A46 Newark Bypass

TR010065/APP/7.4

7.4 Transport Assessment

APFP Regulation 5(2)(q)

Planning Act 2008

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

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

A46 Newark Bypass

Development Consent Order 202[x]

TRANSPORT ASSESSMENT

Regulation Number:	Regulation 5(2)(q)
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Contents

1 Introduction

1.1 Document purpose

1.1.1 This Transport Assessment (this TA) relates to an application made by National Highways (the Applicant) to the Secretary of State for Transport via the Planning Inspectorate (the Inspectorate) under the Planning Act 2008 (the 2008 Act) for a Development Consent Order (DCO). If made, the DCO would grant consent for the A46 Newark Bypass (the Scheme). A detailed description of the Scheme can be found in Chapter 2 (The Scheme) of the Environmental Statement (ES) [APP-046].

1.1.2 The purpose of this TA is to assess the impact of the Scheme on the strategic and local highway network and road safety.

1.1.3 This TA links to, and summarises, many other key pieces of technical work undertaken as part of this Scheme, which should be read in conjunction with this document. These are appended or referenced where appropriate. This includes:

- Appendix A: Combined Modelling and Appraisal (ComMA) Report
- Appendix B: Road Safety Audit & Designer's Response
- Appendix C: Walking, Cycling and Horse-Riding Assessment & Review (WCHAR)

1.2 Background

1.2.1 The existing A46 forms part of the strategic Trans-Midlands Trade Corridor between the M5 in the south-west and the Humber Ports in the north-east. The improvements to the existing A46 corridor are detailed within the Department for Transport's (DfT) Road Investment Strategy 2: 2020-2025 (RIS2) as a mechanism for underpinning the wider economic transformation of the country. RIS2 makes a commitment to create a continuous dual carriageway from Lincoln to Warwick.

1.2.2 The stretch of the existing A46 between the Farndon roundabout, to the west of Newark-on-Trent and the A1 to the east of Newark-on-Trent, is the last remaining stretch of single carriageway between the M1 and A1. As a result of this, the following issues have arisen:

- Poor journey time reliability
- High level of low-speed shunts and recorded accidents, which lead to lane closures on this single lane carriageway
- High traffic flows which exceed the network design capacity and are forecast to increase
- The lack of capacity at Cattle Market roundabout is being compounded by queuing on the B6326 caused by frequent rail level crossing downtimes on Great North Road
- Congestion on the A1/A46 Winthorpe roundabout impacting on journey time reliability

1.2.3 Additional information on these points can be found in Appendix A: Combined Modelling and Appraisal Report (ComMA) of this TA.

1.3 Scheme aims and objectives

1.3.1 The transport related aim of the Scheme is to increase capacity, reduce traffic congestion, improve road safety and achieve better journey time reliability on the existing A46 around Newark-on-Trent. This would directly contribute to the national, regional and local government's transport and economic growth plans by improving connectivity from Lincolnshire to the national motorway network, and improving route standard consistency for the existing A46, providing a consistent high standard dual carriageway between the Midlands and Lincoln.

1.3.2 Scheme-specific objectives have been used to develop the design which are set out in Table 1-1. The Case for the Scheme [APP-190] also provides detail of how the Scheme meets each of the objectives.

Table 1-1: National Highways Scheme Objectives (Case for the Scheme)

Objective	Description	Detail of how the Scheme meets the objectives
Safety	Improving safety through Scheme design to reduce collisions for all users of the Scheme.	A COBALT assessment has been undertaken to assess the impact of the Scheme in terms of accidents over a 5-year period against a baseline of data obtained between 2015 and 2019. This shows overall that the Scheme would provide safety benefits equivalent to £29.3m over the 60-year appraisal period; translated into eight fewer fatalities, 81 fewer serious accidents and 594 fewer accidents resulting in slight injuries. The overall impact is therefore positive, with a reduction in accidents and a reduction in casualties across all levels of severity. This TA concludes the Scheme would overall have a positive impact on road safety and is not expected to result in any safety issues. Further details on safety are also set out in Chapter 5 of the Case for the Scheme (CftS) [APP-190].
Congestion	Improve journey time and journey time reliability along the A46 and its junctions between Farndon and Winthorpe, including all approaches and A1 slip roads.	This TA forecasts an improvement in journey times along the A46. This is due to the grade separation of the Cattle Market roundabout, allowing the mainline traffic to bypass the roundabout and giving traffic from the minor roads a lower opposing flow on the circulatory. There are forecast to be significant improvements to journey times on the A46 in both directions between Lodge Lane (south of Farndon roundabout) and Brough Lane (north of Winthorpe roundabout) as a result of the Scheme in both 2028 (opening year) and 2043 (15 years post opening). In 2028 the largest reductions in journey times are forecast to be in the PM peak, with journey times in the northbound direction reducing from approximately 16 minutes down to 11 minutes, a saving of almost five minutes, or approximately 29%. The Scheme would increase capacity and reduce congestion on the existing A46 around Newark-on-Trent, which would support future traffic growth.
Connectivity	Accommodate economic growth in Newark-on-Trent and the wider area by improving its strategic and local connectivity.	The Scheme would help support the delivery of planned new housing and employment growth within Newark-On-Trent. For example, the Newark Business Park represents a significant part of Newark-on-Trent's planned growth but is currently considered to be limited by the available capacity at Brownhills roundabout. This TA indicates that delays at Brownhills roundabout are notably reduced in the AM and PM peaks due to the new layout of the A46 mainline which bypasses this section of the network. There are also a number of housing development sites identified within the Newark and Sherwood District Allocations and Development Management Development Plan Document, which would benefit from the Scheme to achieve their full completion as detailed within Section 3.12 of the CftS [APP-190].

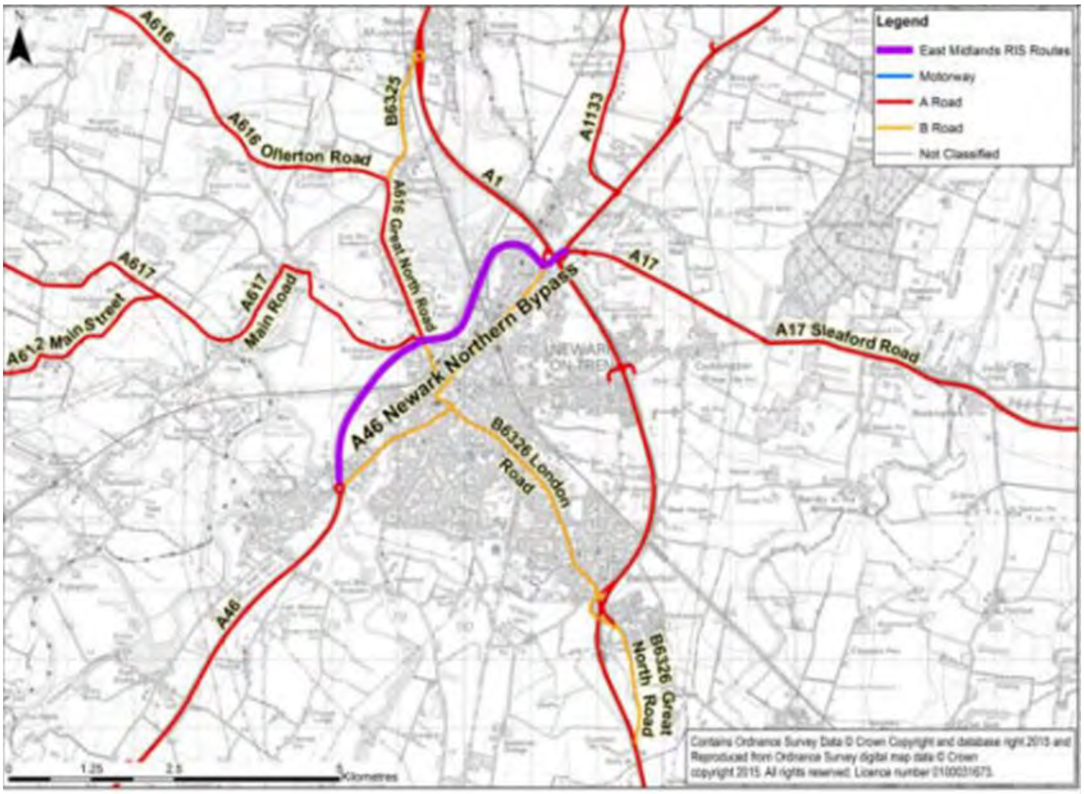
Objective	Description	Detail of how the Scheme meets the objectives
		For example, Land East of Newark (as set out in Policy NAP 2B) is located between the A1, the East Coast Mainline and Beacon Hill Road. Traffic flows are, therefore, likely to be directed to the town centre and its access to the A46 and the A1 through Beacon Hill Road. The Scheme would also help support the delivery of planned growth within the wider Midlands area. As detailed in Section 3.11 of the CftS [APP-190], the Scheme would ease traffic flows on key junctions of the A46, thereby unlocking investment.
Environment	Deliver better environmental outcomes by achieving a net gain in biodiversity and improve noise levels at Noise Important Areas along the A46 between Farndon and Winthorpe junctions.	The Applicant has submitted a Biodiversity Net Gain (BNG) Technical Report in Appendix 8.14 of the ES Appendices [APP-159] which reports that the Scheme would result in a predicted net gain in biodiversity. Chapter 2 (The Scheme) of the ES [APP-046] outlines the provision of embedded mitigation for the Scheme including the provision of noise bunds and barriers integrated as part of the landscape design to reduce adverse effects to noise receptors where required. The locations are shown on Figure 2.3 Environmental Masterplan of the ES Figures [AS-026]. Chapter 11 (Noise and Vibration) of the ES [APP-055] outlines the operational noise effects of the Scheme following the incorporation of mitigations measures. Table 11.37 of Chapter 11 (Noise and Vibration) of the ES [APP-055] provides a summary of the short-term noise impact at relevant Noise Important Areas.
Customer	Build an inclusive Scheme which improves facilities for cyclists, walkers and other vulnerable users where existing routes are affected.	As set out in Section 4.14 of the CftS [APP-190], the Scheme seeks to provide facilities for cyclists, walkers and horse-riders (WCH) where existing routes are affected and seeks to improve facilities for all users where practical, including addressing historical severance issues. For example, historically there was a Public Rights of Way (PRoW) that ran north to south between Winthorpe and the Newark Showground. This has been severed by the existing A46 with a footpath (FP2) ending at the northern boundary of the A46 and another footpath (FP3) ending at the southern boundary. The Scheme would reconnect these two PRoWs via a new footway/cycleway that links to the north and runs parallel to the new dual carriageway before crossing beneath it alongside the A1. On the south side of the new dual carriageway, it would cross the existing A46 via a new signalised crossing and join the existing PRoW network. A Walking, Cycling and Horse Riding Assessment and Review (WCHAR) was completed in June 2023 on the basis of the preliminary design and is available at **Appendix C** of this TA. A further WCHAR would follow at the detailed design stage to ensure that the needs of WCH users continue to be considered as

Objective	Description	Detail of how the Scheme meets the objectives
		the design progresses.

1.4 Existing road network

1.4.1 The A46 forms part of the strategic Trans-Midlands Trade Corridor between the M5 in the south-west and the Humber Ports in the north-east. Figure 1-1 shows the surrounding highway network in relation to the Scheme.

Figure 1-1: Highway network in Newark-on-Trent



Source: Combined Modelling and Appraisal Report, Appendix A

1.4.2 The existing A46 forms part of the Strategic Road Network (SRN), which in total comprises approximately 4,300 miles of motorways and major trunk A-roads in England. The SRN is owned by the Secretary of State for Transport and operated on their behalf by National Highways. The SRN only accounts for approximately 2% of the total road network in England by distance, but it carries approximately one-third of total motor vehicle traffic.

1.4.3 The section of the existing A46 between Farndon roundabout and Brownhills roundabout (A1/A46 Junction) is a wide single carriageway road, with one lane in each direction and a hatched central road marking to discourage overtaking. The section of the existing A46 between Friendly Farmer roundabout (A1/A46 Junction) and Winthorpe roundabout is a two-lane dual carriageway. The single and dual carriageway sections are subject to national speed limits, which are 60mph and 70mph respectively.

1.4.4 The A1 intersects with the existing A46 at the A1/A46 Junction, east of Newark-on-Trent. This section of the A1 is a two-lane dual carriageway with slip roads to and from the grade separated junction. Single lane slip roads join the A1 southbound from Winthorpe interchange and northbound from Brownhills roundabout.

1.4.5 A number of local roads, which are managed by the local highway authority, Nottinghamshire County Council, intersect with the existing A46. These include:

- **Fosse Road** – Fosse Road is a single carriageway road with a 40mph speed limit, which links to the existing A46 by connecting to Farndon roundabout from the west. It runs adjacent to the existing A46 carriageway to the south of Farndon roundabout, providing access to Farndon and other villages.
- **A617 Kelham Road** – The A617 is a single carriageway road that links to Cattle Market roundabout from the west. It provides access between the existing A46 and Kelham village, to the north-west of Newark-on-Trent, and continues to Mansfield. The road has a speed limit of 50mph.
- **A616 Great North Road** – The A616 is a single carriageway road that links to the existing A46, via Cattle Market roundabout, from the north. The route provides access to and from the area north-east of Newark-on-Trent and joins the A1 at Junction 30. The section of the A616 that links to Cattle Market roundabout has a 50mph speed limit.
- **B6326 Great North Road** – The B6326 is a single carriageway road that provides access between Cattle Market roundabout and Newark-on-Trent town centre. There is a level crossing along the B6326 south of Cattle Market roundabout, where the road crosses the Nottingham to Lincoln railway line. The speed limit along the B6326 immediately south of the roundabout is 60mph, but reduces to 30mph before the level crossing, on the approach to the town centre.
- **A17** – The A17 starts at King’s Lynn, Norfolk, and extends to Newark-on-Trent, where it terminates at Friendly Farmer roundabout on the A1/A46 Junction. The road consists of a single carriageway but is widened to a two-lane dual carriageway between Friendly Farmer roundabout and the roundabout immediately to the east. The road is subject to national speed limits.
- **A1133** – The A1133 is a single carriageway road with a national speed limit (60mph) that links to the existing A46, from the north-west, at Winthorpe roundabout. It provides access between the existing A46 mainline and Winthorpe as well as villages to the north of Winthorpe.
- **Drove Lane** – Drove Lane is a single carriageway road that passes to the north and east of Newark Showground and Newark Air Museum, which are located north-east of Newark-on-Trent. The road provides access between Winthorpe roundabout and the A17. There is a national speed limit of 60mph along the full length.

~~1.4.1~~1.4.6 In relation to the Scheme, the following key junctions on the A46 are considered to be:

- **Farndon roundabout** – The existing Farndon roundabout to the south-west of Newark-on-Trent is a priority-controlled five-arm roundabout with a two-lane circulatory. It links the existing A46 with Newark-on-Trent to the east and Farndon to the west and also provides private means of access to properties and a nearby freight business from the east of the roundabout. The existing A46 southern approach to the roundabout is dual carriageway. Travelling north from the roundabout, the existing A46 is a single carriageway with one lane in each direction widening to two lanes on the approach to the junction.
- **Cattle Market roundabout** – Cattle Market roundabout to the north-west of Newark-on-Trent is a priority-controlled five-arm roundabout. It connects the existing A46 to the A616 (Great North Road) and A617 (Kelham Road) to the north, and the B6326 (Great North Road) to the south, towards Newark-on-Trent town centre.
- **A1/A46 junction** – The A1/A46 junction consists of a dumbbell style arrangement of Brownhills and Friendly Farmer roundabouts, linked by a bridge over the A1.
- Friendly Farmer roundabout is a four-arm priority-controlled roundabout which provides access to and from the A17 and the existing A46 northbound.
- Brownhills roundabout is a four-arm priority-controlled roundabout which provides access to and from Lincoln Road, towards Newark-on-Trent town centre, and the existing A46 southbound.
- **Winthorpe roundabout** – Winthorpe roundabout located east of Winthorpe is a four-arm priority-controlled roundabout that connects the existing A46 to the A1133 to the north and Drove Lane to the south.

1.5 Scheme description

1.5.1 The section of the existing A46 that is to be upgraded is approximately 6.5 kilometres in length. The Scheme comprises on-line widening for the majority of its length between Farndon roundabout and the A1. A new section of offline dual carriageway is proposed between the western and eastern sides of the A1 before the new dual carriageway ties into the existing A46 to the west of Winthorpe roundabout. The widening works include earthwork widening along the existing embankments, and new structures where the route crosses the railway lines, River Trent, the A1 and local roads.

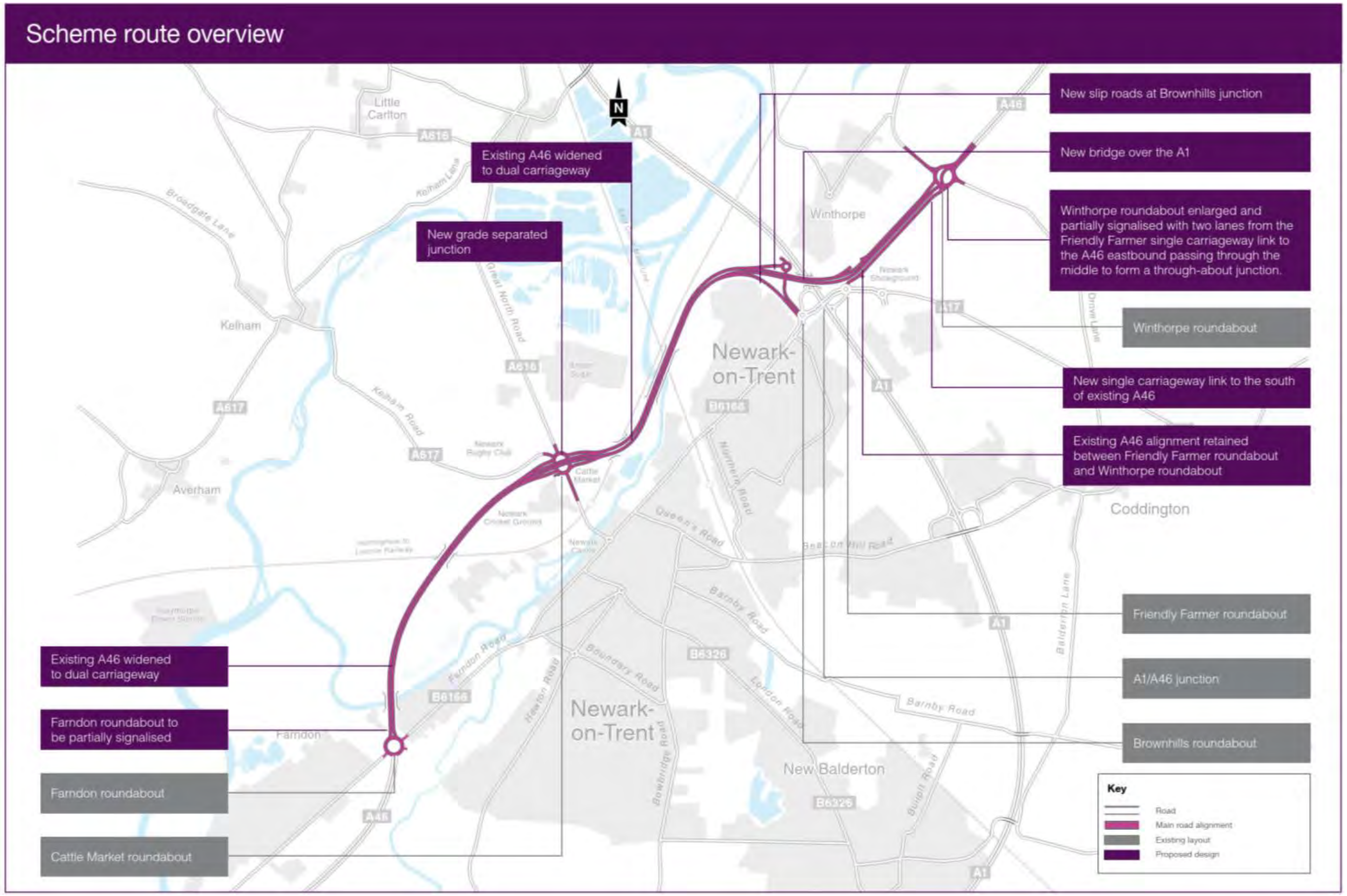
1.5.2 The Scheme consists of the following principal elements:

- Widening of the existing A46 to a dual carriageway for a distance of 6.5 kilometres to provide two traffic lanes in both directions.
- Partial signalisation of Farndon roundabout at the southern extents of the Scheme.
- A new grade separated junction at Cattle Market roundabout with the widened A46 elevated to pass over the roundabout. A larger roundabout beneath the widened A46 to provide increased capacity.
- A new off-line section to bypass the existing Brownhills roundabout and Friendly Farmer roundabout.
- A new grade separated northbound exit slip to a new roundabout providing local access, with a two-way link road on the southern arm to connect with the existing Brownhills roundabout.
- A two-way parallel link road from Friendly Farmer to Winthorpe roundabout to the southern side of the existing dual carriageway.
- A new bridge structure across the existing A1, located to the north of the existing bridge and new roundabout to the north of Brownhills.
- An upgraded roundabout with partial signal controls at Winthorpe roundabout.
- Improvements to WCH facilities through safer, enhanced routes.
- Three areas have been identified for floodplain compensation which are being referred to as the Kelham and Averham Floodplain Compensation Area (FCA), Farndon West FCA and Farndon East FCA. In addition, the Farndon East FCA and Farndon West FCA would also be used as a borrow pit to support the creation of embankments required for the Scheme.
- Drainage features including attenuation ponds.
- Environmental mitigation including landscape planting.
- Associated accommodation works and maintenance access tracks.

1.5.3 Figure 1-2 shows the location of the Scheme and the location of the principal elements.

1.5.4 Details of how the Scheme meets the objectives of the Scheme can be found in the Case for the Scheme [APP-190].

Figure 1-2: Scheme route overview



Source: National Highways (2023)

1.6 Scheme selection

1.6.1 An initial 'option generation' exercise began in 2015. The initial options were considered against the Scheme objectives, the 2015 National Policy Statement for National Networks (NPSNN) and DfT's Early Assessment and Sifting Tool (EAST). Following the assessment undertaken for this sifting, two options were taken forward to options consultation. The 'options for public consultation' ran for eight weeks between 9 December 2020 and 2 February 2021. After further analysis, the Preferred Route announcement was made in February 2022.

1.6.2 This TA, which supports the DCO application, has been based on the Scheme's preliminary design, which has been developed from the preferred route assessment.

1.6.3 Further details of the Scheme evolution as well as the alternative 'options' which were considered in determining the preferred route can be found in the Case for the Scheme [APP-190] and Chapter 3 (Assessment of Alternatives) of the Environmental Statement [APP-047].

1.7 Consultation

1.7.1 An extensive programme of engagement was undertaken at earlier stages in the development of the Scheme including options consultation and targeted consultation with potentially affected landowners and community stakeholders. A full summary of the options consultation and statutory consultation on the Scheme can be found in the Consultation Report [APP-028 to APP-044]. A summary of engagement with stakeholders can be found in Table 3.2 in the Consultation Report [APP-028 to APP-044]. Evidence of how the Applicant has shown regard to consultation responses on traffic matters is also provided in Annex N of Consultation Report Annexes [APP-044].

1.7.2 As part of the Transport Assessment, Nottinghamshire County Council (NCC) and Newark and Sherwood District Council (NSDC) have been consulted. Table 1-2 presents a summary of this engagement.

Table 1-2: Summary of engagement on the Transport Assessment

Date and time	Stakeholder	Purpose and discussion points
18 January 2023, 10am	NCC	Initial scoping meeting to introduce the scheme and approach to the assessment. More information on the traffic management during construction was requested and presented at a later meeting (meeting dated 15 June 2023). Additional meetings were requested to discuss walking, cycling and horse-riding, public rights of way and public transport in more detail (meetings dated between 15 March 2023 and 5 April 2023). An additional meeting was requested to run through the modelling in more detail (meeting dated 15 June 2023). NCC reviewed and provided additional policy documents and reviewed the list of future developments / schemes included in the modelling.
15 March 2023, 11am	NCC	Follow up on the approach to the assessment with a focus on the walking, cycling and horse-riding elements. NCC shared the latest Local Walking and Cycling Infrastructure Plan (LCWIP) for consideration in the assessment and requested active travel routes are designed to LTN1/20 standards. No walking, cycling and horse-riding issues were identified.
23 March 2023, 3pm	NCC	Follow up on the approach to the assessment with a focus on the public transport elements. NCC shared the latest bus services map and requested that traffic signals were designed with signal head types to support bus priority. No public transport issues were identified.
5 April 2023, 3pm	NCC	Follow up on the approach to the assessment with a focus on the public rights of way elements. NCC shared the latest public rights of way information requested a follow up on discussions with the wider project team about engagement and response to Newark Active Travel Group, as covered in the Consultation report. No public rights of way issues were identified.
15 June 2023, 11am	NCC	Update on the assessment with a focus on the strategic and operational modelling outputs, as well as further details shared on the construction programme. No issues were identified.
10 August 2023, 9am	NSDC	Initial meeting to run through strategic and operational modelling outputs and construction programme. The outputs were presented on a PowerPoint slide deck and shared with NSDC. A follow up meeting was requested on the modelling outputs once NSDC had a chance to digest the results.
18 August 2023, 11am	NSDC	Follow up meeting to respond to questions on the strategic and operational modelling outputs shared as part of the previous meeting. No issues were identified.

1.8 Funding and delivery

1.8.1 The Road Investment Strategy 2 (RIS2), setting out government policy, explains the intent to fund investment in the Scheme, as explained further in the Funding Statement [APP-026].

1.9 Report structure

1.9.1 Following this introductory chapter, the remainder of this TA is structured as follows:

- **Chapter 2** provides a summary of national, regional and local planning policy relevant to the Scheme.
- **Chapter 3** provides detail on the collection of baseline traffic data, the development of the traffic model, previous A46 studies and commitment to the Scheme.
- **Chapter 4** describes the safety performance of the existing road network and assesses the impact of the Scheme on road safety.
- **Chapter 5** summarises the current performance of the highway network
- **Chapter 6** presents the traffic forecasts with and without the Scheme and assesses the impact of the Scheme on the strategic and local highway network.
- **Chapter 7** provides an overview of travel by sustainable modes of transport, including walking, cycling, horse-riding (WCH) and public transport. It identifies both the current type and quality of provision as well as improvements and enhancements delivered as part of the Scheme.
- **Chapter 8** presents information relating to construction activity and presents the construction impact assessment.
- **Chapter 9** summarises the assessment.

2 Planning policy and guidance

~~3~~

~~3.1~~2.1 Introduction

2.1.1 This chapter sets out the relevant national, regional and local planning policy and guidance which has been reviewed with a view to establishing the policy context of the Scheme. Other relevant strategies and guidance are also considered.

~~3.2~~2.2 National planning policy and guidance

National Policy Statement for National Networks (2014)[1]

2.2.1 The 2015 National Policy Statement for National Networks (NPSNN) sets out the need for development of road, rail and strategic rail freight interchange schemes on the national networks and the policy against which decisions on major road and rail schemes will be made. It provides planning guidance for promoters of nationally significant infrastructure schemes on the road and rail.

2.2.2 The Government's vision and strategic objectives for national networks is to ensure they meet the country's long-term needs; support a prosperous and competitive economy and improve overall quality of life.

2.2.3 The 2015 NPSNN (paragraph 2.2) recognises that there is a *"critical need"* to improve the national road and rail networks to address road congestion 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. This is further emphasised in paragraph 2.13 which 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."*

Paragraph 2.6 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".* This is further enforced in paragraph 2.22 which confirms the importance of

[1] *National policy statement for national networks:* https://www.gov.uk/government/publications/national-policy-statement-for-national-networks

improving the road network as without doing so it will be difficult to not only support further economic development but also

~~2.1~~

~~2.2~~

2.2.4 employment and housing which will impede economic growth and reduce people’s quality of life.

~~3.2.1~~2.2.5 The ~~current~~ 2015 NPSNN was designated in 2015, before the Government’s legal commitment to net zero, the 10 point plan for a green industrial revolution, the new sixth carbon budget and the Transport Decarbonisation Plan (TDP). At the time of the DCO application submission in April 2024, a Draft NPSNN (2024) Accordance Table [APP-192] was submitted with the application which summarised compliance of the Scheme with the draft NPSNN. This was because, even though the NPSNN 2024 was still in draft at that time (having been published for consultation in March 2023), it was still capable of constituting a material consideration in the Secretary of State's decision on the Application. As the 2024 NPSNN was designated on 24 May 2024, the Draft NPSNN (2024) Accordance Table [APP-192] has been superseded by the NPSNN (2024) Accordance Table [REP5-032], which assesses the Scheme against the designated 2024 NPSNN. The application for development consent for the Scheme was accepted for examination on 23 May 2024. As set out in the transitional provisions of the 2024 NPSNN (paragraphs 1.16 and 1.17), the 2015 NPSNN has effect for any application for development consent accepted for examination prior to 24 May 2024 and will inform decisions made by the Secretary of State in relation to those applications. However, it is noted that the 2024 NPSNN may still be an important consideration for the Secretary of State for Transport when determining whether to consent the DCO for this Scheme. Therefore, the NPSNN (2024) Accordance Tables [REP5-032] summarised compliance of the Scheme with the 2024 NPSNN.~~A draft NPSNN was published for consultation in March 2023. The consultation period ended in June 2023. The draft NPSNN may be subject to change following the consultation before being published in its designated form. Although this is currently in draft it is still a material consideration for the Secretary of State when determining whether to consent the DCO for this Scheme, accordingly the Draft~~

~~NPSNN Accordance Table [REP2-023] summarises compliance of the Scheme with the draft NPSNN.~~

National Planning Policy Framework (2024~~3~~)[2]

2.2.6 The National Planning Policy Framework (NPPF) was initially published in March 2012 and most recently updated in December 2024~~3~~. This document sets out the Government's planning policies for England, providing a framework within which local people and councils can encourage development which reflects the needs and priorities of their communities.

2.2.7 A key principle of the NPPF is the presumption in favour of sustainable development, which contributes to the economic, social, and environmental aspects of a community, as set out in paragraph seven of the NPPF.

2.2.8 The scheme aims to build an inclusive scheme which improves facilities for cyclists, walkers and other vulnerable users where existing routes are affected supporting the key principle of sustainable development in paragraph seven.

Levelling Up the United Kingdom White Paper (2022)[3]

2.2.9 Published in February 2022, Levelling Up the United Kingdom is a white paper that sets out how the Government will spread opportunity more equally across the UK. It refers to a number of road upgrades including improving capacity along the existing A46 Newark Bypass.

DfT Decarbonising transport: a better, greener Britain, Transport Decarbonisation Plan (2021)[4]

2.2.10 The TDP outlines the course which the DfT surmise will secure carbon net zero within travel across the UK, as well as the various benefits associated with carbon net zero travel. The DfT's TDP summarises its commitment to decarbonise transport.

2.2.11 The TDP includes a commitment to invest £15 million in 2021/22 to help address the backlog in traffic signal maintenance to improve traffic flow

[2] Ministry of Housing, Communities and Local Government (December 2024) National Planning Policy Framework [online] available at: https://assets.publishing.service.gov.uk/media/67aafe8f3b41f783cca46251/NPPF_December_2024.pdf (last accessed March 2025)~~*National Planning Policy Framework: https://www.gov.uk/government/publications/national-planning-policy-framework--2*~~

[3] *Levelling Up the United Kingdom White Paper: https://www.gov.uk/government/publications/levelling-up-the-united-kingdom*

[4] *Transport decarbonisation plan: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1009448/decarbonising-transport-a-better-greener-britain.pdf*

and reduce emissions. It also includes a commitment to review the National Networks National Policy Statement.

Transport Assessment guidance (2014)[5]

2.2.12 In 2014 the Government produced guidance and advice on when Transport Assessments (TAs) and Transport Statements are required, and what they should contain.

2.2.13 The guidance sets out that TAs should be:

- proportionate to the size and scope of the proposed development to which they relate and build on existing information wherever possible
- established at the earliest practicable possible stage of a development proposal
- tailored to particular local circumstances (other locally determined factors and information beyond those which are set out in this guidance may need to be considered in these studies provided there is robust evidence for doing so locally)
- brought forward through collaborative ongoing working between the local planning authority/transport authority, transport operators, rail network operators, National Highways where there may be implications for the SRN and other relevant bodies, engaging communities and local businesses in transport assessments can also be beneficial
- the timeframes over which they are conducted or operate should be appropriate in relation to the nature of developments to which they relate (and planned changed to transport infrastructure and management in the area)

2.2.14 The guidance also identifies the importance of appropriately considered cumulative impacts arising from other committed developments.

2.2.15 This TA has been prepared with regard to the above points. This TA is proportionate to the size and scope and has been produced in preparation for a DCO application. Engagement has taken place with Nottinghamshire County Council (NCC) to tailor it to local circumstances, with the TA being brought forwards through a collaborative approach. In addition to this, through the usage of the uncertainty log, this TA

[5] *Travel Plans, Transport Assessments and Statements:* https://www.gov.uk/guidance/travel-plans-transport-assessments-and-statements

considers the cumulative impacts arising from other committed developments.

~~3.3~~2.3 Regional planning policy and guidance

The Nottinghamshire Plan 2021-2031 (2021)[6]

2.3.1 The Nottinghamshire Plan 2021-2031, published in 2021, sets out NCC's vision for *"A healthy, prosperous and greener future for everyone"*, followed by four key ambitions for the duration of the plan being in place:

- improving health and wellbeing in all our communities
- growing our economy and improving living standards
- reducing the county's impact on the environment
- helping everyone access the best of Nottinghamshire

2.3.2 The objectives of the Scheme support these ambitions by aiming to accommodate economic growth and deliver better environmental outcomes for Newark-on-Trent and the wider area.

Nottinghamshire Local Transport Plan 2011-2026 (2011)[7]

2.3.3 In its Local Transport Plan (LTP), NCC sets out "Our vision is for Nottinghamshire to be a county that is safe; economically prosperous; a place where businesses want to invest; and where we are proud of our past and ambitious for our future".

2.3.4 The following are the spatial transport goals of the Nottinghamshire LTP:

- to provide safe and sustainable access to local facilities and services
- to provide everyone with safe and sustainable transport options for movement within and between our towns and district centres
- to connect our towns, district centres and villages to other parts of the plan area and beyond

2.3.5 The following are the strategic transport goals of the Nottinghamshire LTP:

- provide a reliable, resilient transport system which supports a thriving economy and growth whilst encouraging sustainable and healthy travel
- improve access to key services, particularly enabling employment and training opportunities

[6] *The Nottinghamshire Plan: https://plan.nottinghamshire.gov.uk/media/wxvn35ce/thenottinghamshireplan2021.pdf*

[7] *Nottinghamshire Local Transport Plan 2011-2026: https://www.nottinghamshire.gov.uk/media/123040/local-transport-plan-strategy.pdf*

- minimise the impacts of transport on people's lives, maximise opportunities to improve the environment and help tackle carbon emissions

2.3.6 The objectives of the Scheme align with the spatial and strategic transport goals of the Nottinghamshire LTP. The Scheme aims to enable economic growth, improve safety and journey times, deliver better environmental outcomes and be inclusive and support all user groups and modes.

D2N2 Local Cycling and Walking Infrastructure Plan (2017)[8]

2.3.7 The four local authorities of Derby City Council, Derbyshire County Council, Nottingham City Council and Nottinghamshire County Council have collaborated to produce this local cycling and walking infrastructure plan, a requirement of the Infrastructure Act 2015. The strategy sets objectives to increase levels of cycling and walking. The 6 key objectives of this plan are:

- supporting economic growth
- supporting tourism and the visitor economy
- addressing transport congestion
- addressing climate change and poor air quality
- addressing health deprivation
- meeting the cycling and walking investment strategy cycling and walking mode share targets

2.3.8 The Scheme objectives for relieving congestion, improving connectivity and customer experience particularly align with the above objectives, with the Scheme aiming to improve journey times, accommodate economic growth and build an inclusive Scheme which improves facilities for active travel and vulnerable users where existing routes are affected.

~~3.4~~2.4 Local planning policy and guidance

Newark and Sherwood District Council Local Development Framework – Amended core strategy (2019)[9]

2.4.1 The Local Development Framework (LDF) sets out how Newark and Sherwood District Council (NSDC) is working to tackle a range of future challenges, including the provision of new housing and jobs, creating new infrastructure and facilities and tackling climate change. The LDF is made up of the amended core strategy Development Plan Document

[8] *D2N2* local cycling and walking infrastructure plan: https://www.nottinghamshire.gov.uk/transport/d2n2-local-cycling-and-walking-infrastructure-plan-lcwip/

[9] *Newark & Sherwood District Council, amended core strategy DPD: https://www.newark-sherwooddc.gov.uk/media/newark-and-sherwood/images-and-files/planning-policy/pdfs/core-strategy/ACS2019.pdf*

(DPD), allocations and development management DPD, a policies map, supplementary planning documents (SPDs) and Neighbourhood Plans.

2.4.2 The Newark and Sherwood amended core strategy sets out a vision, objectives and policies to help deliver development and change. The core strategy sets out individual area policies, with the following area policies for Newark-on-Trent, referred to as the Newark Urban Area (NAP1):

- to manage growth in and around Newark-on-Trent urban area (Newark-on-Trent, Balderton and Fernwood) and ensure that housing and employment growth are developed alongside appropriate infrastructure and facilities
- to promote, protect and enhance the character and qualities of Newark-on-Trent town centre as a place for retail, business, administration, entertainment and tourism
- to promote local services in rural areas and secure public transport linkages to Newark-on-Trent urban area, Collingham and Sutton-on-Trent

2.4.3 Part B of NAP1 relates to the provision of infrastructure, and this states that it will support the implementation of strategic highway schemes including:

i. Southern Link Road from Farndon to Balderton
ii. A46 Link Capacity, Newark-on-Trent Bypass
iii. A36/A617 Cattle Market Roundabout
iv. A46 Roundabout at Farndon
v. A1/A17/A46 Roundabout
vi. A1/A46 Brownhills Roundabout
vii. A1 Overbridge, Fernwood
viii. A617 Kelham Bypass

~~3.5~~2.5 Summary

National planning policy

2.5.1 The ~~draft~~ 2015 and 2024 NPSNN highlights the importance of the national road network and that responding to economic and traffic growth are the key drivers for its development.

2.5.2 The Scheme is also consistent with the core planning principles laid out in the NPPF and is consistent with national planning policy through local planning documentation.

2.5.3 In this aspect the Scheme is wholly aligned with national policy. The Scheme is intended to alleviate congestion and accommodate future traffic growth, and contribute to increased economic growth, both regionally and nationally.

Regional and local planning policy

2.5.4 Regional and local planning policy recognises the A46 as a crucial piece of local infrastructure and highlights that the A46 currently suffers from congestion which is placing a constraint on local growth.

2.5.5 The Scheme is one of Transport for the East Midlands (TfEM) and Midlands Connect's (the sub-national transport body for the Midlands) top strategic priorities. It is widely recognised that the A46 around Newark-on-Trent, from Farndon to the interchange with the A1, and the A1 ''has been a bottleneck for many years which has caused congestion, pollution and safety issues''.

2.5.6 The Scheme supports the goals of the Nottinghamshire LTP 2011-2026, which aims to provide a reliable, resilient transport system which supports a thriving economy and growth whilst encouraging sustainable and healthy travel.

2.5.7 The Scheme is also listed as a key policy in the Newark and Sherwood District Council (NSDC) core strategy, with policy NAP1 listing all the junctions on this A46 corridor as being key strategic highway schemes required to support NSDC's vision for the Newark Urban Area.

2.5.8 The Scheme would be a key part of local planning policy that delivers against many local objectives.

~~4~~3 Baseline data, model development and previous studies

5

~~5.1~~3.1 Introduction

3.1.1 This chapter provides details on the development of the strategic Highway Assignment Model (HAM)[10] and micro-simulation model[11] used to assess the impact of the Scheme. It provides information on the

[10] The strategic highway assignment model assigns travel demand to the road network in order to forecast the routes used by traffic to travel between different locations in the study area.

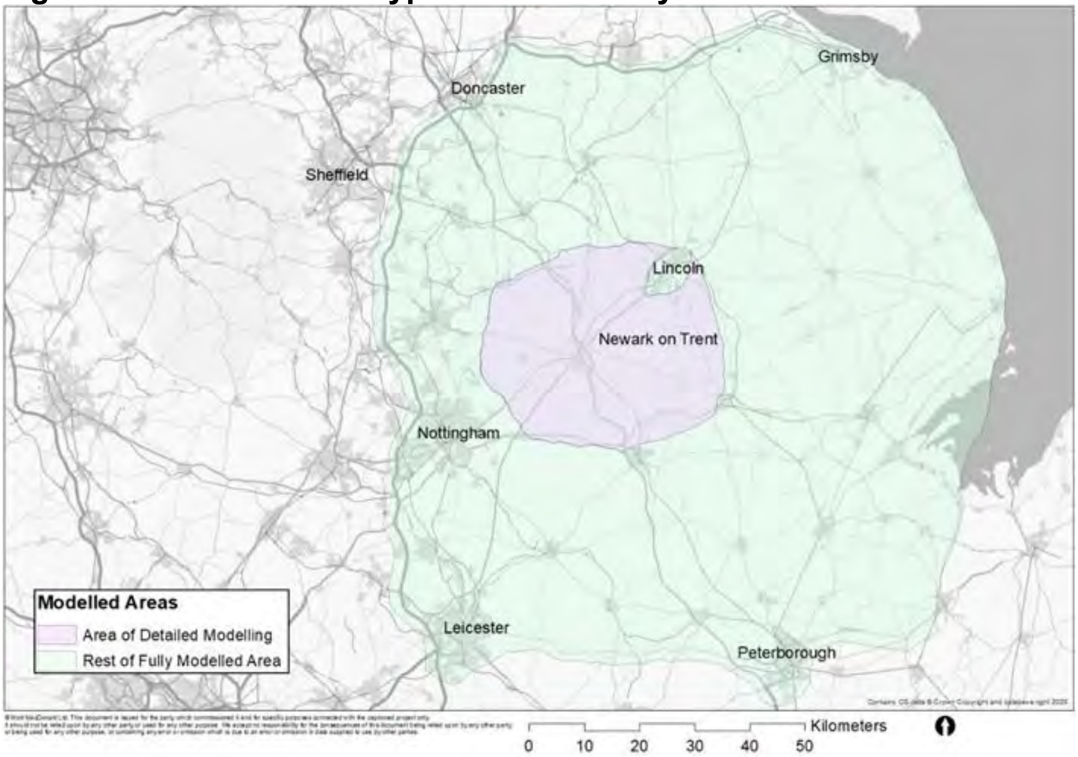
[11] The traffic micro-simulation model simulates the behaviour of individual vehicles within a predefined road network and are used to predict the likely impact of traffic patterns resulting from changes to traffic flow or from changes to the physical environment.

modelling suite including the base and future year model development process for both the strategic and micro-simulation models.

~~5.2~~3.2 Scheme study area

3.2.1 Figure 3-1 shows the extents of the study area modelled in the strategic HAM, which is referred to as the A46 Newark Bypass Model.

Figure 3-1: A46 Newark Bypass Model study area



Source: Combined Modelling and Appraisal Report, Appendix A

~~5.3~~3.3 Transport demand modelling and model development process

3.3.1 In order to assess the potential benefits of the Scheme, a suite of transport models has been used to forecast the expected travel demand, both with and without the Scheme in place.

3.3.2 The following sections provide a summary of the base and future year model development process, both in terms of the strategic HAM and micro-simulation model development.

Model suite

3.3.3 The Scheme has been assessed using the A46 Newark Bypass Model, which comprises three primary modelling components:

- The HAM using SATURN software to predict traffic flows, speeds, delays, routing and journey costs on the network, taking into account congestion. This is also referred to as the strategic model.
- The Variable Demand Model (VDM) which is used to predict the future levels of demand for private vehicle travel, taking into account trip generation, distribution and mode split.
- A microsimulation model, using VISSIM software, covering the Scheme corridor to enable detailed operational assessments of the Scheme junctions. Hereafter this is referred to as the operational model.

3.3.4 There is no public transport assignment model, although a representation of rail costs and demands is included in the VDM so that impacts on modal split can be assessed.

Strategic highway assignment model

~~5.3.1.1~~Model suite

3.3.5 A number of existing regional traffic models (RTM) were adapted to create the A46 Newark Bypass Model. The second generation of the Midlands Regional Traffic Model (MRTM2) has been used as the main starting point in the development of a base year for the A46 Newark Bypass Model, together with elements from the Trans-Pennine South Regional Traffic Model (TPSRTM2) and the enhanced A46 Midland Regional Traffic Model (EMRTM). Further details of this process are included in Appendix A: Combined Modelling and Appraisal Report (ComMA) of this TA.

~~5.3.1.2~~Baseline data collection

3.3.6 A range of existing data sources were reviewed as part of the base model development process. During this process, only National Highways' Traffic Information System (WebTRIS) count data was considered to be suitable for use in developing the A46 Newark Bypass

Model, as it provides a reliable source of continuous data. Other datasets were considered to be too old or of low quality.

3.3.7 The review of existing datasets concluded that a range of new count and journey time data would be required for the completion of the A46 Newark Bypass Model. The main purpose of the new data collection programme was to gather data that was up-to-date to calibrate and validate the base 2019 strategic and operational traffic models. The data collection programme was carried out in July 2022, with further details included in Appendix A: Combined Modelling and Appraisal Report (ComMA) of this TA.

3.3.8 The review of traffic count data highlighted that there would be a need to collect new traffic data from Automatic Traffic Counts (ATC) across the Newark-on-Trent area and Manual Classified Counts (MCC) in the immediate area around the Scheme. Turning counts were also required in order to calibrate the operational model.

3.3.9 Up to-date journey time data was also required for two routes along the section of the A46 that is covered by the operational model. The review of data also highlighted the need to collect up-to-date queue length and level crossing closure data.

~~5.3.1.3~~Base model development

3.3.10 The base year for the A46 Newark Bypass Model represents an average weekday (Monday to Friday) in March 2019. The base year model is based on mobile phone data collected in March 2019 from the National Highways Trip Information System (TIS) dataset. The data represents pre COVID-19 travel patterns.

3.3.11 The HAM covers a single hour across the following three time-periods on a March weekday:

- AM peak hour (07:30 to 08:30)
- Inter peak (IP) average hour (10:00 to 16:00)
- PM peak hour (16:30 to 17:30)

3.3.12 There is also an off-peak average hour model which represents the period 19:00 to 07:00 which has been used to generate costs for the VDM.

3.3.13 The base year A46 Newark Bypass Model is calibrated and validated against link flows, turning movements and journey times in accordance with Transport Analysis Guidance (TAG) Unit M3.1, Highway Assignment Modelling. Further details of the model development and calibration and validation process are included in Appendix A: Combined Modelling and Appraisal Report (ComMA) of this TA.

~~5.3.1.4~~Forecast model development

3.3.14 The following sections provide an overview of the approach taken when developing future year traffic forecasts used to assess the impact of the Scheme.

3.3.15 The forecast traffic models account for future proposed residential and employment developments in the local area, as well as proposed transport network changes relative to the A46 Newark Bypass Model base year (2019).

3.3.16 The core forecast scenarios comprise the following:

- A set of transport network changes
- Assumptions about changes in values of time and vehicle operating costs over time using the January 2023 version of the Transport Analysis Guidance (TAG) Data Book (v1.23)
- A set of development assumptions
- Application of National Trip End Model Core (NTEM v8.0) growth factors for cars as a control for demand growth
- Application of speed adjustments based on the Department for Transport (DfT) scenario 1 for fixed speed links in the external area of the model

3.3.17 The future year transport network changes and development assumptions have been determined in-line with TAG and make use of uncertainty logs. An uncertainty log is required for transport model forecasting. The purpose of an uncertainty log is to record the central forecasting assumptions that underpin the core scenario, as well as uncertainty around those central assumptions. The uncertainty log should summarise all known uncertainties in the modelling and forecasting.

3.3.18 Further details are included in Appendix A: Combined Modelling and Appraisal Report (ComMA) of this TA.

Forecast years

3.3.19 For the Scheme, forecasts have been produced for 2028, which is the year that the Scheme is expected to open, for 2043, which is an intermediate year (15 years post construction), and for 2061, which is the last year for which National Trip End Model (NTEM) data is available.

Forecast scenarios

3.3.20 The forecasts consider scenarios both without the Scheme (a 'Do Minimum' scenario) and with the Scheme (a 'Do Something' scenario).

3.3.21 These forecasts reflect the best information currently available and are intended to give a broad indication of the likely travel conditions on the A46 and surrounding road network, both with and without the Scheme.

~~5.3.1.5~~Do Minimum scenario

Demand changes

3.3.22 The development of future year travel demand draws on a number of sources including the NTEM v8.0, National Road Traffic Projections (NRTP22), freight forecasts provided through the RTMs by MDS Transmodal (MDST), as well as local development data in the form of a development uncertainty log.

3.3.23 Traffic demand associated with future planned developments in local authority districts close to the Scheme was accounted for in the forecasts. Traffic growth associated with developments was applied and aligned with NTEM growth.

3.3.24 Table 3-1 tabulates the growth by trip purpose for trips with at least one end in the fully modelled area. Values are rounded to the nearest 100. This indicates that without the Scheme, traffic is forecast to grow by around 8% between 2019 and 2028, by around 18% between 2019 and 2043 and by around 25% between 2019 and 2061.

Table 3-1: Reference growth summary

	Demand				**Growth from 2019**		
Purpose	**2019**	**2028**	**2043**	**2061**	**2028**	**2043**	**2061**
Car Business	238,500	255,400	272,212	279,500	7%	14%	17%
Car Commute	463,600	493,100	518,370	522,400	6%	12%	13%
Car Other	827,600	897,600	976,129	1,031,800	8%	18%	25%
LGV	258,900	298,300	352,076	409,900	15%	36%	58%
HGV	115,300	120,100	127,513	133,300	4%	11%	16%
Total	**1,903,900**	**2,064,550**	**2,246,500**	**2,376,900**	**8%**	**18%**	**25%**

Source: Combined Modelling and Appraisal Report, Appendix A

3.3.25 Full details relating to changes in traffic demand are included in Appendix A: Combined Modelling and Appraisal Report (ComMA) of this TA.

3.3.26 Forecasting the impact of transport schemes, including option testing and appraisal, involves running traffic models with different sets of precautionary assumptions. The Scheme follows advice from DfT. In July 2020 DfT issued “Appraisal and Modelling Strategy: A route map for updating TAG (Transport Analysis Guidance) during uncertain times”. The Appraisal and Modelling Strategy route map sets out the DfT’s approach to appraisal in a time of change. Amongst many issues, the route map considers both long term Office for Budget Responsibility (OBR) growth revisions issued in March 2020 at the time of the budget, and growth revisions issued in July 2020 in the OBR fiscal sustainability report in response to COVID-19 impacts in the period up to 2025.

3.3.27 These revisions in tandem represent a significant reduction in growth compared to any previous OBR update. An appraisal update was issued in November 2021, which provided minor updates to the appraisal parameters issued in July 2020. The November 2021 parameters have therefore been used within the modelling to inform this DCO application.

3.3.28 It should be noted that the appraisal update issued by DfT also accounts for the department’s latest view on likely technology changes within the forecast years. Most pertinently this reflects anticipated changes to the vehicle fleet in terms of the mix of fuel types and fuel efficiency.

Infrastructure changes

3.3.29 A transport supply uncertainty log was compiled using details held by the Applicant and local authorities. The supply uncertainty log identified transport infrastructure schemes across the fully modelled area. Each scheme was allocated a level of certainty in-line with criteria in TAG Unit M4 (Forecasting and Uncertainty).

3.3.30 The Do Minimum (DM) network also included a limited number of amendments to facilitate the modelling of some larger developments where the skeletal nature of the base model network was enhanced locally to enable trips to/from these developments to access the wider network unimpeded.

3.3.31 Full details relating to changes in infrastructure are included in Appendix A: Combined Modelling and Appraisal Report (ComMA) of this TA.

~~5.3.1.6~~Do Something scenario

Infrastructure changes

3.3.32 The Do Something (DS) network is identical to the DM network apart from the inclusion of the Scheme.

Demand changes

3.3.33 On completion of the preliminary forecast networks, a number of reviews and checks were undertaken to ensure that the future year networks responded in a realistic way to the changes in traffic and infrastructure.

3.3.34 The VDM was used to generate the future year forecasts. The VDM adjusts the reference demand according to changes in travel costs compared to the base year scenario. Three travel responses were included representing the choice of where to travel to (distribution), which travel mode to use (car or rail), and what time of day to travel (time period choice).

3.3.35 Future travel costs would change as a result of network performance and future changes in the value of time, vehicle operating costs, tolls and rail fares. The VDM was run for both the DM and DS scenarios and all forecast years. Full details relating to the VDM are included in Appendix A: Combined Modelling and Appraisal Report (ComMA) of this TA.

Operational model development

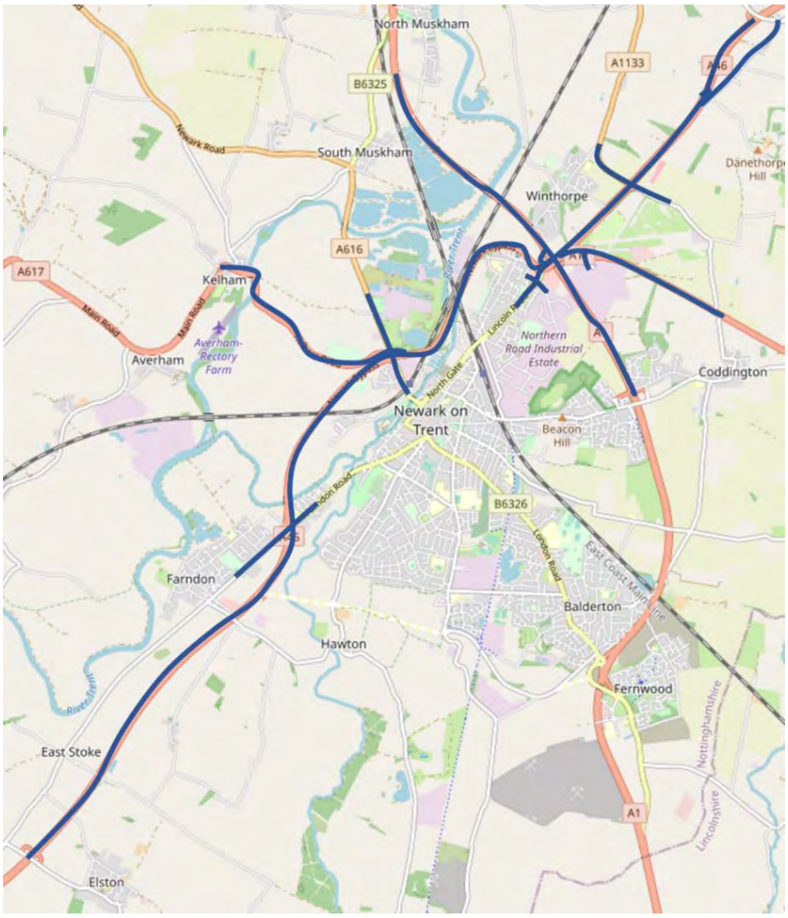
~~5.3.1.7~~Overview

3.3.36 The operational model has been developed to assess the impact of the Scheme at a local level.

~~5.3.1.8~~Model Extents

3.3.37 The operational model predominantly covers the A46 between Lodge Lane (south of Farndon roundabout) and Brough Lane (north of Winthorpe roundabout). It includes all major junctions and pedestrian crossings and covers the adjacent road network. The roads covered by the operational model are shown in dark blue in Figure 3-2.

Figure 3-2: Operational model extents



Source: Combined Modelling and Appraisal Report, Appendix A

~~5.3.1.9~~Base model development

3.3.38 The base operational model has been developed from the Options Identification (Stage 2) model, which was based on electronic drawings from the Ordnance Survey. The assessment periods cover the network peak hours of 07:30-08:30 and 16:30-17:30.

3.3.39 Public transport routes and stops have been coded into the model based upon the data received from online sources. Level crossing data for Newark Castle railway station was provided and verified by the online timetable.

3.3.40 Since VISSIM uses stochastic variations of traffic arrivals, the results differ slightly depending on the random seed used. This is intended to replicate variations in real world traffic conditions. The model was simulated ten times per peak with different random seeds, to obtain a range of representative results. The final result is an average of these ten runs.

3.3.41 The model has been calibrated against turning movement counts, using several other parameters, including priority rules and lane change distances. The model has been validated by comparing observed journey times to the modelled journey times. The model is not validated against queue data collected. However, this data has been used to give an indication of whether the levels of congestion in the model are representative of observed conditions.

3.3.42 In summary, the model has been calibrated and validated to criteria set out in TAG and Design Manual for Roads and Bridges (DMRB) and is therefore deemed suitable and can be used for future evaluations of the Scheme. Further details of the operational model development process are included in Appendix A: Combined Modelling and Appraisal Report (ComMA) of this TA.

~~5.3.1.10~~Forecast model development

3.3.43 The following sections provide an overview of the forecast model development process. Further details are included in Appendix A: Combined Modelling and Appraisal Report (ComMA) of this TA.

Forecast years

3.3.44 Operational models have been produced for 2028 and 2043 as this covers the period 15 years post construction.

Forecast scenarios

3.3.45 As with the strategic HAM, forecasts have been prepared for the DM and DS scenarios. These forecasts reflect the best information currently available and are intended to give a broad indication of the likely travel conditions on the A46 and surrounding road network, both with and without the Scheme.

~~5.3.1.11~~Do Minimum scenario

3.3.46 The DM scenario includes committed infrastructure changes, changes to signal timings and demand changes.

Infrastructure changes

3.3.47 The DM scenario contains the introduction of the Newark Southern Link Road (SLR) roundabout, south of Farndon roundabout. The Newark SLR provides a new eastbound-westbound connection off the A46; and is being delivered by NSDC and is separate to this Scheme. This new junction is partially signalised with traffic signal control on both the A46 north and A46 south arms and adjacent circulatory carriageway.

Demand changes

3.3.48 To account for the traffic growth from the base year to the forecast years of 2028 and 2043, flows from the strategic HAM were used. The absolute difference between the strategic HAM base year flows and the strategic HAM DM flows has been added to the operational model base year flows to give the operational model DM flows. In cases where this would cause the operational model DM flows to be negative, the percentage decrease from the strategic HAM base flows to the strategic HAM DM flows was used instead. The pedestrian demand at both Cattle Market and Brownhills roundabout remains unchanged.

3.3.49 In the AM peak without the Scheme, the overall level of demand is forecast to increase by around 8% between 2019 and 2028 and by 26% between 2019 and 2043. In the PM peak, demand is forecast to increase by around 11% between 2019 and 2028 and by 28% between 2019 and 2043.

Signal timing changes

3.3.50 A LinSig model (which allows modelling of traffic signals and their effect on traffic capacities and queuing) has been used to generate the initial signal timings for the Southern Link Road roundabout and Lincoln Road junction in the 2028 and 2043 DM networks. During the testing phase in the operational model, these signal timings were checked and adjusted based on observations of variable capacity and queuing.

~~5.3.1.12~~Do Something scenario

3.3.51 The DS models include all the DM changes as well as changes associated with the Scheme.

Infrastructure changes

3.3.52 A plan showing a high-level overview of design changes is included in Section 1.5.

3.3.53 The A46 is designed as a dual carriageway with a national speed limit between Farndon and Cattle Market roundabouts and a 50-mph speed limit between Cattle Market and Winthorpe roundabouts, with additional changes to the junctions below:

- Farndon roundabout
- Cattle Market roundabout
- Brownhills roundabout
- Friendly Farmer roundabout
- New roundabout north of Brownhills
- Winthorpe roundabout

3.3.54 A summary of the infrastructure changes for each junction is provided below.

3.3.55 At the Farndon roundabout, the A46 (east) and A46 (west) approaches would be signalised and a third lane would be added to both approaches. The circulatory would also be increased from two to three lanes as part of the Scheme.

3.3.56 The Cattle Market roundabout would be upgraded to a grade-separated roundabout. As part of the Scheme, the A46 (east) approach would be signalised and a third lane would be introduced on the A46 (east), Great Northern Road, A46 (west) and Kelham Road approaches. The Great Northern Road exit would also be increased to two lanes up to the level crossing.

3.3.57 At the Brownhills roundabout, slip roads onto the A46 would be provided.

3.3.58 At the Friendly Farmer roundabout, a new free-flow slip is proposed between the A17 (east) and A1 link. Additionally, a new pedestrian crossing would be provided on the A46 (west) approach.

3.3.59 The Scheme also includes the introduction of new three-arm roundabout to the north of the existing Brownhills roundabout.

3.3.60 The Winthorpe roundabout would be converted to a through-about, with two new lanes passing through the junction from the Friendly Farmer single carriageway link to the A46 eastbound. In addition, the A46 (east), A46 (west) and Old A46 (west) approaches would be signalised, with a third lane also introduced on the A46 (east) approach. Finally a short 5m flare would be introduced on the A1133 approach.

Demand changes

The demand changes have been applied to the DS model using the same methodology as described above for the DM model. Whilst the DM demand was calculated using the difference between the base and DM flows from the strategic HAM, the DS demand change have been calculated using the difference between the DM and DS flows from the strategic HAM and applying this to the operational model DM flows. The pedestrian demand at both the Cattle Market and Brownhills roundabout remains unchanged.

In the AM peak with the Scheme (DS), the demand is forecast to increase by 7% in 2028 and by 8% in 2043 when compared with the DM scenario. In the PM peak, demand is forecast to increase by 7% in 2028 and by 9% in 2043 compared with the DM scenario.

Signal timings changes

3.3.61 A LinSig model was used to generate the initial signal timings for Farndon roundabout, SLR roundabout, Winthorpe roundabout, and the signalised part of Cattle Market roundabout in the 2028 and 2043 DS networks. These signal timings were further optimised during simulation runs of the DS operational models.

~~5.3.1.13~~Network performance parameters

3.3.62 Network performance statistics have been extracted from the operational model to show how the network is forecast to change as a result of the Scheme. Table 3-2 below summarises the parameters used to assess overall network performance, which is reported in Chapter 5 (current network performance) and Chapter 6 (forecast network performance).

Table 3-2: Network parameters performance

Parameter	Definition	Unit
Average delay time	Average delay time per vehicle. Total delay / (Number of vehicles in the network + number of vehicles that have arrived)	Seconds
Average number of stops	Average number of stops that vehicles make on the network (exclude bus stops)	No.
Average network speed	Average speed of all vehicles that are in or have left the network	mph
Average stopped delay	Average delay to vehicles while stopped on the network	Seconds
Total distance travelled	Total distance travelled of all vehicles that are in or have left the network	Miles
Total travel time	Total travel time of all vehicles that are in or have left the network	Hours
Total delay	Total delay time of all vehicles that are in or have left the network	Hours
Total number of stops	Total number of stops that vehicles make on the network (exclude bus stops)	No.
Total stopped delay	Total delay to vehicles while stopped on the network	Hours
Remaining vehicles in network	Total number of vehicles remaining in the network at the end of the simulation	Vehicles
Processed vehicles	Total number of vehicles which have already reached their destination and have been removed from the network before the end of the simulation	Vehicles
Latent demand delay	Total waiting time of vehicles from input flows that were not used at their actual start time in the network.	Minutes
Latent Demand	Number of vehicles that could not enter the network before the simulation ended due to congestion	Vehicles

~~5.3.1.14~~Junction performance parameters

3.3.63 The predicted performance at junctions or node evaluation has been measured in terms of the following:

- Maximum queue length in metres across the modelled period
- Average queue length in metres across the modelled period
- Average delay in seconds
- Level of Service (A to F)

3.3.64 The Level of Service (LOS) is a concept derived from the Highway Capacity Manual (2000) by the USA Transportation Research Board. It rates performance based upon thresholds of delay on an A to F grading as follows:

- LOS A – 0 to 10 seconds
- LOS B – 10 to 20 seconds (or 10 to 15 seconds for unsignalised junctions)
- LOS C – 20 to 35 seconds (or 15 to 25 seconds for unsignalised junctions)
- LOS D – 35 to 55 seconds (or 25 to 35 seconds for unsignalised junctions)
- LOS E – 55 to 80 seconds (or 35 to 50 seconds for unsignalised junctions)
- LOS F – over 80 seconds (or over 50 seconds for unsignalised junctions)

3.3.65 A junction operating with a LOS of E is considered to be at capacity while a junction operating with a LOS of F is considered to be over-capacity.

3.3.66 The LOS has been extracted from the operational model for each movement at each junction, as well as for the overall junction.

~~5.4~~3.4 Previous A46 studies

~~2.3~~

Midlands Connect, A46 corridor study

3.4.1 Midlands Connect illustrated its commitment to the importance of the A46 corridor in the wider region through the *"A46 corridor study"*, which informs Midlands Connect's 20-year improvement plan to *"futureproof the route and boost the national economy".* The Stage 1 – Enhanced strategic case was published in 2018[12].

3.4.2 The A46 study highlighted the growth potential for the Newark-on-Trent area and level of constraint which is currently evident due to the congestion caused at Newark-on-Trent. It goes on to state that "*overcoming this hotspot will make a significant contribution in locking in the benefits of previous upgrades to the A46 in this section and help provide an effective link between the M1 and A1*".

3.4.3 Midlands Connect commissioned phase two of the A46 study to carry out more detailed work on those locations identified in the phase one study and ultimately provide evidence to support a sequenced

[12] *Midlands Connect A46 Corridor Study Stage One Enhanced Strategic Case:* *https://www.midlandsconnect.uk/media/1533/a46-corridor-study-stage-one-enhanced-strategic-case-final-november-2018.pdf*

programme for the corridor as a whole. Published in November 2020[13], the stage two study reiterates the findings of the 2018 study and concludes that the Scheme's junction improvements (including A1, A46 and A17) need to progress as soon as possible given existing plans for housing and employment growth in the area.

3.4.4 In terms of barriers to growth, the study notes that on the section of the A46 between Hobby Horse Interchange (A607) and Newark (A1), major delays are currently experienced around Newark-on-Trent. These delays are due to at-grade roundabouts and a dumb-bell junction with the A1 and the Inrix journey time data clearly shows this as a major bottleneck.

~~5.5~~3.5 Commitment to the Scheme

National

3.5.1 There are a number of documents which set out the commitment to and funding of the Scheme.

~~5.5.1.1~~National Infrastructure Delivery Plan 2016-2021 (2016)[14]

3.5.2 The National Infrastructure Delivery Plan (2016), published in March 2016, sets out the commitment to delivering better infrastructure in the UK. The Scheme was announced as part of this plan within the 2016 Budget announcements on infrastructure. As part of the Midlands roads schemes, the Scheme was noted as being funded to improve the existing A46 Newark Bypass Junction with the A1, thereby enhancing performance, capacity, and connectivity and reducing congestion. This aligns with the five objectives of the Scheme on the topics of: safety, congestion, connectivity, environment and customer.

~~5.5.1.2~~National Infrastructure Strategy – Faster, Fairer, Greener (2020)[15]

3.5.3 Published in November 2020, the National Infrastructure Strategy sets out the government's plans for investment in infrastructure with a pledge to invest £27.5 billion in national traffic corridors over the Parliament period. It makes direct reference to the Scheme, stating that new

[13] *Midlands Connect A46 Corridor Study – Phase 2 Task 1 Final Report: https://www.midlandsconnect.uk/media/1756/mc-a46-corridor-study-phase-2-final-report-march-2021-with-appendix.pdf*

[14] *National Infrastructure Delivery Plan 2016 to 2021: https://www.gov.uk/government/publications/national-infrastructure-delivery-plan-2016-to-2021*

[15] *National Infrastructure Strategy: https://www.gov.uk/government/publications/national-infrastructure-strategy*

upgrades will include upgrading the A46 Newark Bypass in the East Midlands.

~~5.5.1.3~~DfT Transport Investment Strategy (2017)[16]

3.5.4 The DfT's "Transport Investment Strategy – Moving Britain Ahead" is a high-level policy document setting out the DfT's priorities and approach for future transport investment decisions. Published in July 2017, the policy sets out a number of strategic objectives including creating a more reliable, less congested and better-connected transport network.

3.5.5 The Scheme objectives clearly align with this, in particular, the congestion and connectivity objectives which aim to improve journey time reliability, reduce congestion and accommodate economic growth within Newark-on-Trent and the wider area.

~~5.5.1.4~~DfT Road Investment Strategy

3.5.6 Within the Government's first Road Investment Strategy (RIS) (2015-2020), published in 2014[17], there is acknowledgement of the need for improvement of the existing A46 north of Newark-on-Trent to dual carriageway standard, thereby raising the last section of the existing A46 between the A1 and M1 to a standard in line with the wider route corridor. The Scheme was announced as a scheme to be developed for the next road investment period. RIS2, published in 2020[18], reaffirms the Government's commitment to improvements to the existing A46 single carriageway and to the junctions along the A46 in the vicinity of Newark-on-Trent.

~~5.5.1.5~~National Highways, Delivery Plan

3.5.7 The National Highways' Delivery Plan 2015-2020, published in 2015[19], identifies the A1/A46 junctions (Brownhills and Friendly Farmer roundabout) and the A46/A616/A617 (Cattle Market roundabout) schemes for delivery in the next road period. The commitment to the Scheme was reaffirmed in the National Highways Delivery Plan 2020 to

[16] *DfT's Transport Investment Strategy: https://www.gov.uk/government/publications/transport-investment-strategy*

[17] *Road investment strategy 1 (RIS1): 2015 to 2020: https://www.gov.uk/government/collections/road-investment-strategy*

[18] *Road Investment Strategy 2 (RIS2): 2020 to 2025: https://www.gov.uk/government/publications/road-investment-strategy-2-ris2-2020-to-2025*

[19] *Highways England Delivery Plan 2015-2020: https://www.gov.uk/government/publications/highways-england-delivery-plan-2015-2020*

2025[20], providing a start of works commitment of the 2024-2025 financial year.

Regional

3.5.8 The Scheme is key for unlocking major housing and economic growth in the Midlands and is one of the key strategic investment priorities.

~~5.5.1.6~~Derby, Derbyshire, Nottingham and Nottinghamshire, Vision 2030 (2018)[21]

3.5.9 The Derby, Derbyshire, Nottingham, Nottinghamshire (D2N2) Local Enterprise Partnership's (LEP) *"Vision 2030 - strategic economic plan"* includes a commitment to the Scheme. For the existing A46 corridor, the strategic economic plan further defines the need to upgrade the section around Newark-on-Trent as a regional priority for unlocking major housing and economic development and commits the LEP to working alongside Midlands Connect to promote this upgrade.

~~5.5.1.7~~Transport for the East Midlands & Midlands Connect, Our Shared Vision for the East Midlands (2022)[22]

3.5.10 Midlands Connect in conjunction with TfEM have produced a shared vision for the East Midlands. One of the eight key strategic investment priorities is the A46 growth corridor and Newark-on-Trent. The vision sets out that the delivery of the '*A46 Newark Northern Bypass'* remains TfEM's top strategic priority and that the A46 around Newark-on-Trent from Farndon to the interchange with the A1 and A1 'has been a bottleneck for many years which has caused congestion, pollution and safety issues'.

~~5.5.1.8~~Freight

3.5.11 Within Her Majesties Treasury Budget 2021, it was announced that the Humber ports would be provided Freeport status[23], providing investment to allow for expansion of the ports in Grimsby, Goole, Immingham and Hull.

