 also states that DCO applications should be determined in accordance

with the relevant NPS except in certain circumstances including where adverse impacts would outweigh benefits, or where to do so would be unlawful, in breach of duty or condition, or in breach of international obligations.

- 7.7.3 The Scheme complies with the NPS NN and accords with all other relevant and important matters that the Secretary of State might need to take into consideration, including the adopted development plan for the local area and the NPPF.

8 GLOSSARY

Definitions	
Annual Average Daily Traffic (AADT)	One of several ways of measuring the flow of traffic; represents the daily average number of vehicles using a particular link in the network, averaged across the whole year.
Air Quality Management Area (AQMA)	An area identified by a local authority where the local air quality objectives not being achieved, or are not likely to be achieved within the relevant period. As required by Part IV of the Environment Act 1995. The authority declaring an AQMA is obliged to prepare a management plan to prevent or remove any such exceedances.
Air quality objectives	Ambient concentration not to be exceeded, either without exception or with a permitted number of exceedances, within a specified timescale. Intended to represent the concentration of any pollutant below which no effects on human health would be expected to occur, even in the most vulnerable individuals.
Air Quality Strategy (AQS)	The Government's air quality policy document for England, Scotland, Wales and Northern Ireland; establishes the national AQOs for a number of specific air pollutants.
Agricultural Land Classification (ALC)	A system of classifying the quality of agricultural land from Grade 1 (best) to Grade 5 (worst). Grade 3 is subdivided into 3a and 3b.
Amenity	Amenity can be defined as 'the pleasantness or attractiveness of a place' (Oxford Dictionary of English), and visual amenity is therefore the contribution of views towards the pleasantness or attractiveness of a place. The degree of visual amenity varies between locations according to the quality of views available.
Applicant	Highways England Company Limited.
At-grade	A term meaning 'on the same' level – i.e. when a roundabout or junction and all the roads joining it are at the same ground level so all the traffic needs to go around the roundabout or through the junction.
Attenuation	During rainfall, water can run off rapidly from the impermeable surface of the road, increasing water level in the streams to which it discharges. An 'attenuation pond' (or balancing pond) holds back the water before discharge, allowing it to be released slowly and reducing flood risk. While the water is held in the pond, sediment and pollutants can settle out, which improves the quality of the water before it is discharged.

Definitions	
Authorised Development	The development which is consented under an approved DCO.
Baseline	In EIA, 'baseline conditions' are the environmental conditions in existence just before the occurrence of an impact – i.e. they are the conditions that would be affected. Baseline conditions are not the same as existing conditions, which are those in existence at the time of carrying out the EIA, because, this may be some time in advance of the occurrence of an impact and environmental conditions may change in the intervening period.
Biodiversity	The variety of life in all its forms as discussed in the UK Action Plan published in 1994 – HMSO Cm 2428.
Best and Most Versatile Land (BMV)	Grades 1, 2 and 3a of the Agricultural Land Classification system, deemed by government policy to be a national strategic resource.
Environmental Management Plan (EMP)	A plan prepared by a contractor before the start of construction work, detailing 'environmental aspects' that may be affected by the construction work and management methods to prevent any such effects. The EMP would include methods and site management practices to be applied to prevent generation of nuisance dust, accidental pollution events and a range of other potential sources of accidental damage to the environment, and response and reporting procedures to minimise the damage in the event of a pollution incident.
Construction activity	Vegetation removal, topsoil stripping, temporary storage of materials, ground excavation and remodelling, bare earth, movement of construction vehicles and tall features such as cranes and other construction plant.
Contaminated Land	Any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land that – (a) significant harm is being caused or there is the significant possibility of such harm being caused.
Development Consent Order (DCO)	The legal document under which the relevant Secretary of State can grant consent for construction of a Nationally Significant Infrastructure Project, on the advice of the Planning Inspectorate, in accordance with the Planning Act 2008.
Design Manual for Roads and Bridges (DMRB)	The 15 volumes of DMRB provide guidance for all aspects of the design of roads and bridges in the UK. Volume 10 covers environmental mitigation and Volume 11 governs environmental impact assessment. Other volumes cover other aspects of the