3.5.12 This opportunity for growth in the ports to the north-east of the existing A46 looks to enable growth in the manufacturing and agri-food economies, with a potential increase in productivity at the ports and the subsequent logistical requirements which could utilise the A46 corridor. These plans are at an early stage but are a clear strategic consideration

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[20] *Highways England Delivery Plan 2020-2025: https://nationalhighways.co.uk/media/vh0byhfl/5-year-delivery-plan-2020-2025-final.pdf*

[21] *Derby-Derbyshire-Nottingham-Nottinghamshire Vision 2030: https://www.mansfield.gov.uk/downloads/file/914/e7-d2n2-lep-strategic-economic-plan-vision-2030*

[22] *Midlands Connect and Transport for the East Midlands joint statement: https://www.midlandsconnect.uk/media/1158/81901_tfem-mc_joint_priorities_summary_2022_final.pdf*

[23] *Humber ports Freeport: https://humberfreeport.org/*

when assessing the requirements to close the “missing link” of dual carriageway around Newark-on-Trent.

~~6~~4 Road safety

~~7~~

Introduction

~~7.1.1~~4.1.1 This chapter provides a summary of the existing road safety record on the A46 between Farndon and Winthorpe roundabout and the forecast impact of the Scheme on accidents over a 60-year appraisal period. It also provides responses to the road safety audit (RSA) undertaken for the Scheme, including the designer's response on behalf of the Applicant, in order to demonstrate the suitability of the Scheme design in safety terms.

~~7.2~~4.2 Accident data

Overview

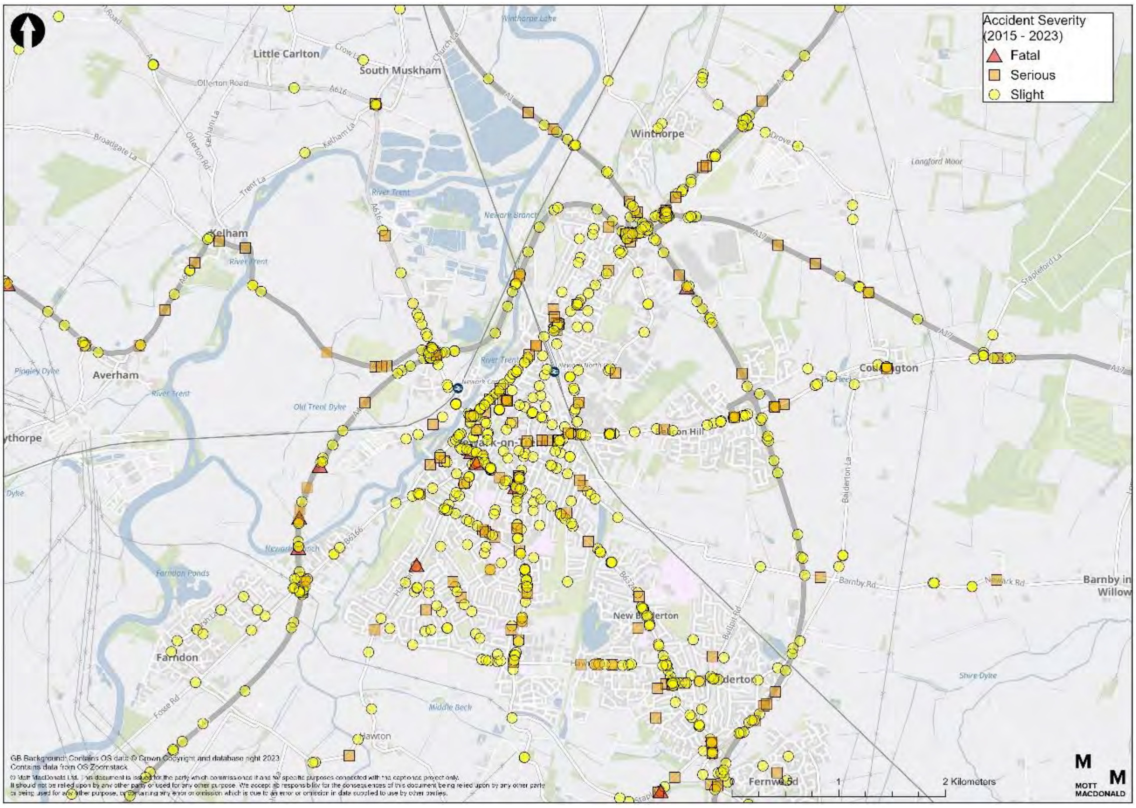
~~7.2.1~~4.2.1 The economic appraisal for the Scheme includes monetised benefits associated with improved road safety. This assessment was based on Personal Injury Accident (PIA) data obtained from the DfT's Road Safety Data website (Stats19) for the full five-year period from 2015 to 2019 (pre-COVID-19). Accident data was collated for the whole of the Newark-on-Trent area.

~~7.2.2~~4.2.2 For the purposes of this TA, up-to-date PIA data has been obtained for the study area from Via in Nottinghamshire, who maintain the Stats19 database within the area covered by Nottinghamshire Police. This data covers an eight-year period from 01 January 2015 to 31 December 2022.

~~7.2.3~~4.2.3 The PIA data includes data on road accidents reported to the police where at least one person is injured. Several people can be injured in one accident, resulting in multiple casualties being recorded.

~~7.2.4~~4.2.4 Figure 4-1 shows the location of the PIAs in the study area by severity. This indicates that the vast majority of accidents are clustered around key junctions along the A46 corridor.

Figure 4-1: Accidents by severity in Newark-on-Trent



Source: Analysis of *STATS19 Data*

~~7.2.5~~4.2.5 Table 4-1 summarises the number of PIAs and resulting casualties by severity that have occurred between 2015 and 2022.

~~7.2.6~~4.2.6 This analysis indicates that there have been 1,024 PIAs over the eight-year period, resulting in 1,358 casualties, of which 13 were fatal (1%), 179 were serious (13%) and 1,166 were slight (86%).

Table 4-1: Personal injury accidents and casualties by severity

	PIAs				**Casualties**			
Year	**Fatal**	**Serious**	**Slight**	**Total**	**Fatal**	**Serious**	**Slight**	**Total**
2015	1	28	131	160	1	31	183	215
2016	3	18	122	143	3	18	179	200
2017	3	22	141	166	3	25	194	222
2018	3	21	117	141	3	22	168	193
2019	0	20	112	132	0	22	139	161
2020	1	13	66	80	1	13	84	98
2021	1	24	78	103	1	26	114	141

	PIAs				Casualties			
Year	**Fatal**	**Serious**	**Slight**	**Total**	**Fatal**	**Serious**	**Slight**	**Total**
2022	1	19	79	99	1	22	105	128
Total	13	165	846	1,024	13	179	1,166	1,358

Source: Analysis of *STATS19 Data*

~~7.2.7~~4.2.7As this TA is focused primarily on the improvement of the A46, subsequent analysis focuses on the key junctions along this corridor. Table 4-2 shows the overall number of PIAs and casualties at these key junctions.

~~7.2.8~~4.2.8This analysis indicates that there were 131 PIAs that took place at the key junctions along the A46 over the eight-year period between 2015 and 2022, resulting in 163 casualties. Of the 131 PIAs, the highest number of incidents occurred at the Cattle Market roundabout, with 46 PIAs resulting in 60 casualties.

Table 4-2: Total number of personal injury accidents and casualties at key junctions (2015-2022)

Junction	Total PIAs	Total Casualties
Farndon	23	25
Cattle Market	46	60
Brownhills	24	30
Friendly Farmer	28	36
Winthorpe	10	12
Total	**131**	**163**

Source: Analysis of *STATS19 Data*

~~7.2.9~~4.2.9Given that this stretch of the A46 is currently a single carriageway, incidents that lead to lane closures contribute to increased delay and poor journey time reliability through the network.

Farndon Roundabout

~~7.2.10~~4.2.10Further analysis has been undertaken at Farndon roundabout to understand the volume of PIAs by severity that took place between 2015 and 2022, as shown in Table 4-3.

Table 4-3: Farndon roundabout personal injury accidents (2015-2022)

	Personal Injury Accidents				Casualties			
	Fatal	**Serious**	**Slight**	**Total**	**Fatal**	**Serious**	**Slight**	**Total**
2015	0	2	7	9	0	2	9	**11**
2016	0	0	1	1	0	0	1	**1**
2017	0	0	1	1	0	0	1	**1**

	Personal Injury Accidents				Casualties			
	Fatal	**Serious**	**Slight**	**Total**	**Fatal**	**Serious**	**Slight**	**Total**
2018	0	0	2	2	0	0	2	**2**
2019	0	0	3	3	0	0	3	**3**
2020	0	0	2	2	0	0	2	**2**
2021	0	0	3	3	0	0	3	**3**
2022	0	0	2	2	0	0	2	**2**
Total	**0**	**2**	**21**	**23**	**0**	**2**	**23**	**25**

Source: *Analysis of STATS19 Data*

A total of 23 PIAs occurred at the Farndon roundabout over the eight-year period, resulting in 25 casualties, of which 23 were classified as slight (92%) and two were serious (8%). There were no fatal PIAs. None of the PIAs involved pedestrians or cyclists.

Cattle Market Roundabout

~~7.2.11~~4.2.11Further analysis has been undertaken at Cattle Market roundabout to understand the volume of PIAs by severity that took place between 2015 and 2022, as shown in Table 4-4.

Table 4-4: Cattle Market roundabout personal injury accidents (2015-2022)

	Personal Injury Accidents				Casualties			
	Fatal	**Serious**	**Slight**	**Total**	**Fatal**	**Serious**	**Slight**	**Total**
2015	0	0	5	**5**	0	0	5	**5**
2016	0	1	9	**10**	0	1	14	**15**
2017	0	1	8	**9**	0	1	12	**13**
2018	0	0	9	**9**	0	0	13	**13**
2019	0	0	2	**2**	0	0	2	**2**
2020	0	0	6	**6**	0	0	6	**6**
2021	0	1	1	**2**	0	1	2	**3**
2022	0	1	2	**3**	0	1	2	**3**
Total	**0**	**4**	**42**	**46**	**0**	**4**	**56**	**60**

Source: *Analysis of STATS19 Data*

~~7.2.12~~4.2.12A total of 46 PIAs occurred at the Cattle Market roundabout over the eight-year period, resulting in 60 casualties, of which 56 were classified as slight (93%) and four were serious (7%). There were no fatal PIAs. Of the 46 PIAs, six involved cyclists (13%).

Brownhills Roundabout

~~7.2.13~~4.2.13Further analysis has been undertaken at Brownhills roundabout to understand the volume of PIAs by severity that took place between 2015 and 2022, as shown in Table 4-5.

Table 4-5: Brownhills roundabout personal injury accidents (2015-2022)

	Personal Injury Accidents				Casualties			
	Fatal	**Serious**	**Slight**	**Total**	**Fatal**	**Serious**	**Slight**	**Total**
2015	0	0	2	**2**	0	0	2	**2**
2016	0	0	5	**5**	0	0	5	**5**
2017	0	1	2	**3**	0	1	2	**3**
2018	0	2	3	**5**	0	2	4	**6**
2019	0	1	4	**5**	0	1	7	**8**
2020	0	0	0	**0**	0	0	0	**0**
2021	0	1	1	**2**	0	1	3	**4**
2022	0	0	2	**2**	0	0	2	**2**
Total	**0**	**5**	**19**	**24**	**0**	**5**	**25**	**30**

Source: *Analysis of STATS19 Data*

~~7.2.14~~4.2.14A total of 24 PIAs occurred at the Brownhills roundabout over the eight-year period, resulting in 30 casualties, of which 25 were classified as slight (83%) and five were serious (17%). There were no fatal PIAs. Of the 24 PIAs, two involved cyclists (8%).

Friendly Farmer Roundabout

~~7.2.15~~4.2.15Further analysis has been undertaken at Friendly Farmer roundabout to understand the volume of PIAs by severity that took place between 2015 and 2022, as shown in Table 4-6.

Table 4-6: Friendly Farmer roundabout personal injury accidents (2015-2022)

	Personal Injury Accidents				Casualties			
	Fatal	**Serious**	**Slight**	**Total**	**Fatal**	**Serious**	**Slight**	**Total**
2015	0	0	5	**5**	0	0	5	**5**
2016	0	0	5	**5**	0	0	6	**6**

	Personal Injury Accidents				Casualties			
	Fatal	**Serious**	**Slight**	**Total**	**Fatal**	**Serious**	**Slight**	**Total**
2017	0	0	3	**3**	0	0	6	**6**
2018	0	1	3	**4**	0	1	3	**4**
2019	0	0	3	**3**	0	0	4	**4**
2020	0	1	2	**3**	0	1	2	**3**
2021	0	0	1	**1**	0	0	2	**2**
2022	0	1	3	**4**	0	2	4	**6**
Total	**0**	**3**	**25**	**28**	**0**	**4**	**32**	**36**

Source: *Analysis of STATS19 Data*

~~7.2.16~~4.2.16A total of 28 PIAs occurred at the Friendly Farmer roundabout over the eight-year period, resulting in 36 casualties, of which 32 were classified as slight (89%) and four were serious (11%). There were no fatal PIAs. None of the PIAs involved pedestrians or cyclists.

Winthorpe Roundabout

~~7.2.17~~4.2.17Further analysis has been undertaken at the Winthorpe roundabout to understand the volume of PIAs by severity that took place between 2015 and 2022, as shown in Table 4-7.

Table 4-7: Winthorpe roundabout personal injury accidents (2015-2022)

	Personal Injury Accidents				Casualties			
	Fatal	**Serious**	**Slight**	**Total**	**Fatal**	**Serious**	**Slight**	**Total**
2015	0	0	2	**2**	0	0	3	**3**
2016	0	0	1	**1**	0	0	1	**1**
2017	0	0	0	**0**	0	0	0	**0**
2018	0	0	4	**4**	0	0	4	**4**
2019	0	0	2	**2**	0	0	3	**3**
2020	0	0	0	**0**	0	0	0	**0**
2021	0	0	1	**1**	0	0	1	**1**
2022	0	0	0	**0**	0	0	0	**0**
Total	**0**	**0**	**10**	**10**	**0**	**0**	**12**	**12**

Source: *Analysis of STATS19 Data*

~~7.2.18~~4.2.18 A total of 10 PIAs occurred at the Winthorpe roundabout over the eight-year period, resulting in 12 casualties, all of which were classified as slight. None of the PIAs involved pedestrians or cyclists.

~~7.3~~4.3 Road Safety Audit 1 and Designer's Response

~~7.3.1~~4.3.1 The Stage 1 Road Safety Audit (RSA1) has been undertaken during the preliminary design of the Scheme in line with the National Highways standard, DMRB GG 119 'Road safety audit' revision two.

~~7.3.2~~4.3.2 The Applicant has carefully considered the points and recommendations raised in the RSA1. A response to all points and the agreed actions has been provided. A copy of this is included in Appendix B: Road Safety Audit & Designer's Response.

~~7.3.3~~4.3.3 The key points raised in the RSA1 are summarised in Table 4-8 below.

Table 4-8: Key themes from RSA1

Category	Point raised	Agreed action
Safety for WCHs	Severed WCH routes with no replacement features, in particular poor crossings.	An assessment has been undertaken as part of the WCHAR report (Appendix C of this TA). Replacements have been provided for all severed routes, and additional WCH routes provided. All crossings are to be signalised other than the crossing of the A1133 and Drove Lane (north and south of Winthorpe Roundabout).
Speed limits	Speed limits on approach to junctions and measures to enforce speed limits generally.	Appropriate advance signage, road markings and traffic signals on raised poles would be provided to warn drivers of the upcoming junctions (where applicable) to allow them to adjust their speed accordingly. Further to this, average speed cameras would be in place to enforce speed limits between Cattle Market Junction and Winthorpe Roundabout.
Converging of traffic	Limited signage and information at points where highways converge.	Appropriate advance signage and road markings warning drivers of the potential for traffic merging would be provided in the detailed design.
Kerbed traffic islands	Un-anticipation of kerbed traffic islands by motorists resulting in a higher risk of collisions.	Where deemed appropriate, hatched road marking would be provided rather than kerbed traffic islands at detailed design.
Signage and desire lines	Lack of appropriate signage and desire lines.	Appropriate signage and desire lines would be confirmed at detailed design stage.
Suicide prevention	Making sure design of structures includes reasonable steps to reduce the	Nationally recognised guidance, such as the National Highways Suicide Prevention Toolkit, would be utilised at the detailed design stage to minimise

Category	Point raised	Agreed action
	likelihood of suicide / self-harm injuries at all overbridge sites.	this risk.
Absence of information	Some information has been absent for the RSA1.	Full design information would be provided for the Stage 2 RSA at the detailed design stage.

~~7.3.4~~4.3.4 Some of the agreed actions have already been incorporated within the current design. Others, where the change relates to the detail and would not be considered a material change to the DCO (e.g. proposed signs), would be implemented within the detailed design stage prior to the completion of the Stage 2 RSA.

~~7.4~~4.4 Scheme benefits

~~7.4.1~~4.4.1 An assessment has been made of the number of accidents, and their associated costs, using COBALT. COBALT assesses the safety aspects of road schemes using detailed inputs of either separate road links and road junctions that would be impacted by a scheme; or combined links and junctions. The assessment is based on a comparison of accidents by severity and associated costs across an identified network in ‘without scheme’ and ‘with scheme’ forecasts, using details of link and junction characteristics, relevant accident rates and costs and forecast traffic volumes by link and junction.

~~7.4.2~~4.4.2 Full details of the COBALT assessment can be found in Appendix A: Combined Modelling and Appraisal Report (ComMA) of this TA.

~~7.4.3~~4.4.3 Table 4-9 shows the decrease in the predicted number of accidents and casualties over the 60-year assessment period for the wider study area. This indicates that there are forecast to be around 494 fewer accidents and 685 fewer casualties as a result of the Scheme over the 60-year appraisal period.

Table 4-9: Predicted accident reductions (60-year period)

Impact		Do Minimum (without Scheme)	Do Something (with Scheme)	Savings due to Scheme
Accident costs (2010 prices, discounted to 2010, £m)		8,191.4	8,162.1	29.3
Number of accidents		191,688.0	191,194.5	493.5
Number of casualties	Fatal	2,983.4	2,974.8	8.6
	Serious	26,699.4	26,617.8	81.6
	Slight	240,327.6	239,733.3	594.3

Impact		Do Minimum (without Scheme)	Do Something (with Scheme)	Savings due to Scheme
	Total	270,010.4	269,325.9	684.5

Source: Combined Modelling and Appraisal Report, Appendix A

~~7.4.4~~4.4.4 Table 4-10 shows the forecast monetary benefits due to the Scheme. This indicates that the reduction of almost 500 accidents provides a monetised benefit of over £29m.

Table 4-10: Forecast accident impacts by COBALT element

COBALT Element	**Accident reduction**	**Benefits due to Scheme** (2010 prices, discounted to 2010)
Links	210.1	£15.3
Junctions	338.7	£10.1
Combined	-55.3	£3.9
Total	**493.5**	**£29.3**

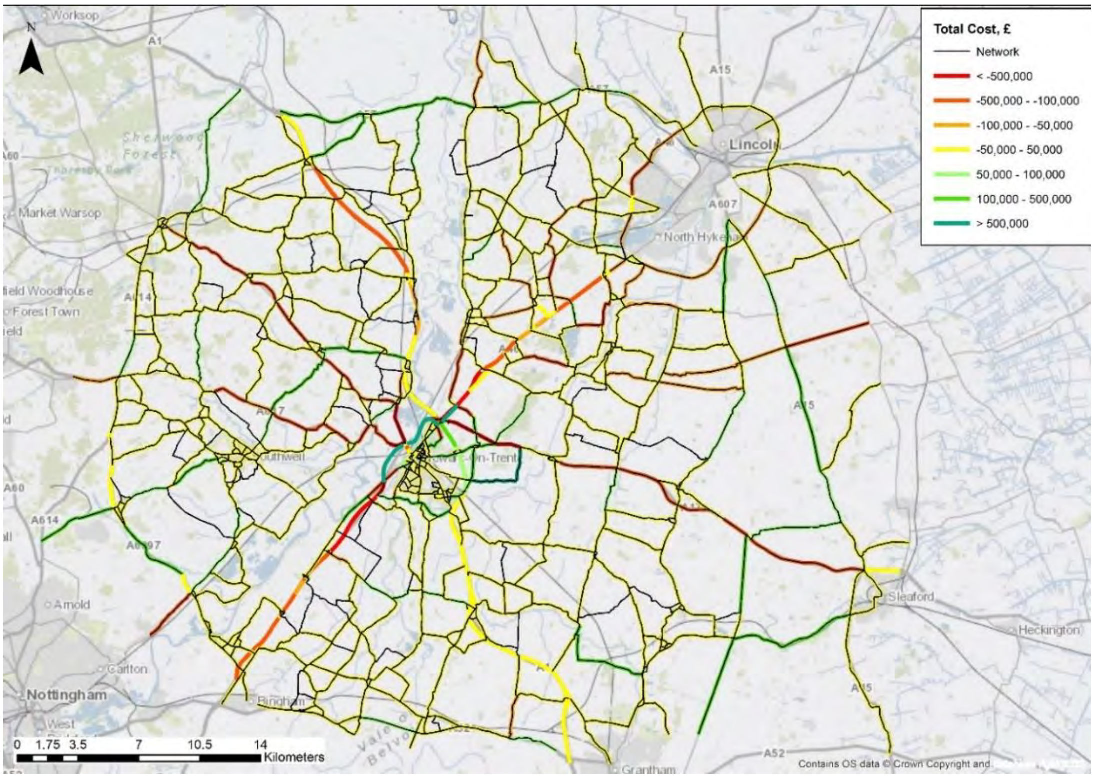
Source: Combined Modelling and Appraisal Report, Appendix A

~~7.4.5~~4.4.5 Figure 4-2 shows the spatial distribution of accident benefits, as measured in monetary terms, by section of road for the Area of Detailed Modelling (AoDM). As set out in TAG unit M3.1 (Highway Assignment Modelling) the AoDM is the area over which significant impacts of interventions are certain. Links shown in yellow indicate that minimal change is forecast, while links shown in green experience benefits and links shown in orange and red experience disbenefits.

~~7.4.6~~4.4.6 Information relating to benefits in the Fully Modelled Area (FMA) can be found in Appendix A: Combined Modelling and Appraisal Report (ComMA) of this TA. The FMA comprises the AoDM and the Rest of the Fully Modelled Area, which TAG unit M3.1 (Highway Assignment Modelling) defines as the area over which the impacts of interventions are considered to be quite likely but relatively weak in magnitude.

~~7.4.7~~4.4.7 This analysis indicates the vast majority of roads within Newark-on-Trent are forecast to experience a benefit as a result of Scheme improvements, reducing the number and severity of accidents (green coloured links). For example, at Cattle Market roundabout where a grade separated junction would be provided, queueing and delays are forecast to decrease, therefore reducing the potential risk of accidents.

Figure 4-2: Summary of accident benefits by section



Source: Combined Modelling and Appraisal Report, Appendix A

~~7.4.8~~4.4.8 Network benefits arise from the upgrade of the single carriageway sections of the widened A46 to dual carriageway, and from some traffic reassigning onto the widened A46 from comparatively less safe local roads. Increases in traffic on some roads adjacent to the Scheme, such as the A17, are forecast to lead to some localised increases in accidents, although these are not of sufficient magnitude to outweigh benefits elsewhere.

~~7.4.9~~4.4.9 The accident results for the wider study area show that there would be an overall decrease in accidents over the 60-year assessment period when compared against a scenario in which the Scheme is not constructed. This corresponds with an overall net monetised benefit of £29.3 million (2010 prices, discounted to 2010).

~~7.4.10~~4.4.10 It should be noted that safety analysis is complex, and there are different road user safety baselines and objectives for trunk roads and local roads provided by the Scheme. The TA covers a wide network area and has identified an overall net benefit across that wider network.

~~8~~5 Current network performance

~~8.1~~5.1 Introduction

~~8.1.1~~5.1.1 This chapter sets out the current traffic conditions on the A46 between Farndon and Winthorpe roundabout, the major junctions along it and on the surrounding roads. Base year[24] (2019) operational assessments are presented for a selection of junctions along the A46 corridor.

~~8.1.2~~5.1.2 Further information on current network performance is contained in Appendix A: Combined Modelling and Appraisal Report (ComMA) of this TA.

~~8.2~~5.2 Base year traffic flows

Strategic highway network

~~8.2.1~~5.2.1 Traffic flows have been extracted from the base year (2019) strategic HAM for a number of sections of road along the A1, A46, A17, A617, A616 and A1133 corridors.

~~8.2.2~~5.2.2 Table 5-1 summarises the Annual Average Daily Traffic (AADT) flows on each section of road.

~~8.2.3~~5.2.3 This analysis indicates that in the base year (2019), the A46 between Farndon and Winthorpe roundabout carries between 28,300 and 41,800 vehicles per day, with around 15% of the traffic consisting of HGVs. The strategic HAM indicates that the busiest section of the A46 is currently between Brownhills roundabout and the A17.

[24] The base year model is a representation of current highway conditions and the base year is the year from which all forecasting commences

Table 5-1: Two-way AADT forecasts on major routes in base year (2019)

Road	Section	Total vehicles	HGVs	% HGVs
A1	B6326 and Beacon Hill Rd	44,400	6,500	15%
A1	Beacon Hill Rd and A46	47,700	7,100	15%
A1	A46 and Great North Road	48,900	7,900	16%
A1	Great North Rd and Cromwell	46,600	7,900	17%
A46	Lodge Ln and Hawton Ln	36,600	4,700	13%
A46	Hawton Lane and B6166	36,600	4,700	13%
A46	B6166 and A617	28,300	4,200	15%
A46	A617 and A1	29,600	4,800	16%
A46	A1 and A17	48,100	7,300	15%
A46	A17 and A1133	41,800	6,000	14%
A46	A1133 and Brough Lane	36,200	5,300	15%
A17	Beckingham and Coddington	18,200	2,300	13%
A17	Coddington and A46	11,800	2,100	18%
A617	Hockerton and Averham	7,200	1,600	22%
A617	Averham and A46	16,900	2,500	15%
A616	A46 and South Muskham	12,600	1,200	10%
A616	South Muskham and Caunton	5,100	600	12%
A1133	West of Winthorpe	7,600	900	12%

Source: Analysis of A46 Strategic Model, Note: Total daily traffic in vehicles, all values rounded to nearest 100

A46 junctions

~~8.2.4~~5.2.4 Table 5-2 summarises the volume of traffic passing through each junction in the weekday AM and PM peak hours, as extracted from the operational model, providing an indication of the relative importance of each junction.

~~8.2.5~~5.2.5 This analysis shows that the Friendly Farmer roundabout currently carries the highest volume of traffic across this section of the route, with around 4,500-4,700 vehicles in the weekday AM and PM peak hours.

Table 5-2: Summary of weekday peak hour traffic flows on A46 junctions in 2019

Junction	AM Peak	PM Peak
Farndon	3,399	3,400
Cattle Market	4,124	3,919
Brownhills	4,375	4,331
Friendly Farmer	4,692	4,541
Winthorpe	3,628	3,484

Source: Analysis of A46 Strategic Model

~~8.3~~5.3 Base year operational assessment

Overarching network performance

~~8.3.1~~5.3.1 The operational model has been used to assess the performance of the Scheme. Table 5-3 summarises the 2019 base year network performance statistics across the whole network without the Scheme.

~~8.3.2~~5.3.2 The analysis indicates that there are around 1,300 vehicles remaining in the network in both the weekday AM and PM peak hours, which is an indicator that there is a level of congestion in the base network.

Table 5-3: Base year network performance

Measure	AM Peak	PM Peak
Average delay (s)	103	92
Average number of stops	8	6
Average network speed (mph)	36	36
Average stopped delay (s)	25	23
Total distance travelled (mi)	68,755	65,575
Total travel time (h)	1,204	1,128
Total delay (h)	346	310
Total number of stops	100,371	77,425
Total stopped delay (h)	84	77
Remaining vehicles in network	1,355	1,249
Processed vehicles	10,725	10,882
Latent demand delay (m)	35	84
Latent Demand (vehs)	0	3

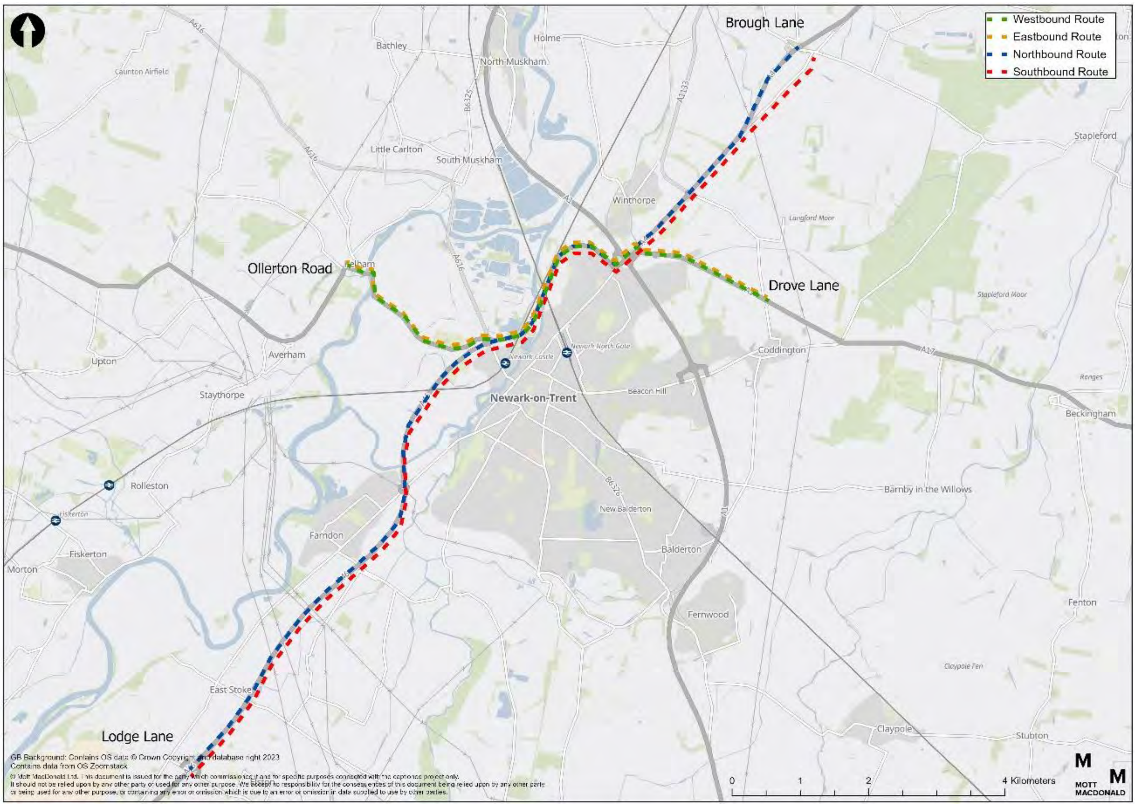
Source: Combined Modelling and Appraisal Report, Appendix A

Journey times

~~8.3.3~~5.3.3 Base year journey times have been extracted from the operational model for the two routes shown in Figure 5-1. These routes include:

- A46 between Lodge Lane (south of Farndon roundabout) and Brough Lane (north of Winthorpe roundabout) (Northbound Route and Southbound Route)
- A617 between Ollerton Road and Drove Lane (Eastbound Route and Westbound Route)

Figure 5-1: Operational model journey time routes



~~8.3.4~~5.3.4 Table 5-4 summarises the weekday peak hour journey times in the base year. On this section of the A46, peak hour journey times are around 12 to 19 minutes in each direction, while on the A617, peak hour journey times are around 8 to 12 minutes in each direction.

~~8.3.5~~5.3.5 Further analysis of operational model journey times is included in Appendix A: Combined Modelling and Appraisal Report (ComMA) of this TA.

Table 5-4: Base year journey times (hh:mm:ss)

	AM Peak	PM peak
A46 NB	00:13:02	00:19:28
A46 SB	00:16:47	00:12:11
A617 EB	00:09:00	00:12:04
A617 WB	00:09:03	00:08:20

Source: Analysis of operational model

Junction performance

~~8.3.6~~5.3.6 The operational model has been used to assess junction performance in the weekday peak hours. A summary of the performance of the key junctions on the A46 corridor in the 2019 base year is provided in Table 5-5. Detailed information relating to the performance of each junction can be found in the sections below.

~~8.3.7~~5.3.7 A junction operating with a LOS of E is considered to be at capacity, while a junction operating with a LOS of F is considered to be over capacity. The LOS has been colour-coded with the lightest green as A through to a dark green as D, orange for E and red for F.

~~8.3.8~~5.3.8 This analysis indicates that the majority of junctions on this section of the A46 currently operate within capacity. The only exception is the Cattle Market roundabout which operates with a LOS of E, indicating that the junction is operating at capacity.

Table 5-5: Summary of Level of Service in base year assessments

Junction	AM Peak	PM Peak
Farndon	A	A
Cattle Market	E	E
Brownhills	B	C
Friendly Farmer	C	A
Winthorpe	A	A

Source: Analysis of operational model

~~8.3.8.1~~Farndon roundabout

~~8.3.9~~5.3.9 The Farndon roundabout is a five-arm priority-controlled roundabout. The results of the 2019 base year operational assessments for the weekday AM and PM peak hour are summarised in Table 5-6.

~~8.3.10~~5.3.10 The operational assessments indicate that overall, the junction is operating with a LOS of A in both the weekday AM and PM peak hour, indicating that the junction is currently operating well within capacity.

Table 5-6: Farndon junction assessment (2019 base)

Arm	Movement	AM				PM			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A46 (N)	A46 (North) to Fosse Road	68	A	10	135	110	A	17	182
	A46 (North) to Farndon Road	84	A	10	135	118	A	17	182
	A46 (North) to A46 (South)	1,037	A	10	135	799	A	17	182
Farndon Road	Farndon Road to Fosse Road	123	A	3	51	192	A	2	38
	Farndon Road to A46 (North)	66	A	3	51	113	A	2	38
	Farndon Road to A46 (South)	414	A	3	51	334	A	2	38
A46 (S)	A46 (South) to Fosse Road	11	A	10	133	21	A	34	196
	A46 (South) to A46 (North)	1,021	A	10	133	913	A	34	196
	A46 (South) to Farndon Road	404	A	10	133	549	A	34	196
Fosse Road	Fosse Road to A46 (North)	59	A	1	28	100	A	1	28
	Fosse Road to Farndon Road	109	A	1	28	144	B	1	28
	Fosse Road to A46 (South)	5	B	1	28	7	B	1	28
Overall	**Farndon_Total**	**3,399**	**A**			**3,400**	**A**		

Source: Analysis of operational model

~~8.3.10.1~~Cattle Market roundabout

~~8.3.11~~5.3.11 The Cattle Market roundabout is a five-arm priority-controlled roundabout. The results of the 2019 base year operational assessments for the weekday AM and PM peak hour are summarised in Table 5-7.

~~8.3.12~~5.3.12 The operational assessments indicate that overall, the junction is operating with a LOS of E in both the weekday AM and PM peak hour. The A46 (south) approach operates with a LOS of F in the PM peak hour, indicating that this one approach operates over capacity. Overall the junction is considered to be operating at capacity in both the weekday AM and PM peak hours.

Table 5-7: Cattle Market junction assessment (2019 base)

Arm	Movement	AM Total Flow (vehs)	AM LOS (A-F)	AM Mean Queue (m)	AM Max Queue (m)	PM Total Flow (vehs)	PM LOS (A-F)	PM Mean Queue (m)	PM Max Queue (m)
A616 Great North Rd (N)	Great North Road (North) to A46 (South)	273	E	238	531	208	C	20	165
	Great North Road (North) to Kelham Road	14	E	238	531	12	D	20	165
	Great North Road (North) to A46 (North)	67	E	238	531	68	D	20	165
	Great North Road (North) to Great North Road (South)	208	E	238	531	172	D	20	165
A46 (N)	A46 (North) to A46 (South)	786	E	160	736	613	D	42	337
	A46 (North) to Kelham Road	294	E	160	736	389	E	42	337
	A46 (North) to Great North Road (North)	85	E	160	736	78	E	42	337
	A46 (North) to Great North Road (South)	46	E	160	736	77	D	42	337
B6326 Great North Rd (S)	Great North Road (South) to A46 (South)	78	C	47	360	122	C	102	486
	Great North Road (South) to Kelham Road	179	C	47	360	256	C	102	486
	Great North Road (South) to Great North Road (North)	177	D	47	360	199	D	102	486
	Great North Road (South) to A46 (North)	59	D	47	360	124	D	102	486
A46 (S)	A46 (South) to Kelham Road	91	D	47	349	51	F	697	1,706
	A46 (South) to Great North Road (North)	228	D	47	349	222	F	697	1,706
	A46 (South) to A46 (North)	779	D	47	349	663	F	697	1,706
	A46 (South) to Great North Road (South)	54	D	47	349	101	F	697	1,706
A617 Kelham Rd	Kelham Road to A46 (South)	54	E	58	310	80	E	24	142
	Kelham Road to Great North Road (North)	19	D	58	310	11	C	24	142
	Kelham Road to A46 (North)	371	D	58	310	284	C	24	142
	Kelham Road to Great North Road (South)	265	E	58	310	191	E	24	142
Overall	**Cattle Market_Total**	**4,124**	E			**3,919**	E		

Source: Analysis of operational model

~~8.3.12.1~~Brownhills roundabout

~~8.3.13~~5.3.13 The Brownhills roundabout is a four-arm priority-controlled roundabout. The results of the 2019 base year operational assessments for the weekday AM and PM peak hour are summarised in Table 5-8.

~~8.3.14~~5.3.14 The operational assessments indicate that overall, the junction is operating with a LOS of B in the AM peak hour and a LOS of C in the PM peak hour. The A46 (west) approach operates with a LOS of F in the PM peak hour, indicating that this one approach operates over capacity.

Overall, the junction is considered to be operating within capacity in both the weekday AM and PM peak hours.

Table 5-8: Brownhills junction assessment (2019 base)

Arm	Movement	AM				PM			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A1 Link	A1 (North) to A46 (South)	35	C	14	140	84	C	10	102
	A1 (North) to A46 (North)	430	C	14	140	456	C	10	102
	A1 (North) to Lincoln Road (South)	87	C	14	140	76	C	10	102
A46 (E)	A46 (North) to A46 (South)	1,079	A	2	62	903	A	1	52
	A46 (North) to A1 (North)	264	A	2	62	387	A	1	52
	A46 (North) to Lincoln Road (South)	608	A	1	67	458	A	1	54
B6166 Lincoln Road	Lincoln Road (South) to A46 (South)	114	B	6	76	168	B	23	137
	Lincoln Road (South) to A1 (North)	91	C	10	75	122	D	33	133
	Lincoln Road (South) to A46 (North)	400	C	10	75	641	C	33	133
A46 (W)	A46 (South) to A1 (North)	63	B	37	513	35	D	736	1,408
	A46 (South) to A46 (North)	1,073	C	64	513	918	F	775	1,406
	A46 (South) to Lincoln Road (South)	132	D	64	513	83	F	775	1,406
Overall	**Brownhills_Total**	**4,375**	B			**4,331**	C		

Source: Analysis of operational model

~~8.3.14.1~~Friendly Farmer roundabout

~~8.3.15~~5.3.15The Friendly Farmer roundabout is a four-arm priority controlled roundabout. The results of the 2019 base year operational assessments for the weekday AM and PM peak hour are summarised in Table 5-9.

~~8.3.16~~5.3.16The operational assessments indicate that overall, the junction is operating with a LOS of C in the AM peak hour and a LOS of A in the PM peak hour. A couple of the movements on the A46 (north) and A1 Link are operating with a LOS of E in the AM peak hour, indicating that these movements operate at capacity. Overall, the junction is considered to be operating within capacity in both the weekday AM and PM peak hours.

Table 5-9: Friendly Farmer junction assessment (2019 base)

Arm	Movement	AM				PM			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A46 (N)	A46 (North) to A46 (South)	1,273	E	429	571	1,049	B	12	104
	A46 (North) to A17	29	D	429	571	21	A	12	104
	A46 (North) to A1 (South)	426	C	429	571	383	A	12	104
A17	A17 to A46 (North)	477	C	15	97	562	C	14	96
	A17 to A46 (South)	29	C	15	97	22	C	14	96
	A17 to A1 (South)	29	A	8	97	53	A	7	96
A1 Link	A1 (South) to A46 (South)	199	D	111	495	134	C	18	119
	A1 (South) to A46 (North)	135	E	111	490	129	E	20	114
	A1 (South) to A17	193	E	111	490	174	D	20	114
A46 (S)	A46 (South) to A46 (North)	1,389	A	0	39	1,615	A	0	35
	A46 (South) to A17	358	A	0	24	284	A	0	21
	A46 (South) to A1 (South)	155	A	0	24	116	A	0	21
Overall	**Friendly Farmer_Total**	**4,692**	C			**4,541**	**A**		

Source: Analysis of operational model

~~8.3.16.1~~Winthorpe roundabout

~~8.3.17~~5.3.17The Winthorpe roundabout is a four-arm priority-controlled roundabout. The results of the 2019 base year operational assessments for the AM and PM peak hour are summarised in Table 5-10.

~~8.3.18~~5.3.18The operational assessments indicate that overall, the junction is operating with a LOS of A in both the weekday AM and PM peak hours, indicating that the junction currently operates well within capacity.

Table 5-10: Winthorpe junction assessment (2019 base)

Arm	Movement	AM				PM			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A46 (N)	A46 (North) to A46 (South) - Old	1,542	A	55	323	1,204	A	2	60
	A46 (North) to A1133	3	A	55	323	2	A	2	60
	A46 (North) to Drove Lane	54	A	55	323	57	A	2	60
Drove Lane	Drove Lane to A46 (South) - Old	9	D	3	41	23	A	1	35
	Drove Lane to A1133	33	D	3	41	93	B	1	35
	Drove Lane to A46 (North)	56	C	3	41	92	A	1	35
A46 (S)	A46 (South) - Old to A1133	211	A	11	109	274	A	15	126
	A46 (South) - Old to A46 (North)	1,325	A	11	109	1,476	A	15	126
	A46 (South) - Old to Drove Lane	19	A	11	109	11	A	15	126
A1133	A1133 to A46 (South) - Old	297	C	8	88	224	B	4	63
	A1133 to A46 (North)	3	B	8	88	1	C	4	63
	A1133 to Drove Lane	76	C	8	88	27	B	4	63
Overall	**Winthorpe_Total**	**3,628**	**A**			**3,484**	**A**		

Source: Analysis of operational model

~~8.4~~5.4Summary

~~8.4.1~~5.4.1Regional and local planning policy recognises the A46 as a crucial piece of local infrastructure and highlights that the A46 currently suffers from congestion, which is placing a constraint on local growth.

~~8.4.2~~5.4.2Base year journey times have been extracted from the operational model for the A46 between Lodge Lane (south of Farndon roundabout) and Brough Lane (north of Winthorpe roundabout) and for the A617 between Ollerton Road and Drove Lane. This indicates that on this section of the A46, peak hour journey times are around 12 to 19 minutes in each direction, while on the A617, peak hour journey times are around 8 to 12 minutes in each direction.

~~8.4.3~~5.4.3The operational model has been used to assess junction performance of the key junctions on the A46 corridor. This analysis indicates that the majority of junctions on this section of the A46 currently operate within capacity. The only exception is the Cattle Market roundabout which operates with a LOS of E, indicating that the junction is operating at capacity.

~~9~~6 Forecast network performance

~~9.1~~6.1 Introduction

~~9.1.1~~6.1.1 This chapter of the TA outlines the Scheme and associated impact on forecast traffic flows along the A46 and surrounding highway network.

~~9.1.2~~6.1.2 Traffic flows from the strategic model have been analysed to show how traffic levels are forecast to change on both the strategic and local road network because of the Scheme. This analysis focuses on the future years of 2028 and 2043, with further information included in **Appendix A**: Combined Modelling and Appraisal Report (ComMA) of this TA.

~~9.1.3~~6.1.3 Modelling has been undertaken using the operational model for the purposes of assessing the performance of the network along the route of the Scheme. Details of the operational model development process are included in Section 3.3. Operational models have been prepared for 2028 and 2043 with and without the Scheme.

~~9.2~~6.2 Traffic flow forecast

Overview

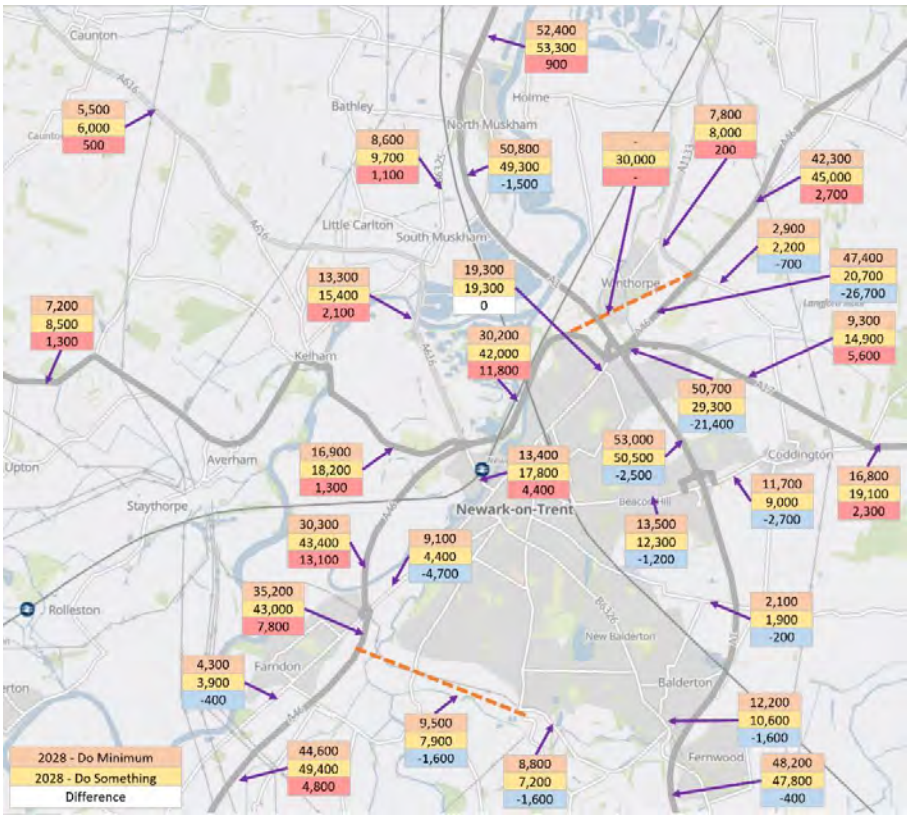
~~9.2.1~~6.2.1 Forecasts of AADT flows have been prepared for 2028 and 2043, which are shown in Figure 6-1 and Figure 6-2. All traffic flows are rounded to the nearest 100. Equivalent figures showing peak hour traffic flows are contained in **Appendix A**: Combined Modelling and Appraisal (ComMA) Report of this TA.

~~9.2.2~~6.2.2 The Do Minimum AADT values are shown in orange while the Do Something AADT values are shown in yellow. An increase in traffic forecast as a result of the Scheme is shown in red, while a reduction in traffic is shown in blue.

~~9.2.3~~6.2.3 The figures contain two dashed orange lines which represent new sections of road that have been considered within the traffic modelling. The northern line represents the new bypass section of the Scheme, and the southern line represents the Newark Southern Link Road (SLR). The Newark SLR provides a new eastbound-westbound connection off the A46; and is being delivered by NSDC and is separate to this Scheme.

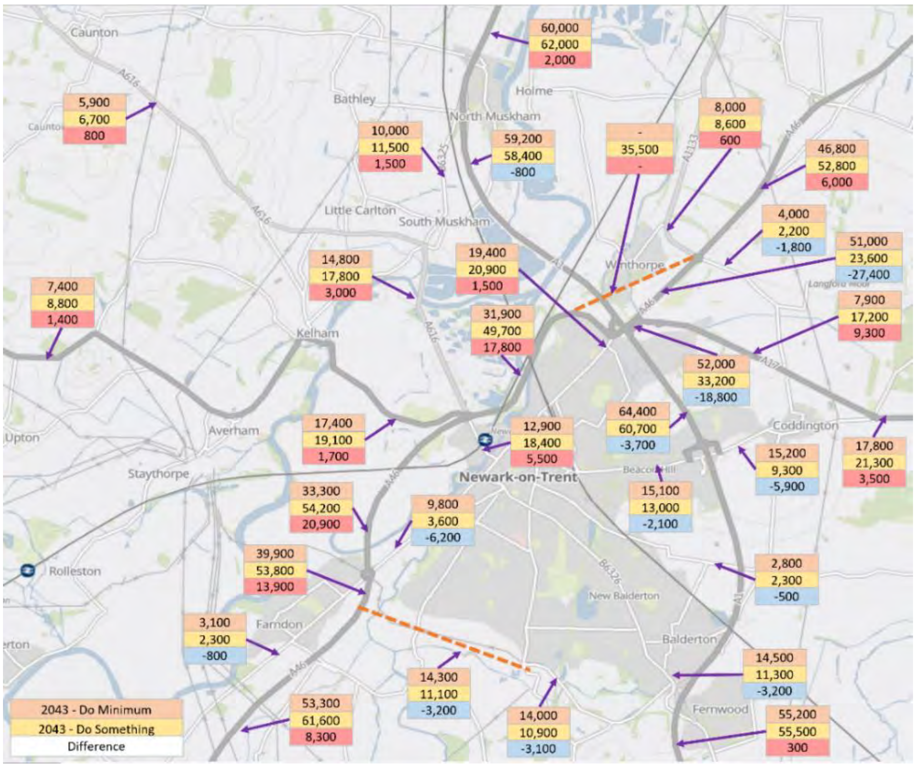
~~9.2.4~~6.2.4 Overall, these figures indicate that there is forecast to be an increase in traffic on the A46 corridor because of the Scheme. Due to the increased capacity and reduced delay on the A46, there is forecast to be an overall reduction in the volume of traffic using the A1 corridor as traffic switches to the A46.

Figure 6-1: Forecast AADT 2028



Source: Combined Modelling and Appraisal Report, Appendix A

Figure 6-2: Forecast AADT 2043



Source: Combined Modelling and Appraisal Report, Appendix A

Traffic flows on strategic routes

~~9.2.5~~6.2.5 Forecasts with and without the Scheme are presented for each of the key sections of the A46, and for a range of other strategic routes that are likely to experience a change in traffic levels as a result of the Scheme.

~~9.2.5.1~~Without Scheme demand

~~9.2.6~~6.2.6 Section 3.3 summarised that without the Scheme, total traffic in the area is forecast to grow by around 8% between 2019 and 2028 and by 18% between 2019 and 2043.

~~9.2.7~~6.2.7 Without improvements to the A46 nearly all sections of the road network in the vicinity of the Scheme are forecast to experience further increases in total and HGV traffic flows between 2028 and 2043. The AADT forecasts at a number of representative sections of road are shown in Table 6-1. Numbers in brackets represent the total HGV flow on a link.

~~9.2.8~~6.2.8 This analysis indicates that without the Scheme improvements to the A46, approximately 15% of traffic on the A1 and A46 would be HGVs.

Table 6-1: Comparison of two-way AADT forecasts on major routes in 2019, 2028 and 2043 (without Scheme)

Road	Section	2019	2028	2043
A1	B6326 and Beacon Hill Rd	44,400 (6,500)	48,200 (6,600)	55,200 (6,900)
A1	Beacon Hill Rd and A46	47,700 (7,100)	53,000 (7,100)	64,400 (7,500)
A1	A46 and Great North Road	48,900 (7,900)	50,800 (8,200)	59,200 (8,900)
A1	Great North Rd and Cromwell	46,600 (7,900)	52,400 (8,200)	60,000 (8,900)
A46	Lodge Ln and Hawton Ln	36,600 (4,700)	44,600 (5,000)	53,300 (5,100)
A46	Hawton Lane and B6166	36,600 (4,700)	35,200 (4,500)	39,900 (4,600)
A46	B6166 and A617	28,300 (4,200)	30,300 (4,200)	33,300 (4,100)
A46	A617 and A1	29,600 (4,800)	30,200 (4,600)	31,900 (4,400)
A46	A1 and A17	48,100 (7,300)	50,700 (7,200)	52,000 (6,900)
A46	A17 and A1133	41,800 (6,000)	47,400 (6,000)	51,000 (5,600)
A46	A1133 and Brough Lane	36,200 (5,300)	42,300 (5,300)	46,800 (4,900)
A17	Beckingham and Coddington	18,200 (2,300)	16,800 (2,300)	17,800 (2,500)
A17	Coddington and A46	11,800	9,300	7,900

Road	Section	2019	2028	2043
		(2,100)	(2,000)	(2,200)
A617	Hockerton and Averham	7,200 (1,600)	7,200 (1,500)	7,400 (1,500)
A617	Averham and A46	16,900 (2,500)	16,900 (2,500)	17,400 (2,400)
A616	A46 and South Muskham	12,600 (1200)	13,300 (1,200)	14,800 (1,400)
A616	South Muskham and Caunton	5,100 (600)	5,500 (700)	5,900 (700)
A1133	West of Winthorpe	7,600 (900)	7,800 (900)	8,000 (900)

Source: Analysis of A46 Strategic Model, Note: Total daily traffic in vehicles, Numbers in brackets represent daily HGVs in vehicle. All values rounded to nearest 100

~~9.2.8.1~~With Scheme demand

~~9.2.9~~6.2.9The Scheme would offer a number of benefits. It would provide increased capacity (i.e. more road space), which would enable more traffic to use the A46 corridor. In addition, the Newark SLR would enhance the connection between the A1 and A46, offering strategic (non-local) traffic an alternative route, avoiding routes through the centre of Newark-upon-Trent.

~~9.2.10~~6.2.10As a result, whilst some A-roads are forecast to experience an increase in the number of trips, others are expected to experience a reduction in traffic. The forecast changes in traffic flows in 2028 are shown in Table 6-2 for a number of representative sections of road, while the forecast traffic flows for 2043 are shown in Table 6-3. Numbers in brackets represent the total HGV flow on a link.

~~9.2.11~~6.2.11This analysis indicates the proportion of HGVs on the A46 is forecast to stay broadly the same with the implementation of the Scheme.

Table 6-2: Comparison of two-way AADT forecasts on major routes in 2028 with and without the Scheme

Road	Section	Without Scheme	With Scheme	Change	% Change
A1	B6326 and Beacon Hill Rd	48,200 (6,600)	47,800 (6,500)	-400 (-100)	-1% (-2%)
A1	Beacon Hill Rd and A46	53,000 (7,100)	50,500 (7,000)	-2,500 (-100)	-5% (-1%)
A1	A46 and Great North Road	50,800 (8,200)	49,300 (8,100)	-1,500 (-100)	-3% (-1%)
A1	Great North Rd and Cromwell	52,400 (8,200)	53,300 (8,200)	900 (0)	2% (0%)
A46	Lodge Ln and Hawton Ln	44,600 (5,000)	49,400 (5,400)	4,800 (400)	11% (8%)
A46	Hawton Lane and B6166	35,200 (4,500)	43,000 (5,100)	7,800 (600)	22% (13%)
A46	B6166 and A617	30,300 (4,200)	43,400 (5,000)	13,100 (800)	43% (19%)
A46	A617 and A1	30,200 (4,600)	42,000 (5,300)	11,800 (700)	39% (15%)
A46	A1 and A17	50,700 (7,200)	29,300 (4,000)	-21,400 (-3200)	-42% (-44%)
A46	A17 and A1133	47,400 (6,000)	20,700 (2,300)	-26,700 (-3700)	-56% (-62%)
A46	A1133 and Brough Lane	42,300 (5,300)	45,000 (5,400)	2,700 (100)	6% (2%)
A17	Beckingham and Coddington	16,800 (2,300)	19,100 (2,500)	2,300 (200)	14% (9%)
A17	Coddington and A46	9,300	14,900	5,600	60%

Road	Section	Without Scheme	With Scheme	Change	% Change
		(2,000)	(2,300)	(300)	(15%)
A617	Hockerton and Averham	7,200 (1,500)	8,500 (1,600)	1,300 (100)	18% (7%)
A617	Averham and A46	16,900 (2,500)	18,200 (2,500)	1,300 (0)	8% (0%)
A616	A46 and South Muskham	13,300 (1,200)	15,400 (1,400)	2,100 (200)	16% (17%)
A616	South Muskham and Caunton	5,500 (700)	6,000 (800)	500 (100)	9% (14%)
A1133	West of Winthorpe	7,800 (900)	8,000 (900)	200 (0)	3% (0%)

Source: Analysis of A46 Strategic Model, Note: Total daily traffic in vehicles, Numbers in brackets represent daily HGVs in vehicle. All values rounded to nearest 100

Table 6-3: Comparison of two-way AADT forecasts on major routes in 2043 with and without the Scheme

Road	Section	Without Scheme	With Scheme	Change	% Change
A1	B6326 and Beacon Hill Rd	55,200 (6,900)	55,500 (7,000)	300 (100)	1% (1%)
A1	Beacon Hill Rd and A46	64,400 (7,500)	60,700 (7,500)	-3,700 (0)	-6% (0%)
A1	A46 and Great North Road	59,200 (8,900)	58,400 (8,700)	-800 (-200)	-1% (-2%)
A1	Great North Rd and Cromwell	60,000 (8,900)	62,000 (9,000)	2,000 (100)	3% (1%)
A46	Lodge Ln and Hawton Ln	53,300 (5,100)	61,600 (5,800)	8,300 (700)	16% (14%)
A46	Hawton Lane and B6166	39,900	53,800	13,900	35%

Road	Section	Without Scheme	With Scheme	Change	% Change
		(4,600)	(5,400)	(800)	(17%)
A46	B6166 and A617	33,300 (4,100)	54,200 (5,500)	20,900 (1400)	63% (34%)
A46	A617 and A1	31,900 (4,400)	49,700 (5,400)	17,800 (1000)	56% (23%)
A46	A1 and A17	52,000 (6,900)	33,200 (4,200)	-18,800 (-2700)	-36% (-39%)
A46	A17 and A1133	51,000 (5,600)	23,600 (2,200)	-27,400 (-3400)	-54% (-61%)
A46	A1133 and Brough Lane	46,800 (4,900)	52,800 (5,200)	6,000 (300)	13% (6%)
A17	Beckingham and Coddington	17,800 (2,500)	21,300 (2,800)	3,500 (300)	20% (12%)
A17	Coddington and A46	7,900 (2,200)	17,200 (2,600)	9,300 (400)	118% (18%)
A617	Hockerton and Averham	7,400 (1,500)	8,800 (1,700)	1,400 (200)	19% (13%)
A617	Averham and A46	17,400 (2,400)	19,100 (2,600)	1,700 (200)	10% (8%)
A616	A46 and South Muskham	14,800 (1,400)	17,800 (1,700)	3,000 (300)	20% (21%)
A616	South Muskham and Caunton	5,900 (700)	6,700 (900)	800 (200)	14% (29%)
A1133	West of Winthorpe	8,000 (900)	8,600 (900)	600 (0)	8% (0%)

Source: Analysis of A46 Strategic Model , Note: Total daily traffic in vehicles, Numbers in brackets represent daily HGVs in vehicle. All values rounded to nearest 100

Traffic flows on local roads

~~9.2.11.1~~Without Scheme demand

~~9.2.12~~6.2.12 Table 6-4 compares forecast AADT traffic flows in 2019, 2028 and 2043 on a selection of local roads around Newark-on-Trent without the Scheme in place. Numbers in brackets represent the total HGV flow on a link.

~~9.2.13~~6.2.13 This data shows that traffic flows are typically forecast to grow around 5% between 2019 and 2028 and a further 10% to 2043 (although the level of growth on individual routes varies significantly). This increase is attributable to both an increase in background traffic associated with expected economic growth in the region and traffic diverting on to local roads to avoid congestion on the A46.

~~9.2.14~~6.2.14 This analysis indicates that without the improvements to the A46, typically around 5 to 10% of traffic on local roads consists of HGVs.

Table 6-4: Comparison of two-way AADT forecasts on local roads in 2019, 2028 and 2043 (without Scheme)

Section	2019	2028	2043
B6166 Lincoln Road	18,200 (1,400)	19,300 (1,500)	19,400 (1,500)
B6325 Great North Road (South Muskham)	8,100 (600)	8,600 (700)	10,000 (800)
B6326 Great North Road (south of Cattle Market)	13,200 (1,100)	13,400 (1,100)	12,900 (1,100)
B6326 London Road	10,300 (800)	12,200 (800)	14,500 (600)
Barnaby Road	1,900 (100)	2,100 (100)	2,800 (200)
Beacon Hill Road	12,800 (900)	13,500 (1,000)	15,100 (1,100)
Beckingham Road	10,600 (300)	11,700 (400)	15,200 (500)
Drove Lane	2,100 (100)	2,900 (200)	4,000 (200)
Farndon Road	12,400 (1,000)	9,100 (800)	9,800 (900)
Fosse Road	4,100 (500)	4,300 (500)	3,100 (500)

Source: Analysis of A46 Strategic Model, Note: Total daily traffic in vehicles, Numbers in brackets represent daily HGVs in vehicle. All values rounded to nearest 100

~~9.2.14.1~~With Scheme demand

~~9.2.15~~6.2.15Table 6-5 and Table 6-6 compare forecast AADT flows on local roads with and without the Scheme in 2028 and 2043 respectively. Numbers in brackets represent the total HGV flows on a link.

~~9.2.16~~6.2.16Forecasts shows that the majority of local roads through Newark-on-Trent would experience a reduction in traffic as a result of the Scheme in all years. This analysis indicates the proportion of HGVs on local roads is forecast to stay broadly the same.

~~9.2.17~~6.2.17The only roads forecast to experience an increase in traffic are likely to be the B6346 Great North Road and B6166 Lincoln Road.

~~9.2.18~~6.2.18Traffic on Great North Road is forecast to increase by 33% in 2028 and by 43% in 2043. Lincoln Road is not expected to experience an increase in traffic as a result of the Scheme in 2028, however traffic is forecast to increase by around 8% in 2043.

Table 6-5: Comparison of two-way AADT total vehicle forecasts on local roads in 2028 with and without the Scheme

Section	Without Scheme	With Scheme	Change	% Change
B6166 Lincoln Road	19,300 (1,500)	19,300 (1,600)	0 (100)	0% (7%)
B6325 Great North Road (South Muskham)	8,600 (700)	9,700 (700)	1,100 (0)	13% (0%)
B6326 Great North Road (south of Cattle Market)	13,400 (1,100)	17,800 (1,100)	4,400 (0)	33% (0%)
B6326 London Road	12,200 (800)	10,600 (700)	-1,600 (-100)	-13% (-13%)
Barnaby Road	2,100 (100)	1,900 (100)	-200 (0)	-10% (0%)
Beacon Hill Road	13,500 (1,000)	12,300 (900)	-1,200 (-100)	-9% (-10%)
Beckingham Road	11,700 (400)	9,000 (300)	-2,700 (-100)	-23% (-25%)
Drove Lane	2,900	2,200	-700	-24%

Section	Without Scheme	With Scheme	Change	% Change
	(200)	(100)	(-100)	(-50%)
Farndon Road	9,100 (800)	4,400 (500)	-4,700 (-300)	-52% (-38%)
Fosse Road	4,300 (500)	3,900 (500)	-400 (0)	-9% (0%)

Source: Analysis of A46 Strategic Model, Note: Total daily traffic in vehicles, Numbers in brackets represent daily HGVs in vehicle. All values rounded to nearest 100

Table 6-6: Comparison of two-way AADT total vehicle forecasts on local roads in 2043 with and without the Scheme

Section	Without Scheme	With Scheme	Change	% Change
B6166 Lincoln Road	19,400 (1,500)	20,900 (1,600)	1,500 (100)	8% (7%)
B6325 Great North Road (South Muskham)	10,000 (800)	11,500 (900)	1,500 (100)	15% (13%)
B6326 Great North Road (south of Cattle Market)	12,900 (1100)	18,400 (1,200)	5,500 (100)	43% (9%)
B6326 London Road	14,500 (600)	11,300 (600)	-3,200 (0)	-22% (0%)
Barnaby Road	2,800 (200)	2,300 (100)	-500 (-100)	-18% (-50%)
Beacon Hill Road	15,100 (1,100)	13,000 (1000)	-2,100 (-100)	-14% (-9%)
Beckingham Road	15,200 (500)	9,300 (300)	-5,900 (-200)	-39% (-40%)
Drove Lane	4,000 (200)	2,200 (100)	-1,800 (-100)	-45% (-50%)
Farndon Road	9,800 (900)	3,600 (500)	-6,200 (-400)	-63% (-44%)

Section	Without Scheme	With Scheme	Change	% Change
Fosse Road	3,100 (500)	2,300 (500)	-800 (0)	-26% (0%)

Source: Analysis of A46 Strategic Model, Note: Total daily traffic in vehicles, Numbers in brackets represent daily HGVs in vehicle. All values rounded to nearest 100

Traffic flows through A46 junctions

~~9.2.19~~6.2.19 Table 6-7 and Table 6-8 compare the volume of traffic passing through each junction in the weekday peak hours with and without the Scheme in 2028 and 2043 respectively, as extracted from the operational model.

~~9.2.20~~6.2.20 This analysis shows that the Cattle Market and Farndon roundabouts are forecast to experience the highest increase in traffic as a result of the Scheme, with increases of up to 50-60% in 2043. As a result of the new highway layout changes around the A1/A46 junctions, traffic at both the Brownhills and Friendly Farmer roundabouts is forecast to reduce by up to 20%.

Table 6-7: Comparison of traffic flows on A46 junctions in 2028 with and without the Scheme

Junction	Weekday AM Peak				Weekday PM Peak			
	DM	DS	Change	% Change	DM	DS	Change	% Change
Farndon	3,016	4,071	1,055	35%	2,983	4,177	1,194	40%
Cattle Market	4,093	6,022	1,929	47%	3,973	5,689	1,716	43%
Brownhills	4,487	3,535	-952	-21%	4,477	3,628	-849	-19%
New roundabout north of Brownhills	-	4,308	-	-	-	4,243	-	-
Friendly Farmer	4,671	3,878	-793	-17%	4,595	3,778	-817	-18%
Winthorpe	3,823	4,250	427	11%	3,918	4,474	556	14%

Source: Analysis of operational model

Table 6-8: Comparison of traffic flows on A46 junctions in 2043 with and without the Scheme

Junction	Weekday AM Peak				Weekday PM Peak			
	DM	DS	Change	% Change	DM	DS	Change	% Change
Farndon	3,370	4,930	1,560	46%	3,399	5,104	1,705	50%
Cattle Market	4,293	6,868	2,575	60%	4,259	6,742	2,483	58%
Brownhills	4,756	3,908	-848	-18%	4,747	4,042	-705	-15%
New roundabout north of Brownhills	-	5,459	-	-	-	5,405	-	-
Friendly Farmer	5,069	4,313	-756	-15%	4,840	4,175	-665	-14%
Winthorpe	4,212	4,910	698	17%	4,212	5,121	909	22%

Source: Analysis of operational model

~~9.3~~6.3 Network performance

Strategic network performance

~~9.3.1.1~~Journey times

~~9.3.2~~6.3.1 Forecast journey times have been extracted from the strategic HAM for the DM and DS scenarios to show how journey times are forecast to change across the region as a result of the Scheme.

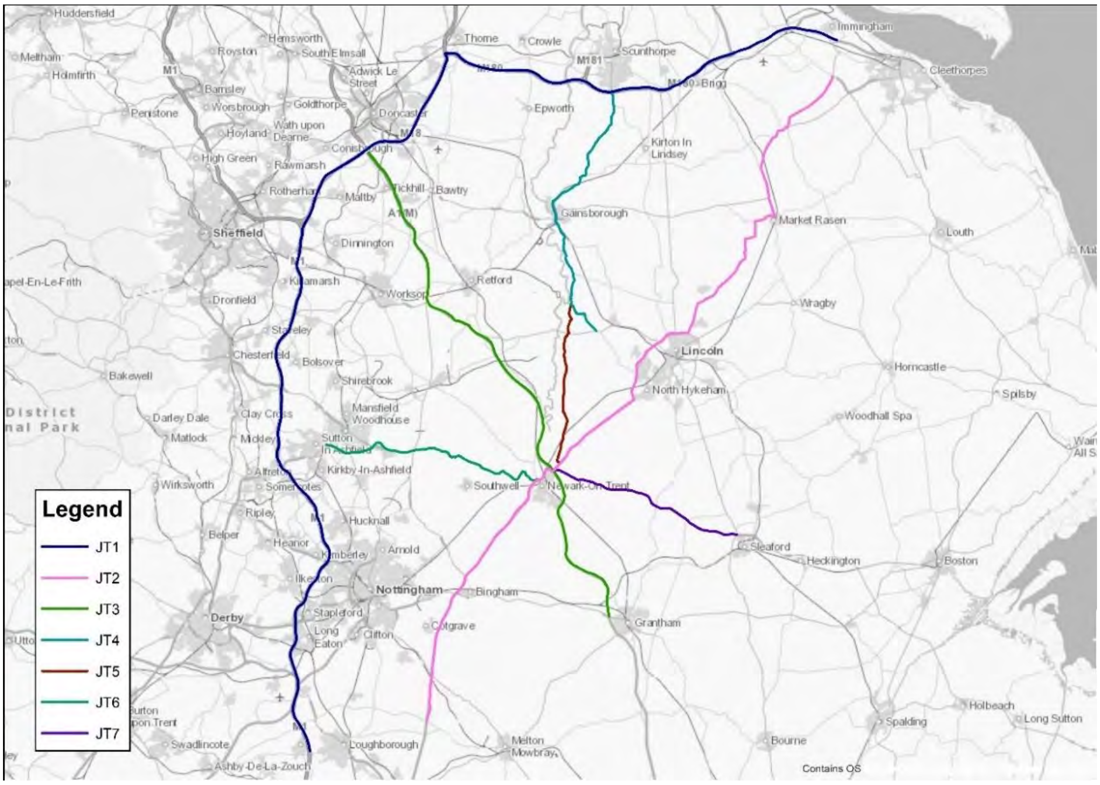
~~9.3.3~~6.3.2 As part of the strategic HAM validation process, journey time data was obtained by the Applicant for nine routes (JT1-JT9) in and around Newark-on-Trent. It should be noted that two of the routes, JT8 and JT9, represent shorter sections of routes JT2 (A46/A1173) and JT3 (A1) that are also covered by the operational model. Therefore, the analysis in this section focuses on journey time routes 1-7, which are shown in Figure 6-3. Further details regarding the journey time routes can be found in Appendix A: Combined Modelling and Appraisal Report (ComMA) of this TA.

~~9.3.4~~6.3.3 The seven routes presented in this section include:

- JT1 – M1/M180/A1 from M1/A512 to A1173
- JT2 – A46/A1173 from Dalby Interchange to Riby
- JT3 – A1 from Grantham to Wadworth Interchange
- JT4 – A46/A1173 from Drinsey Nook to M180
- JT5 – A1133 from A46 to Torksey Lock

- JT6 – A617 from A38 to A46
- JT7 – A17 from A46 to A15

Figure 6-3: Strategic journey time routes



Source: Combined Modelling and Appraisal Report, Appendix A

~~9.3.5~~6.3.4 Table 6-9 and Table 6-10 below compare the journey times across the network in 2028 and 2043 with and without the Scheme.

~~9.3.6~~6.3.5 There are forecast to be improvements to journey times on the A46 (JT2) in both directions as a result of the Scheme in both 2028 and 2043, with a reduction of around 3-5% in the weekday AM and PM peak hours. This equates to savings of around three to five minutes on journeys that take around 90 minutes.

~~9.3.7~~6.3.6 There are also forecast to be reductions in journey times on the A617 (JT6) and A17 (JT7) corridors as a result of the Scheme. Journey times savings are broadly comparable between 2028 and 2043, with the journey times on the A617 forecast to reduce in the AM peak by around 6% in the eastbound direction. Journey times on the A17 are forecast to reduce in the PM peak by around 7% in the westbound direction.

~~9.3.8~~6.3.7 Journey times on all other routes are forecast to remain largely unchanged as a result of the Scheme.

Table 6-9: Comparison of journey times in 2028 with and without the Scheme (hh:mm:ss)

		Weekday AM Peak				Weekday PM Peak			
Route		DM	DS	Change	%	DM	DS	Change	%
JT1	NB	01:42:24	01:42:11	-00:00:13	0%	01:41:11	01:40:57	-00:00:14	0%
	SB	01:38:52	01:38:46	-00:00:06	0%	01:36:17	01:36:14	-00:00:03	0%
JT2	NB	01:27:28	01:25:02	-00:02:26	-3%	01:31:29	01:27:37	-00:03:52	-4%
	SB	01:34:02	01:31:17	-00:02:45	-3%	01:29:16	01:26:42	-00:02:34	-3%
JT3	NB	00:44:03	00:44:06	00:00:03	0%	00:46:07	00:46:11	00:00:04	0%
	SB	00:44:52	00:44:48	-00:00:04	0%	00:44:11	00:44:15	00:00:04	0%
JT4	NB	00:37:51	00:37:55	00:00:04	0%	00:38:06	00:38:13	00:00:07	0%
	SB	00:37:53	00:37:53	00:00:00	0%	00:37:40	00:37:42	00:00:02	0%
JT5	NB	00:19:42	00:19:47	00:00:05	0%	00:19:59	00:20:12	00:00:13	1%
	SB	00:19:48	00:19:44	-00:00:04	0%	00:19:44	00:19:42	-00:00:02	0%
JT6	EB	00:33:42	00:32:11	-00:01:31	-5%	00:31:14	00:30:45	-00:00:29	-2%
	WB	00:31:35	00:31:54	00:00:19	1%	00:31:33	00:31:46	00:00:13	1%
JT7	EB	00:22:26	00:22:42	00:00:16	1%	00:21:57	00:22:10	00:00:13	1%
	WB	00:24:06	00:23:02	-00:01:04	-4%	00:23:08	00:22:01	-00:01:07	-5%

Source: Analysis of A46 Strategic Model

Table 6-10: Comparison of journey times in 2043 with and without the Scheme (hh:mm:ss)

		Weekday AM Peak				Weekday PM Peak			
Route		DM	DS	Change	%	DM	DS	Change	%
JT1	NB	01:48:21	01:47:57	-00:00:24	0%	01:48:31	01:48:07	-00:00:24	0%
	SB	01:44:45	01:44:28	-00:00:17	0%	01:41:49	01:42:22	00:00:33	1%
JT2	NB	01:32:43	01:29:41	-00:03:02	-3%	01:36:06	01:31:45	-00:04:21	-5%
	SB	01:38:02	01:34:06	-00:03:56	-4%	01:33:11	01:30:43	-00:02:28	-3%
JT3	NB	00:46:25	00:46:33	00:00:08	0%	00:48:59	00:49:13	00:00:14	0%
	SB	00:46:34	00:46:31	-00:00:03	0%	00:45:33	00:45:53	00:00:20	1%
JT4	NB	00:38:11	00:38:15	00:00:04	0%	00:38:36	00:38:47	00:00:11	0%
	SB	00:38:10	00:38:11	00:00:01	0%	00:38:01	00:38:03	00:00:02	0%

		Weekday AM Peak				Weekday PM Peak			
Route		DM	DS	Change	%	DM	DS	Change	%
JT5	NB	00:19:55	00:19:58	00:00:03	0%	00:20:18	00:20:54	00:00:36	3%
	SB	00:19:55	00:19:53	-00:00:02	0%	00:19:55	00:19:53	-00:00:02	0%
JT6	EB	00:35:42	00:33:44	-00:01:58	-6%	00:31:56	00:31:22	-00:00:34	-2%
	WB	00:31:59	00:32:24	00:00:25	1%	00:32:10	00:32:53	00:00:43	2%
JT7	EB	00:23:32	00:24:01	00:00:29	2%	00:23:02	00:23:17	00:00:15	1%
	WB	00:24:59	00:24:18	-00:00:41	-3%	00:24:59	00:23:18	-00:01:41	-7%

Source: Analysis of A46 Strategic Model

~~9.3.8.1~~Summary

~~9.3.9~~6.3.8 In summary, this journey time analysis demonstrates that there is forecast to be improvements to weekday peak hour journey times on the A46 in both directions between Dalby Interchange and Riby (JT2) as result of the Scheme. Improving journey times and journey time reliability along the A46 and its junctions between Farndon and Winthorpe is one of the key objectives of the Scheme, as set out in Section 1.1 of this TA. The information presented in this section demonstrates how the Scheme is forecast to meet this objective.

~~9.4~~6.4 Local network performance

Overarching network performance

~~9.4.1~~6.4.1 The operational model has been used to assess the performance of the Scheme. Table 6-11 and Table 6-12 compare network performance across the whole network with and without the Scheme in 2028 and 2043 respectively.

~~9.4.2~~6.4.2 This analysis broadly indicates that the Scheme is likely to result in additional traffic using the network in both the weekday AM and PM peak hours in 2028 and 2043. However, despite the increase in the number of vehicles using the network, average delay is forecast to reduce substantially as a result of the Scheme.

Table 6-11: Comparison of network performance in 2028 with and without the Scheme

	Weekday AM Peak			Weekday PM Peak		
Measure	DM	DS	% Change	DM	DS	% Change

Average delay (s)	60	55	-8%	76	53	-30%
Average number of stops	3	2	-33%	4	1	-75%
Average network speed (mph)	40	41	2%	38	42	11%
Average stopped delay (s)	16	19	19%	22	20	-9%
Total distance travelled (mi)	45,383	54,223	19%	44,389	54,030	22%
Total travel time (h)	1,125	1,308	16%	1,171	1,299	11%
Total delay (h)	216	213	-1%	281	211	-25%
Total number of stops	34,457	23,647	-31%	52,903	21,213	-60%
Total stopped delay (h)	57	72	27%	80	82	2%
Remaining vehicles in network	1,201	1,347	12%	1,251	1,343	7%
Processed vehicles	11,726	12,621	8%	12,130	13,115	8%
Latent demand delay (m)	28	46	68%	174	132	-24%
Latent Demand (vehs)	1	0	-100%	4	6	50%

Source: Analysis of operational model

Table 6-12: Comparison of network performance in 2043 with and without the Scheme

	Weekday AM Peak			Weekday PM Peak		
Measure	DM	DS	% Change	DM	DS	% Change
Average delay (s)	92	81	-12%	111	70	-37%
Average number of stops	7	3	-57%	7	3	-57%
Average network speed (mph)	37	39	5%	35	40	14%
Average stopped delay (s)	23	26	13%	25	25	0%
Total distance travelled (mi)	52,586	64,935	23%	51,425	65,313	27%
Total travel time (h)	1,429	1,671	17%	1,492	1,632	9%
Total delay (h)	387	371	-4%	475	329	-31%
Total number of stops	109,440	53,810	-51%	108,247	42,697	-61%
Total stopped delay (h)	95	121	27%	108	120	12%
Remaining vehicles in network	1,596	1,789	12%	1,713	1,700	-1%
Processed vehicles	13,488	14,701	9%	13,717	15,288	11%
Latent demand delay (m)	60	60	1%	189	150	-21%
Latent Demand (vehs)	4	1	-75%	11	10	-9%

Source: Analysis of operational model

~~9.4.3~~6.4.3 The number of processed vehicles is an indicator of how many vehicles are able to successfully pass through the network during the modelled time period. In 2028, the number of vehicles passing through the network in the weekday AM and PM peak hour is forecast to increase by around 900 to 1,000 vehicles as a result of the Scheme, which is an increase of around 8%. By 2043, the number of vehicles passing through the network is forecast to increase by around 1,200 to 1,600 vehicles as a result of the Scheme, which is an increase of around 9 to 11%.

~~9.4.4~~6.4.4 The analysis indicates that there are likely to be an additional 100 to 200 vehicles remaining in the network as a result of the Scheme in 2028 and 2043. Whilst this is usually an indicator of congestion, it must be viewed in the context of the increase in the total number of vehicles passing through the network.

~~9.4.5~~6.4.5 Despite the increase in the number of vehicles using the network, average delay in the weekday peak hours is forecast to reduce substantially as a result of the Scheme in both 2028 and 2043. In 2028, the largest reductions in average delay across the network are forecast to be in the PM peak where delay is forecast to reduce from around 76 seconds to 53 seconds, a reduction of around 30%. By 2043 there is forecast to be a larger reduction in average delay, with delay in the PM peak forecast to reduce from around 111 seconds to 70 seconds, a reduction of around 37%.

~~9.4.6~~6.4.6 The average number of stops that a vehicle has to make while using the network in the weekday peak hours is also forecast to reduce as a result of the Scheme in both 2028 and 2043. In 2028, the average number of stops in the AM peak is forecast to reduce from three to two, while in the PM peak it is forecast to reduce from four to one. By 2043, the average number of stops is forecast to decrease as a result of increased congestion in the DM network. In both the AM and PM peak hour, the average number of stops is forecast to reduce from seven to three a result of the Scheme.

~~9.4.7~~6.4.7 This analysis indicates that in both 2028 and 2043, the network is able to accommodate more traffic as a result of the Scheme. It also reduces average delays and the number of times each vehicle has to stop, which is indicative or more free-flowing conditions.

Journey times

~~9.4.8~~6.4.8 Forecast journey times in the weekday peak hours have been extracted from the operational model for the DM and DS scenarios to show how journey times are forecast to change across the Scheme extents as a result of the Scheme.

~~9.4.9~~6.4.9 Journey times have been extracted for the A46 between Lodge Lane (south of Farndon roundabout) and Brough Lane (north of Winthorpe roundabout), and the A617 between Ollerton Road and Drive Lane. Table 6-13 and Table 6-14 compare the journey times across the Scheme extents in 2028 and 2043 with and without the Scheme.

~~9.4.10~~6.4.10 This analysis indicates that there are forecast to be substantial improvement to journey times on the A46 in both directions between Lodge Lane (south of Farndon roundabout) and Brough Lane (north of Winthorpe roundabout) as result of the Scheme in both 2028 and 2043.

In 2043 there are forecast to be journey time savings of around seven minutes in each direction in the PM peak as a result of the Scheme.

Table 6-13: Comparison of journey times in 2028 with and without the Scheme (hh:mm:ss)

	Weekday AM Peak				Weekday PM Peak			
	DM	DS	Change	% Change	DM	DS	Change	% Change
A46 NB	00:12:57	00:11:21	-00:01:36	-12%	00:16:12	00:11:26	-00:04:46	-29%
A46 SB	00:13:06	00:11:17	-00:01:49	-14%	00:12:37	00:11:06	-00:01:31	-12%
A617 EB	00:08:39	00:08:51	00:00:12	2%	00:09:21	00:09:08	-00:00:13	-2%
A617 WB	00:08:44	00:08:52	00:00:08	2%	00:08:27	00:08:17	-00:00:10	-2%

Source: Analysis of operational model

Table 6-14: Comparison of journey times in 2043 with and without the Scheme (hh:mm:ss)

	Weekday AM Peak				Weekday PM Peak			
	DM	**DS**	**Change**	**% Change**	**DM**	**DS**	**Change**	**% Change**
A46 NB	00:14:25	00:11:43	-00:02:42	-19%	00:18:36	00:11:41	-00:06:55	-37%
A46 SB	00:13:30	00:11:28	-00:02:02	-15%	00:14:59	00:07:58	-00:07:01	-47%
A617 EB	00:10:04	00:09:45	-00:00:19	-3%	00:10:17	00:11:46	00:01:29	14%
A617 WB	00:09:06	00:09:53	00:00:47	9%	00:10:40	00:08:55	-00:01:45	-16%

Source: Analysis of operational model

~~9.4.11~~6.4.11 There are forecast to be improvements to weekday peak hour journey times on the A46 in both directions between Lodge Lane (south of Farndon roundabout) and Brough Lane (north of Winthorpe roundabout) as result of the Scheme in both 2028 and 2043. In 2028 the largest reductions in journey times are forecast to be in the PM peak, with journey times in the northbound direction reducing from around 16 minutes down to 11 minutes, a saving of almost five minutes, or around 29%.

~~9.4.12~~6.4.12 By 2043 the journey time savings are forecast to increase as a result of the Scheme, as the network would experience greater congestion in the DM scenario. The largest reductions in journey times are forecast to be in the PM peak, with journey times reducing from around 15 minutes down to eight minutes, a saving of around seven minutes, or around 47%.

~~9.4.13~~6.4.13 There is forecast to be minimal change to journey times on the A617-A17 corridor between Ollerton Road and Drove Lane as a result of the Scheme in 2028. By 2043 there is forecast to be a more marked change in journey times in the PM peak, with journey times increasing by around 14% in the eastbound direction but reducing by around 16% in the westbound direction. This increase in journey times is likely to be as a result of queuing back from Brownhills junctions, however it is worth noting that this increase equates to less than an extra 1 minute 30 seconds on each journey.

Delay from strategic model

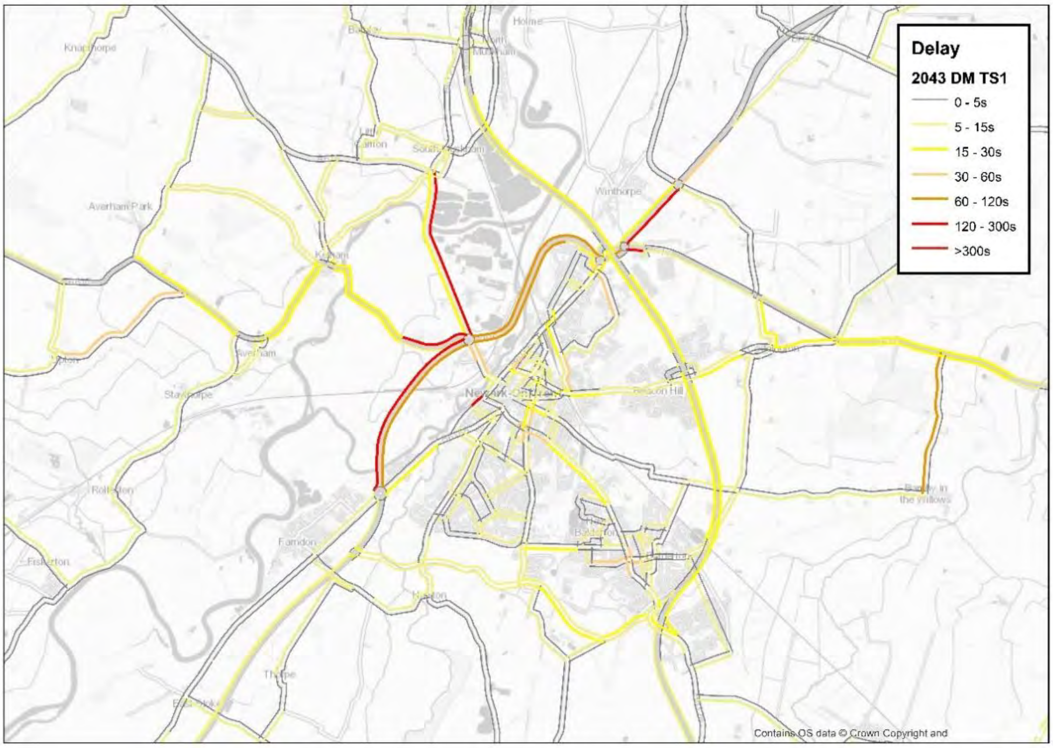
~~9.4.14~~6.4.14 Vehicle delay has been extracted from the strategic model to show how delay is forecast to change as a result of the Scheme.

~~9.4.15~~6.4.15 Figure 6-4 to Figure 6-7 present weekday peak hour link delays for the DM and DS scenario in 2043. The analysis focuses on 2043 as traffic flows are forecast to be higher than in 2028.

~~9.4.16~~6.4.16 The figures show a reduction in link delay along the A46 mainline with the introduction of the Scheme. Delays on the approaches to the Cattle Market roundabout reduce in the DS scenario. This is due to the introduction of grade separation at the junction which allows mainline traffic to bypass the roundabout, leading to the minor arms having to give-way to less traffic on the circulatory. Delays at the Brownhills and Friendly Farmer roundabouts are notably reduced in the weekday AM and PM peaks due to the new layout of the A46 mainline which bypasses this section of the network.

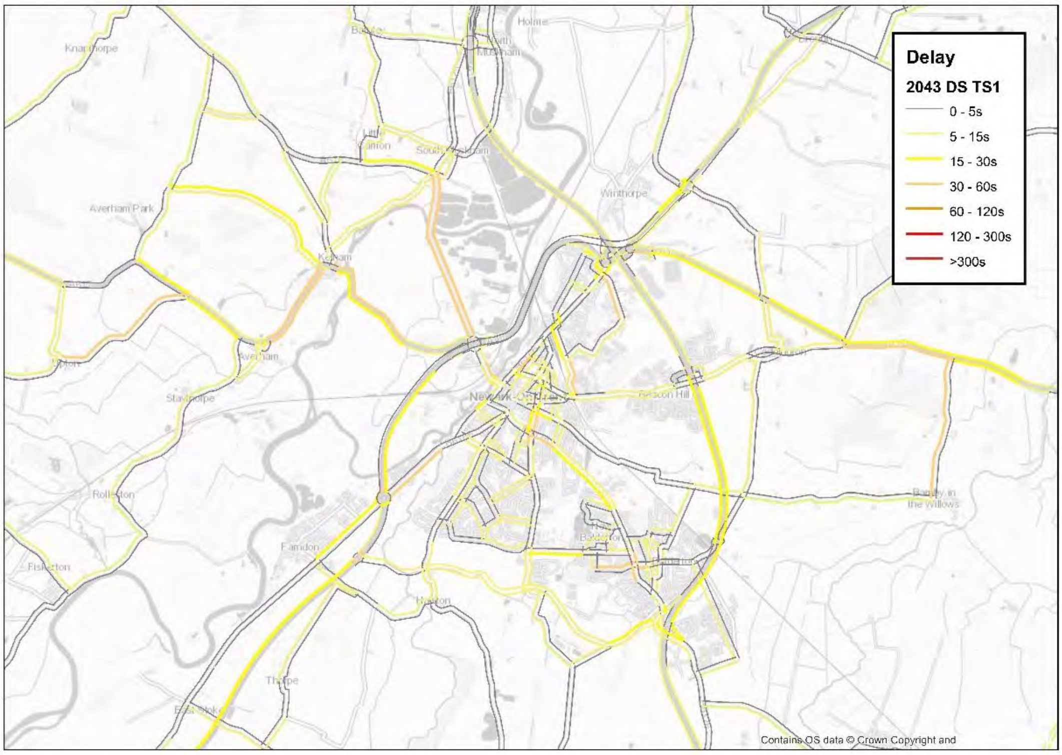
~~9.4.17~~6.4.17 This analysis indicates that, despite the network being used by substantially more traffic as a result of the Scheme, delays across the network are forecast to be reduced.

Figure 6-4: 2043 DM link delays (AM peak)



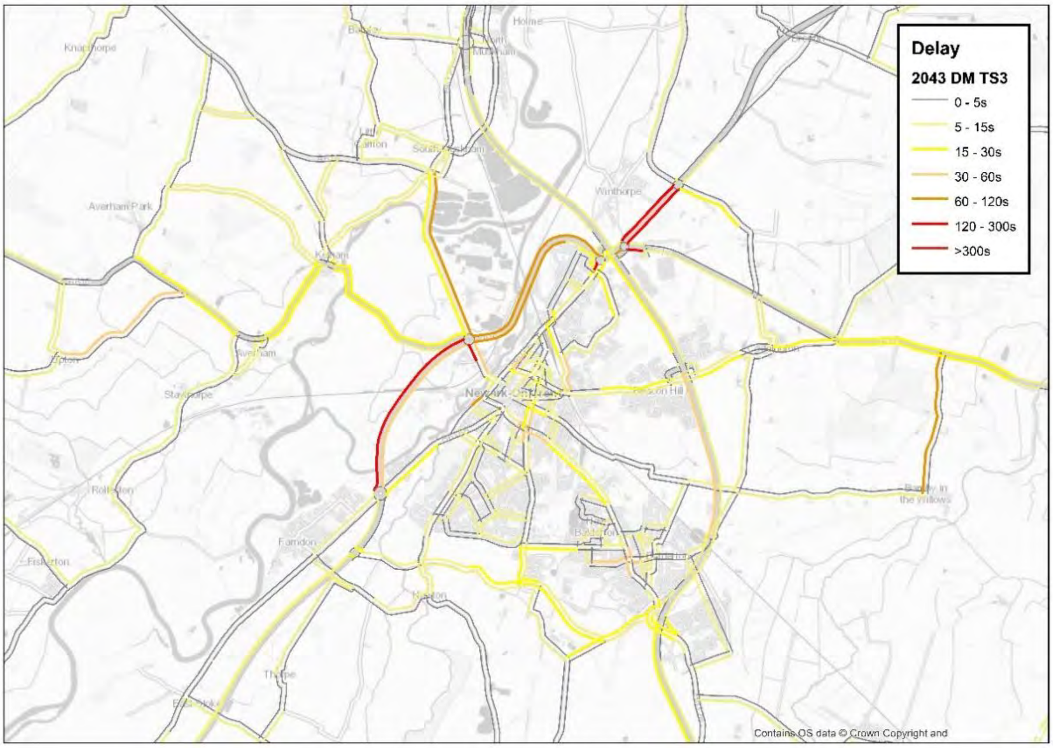
Source: Combined Modelling and Appraisal Report, Appendix A

Figure 6-5: 2043 DS link delays (AM peak)



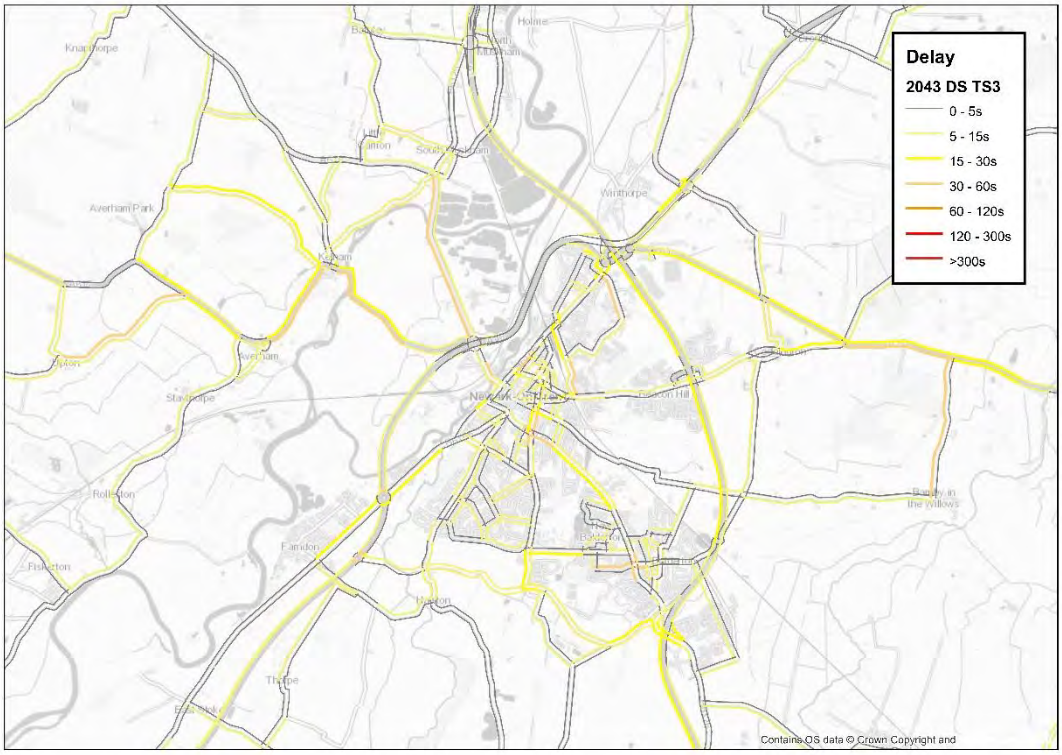
Source: Combined Modelling and Appraisal Report, Appendix A

Figure 6-6: 2043 DM link delays (PM peak)



Source: Combined Modelling and Appraisal Report, Appendix A

Figure 6-7: 2043 DS link delays (PM peak)



Source: Combined Modelling and Appraisal Report, Appendix A

Summary

~~9.4.18~~6.4.18 In summary, the traffic model indicates that the Scheme is likely to result in additional traffic using the network. Average delay and journey times between Lodge Lane (south of Farndon roundabout) and Brough Lane (north of Winthorpe roundabout) are forecast to reduce as a result of the Scheme. In 2043 there are forecast to be journey time savings of around seven minutes in each direction in the PM peak as a result of the Scheme.

~~9.4.19~~6.4.19 Improving journey times and journey time reliability along the A46 and its junctions between Farndon and Winthorpe is one of the key objectives of the Scheme, as set out in Section 1.1 of this TA. Information presented in this section demonstrates how the Scheme is forecast to meet this objective.

~~9.5~~6.5 Junction performance

~~9.5.1~~6.5.1 The following sections summarise the results of the junction assessments along the route of the Scheme between Farndon and Winthorpe in 2028 (the year of opening) and 2043 (a future forecast year) undertaken using the operational model.

Method of assessment

~~9.5.2~~6.5.2 Modelling has been undertaken using the operational model for the purposes of assessing the performance of the network along the route of the Scheme. Details of the operational model development process are included in Section 3.3.

~~9.5.3~~6.5.3 As noted in Section 3.3, the predicted performance at junctions has been measured in terms of the following:

- Maximum queue length in metres
- Average queue length in metres
- Average delay in seconds
- Level of Service (A to F)

~~9.5.4~~6.5.4 A junction operating with a LOS of E is considered to be at capacity while a junction operating with a LOS of F is considered to be over capacity. The LOS has been colour-coded with the lightest green as A through to a dark green as D, orange for E and red for F.

Junction performance

~~9.5.4.1~~Summary

~~9.5.5~~6.5.5 A summary of the operational modelling undertaken in this section is provided in Table 6-15 and Table 6-16. Detailed information relating to the performance of each junction can be found in the sections below.

~~9.5.6~~6.5.6 This analysis indicates that the Cattle Market roundabout is forecast to experience a substantial improvement in performance as a result of the Scheme in both 2028 and 2043. All other junctions are forecast to continue to operate well within capacity with the Scheme.

~~9.5.7~~6.5.7 The new roundabout to the north of Brownhills roundabout is only included in the DS scenario and therefore no modelling results are presented for this junction in the DM scenario.

Table 6-15: Summary of Level of Service in operational assessments (2028)

Junction	Peak Hour	Overall LoS		Summary of assessment
		DM	DS	
Farndon	AM	A	A	Junction operating well within capacity
	PM	A	A	
Cattle Market	AM	D	A	Substantial improvement in performance
	PM	E	A	
Brownhills	AM	B	A	Junction operating well within capacity
	PM	C	B	
New roundabout north of Brownhills	AM	-	A	Junction operating well within capacity
	PM	-	A	
Friendly Farmer	AM	B	B	Junction operating well within capacity
	PM	A	B	
Winthorpe	AM	A	B	Junction operating well within capacity
	PM	A	B	

Source: Analysis of operational model

Table 6-16: Summary of Level of Service in operational assessments (2043)

Junction	Peak Hour	Overall LoS		Summary of assessment
		DM	DS	
Farndon	AM	A	A	Junction operating well within capacity
	PM	A	A	
Cattle Market	AM	E	B	Substantial improvement in performance
	PM	F	B	
Brownhills	AM	C	B	Junction operating well within capacity
	PM	C	C	
New roundabout north of Brownhills	AM	-	A	Junction operating well within capacity
	PM	-	A	
Friendly Farmer	AM	B	C	Junction operating well within capacity
	PM	A	B	
Winthorpe	AM	A	B	Junction operating well within capacity
	PM	A	B	

Source: Analysis of operational model

~~9.5.7.1~~Farndon roundabout

~~9.5.8~~6.5.8The results of the DM (without Scheme) operational assessments of the Farndon roundabout in 2028 and 2043 are summarised in Table 6-17 and Table 6-18.

~~9.5.9~~6.5.9The analysis indicates that without the Scheme, the junction is forecast to operate well within capacity in both the weekday AM and PM peak hours of 2028 and 2043, with an overall LOS of A.

Table 6-17: Farndon junction assessment in 2028 (without the Scheme)

Arm	Movement	AM				PM			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A46 (N)	A46 (North) to Fosse Road	74	A	7	126	121	A	6	94
	A46 (North) to Farndon Road	88	A	7	126	121	A	6	94
	A46 (North) to A46 (South)	1,060	A	7	126	873	A	6	94
Farndon Road	Farndon Road to Fosse Road	121	A	1	27	201	A	1	27
	Farndon Road to A46 (North)	70	A	1	27	108	A	1	27
	Farndon Road to A46 (South)	92	A	1	27	95	A	1	27
A46 (S)	A46 (South) to Fosse Road	7	A	8	125	11	A	13	118
	A46 (South) to A46 (North)	1,003	A	8	125	879	A	13	118
	A46 (South) to Farndon Road	321	A	8	125	322	A	13	118
Fosse Road	Fosse Road to A46 (North)	59	A	1	22	93	A	1	20
	Fosse Road to Farndon Road	118	A	1	22	153	A	1	20
	Fosse Road to A46 (South)	4	B	1	22	7	A	1	20
Overall	**Farndon_Total**	**3,016**	**A**			**2,983**	**A**		

Source: Analysis of operational model

Table 6-18: Farndon junction assessment in 2043 (without the Scheme)

Arm	Movement	AM				PM			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A46 (N)	A46 (North) to Fosse Road	63	A	16	233	96	A	9	129
	A46 (North) to Farndon Road	81	A	16	233	115	A	9	129
	A46 (North) to A46 (South)	1,130	A	16	233	1,067	A	9	129
Farndon Road	Farndon Road to Fosse Road	122	A	1	22	201	A	2	39
	Farndon Road to A46 (North)	69	A	1	22	107	A	2	39
	Farndon Road to A46 (South)	92	A	1	22	165	A	2	39
A46 (S)	A46 (South) to Fosse Road	8	A	22	192	14	A	20	158
	A46 (South) to A46 (North)	1,224	A	22	192	1,063	A	20	158
	A46 (South) to Farndon Road	448	A	22	192	346	A	20	158
Fosse Road	Fosse Road to A46 (North)	44	B	1	20	84	A	1	24
	Fosse Road to Farndon Road	84	B	1	20	134	A	1	24
	Fosse Road to A46 (South)	4	C	1	20	7	B	1	24
Overall	**Farndon_Total**	**3,370**	**A**			**3,399**	**A**		

Source: Analysis of operational model

~~9.5.10~~6.5.10The results for the DS (with Scheme) operational assessments of the Farndon roundabout in 2028 and 2043 are summarised in Table 6-19 and Table 6-20.

~~9.5.11~~6.5.11The analysis indicates that the junction is forecast to carry an additional 40-50% of traffic as a result of the Scheme in 2028 and 2043. Despite this increase in traffic, the junction is forecast to continue to operate well within capacity in both the weekday AM and PM peak hours in 2028 and 2043 as a result of the Scheme, with an overall LOS of A.

Table 6-19: Farndon junction assessment in 2028 (with the Scheme)

Arm	Movement	AM				PM			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A46 (N)	A46 (North) to Fosse Road	89	D	8	157	116	D	6	118
	A46 (North) to Farndon Road	142	A	8	157	171	A	6	118
	A46 (North) to Access Road	0	A	8	157	0	A	6	118
	A46 (North) to A46 (South)	1,736	A	8	157	1,339	A	6	118
Access Road	Access Road to Fosse Road	0	A	11	80	0	A	17	105
	Access Road to A46 (North)	0	A	11	80	0	A	17	105
	Access Road to Farndon Road	0	A	11	80	0	A	17	105
	Access Road to A46 (South)	0	A	0	0	0	A	0	0
Farndon Road	Farndon Road to Fosse Road	93	D	2	24	169	D	2	33
	Farndon Road to A46 (North)	71	D	2	24	105	D	2	33
	Farndon Road to Access Road	0	A	2	24	0	A	2	33
	Farndon Road to A46 (South)	24	A	2	24	66	A	2	33
A46 (S)	A46 (South) to Fosse Road	5	A	12	170	7	A	9	138
	A46 (South) to A46 (North)	1,672	A	12	170	1,833	A	9	138
	A46 (South) to Farndon Road	59	D	12	170	116	C	9	138
	A46 (South) to Access Road	0	A	12	170	0	A	9	138
Fosse Road	Fosse Road to A46 (North)	116	B	1	25	132	B	3	38
	Fosse Road to Farndon Road	61	D	1	25	117	D	3	38
	Fosse Road to Access Road	0	A	1	25	0	A	3	38
	Fosse Road to A46 (South)	4	D	1	25	7	D	3	38
Overall	**Farndon_Total**	**4,071**	**A**			**4,177**	**A**		

Source: Analysis of operational model

Table 6-20: Farndon junction assessment in 2043 (with the Scheme)

Arm	Movement	AM				PM			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A46 (N)	A46 (North) to Fosse Road	67	C	13	183	102	D	9	141
	A46 (North) to Farndon Road	162	A	13	183	215	A	9	141
	A46 (North) to Access Road	0	A	13	183	0	A	9	141
	A46 (North) to A46 (South)	2,109	A	13	183	1,864	A	9	141
Access Road	Access Road to Fosse Road	0	A	8	77	0	A	20	131
	Access Road to A46 (North)	0	A	8	77	0	A	20	131
	Access Road to Farndon Road	0	A	8	77	0	A	20	131
	Access Road to A46 (South)	0	A	0	0	0	A	0	0
Farndon Road	Farndon Road to Fosse Road	81	D	2	22	156	D	4	33
	Farndon Road to A46 (North)	68	D	2	22	105	D	4	33
	Farndon Road to Access Road	0	A	2	22	0	A	4	33
	Farndon Road to A46 (South)	7	B	2	22	31	B	4	33
A46 (S)	A46 (South) to Fosse Road	7	A	50	344	13	A	63	361
	A46 (South) to A46 (North)	2,207	A	50	344	2,286	A	63	361
	A46 (South) to Farndon Road	87	D	50	344	104	D	63	361
	A46 (South) to Access Road	0	A	50	344	0	A	63	361
Fosse Road	Fosse Road to A46 (North)	82	B	2	29	114	C	5	45
	Fosse Road to Farndon Road	49	D	2	29	106	D	5	45
	Fosse Road to Access Road	0	A	2	29	0	A	5	45
	Fosse Road to A46 (South)	4	D	2	29	7	D	5	45
Overall	**Farndon_Total**	**4,930**	**A**			**5,104**	**A**		

Source: Analysis of operational model

~~9.5.11.1~~Cattle Market roundabout

~~9.5.12~~6.5.12The results for the DM (without Scheme) operational assessments of the Cattle Market roundabout in 2028 and 2043 are summarised in Table 6-21 and Table 6-22. The analysis indicates that without the Scheme, the junction is forecast to operate at capacity in 2028 (LOS E) and over capacity in 2043 (LOS F).

Table 6-21: Cattle Market junction assessment in 2028 (without the Scheme)

Arm	Movement	AM				PM			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A616 Great North Rd (N)	Great North Road (North) to A46 (South)	296	D	80	321	223	C	14	132
	Great North Road (North) to Kelham Road	14	D	80	321	14	C	14	132
	Great North Road (North) to A46 (North)	71	E	80	321	69	C	14	132
	Great North Road (North) to Great North Road (South)	178	E	80	321	165	C	14	132
A46 (N)	A46 (North) to A46 (South)	781	E	80	556	680	D	61	400
	A46 (North) to Kelham Road	304	E	80	556	386	E	61	400
	A46 (North) to Great North Road (North)	88	E	80	556	77	E	61	400
	A46 (North) to Great North Road (South)	43	E	80	556	80	D	61	400
B6326 Great North Rd (S)	Great North Road (South) to A46 (South)	82	C	48	317	120	C	283	686
	Great North Road (South) to Kelham Road	166	C	48	317	255	C	283	686
	Great North Road (South) to Great North Road (North)	181	D	48	317	227	D	283	686
	Great North Road (South) to A46 (North)	58	D	48	317	123	E	283	686
A46 (S)	A46 (South) to Kelham Road	82	D	45	394	50	F	383	1,176
	A46 (South) to Great North Road (North)	208	D	45	394	229	F	383	1,176
	A46 (South) to A46 (North)	784	D	45	394	631	F	383	1,176
	A46 (South) to Great North Road (South)	55	D	45	394	102	F	383	1,176
A617 Kelham Rd	Kelham Road to A46 (South)	69	E	48	270	87	D	16	108
	Kelham Road to Great North Road (North)	20	C	48	270	11	B	16	108
	Kelham Road to A46 (North)	352	D	48	270	280	C	16	108
	Kelham Road to Great North Road (South)	262	E	48	270	164	D	16	108
Overall	**Cattle Market_Total**	**4,093**	D			**3,973**	E		

Source: Analysis of operational model

~~9.5.13~~6.5.13The analysis indicates that in 2028 without the Scheme, the junction is forecast to operate within capacity in the AM peak hour, with a LOS of D, but at capacity in the PM peak hour, with a LOS of E.

Table 6-22: Cattle Market junction assessment in 2043 (without the Scheme)

Arm	Movement	AM				PM			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A616 Great North Rd (N)	Great North Road (North) to A46 (South)	336	E	169	439	327	D	59	241
	Great North Road (North) to Kelham Road	13	E	169	439	13	D	59	241
	Great North Road (North) to A46 (North)	73	E	169	439	70	E	59	241
	Great North Road (North) to Great North Road (South)	149	E	169	439	157	E	59	241
A46 (N)	A46 (North) to A46 (South)	813	E	127	615	801	F	564	1,209
	A46 (North) to Kelham Road	324	E	127	615	366	F	564	1,209
	A46 (North) to Great North Road (North)	88	E	127	615	67	F	564	1,209
	A46 (North) to Great North Road (South)	42	E	127	615	72	F	564	1,209
B6326 Great North Rd (S)	Great North Road (South) to A46 (South)	69	D	80	377	60	D	405	694
	Great North Road (South) to Kelham Road	164	D	80	377	246	E	405	694
	Great North Road (South) to Great North Road (North)	190	E	80	377	187	F	405	694
	Great North Road (South) to A46 (North)	60	E	80	377	120	F	405	694
A46 (S)	A46 (South) to Kelham Road	87	E	331	1,393	54	F	497	1,353
	A46 (South) to Great North Road (North)	279	E	331	1,393	317	F	497	1,353
	A46 (South) to A46 (North)	861	E	331	1,393	703	F	497	1,353
	A46 (South) to Great North Road (South)	55	F	331	1,393	98	F	497	1,353
A617 Kelham Rd	Kelham Road to A46 (South)	64	F	86	315	98	E	22	140
	Kelham Road to Great North Road (North)	20	E	86	315	12	C	22	140
	Kelham Road to A46 (North)	356	E	86	315	336	C	22	140
	Kelham Road to Great North Road (South)	250	F	86	315	156	E	22	140
Overall	**Cattle Market_Total**	**4,293**	E			**4,259**	F		

Source: Analysis of operational model

~~9.5.14~~6.5.14The analysis indicates that in 2043 without the Scheme, the junction is forecast to operate at capacity in the AM peak hour, with a LOS of E, but over capacity in the PM peak hour, with a LOS of F.

~~9.5.15~~6.5.15The results for the DS (with scheme) operational assessments of the Cattle Market roundabout in 2028 and 2043 are summarised in Table 6-23 and Table 6-24.

~~9.5.16~~6.5.16The analysis indicates that the junction is forecast to carry an additional 40-60% of traffic as a result of the Scheme in 2028 and 2043. The new grade separated layout and part-signalisation of the junction is forecast to lead to an improvement in performance. The junction is forecast to operate well within capacity in both the weekday AM and PM peak hours, with an overall LOS of A in 2028 and a LOS of B in 2043.

Table 6-23: Cattle Market junction assessment in 2028 (with the Scheme)

Arm	Movement	AM				PM			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A616 Great North Rd (N)	Great North Road (North) to A46 (South)	461	C	48	361	267	B	2	53
	Great North Road (North) to Kelham Road	13	C	48	361	12	B	2	53
	Great North Road (North) to A46 (North)	76	A	48	361	76	A	2	53
	Great North Road (North) to Great North Road (South)	354	B	48	361	145	B	2	53
A46 (N)	A46 (North) to A46 (South)	0	A	18	70	0	A	12	67
	A46 (North) to Kelham Road	375	B	18	70	434	B	12	67
	A46 (North) to Great North Road (North)	85	B	18	70	73	B	12	67
	A46 (North) to Great North Road (South)	169	C	18	70	215	B	12	67
B6326 Great North Rd (S)	Great North Road (South) to A46 (South)	139	A	7	82	182	A	9	101
	Great North Road (South) to Kelham Road	153	A	7	82	246	A	9	101
	Great North Road (South) to Great North Road (North)	180	A	7	82	188	A	9	101
	Great North Road (South) to A46 (North)	98	B	7	82	195	A	9	101
A46 (S)	A46 (South) to Kelham Road	121	B	8	72	100	C	18	104
	A46 (South) to Great North Road (North)	326	B	8	72	396	C	18	104
	A46 (South) to A46 (North)	0	A	8	72	0	A	18	104
	A46 (South) to Great North Road (South)	217	C	8	72	253	C	18	104
A617 Kelham Rd	Kelham Road to A46 (South)	77	C	11	81	116	C	9	61
	Kelham Road to Great North Road (North)	19	A	11	81	11	B	9	61
	Kelham Road to A46 (North)	477	B	11	81	236	B	9	61
	Kelham Road to Great North Road (South)	191	C	11	81	156	C	9	61
Overall	**Cattle Market_Total**	**6,022**	**A**			**5,689**	**A**		

Source: Analysis of operational model

Table 6-24: Cattle Market junction assessment in 2043 (with the Scheme)

Arm	Movement	AM				PM			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A616 Great North Rd (N)	Great North Road (North) to A46 (South)	580	C	227	823	422	B	4	79
	Great North Road (North) to Kelham Road	14	C	227	823	14	C	4	79
	Great North Road (North) to A46 (North)	72	B	227	823	74	A	4	79
	Great North Road (North) to Great North Road (South)	344	C	227	823	132	B	4	79
A46 (N)	A46 (North) to A46 (South)	0	A	16	85	0	A	14	74
	A46 (North) to Kelham Road	392	B	16	85	493	B	14	74
	A46 (North) to Great North Road (North)	87	B	16	85	72	B	14	74
	A46 (North) to Great North Road (South)	191	B	16	85	223	B	14	74
B6326 Great North Rd (S)	Great North Road (South) to A46 (South)	175	A	10	99	221	A	25	185
	Great North Road (South) to Kelham Road	142	B	10	99	243	B	25	185
	Great North Road (South) to Great North Road (North)	153	B	10	99	149	B	25	185
	Great North Road (South) to A46 (North)	97	B	10	99	232	B	25	185
A46 (S)	A46 (South) to Kelham Road	139	B	11	76	131	D	36	171
	A46 (South) to Great North Road (North)	454	B	11	76	547	C	36	171
	A46 (South) to A46 (North)	0	A	11	76	0	A	36	171
	A46 (South) to Great North Road (South)	241	C	11	76	259	C	36	171
A617 Kelham Rd	Kelham Road to A46 (South)	106	C	19	130	132	C	15	98
	Kelham Road to Great North Road (North)	20	B	19	130	11	B	15	98
	Kelham Road to A46 (North)	501	B	19	130	281	B	15	98
	Kelham Road to Great North Road (South)	184	C	19	130	143	C	15	98
Overall	**Cattle Market_Total**	**6,868**	**B**			**6,742**	**B**		

Source: Analysis of operational model

~~9.5.16.1~~Brownhills roundabout

~~9.5.17~~6.5.17The results for the DM (without Scheme) operational assessments of the Brownhills roundabout in 2028 and 2043 are summarised in Table 6-25 and Table 6-26.

~~9.5.18~~6.5.18The analysis indicates that without the Scheme, the junction is forecast to operate within capacity in both the weekday AM and PM peak hours in 2028 and 2043, with an overall LOS of C.

Table 6-25: Brownhills junction assessment in 2028 (without the Scheme)

Arm	Movement	AM				PM			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A1 Link	A1 (North) to A46 (South)	48	C	14	136	84	C	16	164
	A1 (North) to A46 (North)	481	C	14	136	487	C	16	164
	A1 (North) to Lincoln Road (South)	102	C	14	136	97	C	16	164
A46 (E)	A46 (North) to A46 (South)	1,065	A	2	56	971	A	1	50
	A46 (North) to A1 (North)	217	A	2	56	333	A	1	50
	A46 (North) to Lincoln Road (South)	670	A	1	59	448	A	1	55
B6166 Lincoln Road	Lincoln Road (South) to A46 (South)	121	B	7	82	172	B	48	175
	Lincoln Road (South) to A1 (North)	95	C	11	80	103	D	62	171
	Lincoln Road (South) to A46 (North)	438	C	11	80	710	D	62	171
A46 (W)	A46 (South) to A1 (North)	62	A	15	310	34	D	158	718
	A46 (South) to A46 (North)	1,087	C	28	309	962	E	195	717
	A46 (South) to Lincoln Road (South)	100	C	28	309	77	F	195	717
Overall	**Brownhills_Total**	**4,487**	B			**4,477**	C		

Source: Analysis of operational model

Table 6-26: Brownhills junction assessment in 2043 (without the Scheme)

Arm	Movement	AM				PM			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A1 Link	A1 (North) to A46 (South)	56	D	65	297	102	C	20	188
	A1 (North) to A46 (North)	591	E	65	297	593	C	20	188
	A1 (North) to Lincoln Road (South)	110	D	65	297	117	C	20	188
A46 (E)	A46 (North) to A46 (South)	1,103	A	2	57	1,152	A	3	76
	A46 (North) to A1 (North)	214	A	2	57	371	A	3	76
	A46 (North) to Lincoln Road (South)	643	A	1	63	403	A	2	77
B6166 Lincoln Road	Lincoln Road (South) to A46 (South)	130	B	11	99	147	C	74	178
	Lincoln Road (South) to A1 (North)	74	C	18	97	135	E	84	174
	Lincoln Road (South) to A46 (North)	502	C	18	97	552	E	84	174
A46 (W)	A46 (South) to A1 (North)	61	B	69	790	33	D	476	1,244
	A46 (South) to A46 (North)	1,174	C	106	789	1,062	E	520	1,243
	A46 (South) to Lincoln Road (South)	99	C	106	789	81	F	520	1,243
Overall	**Brownhills_Total**	**4,756**	C			**4,747**	C		

Source: Analysis of operational model

~~9.5.19~~6.5.19The results for the DS (with Scheme) operational assessments of the Brownhills roundabout in 2028 and 2043 are summarised in Table 6-27 and Table 6-28.

~~9.5.20~~6.5.20The analysis indicates that the junction is forecast to carry around 20% less traffic as a result of the Scheme in 2028 and 2043. This is due to the A46 bypassing the roundabout. In terms of junction performance, the analysis indicates that the junction is forecast to continue to operate within capacity in both the weekday AM and PM peak hours in 2028 and

2043 as a result of the Scheme, with a LOS of B in 2028 and a LOS of C in 2043.

Table 6-27: Brownhills junction assessment in 2028 (with the Scheme)

Arm	Movement	AM				PM			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A1 Link	A1 (North) to A46 (South)	113	B	3	50	117	B	4	55
	A1 (North) to A46 (North)	463	A	3	50	496	A	4	55
	A1 (North) to Lincoln Road (South)	75	B	3	50	70	B	4	55
Friendly Farmer Link	A46 (North) to A46 (South)	655	A	7	90	461	A	4	86
	A46 (North) to A1 (North)	379	A	7	90	522	A	4	86
	A46 (North) to Lincoln Road (South)	570	A	6	100	405	A	2	91
B6166 Lincoln Road	Lincoln Road (South) to A46 (South)	125	A	3	56	189	A	8	108
	Lincoln Road (South) to A1 (North)	86	B	4	55	136	C	14	108
	Lincoln Road (South) to A46 (North)	393	A	4	55	671	B	14	108
A46 Link	A46 (South) to A1 (North)	61	A	8	107	37	C	16	129
	A46 (South) to A46 (North)	334	B	13	107	303	D	29	128
	A46 (South) to Lincoln Road (South)	283	C	13	107	222	F	29	128
Overall	**Brownhills_Total**	**3,535**	**A**			**3,628**	**B**		

Source: Analysis of operational model

Table 6-28: Brownhills junction assessment in 2043 (with the Scheme)

Arm	Movement	AM				PM			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A1 Link	A1 (North) to A46 (South)	127	B	6	67	136	B	7	88
	A1 (North) to A46 (North)	573	B	6	67	613	B	7	88
	A1 (North) to Lincoln Road (South)	89	B	6	67	100	B	7	88
Friendly Farmer Link	A46 (North) to A46 (South)	670	A	11	111	518	A	8	120
	A46 (North) to A1 (North)	451	A	11	111	603	A	8	120
	A46 (North) to Lincoln Road (South)	550	A	9	121	398	A	5	123
B6166 Lincoln Road	Lincoln Road (South) to A46 (South)	148	A	4	76	221	A	14	130
	Lincoln Road (South) to A1 (North)	118	B	7	75	197	C	23	128
	Lincoln Road (South) to A46 (North)	438	B	7	75	647	C	23	128
A46 Link	A46 (South) to A1 (North)	61	B	18	168	36	E	171	453
	A46 (South) to A46 (North)	385	C	31	168	341	F	191	452
	A46 (South) to Lincoln Road (South)	300	E	31	168	233	F	191	452
Overall	**Brownhills_Total**	**3,908**	**B**			**4,042**	**C**		

Source: Analysis of operational model

~~9.5.20.1~~New roundabout north of Brownhills

~~9.5.21~~6.5.21The new roundabout north of Brownhills is a new junction and therefore no operational assessment has undertaken for the DM scenario.

~~9.5.22~~6.5.22The results for the DS (with scheme) operational assessments in 2028 and 2043 are summarised in Table 6-29 and Table 6-30.

~~9.5.23~~6.5.23The analysis indicates that the junction is forecast to operate well within capacity in both the weekday AM and PM peak hours in 2028 and 2043 as a result of the Scheme, with an overall LOS of A.

Table 6-29: New roundabout north of Brownhills junction assessment in 2028 (with the Scheme)

Arm	Movement	AM				PM			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
Kennels Access	Long Hollow Way to A17 (North)	365	D	8	155	545	C	10	174
	Long Hollow Way to A17 (South)	0	A	8	155	0	A	10	174
A46 EB off-slip	A17 (South) to A17 (North)	0	A	5	61	0	A	3	47
	A17 (South) to Long Hollow Way	68	E	5	61	123	E	3	47
A46 Bridge	A17 (North) to A17 (South)	1,687	A	14	127	1,298	A	12	71
	A17 (North) to Long Hollow Way	0	A	14	127	0	A	12	71
Overall	**Kennel_Total**	**4,308**	**A**			**4,243**	**A**		

Source: Analysis of operational model

Table 6-30: New roundabout north of Brownhills junction assessment in 2043 (with the Scheme)

Arm	Movement	AM				PM			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
Kennels Access	Long Hollow Way to A17 (North)	474	D	19	295	653	C	22	263
	Long Hollow Way to A17 (South)	0	A	19	295	0	A	22	263
A46 EB off-slip	A17 (South) to A17 (North)	0	A	19	158	0	A	12	118
	A17 (South) to Long Hollow Way	101	D	19	158	204	D	12	118
A46 Bridge	A17 (North) to A17 (South)	2,039	A	21	156	1,695	A	24	107
	A17 (North) to Long Hollow Way	0	A	21	156	0	A	24	107
Overall	**Kennel_Total**	**5,459**	**A**			**5,405**	**A**		

Source: Analysis of operational model

~~9.5.23.1~~Friendly Farmer roundabout

~~9.5.24~~6.5.24The results for the DM (without scheme) operational assessments of the Friendly Farmer roundabout in 2028 and 2043 are summarised in Table 6-31 and Table 6-32.

~~9.5.25~~6.5.25The analysis indicates that without the Scheme, the junction is forecast to operate well within capacity in both the weekday AM and PM peak hours in 2028 and 2043, with an overall LOS of B.

Table 6-31: Friendly Farmer junction assessment in 2028 (without the Scheme)

Arm	Movement	AM				PM			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A46 (N)	A46 (North) to A46 (South)	1,336	B	23	177	1,174	A	7	86
	A46 (North) to A17	27	A	23	177	20	A	7	86
	A46 (North) to A1 (South)	357	A	23	177	354	A	7	86
A17	A17 to A46 (North)	394	C	14	83	445	C	12	81
	A17 to A46 (South)	28	D	14	83	21	C	12	81
	A17 to A1 (South)	27	A	7	83	56	A	6	81
A1 Link	A1 (South) to A46 (South)	226	D	89	249	134	C	20	148
	A1 (South) to A46 (North)	171	F	88	244	149	E	21	143
	A1 (South) to A17	100	E	88	244	85	D	21	143
A46 (S)	A46 (South) to A46 (North)	1,603	A	0	44	1,815	A	0	40
	A46 (South) to A17	235	A	0	21	223	A	0	18
	A46 (South) to A1 (South)	170	A	0	21	121	A	0	18
Overall	**Friendly Farmer_Total**	**4,671**	**B**			**4,595**	**A**		

Source: Analysis of operational model

Table 6-32: Friendly Farmer junction assessment in 2043 (without the Scheme)

Arm	Movement	AM				PM			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A46 (N)	A46 (North) to A46 (South)	1,286	C	31	244	1,331	A	11	123
	A46 (North) to A17	26	A	31	244	20	A	11	123
	A46 (North) to A1 (South)	448	A	31	244	402	A	11	123
A17	A17 to A46 (North)	421	D	21	102	456	C	18	94
	A17 to A46 (South)	29	D	21	102	23	D	18	94
	A17 to A1 (South)	25	A	11	102	55	A	9	94
A1 Link	A1 (South) to A46 (South)	255	E	157	263	140	C	20	120
	A1 (South) to A46 (North)	221	E	156	257	122	E	21	114
	A1 (South) to A17	90	D	156	257	86	E	21	114
A46 (S)	A46 (South) to A46 (North)	1,821	A	0	40	1,844	A	0	28
	A46 (South) to A17	243	A	0	28	233	A	0	21
	A46 (South) to A1 (South)	204	A	0	28	129	A	0	21
Overall	**Friendly Farmer_Total**	**5,069**	**B**			**4,840**	**A**		

Source: Analysis of operational model

~~9.5.26~~6.5.26The results for the DS (with Scheme) operational assessments of the Friendly Farmer roundabout in 2028 and 2043 are summarised in Table 6-33 and Table 6-34.

~~9.5.27~~6.5.27The analysis indicates that the junction is forecast to carry around 20% less traffic as a result of the Scheme in 2028 and 2043. In terms of junction performance, the analysis indicates that the junction is forecast to continue to operate well within capacity in both the weekday AM and

PM peak hours in 2028 and 2043 as a result of the Scheme, with a LOS of B in 2028 and a LOS of C in 2043.

Table 6-33: Friendly Farmer junction assessment in 2028 (with the Scheme)

Arm	Movement	AM				PM			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A46 SB off-slip	A46 (North) to A46 (South)	518	A	20	110	421	A	9	71
	A46 (North) to A17	27	B	20	110	20	A	9	71
	A46 (North) to A1 (South)	481	B	20	110	455	A	9	71
A17	A17 to A46 (North)	31	C	43	184	22	C	14	104
	A17 to A46 (South)	875	C	43	184	821	B	14	104
	A17 to A1 (South)	23	A	22	184	53	A	7	104
A1 Link	A1 (South) to A46 (South)	214	B	14	117	146	A	4	65
	A1 (South) to A46 (North)	128	C	15	112	138	B	5	60
	A1 (South) to A17	389	C	15	112	237	B	5	60
Friendly Farmer Link	A46 (South) to A46 (North)	632	A	16	123	897	B	36	138
	A46 (South) to A17	353	A	16	123	413	A	36	138
	A46 (South) to A1 (South)	207	B	16	123	156	A	36	138
Overall	**Friendly Farmer_Total**	**3,878**	**B**			**3,778**	**B**		

Source: Analysis of operational model

Table 6-34: Friendly Farmer junction assessment in 2043 (with the Scheme)

Arm	Movement	AM				PM			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A46 SB off-slip	A46 (North) to A46 (South)	515	B	262	568	415	A	20	111
	A46 (North) to A17	29	C	262	568	21	B	20	111
	A46 (North) to A1 (South)	550	C	262	568	507	B	20	111
A17	A17 to A46 (North)	26	D	129	277	31	C	59	221
	A17 to A46 (South)	930	D	129	277	948	C	59	221
	A17 to A1 (South)	21	A	71	278	56	A	35	223
A1 Link	A1 (South) to A46 (South)	229	B	25	192	155	B	8	88
	A1 (South) to A46 (North)	137	C	26	187	139	C	9	82
	A1 (South) to A17	494	C	26	187	316	B	9	82
Friendly Farmer Link	A46 (South) to A46 (North)	730	C	75	144	953	B	68	143
	A46 (South) to A17	395	B	75	144	439	A	68	143
	A46 (South) to A1 (South)	257	C	75	144	195	B	68	143
Overall	**Friendly Farmer_Total**	**4,313**	**C**			**4,175**	**B**		

Source: Analysis of operational model

~~9.5.27.1~~Winthorpe roundabout

~~9.5.28~~6.5.28The results for the DM (without Scheme) operational assessments of the Winthorpe roundabout in 2028 and 2043 are summarised in Table 6-35 and Table 6-36.

~~9.5.29~~6.5.29The analysis indicates that without the Scheme, the junction is forecast to operate well within capacity in both the weekday AM and PM peak hours in 2028 and 2043, with an overall LOS of A.

Table 6-35: Winthorpe junction assessment in 2028 (without the Scheme)

Arm	Movement	AM				PM			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A46 (N)	A46 (North) to A46 (South) - Old	1,428	A	10	102	1,278	A	3	70
	A46 (North) to A1133	3	A	10	102	2	A	3	70
	A46 (North) to Drove Lane	86	A	10	102	125	A	3	70
Drove Lane	Drove Lane to A46 (South) - Old	7	A	0	24	18	A	1	40
	Drove Lane to A1133	33	B	0	24	95	B	1	40
	Drove Lane to A46 (North)	78	A	0	24	132	A	1	40
A46 (S)	A46 (South) - Old to A1133	205	A	18	148	242	A	62	236
	A46 (South) - Old to A46 (North)	1,572	A	18	148	1,724	A	62	236
	A46 (South) - Old to Drove Lane	18	A	18	148	11	A	62	236
A1133	A1133 to A46 (South) - Old	289	D	30	160	254	D	13	83
	A1133 to A46 (North)	3	D	30	160	1	B	13	83
	A1133 to Drove Lane	101	D	30	160	37	D	13	83
Overall	**Winthorpe_Total**	**3,823**	**A**			**3,918**	**A**		

Source: Analysis of operational model

Table 6-36: Winthorpe junction assessment in 2043 (without the Scheme)

Arm	Movement	AM				PM			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A46 (N)	A46 (North) to A46 (South) - Old	1,536	A	13	134	1,472	A	5	73
	A46 (North) to A1133	3	A	13	134	2	A	5	73
	A46 (North) to Drove Lane	143	A	13	134	176	A	5	73
Drove Lane	Drove Lane to A46 (South) - Old	5	A	1	25	18	C	8	79
	Drove Lane to A1133	35	B	1	25	116	C	8	79
	Drove Lane to A46 (North)	90	A	1	25	238	C	8	79
A46 (S)	A46 (South) - Old to A1133	210	A	76	284	217	A	353	571
	A46 (South) - Old to A46 (North)	1,837	A	76	284	1,658	A	353	571
	A46 (South) - Old to Drove Lane	18	A	76	284	10	A	353	571
A1133	A1133 to A46 (South) - Old	232	F	232	535	266	E	23	121
	A1133 to A46 (North)	3	F	232	535	1	D	23	121
	A1133 to Drove Lane	103	F	232	535	37	E	23	121
Overall	**Winthorpe_Total**	**4,212**	**A**			**4,212**	**A**		

Source: Analysis of operational model

~~9.5.30~~6.5.30The results for the DS (with Scheme) operational assessment of the Winthorpe roundabout in 2028 and 2043 are summarised in Table 6-37 and Table 6-38. The Scheme includes an additional fifth arm at the junction, as set out in Section 1.5.

~~9.5.31~~6.5.31The analysis indicates that the junction is forecast to carry an additional 10-20% of traffic as a result of the Scheme in 2028 and 2043. Despite this increase in traffic, the junction is forecast to continue to operate well within capacity in both the weekday AM and PM peak hours in 2028 and 2043 as a result of the Scheme, with an overall LOS of B.

Table 6-37: Winthorpe junction assessment in 2028 (with the Scheme)

Arm	Movement	AM				PM			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A46 (N)	A46 (North) to A46 (South) - Old	875	A	8	77	747	A	6	65
	A46 (North) to A1133	3	E	1	32	2	E	2	47
	A46 (North) to Drove Lane	63	A	8	77	73	A	6	65
	A46 (North) to A46 New	902	B	23	110	898	C	30	117
Drove Lane	Drove Lane to A46 (South) - Old	3	A	2	39	7	A	4	48
	Drove Lane to A1133	29	E	2	39	77	E	4	48
	Drove Lane to A46 (North)	52	E	2	39	66	E	4	48
	Drove Lane to A46 New	3	C	2	39	11	C	4	48
A46 (S)	A46 (South) - Old to A1133	130	C	37	226	156	B	36	127
	A46 (South) - Old to A46 (North)	42	D	37	226	116	C	36	127
	A46 (South) - Old to Drove Lane	12	D	37	226	6	D	36	127
	A46 (South) - Old to A46 New	0	A	37	226	0	A	36	127
A1133	A1133 to A46 (South) - Old	154	C	1	30	142	C	1	29
	A1133 to A46 (North)	3	B	1	30	1	B	1	29
	A1133 to Drove Lane	78	C	1	30	33	C	1	29
	A1133 to A46 New	119	C	1	30	113	D	1	29
A46 New	A46 New to A46 (South) - Old	0	A	10	62	0	A	11	86
	A46 New to A1133	112	A	5	72	181	A	10	80
	A46 New to A46 (North)	1,041	A	5	72	1,055	A	10	80
	A46 New to Drove Lane	7	C	10	62	6	D	11	86
Overall	**Winthorpe_Total**	**4,250**	**B**			**4,474**	**B**		

Source: Analysis of operational model.

Table 6-38: Winthorpe junction assessment in 2043 (with the Scheme)

Arm	Movement	AM				PM			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A46 (N)	A46 (North) to A46 (South) - Old	979	B	14	124	783	A	7	73
	A46 (North) to A1133	3	D	0	27	2	E	4	71
	A46 (North) to Drove Lane	63	A	14	124	70	A	7	73
	A46 (North) to A46 New	1,060	B	57	211	1,186	C	60	157
Drove Lane	Drove Lane to A46 (South) - Old	4	C	16	89	7	A	14	77
	Drove Lane to A1133	24	E	16	89	76	E	14	77
	Drove Lane to A46 (North)	38	E	16	89	60	E	14	77
	Drove Lane to A46 New	3	E	16	89	11	D	14	77
A46 (S)	A46 (South) - Old to A1133	146	B	33	330	168	B	11	94
	A46 (South) - Old to A46 (North)	54	D	33	330	36	D	11	94
	A46 (South) - Old to Drove Lane	11	D	33	330	5	D	11	94
	A46 (South) - Old to A46 New	0	A	33	330	0	A	11	94
A1133	A1133 to A46 (South) - Old	177	D	2	43	157	C	1	27
	A1133 to A46 (North)	3	B	2	43	1	B	1	27
	A1133 to Drove Lane	80	C	2	43	36	C	1	27
	A1133 to A46 New	137	C	2	43	134	D	1	27
A46 New	A46 New to A46 (South) - Old	0	A	12	78	0	A	11	65
	A46 New to A1133	124	A	11	104	190	A	9	91
	A46 New to A46 (North)	1,295	A	11	104	1,283	A	9	91
	A46 New to Drove Lane	7	D	12	78	6	D	11	65
Overall	**Winthorpe_Total**	**4,910**	**B**			**5,121**	**B**		

Source: Analysis of operational model

~~10~~7 Sustainable transport

~~10.1~~7.1 Introduction

~~10.1.1~~7.1.1 This chapter of the TA provides an overview for travel in the vicinity of the Scheme by sustainable modes of transport. It also seeks to identify both the current type and quality of provision as well as improvements and enhancements delivered as part of the Scheme.

~~10.1.2~~7.1.2 A Walking Cycling and Horse-riding Assessment Review (WCHAR) has been undertaken to consider the impacts of the Scheme on walking, cycling and horse-riding facilities. The purpose of the WCHAR process is to ensure that walking, cycling and horse-riding (WCH) facilities are considered within the Scheme.

~~10.1.3~~7.1.3 The aims of carrying out the WCHAR are:

- To gain an appropriate understanding of all relevant existing facilities for walkers, cyclists and equestrians (users) in the local area
- To provide background user information that can be referred to throughout the development of the Scheme

~~10.1.4~~7.1.4 A copy of the WCHAR is included in Appendix C: Walking, Cycling and Horse-Riding Assessment & Review (WCHAR) of this TA.

~~10.2~~7.2 Walking, cycling and horse-riding

~~10.2.1~~7.2.1 A WCHAR for the Scheme was completed in June 2023 based on the preliminary design for this Scheme included in Appendix C: Walking, Cycling and Horse-Riding Assessment & Review (WCHAR) of this TA**.** A further WCHAR would follow at the detailed design stage to ensure that the needs of WCH continue to be considered as the design progresses.

~~10.2.2~~7.2.2 WCH considered in this section are:

- Pedestrians – including mobility impaired and vulnerable pedestrians
- Cyclists – including mobility impaired and vulnerable cyclists
- Equestrians – including mobility impaired and vulnerable equestrians

~~10.2.3~~7.2.3 In accordance with DMRB GG 142 (Walking, cycling and horse-riding assessment and review), the Scheme is considered as a ‘large’ scheme for the purposes of the assessment. As such, the overall study area covers a 5km buffer zone around the Scheme, which includes the whole of Newark-on-Trent, as well as many surrounding villages and settlements.

Existing infrastructure

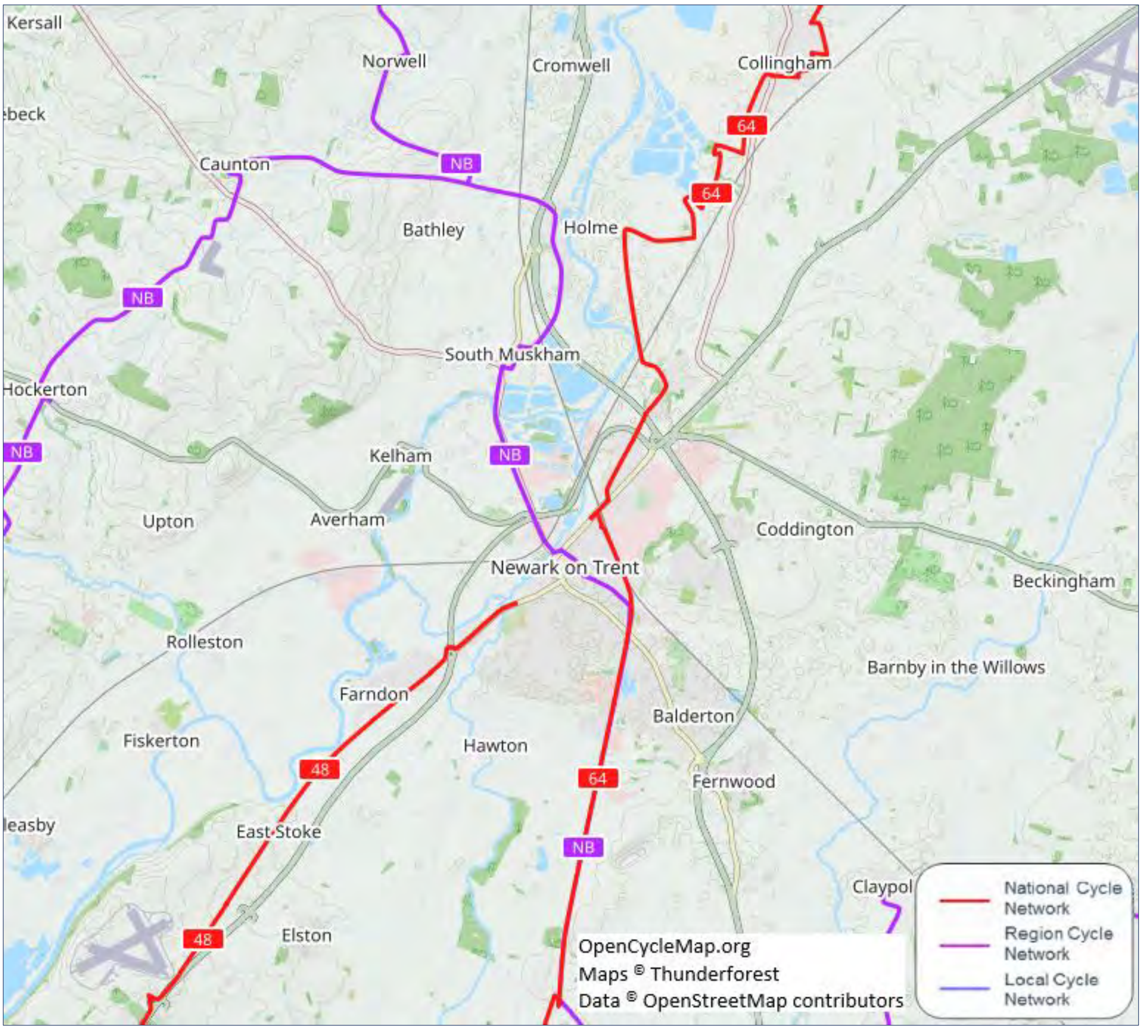
~~10.2.3.1~~Strategic routes

Cycling

~~10.2.4~~7.2.4The existing strategic cycle network is presented in Figure 7-1, illustrating the network of long-distance cycle routes within Newark-on-Trent.

~~10.2.5~~7.2.5National Cycling Network (NCN) 48 and NCN 64, both shown in red in Figure 7-1, provide routes to Nottingham and Leicester in the south, while NCN 64 links to Lincoln in the north. Both these long-distance routes regularly link into other national routes, as well as into the regional and local cycle networks.