Definitions	
	design and preparation of highways projects.
Do-Minimum	A hypothetical scenario used to provide a realistic comparison of the effects of the Scheme. The do-minimum scenario includes and changes to the highways infrastructure that would occur even if the Scheme does not go ahead, and any other developments in the surrounding area that would influence the movement of traffic and would occur independently of the Scheme.
Do-Something	A hypothetical scenario used to provide a realistic comparison of the effects of the Scheme. The do-something scenario includes changes in traffic flows caused by the Scheme as well as any other developments in the surrounding area that would influence the movement of traffic.
Earthworks	The moving of soil or rock to reconfigure the topography of a site.
Environmental Impact Assessment (EIA)	An assessment of certain types of major project of the significant effects that the project could have on the environment. The applicant is required to carry out the assessment by law, in this case under the Infrastructure Planning (Environmental Impact Assessment) Regulations, 2017.
Embodied Carbon	The amount of carbon released from material extraction, transport, manufacturing and related activities. This may be calculated from cradle to (factory) gate, cradle to (installation) site or from cradle to grave (final point of disposal).
Environment Agency (EA)	A non-departmental government body covering England and Wales, responsible for the protection of the environment, including the regulation of polluting activities and the control and prevention of flooding.
Environmental Management Plan (EMP)	A plan prepared before the start of construction work, detailing 'environmental aspects' that may be affected by the construction work and management methods to prevent any such effects. The EMP would include methods and site management practices to be applied to prevent generation of nuisance dust, accidental pollution events and a range of other potential sources of accidental damage to the environment, and response and reporting procedures to minimise the damage in the event of a pollution incident.
Environmental Statement (ES)	The report on the results of the EIA.
European site	A nature conservation site protected under the EU Habitats Directive (SAC) or the EU Birds Directive (SPA).

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Future Year	This is a specified year in the future, usually 15 years after the opening of the project. This is used to make predictions using computer models for both traffic flows and related environmental effects.
Geology	Geology is the study of solid earth, the material of which it is composed (principally rocks) and the processes by which they evolve.
Grade Separated	Refers to a junction where one road has been elevated or lowered to a different level so that the main flow of traffic is separated.
Greenfield runoff	The rate of discharge that would be expected from an area of undeveloped land with entirely soil covered, permeable surfaces. Such areas release water into watercourses much more slowly than areas with hard, impermeable surfaces.
Heritage asset	An item of heritage interest, for example an historic building or an archaeological find.
Highways England	The applicant and government company charged with operating, maintaining and improving England's motorway and major A roads. Formerly the Highways Agency.
Landscape Character Assessment (LCA)	Landscape character assessment is the process of categorising the landscape into different Landscape Character Areas. The purpose of this process is to aid the formulation and implementation of planning policies relating to the landscape.
Mitigation	Measures which have the purpose of avoiding, reducing or compensating for adverse environmental impacts. It may also include measures to create environmental benefits.
Nationally Significant Infrastructure Project (NSIP)	Any infrastructure project that is deemed, according to the criteria set in the Planning Act, 2008 (as amended) to be nationally significant. Such projects are authorised through a statutory process that requires an application for a DCO, rather than a conventional planning application or the traditional model through the publication of Statutory Orders and the holding of Public Inquiries.
Natural England (NE)	A public body responsible for the protection of the natural environment and landscape in England and the management of NNRs and SSSIs.
Noise Important Area	Where 1% of the population are affected by the highest noise levels from major roads according to the results of Defra's strategic noise

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	maps.
Outfalls	The location at which runoff is discharged into a watercourse.
Ramsar site	A site listed as a wetland of international importance under the Convention on Wetlands of International Importance Especially as Waterfowl Habitat 1973 (The Ramsar Convention).
Receptor	The existing environmental feature that would be affected by an impact – for instance, the population of a protected species, or a specific archaeological site, or the occupants of a residential property.
Requirement	A requirement listed in the Development Consent Order which is a condition of the grant of development consent.
The Scheme	The development for which the order granting development consent is sought
Site of Special Scientific Interest	A statutory designation under the Wildlife and Countryside Act 1981 (as amended), protecting nationally important wildlife sites, habitats and geological sites.
Site Waste Management Plan (SWMP)	A plan which specifies how waste generated throughout the construction works will be managed and volumes estimated. This includes minimisation, storage, segregation, re-use and final disposal of wastes generated.
Special Area of Conservation (SAC)	Strictly protected sites designed under the EU Habitats Directive, representing internationally important, high-quality conservation sites that significantly contribute to conserving the 189 habitat types and 788 species identified in Annexes I and II of the Directive (as amended).
Special Protection Area (SPA)	SPAs are classified in accordance with EU Directive on the conservation of wild birds, known as the Birds Directive. SPAs protect rare and vulnerable birds (as listed on Annex I of the Birds Directive), and regularly occurring migratory species.
Statutory Consultation	Community and stakeholder consultation carried out in line with the statutory requirements set out in s42, s47 and s48 of the Planning Act 2008.
Statutory undertakers (SU)	Companies or bodies with statutory powers and duties to carry out functions of a public nature, such as gas, electricity, water, telecommunications code operators and transport providers.