Figure 7-1: Existing strategic cycle network



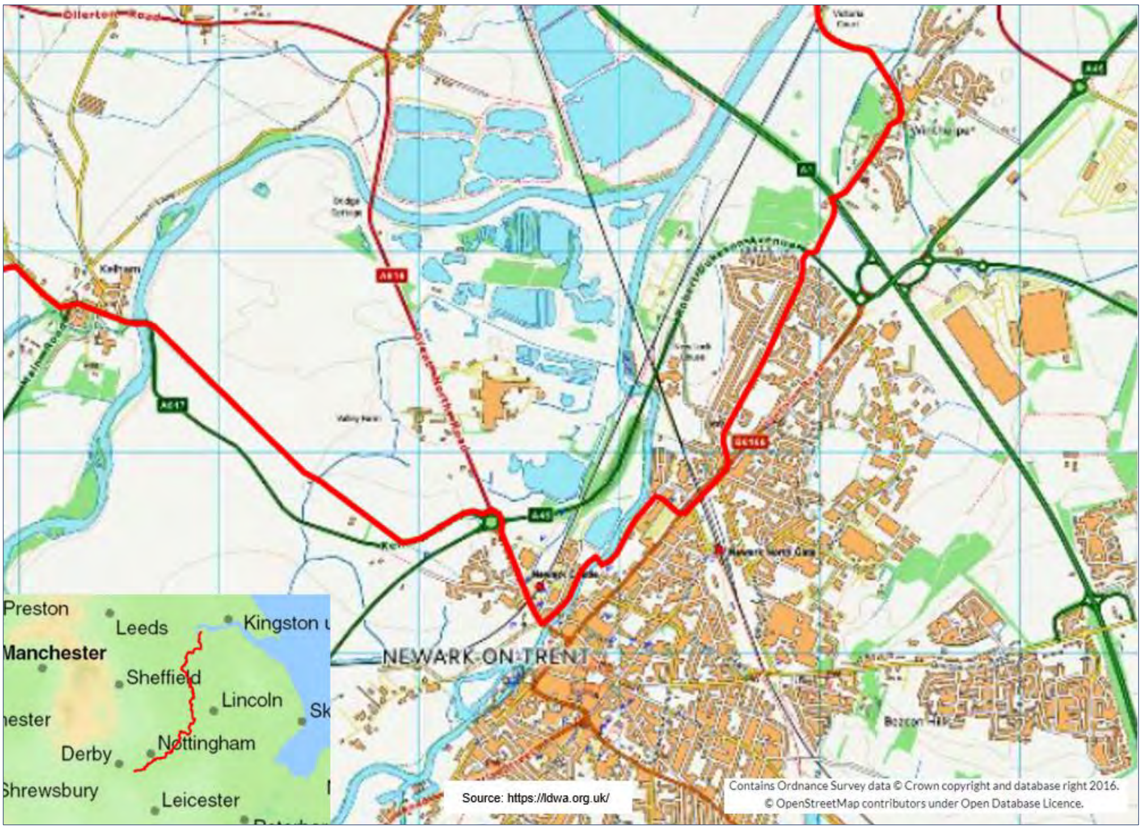
Source: Walking, Cycling and Horse-Riding Assessment & Review (WCHAR), Appendix C

Walking

~~10.2.6~~7.2.6 With regard to strategic walking routes, the Trent Valley Way is a long-distance walking route which follows the direction of the River Trent from its source to estuary.

~~10.2.7~~7.2.7 In the vicinity of the Scheme, the Trent Valley Way intersects the existing A46 at two locations. The first crossing is through Cattle Market roundabout, which is currently partially signalised. The second crossing is under the existing A46, north-west of Brownhills roundabout. Figure 7-2 below shows the route of the Trent Valley Way and its interaction with the existing A46.

Figure 7-2: Existing Trent Valley Way walking route



Source: Walking, Cycling and Horse-Riding Assessment & Review (WCHAR), Appendix C

Horse-Riding

~~10.2.8~~7.2.8 There are no strategic routes identified for horse-riders, recognising that equestrians are permitted to ride on all highways except motorways and roads with specific restrictions.

~~10.2.9~~7.2.9 There are a number of local routes which cross or interact with the existing A46. These are summarised below with more information available in Appendix C: Walking, Cycling and Horse-Riding Assessment & Review (WCHAR) of this TA.

~~10.2.9.1~~Local routes

~~10.2.10~~7.2.10 The following sections summarise the walking, cycling and horse-riding connections through the local area.

~~10.2.11~~7.2.11 At the Farndon roundabout, a shared-use footway/cycle track passes under the existing A46 to the north of the roundabout. A bridleway (BW2) also passes underneath the existing A46, adjacent to the River Trent to the north of the roundabout.

~~10.2.12~~7.2.12 At the Cattle Market roundabout, the Trent Valley Way passes through the roundabout using the existing footways and crossing points around the eastern side of the roundabout. There is also another footpath (FP14) which crosses through fields over the existing A46 to the west of Cattle Market roundabout via an uncontrolled crossing.

~~10.2.13~~7.2.13 At the Nether Lock Viaduct, a bridleway (BW6) travels alongside the River Trent, passing beneath the existing A46 under the Nether Lock Viaduct. Close to this route, there is a footpath (FP48-1) that travels underneath the existing A46 adjacent to the Sewage Works and then joins the bridleway on the northern side of the Nottingham-Lincoln railway line.

~~10.2.14~~7.2.14 At the Brownhills and Friendly Farmer roundabouts, a shared use route crosses underneath the existing A46 to the west of Brownhills roundabout and travels northbound where it passes underneath the A1 and onwards through Winthorpe village. This route forms part of the Trent Valley Way and the NCN 64.

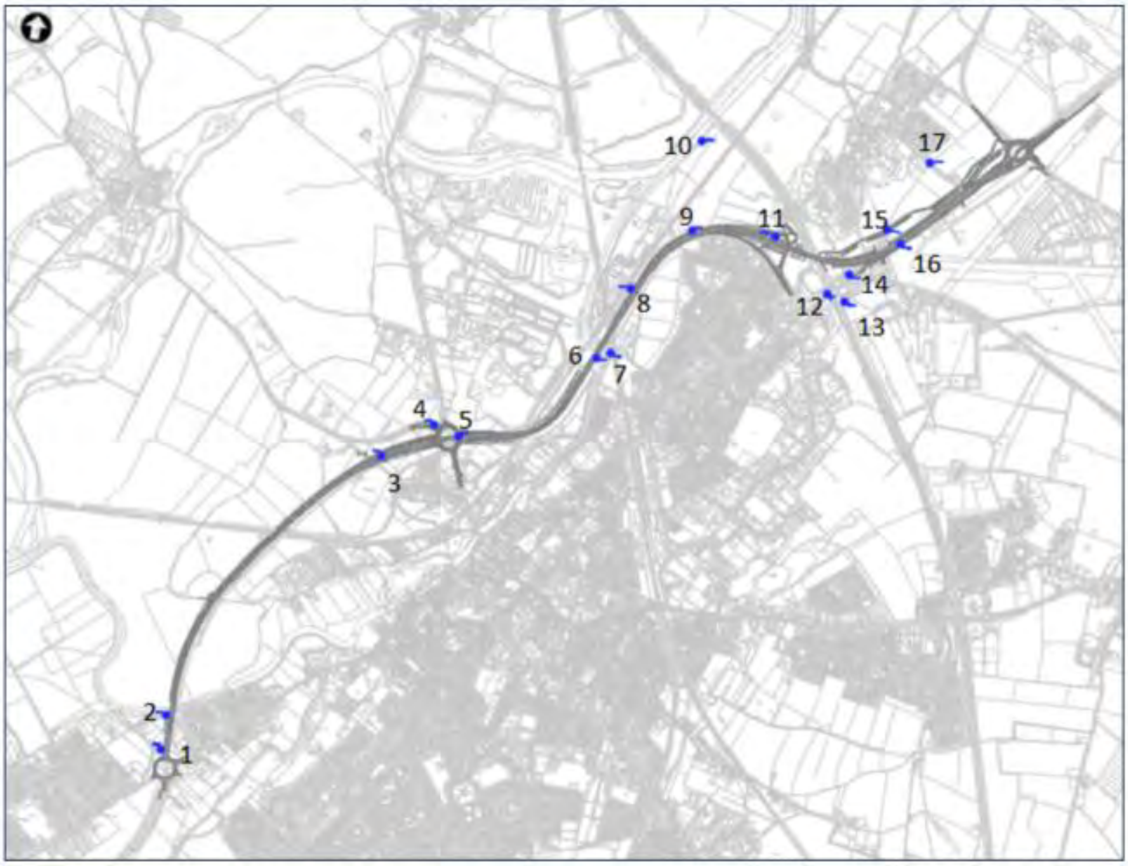
~~10.2.15~~7.2.15 There are also two footpaths (FP2 and FP3) that historically connected Winthorpe to Newark Showground but this route is currently severed by a vehicle restraint barrier on the existing A46. There is evidence of pedestrians still using this route, although it is formally stopped-up.

~~10.2.16~~7.2.16 At the Winthorpe roundabout, a footway travels adjacent to the existing A46 from Winthorpe roundabout in a south-westerly direction, past the two existing service stations either side of the existing A46, to the east of Friendly Farmer roundabout. This footway then connects with Lincoln Road and forms a continuous route onwards to Newark-on-Trent.

Existing usage

~~10.2.17~~7.2.17 Weekday and weekend surveys were undertaken at 17 sites along the A46 between January 2023 and April 2023 in order to understand the existing usage of routes by WCHs. The survey locations are shown in Figure 7-3.

Figure 7-3: WCH survey locations



Source: Walking, Cycling and Horse-Riding Assessment & Review (WCHAR), Appendix C

~~10.2.18~~7.2.18 Figure 7-4 summarises the daily maximum number of WCH users that were counted at each survey location during the weekday and weekend.

Figure 7-4: Existing WCH usage

Source: Walking, Cycling and Horse-Riding Assessment & Review (WCHAR), Appendix C

~~10.2.19~~7.2.19 This analysis shows that Sites 12 and 13 are the most heavily used. These are routes south of the existing A46 between Brownhills roundabout and Friendly Farmer roundabout. These routes are typically used by around 250 people per day during the week and by around 200 people per day at the weekend.

~~10.2.20~~7.2.20 The data also shows that Site 2 is a popular route providing a connection under the existing A46 to the north of Farndon roundabout. This route is typically used by around 150 people per day during both the week and weekend.

~~10.2.21~~7.2.21 The results show that there is relatively low usage on routes connecting the northern and southern sides of the existing A46. A number of concerns have previously been raised during consultation with local user groups, including:

- Site 5 – users can cross the existing A46 at Cattle Market roundabout however it is only partially signalised and currently not suitable for mobility impaired users
- Site 3 – the footpath which crosses through fields over the existing A46 to the west of Cattle Market roundabout via an uncontrolled crossing is considered to be unsafe and not suitable for mobility impaired users
- Sites 15 and 16 – two footpaths historically connected Winthorpe to Newark Showground but this route was severed by the construction of the existing A46 carriageway and a vehicle restraint system

~~10.2.22~~7.2.22 Further details of these surveys are included in Appendix C: Walking, Cycling and Horse-Riding Assessment & Review (WCHAR) of this TA.

Scheme impacts

~~10.2.23~~7.2.23 There are likely to be both beneficial and adverse impacts upon people’s journey patterns and amenity resulting from the Scheme. These impacts would include some diversions of some routes, but there are also opportunities to improve conditions for WCHs through new routes and improved crossings. Information relating to temporary diversions can be found in Appendix 12.2 (Population and Human Health Supplementary Information) of the Environmental Statement Appendices ~~(TR010065/APP/6.3)~~.

~~10.2.24~~7.2.24 Following a review of site surveys, user counts and consultation with the public, stakeholders and user groups, the WCH design has been revised in a number of locations across the Scheme. The primary design improvements are summarised as follows:

- Improved connectivity from Winthorpe to Newark-on-Trent, across the widened A46 via new, at-grade crossing points at Brownhills junction and Winthorpe through-about

- Creation of a combined footway / cycle track ‘circular’ route between Brownhills and Winthorpe through-about which also provides improved access to Newark Showground
- Signalisation of additional crossing points on a number of junctions, including Cattle Market roundabout and Winthorpe through-about
- Reduction of the north-south severance by providing a new crossing west of Friendly Farmer roundabout
- Retention of existing routes where possible. Where it is unsafe to retain a route, a suitable diversion would be provided
- Localised maintenance and lighting improvements on existing routes
- New shared-use route adjacent to the widened A46 allowing improved connectivity to Newark Showground, as well as the opportunity for future development

~~10.2.25~~7.2.25 During the construction phase, the Applicant would adopt construction and traffic management methods which, as far as possible, maintain access to existing WCH routes for all road users during construction periods.

~~10.2.26~~7.2.26 During the enabling works phase, the following measures would be implemented on the WCH routes that would be affected by the construction activities.

- Segregation of users from the construction works areas. In locations where construction works are close to users, works areas would be fenced off using temporary ‘Heras’ type panels (or similar) to segregate the site works from users.
- Diversion of users onto new temporary routes. Temporary diversion routes would be provided where practical and feasible, with users diverted around construction works via adjacent routes or locally around the perimeter of the fenced works site, with appropriate signage erected.
- Temporary closure of routes. Where local diversions cannot be provided, temporary closures and appropriate signage would be erected at the extent of the route closure to ensure that the public are informed, with wider communications via methods including the Scheme website, social media and newsletters also provided.
- Use of temporary marshals. Where construction activities do not prohibit use of the routes but the safety of users needs to be maintained.

~~10.2.27~~7.2.27 The Principal Contractor would consult with the relevant local authorities to identify, agree, implement and manage appropriate measures within the Order Limits for WCH routes affected by construction phase.

~~10.2.28~~7.2.28 Table 7-1 outlines the intended diversions and control measures on the WCH routes during construction. Full details are included in the Outline Traffic Management Plan [REP6-018]~~(TR010065/APP/7.7)~~ as part of the development consent application. The Outline Traffic Management Plan [REP6-018]~~(TR010065/APP/7.7)~~ provides details of how the construction works for the Scheme would be phased and how the temporary traffic management measures, including closures and diversions, would be implemented for each phase of the Scheme.

Table 7-1: Intended diversions and control measures on WCH routes

WCH route reference	Impact	Diversion	Duration
Farndon roundabout BW2	Temporary closure and diversion during construction of Windmill Viaduct (Works Area Ref).	Option 1 Divert west along Farndon FP4 then south along Farndon FP2 onto Marsh Lane and Farndon FP5, south through field adjacent to Crees Lane, across temporary crossing at Crees Lane, under A46 underpass, along footway/cycleway and north on Newark FP3 to rejoin BW2. Option 2 Divert west along access track from Marsh Lane, head north along Farndon FP5, head south through field adjacent to Crees Lane, across temporary crossing at Crees Lane, under A46 underpass, along footway/cycleway and north on Newark FP3 to rejoin BW2. The segregation between BW2 and the working area for the Windmill Viaduct (Works Area Ref) has been designed and would be installed such as to permit access to the driveway to Windmill cottage.	24 months
Cattle Market roundabout FP14	Permanent closure	The crossing is not currently used due to safety hazards associated with crossing the A46. Foot traffic diverted along Kelham Road and Great North Road utilising the route of the existing Trent Valley Way.	Closed in enabling works
Footpath/Cycleway along Great North Road	Temporary diversions during construction and permanent re-alignment	The construction of the new Cattle Market grade separated junction (Works Area Ref) requires multiple construction phases to manage the traffic movements around the existing junction. Temporary signalised crossings would be installed during construction to segregate users from the construction operations.	30 months

WCH route reference	Impact	Diversion	Duration
Nether Lock Viaduct BW6	Temporary closures with marshals	The bridleway would need to be temporarily closed during the construction and demobilisation of the temporary bridge crossing at Nether Lock and the installation of the new bridge deck elements to the Nether Lock Viaduct (works area ref). Marshals would be positioned to control movements during the construction operations. Temporary bridge abutment working area on the south side of the riverbank would be segregated during the works.	Four weeks of marshal control in enabling works and six weeks of marshal control in main works.
Nether Lock Viaduct FP48#1	Temporary closure and diversion	Footpath would be impacted during the construction of the Crankley Point Sewage Treatment Works underpass extension (works area ref) and the earthworks operations associated with the embankment widening. South on Quibell's Lane to Newark-on-Trent, cross the Lincoln Road railway bridge and join the Trent Valley Way.	24 months
National Cycle NCN 64 and Trent Valley Way along Winthorpe Road	Temporary diversion during construction and diversion onto new permanent alignment.	NCN 64 and the Trent Valley Way along the Winthorpe Road is impacted by the construction of the new Brownhills junction (works area ref). The existing pathway on the southbound side of the road would be cleared and segregated to provide a segregated route along Winthorpe Road. The construction of the new junction would be phased, such that the new footway/cycle track would be constructed and put into operation before the earthwork operations commence over the Winthorpe Road.	Phased diversions over 24 months
Winthorpe FP2		There is currently no link between Winthorpe FP2 and FP3 across the A46. During construction Winthorpe FP2 would be permanently stopped up approximately 100 metres before the A46. A new PRoW alignment would be constructed along the alignment of the private means of access (works area ref).	

WCH route reference	**Impact**	**Diversion**	**Duration**
Winthorpe FP3		There is currently no link between Winthorpe FP2 and FP3 across the A46. Winthorpe FP3 current joins the footway/cycleway along the southbound carriageway of the A46. Winthorpe FP3 would rejoin the proposed new footpath/cycle track that would be constructed in the verge of the new Friendly Farmer link road (works area ref).	
Footpath along the A46 between Drove Lane and Friendly Farmer Roundabout	Temporary diversion during construction and diversion onto new permanent alignment.	The footpath would be temporarily diverted to the south of its existing alignment prior to the start of the construction of the new Friendly Farmer Link.	18 months

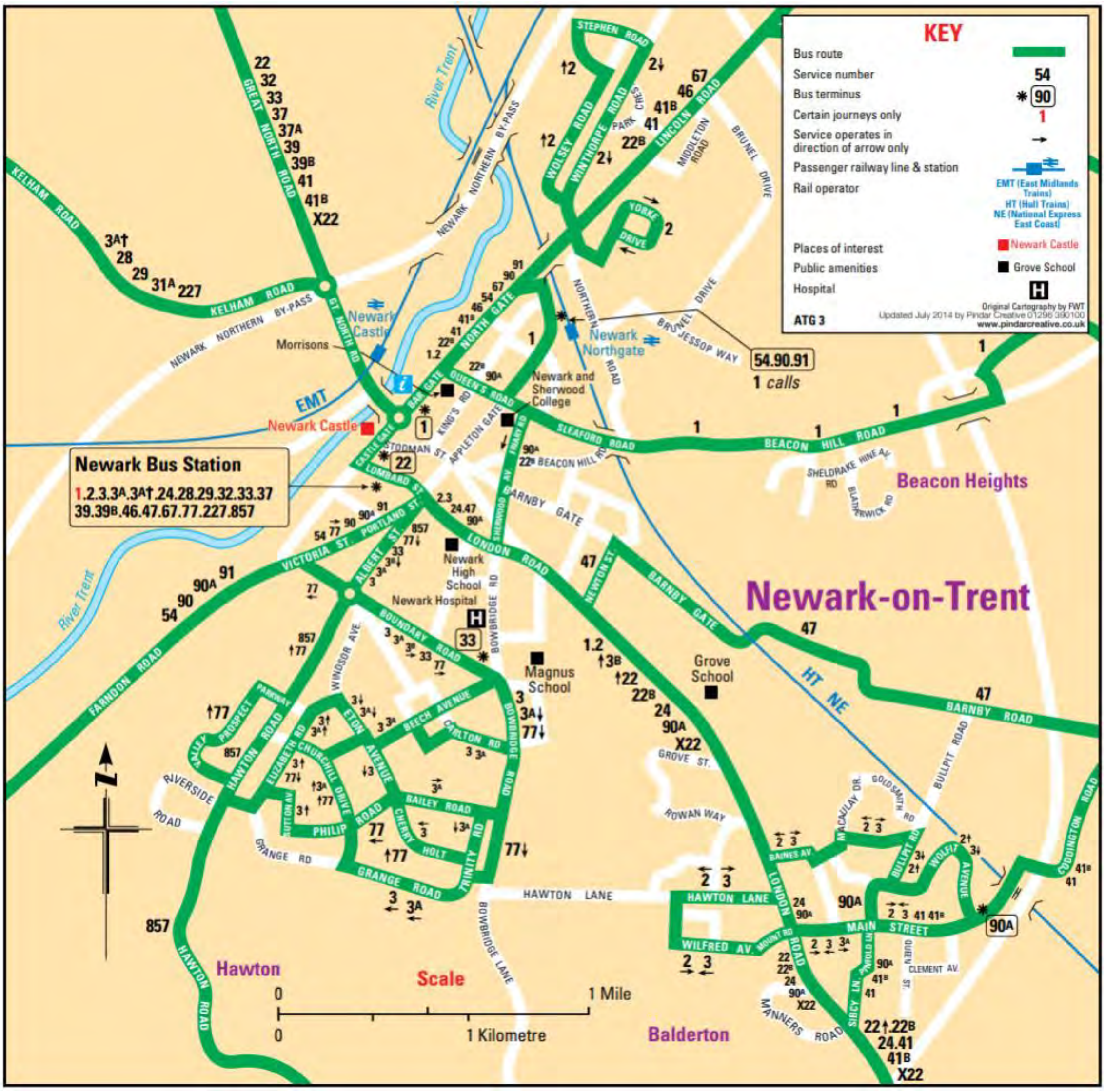
Source: Outline Traffic Management Plan **(TR010065/APP/7.7)**

~~10.3~~7.3 Public transport

Existing infrastructure

7.3.1 Figure 7-5 shows the public transport network in and around Newark-on-Trent.

Figure 7-5: Existing public transport network in Newark-on-Trent



Source: Walking, Cycling and Horse-Riding Assessment & Review (WCHAR), Appendix C

~~10.3.1.1~~Rail

7.3.2 Newark-on-Trent is served by two railway stations - Newark North Gate and Newark Castle. These stations are approximately one kilometre apart on separate train lines.

7.3.3 North of these two stations is the Newark Flat Crossing which is the point where the Nottingham to Lincoln line intersects with the East Coast Main Line. It is the last remaining flat railway crossing in the UK.

7.3.4 The flat crossing is to the immediate north of the existing A46 and may be impacted by the Scheme. The Applicant has worked with Network Rail and the Department for Transport (DfT) to identify and understand any conflicts between the Scheme and the potential grade separation of the railway lines, and to discuss opportunities for working together. The Applicant worked with the DfT designer to respond to each of the identified areas to provide confidence that the Scheme did not preclude a future grade separated rail scheme from being delivered in the future. Further details of the engagement can be found in the Consultation Report ~~(TR010065/APP/5.1)~~[APP-028].

Newark North Gate station

7.3.5 Newark North Gate station is located on the eastern side of the existing A46 and is approximately 1km to the east of the Cattle Market roundabout and 1.5km west of the Brownhills roundabout. It is served by London North Eastern Railway and East Midlands Railway. Newark North Gate station is served on average by two trains per hour southbound to London King's Cross, and approximately three trains per hour northbound to destinations such as Newcastle, Glasgow and York.

7.3.6 Rail station patronage at Newark North Gate station had been close to one million entries and exits a year, however, numbers drastically reduced during the COVID-19 pandemic, with only 181,014 entries and exits recorded between April 2020 and March 2021 and numbers rising to 674,472 between April 2021 and March 2022[25].

Newark Castle station

7.3.7 Newark Castle station is located just under 400m south of Cattle Market roundabout. The station is served by East Midlands Railway with approximately one train per hour serving Newark Castle station northbound, terminating at Lincoln. Southbound, the station is served by two trains per hour, most commonly continuing to Nottingham and Leicester.

7.3.8 A similar story of rail station patronage is also evident for Newark Castle rail station. Numbers were increasing pre-pandemic, from around

[25] *Estimations of station usage – Office of Rail and Road*

767,200 entries and exits in the 2017-2018 period, to 802,600 entries and exits in the 2018-2019 period. However, the number drastically reduced during the COVID-19 pandemic, with 151,200 entries and exits recorded between April 2020 and March 2021 and numbers rising to 563,300 between April 2021 and March 2022[26].

~~10.3.1.2~~Bus

7.3.9 The main hub for buses is the Newark Bus Station, which is located off Lombard Street. This is an approximate 11-minute walk from Newark Castle station and 17-minutes from Newark Northgate station.

7.3.10 There are multiple local bus services that serve Newark-on-Trent from nearby villages, and some long-distance bus services from Lincoln, Nottingham, and Mansfield.

7.3.11 There are four bus services that currently travel through the Cattle Market roundabout:

- Bus route 1K – Kesteven Callconnect
- Bus route 300 – Lowdham – Southwell – Newark-on-Trent
- Bus route X37 – Newark-on-Trent – Tuxford (am) & Tuxford – Retford (pm)
- Bus route 37 – Newark-on-Trent – Tuxford – Retford

7.3.12 There are also three bus services serving Newark-on-Trent that travel through Brownhills roundabout:

- Bus route 367 – Newark-on-Trent – Collingham – Harby (by request only)
- Bus route B3 – Lincoln – Bakkavor
- Bus route 1K – Kesteven Callconnect

7.3.13 Bus route 1K – Kesteven Callconnect is an on-demand bus service which can be booked via phone or app. The service is operated by Lincs Bus.

7.3.14 Through discussions held between the Applicant and NCC in March 2023, it was noted that NCC holds ambitions to install bus priority signals on the network. NCC emphasised the need for the Scheme to install, where possible, bus priority signal heads into traffic signals.

7.3.15 Also through discussions, NCC noted that a new demand responsive bus service, bus route 67, is planned to operate in and near Collingham. Bus route 67 would be based on the existing bus route 367, which runs on a fixed route from Newark-on-Trent until Collingham, at which point the service turns into a ring and ride bus service. With bus route 67, this would be changed to an app-based or phone-based service in

[26] *Estimations of station usage - ORR*

Collingham. The new service is expected to utilise Winthorpe roundabout.

Scheme impacts

7.3.16 The Scheme is considered unlikely to affect rail stations or rail services.

7.3.17 The main impacts of the Scheme on local bus services are related to the potential temporary route diversions or suspensions during the construction phase. Once operational, the Scheme would not sever communities or adversely impact the existing bus service provision.

7.3.18 Overall, the impact of the Scheme construction is expected to be minimal. The Principal Contractor would liaise with bus operators and NCC to determine if any measures are needed to maintain existing bus routes and to minimise the impact of construction on punctuality. There is a commitment to communicate with public transport providers in the Outline Traffic Management Plan [REP6-018]~~(TR010065/APP/7.6)~~.

~~11~~8 Construction impact assessment

~~11.1~~8.1 Introduction

~~11.1.1~~8.1.1 This chapter of the TA sets out key information relating to the construction of the Scheme, including construction programme, compound locations, construction routes and volume of forecast construction traffic. It then sets out how construction activity is forecast to have an impact on the A46 and surrounding highway network.

~~11.2~~8.2 Construction information

~~11.2.1~~8.2.1 An assessment has been undertaken of the traffic impact during construction of the Scheme. Chapter 2 of the Environmental Statement [APP-046]~~(TR010065/APP/6.1)~~ provides an outline description of construction of the Scheme and includes assumptions on programme, phasing, working hours, workforce, construction compounds and forecast construction vehicle movements. This information is summarised below.

Programme

~~11.2.2~~8.2.2 The construction programme for the Scheme has been prepared by the Applicant. These dates are based on an anticipated DCO decision in June 2025, with the main construction works commencing in August 2025.

~~11.2.3~~8.2.3 To minimise the disruption caused by construction of the Scheme, it is expected that certain works (referred to as advanced and enabling works) would need to be undertaken ahead of the main construction works to allow these works to proceed, and to optimise the overall delivery programme for the Scheme. Advanced works would be undertaken prior to consent for the DCO application being granted and would be secured through separate permissions and landowner agreements outside the powers contained in the DCO.

~~11.2.4~~8.2.4 Table 8-1 presents the indicative key dates and construction programme. These dates are based on an anticipated DCO decision in June 2025.

Table 8-1: Indicative construction programme

Key construction programme element	Start date	Completion date
Anticipated DCO decision date	June 2025	
Advanced works	October 2023	August 2026
Pre-commencement works	June 2025	August 2026
Main construction works	August 2025	November 2028
Section 1 Farndon roundabout to Nottingham to Lincoln railway line	August 2025	May 2028
Section 2 Nottingham to Lincoln railway line to East Coast Main Line (ECML)	August 2025	June 2028
Section 3 ECML to A1	August 2025	May 2028
Section 4 A1 to Winthorpe roundabout	August 2025	June 2028
Section 5 Modifications to existing carriageway	June 2028	November 2028
Section 6 Kelham and Averham flood compensation	August 2025	June 2026
Scheme open for traffic	November 2028	

Source: Skanska

~~11.2.5~~8.2.5 It should be noted that these dates would be refined through the detailed design stage of the Scheme with appropriate regard given to reducing the overall traffic impacts during construction.

Construction sections and compounds

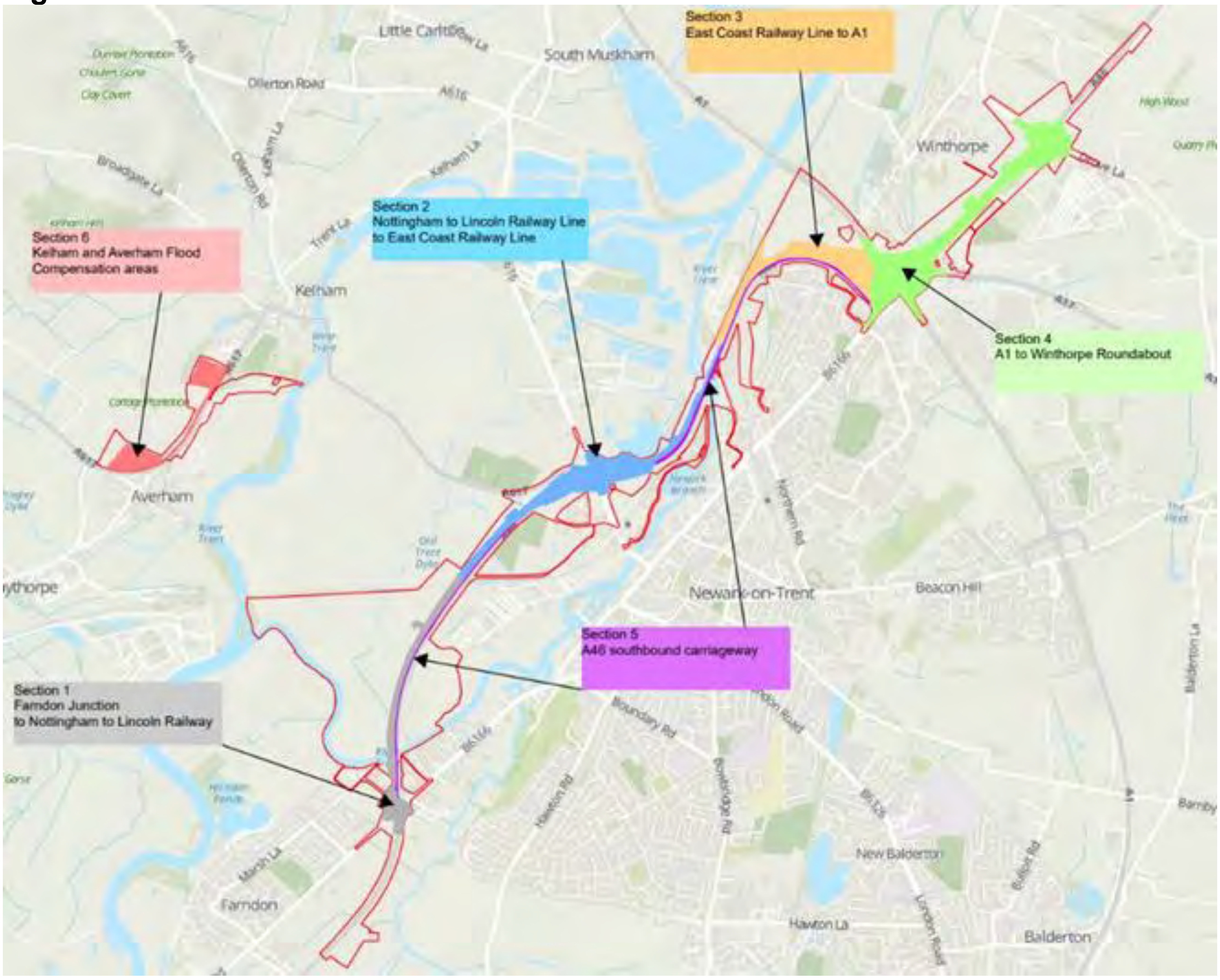
~~11.2.5.1~~Construction sections

~~11.2.6~~8.2.6 The main construction works would follow the advanced and enabling works, with construction work split across the following sections of the Scheme:

- Section 1: Farndon roundabout to Nottingham to Lincoln railway line
- Section 2: Nottingham to Lincoln railway line to East Coast Main Line
- Section 3: East Coast Main Line to A1
- Section 4: A1 to Winthorpe roundabout
- Section 5: Modifications to existing carriageway
- Section 6: Kelham and Averham flood compensation area

~~11.2.7~~8.2.7 Figure 8-1 below provides an overview of the sections of the Scheme.

Figure 8-1: Main construction works sections



Source: Skanska

~~11.2.8~~8.2.8 Sections 1 to 4 would be delivered in parallel and would involve the widening of the existing A46 to form the two lanes for the new northbound carriageway and the central reserve. The new bridge structures and junctions would be constructed in this period.

~~11.2.9~~8.2.9 Section 5 involves the modifications required to convert the existing A46 carriageway into the two lanes for the new southbound carriageway. This would involve installation of new signage, road restraint systems and surfacing. This would take place following the completion of the new northbound carriageway, so that traffic can be diverted onto the new alignment, providing a traffic free working area.

~~11.2.10~~8.2.10 Section 6 incorporates the works to form the flood compensation requirements in the land between the villages of Kelham and Averham. These works would be undertaken at the start of the programme to provide the required compensation ahead of the main embankment widening works commencing.

~~11.2.11~~8.2.11 A phased approach to construction of some sections of the Scheme, particularly at the new and modified junctions at Farndon, Cattle Market, Brownhills and Winthorpe, would be adopted, with phasing determined by the requirements for Temporary Traffic Management (TTM) on existing routes and the need to minimise disruption to the travelling public, residents and businesses.

~~11.2.12~~8.2.12 To minimise the disruption caused by construction of the Scheme, it is expected that certain works (referred to as advanced and enabling works) would need to be undertaken ahead of the main construction works to allow these works to proceed, and to optimise the overall delivery programme for the Scheme.

~~11.2.12.1~~Construction compounds

~~11.2.13~~8.2.13 The main construction compound would be located at the site of the old NCC highway depot, to the south of the Cattle Market roundabout. Vehicle access to the compound would be via the Great North Road, with the existing access amended as part of the compound establishment works.

~~11.2.14~~8.2.14 The main construction compound would be manned on a 24-hour basis and would be in place throughout the entire duration of the construction phase. Although construction of the Scheme would primarily be undertaken during core working hours (07:00 to 18:00 on weekdays), a number of functions associated with the works would need to operate 24 hours per day. These functions include site security, vehicle recovery, traffic management, water management and deliveries of large components and/or plant which are moved during off-peak hours in order to minimise disruption on the highway network.

~~11.2.15~~8.2.15 A number of satellite construction compounds would be formed to facilitate the construction of the Scheme. These smaller compounds would generally be located adjacent to bridge structures and be in operation for a limited duration whilst undertaking these works. Works within the compounds would normally only be undertaken during core hours; however, during periods of overnight works such as bridge beam installation, road tie-ins and other critical works, these compounds would need to operate outside of these hours.

Construction traffic routes

~~11.2.16~~8.2.16 While there is no set route for construction vehicles, where practicable they would primarily travel on the A46 and A1, and limit travel on local or side roads when travelling to work sites and compounds, as set out in the Outline Traffic Management Plan ~~-~~[REP6-018]~~(TR010065/APP/7.6)~~.

~~11.2.17~~8.2.17 The distributional split of construction traffic flows has been based on the source location of identified construction materials and the route that deliveries would take to construction compounds. The overall distribution of construction traffic to the main construction compounds/satellite compounds is estimated to be split equally between the A46 north and south of Newark-on-Trent. In the traffic modelling, 50% of traffic would be assigned from the A46 west of Farndon roundabout and 50% from the A46 east of Winthorpe roundabout.

~~11.2.18~~8.2.18 Based on the construction routes and the directional distribution, the volumes of construction vehicles for each compound have been assigned to specific routes on the road network and modelled accordingly.

Workforce

~~11.2.18.1~~Number of staff

~~11.2.19~~8.2.19 The number of staff is expected to peak in 2026, with a maximum of 350 staff on-site per day, of which 250 would be site-based staff and 100 would be office based. All of the 250 site-based staff are expected to be on-site, with the 100 office base staff expected to be working at the site-office or from home.

~~11.2.19.1~~Working hours

~~11.2.20~~8.2.20 The core construction working hours would be 07:00 to 18:00 on weekdays (11-hour working day) and 07:00 to 13:00 on Saturdays.

~~11.2.21~~8.2.21 The vast majority of staff are expected to arrive between 06:30 and 08:15 and depart after 18:00.

~~11.2.21.1~~Staff travel

~~11.2.22~~8.2.22 It is expected that a large proportion of site staff would commute from local towns and cities that are within an hour’s drive from the Scheme. Individuals working away from home would stay overnight in the local area, using accommodation in settlements such as Newark-on-Trent, Grantham and Nottingham. Given that the construction sites are located close to several settlements with suitable accommodation options, no on-site accommodation is proposed. The exception to this would be the road work recovery teams who would be working shift patterns on-site. Welfare and accommodation facilities would be installed for these teams at the main compound.

~~11.2.23~~8.2.23 Car sharing and travel by sustainable and active modes would be encouraged and promoted. Details relating to staff travel and the delivery of sustainable transportation infrastructure is discussed in the Outline Traffic Management Plan [REP6-018]~~(TR010065/APP/7.6)~~.

Construction traffic forecasts

~~11.2.24~~8.2.24The total daily construction vehicle volumes for each year of the construction programme is provided in Table 8-2 below. These numbers include travel associated with the workforce.

~~11.2.25~~8.2.25This analysis is based on a peak construction year, which is expected to be 2026. During the peak year, it is forecast there would be 1,900 two-way vehicle movements per day. The construction year of 2026 includes the earthworks stage, which is estimated to require the highest volume of construction vehicles.

Table 8-2: Peak year daily construction vehicle volumes (working day)

	One-way	Two-way
HGV	742	1,484
Car/Van	210	420
Total	**952**	**1,904**

Source: Skanska

~~11.2.26~~8.2.26In order to calculate the estimated hourly HGV construction volume, the daily values in the table above can be divided by the 11 core working hours. This results in 135 two-way HGV movements per hour in the peak year.

~~11.2.27~~8.2.27The vast majority of cars are forecast to be associated with the workforce. For the purpose of the assessment, it assumed they all arrive in the AM peak and depart after 18:00.

~~11.3~~8.3Construction phase traffic management

Overview

~~11.3.1~~8.3.1During construction, TTM measures would be put in place to ensure that traffic associated with construction activity can be accommodated on both the strategic and local road network and to provide a safe working environment for staff.

~~11.3.2~~8.3.2The detail presented in this section is based on the preliminary design for the Scheme and the construction traffic management measures presented in the Outline Traffic Management Plan [REP6-018]~~(TR010065/APP/7.6)~~. The Outline Traffic Management Plan would be developed into the Traffic Management Plan for implementation during consultation.

~~11.3.3~~8.3.3The Applicant would consult with the Local Highway Authorities and Royal Mail to review and agree the detailed construction traffic management measures in line with Requirement 11 of the draft DCO [REP6-004]~~(TR010065/APP/3.1)~~. Further details on stakeholder engagement with regard to construction traffic management can be found in Table 2.1 of the Outline Traffic Management Plan [REP6-018]~~(TR010065/APP/7.6)~~.

Purpose of TTM

~~11.3.4~~8.3.4The main objectives of the TTM are:

- To protect the construction workforce against the risks to health and safety associated with working on or adjacent to live carriageways
- To ensure the safety of all road users, including WCH as they approach, and travel through, routes affected by roadworks
- To minimise the health and safety risks to the local community resulting from construction operations, including the impacts (intended and unintended) of traffic diversions onto the local road network
- Minimise disruption to road users, local businesses and communities during construction works

~~11.3.5~~8.3.5TTM would include, but not be limited to, the following types of measures:

- The application of temporary speed limits
- Carriageway and slip road closures
- The segregation of routes
- The use of signage and clear road marking systems
- Formation of safe access and egress points
- Communication of measures to stakeholders

~~11.3.6~~8.3.6The aim during the construction period would be to minimise the number of construction vehicles on the highway network. This would be achieved in part through the use of borrow pits located adjacent to the Scheme and the use of haul routes along the Scheme to minimise the need for transporting material on the surrounding highway network. This approach would help to reduce the potential for delays on the highway network. In addition, construction works traffic routing would be controlled, with HGVs being prevented from using a number of routes, as described below in further detail.

Restricted routes for construction vehicles

~~11.3.7~~8.3.7During construction, where practicable, access into work areas has been planned to use the A46 via temporary access points and junctions. However, there are areas of the Scheme where this form of access would not be feasible, and the use of local side roads would be required to access these work areas.

~~11.3.8~~8.3.8 To minimise the use of local roads and to reduce disruption to local stakeholders and residential areas, routes have been split into three statuses:

- Permitted route
- Permitted route with restrictions
- Excluded route

~~11.3.9~~8.3.9 Table 8-3 below provides an overview of the status and details relating to construction access on the surrounding road network. This shows that on the vast majority of roads, construction vehicle activity would be permitted with restrictions. The only exception is Tolney Lane where construction vehicles would be banned.

Table 8-3: Road status for construction access

Road	Status	Details
Crees Lane	Permitted with restrictions	Construction vehicles not permitted along the private road section.
Fosse Road	Permitted with restrictions	Construction traffic would use Fosse Road to access Crees Lane and the Satellite compound.
Tolney Lane	Excluded	-
Kelham Road (North and South of the A46)	Permitted with restrictions	On street parking along this section of the road makes it unsuitable for HGV's. Restricted to works Light Goods Vehicles (LGV's), vans and cars for the main works.
A616	Permitted	-
A617	Permitted	-
Mather Road	Permitted with restrictions	Used as access to Nether Lock Viaduct during advanced and enabling works.
Lincoln Road, Lincoln Road Bridge and Northgate.	Permitted with restrictions	Construction vehicles to access Trent Lane via Lincoln Road from the Brownhills junction only.
Winthorpe Road and Quibell's Lane	Permitted with restrictions	Access along Winthorpe Road to the Quibell's Lane junction only.
Winthorpe Road between A46 and A1	Permitted with restrictions	Used during advanced and enabling work. Separate construction access and egress routes to be provided from the A46.
Drove Lane	Permitted with restrictions	Used to access the works access at the western end of Drove Lane only. No construction vehicles permitted past the Order Limits on Drove Lane.
A1133	Permitted with restrictions	Used to access the works access only.
Gainsborough Road	Permitted with restrictions	No HGV's or LGV's. Limited to cars to undertake inspection of the technology and electrical equipment on the east side of the A1.

Source: Skanska

Speed limits

~~11.3.10~~8.3.10 Details on anticipated temporary speed limits, including details on the maintenance of existing limits and temporary restrictions, are contained within the Outline Traffic Management Plan [REP6-

018]~~(TR010065/APP/7.6)~~. These would be implemented via Traffic Regulation Orders (TRO).

~~11.3.11~~8.3.11 All speed limits are to be assessed under the latest National Highways guidance “Safe highest speed” and in accordance with Traffic and Signs Manual, Chapter 8, Part 3.

~~11.3.12~~8.3.12 Narrow running lanes and running of the hard strips would be required for the TTM along the A46. It anticipated that a 50mph temporary maximum speed limit would be implemented.

Carriageway and slip road closures

~~11.3.13~~8.3.13 The Scheme would attempt to limit the number of full carriageway closures to minimise impact on and disruption to the travelling public.

~~11.3.14~~8.3.14 Extended full carriageway closures for the A1 bridge installation operations would be required. Details would be confirmed following consultation with the highway authorities. Advanced communication for road users would be provided such that alternative routes can be chosen. Strategic diversions would be signed on the main approaches to the A1 (M25, M11, A1(M) and ports) such that strategic traffic can be directed onto alternative, suitable routes such as the M1.

~~11.3.15~~8.3.15 Details of anticipated carriageway and slip road closures are available in the Outline Traffic Management Plan [REP6-018]~~(TR010065/APP/7.6)~~.

Staff Travel

~~11.3.16~~8.3.16 A Construction Worker Travel and Accommodation Plan (CWTAP) would also be developed by the Principal Contractor as the Scheme progresses through the detailed design phase. The CWTAP would be produced as part of the second iteration of the Environmental Management Plan [REP6-012]~~(TR010065/APP/6.5)~~.

~~11.3.17~~8.3.17 The CWTAP is crucial for understanding the approach to managing travel and accommodation demand for construction workers. It would set out the procedures that would be put in place to ensure successful delivery of sustainable transportation for the daily movement of the construction workforce. This would provide a solution for meeting the temporary increase in local accommodation demand generated by the Scheme during construction.

~~11.4~~8.4 Model development for construction phase

~~11.4.1~~8.4.1 As set out previously, the vast majority of vehicles associated with construction activity would utilise key strategic corridors such as the A46 and A1 to access the area, therefore the impacts of the Scheme are expected to be very localised, based on site access points, which are close to the A46. The construction assessment is therefore based on a detailed assessment using microsimulation (VISSIM) to assess the local road network in and around the Scheme during construction.

~~11.4.2~~8.4.2 Haul roads themselves are unlikely to require detailed assessment as these would be newly built during the enabling works phase prior to the main construction phase and would not have any other traffic than construction traffic.

Model development

~~11.4.2.1~~Demand Changes

~~11.4.3~~8.4.3 The following sections provide an overview of the assumptions that have been built into the operational model.

~~11.4.4~~8.4.4 The model only considers the AM (07:30-08:30) peak hour as initial analysis indicates that the addition of construction vehicles in the AM peak hour has a greater impact than in the PM peak hour.

Do Minimum

~~11.4.5~~8.4.5 The operational model for the construction assessment is based on the adaptation of the A46 operational model for 2028. Details relating to the development of the base and forecast highway models can be found in Section 3.3 of this TA.

Construction traffic

~~11.4.6~~8.4.6 Section 8.2 sets out the forecast level of construction traffic associated with the Scheme.

~~11.4.7~~8.4.7 In terms of staff arrivals and departures from the site, there is a mobilisation period that occurs for staff to/from accommodation to work sites. It has been assumed that workforce and staff would arrive gradually between 06:30 and 08:15. In the model, the peak volume of staff and workforce have been assumed to arrive in the AM peak hour to represent a worst-case scenario.

~~11.4.8~~8.4.8 In the AM, 50% of the site-based workforce would travel to the main compound first before travelling to their assigned work site. The remaining 50% would travel directly to their assigned locations however this has not been modelled as the assigned location and the associated trip would likely vary frequently.

~~11.4.9~~8.4.9 Of the workforce, 50% would report to the main construction compound at the beginning of the first shift and then travel to their assigned compound. The remaining 50% of the workforce would travel directly to the relevant satellite compounds.

~~11.4.10~~8.4.10 Labour and staff are expected to arrive between 06:30 and 08:15 and depart after 18:00.

~~11.4.11~~8.4.11 Section 8.2 estimated the hourly HGV construction volume to be around 135 two-way HGV movements per hour in the peak year. Whilst this has been included in the modelling for the construction assessment, in reality these vehicles are likely to be timed outside of peak hours to avoid congestion.

~~11.4.12~~8.4.12 The modelling has only considered peak construction flows which are expected to take place in 2026 as this is forecast to represent the worst case in terms of trip generation. The peak year construction matrices have been combined with the 2028 DM matrices in order to assess the likely impact of construction activity associated with the Scheme.

~~11.4.13~~8.4.13 The construction impact assessment does not take into account advanced and enabling works that would take place prior to the main construction works phase.

~~11.4.13.1~~Infrastructure changes

~~11.4.14~~8.4.14 The DM scenario includes committed infrastructure changes, changes to signal timings and demand changes as discussed in Section 3.3.

~~11.4.15~~8.4.15 The operational model is being used as a diagnostic tool to identify potential issues so that mitigation measures can be put in place. The model includes a number of TTM measures from the Outline Traffic Management Plan [REP6-018]~~(TR010065/APP/7.6)~~, as shown in Table 8-4.

Table 8-4 TTM measures within the construction model

TTM measures	Justification
Restrictions on access (permitted, permitted with restriction, restricted routes)	Considered within the construction model. No fully permitted with restriction or restricted routes are contained within the model.
Anticipated temporary speed limits	The detailed speed limits for each specific sections of the road network are considered within the model.
Carriageway and slip road closures	As these are required overnight (21:00 to 05:00), these have not been accounted for in the model which only looks at the AM peak hour (07:30-08:30).
Narrow running lanes on operating lanes	Lane widths for narrow lanes would be designed at a later stage of the Outline Traffic Management Plan (TR010065/APP/7.6) and would be finalised in the

	Traffic Management Plan and have therefore not been included in the construction model
Diversion routes	Not included within the model as the diversions are mainly required for overnight movements which the model does not cover

~~11.5~~8.5 Forecast network performance

~~11.5.1~~8.5.1 The following sections present how the highway network is forecast to operate as a result of construction activity associated with the Scheme.

~~11.5.2~~8.5.2 Modelling has been undertaken using the operational model for the purposes of assessing the performance of the network along the route of the Scheme with the additional construction traffic. Details of the operational model development process are included in Section 8.4 above.

Overarching network performance

~~11.5.3~~8.5.3 Network performance statistics have been extracted from the operational model to show how the network is forecast to change as a result of construction activity associated with the Scheme. The results of the construction assessment are presented in Table 8-5.

~~11.5.4~~8.5.4 This analysis broadly indicates there is forecast to be a minimal increase in the number of vehicles on the network as a result of construction activity. However, given that the network is forecast to be heavily congested in the DM scenario, this relatively small increase in additional traffic is likely to further increase delay and congestion on the network. Whilst overall network performance is forecast to deteriorate as a result of construction activity, it should be emphasised that this would be for a relatively short period of time (up to six months) and is crucial for the delivery of the Scheme and the longer term benefits that it brings.

Table 8-5 Comparison of AM peak network performance in 2028 with and without construction activity

Measure	DM	DM + Construction	% Change
Average delay (s)	60	83	38%
Average number of stops	3	6	110%
Average network speed (mph)	40	36	-10%
Average stopped delay (s)	16	21	35%
Total distance travelled (mi)	45,383	73,946	63%
Total travel time (h)	1,125	1,266	13%
Total delay (h)	216	305	41%
Total number of stops	34,457	74,139	115%
Total stopped delay (h)	57	78	38%

Measure	DM	DM + Construction	% Change
Remaining vehicles in network	1,201	1,356	13%
Processed vehicles	11,726	11,855	1%
Latent demand delay (m)	28	41	48%
Latent Demand (vehs)	1	0	-

Source: Analysis of operational model

~~11.5.5~~8.5.5 There is a forecast to be a minimal increase in the number of vehicles on the network as a result of construction activity. Traffic flows are forecast to increase from around 12,900 vehicles to around 13,200 vehicles (sum of processed vehicles and remaining vehicles in network), which equates to a 2% increase compared to the DM.

~~11.5.6~~8.5.6 The proportion of vehicles remaining in the network is forecast to remain broadly consistent at around 9% in the DM scenario and around 10% in the construction scenario, showing that there is forecast to be a relatively high level of congestion in the network even without the relatively small increase in traffic associated with construction activity.

~~11.5.7~~8.5.7 Latent demand which represents the number of vehicles that were not able to enter the network due to constraints on the network is forecast to reduce from one vehicle in the DM to no vehicles in the construction scenario. This indicates that all vehicles are forecast to be able to access the network even with the additional construction traffic associated with the Scheme.

Journey times

~~11.5.8~~8.5.8 Forecast journey times for the weekday AM peak have been extracted from the operational model to show how journey times are forecast to change across the Scheme extents as a result of construction activity associated with the Scheme.

~~11.5.9~~8.5.9 Journey times have been extracted for the A46 between Lodge Lane (south of Farndon roundabout) and Brough Lane (north of Winthorpe roundabout), and for the A617 between Ollerton Road and Drive Lane. Table 8-6 compares the journey times across the Scheme extents with and without the proposed construction activity.

~~11.5.10~~8.5.10 This analysis broadly indicates that there are forecast to be increases in journey times on both the A46 and A617 in both directions as result of construction activity associated with the Scheme.

Table 8-6: Comparison of AM peak journey times in 2028 with and without construction activity (hh:mm:ss)

	DM	DM + Construction	Change	% Change
A46 NB	00:12:57	00:13:39	00:00:42	5%
A46	00:13:06	00:15:34	00:02:28	19%

	DM	DM + Construction	Change	% Change
SB				
A617 EB	00:08:39	00:09:41	00:01:02	12%
A617 WB	00:08:44	00:10:42	00:01:59	23%

Source: Analysis of operational model

~~11.5.11~~8.5.11 The largest increase in journey time is forecast to be on the A46 in the southbound direction, where journey times are forecast to increase from around 13 minutes to over 15 minutes, an increase of around 19%. Journey times on the A617 in the westbound direction are also forecast to increase by around two minutes, from almost nine minutes to almost 11 minutes, an increase of around 23%.

Junction performance

~~11.5.11.1~~Summary

~~11.5.12~~8.5.12 A summary of the construction modelling undertaken in this section is provided in Table 8-7. Detailed information relating to the performance of each junction can be found in the sections below.

~~11.5.13~~8.5.13 This analysis indicates that there is forecast to be no material change in the performance of the Farndon, Brownhills, Friendly Farmer and Winthorpe roundabouts as a result of the proposed construction activity. There is forecast to be a small impact on performance of the Cattle Market roundabout as a result of the construction activity, however overall, this junction is not forecast to operate over capacity.

Table 8-7: Summary of Level of Service in 2028 AM peak construction assessments

Junction	Overall LoS		Summary of assessment
	DM	DM + Con	
Farndon	A	A	Junction operating well within capacity
Cattle Market	D	E	Junction forecast to operate at capacity
Brownhills	B	B	Junction operating well within capacity
Friendly Farmer	B	B	Junction operating well within capacity
Winthorpe	A	A	Junction operating well within capacity

Source: Analysis of operational model

~~11.5.13.1~~Farndon roundabout

~~11.5.14~~8.5.14The results for the construction assessment undertaken for the Farndon roundabout are summarised in Table 8-8.

Table 8-8: Comparison of junction performance for Farndon junction (2028 AM peak construction assessment)

Arm	Movement	DM				DM + Construction			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A46 (N)	A46 (North) to Fosse Road	74	A	7	126	79	A	7	119
	A46 (North) to Farndon Road	88	A	7	126	87	A	7	119
	A46 (North) to A46 (South)	1,060	A	7	126	1,043	A	7	119
Farndon Road	Farndon Road to Fosse Road	121	A	1	27	121	A	1	23
	Farndon Road to A46 (North)	70	A	1	27	69	A	1	23
	Farndon Road to A46 (South)	92	A	1	27	92	A	1	23
A46 (S)	A46 (South) to Fosse Road	7	A	8	125	9	A	10	134
	A46 (South) to A46 (North)	1,003	A	8	125	1,057	A	10	134
	A46 (South) to Farndon Road	321	A	8	125	325	A	10	134
Fosse Road	Fosse Road to A46 (North)	59	A	1	22	61	A	1	25
	Fosse Road to Farndon Road	118	A	1	22	117	A	1	25
	Fosse Road to A46 (South)	4	B	1	22	6	B	1	25
Overall	**Farndon_Total**	**3,016**	**A**			**3,067**	**A**		

Source: Analysis of operational model

~~11.5.15~~8.5.15The analysis indicates that the junction is forecast to continue to operate well within capacity, with an overall LOS of A, in the weekday AM peak hour even with the additional construction traffic.

~~11.5.15.1~~Cattle Market roundabout

~~11.5.16~~8.5.16The results for the construction assessment undertaken for the Cattle Market roundabout are summarised in Table 8-9 below.

Table 8-9: Comparison of junction performance for Cattle Market junction (2028 AM peak construction assessment)

Arm	Movement	DM				DM + Construction			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A616 Great North Rd (N)	Great North Road (North) to A46 (South)	296	D	80	321	282	E	283	602
	Great North Road (North) to Kelham Road	14	D	80	321	12	E	283	602
	Great North Road (North) to A46 (North)	71	E	80	321	70	E	283	602
	Great North Road (North) to Great North Road (South)	178	E	80	321	170	F	283	602
A46 (N)	A46 (North) to A46 (South)	781	E	80	556	775	F	533	1,155
	A46 (North) to Kelham Road	304	E	80	556	305	F	533	1,155
	A46 (North) to Great North Road (North)	88	E	80	556	90	F	533	1,155
	A46 (North) to Great North Road (South)	43	E	80	556	77	F	533	1,155
B6326 Great North Rd (S)	Great North Road (South) to A46 (South)	82	C	48	317	89	D	46	148
	Great North Road (South) to Kelham Road	166	C	48	317	169	D	46	148
	Great North Road (South) to Great North Road (North)	181	D	48	317	184	E	46	148
	Great North Road (South) to A46 (North)	58	D	48	317	86	E	46	148
A46 (S)	A46 (South) to Kelham Road	82	D	45	394	90	D	61	368
	A46 (South) to Great North Road (North)	208	D	45	394	207	D	61	368
	A46 (South) to A46 (North)	784	D	45	394	795	D	61	368
	A46 (South) to Great North Road (South)	55	D	45	394	89	E	61	368
A617 Kelham Rd	Kelham Road to A46 (South)	69	E	48	270	72	F	145	473
	Kelham Road to Great North Road (North)	20	C	48	270	20	E	145	473
	Kelham Road to A46 (North)	352	D	48	270	353	E	145	473
	Kelham Road to Great North Road (South)	262	E	48	270	257	F	145	473
Overall	**Cattle Market_Total**	**4,093**	**D**			**4,190**	**E**		

Source: Analysis of operational model

~~11.5.17~~8.5.17The analysis indicates that whilst the junction is forecast to operate within capacity in the 2028 DM scenario, with an overall LOS of D, multiple individual movements at the junction are forecast to operate at capacity, with a LOS of E. As a result of the forecast construction activity, the junction is forecast to operate at capacity, with an overall LOS of E in the weekday AM peak hour, with some individual movements forecast to operate over capacity, with a LOS of F.

~~11.5.18~~8.5.18 It should be emphasised that the junction would already be operating close to capacity in the DM scenario and that the construction period, the peak of which would last for a relatively short period of time (up to six months), is crucial for the delivery of the Scheme and the longer-term benefits that it brings.

~~11.5.18.1~~ Brownhills roundabout

~~11.5.19~~8.5.19 The results for the construction assessment undertaken for the Brownhills roundabout are summarised in Table 8-10 below.

Table 8-10: Comparison of junction performance for Brownhills junction (2028 AM peak construction assessment)

Arm	Movement	DM				DM + Construction			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A1 Link	A1 (North) to A46 (South)	48	C	14	136	47	D	16	148
	A1 (North) to A46 (North)	481	C	14	136	479	C	16	148
	A1 (North) to Lincoln Road (South)	102	C	14	136	101	C	16	148
A46 (E)	A46 (North) to A46 (South)	1,065	A	2	56	1,111	A	2	52
	A46 (North) to A1 (North)	217	A	2	56	216	A	2	52
	A46 (North) to Lincoln Road (South)	670	A	1	59	677	A	1	57
B6166 Lincoln Road	Lincoln Road (South) to A46 (South)	121	B	7	82	125	B	11	112
	Lincoln Road (South) to A1 (North)	95	C	11	80	96	C	16	111
	Lincoln Road (South) to A46 (North)	438	C	11	80	447	C	16	111
A46 (W)	A46 (South) to A1 (North)	62	A	15	310	61	A	18	384
	A46 (South) to A46 (North)	1,087	C	28	309	1,112	C	33	384
	A46 (South) to Lincoln Road (South)	100	C	28	309	112	C	33	384
Overall	**Brownhills_Total**	**4,487**	**B**			**4,585**	**B**		

Source: Analysis of operational model

The analysis indicates that the junction is forecast to continue to operate well within capacity, with an overall LOS of B, in the weekday AM peak hour of 2028 even with the additional construction traffic.

~~11.5.19.1~~Friendly Farmer roundabout

~~11.5.20~~8.5.20The results for the construction assessment undertaken for the Friendly Farmer roundabout are summarised in Table 8-11 below.

Table 8-11: Comparison of junction performance for Friendly Farmer junction (2028 AM peak construction assessment)

Arm	Movement	DM				DM + Construction			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A46 SB off-slip	A46 (North) to A46 (South)	1,336	B	23	177	1,375	C	33	227
	A46 (North) to A17	27	A	23	177	28	A	33	227
	A46 (North) to A1 (South)	357	A	23	177	357	A	33	227
A17	A17 to A46 (North)	394	C	14	83	395	D	18	92
	A17 to A46 (South)	28	D	14	83	27	D	18	92
	A17 to A1 (South)	27	A	7	83	27	A	10	93
A1 Link	A1 (South) to A46 (South)	226	D	89	249	231	E	126	262
	A1 (South) to A46 (North)	171	F	88	244	170	F	125	257
	A1 (South) to A17	100	E	88	244	101	E	125	257
Friendly Farmer Link	A46 (South) to A46 (North)	1,603	A	0	44	1,635	A	0	28
	A46 (South) to A17	235	A	0	21	234	A	0	26
	A46 (South) to A1 (South)	170	A	0	21	166	A	0	26
Overall	**Friendly Farmer_Total**	**4,671**	**B**			**4,746**	**B**		

Source: Analysis of operational model

~~11.5.21~~8.5.21The movement from the A1 (south) to A46 (south) is forecast to go from a LOS of D to a LOS of E, indicating that this one movement at the junction is forecast to operate at capacity as a result of the construction activity. However, overall the analysis indicates that the junction is forecast to continue to operate well within capacity, with an overall LOS of B, in the weekday AM peak hour of 2028 even with the additional construction traffic.

~~11.5.21.1~~Winthorpe roundabout

~~11.5.22~~8.5.22The results for the construction assessment undertaken for the Winthorpe roundabout are summarised in Table 8-12 below.

Table 8-12: Comparison of junction performance for Winthorpe junction (2028 AM peak construction assessment)

Arm	Movement	DM				DM + Construction			
		Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)	Total Flow (vehs)	LOS (A-F)	Mean Queue (m)	Max Queue (m)
A46 (N)	A46 (North) to A46 (South) - Old	1,428	A	10	102	1,465	A	13	134
	A46 (North) to A1133	3	A	10	102	5	A	13	134
	A46 (North) to Drove Lane	86	A	10	102	89	A	13	134
Drove Lane	Drove Lane to A46 (South) - Old	7	A	0	24	8	A	0	21
	Drove Lane to A1133	33	B	0	24	33	B	0	21
	Drove Lane to A46 (North)	78	A	0	24	79	A	0	21
A46 (S)	A46 (South) - Old to A1133	205	A	18	148	210	A	24	172
	A46 (South) - Old to A46 (North)	1,572	A	18	148	1,590	A	24	172
	A46 (South) - Old to Drove Lane	18	A	18	148	24	A	24	172
A1133	A1133 to A46 (South) - Old	289	D	30	160	289	D	27	128
	A1133 to A46 (North)	3	D	30	160	5	E	27	128
	A1133 to Drove Lane	101	D	30	160	103	D	27	128
Overall	**Winthorpe_Total**	**3,823**	**A**			**3,899**	**A**		

Source: Analysis of operational model

~~11.5.23~~8.5.23The movement from the A113 to A46 (north) is forecast to go from a LOS of D to a LOS of E, indicating that this one movement at the junction is forecast to operate at capacity as a result of the construction activity. However, overall the analysis indicates that the junction is forecast to continue to operate well within capacity, with an overall LOS of A, in the weekday AM peak hour of 2028 even with the additional construction traffic.

~~11.5.23.1~~Summary

~~11.5.24~~8.5.24 An operational model has been developed to assess the impact of construction activity associated with the Scheme on the strategic and local road network in 2028.

~~11.5.25~~8.5.25 This analysis indicates that there is forecast to be no material change in the performance of the Farndon, Brownhills, Friendly Farmer and Winthorpe roundabouts as a result of the proposed construction activity. There is forecast to be a small impact on performance of the Cattle Market roundabout as a result of the construction activity, however overall this junction is not forecast to operate over capacity.

~~11.5.26~~8.5.26 As a result of the forecast construction activity, the Cattle Market junction is forecast to operate at capacity. It should be emphasised that the junction would already be operating close to capacity in the DM scenario and that the construction period, the peak of which would last for a relatively short period of time (up to six months), is crucial for the delivery of the Scheme and the longer-term benefits that it brings.

~~12~~9 Summary and conclusions

~~12.1~~9.1 Introduction

~~12.1.1~~9.1.1 This TA has assessed the impact of the Scheme on the strategic and local highway network, road safety and local sustainable modes of transport.

~~12.2~~9.2 Scheme description

~~12.2.1~~9.2.1 The section of the existing A46 that would be upgraded is approximately 6.5 kilometres in length. The Scheme comprises on-line widening for the majority of its length between Farndon roundabout and the A1. A new section of offline dual carriageway would be provided between the western and eastern sides of the A1 before the new dual carriageway ties into the existing A46 to the west of Winthorpe roundabout.

~~12.3~~9.3 Planning context

National planning policy

~~12.3.1~~9.3.1 The 2015 and 2024 NPSNN highlights the importance of the national road network and that responding to economic and traffic growth are the key drivers for its development.

~~12.3.2~~9.3.2 The Scheme is also consistent with the core planning principles laid out in the NPPF and supports local and regional planning policy and guidance.

~~12.3.3~~9.3.3 In this aspect the Scheme is wholly aligned with national policy. The Scheme is intended to alleviate congestion and accommodate future traffic growth, and contribute to increased economic growth, both regionally and nationally.

Regional & Local planning policy

~~12.3.4~~9.3.4 Regional and local planning policy recognises the A46 as a crucial piece of local infrastructure whilst highlighting that the A46 currently suffers from congestion which is placing a constraint on local growth.

~~12.3.5~~9.3.5 The Scheme would alleviate congestion and provide increased capacity for both local and strategic traffic, unlocking growth at local, regional and national level.

~~12.3.6~~9.3.6 The Scheme would be a key part of regional and local planning policy that delivers against many local objectives.

~~12.4~~9.4 Road safety

~~12.4.1~~9.4.1 Network benefits arise from the upgrade of the single carriageway sections of the widened A46 to dual carriageway, and from some traffic reassigning onto the widened A46 from comparatively less safe local roads. Increases in traffic on some roads adjacent to the Scheme, such as the A17, are forecast to lead to some localised increases in accidents, although these are not of sufficient magnitude to outweigh benefits elsewhere.

~~12.4.2~~9.4.2 The overall accident results for the wider study area show that there would be an overall decrease in accidents over the 60-year assessment period when compared against a scenario in which the Scheme is not constructed. This corresponds with an overall net monetised benefit of £29.3 million (2010 prices, discounted to 2010).

~~12.5~~9.5 Current and future network performance

Current network performance

~~12.5.1~~9.5.1 Regional and local planning policy recognises the A46 as a crucial piece of local infrastructure whilst highlighting that the A46 currently suffers from congestion and this this is placing a constraint on local growth. The Scheme would alleviate congestion and provide increased capacity for both local and strategic traffic, unlocking growth at local, regional and national level.

~~12.5.2~~9.5.2 Base year journey times have been extracted from the operational model for the A46 between Lodge Lane (south of Farndon roundabout) and Brough Lane (north of Winthorpe roundabout), and for the A617 between Ollerton Road and Drove Lane. This indicates that on this section of the A46, peak hour journey times are around 12 to 19 minutes in each direction, while on the A617, peak hour journey times are around 8 to 12 minutes in each direction.

~~12.5.3~~9.5.3The operational model has been used to assess junction performance of the key junctions on the A46 corridor. This analysis indicates that the majority of junctions on this section of the A46 currently operate within capacity. The only exception is the Cattle Market roundabout which operates with a LOS of E, indicating that the junction is operating at capacity.

Future network performance

~~12.5.4~~9.5.4The overarching network statistics from the operational model indicate that in both 2028 and 2043, the network is able to accommodate substantially more traffic as a result of the Scheme. It also reduces average delays and number of times each vehicle has to stop, which is indicative of more free-flowing conditions.

~~12.5.5~~9.5.5Analysis of journey times from the operational model indicate that the Scheme is likely to result in improvements to journey times on the A46 in both directions between Lodge Lane (south of Farndon roundabout) and Brough Lane (north of Winthorpe roundabout) in both 2028 and 2043. In 2043 there are forecast to be journey time savings of around seven minutes in each direction in the weekday PM peak as a result of the Scheme.

~~12.5.6~~9.5.6A comparison of junction performance, with and without the Scheme, indicates that the Cattle Market roundabout is forecast to experience a substantial level of improvement as a result of the Scheme in both 2028 and 2043. All other junctions are forecast to continue to operate well within capacity in the same assessment years.

~~12.6~~9.6Sustainable transport

~~12.6.1~~9.6.1A WCHAR has been undertaken to consider the impacts of the Scheme on walking, cycling and horse-riding facilities. The Scheme would include some diversions to local routes, but there are also opportunities to improve conditions for WCH’s through the provision of new routes and improved crossings.

~~12.6.2~~9.6.2A number of primary design improvements have been made to the Scheme. New at-grade crossing points would be provided on the A46 at the Brownhills and Winthorpe junctions and a new combined footway/cycleway would be provided between the junctions in order to provide improved connectivity to the village of Winthorpe and Newark

Showground. The Scheme also includes a new crossing to the west of the Friendly Farmer roundabout in order to reduce severance.

~~12.6.3~~9.6.3 The Principal Contractor would consult with the relevant local authorities to identify, agree, implement and manage appropriate measures within the Order Limits for WCH routes affected by construction phase.

~~12.6.4~~9.6.4 In terms of the impact of the Scheme on public transport, it is considered unlikely to affect rail stations or rail services. The main impacts of the Scheme on local bus services are related to the potential temporary route diversions or suspensions during the construction phase. Once operational, the Scheme would not sever communities or adversely impact the existing bus service provision.

~~12.6.5~~9.6.5 The Principal Contractor would liaise with bus operators and Nottinghamshire County Council (NCC) to determine if any measures are needed to maintain existing bus routes and to minimise the impact of construction on punctuality.

~~12.7~~9.7 Construction impact assessment

~~12.7.1~~9.7.1 An operational model has been developed to assess the impact of construction activity associated with the Scheme on the strategic and local road network.

~~12.7.2~~9.7.2 This analysis indicates that there is forecast to be no material change in the performance of the Farndon, Brownhills, Friendly Farmer and Winthorpe roundabouts as a result of the proposed construction activity. There is forecast to be a small impact on performance of the Cattle Market roundabout as a result of the construction activity, however overall this junction is not forecast to operate over capacity.

~~12.7.3~~9.7.3 As a result of the forecast construction activity, the Cattle Market roundabout is forecast to operate at capacity. It should be emphasised that the junction would already be operating close to capacity in the Do Minimum (DM) scenario and that the construction period, the peak of which would last for a relatively short period of time (up to six months), is crucial for the delivery of the Scheme and the longer-term benefits that it brings.

~~12.8~~9.8 Conclusions

~~12.8.1~~9.8.1 The A46 through Newark-on-Trent is already heavily congested at peak times and without improvement, congestion on the A46 would become increasingly worse.

~~12.8.2~~9.8.2 The TA identifies that the Scheme would alleviate the existing and potential future issues with congestion on the section of the A46 through Newark-on-Trent, help to improve highway safety, reduce journey times and create additional capacity to support future growth.

~~13~~10 Glossary

Abbreviation	Definition
AADT	Average Annual Daily Traffic
AADF	The average over a full year of the number of vehicles passing a point in the road network each day
AoDM	Area of Detailed Modelling
ATC	Automatic Traffic Count
COBALT	Cost and Benefits to Accidents Light Touch software
ComMA	Combined Modelling and Appraisal
CWTAP	Construction Workforce Travel and Accommodation Plan
D2N2	Derby, Derbyshire, Nottingham, Nottinghamshire Local Enterprise Partnership (LEP).
DCO	Development Consent Order
DfT	Department for Transport
DM	Do Minimum (i.e. without scheme)
DMRB	Design Manual for Road and Bridges
DPD	Development Plan Document
DS	Do Something (i.e. with scheme)
FMA	Fully Modelled Area
HAM	Highway Assignment Model
HGV	Heavy Goods Vehicle (also referred to as OGV1/OGV2)
LDF	Local Development Framework
LGV	Light Goods Vehicle
LOS	Level of Service
LTP	Local Transport Plan
MCC	Manual Classified Counts
MRTM	Midland Regional Transport Model
NCC	Nottinghamshire County Council
NCN	National Cycling Network
NPSNN	National Policy Statement for National Networks
NPPF	National Planning Policy Framework
NSDC	Newark and Sherwood District Council
NTEM	National Trip End Model
OBG	Office for Budget Responsibility
OTMP	Outline Traffic Management Plan
PCF	National Highways Project Control Framework
PIA	Personal Injury Accident
PRoW	Public Right of Way
RIS	Road Investment Strategy
RSA	Road Safety Audit
RSA1	Stage 1 Road Safety Audit
RTM	Regional Transport Model
SLR	Southern Link Road
SoCC	Statement of Community Consultation
SPD	Supplementary Planning Document
SRN	Strategic Road Network

Abbreviation	Definition
STATS19	Road Accident Dataset
TA	Transport Assessment
TAG	Transport Analysis Guidance
TDP	Transport Decarbonisation Plan
TEMPRO	Trip End Model Presentation Programme software
TfEM	Transport for the East Midlands
TIS	National Highways
TPSRTM2	Trans-Pennine South Regional Transport Model
TRO	Traffic Regulation Order
TTM	Temporary Traffic Management
VDM	Variable Demand Model
WCH	Walking, Cycling and Horse-riding
WCHAR	Walking, Cycling and Horse-Riding Assessment
WebTAG	Web based Traffic Appraisal Guidance
WebTRIS	National Highways Traffic Information System

Appendices

Appendix A: Combined Modelling and Appraisal (ComMA) Report

Contents

1 Introduction

1.1 Document Purpose

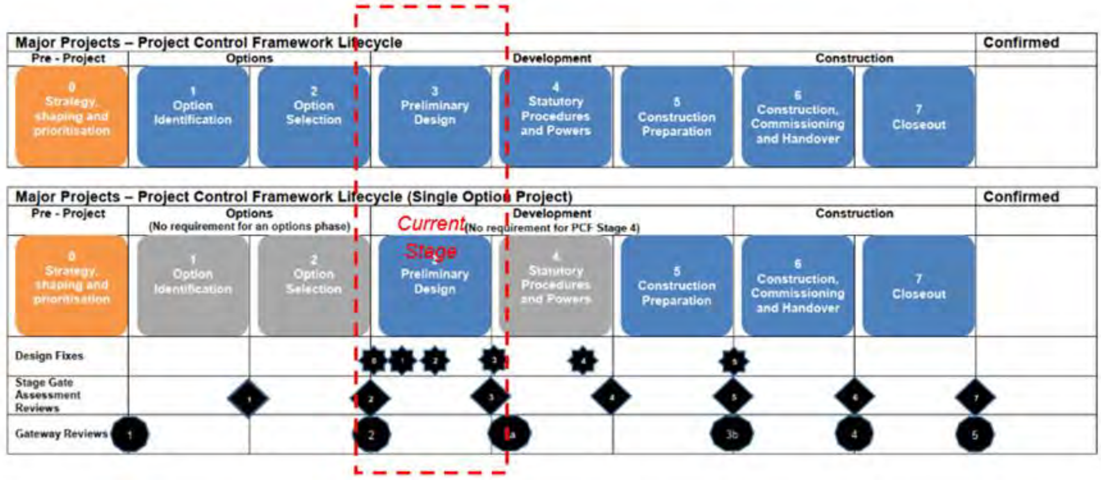
1.1.1 The purpose of the Combined Modelling and Appraisal (ComMA) Report is to inform decision makers and stakeholders on how the evidence underpinning the business case has been developed from the initial identification of the underlying problem through the collection of data and the production of any supporting traffic models and the forecasts impacts of the scheme on traffic to the eventual economic appraisal. The ComMA Report addresses how the analytic requirements set out within the Analytical Requirements Report (ARR), have been met through the approaches laid out in the Appraisal specification Repot (ASR).

1.1.2 The project control framework (PCF) referred to throughout this document is a joint Department for Transport (DfT) and Highways England approach to managing major projects. It comprises of a standard project lifecycle, standard project deliverables, project control processes, and governance arrangements. The framework is not just for project managers within Highways England's major projects directorate. It is for everyone involved in developing and delivering a major road project. This includes DfT, other Highways England directorates and their suppliers.

1.1.3 The ComMA Report summarises all of the transport modelling and appraisal carried out by Skanska Mott MacDonald in Project Control Framework (PCF) Stage 3 (Preliminary Design) for the appraisal of the A46 Newark Bypass scheme.

1.1.4 The approach to traffic modelling and appraisal summarised in this report will support the delivery of the scheme through the Development phase of the major project lifecycle including preliminary design, statutory procedures, and construction preparation, as illustrated in Figure 1-1.

Figure 1-1: The National Highways Project Control Framework Lifecycle



1.1.5 At the preliminary design stage, the traffic model will help inform the design of the scheme and will be used to determine the Value for Money which will be presented in the Business Case. The traffic forecasts and operational assessments will underpin the traffic related elements of the planning submission through the Development Consent Order (DCO) process. This information will be presented in the Environmental Statement, which covers the environmental impacts e.g. noise, air quality and greenhouse gas impacts; and the impact of traffic on the operation and performance of the highway network. As such it is critical that the approach to modelling and appraisal follows guidance and is capable of standing up to scrutiny through both the business case and planning process so that the funds and powers to deliver the scheme are secured.

1.1.6 The economic appraisal detailed within the ComMA will assist decision makes in ensuring that value for public money is achieved.

1.2 Analytical Requirements

1.2.1 The Analytical Requirements Report (ARR) produced at the end of PCF Stage 2 set out the requirements for the analysis to be undertaken within Stage 3. The modelling and appraisal requirements for the Scheme evolved through the course of Stage 3 in agreement with National Highways and a summary of these is presented in Table 1-1 and Table 1-2.

Table 1-1: Summary of Modelling Requirements

Requirement	**Stage 3**
Data Collection	**Count data collected July 2022**
Model Type	SATURN, strategic
VDM	Yes, DIADEM
Appraisal Period	60 Years
Growth scenarios/sensitivity tests	Core, High Economy, Low Economy
Modelled Years	2019 base, 2028 opening year, 2043 design year, 2061

Data Collection	Count data collected July 2022
	horizon year
Modelled Time Periods	AM, IP and PM
Vehicle types and trip purposes	Car – Business, commute, other. LGV, OGV1 and OGV2
Primary Reporting	ASR, Benefits Register, ComMA, Standard PCF packages etc
Alternative Model Assessment	No
Operational modelling	Yes - Vissim
Additional Analysis	Resilience

Table 1-2: Summary of Appraisal Requirements

Requirement	Stage 3
Journey Times Savings	**TUBA, Monetised**
Vehicle Operating Costs	TUBA, Monetised
Accident Analysis	COBALT, Monetised,
Construction and Maintenance	QUADRO, Monetised
Reliability	TAG Urban Roads approach, Monetised
Wider Economic Impacts	WITA, Monetised
Noise	Noise modelling
Air Quality	AQ Modelling
Greenhouse Gases	Chief Analyst Carbon Valuation Toolkit

1.3 Quality assurance

1.3.1 To ensure that First and Second Lines of Assurance expectations, as set out in the National Highways Analytic Assurance Framework, are met, rigorous checking and approval has been carried out throughout the traffic modelling and appraisal process.

1.3.2 The approach to assuring quality in the modelling and appraisal work aligns with National Highways' requirements, and Traffic Modelling Best Practice Guidelines set out within Mott MacDonald were followed.

1.4 Layout of Report

1.4.1 Following on from this introduction the structure of the report is as follows:

- Section 2 provides further details of the project and its development to date.
- Section 3 presents the local transport situation
- Section 4 presents a summary of the key projects impacts and benefits.
- Sections 5, 6 and 7 describe the available existing traffic models and traffic data that could support this project, detail the further data collection exercise carried out and present the final datasets.
- Sections 8, 9 and 10 present the development, calibration and validation of the traffic model.
- Sections 11 and 12 present the forecasting assumptions and the future year forecasts.

- Section 13 and 14 present the approach to economic appraisal and the results of the appraisal.
- Section 15 presents the results of sensitivity testing.
- Section 16 describes the development of the operational model used to undertake a detailed operational assessment of the scheme.

1.4.2 The Data Annex is provided in Section 17.

2 Project Definition

2.1 Introduction

2.1.1 This section provides an overview of the proposed A46 Newark Bypass scheme. This includes details of the scheme design, an outline of the need for the scheme, the scheme objectives and the history of the development of the scheme.

2.2 Description of the scheme

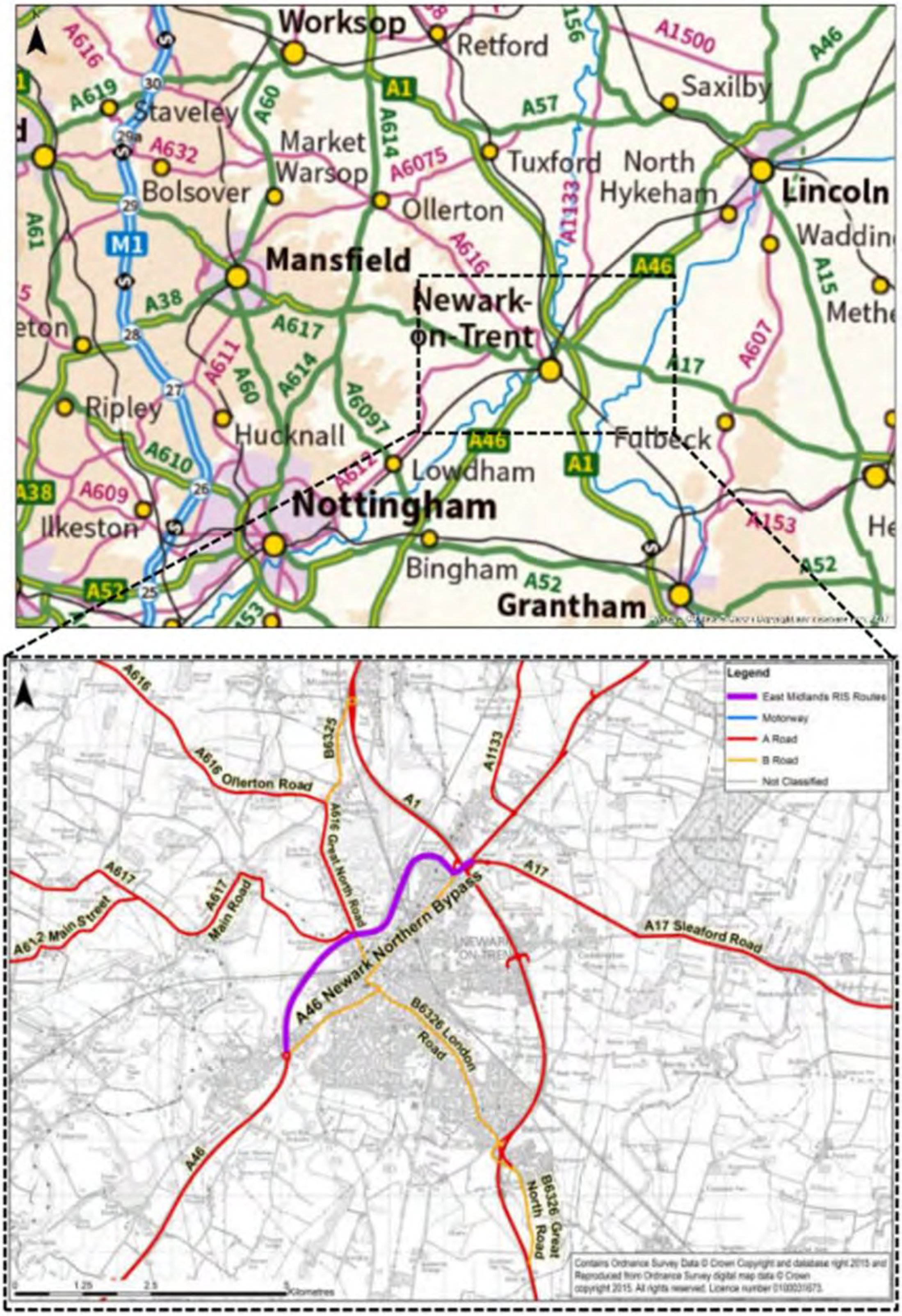
2.2.1 The A46 Newark Bypass scheme covers part of the A46 corridor, which plays a critical role within the Strategic Road Network (SRN), connecting major manufacturing clusters in the Midlands with the Port of Bristol, the Humber Ports and South Wales.

2.2.2 The scheme has been announced as part of the second Roads Investment Strategy (2020-2025), to improve the A46 'Trans-Midland Trade Corridor' between the M5 and the Humber Ports. Much of the A46 is already high-quality dual carriageway and the section past Newark-on-Trent is one of the remaining sections of single carriageway on the route.

2.2.3 As illustrated in Figure 2-1 below, the A46 Newark Bypass scheme focuses on a section of the A46, approximately 6km in length, which passes the western and northern extents of Newark-on-Trent, Nottinghamshire between Farndon roundabout and Winthorpe roundabout. The section links the A46 with other routes on the SRN, as well as the local road network.

2.2.4 The aim of the scheme is to increase capacity and reduce traffic congestion on the A46 in the vicinity of Newark, improve connectivity from Lincolnshire to the national motorway network, and improve route standard consistency for the A46.

Figure 2-1: Strategic and local geographical context



2.3 Scheme Objectives

2.3.1 The main objectives for the scheme identified at PCF Stage 2 have been reviewed, revised and refined through a series of PCF Stage 3 Value Management (VM) Workshops. Three VM workshops were held in total and were attended by representatives from National Highways including the project team, Operations, Environment and Safety, Skanska, Jacobs and Mott MacDonald.

2.3.2 The outcome of the VM process reduced the number of objectives from ten at PCF Stage 2 down to five at PCF Stage 3, in order to make them specific, measurable and achievable. The confirmed PCF Stage 3 objectives are:

- Safety:
  - Improving safety through scheme design to reduce collisions for all users of the A46 Scheme
- Congestion:
  - Improve journey time and journey time reliability along the A46 and its junctions between Farndon and Winthorpe, including all approaches and A1 slip roads
- Connectivity
  - Accommodate economic growth in Newark and the wider area by improving its strategic and local connectivity
- Environment:
  - Deliver better environmental outcomes by achieving a net gain in biodiversity, and improve noise levels at Noise Important Areas along the A46 between Farndon and Winthorpe junctions
  - Customer:
    - Build an inclusive scheme which improves facilities for cyclists, walkers and other vulnerable users where existing routes are affected

2.4 Summary of previous work

2.4.1 Proposals for the improvement of the A46 Newark Bypass have been the subject of extensive study.

PCF Stage 0 and 1

2.4.2 During PCF Stage 0 and 1, two Design fixes were incorporated into the design development process:

- Design Fix A – Corridor identification and initial sifting of corridors

- Design Fix B – Design development, assessment and sifting of individual route and junction options within those corridors passing the Design Fix A gateway

PCF Stage 1 Design Fix A

2.4.3 During Design Fix A, a qualitative assessment was undertaken to determine the degree of fit of five selected corridors. These included four offline options (separate from the existing A46) and one option to widen the existing route.

2.4.4 The corridor assessment led to the conclusion that the four offline corridors could be sifted out on cost, environmental and transport economic grounds leaving Option C which largely following the existing A46 alignment from Farndon junction through to Winthorpe junction and provided the most direct option.

PCF Stage 1 Design Fix B

2.4.5 This corridor option was passed through for further assessment at Design Fix B, which considered the following:

- The development of route and junction options within the shortlisted corridor
- The assessment and sifting of route and junction options
- Recommendations for the combinations of route and junction options to be taken forward for further assessment

2.4.6 Three route options were considered, Route Options 1A, 1B and 2. These developed alternative alignments for the bypass around Winthorpe, northeast of the A1/A46 junction. At this early stage, the focus for assessment was on the best route for delivering the benefits of the scheme. These options assumed grade separated junctions throughout the route to ensure assessment on a level playing field. Route Option 2 was discounted on environmental grounds and cost, noting that it did not provide additional benefits compared to Options 1A and 1B.

2.4.7 Once route options had been identified the next stage was to undertake further detailed work on the specific junction designs, looking at both grade-separated and at-grade junctions for each of the four junctions within the route:

- Farndon Roundabout
- Cattle Market Roundabout
- A1/A46 Junction (comprising the Brownhills and Friendly Farmer Roundabouts)
- Winthorpe Roundabout

2.4.8 Preliminary traffic modelling of options for the four junctions was undertaken to appraise operational performance. Taking into account different junction options a total of three options were identified, together with a sensitivity test (Option C). A brief overview of all options is included in Table 2-1.

Table 2-1: Options considered following route corridor selection

Scheme Option	Farndon	Cattle Market	A1/A46	Winthorpe	Hawton Lane
Option A	**Grade Separated**	**Grade Separated (combined)**	**Grade Separated**	**Grade Separated**	**No Change**
Option B	At-grade	At-grade	Grade Separated	At-grade (4 arm signalised)	No Change
Option C	Grade Separated	Grade Separated	Grade Separated	Grade Separated	New junction
Option D	At-grade signalised	Grade Separated	Grade Separated	At-grade (5 arm signalised)	No change

2.4.9 Further assessment towards the end of PCF Stage 1 concluded that while all options would provide benefit to this section of the A46, the forecast outturn estimate for Option A was significantly more expensive than Options B and D due to the additional construction but did not provide enough additional benefits to justify the increased cost. Option A also had greater environmental impacts, most notably at Farndon roundabout. It was therefore concluded that Option B and D should be taken forward to the options consultation in Stage 2. Option C was a sensitivity test, out of scope of the project, which was carried to understand the impact of the at-grade Newark Southern Link Road junction on a grade separated solution at Farndon.

PCF Stage 2 Option Selection

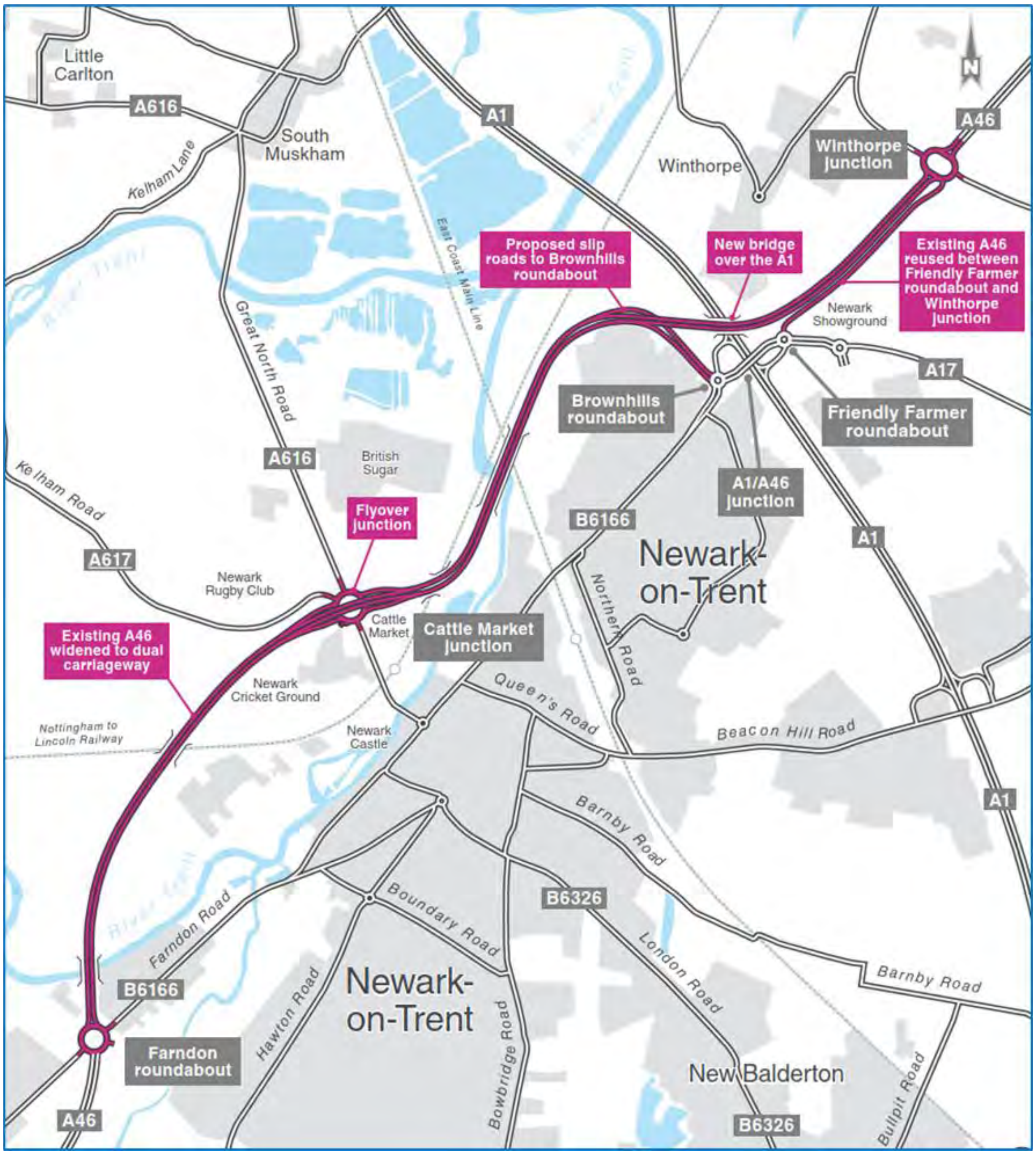
2.4.10 Options 1B and 1D were taken forward to public consultation. To simplify the consultation they were renamed Option 1 and Option 2. Two further options were identified as a result of comments from the public consultation:

- A hybrid of Options 1 and 2, which incorporated the Option 2 design for the two southern junctions and the Option 1 design for the two northern junctions.
- A modification of Option 2, running closer to the existing A46 and mitigating impacts on the village of Winthorpe, known as Option 2 Modified.

Preferred Route Announcement

2.4.11 Option 2 Modified was selected for publication towards the end of Stage 2 (Summer 2021). It was identified as the option which provided the best trade-off between the objectives of the scheme and providing the ability to mitigate the impacts on the local population close to Winthorpe and the impact on an area of cultural heritage. The arrangement for Option 2 Modified is shown in Figure 2-2.

Figure 2-2: Preferred Route Announcement Design (Option 2 Modified)



2.5 Design Development During PCF Stage 3

2.5.1 During PCF Stage 3 further design development was carried out, focusing on value engineering, the operational performance of the scheme junctions, and the reduction of stakeholder impacts, and culminated in Design Fix 3C. The subsequent transport modelling and economic appraisal at PCF Stage 3 is based on Design Fix 3C.

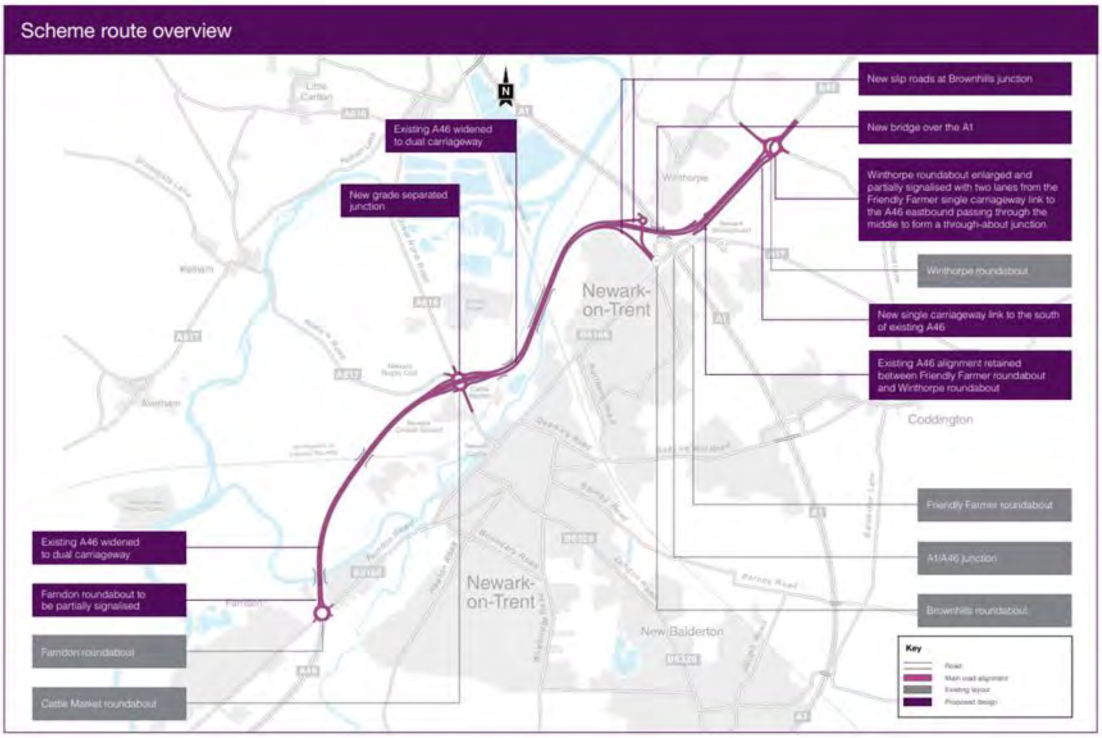
PCF Stage 3 Design Fix 3C

2.5.2 The Design Fix 3C design for the A46 Newark Bypass scheme includes the following elements:

- The scheme widens the existing 6.5km single carriageway A46 Newark Bypass to a dual carriageway, providing two lanes in each direction between Farndon and Winthorpe roundabouts.
- As well as the carriageway widening there will be a change to the junctions along the route, as listed below:
- Farndon Roundabout – Junction footprint remains the same as the PRA design but with signalisation of the A46 approach arms and some widening of the gyratory into the centre of the roundabout.
- Cattle Market Junction – New grade separated junction with the A46 elevated to pass over the roundabout. The existing roundabout is enlarged beneath to provide increased capacity.
- Brownhills roundabout – An eastbound exit and a westbound entry slip road are built between the existing Brownhills Roundabout and the new A46 carriageway. The roundabout footprint remains the same with the new slip roads tying into the existing Brownhills roundabout in the same place as the current A46 links.
- Friendly Farmer – The footprint of the existing roundabout remains the same, with the current A46 to Winthorpe arm forming the new Friendly Farmer Link Road.
- Winthorpe – Developed into a through-about layout, with the through link from the Friendly Farmer Link Road to the A46 NB. The existing roundabout is enlarged to accommodate this and signals are added to the A46 and Friendly Famer Link arms.

2.5.3 The scheme is shown below in Figure 2-3.

Figure 2-3: Scheme Design – Design Fix 3C



3 Local Transport Situation

3.1 The Local Transport Situation

3.1.1 The A46 plays a critical role within the Strategic Road Network (SRN), connecting major manufacturing clusters in the Midlands with the Port of Bristol, the Humber Ports and the South West and South Wales. As a transport corridor, the route creates both a physical and economic connection between these regions.

3.1.2 Much of the A46 is already high-quality dual carriageway and the section past Newark-on-Trent is one of the remaining sections of single carriageway on the route. The A46 Newark Bypass scheme focuses on this section of the A46. The bypass is surrounded on either side by previous improvements to the A46 to dual-carriageway standards, the most recent of these opening in 2012 between Newark and Widmerpool, south of Nottingham. However, the increased capacity these schemes have provided in terms of traffic flow on the A46 has amplified the pressures faced on the bypass section.

3.1.3 The single carriageway section is approximately 6km in length, which passes the western and northern extents of Newark-on-Trent, Nottinghamshire between Farndon roundabout and Winthorpe roundabout. The section links the A46 with other routes on the SRN, as well as the local road network.

3.1.4 Several roundabouts form key junctions along the route, linking with several local ‘A’ roads. The Farndon roundabout is located at the western extent of the route where the B6166 Farndon Road joins the A46. The Winthorpe junction is located at the eastern extent where the A1133 joins the A46. Along its route, it crosses A617 and B6326, at the Cattle Market junction, and A1 between the Friendly Farmer and Brownhills roundabouts.

3.1.5 Newark has two railway stations. The East Coast Main Line serves Newark North Gate railway station with links to London and north to Leeds, Hull, Newcastle upon Tyne and Edinburgh Waverley. Newark Castle railway station on the Leicester – Nottingham – Lincoln line provides cross-country regional links. The Lincoln to Nottingham railway line has an at-grade crossing with the East Coast Main Line, which constrains capacity. This is compounded by other level crossings with the local highway network and public.

3.1.6 The commercial bus network is largely localised on Newark, with limited and long journey times to centres such as Nottingham.

3.1.7 There are several active travel routes across the A46 at-grade or via underpass. These significantly impact on both users and the operation of the A46.

3.2 Key Demands

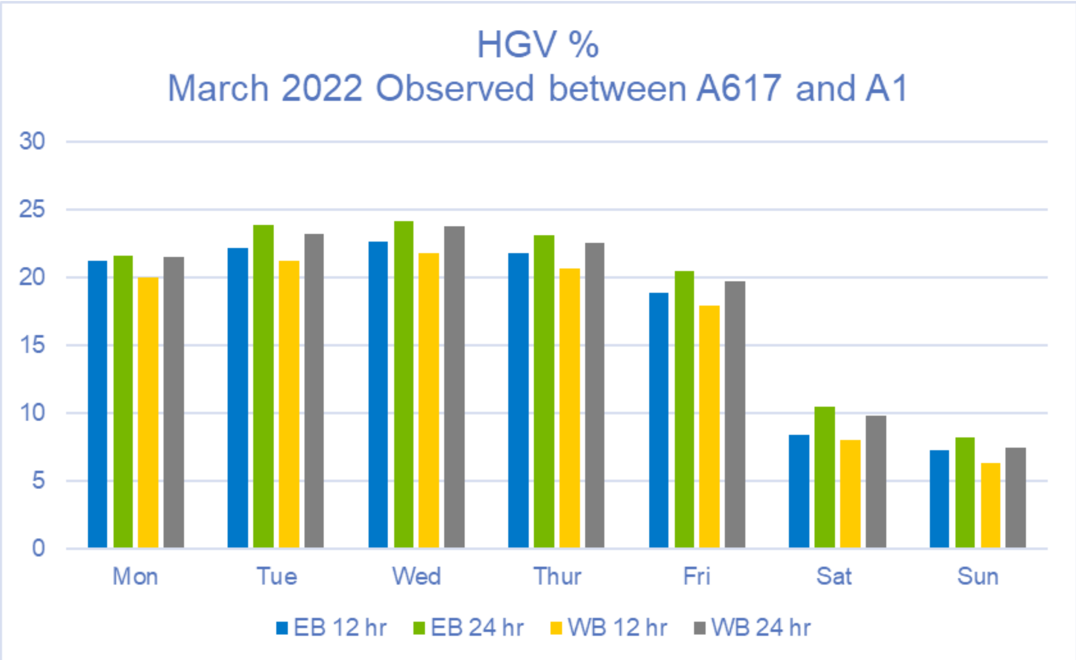
3.2.1 The A46 is used by long-distance traffic with a wide range of origin and destinations, as well as local traffic. The A46 also has a wider alternative link role for the M1 between the Midlands, Lincolnshire and the Humber. This diversionary role is particularly important in times of disruption especially on the M1 in the Nottinghamshire and South Yorkshire area.

3.2.2 An analysis of travel patterns indicates that a significant proportion of trips using this section of the A46 are for greater than 50km, reflecting the strategic nature of the route and the role it plays in regional, medium-length journeys.

3.2.3 This analysis also shows a range of movements. This reveals the scheme is part of a triangle of shorter, regional, and local distance journeys between Newark, Nottingham and Leicester. This is manifested in an examination of journey to work data for Newark where there are strong flows to and from Nottingham, Lincoln, Mansfield and Grantham.

3.2.4 Another key feature relates to the proportion of HGV vehicles, confirming the route is a key freight route. Based on March 2022 observed data, the proportion of HGV vehicles using the A46 from Monday to Thursday exceeds 20%, there is just under 20% on Friday and use falls to below 10% on Saturday and Sunday. This is shown in Figure 3-1. This is also reflected in traffic flows, which show less pronounced traffic peaks in the AM and PM in either direction illustrating a strong non-commuting demand for the route.

Figure 3-1: Proportion of HGV vehicles observed between A617 and A1



3.2.5 This is significantly higher than the average HGV% share on non-motorway SRN routes, which according to the Department for Transport's annual reporting data has remained approximately 10% over the last two decades. This 10% share is similar to certain other corridors which have a similar role and function such as, for example, the A303 in Wiltshire and Somerset.

3.3 Issues with existing arrangements

3.3.1 As a result of the A46 remaining at a single-carriageway standard, the following issues have arisen:

- Poor journey time reliability
- High level of low-speed shunts, as well as recorded accidents, which lead to lane closures on this single lane carriageway
- High traffic flows which exceed the design capacity and are expected to increase
- The lack of a grade separated junction at Cattle Market Junction is being compounded by queuing on the B6326 because of frequent rail level crossing downtimes
- Congestion on the A1/A46 Winthorpe Junction impacting on journey time reliability

3.3.2 Other related issues with existing arrangements:

- High proportion of freight traffic
- Limited alternative mode provision

Poor journey time reliability

3.3.3 An assessment of journey times shows some disparities in the AM, Interpeak and PM periods. These are likely to be more pronounced in the 2028 and 2043 periods if no further intervention is undertaken as shown in the Table 3-1.

Table 3-1: Predicted Average Journey Times

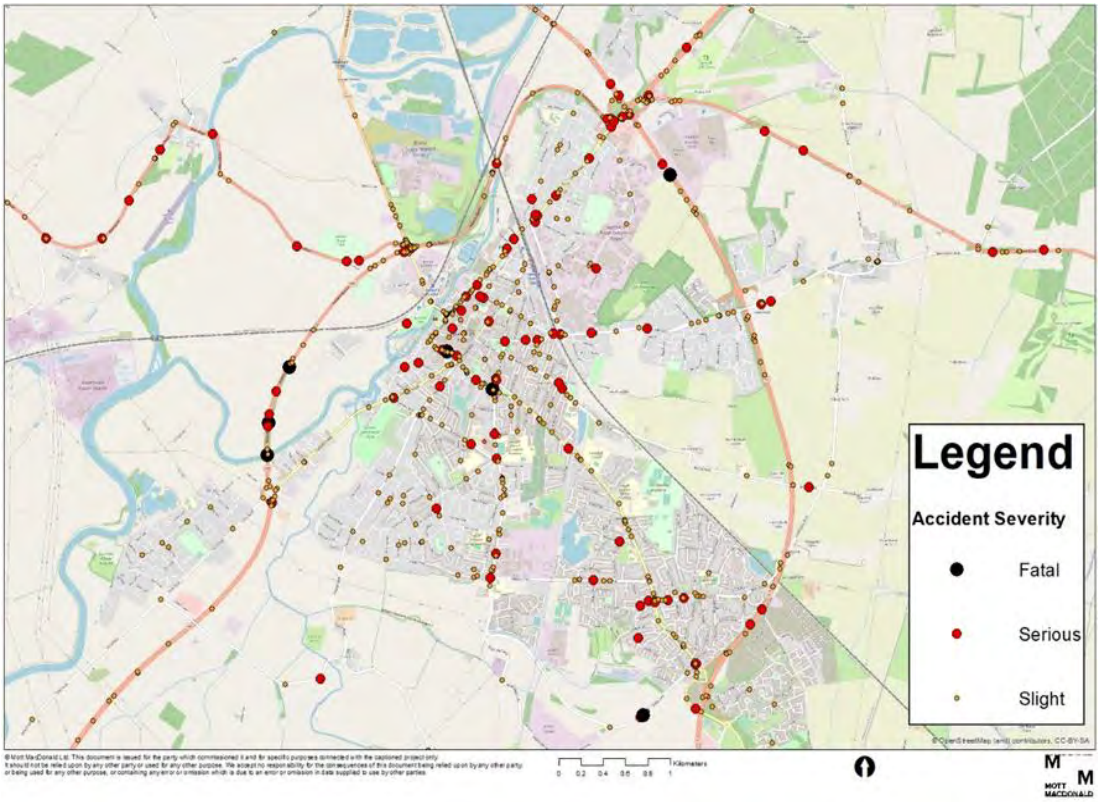
Direction	Period	2028	2043
Northbound / Eastbound	**AM**	**09:53**	**12:15**
	IP	08:48	11:11
	PM	11:56	13:46
Southbound / Westbound	AM	10:23	11:36
	IP	08:03	08:22
	PM	09:14	09:34

High level of accidents

3.3.4 There are a high level of low-speed shunts, as well as recorded accidents, which lead to lane closures on this single lane carriageway.

3.3.5 These accidents are contributing towards both poor journey time reliability and route resilience and are largely concentrated on the approaches to Cattle Market roundabout (32% of accidents) and the A1/A46 (46% of accidents) junction as shown in Figure 3-2. Of these accidents, 92% were categorised as ‘Slight’ severity, indicating a high proportion of low-speed incidents relating to junction performance. Approximately 80% of all casualties were car / van passengers which is expected as this user type accounts for the majority of traffic flows on the A46. Dualling of the route would increase traffic flow and therefore improve resilience by reducing the chance of slow-speed accidents occurring.

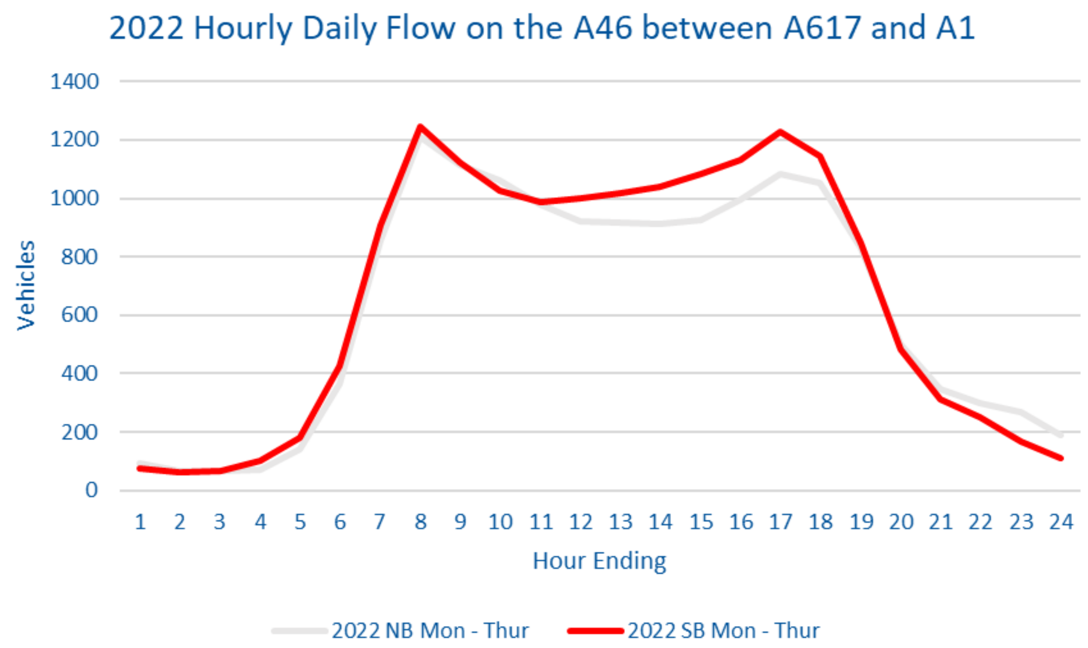
Figure 3-2: Accidents within and around Newark-on-Trent, 2015 - 2019



High traffic flows

3.3.6 This section of the A46 has high traffic flows, which exceed the design capacity and are expected to increase. The A46 between Cattle Market roundabout and the A1/A46 junction is a heavily congested stretch of single carriageway, resulting in unreliable journeys with significant delays. This is concentrated heavily in the peak hours of 0700 – 0900 (AM) and 1700 – 1900 (PM) where hourly daily vehicle flow reaches between 1000 and 1200 in either direction. The hourly traffic flow profile is shown in Figure 3-3.

Figure 3-3: Hourly Daily Traffic Flow on the A46 between A617 and A1

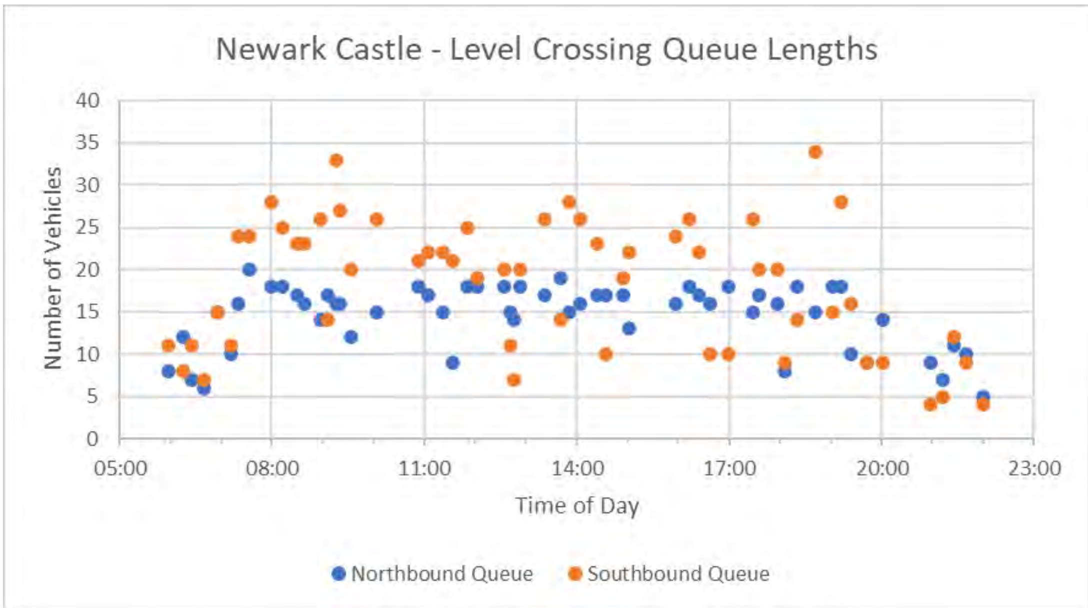


Congestion at Cattle Market junction and impact of railway level crossing

3.3.7 The lack of a grade separated junction at Cattle Market Junction is being compounded by queuing on the B6326 because of frequent railway level crossing downtimes.

3.3.8 The railway level crossing on the B6326 between the A46 and Newark causes traffic to back-up onto the A46 several times during the day, which impacts on the operation of the Cattle Market junction. Data from the 2022 traffic survey data indicates that the level crossing downtimes in the AM peak (07:00 to 09:00) is 2 minutes and 44 seconds and the PM peak (16:30 to 18:30) being 1 minute and 56 seconds. Queue lengths at the level crossing are shown in Figure 3-4.

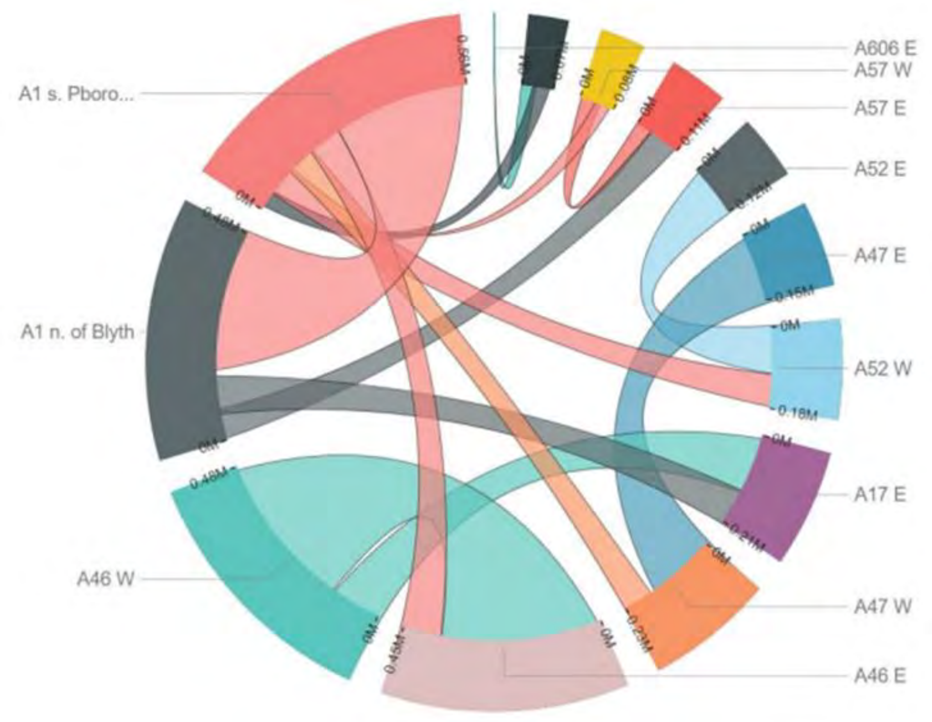
Figure 3-4: Newark Castle level crossing down times



Congestion on the A1/A46 Winthorpe Junction impacting on journey time reliability

3.3.9 The A1/A46 junction is a major intersection between the A1, A17 and A46 which contributes significantly to high variability of journey times, which is stated to be a concern to businesses, particularly those in manufacturing, construction and distribution sectors. The interface with the A46 and A17 are some of the most trafficked junctions along the A1 for Origin-Destination (O-D) movements as seen in Figure 3-5.

Figure 3-5: A1 trip origins and destinations



Limited Alternative Mode Provision

3.3.10 The alternative modes assessment confirms that other modes have constraints or are significantly limited to address the need for this scheme.

4 Project Summary

4.1 Overview of modelling and appraisal results

4.1.1 During Project Control Framework (PCF) Stage 3 a single preferred option was assessed. The summary results are provided in the following sections.

High level benefits and costs

Table 4-1: High level benefits and costs (£,000's)

Present Value of Benefits (initial)	221,879
Present Value of Benefits (adjusted)	318,714
Present Value of Costs	266,037
Initial BCR	0.83
Adjusted BCR	1.20

Note: All monetary values are expressed in 2010 prices, discounted to 2010

4.2 Sources of Costs and Benefits

4.2.1 Key monetised costs and benefits are presented in Table 4-2.

4.2.2 The majority of the monetised benefits are transport economic efficiency (TEE) benefits that arise from the reduction in congestion and associated journey time savings that the scheme is forecast to deliver. Strategic through traffic using the A46 and local traffic that uses the A46 junctions to access Newark both benefit from the scheme. Business users and providers account for a significant proportion of the TEE benefits reflecting the strategic significance of the route for a lot of business users.

4.2.3 Accident savings from the scheme are forecast to be significant. The scheme upgrades the existing single carriageway section to a safer dual carriageway standard and also allows a significant volume of through traffic on the A46 to avoid junctions altogether at the Cattle Market and A1 dumbbell roundabouts reducing conflicts. The scheme is also forecast to encourage some traffic to reassign from local roads leading to additional savings in accidents across the wider network.

4.2.4 The scheme is forecast to lead to wider economic benefits with the majority of these due to agglomeration impacts. Agglomeration is increased by the scheme due to the improved connectivity between the functional urban regions of Lincoln and Nottingham and connectivity to Newark-on-Trent.

4.2.5 Greenhouse gas impacts resulting from the scheme represent a significant disbenefit. These are due to the additional traffic generated as a result of the scheme and the Whole Life Carbon impact, including the construction emissions, operational energy, maintenance and land use change.

Table 4-2: Key monetised benefits and costs - in £'000 (PV)

Category	Costs/Benefits
Business Users	
Journey Time Savings	158,862
Vehicle Operating Costs	16,704
Non-Business users	
Journey Time Savings	91,974
Vehicle Operating Costs	-19,072
Reliability	
Business Reliability	20,751
Non-business Reliability	8,617
Safety	
Safety (COBALT accident)	29,296
Environmental Impacts	
Noise	5,106
Local Air Quality	-1,747
Greenhouse Gases	-56,416
Landscape	Not Monetised
Wider Economic Impacts	
Agglomeration	49,910
Market Competition	17,557
Dependent Development	Not applicable
Labour Supply	433
Customer Impact	
Traffic delays due to Construction	-9,909
Traffic impacts due to Maintenance	Not assessed
Journey Quality	Not Monetised
Developer contributions	
Developer contributions	0
Other Impacts	
Indirect tax Revenues	7,081
Costs	
Cost to Broad Transport Budget	266,037
Cost savings (where relevant)	Not applicable

Note: All monetary values are expressed in 2010 prices, discounted to 2010

Table 4-3: Key quantified benefits / costs

Category	Units	
Journey times		
Journey Time Savings	*Defined as average saving per journey per vehicle across scheme section in minutes) (based on forecast values for 2043) (See note 1 below)*	04:40
Safety		
Accidents	*(total accidents (PIA) saved)*	493.5
Fatalities	*(total casualties saved)*	8.6
Seriously injured	*(total casualties saved)*	81.6
Slightly injured	*(total casualties saved)*	594.3
Environmental Impacts		
Number of Noise important areas affected	*(number)*	11
Names of AQMAs	*(names)*	N/A

Category	Units	
Change in NOx emissions	*(tonnes)*	6.31/year
Change in PM2.5 emissions	*(tonnes)*	0.92
Change in greenhouse gas emissions	*(tonnes CO2e)*	683,200
Customer Impact: Totals		
Traffic delays due to Construction	*(total loss on scheme sections in hours)*	1,244,455
Traffic impact due to Construction	*(total impact in £,000)*	-9,909
Traffic impacts due to Maintenance	*(total impact on scheme sections in hours)*	Not assessed
Customer Impact: Per journey		
Traffic delays due to Construction (cars)	*(average loss per journey on scheme sections in minutes) **	2.38
Traffic delays due to Construction (LGVs)	*(average loss per journey on scheme sections in minutes) **	1.33
Traffic delays due to Construction (HGVs)	*(average loss per journey on scheme sections in minutes) **	0.11
Traffic impacts due to Maintenance (cars)	*(average impact per journey on scheme sections in minutes) **	Not assessed
Traffic impacts due to Maintenance (LGVs)	*(average impact per journey on scheme sections in minutes) **	Not assessed
Traffic impacts due to Maintenance (HGVs)	*(average impact per journey on scheme sections in minutes) **	Not assessed

4.3 Link flows

4.3.1 Link flows for each model year for the Do-Minimum and Do-Something scenarios are presented below in Table 4-4 and Table 4-5.

Table 4-4: Demand growth along the route (Do-Minimum)

Link	AADT 2028 (Veh)	AADT 2043 (Veh)	AADT change (Veh) 2043-2028	AADT change (%) 2043-2028	AADT 2061 (Veh)	AADT change (Veh) 2061-2043	AADT change (%) 2061-2043
South of SLR junction	44,604	53,315	8,710	20%	56,336	3,021	6%
SLR junction to Farndon	35,209	39,893	4,685	13%	41,228	1,334	3%
Farndon to Cattle Market	30,321	33,277	2,956	10%	34,020	743	2%
Cattle Market to Brownhills	30,168	31,899	1,731	6%	32,193	294	1%
Brownhills to Friendly Farmer	50,695	52,049	1,354	3%	52,721	672	1%
Friendly Farmer to Winthorpe	47,399	51,019	3,621	8%	52,570	1,551	3%
East of	42,350	46,771	4,421	10%	48,474	1,703	4%

Link	AADT 2028 (Veh)	AADT 2043 (Veh)	AADT change (Veh) 2043-2028	AADT change (%) 2043-2028	AADT 2061 (Veh)	AADT change (Veh) 2061-2043	AADT change (%) 2061-2043
Winthorpe							
Distance Weighted Average	**38,425**	**43,159**			**44,719**		

Table 4-5: Demand growth along the route (Do-Something)

Link	AADT 2028 (Veh)	AADT 2043 (Veh)	AADT change (Veh) 2043-2028	AADT change (%) 2043-2028	AADT 2061 (Veh)	AADT change (Veh) 2061-2043	AADT change (%) 2061-2043
South of SLR junction	49,393	61,560	12,166	25%	66,386	4,826	8%
SLR junction to Farndon	42,956	53,756	10,800	25%	57,851	4,095	8%
Farndon to Cattle Market	43,434	54,208	10,774	25%	58,714	4,506	8%
Cattle Market to Brownhills	41,967	49,720	7,753	18%	53,321	3,601	7%
New Brownhills to Winthorpe link	29,954	35,524	5,571	19%	38,385	2,861	8%
Brownhills to Friendly Farmer	29,323	33,231	3,908	13%	34,951	1,720	5%
Friendly Farmer to Winthorpe	20,732	23,555	2,824	14%	24,888	1,332	6%
East of Winthorpe	44,970	52,806	7,836	17%	56,310	3,504	7%
Distance Weighted Average	41,040	49,947			53,729		

Table 4-6: Strategic Outcome Summary

Strategic Outcome	KPI	Scheme Contribution – Qualitative	Scheme Contribution – Quantitative
Making the network safer	The number of KSIs on the SRN.	The Scheme includes junction upgrades and the conversion of sections of single-carriageway to dual. These improvements make the scheme network safer. A 50mph speed limit between Cattle Market and Winthorpe will be enforced. A concrete central reserve barrier will prevent cross over incidents.	Overall PIA saving of 493.5 SRN scheme link PIA saving of 443.9 SRN scheme link casualties saved Fatal 8.6 Serious 81.6 Slight 594.3

Strategic Outcome	**KPI**	**Scheme Contribution – Qualitative**	**Scheme Contribution – Quantitative**
Delivery of better environmental outcomes	Noise: Number of Noise Important Areas mitigated. Biodiversity: Delivery of improved biodiversity, as set out in the Company's Biodiversity Action Plan	Noise – Potential noise impacts at all of the eleven noise important areas affected by the Scheme are shown to be 'Negligible' or 'Minor beneficial', see paragraph 11.19.20 of Chapter 11 Noise and Vibration of the environmental Statement (TR010065/APP/6.1). Biodiversity - The environmental design for the scheme has sought to create a range of habitats similar to those already present on site and affected by the proposals, as well as habitats of higher biodiversity where possible, for example a species rich grassland is proposed where much of the existing grassland is species poor. The highway drainage has also been designed to provide swales and ponds of value to biodiversity. This contrasts with the existing road drainage which includes concrete lined channels of minimal biodiversity value. The environmental design for the scheme seeks to obtain a positive biodiversity net gain. Air quality - Concentrations across all human health receptors are expected to be well below the NO_2, PM_{10} and $PM_{2.5}$ air quality objectives and are therefore concluded to be not significant and no mitigation measures were proposed. Ecological receptors that have the potential to be adversely affected by changes in nitrogen deposition have been assessed by the competent expert for Biodiversity and concluded that changes caused by the Scheme were not significant.	N/A
Helping cyclists / walkers and other vulnerable users	The number of new and upgraded crossings	Walking and cycling routes have been provided with 0.5m separation and are 3.0m wide to improve safety for users. Signalised crossings have been provided at Cattle Market, Brownhills and Winthorpe junctions and also across the existing A46 between the Friendly Farmer and Brownhills Roundabouts. Traffic islands provided to non-signalised crossing on Great North Road, A1133 and Drove Lane.	8 No signalised crossings

Strategic Outcome	KPI	Scheme Contribution – Qualitative	Scheme Contribution – Quantitative
		Off network walking / cycling route between Friendly Farmer and Winthorpe. Routes compliant with LTN 1/20 where practicable	

4.4 Summary of assumptions or caveats

4.4.1 The assumptions and caveats relating to each area of modelling and assessment are provided within each section of this report. This section outlines those considered most noteworthy with regards to their potential influence on the economic outcomes.

4.4.2 The model represents a base year of 2019, which reflects a pre-COVID scenario. This was the most up to date origin-destination information available at the time the model was developed. At the time of the model development, travel patterns were not considered to have stabilised enough to collect new origin-destination data. The modelling and appraisal will not reflect any long-term changes in travel behaviour or travel volumes as a result of COVID, this could impact on future travel forecasts and the assessment of scheme benefits.

5 Summary and review of existing data

5.1 Overview

5.1.1 This section of the report summarises the various existing datasets available to inform the traffic modelling and appraisal of the A46 Newark Bypass at Project Control Framework (PCF) Stage 3. This includes existing traffic models, traffic count data, origin destination data, journey time data and network data.

5.2 Existing Traffic Models

5.2.1 Two strategic traffic models are of relevance to this scheme:

- Enhanced A46 MRTM
- MRTM2 (second generation Midlands Regional Traffic Model)

5.2.2 An overview of each of these models is presented below and details of the data that supported each of the models is contained in the relevant sections of this chapter.

A46 Newark Bypass PCF Stage 2 Model

5.2.3 The Enhanced A46 MRTM was developed for the A46 Newark Bypass scheme at PCF Stage 1 and updated for use in PCF Stage 2. This model was based largely on data taken from the first versions of National Highway's Regional Traffic Models (RTMs) developed during 2015/16; primarily the Midlands Regional Traffic Model (MRTM1).

National Highways Regional Transport Models

5.2.4 The original RTMs were developed in 2015/2016. In 2020 National Highways commissioned the next generation of model (RTM2). The second generation of the regional transport models were developed with a 2019 base year. For the A46 Newark Bypass, the Midlands Regional Traffic Model (MRTM2) and Trans Pennine South Regional Transport Model (TPSRTM2) are both of relevance.

5.3 Existing Data

Volumetric and classified data

5.3.1 Volumetric and classified data is available from a number of sources:

- Traffic count data set included with the Enhanced A46 MRTM
- Traffic count data associated with the MRTM2

- National Highways' WebTRIS Count database (data from permanent count sites on the SRN)
- DfT Road Traffic Statistics (Database of existing count data on local and strategic roads)

5.3.2 Only WebTRIS count data was considered to be suitable for use in developing the A46 Newark Bypass Transport Model for PCF Stage 3, as it provides a reliable source of continuous data. Other datasets were considered to be too old or of low quality. The review of the existing count dataset concluded that it would not be sufficient to support the calibration and validation of the traffic model, highlighting that additional data collection would be required.

Demand Data

5.3.3 Existing demand data (origin-destination data) was available the from the Enhanced A46 MRTM and the more recent MRTM2. The base year highway matrices in the Enhanced A46 MRTM were based upon matrices provided from MRTM1, which has been superseded by MRTM2.

5.3.4 The primary source of data used to develop car and rail demand matrices for MRTM2 is mobile network data (MND) sourced through National Highways' Trip Information System (TIS). This was supplemented with data from the National Travel Survey (NTS) and the DfT's MOIRA rail demand forecasting model.

5.3.5 The MRTM2 LGV trip matrices were primarily developed with Teletrac origin destination data. While the source of the MRTM2 HGV matrices was the GB Freight Model (GBFM), which was provided to National Highways from MDS Transmodal (MDST).

5.3.6 The matrices were based on data covering October 2018 to September 2019 and all of the demand data in MRTM2 therefore represents pre COVID-19 conditions.

Conclusion

5.3.7 The MRTM2 matrices are suitable to be used for the PCF Stage 3 model because they represent recent demand patterns (2019). It is noted that they represent pre COVID-19 travel patterns. However, at present there are concerns that travel behaviour and patterns have not stabilised since COVID-19 and there are no plans to collect new demand data until conditions stabilise. There are no plans to collect further demand data.

Journey time data

5.3.8 Both the Enhanced A46 MRTM and MRTM2 made use of TrafficMaster GPS journey time data. Data from these models is available in processed form, i.e. the raw data is not available. Whilst both of the above models have existing journey time data, the PCF Stage 2 model journey time data is from 2017 and the MRTM2 journey time data coverage is not localised enough to accurately assess the PCF Stage 3 model.

5.3.9 Up to date journey time data is available to National Highways from the Teletrac Navman AGPS journey time dataset (Averaged GPS journey time data, by day and by 15-minute segment). This data is available for the whole of the highway network and can be processed for whatever time period is required, including 2019. However, for some minor roads journey time data will not be available or will be of poor quality.

5.3.10 Teletrac AGPS journey time data is not able to differentiate between different turning movements at a junction and so does not reflect potential differences in journey time for vehicles turning left, going straight on or turning right. That further level of detail is useful for the operational model. Therefore, some additional journey time data collection was deemed necessary along the section of the A46 covered by the operational model.

Network data

5.3.11 Network data is required to provide an accurate representation of the characteristics of the current highway network including road length, standards, and speed limits together with the detailed layout and form of control of junctions. This information is available form primary data sources such as the Ordnance Survey Integrated Transport Network but is also available from secondary sources such as existing traffic models. The A46 Newark Bypass PCF Stage 2 model and both RTM2 models (MRTM2 and TPSRTM2) include representations of the characteristics of the highway network.

5.3.12 The Enhanced A46 MRTM includes a detailed representation of the highway network in the scheme area. The MRTM2 provides less detail in the scheme area than the Enhanced A46 MRTM but has more up to date network information in the wider area.

5.3.13 Although not detailed in the Newark area, the TPSRTM2 provides network information in North Nottinghamshire & Lincolnshire and towards the Humber Ports that is not included in MRTM2.

Operational Data

Traffic Signal Data

5.3.14 Traffic signal data was provided by Nottinghamshire County Council for key junctions in the Newark area. This data is suitable for use in both the strategic and operational models.

Queue Length Surveys

5.3.15 Queue length information at key junctions on the A46 corridor was reported in the operational model. However, the source of the data was not evident and only the processed information was provided.

Level Crossing Closure Data

5.3.16 The operation of the level crossing on the Great North Road is noted to have an impact on the operation of the Cattle Market junction, with closure of the level crossing causing queuing back to the Cattle Market junction. The closure of the level crossing is represented in both the strategic traffic model and the operational model; however, the source of the timing data is not evident.

Accidents data

5.3.17 As part of model handover, accident rates for links were included in the COBALT model. However, only the accident rate information was provided and not the raw accident data. This data is based on DfT STATS19 accident and count data. Road casualty statistics data is available from the DfT. The following datasets are available.

- dft-road-casualty-statistics-accident-1979-2020
- dft-road-casualty-statistics-casualty-1979-2020
- dft-road-casualty-statistics-vehicle-1979-2020

5.3.18 The DfT data sets allow the identification of accident information including the number of accidents and casualties by severity, all by location for any period between 1979 and 2020.

Other data

5.3.19 A number of additional datasets were available from the Office of National Statistics (ONS) to support model development, including 2011 Census information and mid-year population estimates. The three following census datasets were available to inform the disaggregation of the MRTM2 demand data into a more detailed zone system.

- Economic activity (Daytime/workday population) (England, Northern Ireland and Wales) 2011 (Economic Activity)
- Mid-Year (30 June) 2019 LSOA population estimate SAPE22DT2 edition (Population)
- Location of usual residence and place of work (OA/OA level) (Journey to work)

5.3.20 Economic activity and population were at a lower super output area (LSOA) level, whilst journey to work was at output area level (OA).

5.4 Summary of additional data requirements

5.4.1 The demand data, journey time data, network data and accident data available from existing models and other existing sources were considered suitable for the development of the Stage 3 model.

5.4.2 The review of traffic count data highlighted that there would be a need to collect new traffic data from ATCs across the Newark area and MCCs around the immediate bypass to update the traffic counts from PCF

Stage 2. Turning counts would also be needed to calibrate the operational model.

5.4.3 Up to-date journey time data also needed to be collected for two routes along the section of the A46 that is covered by the operational model. The review of operational data also highlighted the need to collect up-to-date queue length and level crossing closure data.

6 Data collection

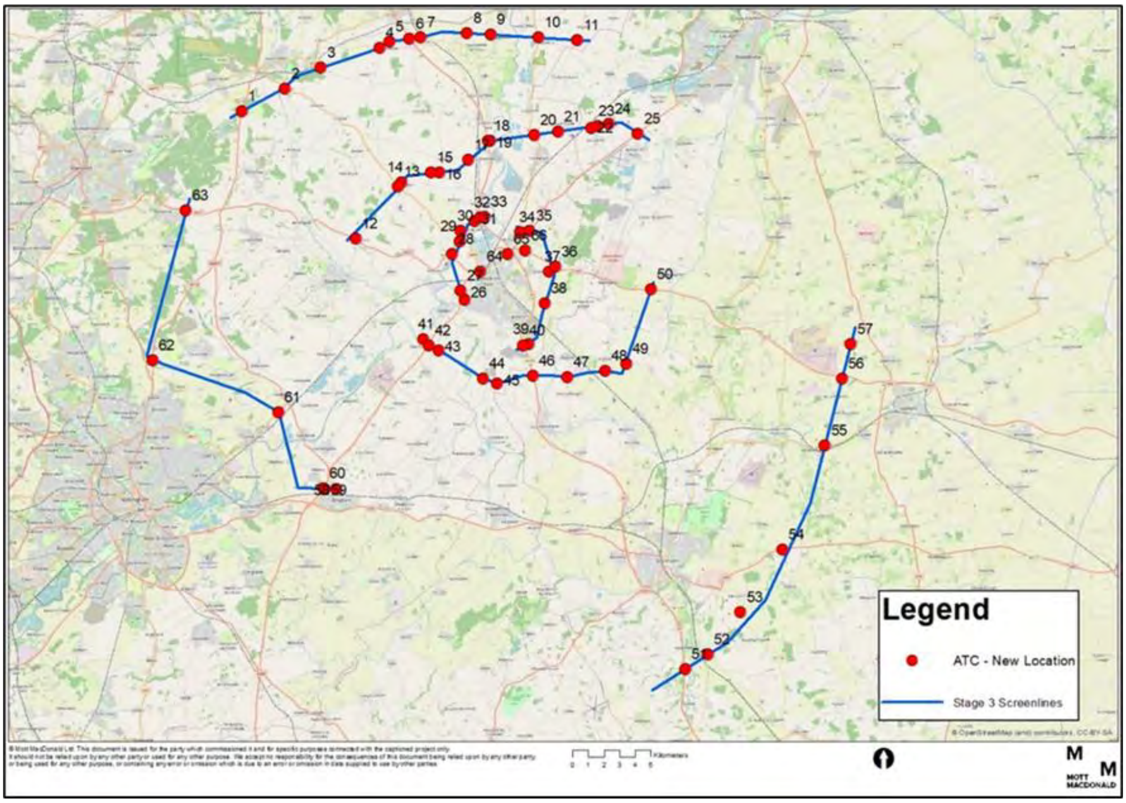
6.1 Overview

6.1.1 This section outlines the details of the commissioning, collection and suitability of the new data that was required for the completion of the PCF Stage 3 Transport Data Package. The main purpose of the new data collection was to gather data that was up-to-date and in enough local detail to calibrate and validate the base 2019 Stage 3 Newark strategic and operational traffic models. The data collection programme was carried out in July 2022.

6.2 Volumetric Data - Link Counts

6.2.1 Link counts were carried out at a number of locations in Newark and the surrounding area. Two weeks of data was collected at each site using either automatic traffic counters or radar. Due to incomplete data, some locations were resurveyed in Autumn 2022 and three sites (18,25,60) were scrapped in favour of WebTRIS data. A map of the locations of counts collected is shown in Figure 6-1.

Figure 6-1: ATC Sites

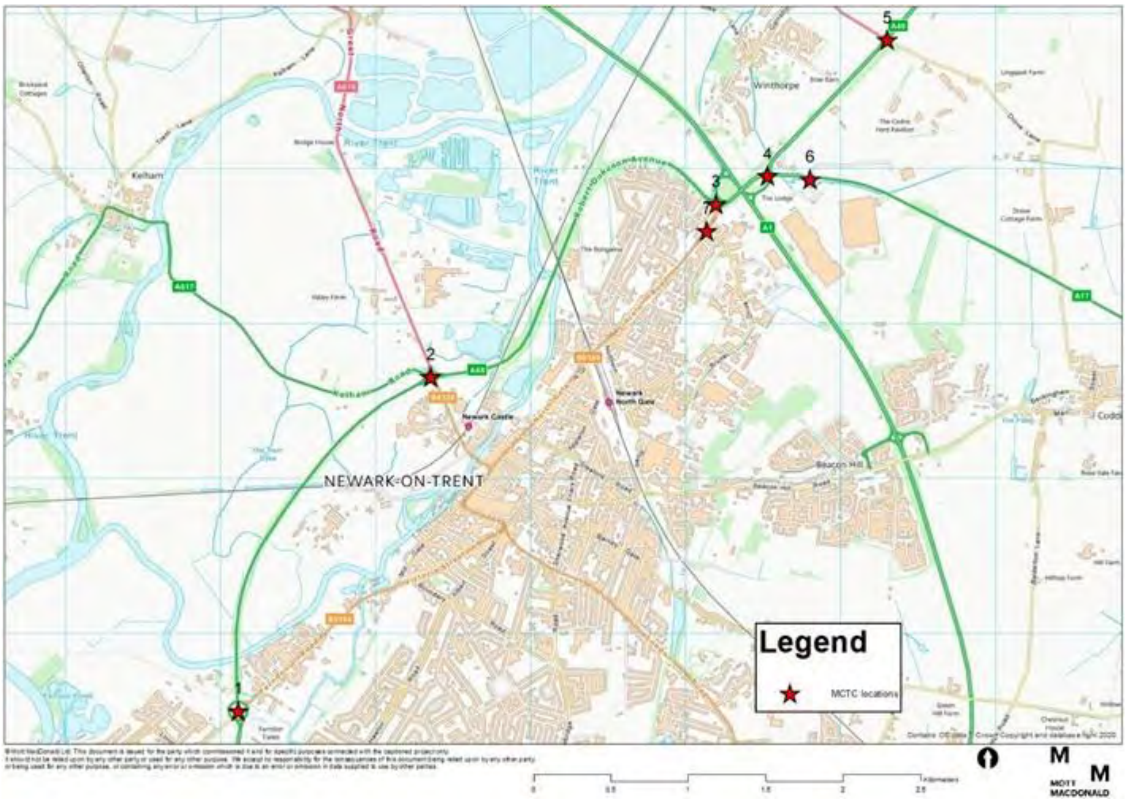


Source: Mott MacDonald

6.3 Volumetric Data - Junction Turning Counts

6.3.1 Single day classified junction turning count surveys were carried out at six locations. A map of the junction turning count survey locations is shown in Figure 6-2.

Figure 6-2: MCTC sites



Source: Mott MacDonald

6.4 Queue Length Data

6.4.1 At each of the junction turning count locations, queue length data was also recorded for each approach arm. The data has been collected in 5-minute intervals for each approaching lane. It consists of the mean and the maximum queue lengths in units of metres and vehicles.

6.5 Level Crossing Data

6.5.1 The B6236 Great North Road (which feeds onto Cattle Market roundabout, the location of an MCTC) crosses the Nottingham to Lincoln rail line by means of a level crossing. This occasionally causes queues to back up onto the roundabout therefore a survey of the level crossing was required to obtain the duration and frequency of its closures along with the scale of associated queuing traffic on the southbound B6236. The location of the level crossing is shown in Figure 6-3.

Figure 6-3: Level crossing survey location, B6236 Great North Road

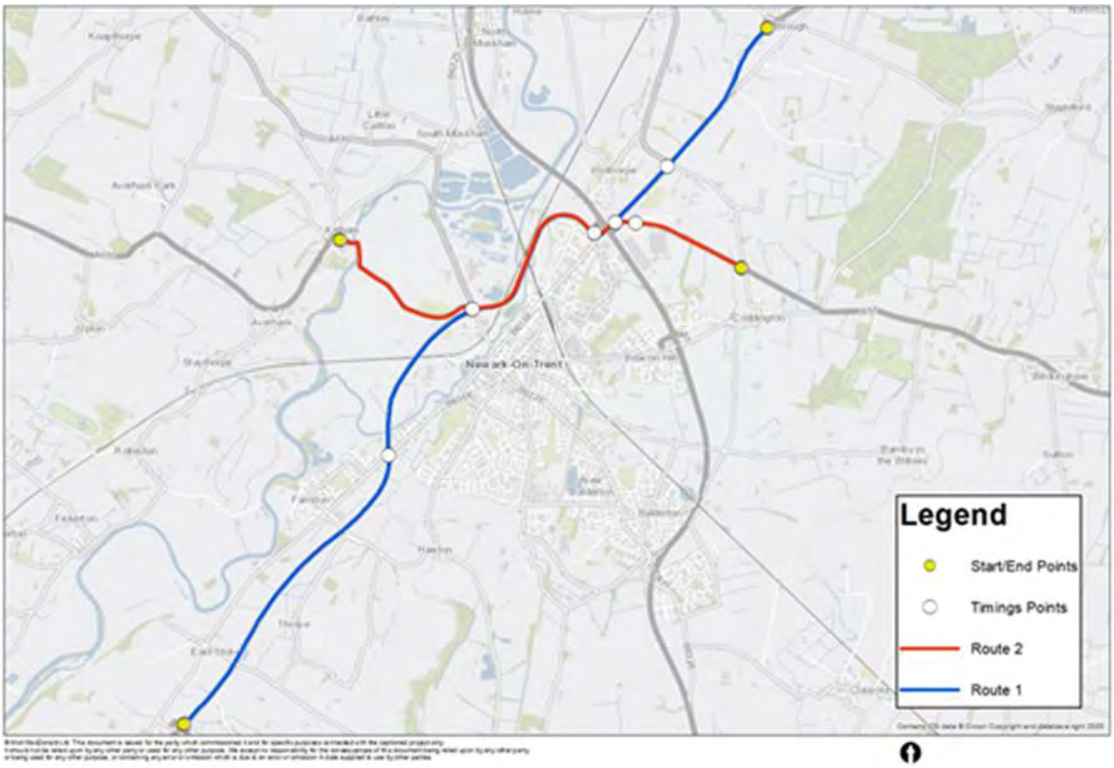
Source: Mott MacDonald

6.6 Journey Time Surveys

6.6.1 Two journey time routes were commissioned (shown in Figure 6-4):

- Route 1 (A46) follows the A46 between the Lodge Lane junction in the south and the Brough junction in the north (and vice versa). The timed route originated/terminated at the A46 slip roads at either end and also included intermediate timing points at the entry point of each junction along the route.
- Route 2 (A617-A17) ran between the A617 at Kelham in the west and the A17 north of Coddington in the east. The western terminal was the Ollerton Road junction with the A617 in Kelham and the eastern terminal was the A17 junction with Drove Lane (the most westerly of the two staggered T-junctions).

Figure 6-4: Journey time survey routes



Source: Mott MacDonald

6.7 Outcome of surveys

6.7.1 The collection of data in July 2022 may be impacted by COVID-19 implications, including changes in travel behaviour and increased working from home. Changes in traffic flows have been reviewed using permanent WebTRIS counts in the local area. These indicated that traffic volumes were returning to pre-COVID-19 levels with similar weekday traffic flow profiles.

6.7.2 The data collection was undertaken in July (avoiding school holidays), September, and October. These are considered to be neutral months as stated in TAG M1.2 section 3.3.7.

7 Final Datasets

7.1 Overview

7.1.1 This section provides an overview of the final datasets selected for use in the traffic modelling and appraisal of the A46 Newark Bypass. A summary of data obtained to support the traffic modelling and appraisal is provided in Table 7-1.

Table 7-1: Overview of datasets

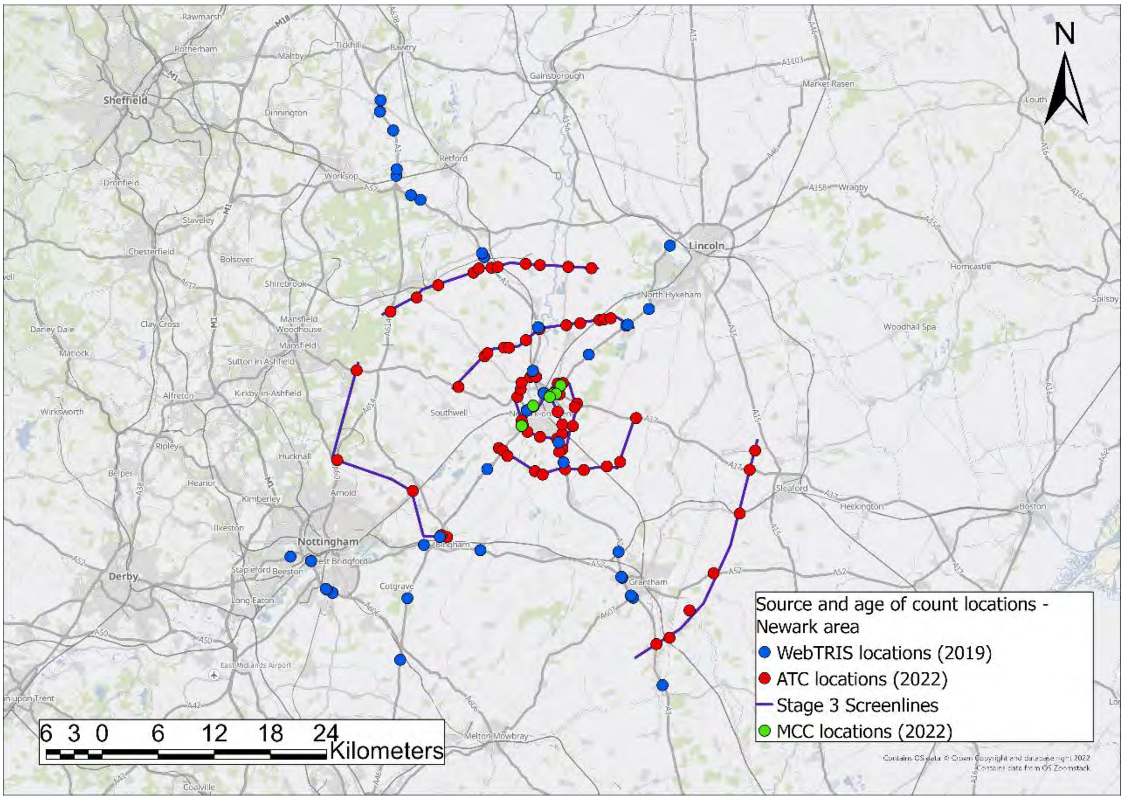
Data Type	Summary	Intended purpose
Network data	A46 Newark Bypass Stage 2, MRTM2 and TPSRTM2	To inform the development of the network for the A46 Newark Bypass stage 3 model.
Matrix data	MRTM2 Prior Matrices	To inform the development of the demand matrix for the A46 Newark Bypass stage 3 model.
Journey time data	Teletrac 2019 AGPS July 2022 surveys	Strategic model validation. Operational model validation.
Traffic count data	A46 Newark Bypass Stage 2, MRTM2, WebTRIS and July 2022 Traffic Surveys	Volumetric traffic data for model calibration and validation.
Accident data	Five-years of data from 2015 to 2019 from DfT (data.gov.uk).	Observed accident data for input into accident assessment.
Operational data	July 2022 queue surveys July 2022 level crossing closure data	To inform strategic and operational model development.
GIS data	Ordnance Survey OpenData, including geographical and Census boundaries.	Various uses, including development of local zoning system.
Other data	Various, including Office of National Statistics and Census datasets.	Various uses, including development of local zoning system.

Source: Mott MacDonald

7.2 Final Volumetric Dataset

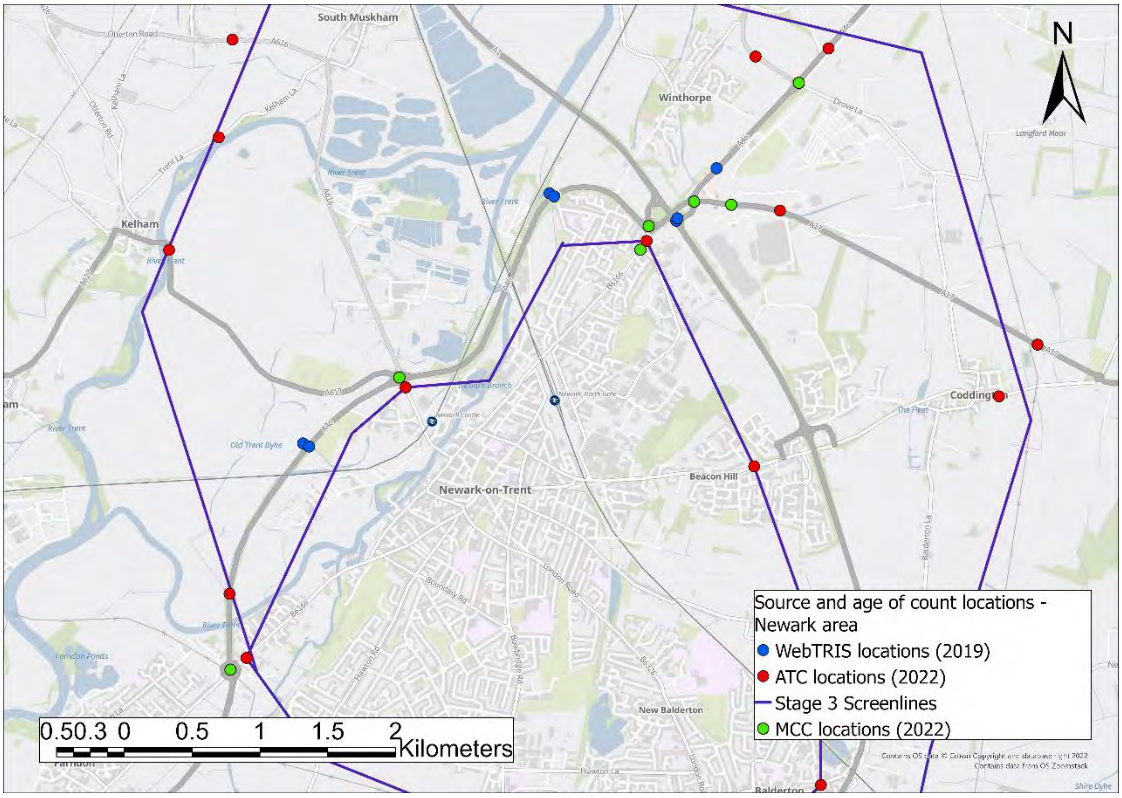
Figure 7-1 and Figure 7-2 show the source and age of the different categories of count data in the wider area and within Newark respectively.

Figure 7-1: Final Count Dataset – Wider area



Source: Mott MacDonald

Figure 7-2: Final Count Dataset – Newark area



Source: Mott MacDonald

7.2.1 The manual classified turning counts were used in both the strategic and operational model.

7.2.2 All traffic counts were adjusted to be representative of March 2019. Factors to adjust counts from July 2022 were developed from continuous traffic counts. The factors that were used to go from July 2022 to March 2019 are presented in Table 7-2.

Table 7-2: July 2022 to March 2019 factors

Road Type	Monthly Factor	Yearly factor	Final Factor
Motorway	**0.96**	**1.05**	**1.01**
Trunk	0.95	1.06	1.01
Principal	0.99	1.01	1.00
Minor	1	1.05	1.05
Private	1	1.05	1.05
Motorway	0.96	1.05	1.01
Trunk	0.95	1.06	1.01
Principal	0.99	1.01	1.00

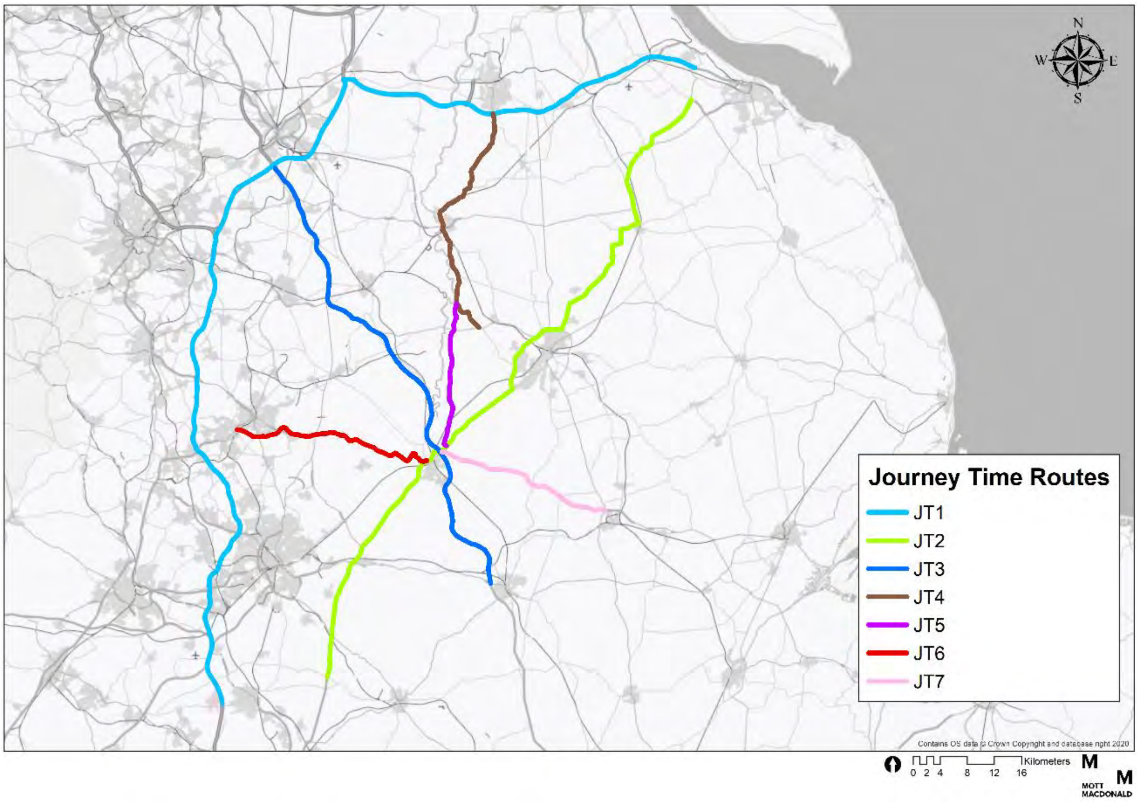
Source: Mott MacDonald

7.3 Final Journey Time Datasets

Strategic Model - Teletrac Data

7.3.1 The journey time routes for the strategic model are shown in Figure 7-3 for Routes 1 to 7. Teletrac AGPS journey time data from March 2019 was used to provide the observed journey times for these routes in each direction.

Figure 7-3: Journey Time Routes



Source: Mott MacDonald

Operational Model - Journey Time Survey Data

7.3.2 The operational model used the journey time data collected in July 2022, as detailed in Section 6.6.

7.4 Adequacy of the Datasets

7.4.1 The traffic flow count datasets summarised above were considered adequate for the purpose of traffic modelling and appraisal for PCF Stage 3, with the datasets generally providing good coverage across the modelled network relevant to the scheme.

7.4.2 Additional data collection was undertaken, comprising volumetric and classified traffic data. There were two sites without Week 1 data, four sites without Week 2 data and three sites without any data. However, there are WebTRIS counters on the same links as these sites, which were considered to be appropriate substitutions for these missing weeks of count data. This means that the traffic counts were not all collected at the same time. However conversion factors derived from the equivalent WebTRIS count sites overcome the issue of traffic count data not being collected all on the same day. These adjustments were deemed acceptable for their use in the PCF Stage 3 modelling.

7.4.3 Journey time data obtained from National Highways' Teletrac platform for the AoDM provided adequate coverage of strategic model routes but to understand in greater detail the impact of localised congestion on the scheme, two new journey time survey routes were commissioned for the PCF Stage 3 operational model.

7.4.4 The network data that were obtained from MRTM2, TPSRTM2 and the A46 Newark Bypass PCF Stage 2 Model are adequate for the March 2019 base.

7.4.5 The matrix data from MRTM2 are from 2019 and are therefore adequate for the March 2019 base model.

8 Model Description/Specification

8.1 Introduction

8.1.1 This chapter provides an overview of the A46 Newark Bypass Model. This includes a summary of the spatial coverage, the modelling system, software used and base year / time periods assessed.

8.1.2 To support the development of the scheme an operational model has also been developed. Details of this are reported in Chapter 16.

8.2 Overall model architecture

8.2.1 The modelling system has been inherited from the National Highways second generation Midlands Regional Traffic Model. There are three primary modelling components of the A46 Newark Bypass Model, namely:

- The Highway Assignment Model (HAM) which is used to predict traffic flows, speeds, delays, routing and journey costs on the network taking into account congestion; and
- The Variable Demand Model (VDM) which is used to predict the future levels of demand for private vehicle travel taking into account trip generation, distribution and mode split.
- A microsimulation operational model covering the scheme corridor, to enable detailed operational assessments of the scheme junctions.

8.2.2 There is no public transport model assignment model, although a representation of rail costs and demands is included in the VDM so that impacts on modal split can be assessed.

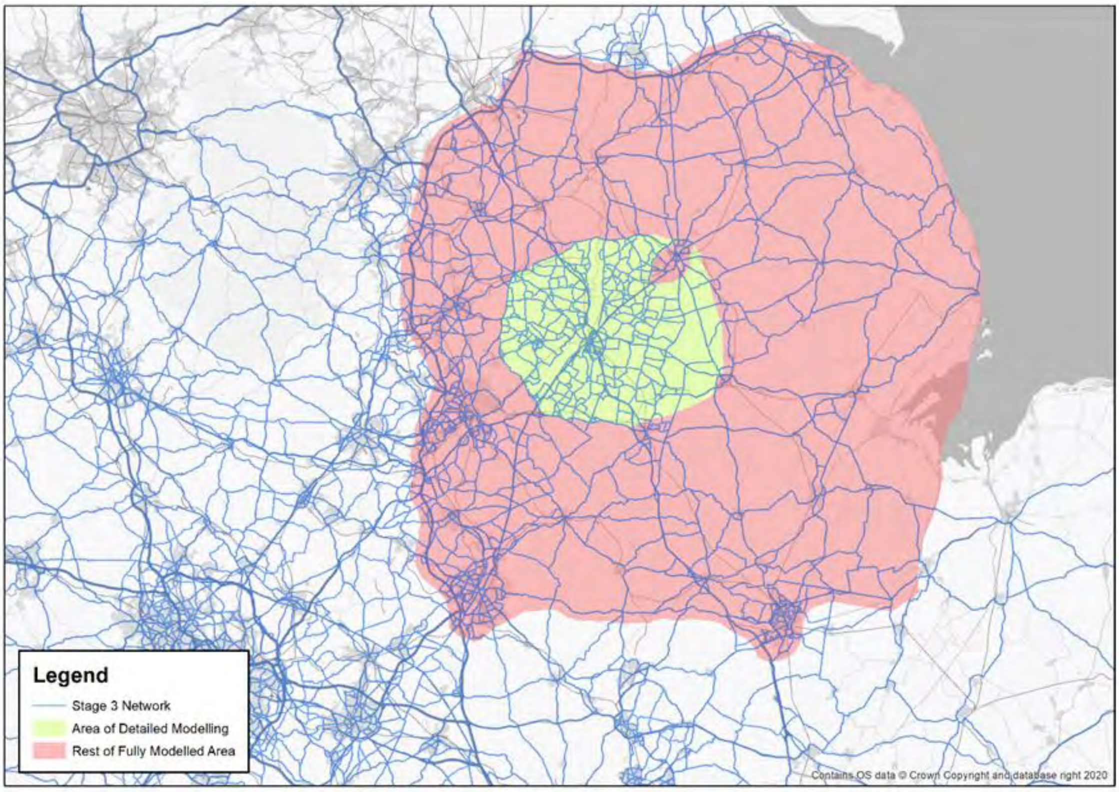
8.3 Model coverage

8.3.1 In line with the modelling approach recommended in TAG Unit M3.1, the A46 Newark Bypass Model consists of the following areas, each containing varying levels of detail:

- Fully modelled Area (FMA)
- External Area (EA)

8.3.2 The FMA is sub-divided into an ‘area of detailed modelling’ (AoDM) and the ‘rest of fully modelled area’ (RoFMA), both of which are shown in Figure 8-1.

Figure 8-1: A46 Newark Bypass Study Area



8.3.3 The AoDM is the area over which significant impacts of a scheme(s) would be expected to occur. This area represents all trips with small zones, very detailed network and junction modelling. The RoFMA is the area over which the impacts of a scheme(s) are considered likely but relatively weak in magnitude. This area still represents all trips with junctions simulated but would have larger zones and less detailed network.

8.3.4 In the EA, scheme impacts would be very small or negligible with partial trip representation, and a skeletal network with speed /flow representation or fixed speeds for network costs.

8.3.5 These areas have been defined on the basis that the main impacts of the A46 Newark Bypass scheme are expected to occur within the FMA. This has been determined through reassignment flow comparison between PCF Stage 2 Do-Something and Do-Minimum 2028 models and professional judgement.

8.4 Temporal coverage

Base Year

8.4.1 The base year for the A46 Newark Bypass Model represents an average (Monday to Friday) weekday in March 2019. (March is classified as a neutral month in TAG M1.2 Para 3.3.6). This was specified as the mobile phone data, the primary source for use in developing base year demand matrices, was collected for March 2019 from the National Highways Trip Information System (TIS) Dataset. It is noted that the data represents pre COVID-19 travel patterns.

Time Periods

8.4.2 The highway assignment model covers a single hour across the following three time-periods on a March weekday:

- AM Peak Hour (07:30 to 08:30)
- Inter peak (IP) Average Hour (10:00 to 16:00)
- PM Peak Hour (16:30 to 17:30)

8.4.3 These hours have been selected after analysis of traffic count data.

8.4.4 There is also an off-peak average hour model (19:00 to 07:00) to generate costs for the VDM, however this model is not subject to formal calibration and validation.

8.5 Software Packages

8.5.1 The following software packages were used in the development of the A46 Newark Bypass traffic model:

- The highway assignment model has been developed using SATURN (Simulation and Assignment of Traffic to Urban Road Networks) version 11.4.07H.
- The Variable Demand Modelling (VDM) capability is provided via DIADEM (Dynamic Integrated Assignment and Demand Modelling) version 7.0 using the HEIDI interface tool (version 7.5c). HEIDI is an interface with DIADEM to help with the setting up of runs and providing a consistent process across the RTM2s, in addition to providing diagnostic tools using SQL.
- ArcGIS Pro Version 2.9.2 – for GIS analysis supporting model development.

8.6 Model Standards

8.6.1 The base year model has been developed in line with the standards presented in Transport Analysis Guidance (TAG) unit M3-1. In relation to the development of a base year highway assignment model, TAG provides standards in relation to:

- Highway assignment calibration and validation
- Impacts of matrix estimation
- Highway assignment convergence

9 Model Development

9.1 Introduction

9.1.1 This chapter presents a summary of the work undertaken to develop the A46 Newark Bypass model base network and demand. The second generation of Midland Regional Traffic Model (MRTM2) has been used as the main starting point in the development of base year for the A46 Newark Bypass Model, together with elements from the Trans-Pennine South Regional Traffic Model (TPSRTM2) and the Enhanced A46 MRTM.

9.2 Demand

Zone Structure

9.2.1 The zoning for the A46 Newark Bypass Model has been developed from the MRTM2, TPSRTM2 and the Enhanced A46 MRTM zoning systems.

9.2.2 The MRTM2 zone system forms the basis of the A46 model zoning system. The following rules were used in developing the MRTM2 zone system:

- Within 200m of SRN junctions, use LSOAs as zone boundaries
- Between 200 and 500m of SRN junctions, use MSOAs as zone boundaries
- For the remainder of the non-urban areas in the Study Area use aggregations of MSOAs
- For urban areas in the Study Area where capacity restraint is not included in the network structure, utilise NTEM urban centre definitions to aggregate zones
- In the External Area use district level grouping of LSOAs in the vicinity of the Study Area boundary use groups of districts beyond that

9.2.3 As part of the development of the A46 Newark Bypass Model zoning system the following further changes have been made to the MRTM2 zoning system:

- Newark and Lincoln are on the boundary edge of MRTM2 model. North of the model boundary the model zones are too large to be able to load traffic at realistic locations, therefore the MRTM2 zones have been split using the TPSRTM2 zone boundaries.
- In the Area of Detailed Modelling, MRTM2 zones were split using LSOA census boundaries.
- Where multiple zones loaded onto the highway network at the same location, zone loading location was reviewed. If the zone loading location for the zones was appropriate, the zones were rationalised.

- The location of developments included in the Development Uncertainty Log has been compared to the zoning system to ensure that the zoning system is suitable to reflect any new developments.

9.2.4 The final zone plans are shown in Figure 9-1, Figure *9-2* and Figure *9-3* at different levels of detail.

9.2.5 The A46 Newark Bypass Model has a total of 2,448 zones, which is 116 additional zones compared to MRTM2.

Figure 9-1: A46 zone plan – Newark area

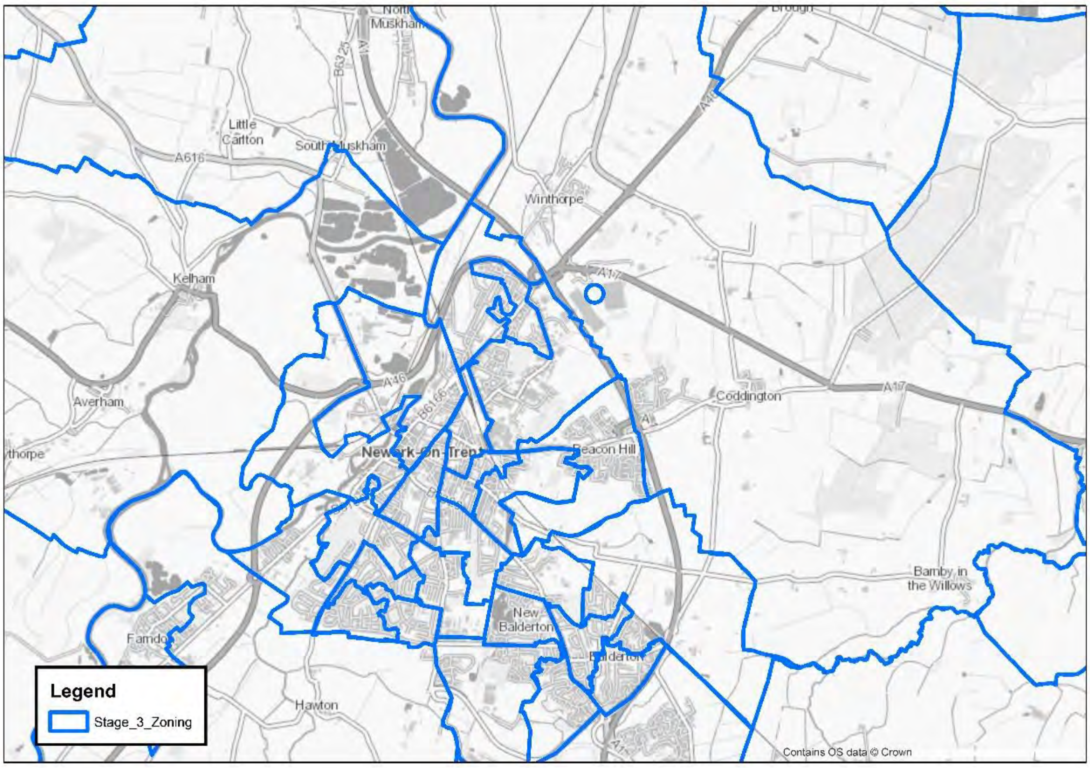


Figure 9-2: A46 zone plan – wider area

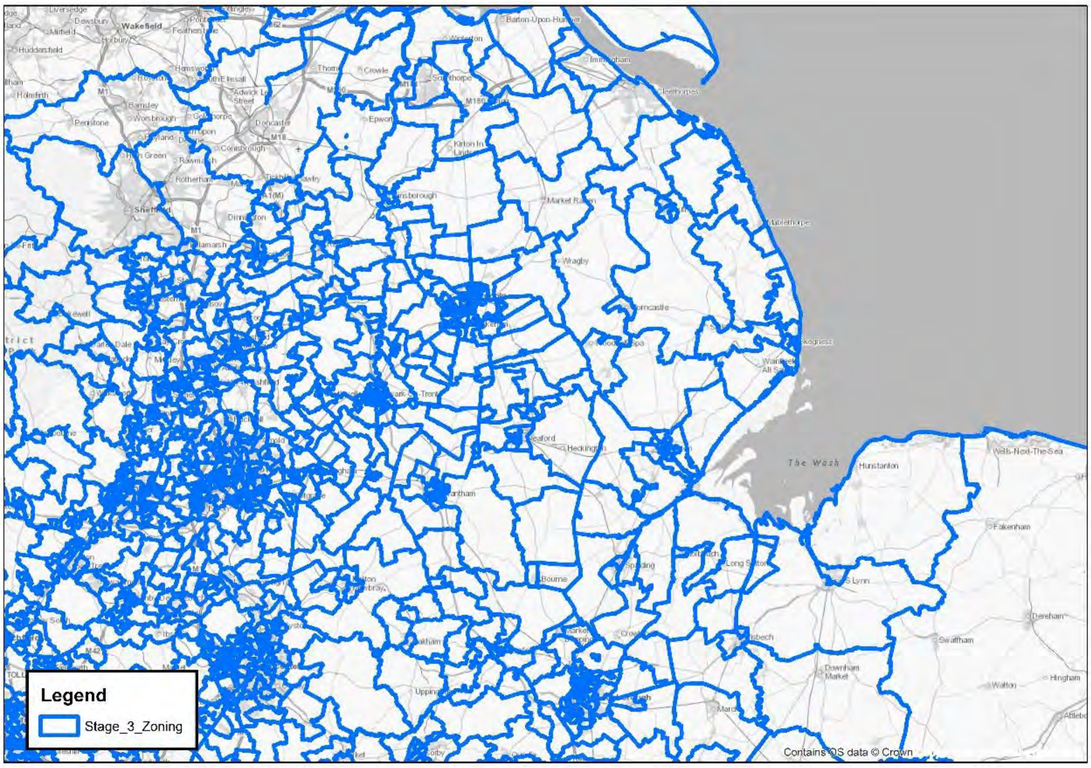
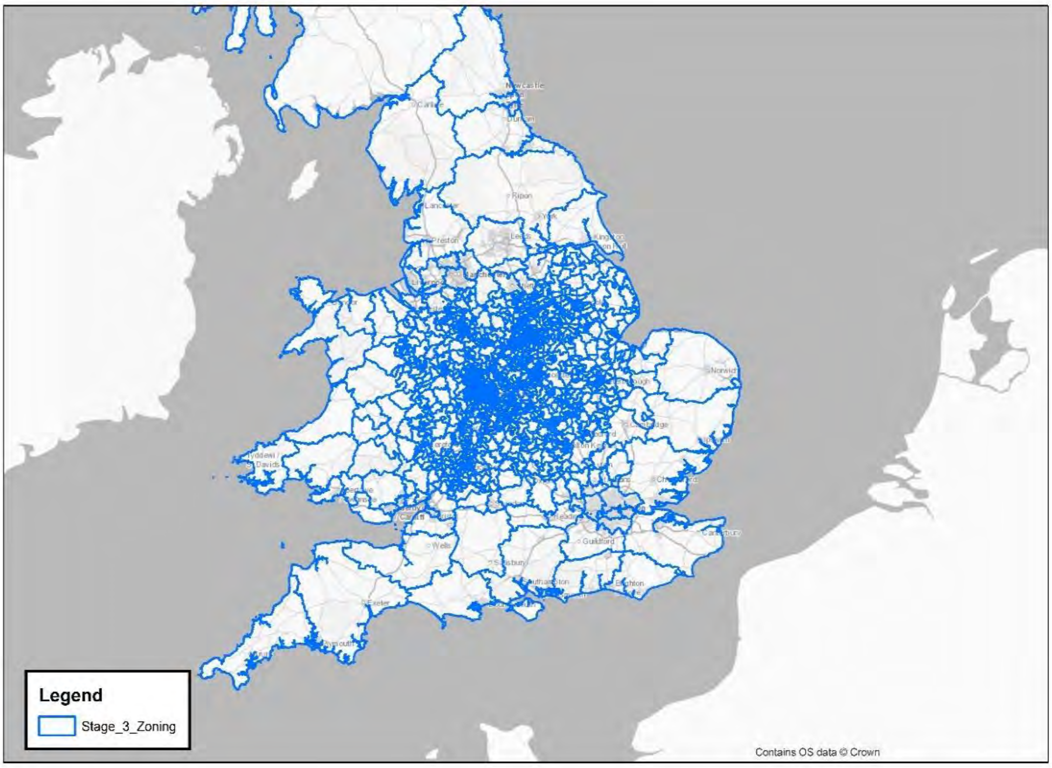


Figure 9-3: A46 zone plan – England



Demand Segmentation

9.2.6 The user class structure is a combination of vehicle class and journey purpose and has been retained from the MRTM2. The following user classes are included in the highway assignment model:

- Car – Employers' Business
- Car – Commute
- Car – Other
- Light Goods Vehicles (LGV)
- Heavy Goods Vehicles (HGV)

9.2.7 In accordance with the MRTM, LGV demand is assumed to be a mix of freight and personal business trips based on the average proportions outlined in the TAG Data Book.

Matrix Development

Source Matrices

9.2.8 The development of the prior matrices for the A46 Newark Bypass Model used the MRTM2 "prior" matrices as the starting point. The development of the MRTM2 car trip matrices was based primarily on mobile phone data supplied through National Highway's Trip Information System (TIS). The MRTM2 Light Goods Vehicle (LGV) was based on the Department for Transport's (DfT) Teletrac OD data and Heavy Goods Vehicle (HGV) matrices used GB Freight Model (GBFM) which was provided to National Highways from MDS Transmodal (MDST). Details on the development of MRTM2 trip matrices, and associated verification tests, can be found in the MRTM2 Model Development Report (March 2022).

Time Period adjustments

9.2.9 The MRTM2 matrices represent an average hour in each period, whereas the A46 Newark Bypass Model, which is a local model, represents specific peak hours. WebTRIS data for sites in the vicinity of the A46 scheme were analysed to develop a set of average peak period hour to peak hour factors to convert matrices to the modelled peak hours used in the A46 Newark Bypass Model.

Re-zoning

9.2.10 As the zoning system differs between the with MRTM2 and the A46 Newark Bypass Model, a process was required to convert the MRTM2 prior matrices into the A46 Newark Bypass Model zoning system. This process varied depending on location.

9.2.11 For zones on the northern boundary edge of the MRTM2 model, where zones have been split based on the TPSRTM2 zone boundaries, MRTM2 demand was allocated to the new zones based on proportions derived from the calibrated TPSRTM2 matrices.

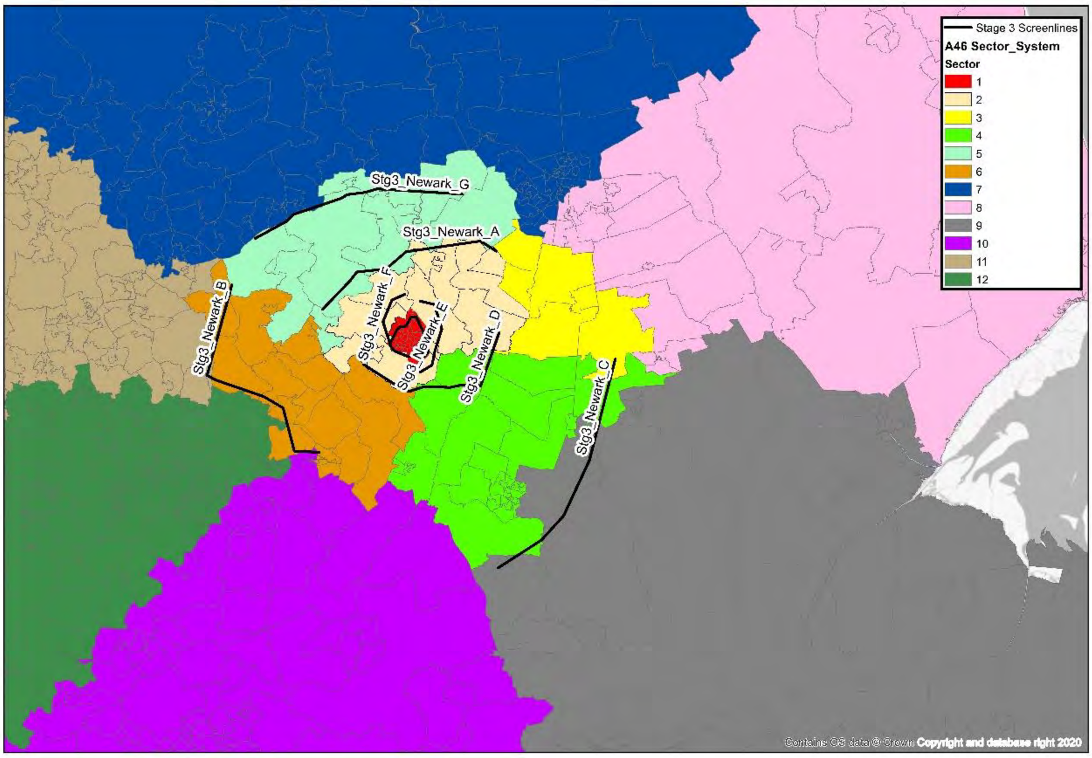
9.2.12 Elsewhere, the MRTM2 zones were disaggregated based on Census data.

Prior Matrix Adjustments

9.2.13 The initial assignment of the prior matrices indicated that the matrix performance across a number of screenlines was outside TAG acceptability standards. Sector-based adjustments were subsequently applied to the prior matrices based on the screenline performance for each time period. The screenlines used to assess the matrix performance together with the sector system are shown in Figure 9-4.

9.2.14 Sector adjustment factors were only considered to be necessary for the three external screenlines (Screenlines B, C and G).

Figure 9-4: Sector system and screenlines



Variable Demand Model

9.2.15 To inform the appraisal of scheme options the future year traffic forecasting made use of a variable demand model (VDM) which allows the demand for travel to change based on changes in travel costs.

9.2.16 The variable demand model used the Dynamic Integrated Assignment and Demand Modelling (DIADEM) software and the Highways England Integrated DIADEM Interface (HEIDI) which was developed for use with National Highways' RTMs. Table 9-1 summarises the VDM parameters, model responses and hierarchy, which are based on the VDM developed and used as part of the original MRTM2.

Table 9-1: VDM parameters, model response and hierarchy

Parameter / setting	Data source	Notes
Segmentation		
Modelled time periods (DIADEM)	AM 07:00-10:00 (3hrs) IP 10:00-16:00 (6hrs) PM 16:00-19:00 (3hrs) OP 19:00-07:00 (12hrs)	AM, IP, and PM travel costs derived from assignments of calibrated SATURN model. OP travel costs derived from uncalibrated assignment of mobile phone data (MPD) derived OP matrix to IP network to represent free-flow conditions.
Time period factors	AM=2.747 IP=6 PM=2.636 OP=12	Simple calculation consistent across all movements and purposes. AM & PM factors are slightly lower than the period duration in hours to reflect the modelled peak period
Assigned user classes	Car Employers Business, Car Commute, Car Other, Light Goods Vehicles, Heavy Goods Vehicles	
VDM segments	Segment – ID Home-based Employers Business – 1 Home-based Commute – 2 Home-based Other – 3 Non-Home-based Employers' Business – 4 Non-Home-based Other – 5 Fixed – Employers Business – 6 Fixed – Commute – 7 Fixed – Other – 8 Light Goods Vehicles (fixed) – 9 Heavy Goods Vehicles (fixed) – 10	Fixed elements relate to 'special zones' which include unique travel patterns that are not subject to VDM response. This may be a port or airport where 'Other' (passengers) and Employers Business are not subject to VDM responses.
Model parameters		
Model type	Home-based: Incremental PA Non-home-based: Incremental OD Goods: Fixed Special generators: Fixed	
Model responses and hierarchy	(Macro) Time of Day Choice Mode Choice Distribution	Distribution is singly constrained for Employer's Business and Other, doubly constrained for Commute.
Logit parameters: lambda and theta	Calibrated through realism testing	
Distribution intra-zonal cost calculation	DIADEM default values (ρ=0.5, minimum cost=5)	

Parameter / setting	Data source		Notes
Cost coefficients (VOTs etc)	TAG with distance based VOT		
Cost damping parameters and specification	Damped utility by function of distance		
Demand matrices			
Highway matrices	Home-based (24hr PA)	NTEM growth factors to calibrated base assignment matrices (split using mobile phone data (MPD) and transposed, then aggregated to 24-hour using PA outbound and return proportions)	
	Non-home-based (hourly OD)	NTEM growth factors to calibrated base assignment matrices	
	Goods (hourly OD)	RTF18 growth factors to calibrated base assignment matrices	
	Special Generators	Specific growth factors to calibrated base assignment matrices (with extraction of demand for specific zones and demand segments)	
Public transport	NTEM growth factors to base matrices (PLANET South East Demand Data)		
Cost matrices			
Reference SATURN UFS files			Extracted from SATURN highway assignment
Rail cost skims for reference and forecast	Base Forecast	VISUM Time skims provided from the RTMs	Extracted from National Rail network and compressed to model zone system
Rail fare skims for reference and forecast	Base Forecast	VISUM In Vehicle Time skim applied to distance-based fare function provided from the RTMs	
PA data			
Outbound and Return proportions (by time period for each demand segment, sector movement and mode)	Outbound and return proportions for the three PA Home-based purposes extracted from the Prior MPD From Home/To Home matrices		
Tour proportions	Default values provided in DIADEM from NTS data, which are then furnessed within DIADEM application to match defined Outbound and Return proportions (see above)		

Parameter / setting	Data source	Notes
DIADEM parameters		
Algorithm	Fixed Step Length (0.5, as per base model calibration)	
Convergence	Target GAP of 0.1% for entire model and 0.2% for A46 simulation area (sub-area)	

9.3 Network development

Overall approach

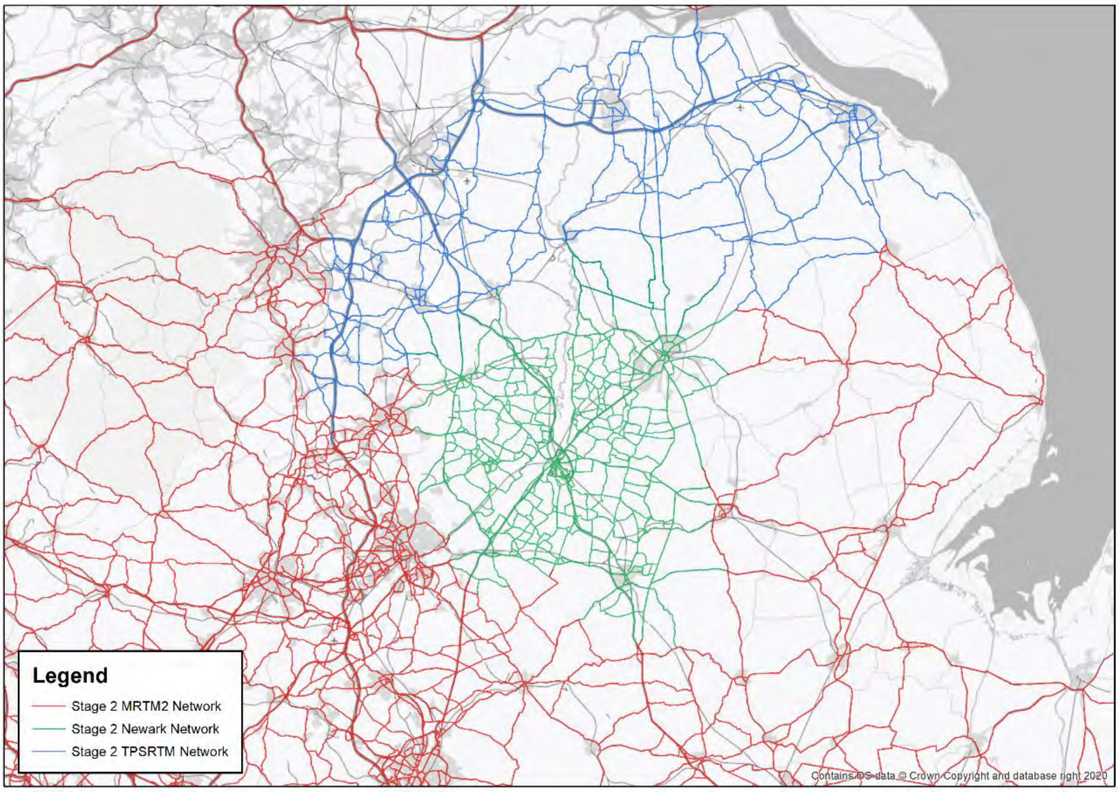
9.3.1 The network for the A46 Newark Bypass Model was initially developed from a combination of the MRTM2 model, the Enhanced A46 MRTM and the TPSRTM2 model. The network was then refined through a series of calibration checks and updates to ensure consistency and robustness.

9.3.2 In each of the modelling sub areas different levels of network definition and coding standards were adopted:

- In the Area of Detailed Modelling all A and B roads were included together with local unclassified roads which carry significant volumes of traffic. Junctions were explicitly represented using SATURN junction simulation coding. Link flow delay curves were introduced for dual carriageway links and all links where there was a separation of greater than 1 kilometre between junctions. Detailed zone loading points were included in the model. e.g. junction spigots. The Regional Traffic Models only include the major roads and any minor roads having considerable impacts on traffic routing. To include urban roads in Newark town centre and its vicinity, the simulation coding around Newark was introduced from the Enhanced A46 MRTM but checked and updated as necessary.
- The network in the Rest of Fully Modelled Area was sourced from MRTM2. MRTM2 used a tiered approach to coding, with differing standards applied across the model areas. This approach was retained. Newark falls inside the MRTM2 boundary, but the simulation area does not extend very far north of it, hence the use of the base network of the TPSRTM2 to extend the simulation network coding to include the M18/M180/A180.
- The External Area was sourced from MRTM2. MRTM2 coding is simulation coding with different levels of detail, depending on location/proximity to SRN. This was converted to fixed speed buffer network, noting that there would not be any scheme impacts in this area. The simplification assumptions applied within the external area were intended to reduce the risk of model noise and convergence issues, which can detrimentally impact on scheme appraisal. This approach meant that traffic in these areas would be less responsive to local delay or congestion, but full trip demands and full trip lengths through the FMA would still be represented.

9.3.3 The simulation coding for the A46 Newark Bypass Model follows the coding guidelines included in the National Highways Regional Traffic Model Coding Manual. Figure 9-5 shows the model network structure, indicating the source model used as the starting point for each area.

Figure 9-5: Extent of Network and Source of Data



Network Checks

9.3.4 All coding was undertaken following the Model Coding Manual to inform the parameters and general principles for consistency across the study area. Prior to commencing base model calibration and validation, a series of verification checks were run on the highway network. These checks compared the coded network against the parameters and general principles laid out in the Model Coding Manual.

9.3.5 The tests undertaken are outlined below.

- Network Routing
- Coded Link Length
- Buffer Zone Connector Distance

PCU Factors

9.3.6 As is common practice in highway modelling, vehicles are converted into ‘Passenger Car Units’ (PCUs) for assignment in the traffic model. The

PCU factors assumed for cars and LGVs were 1.0, and the factor for HGVs was 2.5.

9.3.7 For the purposes of determining queue lengths, PCUs are assumed to occupy a length of 5.75 meters.

Generalised Costs / Routing Parameters

9.3.8 Generalised cost values were calculated by vehicle type and journey purpose based on the vehicle operating costs and values of time outlined within TAG Unit A1.3. The generalised cost parameters used in the base model were informed by version 1.18 of the TAG Data Book (May 2022).

9.3.9 The highway generalised cost parameters used for 2019 are identified below.

9.3.10 Table 9-2 expresses value of time assumptions in pence per minute, and Table 9-3 expresses vehicle operating costs assumptions in pence per kilometre.

Table 9-2: Value of Time Assumptions - Pence Per Minute (PPM)

		AM	**IP**	**PM**
	OGV 2	22.73	22.73	22.73
	OGV Adjusted1	52.28	52.28	52.28
Car	Business	**31.50**	**32.27**	**31.95**
	Commuting	21.12	21.47	21.19
	Other	14.57	15.52	15.26
	Average	20.24	18.98	19.68
LGV	**Work**	23.66	23.66	23.66
	Non-Work	16.72	16.72	16.72
	Average	22.83	22.83	22.83
HGV[2]	**OGV 1**	22.73	22.73	22.73

1 A 60:40 split was assumed for all RTMs based on a review of classified count data

2 Includes HGV multiplier (2.3) for consistency with RTM technical guidance and to reflect the fact that route choice for HGVs is not purely down to the driver's value of time

Table 9-3: Vehicle Operating Cost Assumptions - Pence per Kilometre (PPK)

		AM	**IP**	**PM**
Car	**Business**	11.99	11.99	11.99
	Commuting	5.74	5.74	5.74
	Other	5.74	5.74	5.74
	Weekday Average	6.67	6.67	6.67
LGV	**Work**	14.11	14.11	14.11
	Non-work	7.35	7.35	7.35
	Weekday Average	13.30	13.30	13.30
HGV	**OGV1**	26.20	26.20	26.20
	OGV2	48.45	48.45	48.45
	OGV Adjusted1	40.44	40.44	40.44

1 A 60:40 split was assumed for all RTMs based on a review of classified count data

Assignment methodology

9.3.11 The assignment procedure in the highway model was based on a multiple user-class, steady-state equilibrium assignment. This uses a route choice model that is based on the Principle of Wardrop User Equilibrium (UE).

10 Model Calibration

10.1 Introduction

10.1.1 This chapter summarises the model network and matrix calibration methodology. It presents the calibration count data set, network calibration, the approach to matrix calibration using Matrix Estimation (ME) and the effects of ME.

10.2 Highway Assignment Calibration and Validation Criteria

10.2.1 TAG Unit M3.1 sets out calibration and validation acceptability guidelines for highway assignment models. The validation of a highway assignment model includes comparisons of the following:

- Assigned flows and counts totalled for each screenline or cordon, as a check of the trip matrices.
- Assigned flows and counts on individual links and turning movements at junctions as a check on the quality of the assignment.
- Modelled and observed journey times along routes, as a check on the quality of the network and assignment.

10.2.2 For trip matrix validation, comparisons at screenline level provide information on the quality of the trip matrices. The measure used is the percentage difference between modelled flows and counts. The validation criterion and guideline for screenline flows are defined in Table 10-1.

Table 10-1: Screenline Flow Validation Criterion and Guideline

Criteria	Guideline
Differences between modelled flows and counts should be less than 5% of the counts	**All or nearly all screenlines (i.e. 95%)**

Source: TAG M3.1 – Table 1

10.2.3 For link flow validation, the measures which should be used are:

- the absolute and percentage differences between modelled flows and counts.
- the GEH statistic, which is a form of the Chi-squared statistic that incorporates both relative and absolute errors, and is defined as follows:

$$GEH = \sqrt{\frac{(M-C)^2}{(0.5 \times (M+C))}}$$

where:

M is the modelled flow

C is the observed flow

10.2.4 The Validation criteria and guidelines for link flows and turning movements are defined in Table 10-2.

Table 10-2: Link Flow and Turning Movement Validation Criteria and Guidelines

Criteria	Description of criteria	Guideline
1	**Individual flows within 100 veh/h of counts for flows less than 700 veh/h**	**>85% of cases**
	Individual flows within 15% of counts for flows from 700 veh/h to 2700 veh/h	
	Individual flows within 400 veh/h of counts for flows more than 2700 veh/h	
2	GEH <5 for individual flows	>85% of cases

Source: TAG M3.1 – Table 2

10.2.5 For journey time validation, the measure which should be used is the percentage difference between modelled and observed journey times, subject to an absolute maximum difference. The validation criterion and guideline for journey times are defined in Table 10-3.

Table 10-3: Journey Time Validation Criterion and Guideline

Criteria	Guideline
Modelled times along routes should be within 15% of surveyed times (or 1 minute, if higher than 15%)	>85% of routes

Source: TAG M3.1 – Table 3

10.3 Calibration Dataset

Calibration Screenlines

10.3.1 Eight screenlines were developed for use in the calibration and validation of the model. Screenlines were located to capture all of the key traffic movements in the study area and included a cordon around Newark Town Centre. Six of the screenlines were used for calibration with two reserved for independent validation. The location of the screenlines are shown in Figure 10-1 and Figure 10-2 . Screenlines A and D were used for validation with the others being used for calibration.

Figure 10-1: Local Model Screenlines – wider view

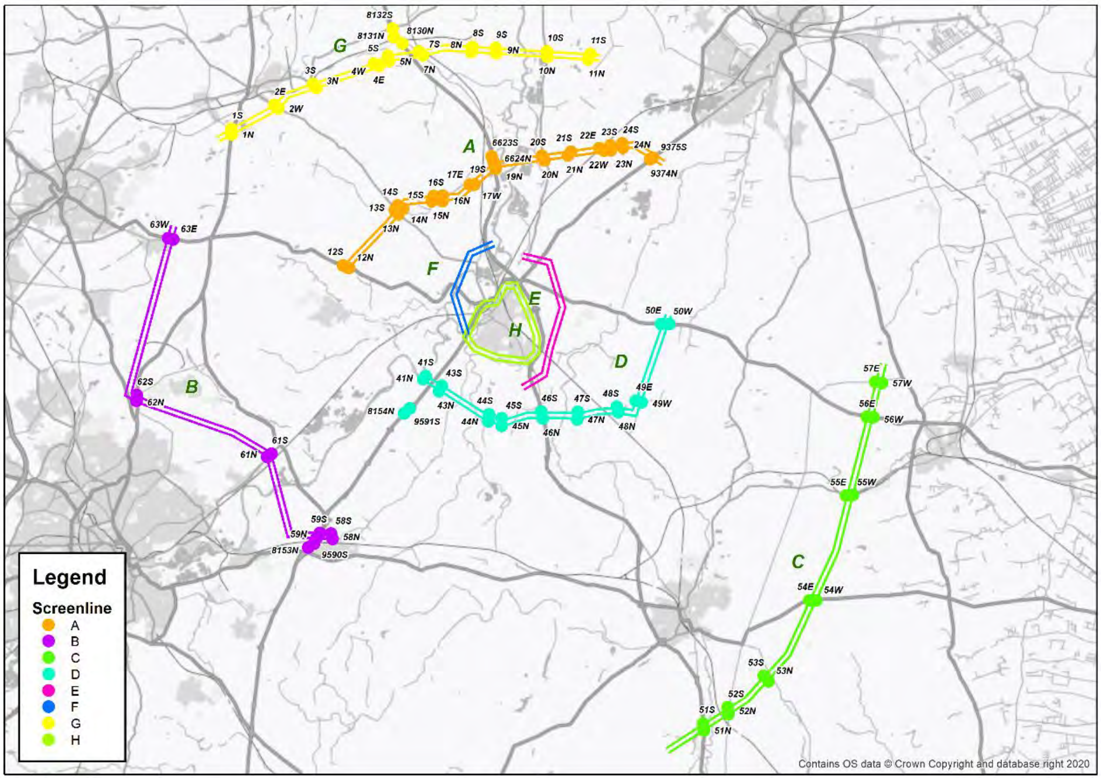
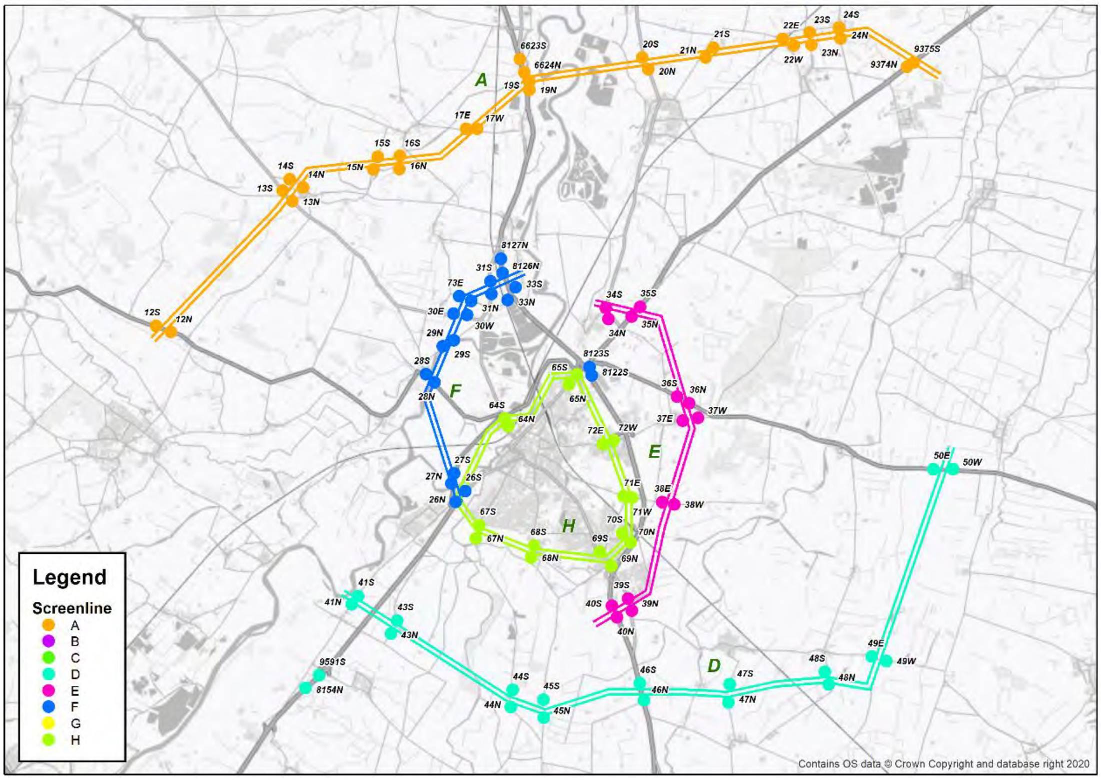


Figure 10-2: Local Model Screenlines – Newark area



Turning Counts

10.3.3 Manually classified turning count (MCTC) data collected at seven key junctions (shown in Figure 7-2) were introduced into the calibration process. Turning count data was constrained by adjacent link counts using a Furness procedure to ensure consistency across the count dataset. As these key junctions were coded in an exploded format with multiple nodes/links, only a limited number of specific turning movements could actually be represented as calibration constraints in the modelling.

Journey Time Validation Routes

10.3.4 Journey time validation was undertaken across nine journey time routes in both directions. The routes include those used in the development of the PCF Stage 2 model, shown in Figure 7-3, together with two further short routes that were added at PCF Stage 3, as illustrated in Figure 10-3.

Figure 10-3: Journey time validation routes 8-9

10.4 Network Calibration

10.4.1 During calibration, various elements of the network were reviewed following comparisons of model data against observations of traffic counts and journey times. A review of all warnings / serious warnings flagged by the software was undertaken, which included an examination of the various output files created by SATURN (i.e. .lpt, .lpn and .lpj files). Any specific issues identified during this review process were resolved through further network editing.

10.4.2 Network calibration was driven by aiming to achieve a good fit between the modelled and observed journey times and link flows/turning movements at junctions. As part of this calibration, nodes with unrealistic delays were checked and modified where necessary to achieve realistic journey times.

10.4.3 Modifications made to the network included changes to turn saturation flows, number of approaching lanes at nodes, signal timings in each time period, roundabout parameters and revisions to the link speed-flow curves /fixed speeds for achieving the observed link journey times. Such enhancements to the network coding were undertaken throughout the A46 simulation area.

10.5 Prior Matrix Performance

The "prior" matrices were assigned to the network to understand the level of performance and determine if further matrix development work was required. A summary of the "prior" matrix calibration and validation results for screenlines, links and journey time routes is presented in Table 10-4.

Table 10-4: Prior Model Calibration and Validation Results

	TAG Criteria		**AM**	**IP**	**PM**
Primary screenlines within 5%	All or nearly all	Calibration	50%	58%	25%
			6/12	7/12	3/12
		Validation	75%	100%	100%
			3/4	4/4	4/4
		Total	56%	69%	44%
			9/16	11/16	7/16
Primary links passing GEH or flow criteria	>85%	Calibration	71%	85%	71%
			70/99	84/99	70/99
		Validation	92%	100%	92%
			44/48	48/48	44/48
		Total	78%	90%	78%
			114/147	132/147	114/147
Journey time routes within 15%	>85%		94%	100%	94%
			17/18	18/18	17/18

10.5.1 Screenline analysis was used to demonstrate the trip matrix validation. The comparison of modelled and observed flows across screenlines indicated that the assignment of the prior matrices was generally poor, with a significant number of screenlines failing to meet the TAG target.

10.5.2 Validation links and journey time route comparison showed much better results, exceeding the TAG criteria in all three time periods.

10.5.3 These results indicated that further matrix calibration was required.

10.6 Matrix Estimation Methodology

10.6.1 The Matrix Estimation (ME) procedure attempts to improve the prior matrix so that a better fit between the modelled flows and observations can be achieved. ME was undertaken within SATURN using the SATPIJA and SATME2 modules and was based on counts by vehicle type (Car, LGV, HGV). To ensure an appropriate level of convergence, the matrix estimation process was run for six iterations.

10.6.2 XAMAX is a parameter that defines the maximum balancing factor used to limit excessive changes to the prior matrix. A value of two was used for car and a value of five used for the LGV and HGVs, which were consistent with all the RTM2 models. These values reflect the relative confidence in the data used to develop the demand for each of the vehicle classes.

10.6.3 The observed counts were generally input into the ME procedure in mini-screenline groups as per the MRTM2 methodology. SATURN then treats these mini-screenlines as an aggregate target against which the software attempts to match modelled and observed flows for each of the three vehicle classes.

10.7 Monitoring Matrix Estimation Changes

General

10.7.1 To understand the changes that matrix estimation had made to the prior matrix and to ensure that the effects were reasonable, it was necessary to undertake various analyses as set out in TAG M3.1. Table 10-5 sets out the criteria to judge the significance of the changes brought by ME as recommended by TAG (M3.1). It was recognised that achieving all these criteria in the A46 Newark Bypass Model could be challenging given the area and coverage of the model and therefore the matrix estimation effect was not considered against strict pass and fail criteria, but the overall level of model calibration/validation was assessed, including the comparison against the observed journey times.

Table 10-5: Significance of Matrix Estimation Changes (TAG M3.1)

Measure	Significance Criteria
Matrix zonal cell values	Slope within 0.98 and 1.02 Intercept near zero R^2 in excess of 0.95
Matrix zonal trip ends	Slope within 0.99 and 1.01 Intercept near zero R^2 in excess of 0.98
Trip Length Distributions	Means within 5% Standard Deviations within 5%
Sector to sector level matrices	Differences within 5%

10.7.2 The results of the analyses are summarised below:

- **Matrix Totals** - changes in car trips arising from ME were less than 1% in each period. LGV and HGV trips changed by a larger amount, approximately 3% and 7% respectively, but the absolute values were still relatively small.
- **Trip Length Distributions -** A comparison of trip length distribution for all trips with at least one trip end in the FMA was undertaken between the prior and final matrices. The change in the mean and standard deviation of trip length was mostly within the 5% TAG criteria for Cars. Larger changes were experienced in LGVs and HGVs, which reflect the reduced confidence in prior LGV and HGV matrices.
- **Sector to Sector Changes** - Analyses of sector-to-sector movements before and after matrix estimation shows that across all vehicle types around 60% of the sector-sector movements changed by less than 10%. However, nearly 80% of movements in each period had a GEH value of less than 5, which reflects the relatively low volume of trips in many of the sector pairs.
- **Zonal Trip Ends** - Linear regression analysis of the change in zonal trip ends indicated that the changes for cars generally satisfy or are very close to the TAG criteria when all purposes are combined. All slope values for cars are slightly below 1, indicating that a slight reduction in car trips was brought about by matrix estimation. The slope and R^2 values for freight purposes are slightly further away from 1 when compared with cars, but are still relatively close to the TAG criteria set out above. These results again reflect the reduced confidence in prior LGV and HGV matrices. All y-intercept values are observed to be near zero.
- **Zonal Cell Values -** Linear regression analysis of the change in zonal cell values indicated that all user classes across all time periods have an intercept near zero when inter-zonal cell values for trips with a trip end in the FMA are considered. The slope and R^2 values for cars and HGVs satisfy the TAG criteria in most periods. The values are slightly lower for LGVs, indicating that matrix estimation is reducing LGV trips by a larger amount when compared to the other vehicle types.

10.7.3 In summary, for most measures the overall changes brought about by matrix estimation meet or are close to the significance criteria recommended by TAG. For LGVs and HGVs some of the significance criteria are not met reflecting the lower level of confidence in the prior matrices. The sector to sector changes do not meet the significance criteria, however are considered acceptable, given the significance of the matrix changes against the other measures.

10.8 Matrix Calibration Results

10.8.1 The results of the model calibration using matrix estimation are presented in Table 10-6. The results demonstrate that following the matrix estimation process, all or nearly all screenlines meet the TAG acceptability criteria in all time periods. At the individual link level, the TAG acceptability criteria are met in all time periods. The results of the calibration exercise demonstrate that following matrix estimation overall the model meets TAG acceptability guidelines in all time periods.

Table 10-6: Model Calibration Summary

	AM	IP	PM	Acceptability guideline
Screenlines Flow Diff. < 5%	92%	83%	83%	All or nearly all screenlines
	11 / 12	10 / 12	10 / 12	
Screenlines GEH < 4	100%	92%	83%	(Legacy target from DMRB no longer included in TAG)
	12 / 12	11 / 12	10 / 12	
Links GEH or Flow Criterion	91%	94%	90%	> 85% of links

11 Model Validation

11.1 Introduction

11.1.1 This chapter outlines the process of validating the base year model and provides a summary of the validation results. Traffic count data not used for the matrix estimation process or for the matrix building exercise provides a set of independent flow validation data. The model was also validated against journey time data.

11.2 Model Assignment Convergence

11.2.1 Section 3 of TAG Unit M3.1 identifies a set of convergence measures (of proximity and stability) considered acceptable for use in establishing a base highway assignment model. TAG further specifies that scheme appraisal may require tighter levels of convergence. The A46 Newark Bypass Model adopts a tighter set of convergence criteria by increasing the SATURN ISTOP parameter from the default of 98% to 99%. The result of this is that the assignment only stops iterating when at least 98.5% of links experience flow changes of less than 1% for four consecutive iterations.

11.2.2 The statistics for post-matrix estimation assignments for the final four loops of each time period show good convergence in all time periods; they all have %GAP statistics of less than 0.1% as specified in the TAG criteria.

11.3 Model Assignment Validation

11.3.1 The TAG criteria detailed above were used to assess all screenline and link flows and journey times within the model. The location of the validation screenlines is presented in Figure 10-1 and Figure 10-2 (screenlines A and D have been used for validation with the others being used for calibration). Results are presented separately for the calibration and validation counts, together with the combined count data set in Table 11-1.

Table 11-1: Model performance summary

	Calibration			Validation			Calibration and Validation			
	AM	IP	PM	AM	IP	PM	AM	IP	PM	Acceptability guideline
Links GEH or Flow Criterion	91%	94 %	90 %	100 %	100 %	96%	94%	96%	92%	> 85% of links
Screenlines Flow Diff. < 5%	92%	83 %	83 %	75%	100 %	100 %	88%	88%	88%	All or nearly all screenlines
	11 / 12	10 / 12	10 / 12	3 / 4	4 / 4	4 / 4	14/16	14/16	14/16	
Screenlines GEH < 4	100 %	92 %	83 %	75%	100 %	100 %	94%	94%	88%	(Legacy target from DMRB no longer included in TAG)
	12 / 12	11 / 12	10 / 12	3 / 4	4 / 4	4 / 4	15/16	15/16	14/16	
JT Routes Diff. < 15%				100 %	100 %	100 %				> 85% of routes

11.3.2 The results indicate that the validation screenlines, individual counts and journey time routes meet TAG acceptability criteria in all time periods. The combined dataset (both calibration and validation counts) meets TAG acceptability criteria for both screenlines and individual counts. This demonstrates that the model is appropriately calibrated and validated.

11.3.3 The results show that flows for calibration screenlines are within 5% of observed flows for nearly all screenlines, with only two of these screenlines not satisfying the criteria in the IP and PM periods and one in the AM period. For validation screenlines, one out of four failed the criteria in the AM period, with all of them passing in the IP and PM periods.

11.3.4 An analysis of the individual links in the model was carried out, showing good results in many cases, with links in the local scheme area and much of the wider area meeting the criteria in each time period. Those links that do fail are generally further away from the scheme area.

11.3.5 Turning counts at the main junctions on the scheme have been used in the calibration of the base highway assignment model. At each junction, all or nearly all of the turns assessed meet TAG acceptability guidelines, noting that observed flows for selected are compared due to the representation of junctions in the SATURN model.

11.4 Journey Time Performance

11.4.1 Table 11-2 presents a comparison of modelled and observed journey times along the entire length of each route. The journey time routes are presented in Figure 7-3 and Figure 10-3. The journey time performance of the model is shown to be good, with all routes in all periods meeting the relevant TAG criteria. Journey times within the model are generally a good match against observations throughout the length of each route.

Table 11-2: Journey time route performance (minutes)

Route ID	AM Period				Inter peak				PM period			
	Obs.	Mod.	% Diff	Pass?	Obs.	Mod.	% Diff	Pass?	Obs.	Mod.	%Diff	Pass?
JT1 NB	93.8	100.0	7%	Yes	93.4	94.2	1%	Yes	92.8	98.7	6%	Yes
JT1 SB	96.6	97.1	1%	Yes	94.4	91.4	-3%	Yes	94.1	95.0	1%	Yes
JT2 NB	83.3	88.4	6%	Yes	81.5	78.9	-3%	Yes	83.1	90.4	9%	Yes
JT2 SB	85.2	97.5	14%	Yes	83.2	80.2	-4%	Yes	86.4	91.4	6%	Yes
JT3 NB	44.4	43.4	-2%	Yes	45.4	44.0	-3%	Yes	44.5	45.0	1%	Yes
JT3 SB	45.0	44.3	-2%	Yes	44.5	43.6	-2%	Yes	44.1	43.7	-1%	Yes
JT4 NB	37.1	37.7	2%	Yes	37.4	37.0	-1%	Yes	36.4	37.9	4%	Yes
JT4 SB	36.9	37.8	3%	Yes	38.5	36.8	-4%	Yes	37.7	37.7	0%	Yes
JT5 NB	19.3	19.7	2%	Yes	18.9	19.6	4%	Yes	18.3	20.0	9%	Yes
JT5 SB	18.8	19.8	5%	Yes	19.2	19.5	2%	Yes	18.5	19.7	6%	Yes
JT6 EB	30.3	32.7	8%	Yes	29.4	30.0	2%	Yes	30.2	31.0	3%	Yes
JT6 WB	30.2	31.3	4%	Yes	29.8	30.6	3%	Yes	29.4	31.3	6%	Yes
JT7 EB	22.2	22.4	1%	Yes	21.0	20.8	-1%	Yes	20.8	21.8	5%	Yes
JT7 WB	21.4	23.6	10%	Yes	21.5	21.3	-1%	Yes	21.5	23.3	8%	Yes
JT8 NB	14.7	14.8	1%	Yes	14.7	13.6	-7%	Yes	16.4	16.5	1%	Yes
JT8 SB	15.7	15.0	-4%	Yes	14.4	13.1	-9%	Yes	14.5	13.5	-7%	Yes
JT9 NB	9.8	10.2	4%	Yes	10.1	10.4	3%	Yes	9.9	10.6	8%	Yes
JT9 SB	9.8	10.4	6%	Yes	9.6	10.0	4%	Yes	9.6	10.1	5%	Yes

11.5 Route Choice Validation

11.5.1 Through the network calibration and validation stages, reviews of routing within the model were undertaken, with focus given to routes for short distance trips that travel north-south and west-east through Newark and long-distance trips such as Sheffield-North Peterborough, Grimsby-Nottingham, Louth-Mansfield, Leeds-East Lincolnshire. The analysis indicated that, in general, the modelled routes appeared logical. Routes were also compared against internet journey time sources such as Google Maps as a further check.

11.6 Variable Demand Model Realism Testing

11.6.1 Fuel cost realism tests were undertaken to assess the impact of a 10% increase in fuel costs on car vehicle kilometres. Rail fare realism tests were also undertaken, to assess the impact on the amount of rail trips with a 10% increase in rail fares.

11.6.2 The values of mode choice and destination choice parameters were retained from the calibrated MRTM2 demand model.

Fuel Cost Realism Test Results

11.6.3 The calculated overall fuel cost elasticity (-0.28) is within the TAG indicated range of -0.35 to -0.25 and is the same (to 2dp) as the elasticity from MRTM2. The all-purpose elasticities are seen to be weaker in the peak periods, which aligns with the suggested patterns in TAG.

Rail Fare Realism Test Results

11.6.4 The calculated overall rail fare elasticity (-0.57) is within the TAG indicated range of -0.2 to -0.9 and is the same (to 2dp) as the elasticity from MRTM2. The all-purpose elasticities are seen to be weaker in the peak periods, which aligns with the suggested patterns in TAG.

11.6.5 The Employers Business and Other segments are more elastic in the A46 model when compared to MRTM2, while the Commute segment is less elastic. This could be due to the differing definitions of the fully modelled area between the two models.

11.6.6 Overall, the elasticities calculated for both the fuel cost and rail fare realism tests are within the acceptability criteria indicated in TAG and are therefore considered suitable for scheme appraisal purposes at PCF Stage 3.

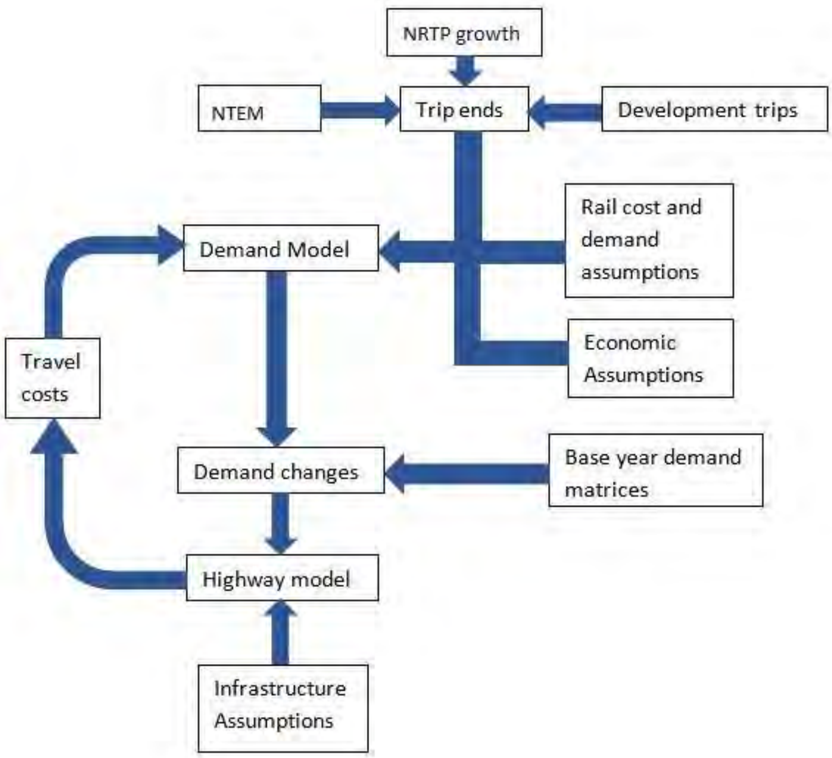
12 Forecasting Assumptions

12.1 Forecasting Approach

12.1.1 This section of the report provides an overview of the approaches taken when developing future year traffic forecasts used to assess the impact of the scheme.

12.1.2 An overview of the approach adopted is given in Figure 12-1.

Figure 12-1: Forecasting Approach



12.1.3 The forecast traffic models account for future proposed residential and employment developments in the local area, as well as proposed transport network changes relative to the A46 Newark Bypass Model base year (2019).

12.1.4 The core forecast scenarios comprise the following:

- A set of transport network changes
- Assumptions about changes in values of time and vehicle operating costs over time using the January 2023 version of the Transport Analysis Guidance (TAG) Data Book (v1.23).
- A specific set of development assumptions
- Application of National Trip End Model Core (NTEM v8.0) growth factors for cars as a control for demand growth
- Application of core National Road Traffic Projections 2022 (NRTP22) for freight growth (LGV and HGVs)

- Application of speed adjustments based on the Department for Transport (DfT) scenario 1 for fixed speed links in the external area of the model

12.1.5 The future year transport network changes and development assumptions have been determined in-line with TAG and make use of Uncertainty Logs.

12.2 Forecast Years

12.2.1 Forecasts have been prepared for an estimated scheme opening year of 2028, an intermediate year of 2043, required for the noise assessment and a horizon forecast year of 2061, representing the latest year currently included in NTEM.

12.3 Forecast Scenarios

12.3.1 The following forecasts have been produced for each forecast year:

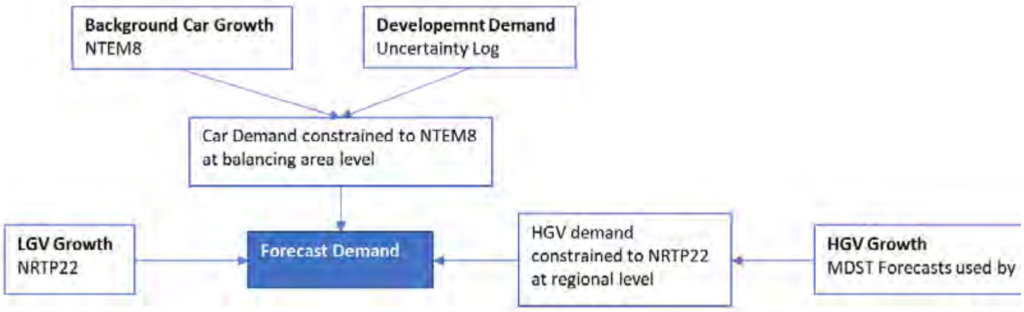
- Do-Minimum forecasts – forecasts of future year trip matrices and future transport networks that exclude the proposed A46 Newark Bypass scheme
- Do-Something forecasts – as per the Do-Minimum forecasts, but also including the A46 Newark Bypass scheme

12.3.2 The future year forecasts have been developed for a ‘Core Scenario’ which is based on the Core Scenario traffic growth from the DfT’s National Transport Model. Sensitivity tests have been carried out for the High Economy and Low Economy scenarios from the DfT’s Common Analytical Scenarios (CAS).

12.4 Future Year Demand

12.4.1 The development of future year travel demand draws on a number of sources including the National Trip End Model (NTEM v8.0), National Road Traffic Projections (NRTP22), freight forecasts provided through the RTMs by MDS Transmodal (MDST), as well as local development data in the form of a development uncertainty log. The process applied is outlined in Figure 12-2 below.

Figure 12-2: Forecast Demand Overview



Development Trips

Uncertainty Log

12.4.2 Traffic demand associated with future planned developments in local authority districts close to the scheme were accounted for in the forecasts. Traffic growth associated with developments was applied and aligned with NTEM growth.

12.4.3 The uncertainty log from PCF Stage 2 was cross referenced with a number of district councils in close proximity to the scheme and updated in line with the latest planning approvals adding further residential and employment developments near the A46 corridor. The district councils approached during the development of the uncertainty log are listed below:

- Bassetlaw
- Gedling
- Lincoln
- Mansfield
- Melton
- Newark & Sherwood
- North Kesteven
- Rushcliffe
- South Kesteven
- West Lindsey

12.4.4 The level of certainty for each development was assigned based on its status, and cross referenced with relevant local authorities in accordance with the definitions of uncertainty contained in TAG Unit M4. A total of 362 developments were identified as being either ‘Near certain’ or ‘More than likely’ and were incorporated within the core forecasts, in accordance with TAG. Figure 12-3 identifies the location of all of the developments included in the model while Figure 12-4 shows the development sites near Newark.

Figure 12-3: Development sites

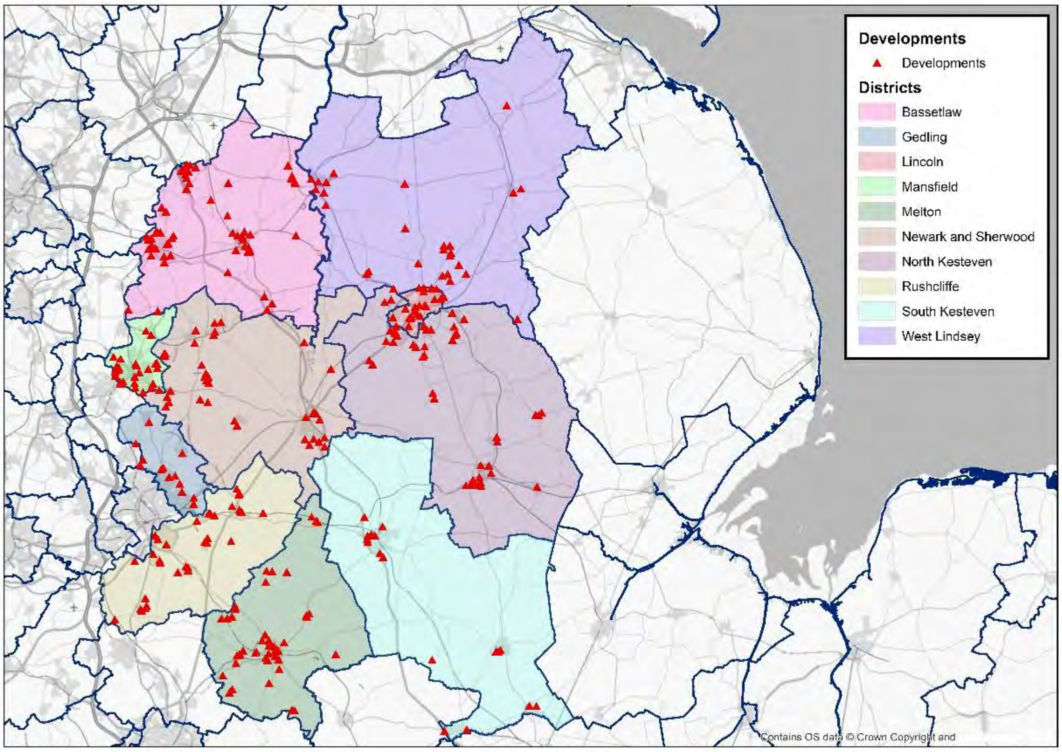
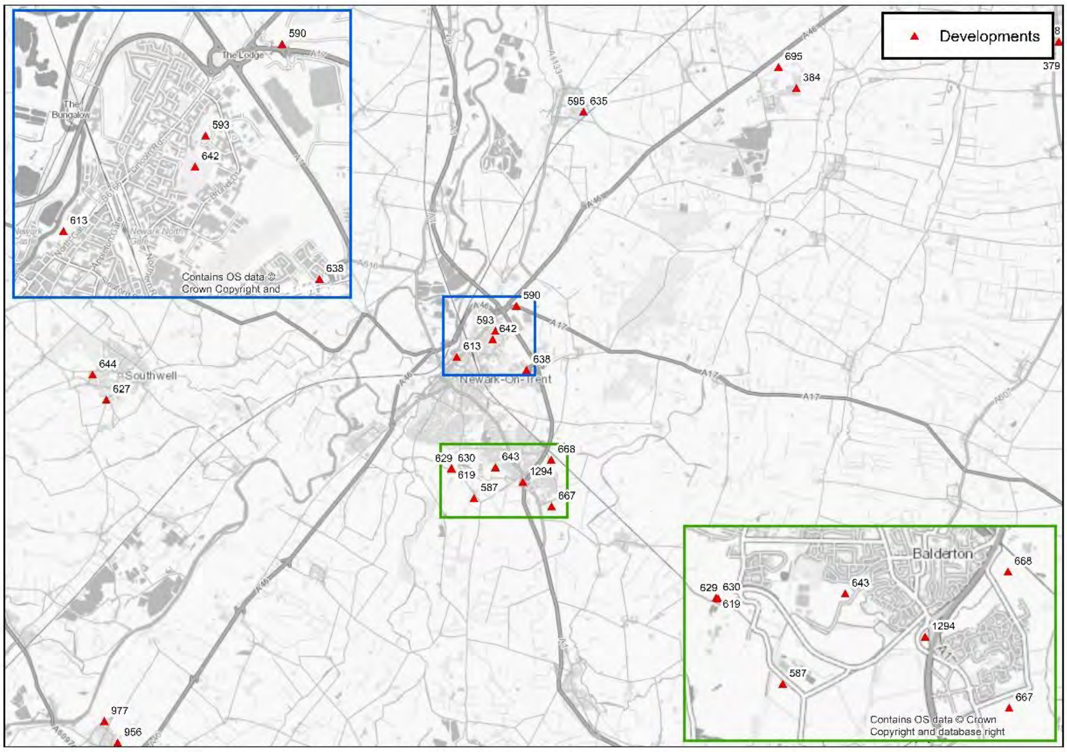


Figure 12-4: Development sites – Newark area



12.4.5 None of the developments were identified as being scheme dependent, either in the uncertainty log, or by the relevant local authority.

Development Trip Generation

12.4.6 Trip end totals for each development were estimated using car driver trip rates (rates per dwelling and rates per job) derived from NTEM Version 8.0 at local authority level. This enabled 24-hour Production / Attraction (PA) and Origin / Destination (OD) trips by period to be calculated for each development based on the quantum of development. This is consistent with an approach devised by National Highways RTM Forecasting Consistency Group (FCG), which was implemented in the original regional model forecasts and in models that were subsequently derived from them.

Development Trip Distribution

12.4.7 The development trip ends were distributed using the Highways England Donor Distribution Tool (HEDDiT), which was developed for Highways England for use in the regional traffic models.

12.4.8 HEDDiT applies a distribution to the development trip ends based on existing distributions of selected ‘donor’ zones. The donor zones are typically zones local to the development and with similar land uses. The output from HEDDiT is a matrix of development trips, which are input into the forecast model runs.

Reference Demand

Private Vehicle Demand – NTEM

12.4.9 Forecast trip ends from Version 8.0 of the National Trip End Model (NTEM) were used to derive trip end growth factors at model zone level, via an NTEM-to-model zone correspondence list.

12.4.10 The growth factors were derived as Origin and Destination factors (or Production and Attraction factors for Home-Based trips) for each of the demand segments required for input into the Variable Demand Model.

12.4.11 The growth factors were derived for car vehicle trips and rail trips separately and from the 2019 base year to each of the forecast years. The factors relate to car available trips only and were derived and applied at model zone level.

12.4.12 To reduce the amount of “double counting” associated with spatially allocated developments, the “alternative assumptions” facility was used in TEMPRO, to derive NTEM growth factors that exclude the uncertainty log developments. The use of alternative assumptions allows for more subtle adjustments to be made to the forecasts when constraining demand at an aggregate level.

12.4.13 Overall growth by purpose was constrained to NTEM at an aggregate level across local authority districts within the region of focus and at regional level outside of this. The areas over which growth was constrained to NTEM are illustrated in Figure 12-5 and Figure 12-6.

Figure 12-5: Trip growth constraint areas – fully modelled area

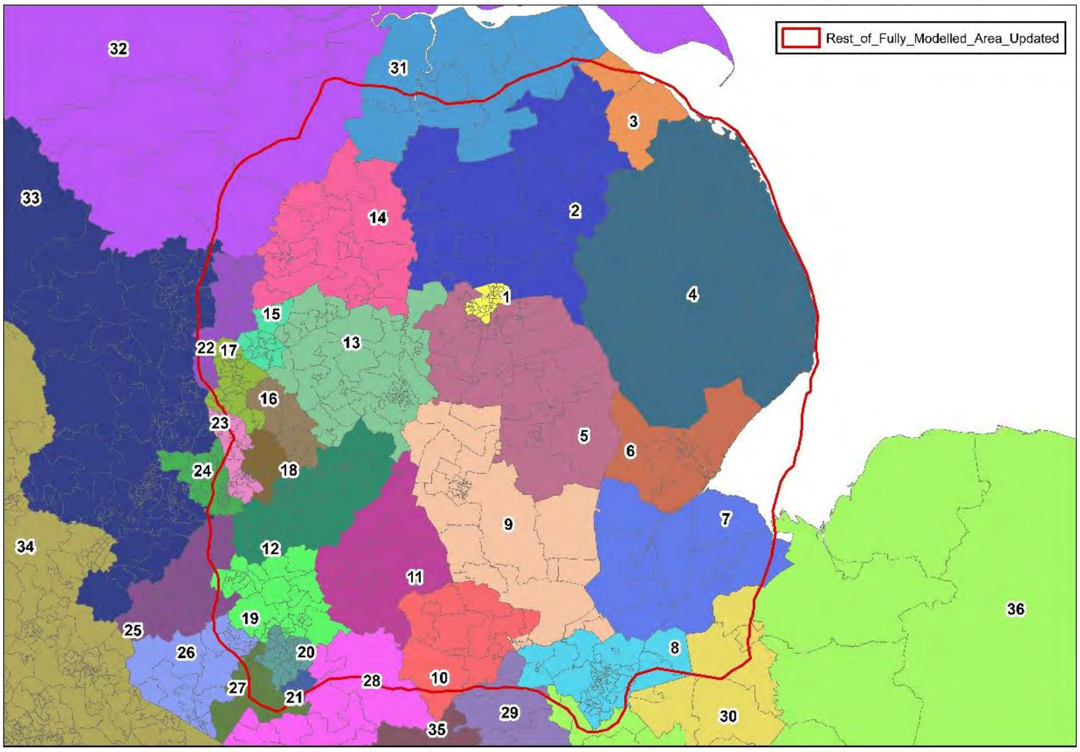
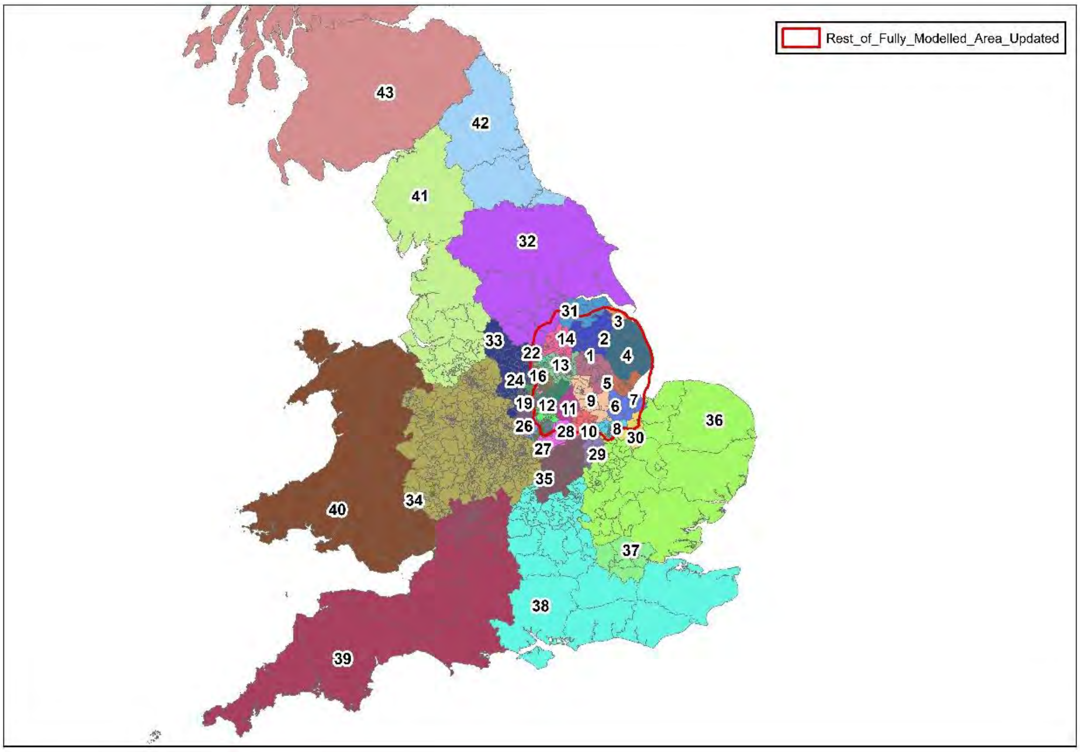


Figure 12-6: Trip growth constraint areas



LGV and HGV Demand

12.4.14 Trip end growth factors for LGVs were derived using National Road Traffic Projections (NRTP) 2022 data (core scenario), which are based on output from the DfT's National Transport Model. Unlike NTEM, which has a final forecast year of 2061, the NRTP22 data only extends to 2060, so for the 2061 forecast year the growth was extrapolated from the forecast 2055 to 2060 growth rates.

12.4.15 HGV growth factors were derived from forecast MDS Transmodal (MDST) matrices used in MRTM2. Factors for each forecast year were interpolated between the MRTM2 forecast years and constrained to NRTP22 at a regional level. In the absence of NRTP22 forecasts for Scotland, growth factors for the North East region were adopted as a proxy for Scotland.

Ports and Airports

12.4.16 Following the methodology from MRTM2, no growth associated with ports was assumed for cars, while freight forecasts were assumed to be in line with the general assumptions around the growth of LGV/HGV trips – i.e. LGV follow NRTP22 and HGVs follow MDST growth constrained to NRTP22.

12.4.17 Airport growth was also developed in line with the method employed at MRTM2. Growth factors were derived from the DfT 2017 UK aviation forecasts for each year and airport.

Forecast Growth Summary

12.4.18 Table 12-1 tabulates the growth by trip purpose for trips with at least one end in the fully modelled area. Values are presented at a 24-hour OD level.

Table 12-1: Reference Growth Summary

	Demand				**Growth**		
Purpose	**2019**	**2028**	**2043**	**2061**	**2028**	**2043**	**2061**
Car Business	238,522	255,383	272,212	279,521	7%	14%	17%
Car Commute	463,598	493,149	518,370	522,399	6%	12%	13%
Car Other	827,559	897,602	976,129	1,031,763	8%	18%	25%
LGV	258,917	298,281	352,076	409,852	15%	36%	58%
HGV	115,264	120,135	127,513	133,308	4%	11%	16%

12.5 Future Year Networks

12.5.1 Highway networks were produced for the Do-Minimum and Do-Something scenarios for each of the three forecast years (2028, 2043 and 2061). The inclusion of the A46 Newark Bypass scheme was the only difference between the Do-Minimum and Do-Something highway networks.

Supply Uncertainty Log

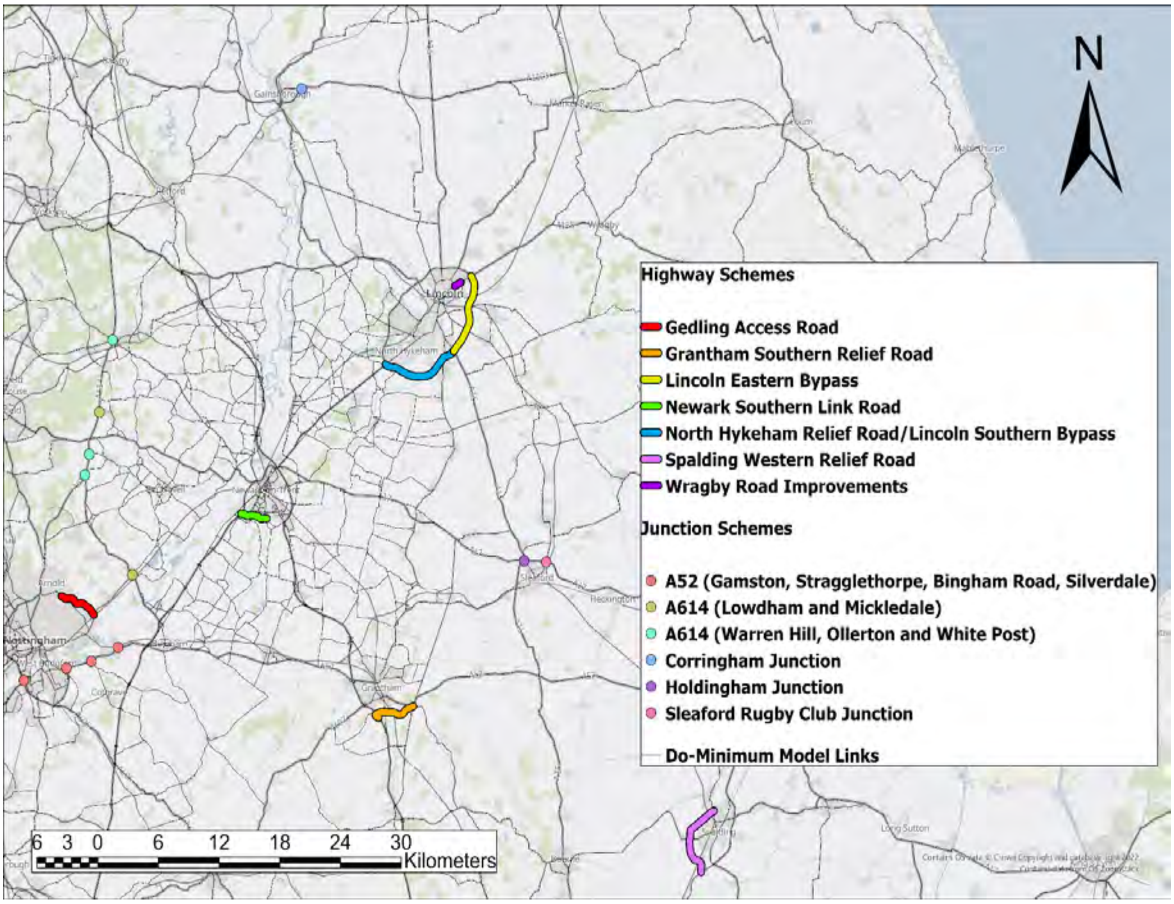
12.5.2 A transport supply uncertainty log was compiled using details provided by National Highways and local authorities.

12.5.3 The supply uncertainty log identified schemes across the fully modelled area. Each scheme was allocated a level of certainty in-line with criteria in TAG Unit M4.

Do-Minimum Network

12.5.4 The schemes identified in the supply uncertainty log as ‘Complete’, ‘Near certain’ or ‘More than likely’ are included within the Do-Minimum network. Schemes that are included in the forecast networks are displayed in Figure 12-7.

Figure 12-7: Do-Minimum Schemes



12.5.5 The Do-Minimum network also included a limited number of amendments to facilitate the modelling of some larger developments where the skeletal nature of the base model was enhanced locally to enable trips to/from these developments to access the wider network unimpeded.

12.5.6 The external area fixed speed links were adjusted from the 2019 base year using forecast speed changes identified in the Department for Transport (DfT's) National Road Traffic Projection 2022 (NRTP22) data.

Do-Something Networks

12.5.7 The Do-Something elements were identical to the Do-Minimum networks apart from the inclusion of the proposed scheme option for the A46 Newark Bypass. Details of the proposed scheme are included in Section 2.5 and illustrated in Figure 2-3.

Network Calibration

12.5.8 On completion of the preliminary forecast networks a number of reviews and checks were undertaken to ensure that the future year networks responded in a realistic way to the changes in traffic and infrastructure.

12.6 Variable Demand Model

12.6.1 The variable demand model, developed using DIADEM, was used to generate the future year forecasts. The VDM adjusts the reference demand according to changes in travel costs compared to the base year scenario. Three travel responses were included representing the choice of where to travel to (distribution), which travel mode to use (car or rail), and what time of day to travel (time period choice).

12.6.2 Future travel costs will change as a result of network performance and future changes in the value of time, vehicle operating costs, tolls and rail fares.

12.6.3 The VDM was run for both the Do-Minimum and Do-Something scenarios and all forecast years.

Reference Travel Costs

12.6.4 The reference travel costs from which all forecast scenarios have been pivoted were from the validated 2019 base-minus assignments. The 2019 base year model includes roadworks when the model data was collected, the base-minus model excludes the roadworks. The off-peak reference costs were obtained from assigning the base year off-peak matrix to the base year inter-peak network.

Forecast Year Travel Costs

12.6.5 Changes in travel costs in the opening and forecast years are to be expected due to increases in incomes and the value of time, changes in fuel costs and improvements in vehicle efficiency. To reflect this, the cost coefficients included in the assignment and demand models were updated for the future years in line with TAG.

12.6.6 The Value of Time (VOT) and Vehicle Operating Cost (VOC) vary by journey purpose and also by forecast year to represent changes in fuel costs and income. Changes in fuel costs, vehicle efficiency and values of time were taken from the TAG Data Book, January 2023. These were used to calculate the forecast year values of time and vehicle operating costs.

Toll Charges

12.6.7 All toll charges have been kept fixed in real terms (i.e. tolls are assumed to rise in line with general inflation) in accordance with the methodology adopted in the MRTM2 forecasts.

Rail Times and Fares

12.6.8 Future year rail times and fares were obtained from the MRTM2 and rezoned to fit the A46 Newark Bypass Model. The times and fares form an input to the VDM forecasting.

12.7 Forecast Sensitivity Tests

12.7.1 Two sensitivity tests were undertaken which model lower and upper bounds of demand growth, as set out in the National Highways TPG guidance note on the use of the NTEM8 Common Analytical Scenarios (CAS).

12.7.2 The two CAS that have been modelled as sensitivity tests were:

- NTEM8 & NRTP22 High Economy CAS
- NTEM8 & NRPT22 Low Economy CAS

12.7.3 The main features of the High and Low Economy CAS include revised assumptions surrounding GDP, population, and employment growth. The assumptions are highlighted in Table 12-2

Table 12-2: Description of High Economy and Low Economy CAS

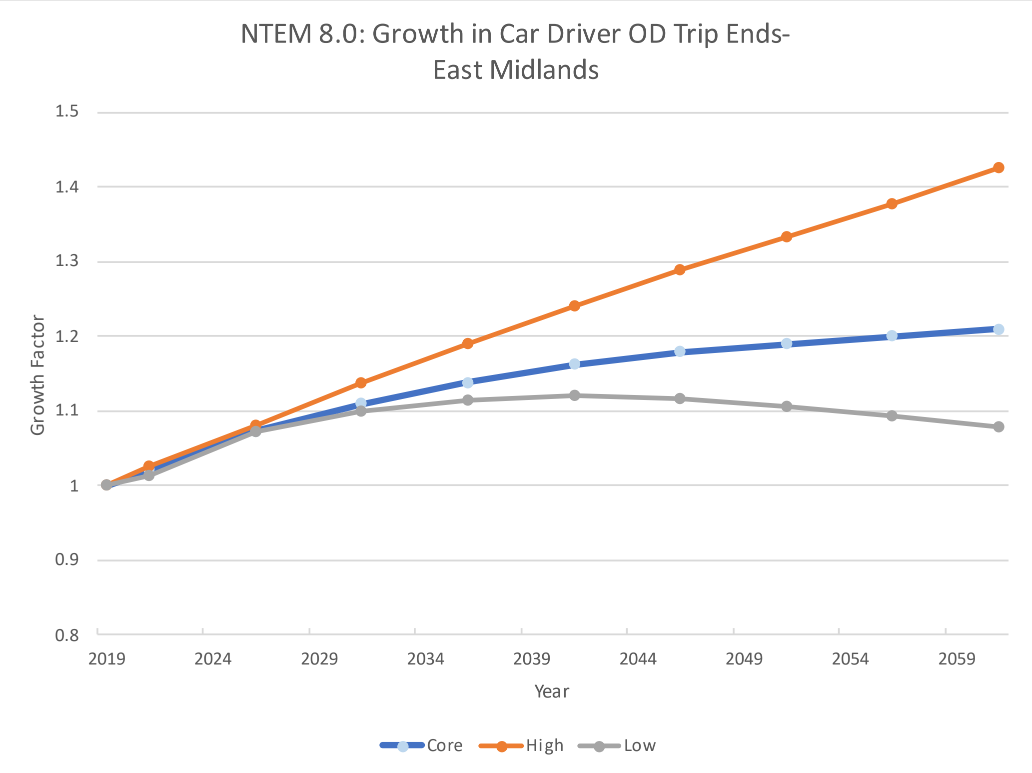
Metric	High Economy	Low Economy
GDP	10% higher in 2050 relative to reference assumptions	31% lower in 2050 relative to reference assumptions
Population	GB total reaches 77.7m by 2050	GB total reaches 64.6m by 2050
Employment	12% higher in 2050 relative to reference assumptions	7% lower in 2050 relative to reference assumptions

Source: National Highways TPG NTEM8 & CAS Guidance Note

12.7.4 The methodology for developing the forecast demand for the High Economy and Low Economy CAS was very similar to the method used in the development of the core forecasts, with the only difference relating to the use of the specific CAS datasets in NTEM8 and NRTP22 when producing the background Car, LGV and HGV growth.

12.7.5 Figure 12-8 displays the forecast demand profile for the Core, High Economy and Low Economy NTEM8 CAS for Car Driver OD trip ends in the East Midlands. The core growth factors sit between the High Economy and Low Economy scenarios, and the differences between the scenarios become more pronounced as time progresses. The Low Economy scenario displays a notably different trend after 2041, where the growth rates start to decline.

Figure 12-8: NTEM8 CAS Demand Profile



12.7.6 Table 12-3 compares the reference highway demand (pre-VDM) to the base for the core and both sensitivity tests. The core demand sits logically between the Low Economy and High Economy demand in all cases. The unique shape of the Low Economy demand profile is reflected in the matrix totals, where both 2028 and 2043 exhibit greater growth than 2061.

Table 12-3: Base and Reference Forecast Highway car demand matrix totals

Mode	Year	Base	Core (vs Base %)	Low (vs Base %)	High (vs Base %)
Highway (cars)	2028	74,819,333	80,560,204 (7.7%)	80,165,868 (7.2%)	81,748,361 (9.3%)
	2043	74,819,333	85,593,780 (14.4%)	81,870,632 (9.4%)	92,315,892 (23.4%)
	2061	74,819,333	88,468,804 (18.2%)	78,777,494 (5.3%)	104,082,740 (39.1%)

Networks

12.7.7 SATURN networks have been developed for each CAS, scenario and forecast year. The differences between the CAS and the core networks are listed below:

- Network links with fixed speeds were adjusted in accordance with the High Economy and Low Economy NTRP22 scenarios
- Unique generalised costs were used for each CAS

12.8 Conversion to AADT and AAWT flows

12.8.1 The traffic models were built to represent an average March weekday, modelling a peak hour in the AM peak period (07:00-10:00), an average hour in the inter-peak period (10:00-16:00) and a peak hour in the PM peak period (16:00-19:00).

12.8.2 To calculate traffic flows for other time periods, including daily flows, a series of factors were developed. These were calculated using continuous WebTRIS data from locations along the A46 and A1 corridors from 2023.

12.8.3 These counts captured both northbound and southbound observations. The weighted average from the five sites was used. This data enabled the calculation of off-peak, evening and night-time factors as well as factors for converting to average annual weekday traffic (AAWT) and annual average daily traffic (AADT) volumes.

12.8.4 The factors that were calculated to derive daily flow forecasts are shown in Table 12-4.

Table 12-4: Time Period Factors

Factor Description	Factor	Comment
AM Modelled hour (07:30 – 08:30) to Period (07:00 – 10:00)	2.748	In line with MRTM after peak hour adjustment
IP Modelled hour-(average hour) to-Period (10:00 – 16:00)	6	In line with MRTM
PM Modelled hour-(16:30 – 17:30) to-Period (16:00 – 19:00)	2.637	In line with MRTM after peak hour adjustment
Interpeak period to off peak period	0.282	Based on WebTRIS
AAWT to AADT	0.952	Based on WebTRIS

13 Forecast Results

13.1.1 This section of the report provides a summary of the forecast results.

13.2 Variable Demand Model Impact

Matrix Totals

13.2.1 The forecast travel demand is shown in the tables below, showing change in demand through assumed trip growth and VDM response for the following scenarios:

- Base
- Reference Forecast (pre-VDM) – future year trip growth only
- Do-Minimum (Post-VDM) – reference demand with VDM impact based on DM supply changes
- Do-Something (Post-VDM) – reference demand with VDM impact based on DS supply changes

13.2.2 The changes summarise impacts by mode, time-periods and purpose. As the analysis below focuses on the impact of VDM, fixed demand trips are not included. The analysis presented below focuses on trips with at least one end in the fully modelled area.

13.2.3 Table 13-1 provides a summary of forecast travel demand over 24 hours by mode for Car and Rail (Car Available). Note that the values of car demand are in units of vehicles while rail demand is in units of people/passengers.

Table 13-1: VDM Forecast Travel Demand by Mode

Mode	Year	Base	Ref minus Base (%)	DM minus Ref (%)	DS minus DM (%)
Car	2028	4,307,568	307,971 (7%)	2,866 (0%)	54 (0%)
	2043		629,750 (15%)	25,559 (1%)	85 (0%)
	2061		809,234 (19%)	20,037 (0%)	293 (0%)
Rail (Car Available)	2028	66,241	4,112 (6%)	-1,635 (-2%)	2 (0%)
	2043		7,824 (12%)	-2,761 (-4%)	-15 (0%)
	2061		8,774 (13%)	10,168 (14%)	-39 (0%)

13.2.4 The table above shows that the growth in reference demand reflects the NTEM growth applied for each of the modelled years. In the Do-Minimum forecasts a small mode shift from rail to car is experienced in 2028 and 2043 as the balance between highway and rail costs change. Rail trips increase in 2061, as rail costs are fixed in real terms from 2041 onwards, following the forecasting methodology of MRTM2. With the scheme a small increase in car demand occurs between DM and DS. The small absolute changes in trip totals show that the VDM impacts in the Do-Minimum and Do-Something scenarios are similar.

13.2.5 Table 13-2 shows the car demand by time period and year for each scenario.

Table 13-2: VDM Forecast Car Travel Demand by Time Period

Year	Period	Base	Ref minus Base (%)	DM minus Ref (%)	DS minus DM (%)
2028	AM	910,922	62,692 (7%)	-1,827 (0%)	42 (0%)
	IP	1,446,771	107,246 (7%)	4,090 (0%)	-40 (0%)
	PM	1,058,475	74,364 (7%)	-4,515 (0%)	196 (0%)
	OP	891,401	63,669 (7%)	5,118 (1%)	-144 (0%)
2043	AM	910,922	125,879 (14%)	-2,835 (0%)	18 (0%)
	IP	1,446,771	223,251 (15%)	13,837 (1%)	216 (0%)
	PM	1,058,475	151,281 (14%)	-10,037 (-1%)	119 (0%)
	OP	891,401	129,338 (15%)	24,595 (2%)	-268 (0%)
2061	AM	910,922	158,036 (17%)	-10,929 (-1%)	642 (0%)
	IP	1,446,771	294,811 (20%)	12,117 (1%)	-58 (0%)
	PM	1,058,475	193,080 (18%)	-16,723 (-1%)	81 (0%)
	OP	891,401	163,307 (18%)	35,571 (3%)	-372 (0%)

13.2.6 Across the time periods, the VDM responses between Reference and Do-Minimum are larger in the IP and OP reflecting a small amount of time period shift from the busier AM and PM periods to the quieter IP and OP periods. This trend is reversed when comparing the Do-Minimum and Do-Something, as the scheme has the largest impact in the busier AM and PM periods.

13.2.7 Table 13-3 shows the car forecast travel demand by trip purpose. Home and Non-home based purposes are combined to give aggregate Business and Other purposes.

Table 13-3: VDM Forecast Car Travel Demand by Purpose

Year	Purpose	Base	Ref minus Base (%)	DM minus Ref (%)	DS minus DM (%)
2028	Business	346,872	22,044 (6%)	1,530 (0%)	50 (0%)

Year	Purpose	Base	Ref minus Base (%)	DM minus Ref (%)	DS minus DM (%)
	Commute	1,169,569	66,974 (6%)	145 (0%)	-15 (0%)
	Other	2,791,128	218,953 (8%)	1,191 (0%)	19 (0%)
2043	Business	346,872	42,297 (12%)	4,779 (1%)	61 (0%)
	Commute	1,169,569	123,476 (11%)	3,594 (0%)	3 (0%)
	Other	2,791,128	463,977 (17%)	17,185 (1%)	22 (0%)
2061	Business	346,872	50,381 (15%)	4,398 (1%)	110 (0%)
	Commute	1,169,569	130,082 (11%)	649 (0%)	-5 (0%)
	Other	2,791,128	628,771 (23%)	14,990 (0%)	188 (0%)

13.2.8 The growth from base to reference is comparable with NTEM for each purpose. Trips in the business purpose have the largest increase relative to total volume in the comparisons between Do-Minimum and Reference, as well as Do-Something and Do-Minimum. This is sensible as the scheme benefits longer distance movements made by business related car trips.

Sectorised Demand Changes

13.2.9 Analysis of the impacts of the variable demand model have been carried out at a sector level. Analysis in the Do-Minimum shows that there is a redistribution of shorter intra-sector trips along the diagonal to longer inter-sector trips elsewhere in the matrix. This reflects the trip lengthening impact brought about by VDM, which is driven by a reduction in vehicle operating costs in future years, making longer distance trips more attractive. There is a small increase in grand totals which indicates a small shift from rail to road as discussed in the section above.

13.2.10 Analysis between the Do-Minimum and Do-Something scenarios indicates that the volume of changes between the scenarios are small, indicating a similar VDM impact occurs in both forecasts. There are small increases in trips from and to sector 1 (the fully modelled area) which represent increases in long distance trips due to the presence of the scheme.

Trip Length Distribution

13.2.11 Analysis of the trip length distribution for the base compared to the Do-Minimum and Do-Something has been undertaken for 2028, 2043 and 2061 respectively. These analyses show that overall, the distribution of trips remains similar between each scenario. A slight reduction in short distance trips between the base and forecast years can be observed which is a result of VDM impacts.

13.3 Convergence statistics

Demand Model Convergence Criteria

13.3.1 The following criteria of relative percentage GAP, set out the forecasting approach employed in the MRTM2, has been retained:

- Full model relative percentage GAP value of less than 0.1%
- Sub-area relative percentage GAP value of less than 0.2%

13.3.2 The model sub-area consists of all zone pairs with at least one end in the fully modelled area.

Demand-Supply Convergence

13.3.3 All scenarios converged within 12 DIADEM loops after achieving a full model GAP lower than 0.1% and a sub-area GAP lower than 0.2%.

Post-VDM Assignment Model Convergence

13.3.4 The post-VDM assignment model convergence statistics for the core forecast scenarios have been assessed in line with the convergence measures (of proximity and stability) outlined in TAG unit M3.1.

13.3.5 All forecast model assignments satisfy the convergence criteria set out in TAG. The assignment model convergence 'gap' is below the recommended TAG value of 0.1% by a substantial margin (values lower than this target mean that the model has better convergence).

13.3.6 It can be concluded that all forecast assignment models are very well converged and are suitable for use in the appraisal of the scheme.

13.4 Analysis of Traffic Flows

13.4.1 Figure 13-1, Figure 13-2 and Figure 13-3 display the Average Annual Daily Traffic (AADT) flows for all vehicles in the Do-Minimum and Do-Something scenarios for each forecast year (rounded to the nearest 100). The figures contain two dashed orange lines – the northern line represents the new bypass section of the scheme, and the southern line represents the Newark Southern Link Road.

Figure 13-1: Forecast AADT 2028

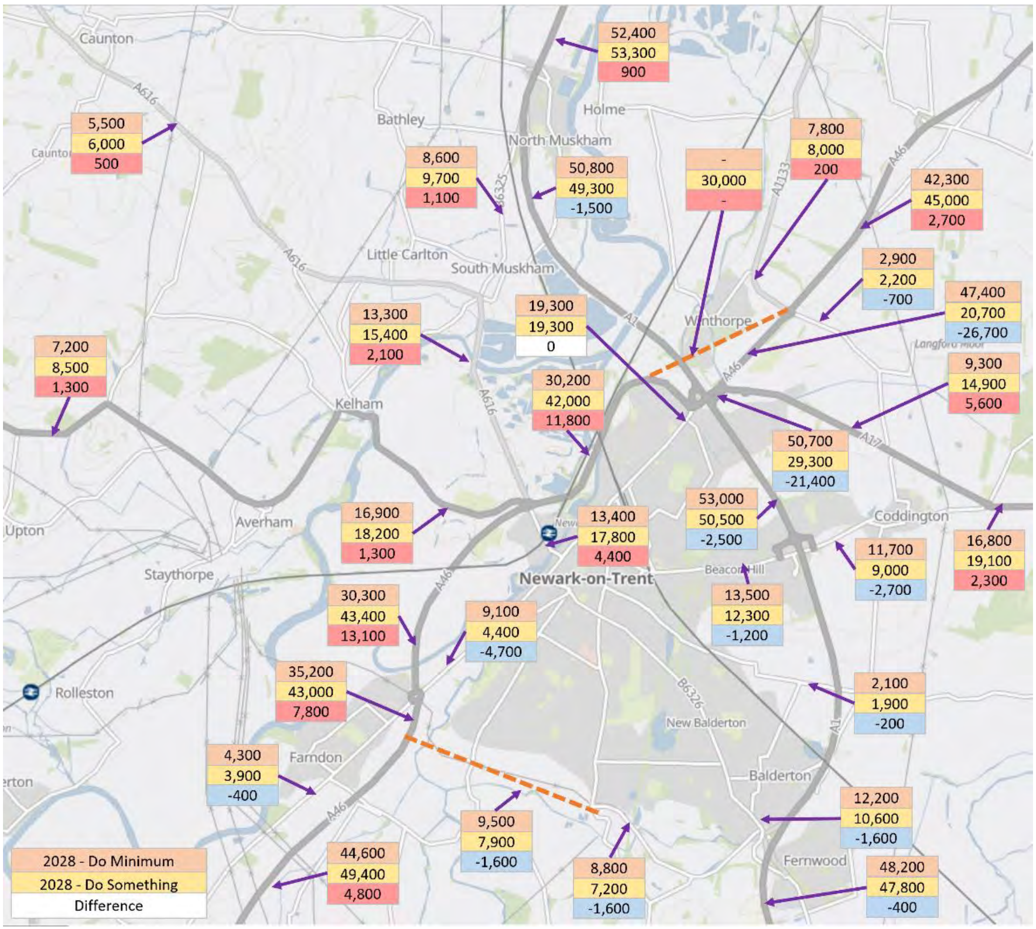


Figure 13-2: Forecast AADT 2043

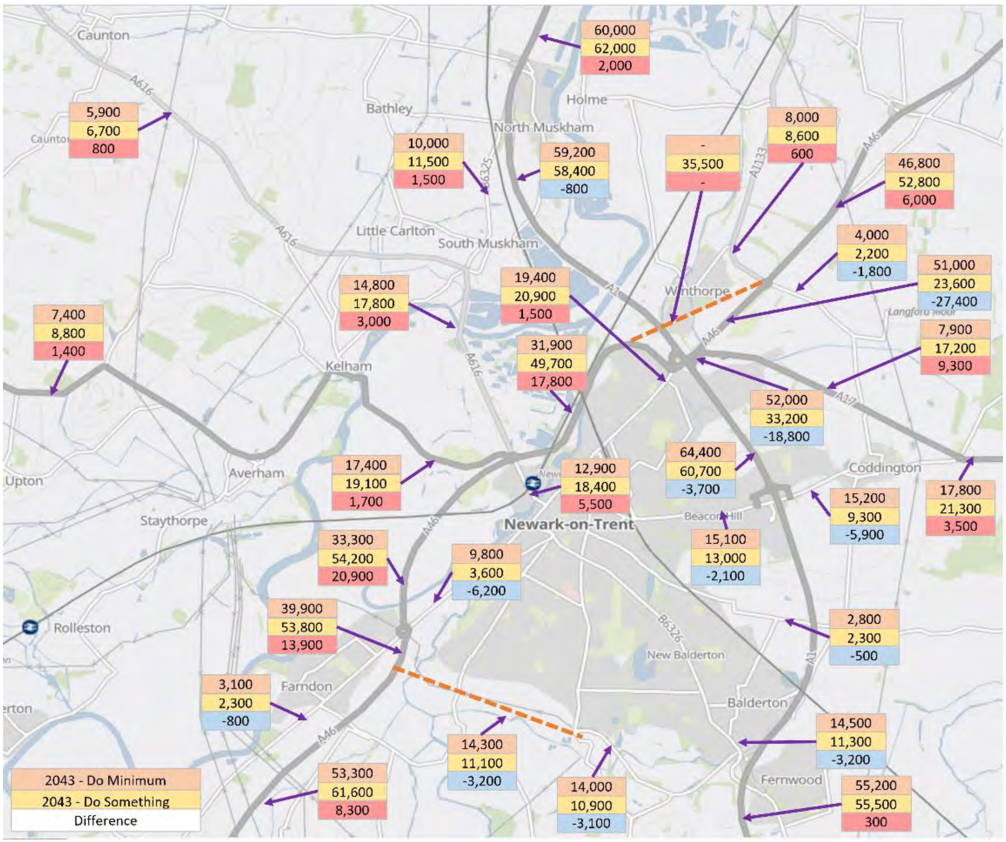
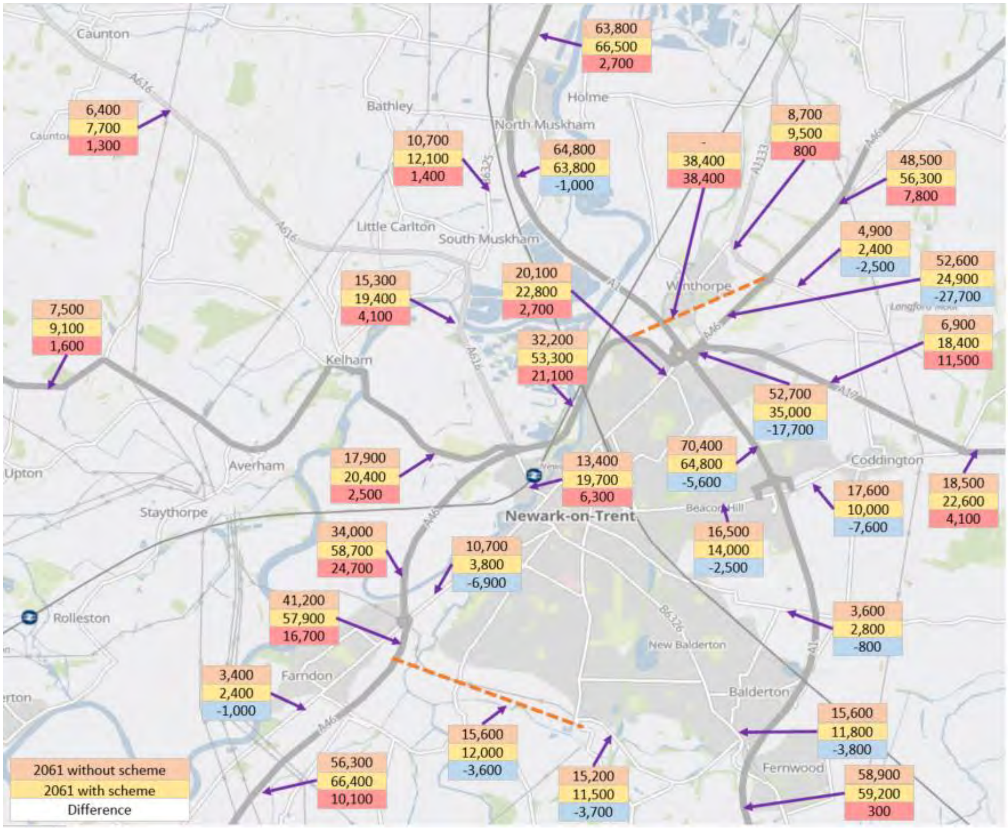


Figure 13-3: Forecast AADT 2061



13.4.2 The following trends in flow difference can be observed when comparing the Do-Something and Do-Minimum scenarios

- There is an increase in flow along the A46 mainline in both directions. This is a direct result of the increased capacity and time savings brought about by the scheme
- There is an increase in flow along the east-west route of the A17-A46-A617. This is a result of the A46 traffic bypassing the Brownhills and Friendly Farmer junctions resulting in a reduction in opposing traffic and delay for traffic using the A17-A46-A617 corridor.
- There is a reduction in flow on the Newark Southern Link Road and the A1 east of Newark. Traffic uses this route in the Do-Minimum to avoid delays on the A46 Newark bypass. With the introduction of the capacity improvements in the Do-Something, traffic now reroutes via the A46
- There are reductions in flow on other north-south routes through Newark (Farndon Rd, Lincoln Rd, Beacon Hill Rd) due to a reduction in delay on the A46
- There is long distance route reassignment of north-south traffic from the M1 onto the A46/A1, and from the A607 onto the A46/A17

13.5 Analysis of Journey Times

13.5.1 To illustrate the impact of the A46 Newark Bypass scheme on forecast journey times, modelled journey times have been extracted from the Do-Minimum and Do-Something scenarios for the journey times routes used for the model validation. These routes are described in Figure 7-3 and Figure 10-3.

13.5.2 The journey times for Route 8, which covers the main extent of the scheme corridor are summarised in the Table 13-4 and Table 13-5 below.

Table 13-4: Journey Time Route 8 performance Northbound

		AM		**IP**		**PM**	
Year	Scenario	Time (mm:ss)	Time Saving (DS vs DM)	Time (mm:ss)	Time Saving (DS vs DM)	Time (mm:ss)	Time Saving (DS vs DM)
2019	Base	14:51	-	13:36	-	16:28	-
2028	DM	16:33	-	14:58	-	18:37	-
2028	DS	13:34	02:59	13:11	01:47	13:46	04:52
2043	DM	18:42	-	16:01	-	21:02	-
2043	DS	13:51	04:51	13:25	02:35	14:04	06:57
2061	DM	20:09	-	17:29	-	22:17	-
2061	DS	14:11	05:58	13:37	03:53	14:20	07:57

Table 13-5: Journey Time Route 8 performance Southbound

		AM		**IP**		**PM**	
Year	Scenario	Time (mm:ss)	Time Saving (DS vs DM)	Time (mm:ss)	Time Saving (DS vs DM)	Time (mm:ss)	Time Saving (DS vs DM)
2019	Base	15:00	-	13:05	-	13:29	-
2028	DM	17:12	-	13:44	-	16:26	-
2028	DS	13:12	04:00	12:33	01:12	12:49	03:38
2043	DM	19:01	-	16:03	-	17:06	-
2043	DS	13:35	05:26	12:51	03:13	13:08	03:58
2061	DM	19:30	-	16:11	-	18:13	-
2061	DS	13:50	05:40	13:00	03:11	13:20	04:53

13.5.3 Journey times are forecast to increase in the Do-Minimum when compared to the base due to an increase in traffic demand. With the introduction of the A46 Newark Bypass scheme time savings are experienced in all scenarios. In the peak periods, time savings of between 3 and 5 minutes are experienced in each direction. The largest time savings are experienced in the southbound direction in the AM period and the northbound direction in the PM period, which reflects traffic travelling to and from Nottingham respectively.

13.6 Sensitivity Tests

13.6.1 The two CAS that have been modelled as sensitivity tests include:

- NTEM8 & NRTP22 High Economy CAS
- NTEM8 & NRPT22 Low Economy CAS

13.6.2 The main features of the High Economy and Low Economy CAS include revised assumptions surrounding GDP, population, and employment growth. The results of these tests are presented below.

Convergence

13.6.3 In terms of demand supply convergence, for the High Economy scenario most scenarios/years converged within 10 DIADEM loops after achieving a full model GAP lower than 0.1% and a sub-area GAP lower than 0.2%. The exceptions to this are the 2061 forecasts, which struggled to converge due to the large amount of demand in the High Economy scenario. In both cases, the loop with the lowest sub area GAP was selected to be used as the final assignment. Both values are approaching the 0.2% threshold, therefore the 2061 models were deemed to be sufficiently converged.

13.6.4 For highway assignment convergence, all forecast model assignments satisfy the convergence criteria set out in TAG Unit M3.1.

13.6.5 In terms of demand supply convergence, for the Low Economy scenario, all scenarios converged within 11 DIADEM loops after achieving a full model GAP lower than 0.1% and a sub-area GAP lower than 0.2%.

13.6.6 For highway assignment convergence, all forecast model assignments satisfy the convergence criteria set out in TAG Unit M3.1.

Matrix Totals

13.6.7 The three tables below (Table 13-6, Table 13-7 and Table 13-8) present the forecast travel demand for each CAS. The analysis presented focuses on trips with at least one end in the fully modelled area.

13.6.8 The following trends can be observed when comparing the demand between the sensitivity tests and the core scenarios.

- The volume of demand for the Core scenario sits between the High Economy and Low Economy scenarios in all cases
- The VDM impacts in the sensitivity tests (i.e., changes between Reference & Do-Minimum, and Do-Minimum & Do-Something) are broadly similar to those seen in the Core both at a high level and when disaggregated by mode, purpose and time period
- There is a reduction in car demand in the 2061 High Economy scenario between reference and Do-Minimum. This is due to the large amount of reference car demand in this scenario resulting in large delays on the network, which encourages a mode shift from car to rail

- Demand in the Low Economy scenario peaks in the 2043 forecast year. This is driven by the unique shape of the 60-year demand profile in the NTEM8 Low Economy CAS

Table 13-6: VDM Forecast Travel Demand by Mode

			Core			High			Low		
Mode	**Year**	**Base**	**Ref minus Base (%)**	**DM minus Ref (%)**	**DS minus DM (%)**	**Ref minus Base (%)**	**DM minus Ref (%)**	**DS minus DM (%)**	**Ref minus Base (%)**	**DM minus Ref (%)**	**DS minus DM (%)**
Car	2028	4,307,568	307,971 (7%)	2,866 (0%)	54 (0%)	372,655 (9%)	2,845 (0%)	126 (0%)	289,773 (7%)	2,992 (0%)	195 (0%)
	2043		629,750 (15%)	25,559 (1%)	85 (0%)	974,682 (23%)	6,859 (0%)	419 (0%)	431,561 (10%)	31,181 (1%)	281 (0%)
	2061		809,234 (19%)	20,037 (0%)	293 (0%)	1,517,368 (35%)	-35,599 (-1%)	140 (0%)	330,445 (8%)	43,940 (1%)	476 (0%)
Rail (Car Available)	2028	66,241	4,112 (6%)	-1,635 (-2%)	2 (0%)	4,586 (7%)	762 (1%)	-13 (0%)	4,229 (6%)	-2,125 (-3%)	-14 (0%)
	2043		7,824 (12%)	-2,761 (-4%)	-15 (0%)	13,221 (20%)	4,153 (5%)	-46 (0%)	5,321 (8%)	-7,895 (-11%)	-13 (0%)
	2061		8,774 (13%)	10,168 (14%)	-39 (0%)	20,193 (30%)	30,655 (35%)	-9 (0%)	1,913 (3%)	-1,603 (-2%)	-20 (0%)

Table 13-7: VDM Forecast Car Travel Demand by Time Period

			Core			High			Low		
Year	**Period**	**Base**	**Ref minus Base (%)**	**DM minus Ref (%)**	**DS minus DM (%)**	**Ref minus Base (%)**	**DM minus Ref (%)**	**DS minus DM (%)**	**Ref minus Base (%)**	**DM minus Ref (%)**	**DS minus DM (%)**
2028	AM	910,922	62,692 (7%)	-1,827 (0%)	42 (0%)	74,682 (8%)	-2,972 (0%)	60 (0%)	60,187 (7%)	-1,459 (0%)	-98 (0%)
	IP	1,446,771	107,246 (7%)	4,090 (0%)	-40 (0%)	132,452 (9%)	4,691 (0%)	-202 (0%)	98,167 (7%)	3,952 (0%)	322 (0%)
	PM	1,058,475	74,364 (7%)	-4,515 (0%)	196 (0%)	89,288 (8%)	-6,402 (-1%)	393 (0%)	70,472 (7%)	-3,876 (0%)	2 (0%)

			Core			High			Low		
Year	**Period**	**Base**	**Ref minus Base (%)**	**DM minus Ref (%)**	**DS minus DM (%)**	**Ref minus Base (%)**	**DM minus Ref (%)**	**DS minus DM (%)**	**Ref minus Base (%)**	**DM minus Ref (%)**	**DS minus DM (%)**
	OP	891,401	63,669 (7%)	5,118 (1%)	-144 (0%)	76,232 (9%)	7,529 (1%)	-124 (0%)	60,947 (7%)	4,375 (0%)	-31 (0%)
2043	AM	910,922	125,879 (14%)	-2,835 (0%)	18 (0%)	198,446 (22%)	-17,577 (-2%)	657 (0%)	86,136 (9%)	1,832 (0%)	274 (0%)
	IP	1,446,771	223,251 (15%)	13,837 (1%)	216 (0%)	340,418 (24%)	10,115 (1%)	-30 (0%)	152,344 (11%)	14,774 (1%)	39 (0%)
	PM	1,058,475	151,281 (14%)	-10,037 (-1%)	119 (0%)	235,834 (22%)	-23,949 (-2%)	348 (0%)	103,533 (10%)	-3,065 (0%)	319 (0%)
	OP	891,401	129,338 (15%)	24,595 (2%)	-268 (0%)	199,984 (22%)	38,269 (4%)	-557 (0%)	89,547 (10%)	17,640 (2%)	-350 (0%)
2061	AM	910,922	158,036 (17%)	-10,929 (-1%)	642 (0%)	307,649 (34%)	-45,937 (-4%)	258 (0%)	61,025 (7%)	5,804 (1%)	211 (0%)
	IP	1,446,771	294,811 (20%)	12,117 (1%)	-58 (0%)	533,474 (37%)	-10,191 (-1%)	896 (0%)	126,708 (9%)	17,161 (1%)	105 (0%)
	PM	1,058,475	193,080 (18%)	-16,723 (-1%)	81 (0%)	366,257 (35%)	-52,400 (-4%)	-669 (0%)	77,367 (7%)	1,704 (0%)	485 (0%)
	OP	891,401	163,307 (18%)	35,571 (3%)	-372 (0%)	309,988 (35%)	72,929 (6%)	-344 (0%)	65,346 (7%)	19,271 (2%)	-324 (0%)

Table 13-8: VDM Forecast Car Travel Demand by Purpose

			Core			High			Low		
Year	**Purpose**	**Base**	**Ref minus Base (%)**	**DM minus Ref (%)**	**DS minus DM (%)**	**Ref minus Base (%)**	**DM minus Ref (%)**	**DS minus DM (%)**	**Ref minus Base (%)**	**DM minus Ref (%)**	**DS minus DM (%)**
2028	Business	346,872	22,044 (6%)	1,530 (0%)	50 (0%)	24,834 (7%)	1,632 (0%)	65 (0%)	23,249 (7%)	1,510 (0%)	87 (0%)
	Commute	1,169,569	66,974 (6%)	145 (0%)	-15 (0%)	72,240 (6%)	-124 (0%)	-16 (0%)	72,790 (6%)	272 (0%)	-33 (0%)
	Other	2,791,128	218,953 (8%)	1,191 (0%)	19 (0%)	275,581 (10%)	1,337 (0%)	76 (0%)	193,733 (7%)	1,210 (0%)	141 (0%)
2043	Business	346,872	42,297 (12%)	4,779 (1%)	61 (0%)	71,161 (21%)	2,840 (1%)	130 (0%)	29,286 (8%)	5,360 (1%)	96 (0%)
	Commute	1,169,569	123,476 (11%)	3,594 (0%)	3 (0%)	210,865 (18%)	-439 (0%)	15 (0%)	85,881 (7%)	5,320 (0%)	6 (0%)
	Other	2,791,128	463,977 (17%)	17,185 (1%)	22 (0%)	692,656 (25%)	4,457 (0%)	275 (0%)	316,393 (11%)	20,501 (1%)	179 (0%)
2061	Business	346,872	50,381 (15%)	4,398 (1%)	110 (0%)	110,213 (32%)	-1,141 (0%)	119 (0%)	14,387 (4%)	6,412 (2%)	109 (0%)
	Commute	1,169,569	130,082 (11%)	649 (0%)	-5 (0%)	315,613 (27%)	-9,628 (-1%)	-116 (0%)	28,764 (2%)	6,806 (1%)	14 (0%)
	Other	2,791,128	628,771 (23%)	14,990 (0%)	188 (0%)	1,091,543 (39%)	-24,766 (-1%)	102 (0%)	287,294 (10%)	30,723 (1%)	354 (0%)

Traffic Flow Impacts

13.6.9 Figure 13-4 and Figure 13-9 present the High Economy and Low Economy traffic flows (AADT). The following trends can be observed when comparing the Core, High Economy and Low Economy scenarios:

- Flow volumes in the Core scenario lie in between the Low Economy and High Economy scenarios
- Flows in the Low Economy 2043 forecasts are greater than the 2061 forecasts due to the shape of the demand profile in the NTEM8 CAS
- The flow differences between the Do-Minimum and Do-Something scenarios are generally consistent between the Core models and the sensitivity tests. Flow impacts described in Section 13.4 also apply to the sensitivity tests.

Figure 13-4: Forecast AADT 2028 High Economy

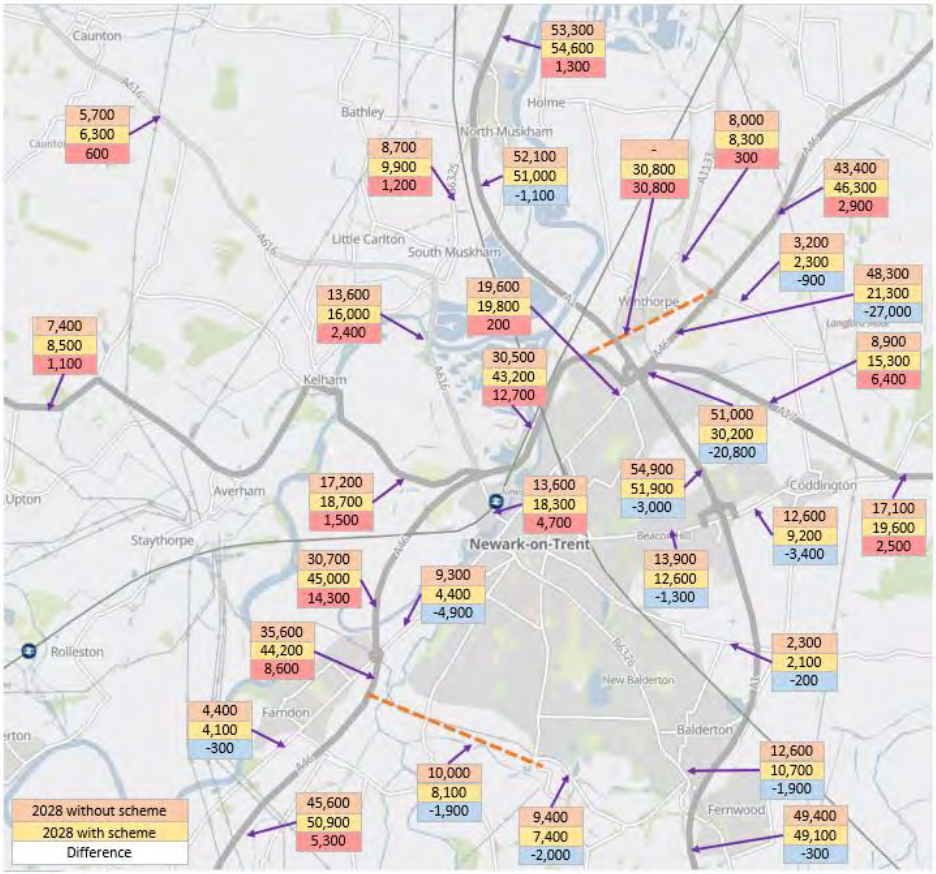


Figure 13-5: Forecast AADT 2028 Low Economy

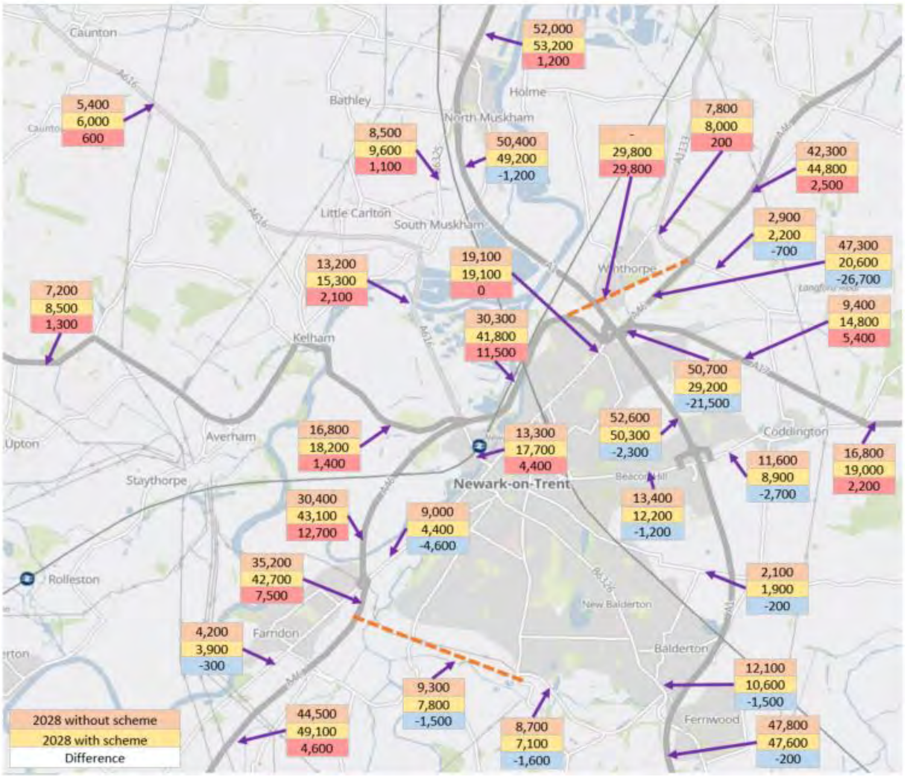


Figure 13-6: Forecast AADT 2043 High Economy

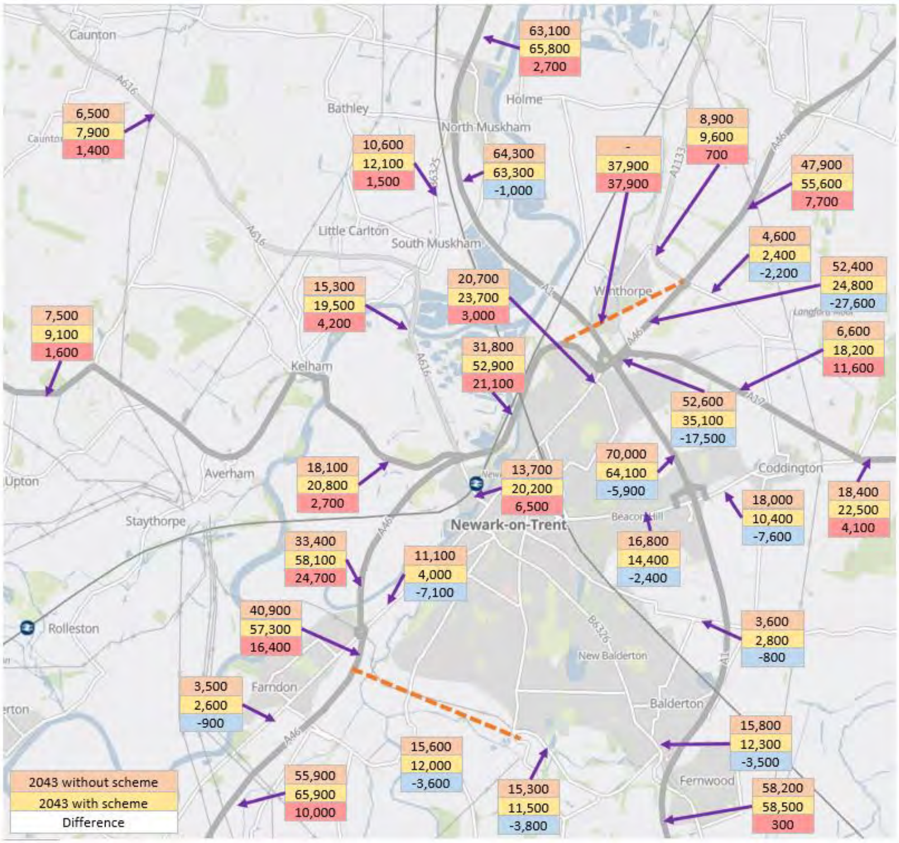


Figure 13-7: Forecast AADT 2043 Low Economy

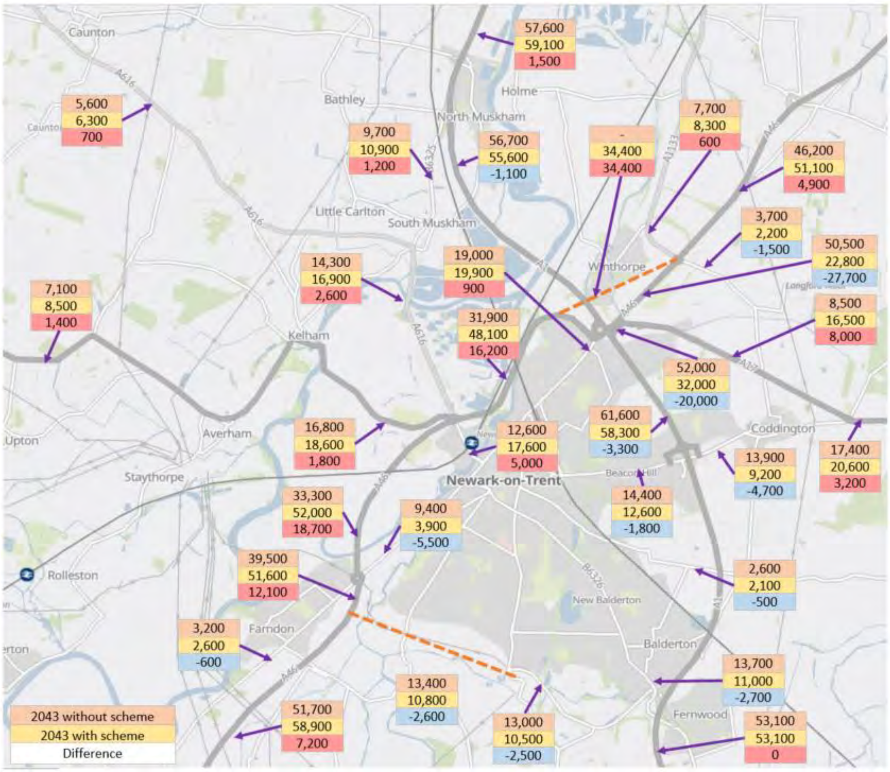


Figure 13-8: Forecast AADT 2061 High Economy

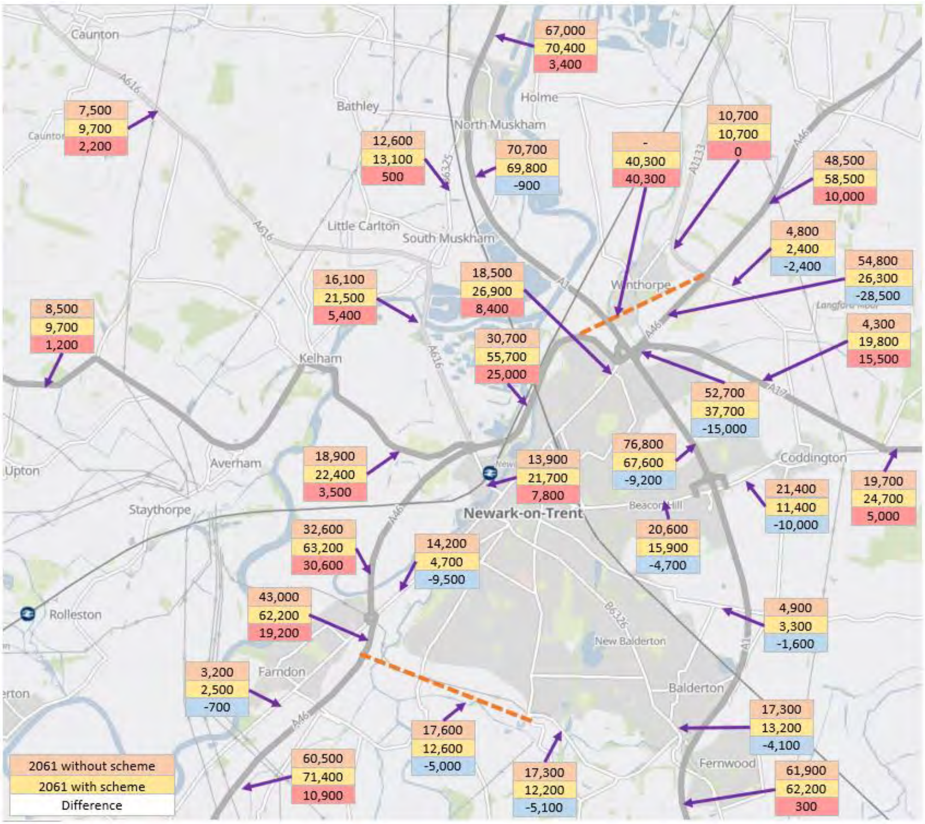
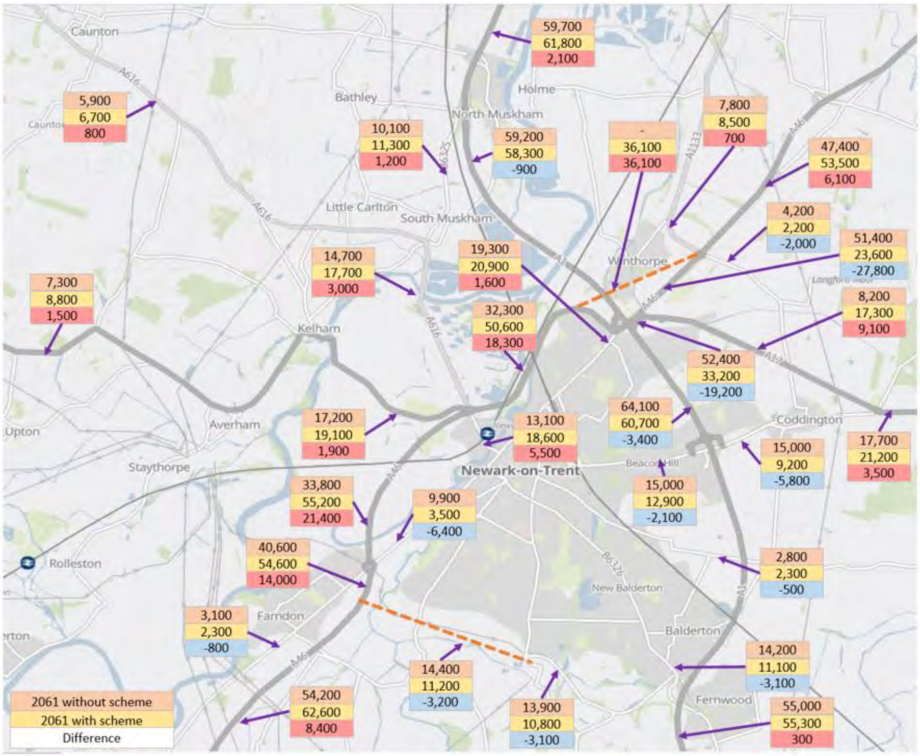


Figure 13-9: Forecast AADT 2061 Low Economy



Journey Time Impacts

13.6.10 The journey times for the A46 between Flintham and Potter Hill have been assessed for the Low Economy and High Economy sensitivity tests.

13.6.11 The DM and DS journey times for the Low Economy scenario and High Economy scenario logically sit either side of the Core scenario journey times. The largest time savings are experienced by the High Economy scenario, followed by the Core and then the Low Economy scenario. This is expected as the delays on the Do-Minimum network increase as the demand increases.

14 Economic Appraisal Approach

14.1 Introduction

14.1.1 This section of the report provides an overview of the approaches taken to carry out the economic appraisal of the scheme. The economic appraisal of a highway scheme is an assessment of the net benefits to users and the wider community as a result of the proposed Scheme, set against the capital construction and operating and maintenance costs, incurred over a 'whole life' period. It compares the monetised costs and benefits of the proposed Scheme (the Do-Something scenario) against the alternative without the Scheme (Do-Minimum scenario).

14.1.2 The economic appraisal of the Scheme has been prepared in accordance with the Green Book – Appraisal and Evaluation in Central Government, 2022 edition ("the Green Book").

14.2 Overview

14.2.1 The costs of the scheme comprised of:

- The Scheme capital costs.
- The additional operating costs of the new road and junctions.
- The net difference between the Do-Minimum and Do-Something forecast future maintenance capital costs.

14.2.2 The economic appraisal comprised four components:

- Economic benefits to road users, including time savings and vehicle operating costs.
- Economic disbenefits to road users associated with the delays during the construction of the Scheme.
- Accident savings and associated economic benefits.
- Monetised environmental benefits/disbenefits from changes to greenhouse gas emissions, local air quality and noise.

14.2.3 The benefits from these four categories were combined and compared to costs to produce an initial benefit to cost ratio (BCR).

14.2.4 The following additional assessments were carried out and were included in the adjusted BCR:

- Wider economic impacts resulting from the Scheme. This was carried out using the Wider Impacts in Transport Appraisal (WITA) program which follows the principles and formula set out in the TAG Unit A2.1 guidance.
- Journey time reliability benefits. This comprised economic benefits as a result of more reliable journey times.

14.2.5 The two additional assessments provided the basis for deriving an adjusted BCR.

14.2.6 The benefits of the Scheme were calculated from a number of sources, all of which took inputs from the SATURN assignment models:

- Transport Economic Efficiency (TEE) benefits (savings relating to travel times, vehicle operating costs, indirect tax revenues and user charges) obtained using TUBA.
- Delay costs to users due to construction, obtained using QUeues And Delays at ROadworks (QUADRO)).
- Accident (Collision) costs, forecast using CoBALT (Cost and Benefit to Accidents – 'Light Touch').
- Reliability benefits, obtained using the urban roads approach presented in TAG unit A1.3.
- Wider economic impacts, obtained using WITA.

14.2.7 In addition, a monetised estimate of greenhouse gas impacts was calculated using the Emissions Factor Toolkit (Version 11), Chief Analyst Carbon Valuation Toolkit (v1.5) and TAG workbooks. Noise and Air Quality impacts were also similarly appraised.

14.2.8 Delays during maintenance periods were not considered as part of this appraisal but would be expected to be lower for the Do-Something scenario compared to the Do-Minimum scenario. This is because in the Do-Something scenario, the dual carriageway would provide more capacity so that traffic could be managed more effectively in the event that carriageway closures are required for maintenance.

14.2.9 The results from the different elements of the economic assessment are presented in three summary tables:

- The Transport Economic Efficiency (TEE) Table.
- The Public Accounts (PA) Table.
- The Analysis of Monetised Costs and Benefits (AMCB) Table.

14.2.10 The economic assessment was undertaken for the Core Scenario (central growth) together with two sensitivity tests from the DfTs Common Analytical Scenarios (CAS):

- A Low Economy sensitivity test.
- A High Economy sensitivity test.

Price base and discount year

14.2.11 The economic modelling used a 2010 price base year. Costs and benefits are discounted to the 2010 price base year from the year in which the costs are incurred and benefits accrued.

Software packages version summary

14.2.12 Throughout this report various software packages are mentioned. Table 14-1 summarises these tools, their acronyms and versions used for the assessments.

Table 14-1: Software Packages Used

Software	Acronym	Version used
Department for Transport Databook	-	v1.20.2 (Jan 2023)
Transport User Benefit Assessment	TUBA	v1.9.17
TUBA economics file		Economics_TAG_db1_20_2
Cost Benefit Analysis Light Touch	COBALT	v2.4
Emissions Factors Toolkit	EFT	v11.0
Queues and Delays at Roadworks	QUADRO	2023 (v4.23.0.1)

14.3 Scheme Costs

Construction costs

14.3.1 Scheme construction costs have been provided by National Highways Commercial Services Division (NHCSD) in October 2023. The cost estimate was based on a Regional Delivery Partnership (RDP) procurement route, with an expected outturn cost of £653 million (2023 Quarter 3 price base), including Portfolio risk and inflation.

14.3.2 The P-mean values without portfolio risk are used for the economic assessment. As the costs are derived via a comprehensive Quantitative Risk Assessment (QRA) process this is considered to mitigate the factors leading to optimism bias. The application of a ‘factor’ type adjustment for optimism bias is therefore considered unnecessary. The costs exclude all recoverable VAT and all historic costs have been removed.

14.3.3 No grants or subsidies are applicable for inclusion of the scheme assessment.

14.3.4 The costs were provided in the standard NHCSD format. The expenditure profiles were based upon cost estimates for each financial year prepared at a base date and then inflated to outturn costs using National Highways projected construction related inflation. These costs were then rebased to 2010 calendar year profiles for economic calculations, using the Gross Domestic Product (GDP)-deflator series as published in the TAG Data Book.

14.3.5 Table 14-2 provides a breakdown of the construction costs in undiscounted 2010 ‘factor’ prices, showing a total undiscounted cost of £376 million.

Table 14-2: Scheme Investment Costs (Undiscounted 2010 Factor Prices)

Year	Preparation	Supervision	Construction	Land	Total
2023	541	-	-	-	541
2024	4,089	-	974	-	5,063
2025	16,930	158	12,046	3,258	32,392
2026	-	4,204	83,383	10,765	98,352
2027	-	6,502	113,103	3,703	123,309
2028	-	5,071	88,502	2,069	95,642
2029	-	1,413	16,832	1,517	19,762
2030	-	339	33	-	372
2031	-	-	33	-	33
2032	-	-	32	-	32
2033	-	-	31	-	31
	-	-	11	-	11
Total	21,560	17,687	314,981	21,312	375,539

14.3.6 The values shown in Table 14-3, indicating that the Present Value of Investment Costs is £250 million.

Table 14-3: Present Value of Scheme Investment Costs (Discounted 2010 Market Prices)

Year	Preparation	Supervision	Construction	Land	Total
2023	412	-	-	-	412
2024	3,006	-	716	-	3,722
2025	12,025	112	8,556	2,314	23,008
2026	-	2,885	57,224	7,388	67,497
2027	-	4,311	74,996	2,456	81,763
2028	-	3,249	56,699	1,325	61,273
2029	-	875	10,419	939	12,232
2030	-	203	20	-	223
2031	-	-	19	-	19
2032	-	-	18	-	18
2033	-	-	17	-	17
	-	-	6	-	6
Total	15,443	11,634	208,689	14,422	250,189

Operating and maintenance costs

14.3.7 Operating and Maintenance (O&M) costs have been provided by National Highways Commercial Services Division in October 2023.

14.3.8 O&M costs have been provided for the Do-Minimum and Do-Something scenarios. For the Do-Something, O&M costs have been estimated based upon the Most Likely Capital Works. The Do-Minimum O&M costs are based on the asset quantities on the existing network. The estimate outputs are provided with a yearly profile over 60 years from the Open for Traffic Date. The maintenance activities and intervention frequencies are based upon Highways England's Asset Delivery Asset Maintenance Requirements (ADAMR).

14.3.9 The tabulated annual breakdown of the estimated O&M costs include the following O&M cost headings and scope:

- Highways and Technology Assets
  - Total & by-Year Routine Maintenance costs

- Total & by-Year Renewals costs

- Structures
  - Total & by-Year Routine Maintenance costs
  - Total & by-Year Renewals costs
  - Energy and NRTS costs
- Technology
  - Total & by-Year Routine Maintenance cost
  - Total & by-Year Renewals cost
  - Total & by Year Energy and NRTS cost
- Adjustments
  - Severe Weather, Incident Response and Other Impacts to Service Delivery
- Tunnel O&M costs

14.3.10 The expenditure profile is based upon the O&M cost estimates prepared in Q1 2019 prices and then inflated to outturn costs using National Highways projected construction related inflation. The "most likely" costs have been used to take account of risk and uncertainty. These costs were then rebased to 2010 calendar year profiles using the Gross Domestic Product (GDP)-deflator series as published in the TAG Data book. Costs have been discounted to 2010 and a Market Adjustment Factor of 1.19 has been applied to the discounted costs for use in cost benefit appraisal.

14.3.11 Table 14-4 displays the O&M costs in undiscounted 2010 'factor prices' for both the existing layout (Do-Minimum) and the scheme (Do-Something) over the 60-year appraisal period.

Table 14-4: Operation & Maintenance Costs (Undiscounted 2010 Factor Prices £000s)

Scenario	Cost
Without Scheme (Do-Minimum)	27,876
With Scheme (Do-Something)	99,679
Net Cost	71,803

14.3.12 The equivalent present value investment costs are presented below in Table 14-5, in 2010 prices, discounted to 2010.

Table 14-5: Operation & Maintenance Costs (2010 Market Prices, Discounted to 2010 £000s)

Scenario	Cost
Without Scheme (Do-Minimum)	7,127
With Scheme (Do-Something)	22,975
Net Cost	15,848

14.4 Transport User Benefits

14.4.1 The Department for Transports (DfT's) economic appraisal software Transport User Benefit Appraisal (TUBA) has been used to calculate the transport user benefits in accordance with TAG unit A1. The following section provides an overview of the TUBA economic appraisal, including the key inputs and parameters used within the appraisal.

14.4.2 The economic appraisal was carried out using demand matrices and cost skims output from the A46 Newark Bypass Model for the opening year and three forecast years. The TEE benefits arise from time and vehicle operating cost savings over the 60-year appraisal period and are evaluated from the difference in demand and costs between the Do-Minimum and Do-Something forecasts.

TUBA Parameters

14.4.3 The transport user benefits appraisal incorporates the economics file based on the latest version of the TAG Data Book at the time of the assessment (v1.20.2 -January 2023). The key appraisal parameters are summarised in Table 14-6.

Table 14-6: TUBA parameters

Parameter	Option
TUBA Version	v1.9.17
TUBA economics file	Economics_TAG_db1_20_2.txt
Opening Year	2028
Intermediate Year	2043
Horizon Year	2061
Final Appraisal Year	2087
Appraisal period	60 Years

Time slices

14.4.4 Transport user benefits have been calculated covering a 12-hour weekday period and part of the weekend where traffic flows are equivalent to interpeak flows. The weekday off peak has not been assessed.

TUBA Annualisation factors

14.4.5 Annualisation factors are required so that the benefits from each distinct modelled time period can be expanded to represent the full appraisal period across the whole year. The economic assessment takes account of the benefits accruing during the 12-hour modelled period, 07:00-19:00 on weekdays.

14.4.6 To assess weekend benefits, observed traffic data was analysed to identify the number of hours during the weekend that were equivalent to weekday inter-peak traffic volumes. Weekday inter-peak trip matrices were adjusted to account for different vehicle and purpose splits between the two periods and input to TUBA in conjunction with inter-peak travel time and distance matrices.

14.4.7 The A46 Newark Bypass Model includes an AM peak hour model (07:30-08:30), an average inter-peak hour model (10:00-16:00), and a PM peak hour model (16:30-17:30). To convert data from the peak hour level to the peak period for both AM and PM, factors were derived from the A46 traffic count database.

14.4.8 The A46 Newark Bypass Model represents an average March model, which is a neutral traffic month (as defined in TAG Unit M1.2). The overall factors are shown in Table 14-7.

Table 14-7: Annualisation factors

Time Slice	Modelled Hour to Period Factor	Number of Days	Annualisation
Weekday AM Period	2.748	253	695
Weekday Inter-Peak Period	6	253	1,518
Weekday PM Period	2.637	253	667
Weekend Period	7.5 (weekend hours with traffic equivalent to Average Inter-Peak Hour)	112	840

Vehicle type and trip purpose

14.4.9 In accordance with TAG, transport user benefits are assessed by vehicle type and journey purposes to reflect the different values of time and vehicle operating costs and vehicle occupancies. Seven user classes are defined in the TUBA standard economic file, representing three distinct trip purposes and vehicle types, the following disaggregation is defined.

- Car – Employer Business (EB)
- Car – Commuting
- Car – Other
- LGV – Personal
- LGV – Freight
- OGV 1
- OGV 2

14.4.10 This differs slightly from the A46 Newark Bypass Model which represents the following five user classes:

- UC1 Car – Employer Business
- UC2 Car – Commuting
- UC3 Car – Other

- UC4 LGV
- UC5 HGV

14.4.11 LGV trips have been split into LGV personal and LGV freight in line with the proportions provided in the TAG Data Book Table A 1.3.4. HGV demand is split into OGV1 and OGV2 by 40/60, which is in alignment with the assumptions underpinning the generalised costs for all of the NH RTMs. OGV trips are also converted from PCUs (Passenger Car Units) to vehicles for the TUBA appraisal.

Journey Purpose Adjustment of Weekend Trips

14.4.12 In the absence of a weekend model the weekend benefits have been estimated using the weekday inter-peak model. For the appraisal of weekend benefits the weekday inter-peak car journey purpose splits have been adjusted to better align with weekend patterns. This adjustment was informed by the weekend average journey purpose splits presented in TAG Data Book Table A 1.3.4.

14.5 Delays During Construction and Maintenance

Overview

14.5.1 The construction of a scheme on the A46 will inevitably lead to disruption on the existing road network. Roadworks during the construction phase would be expected to cause delays to traffic (due to the physical presence of the works with associated speed limits and any delays caused by breakdowns or accidents occurring within the works). This would lead to impacts on travel times, vehicle operating costs, carbon emissions and accident costs.

14.5.2 A quantitative assessment of the impact of on-going maintenance was considered but has not been undertaken at PCF Stage 3.

14.5.3 The option being considered at Stage 3 replaces the existing single-carriageway of the A46 Newark Bypass with dual-carriageway. The impacts of routine maintenance on traffic are therefore expected to be beneficial as the additional capacity provided by the dual carriageway gives more scope to mitigate disruption during roadworks. Furthermore, it is anticipated that routine maintenance would largely be undertaken in the off-peak period and so the benefits of excluding this element from the appraisal would be expected to be very small in scale.

14.5.4 To quantify the impacts of scheme construction on transport users, an economic assessment has been performed with the Queues and Delays During Roadworks software package (QUADRO). The version used for this assessment was QUADRO 2023 v4.23.0.1.

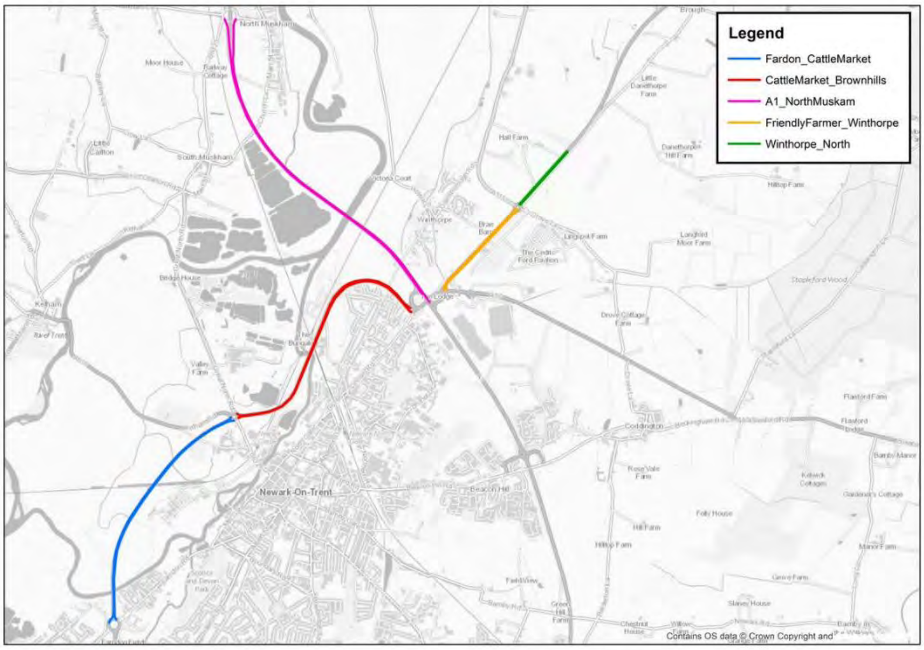
Traffic Management Locations

14.5.5 The assumptions used in the appraisal are based on an assessment of the traffic management arrangements that are considered to be necessary in order to construct the scheme. Sections of carriageway on the A46 and A1 that are affected by traffic management during construction are listed below:

- A46 between Farndon Roundabout & Cattle Market Roundabout
- A46 between Cattle Market Roundabout & Brownhills Roundabout
- A46 between Friendly Farmer Roundabout and Winthorpe Roundabout
- A46 between Winthorpe Roundabout and Brough Junction (750m from Winthorpe roundabout)
- A1 between Brownhills / Friendly Farmer junction and North Muskham junction

14.5.6 These sections are illustrated in Figure 14-1.

Figure 14-1: QUADRO Sections



Traffic Management Proposals

14.5.7 Traffic management proposals covering the operation of the road network during the construction of the scheme have been provided by Skanska as part of the Construction Impact Assessment.

14.5.8 The information provided includes details on speed limits, closures and associated diversion routes for the A46 and A1 mainline sections, as well as the surrounding side-roads connecting into the various roundabouts on the A46 Newark Bypass. To adequately capture the main impacts of the construction of the Scheme on existing road users the following types of traffic management were modelled in QUADRO:

- Speed limits on the A46
- Closures and associated diversion routes of the A46 mainline
- Closures and the associated diversion route of the A1 mainline

14.5.9 The impact of closures of the side roads was considered to be minor and would result in negligible disbenefits when compared to the scenarios that impacted directly on the A46 and A1 mainline sections. Side-road closures have therefore not been modelled in QUADRO.

14.5.10 A summary of the assumed traffic management measures by year in terms of speed limits and the number of closures is provided in Table 14-8:

Table 14-8: Traffic management measures modelled in QUADRO

Section	Year	Months	Speed Limit	Closures
A46 between Farndon and Cattle Market	2025	Apr-Dec	50mph	n/a
	2026	Jan-Dec	50mph	10 nights (2-way) 1 nights (SB only)
	2027	Jan-Dec	50mph	5 nights (2-way) 1 nights (SB only)
	2028	Jan-Jul	50mph	n/a
A46 between Cattle Market and Brownhills	2025	Apr-Dec	50mph	2 nights (2-way)
	2026	Jan-Dec	50mph	6 nights (2-way)
	2027	Jan-Dec	50mph	6 nights (2-way)
	2028	Jan-Jul	50mph	n/a
A46 between Friendly Farmer and Winthorpe	2025	Apr-Dec	50mph	3 nights (2-way) 4 nights (SB only)
	2026	Jan-Dec	50mph	4 nights (SB only)
	2027	Jan-Dec	50mph	3 nights (SB only)
	2028	Jan-Jul	50mph	n/a
A46 between Winthorpe & Brough	2025	Apr-Dec	50mph	3 nights (2-way) 4 nights (SB only)
	2026	Jan-Dec	50mph	4 nights (SB only)
	2027	Jan-Dec	50mph	3 nights (SB only)
	2028	Jan-Jul	50mph	n/a
A1 between A46 and North Muskham	2025	Apr-Dec	n/a	n/a
	2026	Jan-Dec	n/a	n/a
	2027	Jan-Dec	n/a	1 nights (2-way)
	2028	Jan-Jul	n/a	n/a

Speed Reductions

14.5.11 Where temporary reduced speed limits have been proposed, consideration has been given to how those will impact on the behaviour of existing traffic and the speeds that traffic currently achieves in practice.

14.5.12 QUADRO does not explicitly account for the significant junction delays at the roundabouts or for the slowing of vehicles on approach to the roundabouts on the A46. In order to realistically account for these effects, an analysis of observed speeds has been undertaken using observed journey time data.

14.5.13 The analysis involved the production of an hourly speed profile for each section and direction of travel. This was then compared to a proxy speed limit, which represents the observed no-works speed above which the introduction of a 50mph speed limit would have a significant impact. Hours that contain speeds which are lower than this value are not modelled under a reduced speed in QUADRO. Table 14-9 shows the hours for which the speed limit has been modelled in QUADRO across the four sections of the existing bypass.

Table 14-9: Modelled speed limits in QUADRO

	Farndon to Cattle Market		**Cattle Market to Brownhills**		**Friendly Farmer to Winthorpe**		**Winthorpe to Brough**	
Hour	NB	SB	NB	SB	NB	SB	NB	SB
7	N	Y	N	N	Y	N	Y	Y
8	N	N	N	N	Y	N	Y	Y
9	Y	Y	N	Y	Y	N	Y	Y
10	Y	Y	N	Y	Y	Y	Y	Y
11	Y	N	N	N	Y	Y	Y	Y
12	Y	Y	N	Y	Y	Y	Y	Y
13	N	N	N	Y	Y	Y	Y	Y
14	N	Y	N	Y	Y	N	Y	Y
15	N	N	N	N	Y	Y	Y	Y
16	N	N	N	N	Y	N	Y	Y
17	N	N	N	Y	Y	Y	Y	Y
18	Y	Y	Y	Y	Y	Y	Y	Y

14.5.14 This analysis has been applied to weekday daytime periods only. For the OP period and weekends, it has been assumed that a 50mph speed limit will result in genuine disbenefits at all times and has therefore been modelled as such in QUADRO.

Diversion Routes

14.5.15 The assumed traffic management on the A46 and A1 includes several full closures during the construction works. While these closures are active, the existing established diversion routes for incidents on the closed sections will be implemented.

14.5.16 The speed-flow parameters for each diversion route have been calculated using the QDIV module within the QUADRO software package.

14.6 Accident Benefits

Overview

14.6.1 A quantitative approach has been applied for the appraisal of accidents and calculation of the safety benefits of the scheme. The anticipated number of accidents and casualties saved and the associated economic benefits have been calculated using the DfT software Cost and Benefit to Accidents – Light Touch (COBALT), in accordance with TAG unit A4.1.

14.6.2 The appraisal has been carried out using traffic outputs from the A46 Newark Bypass Model for the base year and two forecast years. The change in the number of accidents and casualties over the 60-year appraisal period are evaluated based on the difference in traffic flows on each link in the network between the Do-Minimum and Do-Something forecasts.

14.6.3 The approach adopted uses a combination of separate link and junction accident calculations or combined link and junction accident calculations depending on the geographical location. Observed accident data was used to derive accident rates.

14.6.4 The latest version of COBALT available at the time of the assessment was used (version v2.4). The economic parameter file is based on TAG Data Book v1.20.2 (January 2023), which aligns with the other elements of appraisal.

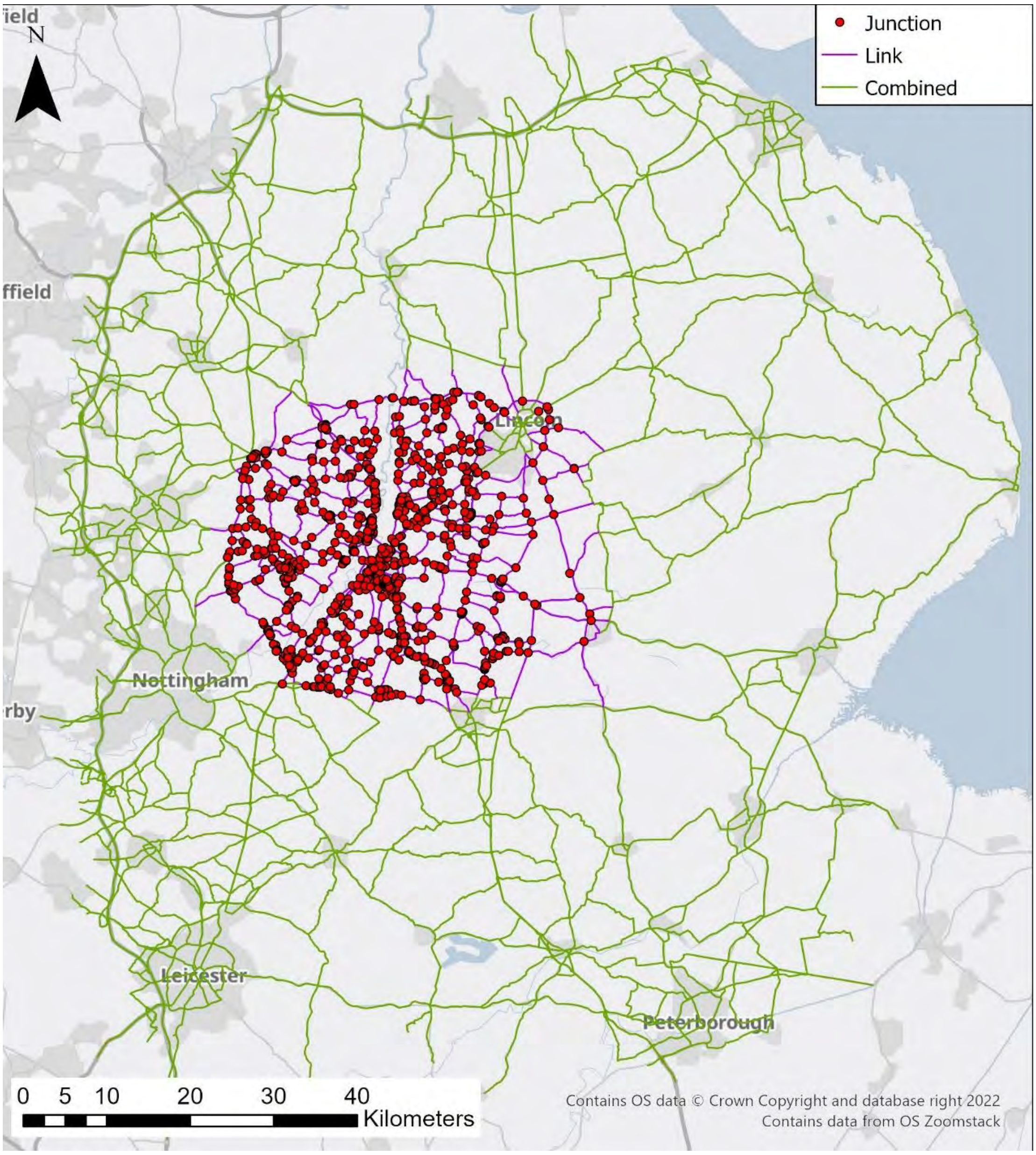
Assessment Area

14.6.5 The COBALT assessment has been carried out for the Fully Modelled Area (FMA), which is made up of the Area of Detailed Modelling (AoDM) and the Rest of the Fully Modelled Area (RoFMA). This is the area of the model that is represented in SATURN simulation coding and where all demand responses are modelled.

- In the AoDM accidents have been calculated separately for links and junctions.
- In the RoFMA accidents have been calculated using the combined link and junction approach

14.6.6 The geographical extent of the accident assessment including the network covered as part of the assessment is shown in Figure 14-2. The extent of the area where links and junctions are assessed separately and the area where combined link and junctions are assessed is also shown.

Figure 14-2: COBALT assessment areas



COBALT Network

14.6.7 Unlike the SATURN network the links in the COBALT model represent both directions of travel. A process was set up to combine links within the traffic model to produce the COBALT network. Exploded junction coding within SATURN were also combined to form a single junction.

14.6.8 Links were allocated a link type based on road standard and carriageway type, and the speed limit was allocated.

Accident Data

14.6.9 Personal injury accident (PIA) data was obtained for the full five-year period from 2015 to 2019 (pre-Covid) from the DfT's Road Safety Data website. Accident data was collated for the whole of the assessment area. Accidents were allocated to the relevant COBALT links using GIS. In the AoDM where link and junction accidents were assessed separately, the accidents occurring at a junction (identified as being within a 20m radius of the junction) were allocated to the corresponding COBALT node. All remaining accidents within 20m of a COBALT link were allocated to the corresponding model network link. In the RoFMA, accidents occurring at junctions included in the combined section of the network were allocated to the nearest link.

14.6.10 The observed accident data, in combination with the 2019 base year modelled traffic flows, was used by the software to derive observed accident rates for each of the COBALT links and junctions.

14.6.11 As observed accident data can only be applied to existing links, and in accordance with COBALT guidance, it was necessary to allocate default accident rates based on the road classification for all new roads in both the Do-Minimum and Do-Something networks.

Traffic Data

14.6.12 For the calculation of accidents COBALT requires the annual average daily traffic (AADT) flows for each link in the network for both the Do-Minimum and Do-Something scenarios. Traffic flows were derived from the A46 Newark Bypass Model for the base year, scheme opening year (2028), and the intermediate and horizon forecast years (2043 and 2061 respectively) for both the Do-Minimum and Do-Something scenarios.

Calculation of Change in Accidents and Casualties and Monetisation of Benefits

14.6.13 Using the accident rates and traffic flows for each scenario, COBALT forecasts the number of accidents and casualties in the Do-Minimum and Do-Something scenarios over the 60-year appraisal period. The number (and severity) of accidents and casualties is monetised by the software using default costs per accident and casualty specified in TAG.

14.6.14 Comparison of the Do-Minimum and Do-Something results provides a quantification of the scheme impacts in terms of the number and severity of accidents and casualties saved as well as the economic benefits.

14.6.15 Monetised accident benefits are output from COBALT in 2010 prices discounted to 2010.

14.7 Environmental Benefits

Noise

14.7.1 An appraisal of the noise impacts of the scheme has been undertaken in accordance with TAG Unit A3 (November 2022), which considers noise impacts from road, in terms of annoyance, sleep disturbance and health impacts. Fundamental to the TAG approach for quantification of noise impacts is methodology of Calculation of Road Traffic Noise (CRTN) and as set out within the Design Manual for Roads and Bridges (DMRB) LA 111, Noise and Vibration for determining noise impacts at sensitive receptors.

14.7.2 As part of the TAG output, the Net Present Values (NPV) for the following have been calculated:

- Amenity
- Acute myocardial infarction (AMI)
- Stroke
- Dementia
- Sleep disturbance

14.7.3 In order to derive this monetary value detailed calculations for daytime and night-time noise levels have been undertaken for the Do-Minimum and Do-Something scenarios in the opening and future years. The assessment is based on traffic flows and speeds extracted from the traffic models for the Do-Minimum and Do-Something scenarios, for the 2028 and 2043 forecast years. and a quantitative appraisal undertaken using standard DfT TAG worksheets (November 2022).

14.7.4 The impact areas used in the calculations are consistent with the DMRB approach, which in broad terms are determined by minimum changes of 1dB in a comparison between with and without scheme scenarios in the scheme opening year. DMRB LA 111 advises the study area to be within 600 metres of new road links or road links physically changed or bypassed by the scheme. Beyond 600 metres, the area within 50 metres of other road links with potential to experience a short-term Basic Noise Level (BNL change of more than 1.0 dB(A), as a result of the project.

Air Quality

14.7.5 Air quality impacts have been quantified as part of the appraisal. The approach to monetise the impacts has followed the ‘Damage Cost’ approach in accordance with the Transport Planning and Appraisal

Guidance[1] (2018) and the DfT's TAG Unit A3 Environmental Impact Appraisal, May 2022[2].This has made use of the TAG air quality valuation workbook (November 2022) and the Emissions Factors Toolkit (EFT, version 11).

14.7.6 In accordance with the guidance, this approach is appropriate as the air quality assessment included with the Environmental Statement has confirmed that the scheme will not affect legal air pollution limits and the Net Present Value (NPV) of the changes are less than £50 million.

14.7.7 The assessment is based on traffic flows and speeds extracted from traffic models for the Do-Minimum and Do-Something scenarios for the 2028 and 2043 forecast years.

14.7.8 The affected road network (ARN) was identified by comparing traffic data for the Do-Minimum and Do-Something scenarios, for relevant forecast years, against criteria outlined in the Design Manual for Roads and Bridges (DMRB) LA 105 Revision 0[3].

14.7.9 The LA 105 guidance defines the ARN for the air quality assessment as all roads that trigger the traffic screening criteria and adjoining roads within 200m. The traffic screening criteria are:

- Annual Average Daily Traffic (AADT) will change by >= 1,000; or
- Heavy Duty Vehicle (HDV) AADT will change by >= 200; or
- a change in speed band; or
- a change in carriageway alignment by >=5m

14.7.10 Net Present Values (NPVs) have been calculated for regional changes in nitrogen oxides (NOx) and particulate matter ($PM_{2.5}$) emissions. The NPV of these changes have been calculated using the 'Air Quality Valuation Workbook' provided as part of TAG Unit A3.

14.7.11 The NPV of these changes are calculated using damage costs derived from analysis by the Interdepartmental Group on Costs and Benefits air quality subject group (IGCB(A)) of the typical health impacts arising from changes in emissions of NOx and $PM_{2.5}$ concentrations.

Greenhouse Gases

14.7.12 TAG Unit A3 Environmental Impact Appraisal outlines the need to identify and monetise the impacts of proposed transport schemes on Greenhouse Gas (GHG) emissions, whether they are increased or decreased. This assessment has been undertaken in accordance with

[1] Department for Transport, 2018. The Transport Appraisal Process. Transport Analysis Guide (TAG).

[2] Department for Transport, 2022. TAG UNIT A3, Environmental Impact Appraisal. Transport Analysis Guidance (TAG).

[3] National Highways (2019) LA 105 –Air quality Revision 0[online] available at: https://www.standardsforhighways.co.uk/tses/attachments/10191621-07df-44a3-892e-c1d5c7a28d90?inline=true

principles in TAG Unit A3 'Environmental Impact Appraisal' (Department for Transport (DfT)), July 2021. The approach has included the direct application of the Emissions Factors Toolkit v11 (EFT).

14.7.13 The assessment is based on traffic flows and speeds extracted from traffic models for the Do-Minimum and Do-Something scenarios. The traffic flows used in the Greenhouse Gas assessment were taken from the whole of the Fully Model Area (FMA). The relevant summary vehicle kilometres, times and speeds were calculated.

14.7.14 Road user emissions were calculated using summary vehicle kilometres for the different vehicle classes. The roads that met the scoping criteria outlined in the Design Manual for Roads and Bridges (DMRB) LA 114 – Climate were considered within the assessment. These were as follows:

- a change of more than 10% in AADT
- a change of more than 10% to the number of heavy-duty vehicles
- a change in daily average speed of more than 20 km/hr

14.7.15 The road links that met the DMRB criteria were fed into the EFT to calculate the emissions for the opening and forecast years for the Do-Minimum and Do-Something scenarios. The EFT provided both the direct and indirect carbon dioxide equivalent (CO_2e) emissions arising from the scheme.

14.7.16 Further scope of emissions are also included in the assessment to show the Whole Life Carbon impact, including the construction emissions, operational energy, maintenance and land use change. The construction assessment includes emissions form the use of materials, construction plant and transport of materials to site based on the most up to date Bill of Quantities. Operational energy has been estimated based on published data on the energy usage for lighting and other equipment per km stretch of road whilst maintenance has been estimated using professional judgement and known maintenance regimes for the key aspects. The land use change assessment is based upon the change in sequestration due to changes to habitats based on data from the Biodiversity Net Gain calculations.

14.7.17 The results from the EFT and the wider assessments were then fed into the Chief Analyst's Carbon Valuation Toolkit v1.5, and the construction emissions, to provide the monetisation and net present value (NPV) of emissions over the 60-year appraisal period of the scheme.

14.8 Reliability Benefits

Overview

14.8.1 The term reliability refers to the variation in journey times that individuals are unable to predict (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 of which travellers are assumed to be aware.

14.8.2 The reliability benefits of the scheme have been calculated using the urban roads approach presented in TAG unit A1.3. As defined in TAG Unit A1.3, 'reliability' in this section refers to unpredictable variations in journey times, which could include day-to-day variation in congestion.

14.8.3 The existing single-carriageway section of the A46, which includes at-grade junctions at Farndon, Cattle Market, Brownhills, Friendly Farmer and Winthorpe, is known to experience large variations in journey times. The removal of some of the existing at-grade junctions and provision of the new dual-carriageway section will lead to improved journey time reliability along the A46 route.

14.8.4 As recommended in TAG, for the purpose of assessing the impact on journey time reliability, the standard deviation of travel time has been adopted as a measure of travel time variability. The standard deviation of travel times on existing single and dual-carriageway sections of the A46 has been derived from TrafficMaster data for March 2019.

14.8.5 Figure 14-3 identifies the sections of the A46 used when calculating travel time variability for the single and dual-carriageway sections. Travel time variability has been calculated in both directions separately for the existing single-carriageway section. An existing dual-carriageway section of the A46 north of Newark was chosen as a proxy for the A46 Newark Bypass, as it includes a grade-separated junction and terminates at either end with at-grade roundabouts that do experience congestion in peak times.

Figure 14-3: Sections of A46 used in reliability calculations

14.8.6 Travel time variability was derived for each weekday time period separately (AM 07:00-10:00, IP 10:00-16:00 and PM 16:00-19:00), by calculating the standard deviation of journey times in seconds per kilometre for the above sections.

14.8.7 Reliability benefits are then monetised by applying the 'rule of a half' method based on the previously derived standard deviations, forecast traffic flows and a forecast value of reliability (VOR) per vehicle. As recommended in TAG Unit A1.3, the VOR (in £'s per hour) has been derived using TAG Values of Time and applying a 'reliability factor' of 0.4 for car/LGV and 0.6 for HGV.

14.8.8 The methodology of deriving the reliability benefit is outlined in the following, which is applied separately for each of the weekday time periods:

$$Benefit = -\frac{1}{2}\Delta\sigma * (F_{DM} + F_{DS}) * VOR$$

Where:

Δσ is the change in standard deviation of journey time between the DM and DS scenarios on the equivalent sections of road (seconds)

F_{DM} is the average hourly flow (by period) on the single-carriageway section in the DM scenario

F_{DS} is the average hourly flow (by period) on the dual-carriageway section in the DS scenario

14.8.9 Full opening year (2028) reliability benefits are calculated by applying annualisation factors (see Table 14-7) to the values derived by period at a daily basis. The opening year benefits are then discounted to 2010 using standard discount rates from the TAG data book. Finally, reliability benefits are calculated for the full 60-year appraisal period by applying an appropriate capitalisation factor to the 2028 opening year benefits.

14.9 Wider Economic Impacts

Overview

14.9.1 Wider economic impacts refer to economic impacts that are additional to the transport user benefits. Wider Economic Impacts for the scheme were assessed in line with TAG unit A2.1.

14.9.2 For the A46 Newark Bypass, Level 2 impacts were assessed based on fixed land use outputs from the traffic model. This was considered to be a proportionate approach in line with TAG Unit A2-1. The Scheme is forecast to reduce travel costs for trips using the A46 and increase the connectivity between Newark, Lincoln, Nottingham and more widely.

14.9.3 The following wider economic impacts have been included in the appraisal undertaken at PCF Stage 3:

- Agglomeration benefits (referred to as Static Clustering)
- Increase in output in markets with imperfect competition
- Labour supply impacts

14.9.4 In line with guidance, benefits from increased output in markets with imperfect competition have been calculated as 10% of the benefits to business users, which were extracted from TUBA.

14.9.5 Agglomeration and labour supply impacts were calculated using the DfT program WITA (v2.3) that follows the principles and formulae set out in the TAG Unit A2.1 guidance. WITA requires a number of inputs including:

- Demand matrices and cost skim matrices
- Local authority employment data
- National economic data

14.9.6 Table 14-10 presents the parameters used in WITA.

Table 14-10: WITA parameters

Parameter	Option
WITA Version	Version 2.3
Scheme Economics File	Economics_TAG_db1_20_2.txt
Local Authority District Economic File	LAD_Economic_Data_TAG_ds3_3_0.dat
WITA Dataset	Version July-2021
Opening Year	2028
Intermediate Year	2043
Horizon Year	2061
Final Appraisal Year	2087
Appraisal period	60 Years

14.10 Distributional Impacts

Overview

14.10.1 The Distributional impacts (DI) considers the distribution of the economic impacts across different social groups, seeking to identify those social groups that would be disproportionately impacted by the intervention. In particular, the DI appraisal considers impacts the scheme might have on social groups who might be particularly vulnerable.

14.10.2 A DI appraisal is comprised of three stages: an initial screening stage; assessment of impacts, should screening require it; and appraisal of the impacts. The eight distributional impacts are as follows:

- User benefits
- Noise
- Air quality
- Accidents
- Security
- Severance
- Accessibility
- Affordability

14.10.3 The DI appraisal has been carried out in line with Transport Analysis Guidance (TAG) Unit A4.21, proportionate to the size of the scheme and the level of quantitative data available.

14.10.4 To comply with TAG Unit A4.2, the social groups that will be assessed for each distributional impact are displayed in Table 14-11 below.

Table 14-11: Scope of socio-demographic analysis

Social group (tick indicated analysis required for each impact)	Distributional impacts							
	User benefits	Noise	Air quality	Accidents	Security	Severance	Accessibility	Affordability
Income distribution	✓	✓	✓				✓	✓
Children: proportion of population aged under 16		✓	✓	✓	✓	✓	✓	
Young adults: proportion of population aged between 16 and 25				✓			✓	
Older people: proportion of population aged 70 and over		✓		✓	✓	✓	✓	
Proportion of population with a long-term health problem or disability (LTHD)					✓	✓	✓	
Proportion of population from ethnic minority groups					✓		✓	
Proportion of households without access to a car						✓	✓	
Carers: proportion of households with dependent children							✓	

Source: Department for Transport (May 2023) TAG Unit A4.2 Distributional Impact Appraisal

14.10.5 The general system that is used for grading DIs is shown in Table 14-12 below.

Table 14-12: System for grading distributional impacts

Assessment	✓ / ×	Impact
Large beneficial	✓✓✓	Beneficial and the population impacted is significantly greater (>5%) than the proportion of the group in the total population.
Moderate beneficial	✓✓	Beneficial and the population impacted is broadly in line (+/-5%) with the proportion of the group in the total population.
Slight beneficial	✓	Beneficial and the population impacted is smaller (>5%) than the proportion of the group in the total population.
Neutral	-	There are no significant benefits or disbenefits experienced by the group for the specified impact.
Slight adverse	×	Adverse and the population impacted is smaller (>5%) than the proportion of the population of the group in the total population.
Moderate adverse	××	Adverse and the population impacted is broadly in line (+/- 5%) with the proportion of the population of the group in the total population.
Large adverse	×××	Adverse and the population impacted is significantly greater (>5%) than the proportion of the group in the total population.

Source: Department for Transport (May 2023) TAG Unit A4.2 Distributional Impact Appraisal

14.11 Social Impacts

Overview

14.11.1 Social Impacts looks to identify and assess the likely significant effects on population and human health. This includes consideration of the potential for both adverse and beneficial effects with regard to:

- Land use and accessibility, including:
  - Residential property and housing
  - Community land and assets
  - Development land and businesses
  - Agricultural land holdings
  - Walkers, cyclists and horse-riders (WCH)
- Human health, including a range of personal, social, economic and environmental factors that influence human health status, such as:
  - Neighbourhood quality
  - Access to services, health and social care
  - Social capital
  - Employment and income
  - Access to green space, recreation, and physical activity

14.11.2 The approach used to undertake the population and human health assessment comprises of two methodologies – one for land-use and accessibility and another for human health.

14.11.3 The assessment has made use of desk-based information available from the Office for National Statistics (ONS), Ordnance Survey AddressBase, Public Health (England) (now known as UK Health Security Agency) and Newark & Sherwood District Council; as well as drawing upon information determined as part of the assessment of other relevant disciplines presented within the Environmental Statement (ES).

14.11.4 The assessment on land-use and accessibility focuses on those impacts that are likely to have significant effects on the community, and has been completed in accordance with the standard on population and human health impact assessment included in DMRB LA 112. Significance has been determined by considering the sensitivity of the receptor, as well as the magnitude of the impact on those receptors.

14.11.5 DMRB LA 112 does not provide a framework for assigning significance of effects to human health impacts. As such, the assessment on human health has been completed in accordance with IEMA's 'Determining Significance for Human Health in Environmental Impact Assessment'.

15 Economic Appraisal Results

15.1 Introduction

15.1.1 The results of the economic appraisal of the scheme are presented in this chapter. The results of the individual appraisal strands are presented together with the overall analysis of monetised costs and benefits. Both the initial benefit cost ratio (BCR) and the adjusted BCR are presented.

15.2 Transport User Benefits

15.2.1 The Transport Economic Efficiency (TEE) user costs and benefits calculated by TUBA are presented in the TEE table. This combines the results for all periods assessed for weekdays and weekends and excludes construction impacts. The TEE table is presented in Table 15-1.

15.2.2 The scheme results in £248.5m of transport user benefits, with business users including freight making up a significant proportion of the benefits.

Table 15-1: Economic Efficiency of the Transport System (TEE) (2010 prices and discounted to 2010, Values, £,000)

Economic Efficiency of the Transport System (TEE)

Non-business: Commuting	**ALL MODES**		**ROAD**	**BUS and COACH**	**RAIL**	**OTHER**
User benefits	**TOTAL**		**Private Cars and LGVs**	**Passengers**	**Passengers**	
Travel time	26565		26565			
Vehicle operating costs	-4029		-4029			
User charges	0		0			
During Construction & Maintenance	0		0			
NET NON-BUSINESS BENEFITS: COMMUTING	22536	*(1a)*	22536			

Non-business: Other	**ALL MODES**		**ROAD**	**BUS and COACH**	**RAIL**	**OTHER**
User benefits	**TOTAL**		**Private Cars and LGVs**	**Passengers**	**Passengers**	
Travel time	65409		65409			
Vehicle operating costs	-15043		-15043			
User charges	0		0			
During Construction & Maintenance	0		0			
NET NON-BUSINESS BENEFITS: OTHER	50366	*(1b)*	50366			

Business								
User benefits			**Goods Vehicles**	**Business Cars & LGVs**	**Passengers**	**Freight**	**Passengers**	
Travel time	158862		88450	70412				
Vehicle operating costs	16704		12481	4223				
User charges	0		0	0				
During Construction & Maintenance	0		0	0				
Subtotal	175566	*(2)*	100931	74635				
Private sector provider impacts						**Freight**	**Passengers**	
Revenue	0							
Operating costs	0							
Investment costs	0							
Grant/subsidy	0							
Subtotal	0	*(3)*						
Other business impacts								
Developer contributions	0	*(4)*						
NET BUSINESS IMPACT	175566	*(5) = (2) + (3) + (4)*						
TOTAL								
Present Value of Transport Economic Efficiency Benefits (TEE)	248468	*(6) = (1a) + (1b) + (5)*						

Notes: Benefits appear as positive numbers, while costs appear as negative numbers.
prices and values

Note: User benefits due to construction are reported separately in section 15.3

15.2.3 Detailed analysis of the breakdown of benefits was carried out. A summary of the key findings is presented below.

- User Benefits by Time Period - benefits are highest in the weekday inter-peak,(this reflects the greater number of inter-peak hours included in the appraisal), followed by weekday morning peak (reflecting the higher levels of delay experienced in this period). Weekend benefits are approximately 46% of the inter-peak benefits

(this is due to different annualisation factors and the purpose-split adjustment applied)

- TUBA User Benefits by Appraisal Year - The results show that annual benefits are fairly consistent between the opening year and horizon year despite the effects of discounting. There is a slight increase in annual benefit from scheme opening in 2028 up to the 2043 intermediate year. Benefits gradually fall back between 2043 and 2061 but remain around the same level as at opening year. Beyond 2061 no further traffic growth is assumed and the level of annual benefit reduces in-line with discounting.
  From opening year up to the horizon year the scheme is forecast to deliver significant benefits as the problems in the DM scenario gradually worsen over time due to traffic growth, however, the increasing annual benefits of the scheme are offset by the effects of discounting, which flattens the profile up to 2061.
- TUBA user benefits by vehicle type - The majority of benefits are realised by light vehicles (car and LGVs). The benefits by vehicle type are broadly in line with expectations with cars generating the highest level of benefit, circa 60%. The proportion attributable to Light Goods Vehicles (LGV) is just over 21%. Other Goods Vehicles (OGVs) realise the least proportion of benefits, reflecting the lower proportion of overall traffic volumes compared to light vehicles. Some of the car user benefits are as a result of cars re-routing from alternative local roads to the improved A46 mainline. This does not impact on OGVs to the same extent as these vehicles generally tend to already be using the A46.
  Analysis of traffic using the route by vehicle type indicates that approximately 68% of total traffic is cars, with 18% LGVs and the remaining 14% OGVs. This aligns with the distribution of benefits by vehicle type with the majority of benefits being attributable to car trips.
- TUBA User Benefits by Trip Purpose - The majority of user benefits are for business trips (this includes both cars and goods vehicles). This is as a result of a relatively large proportion of business users (approximately 52% of trips on the A46 at Newark) benefiting from the improvements combined with their higher value of time. Commuting and other purposes account for a significantly smaller proportions of the overall benefit, at 9% and 22% respectively.
- User Benefits by Change in Travel Time Saving - The results indicate that most of the user benefits are due to travel time savings of between 0 and 5 minutes. There are some disbenefits, with an increase in travel time of between 0 and 2 minutes. The travel time savings are reflective of the journey time savings forecast to result from the Scheme, where trips along the A46 corridor are expected to experience journey time savings of between 3 and 5 minutes.
- User Benefits by Trip Distance Band - The analysis of scheme benefits by trip distance indicates that the majority of the benefits are for trips greater than 50 kilometres, reflecting the strategic nature of

the A46. There are some benefits for more local trips as a result of improvements to the key junctions on the route.

- Sector-to-Sector User Benefits - the majority of benefits are achieved from Newark and its vicinity. The other main benefits are derived from long distance journeys using the A46 such as journeys from the Midlands, Wales and the South West going to Yorkshire and the North, and North Lincolnshire and Bassetlaw. This aligns with the proposed scheme being beneficial to both the Newark local area and through traffic on the A46.

15.3 Delays During Construction

15.3.1 To quantify the impacts of scheme construction on transport users, a QUADRO-based economic assessment was undertaken. The assessment evaluates the disbenefits due to roadworks during the construction of the scheme. The disbenefits are as a result of roadworks causing delays to traffic, leading to impacts on travel times, vehicle operating costs, carbon emissions and accident costs.

15.3.2 Table 15-2 provides a summary of QUADRO outputs. The values are presented as disbenefits, meaning that positive values represent costs.

Table 15-2:QUADRO Impacts (2010 prices, discounted to 2010, £000s)

	Disbenefit (£000s)
Consumer user benefits	
Travel Time	5,567
Vehicle operating costs	110
NET CONSUMER IMPACT	5,677
Business user benefits	
Travel Time	2,753
Vehicle operating costs	-210
Sub-total	2,363
Private Sector Provider Impacts	
Operating costs	-17
NET BUSINESS IMPACT	2,346
Accident Costs	15
Fuel carbon emission costs	1,695
TOTAL NON-EXCHEQUER IMPACTS	9,734
Government Funding	
Present value of costs	175
OVERALL IMPACT	**9,909**

15.3.3 The costs of disruption due to the scheme construction estimated by QUADRO amount to £9.9m. The impacts estimated by QUADRO are primarily a consequence of speed reductions implemented during construction, along with a smaller component of cost arising from several weekend and overnight closures on the A46 and A1.

15.4 Accident Analysis

15.4.1 The forecast number of accidents by severity over the 60-year appraisal period are presented in Table 15-3. The overall impact is positive with a forecast reduction in both accidents and a reduction in casualties of all severities.

Table 15-3: Forecast Accident Impacts – by Severity (60-year appraisal period)

Impact		Do-Minimum	Do-Something	Savings Due to Scheme
Accident costs (2010 prices, discounted to 2010, £m)		8,191.4	8,162.1	29.3
Number of PIAs saved		191,688.0	191,194.5	493.5
Number of casualties saved:	Fatal	2,983.4	2,974.8	8.6
	Serious	26,699.4	26,617.8	81.6
	Slight	240,327.6	239,733.3	594.3
	Total	270,010.4	269,325.9	684.5

15.4.2 Table 15-4 shows the forecast accident impact by network element. Noting that links and junctions are appraised separately in the Area of Detailed Modelling and a combined link and junction assessment is carried out in the Rest of the Fully Modelled Area.

Table 15-4: Forecast accident impacts – by COBALT element

Impact	Number of PIAs saved (60-year appraisal period)	Benefits due to Scheme (2010 prices, discounted to 2010, £m)
Links	210.1	15.3
Junctions	338.7	10.1
Combined	-55.3	3.9
Grand total	493.5	29.3

15.4.3 Outputs from the COBALT assessment indicate that the Scheme is forecast to result in accident benefits for both the modelled links and junctions in the Area of Detailed Modelling and also, to a lesser extent, in the rest of the fully modelled area, where a combined assessment has been undertaken.

15.4.4 Link benefits arise from the upgrade of the single carriageway sections of the A46 to dual carriageway, and from some traffic reassigning onto the A46 from comparatively less safe local roads. Increases in traffic on some roads adjacent to the Scheme, such as the A17, are forecast to lead to some localised increases in accidents, although these are not of sufficient magnitude to outweigh benefits elsewhere.

15.4.5 COBALT junction benefits are largely attributable to the Scheme junctions, particularly those where grade separation is introduced. Other junctions that are relieved of traffic by the Scheme also contribute to an overall net benefit.

15.4.6 In the rest of the fully modelled area the combined link and junction COBALT assessment indicates that the Scheme will lead to a slight increase in PIAs but still deliver £3.9m accident benefits. This result is consistent with accident savings in earlier years deteriorating in this region in the horizon year to give a small net increase in PIAs over the appraisal period but with a small monetised benefit due to the impact of discounting.

15.4.7 Overall the results of the COBALT assessment indicate a forecast saving over the 60-year appraisal period of nearly 500 PIAs, a reduction in casualties of all severities (including 8.6 fatal casualties), and provides a monetised benefit of over £29m. It is also notable that the links and junctions directly improved by the A46 Newark Bypass scheme contribute significantly to the accident benefits, giving rise to three quarters (£22m) of the overall accident benefits.

15.5 Environmental impact results

Noise results

15.5.1 The results of the noise assessment are presented in Table 15-5.

Table 15-5: Noise assessment results

Measurement	Scheme
Net present value of change in noise*	£5,106,488
Households experiencing increased daytime noise in forecast year	1398
Households experiencing reduced daytime noise in forecast year	1333
Households experiencing increased night-time noise in forecast year	550
Households experiencing reduced night-time noise in forecast year	1208

* positive value reflects a net benefit (i.e. a reduction in noise)

15.5.2 Assessment results indicate there would likely be both adverse and beneficial operational noise impacts at receptors as a result of the scheme. Overall there would be a net change showing a monetised benefit.

15.5.3 Potential noise impacts have been reviewed within the context of the noise levels at each receptor in relation to SOAEL (significant observable adverse effect level) and LOAEL (lowest observable adverse effect level) to determine the potential for significant adverse operational noise effects.

15.5.4 No residual significant effects have been identified within the draft order limits. Potentially significant effects outside the draft order limits have been highlighted for a group of receptors at, or in the vicinity of, Pelham Street, Victoria Street, Clinton Street, and Portland Street, where the traffic model resulted in increases in traffic flows due to re-routing behaviour With the Scheme. On the basis the traffic model does not take into account conditions such as parked cars limiting traffic flow to one lane, resultant impacts are not considered to be significant (post-opening monitoring has been proposed to confirm this assumption, with potential mitigation measures to be secured in the DCO).

Air Quality Results

15.5.5 The results of the 'Damage Cost' assessment for the scheme are presented in Table 15-6.

Table 15-6:Air Quality results for the scheme

Measurement	Scheme
Change in Emissions – NOx t/year (2028)	6.31
Change in Emissions – PM2.5 t/year (2028)	0.92
Monetised environmental impact (2010 prices discounted to 2010)*	-£1,747,031

Note: Data obtained from the Air Quality Valuation Workbook

15.5.6 The results indicate there is a net worsening in air quality as a result of the scheme in the opening year and forecast year. The worsening is primarily due to an increase in annual traffic movements due to increased capacity delivered by the scheme, and an overall increase in vehicle kilometres travelled.

15.5.7 The scheme would result in the monetary disbenefit of -£1,747,031.

15.5.8 It should be noted that the results of the detailed air quality assessment undertaken as part of the Environmental Statement demonstrates that the scheme does not affect legal compliance with air quality limits, and it has a positive effect on air quality within Newark.

Greenhouse Gases Results

15.5.9 The Greenhouse Gas (GHG) assessment includes the construction emissions and road user emissions. The results of the assessment, including the monetisation, are summarised in Table 15-7.

Table 15-7: Greenhouse gas results

Measurement	Scheme
Greenhouse Gas emissions (tCO2e)	683,200
Total Value of emissions over 60 years (in £000s) (2010 prices discounted to 2010)	- £56,416

15.5.10 The scheme will result in increased GHG emissions due to the construction of the scheme and the operation of the scheme. The sum of emissions from all sources equals 683,200 tCO_2e. This includes emissions from construction, operational energy, renewal and maintenance, land use change and road user emissions. Road user emission is the largest category as there will be a net increase of vehicle kilometres travelled over the study area and as such a total increase of 523,019 tCO_2e over the 60-year assessment period.

15.5.11 Construction is responsible for approximately 143,887 tCO2e, which is the sum of the embodied GHG emissions within materials, construction plant and transport of materials to site. The renewal and maintenance emissions accounts for 15,416 tCO2e. The operational energy and land use change emissions are responsible for 878 tCO2e over the 60-year assessment period.

15.6 Reliability and Network Resilience Impacts

15.6.1 The total reliability benefits for the 60-year appraisal period are presented in Table 15-8.

Table 15-8: Journey Time Reliability Benefits

	Period	Reliability Benefits (£000s)
Opening year 2028	AM	£167.6
	IP	£482.2
	PM	£89.1
Total (over 60-year appraisal period)		29,367.5

All monetary values are in thousands of pounds expressed in 2010 prices discounted to 2010, Values, £,000.

15.6.2 The scheme results in journey time reliability benefits of £29,367,537.

15.7 Wider Economic Benefits

15.7.1 Table 15-9 presents the wider economic impacts for the scheme. Agglomeration impacts, account for approximately 73% of the total wider economic impacts, with increased outputs in imperfectly competitive markets accounting for the majority of the other benefits.

Table 15-9: Estimated Wider Economic Benefits (2010 prices, discounted to 2010, £,000)

Wider Impact	Benefits due to Scheme
Agglomeration – manufacturing	2,157
Agglomeration – construction	3,370

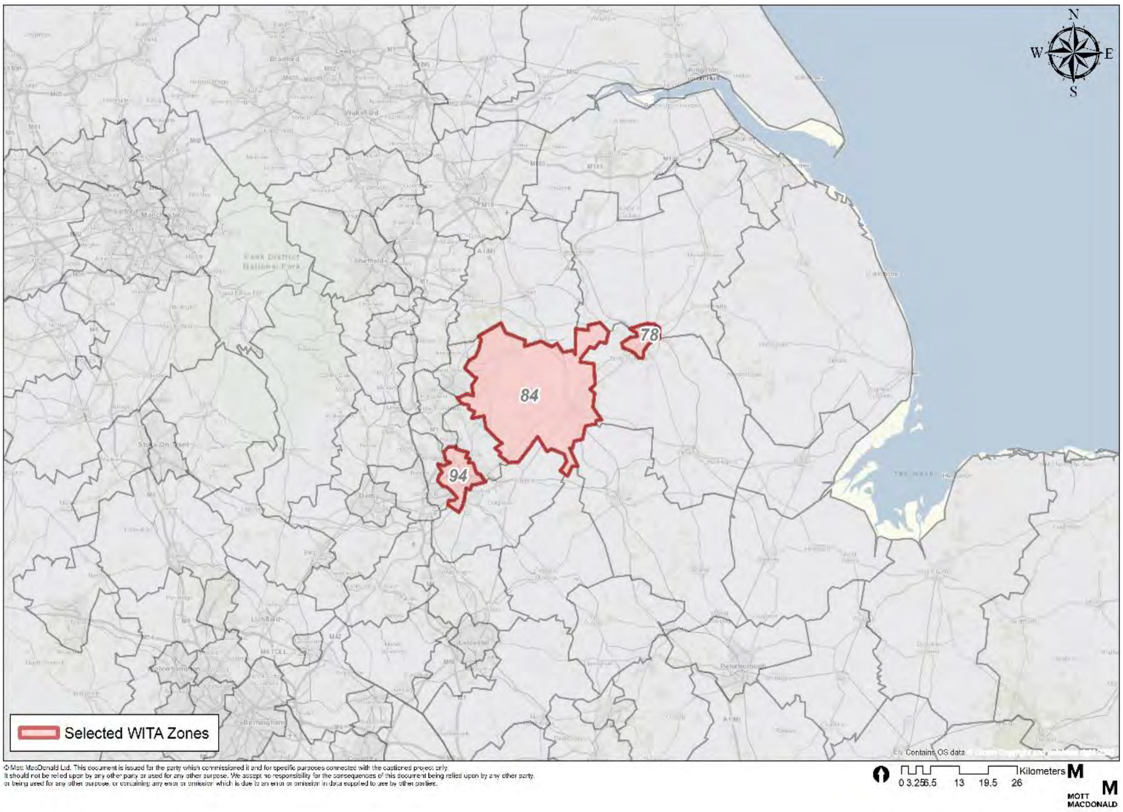
Wider Impact	**Benefits due to Scheme**
Agglomeration – consumer services	16,610
Agglomeration – producer services	27,340
Agglomeration – Total	**49,477**
Labour supply impact	433
Increased output in imperfectly competitive markets	17,557
Total Wider Economic Impacts	**67,467**

15.7.2 The benefits associated with increased output in imperfectly competitive markets, (10% uplift to Business User Benefits), cover the entire model.

15.7.3 Agglomeration and labour supply impacts have been restricted to the local districts of Newark and Sherwood, (which is where the scheme is located) and Nottingham and Lincoln, as these are the main urban areas connected by the A46 corridor and expected to be most influenced by the Scheme. Figure 15-1 shows the location of these districts for reference.

15.7.4 The split of agglomeration benefits between the local districts is fairly evenly spread with £13.5m for Newark and Sherwood, £19.4m for Nottingham and £16.5m for Lincoln. The distribution of benefits appears to be reasonable given the nature of the improvement to the A46 corridor, with the main urban areas of Nottingham and Lincoln realising the greatest share of agglomeration benefits.

Figure 15-1: Selected WITA zones



15.8 Overall Economic Assessment

Public Accounts

15.8.1 The Present Value of Costs (PVC) have been provided by National Highways Commercial Services Division (NHCSD). The scheme investment costs, and indirect tax revenues are allocated to the central government fund. These are summarised in the Public Accounts (PA) table which is presented as Table 15-10 below. Values for indirect tax revenues have been generated through the application of TUBA assessments.

Table 15-10: Public Accounts (2010 prices and discounted to 2010, Values, £,000)

Public Accounts (PA) Table

	ALL MODES		ROAD	BUS and COACH	RAIL	OTHER
Local Government Funding	**TOTAL**		**INFRASTRUCTURE**			
Revenue	0					
Operating Costs	0					
Investment Costs	0					
Developer and Other Contributions	0					
Grant/Subsidy Payments	0					
NET IMPACT	0	*(7)*				
Central Government Funding: Transport						
Revenue	0					
Operating costs	15848					
Investment Costs	250189					
Developer and Other Contributions	0					
Grant/Subsidy Payments	0					
NET IMPACT	266037	*(8)*				
Central Government Funding: Non-Transport						
Indirect Tax Revenues	-7081	*(9)*				
TOTALS						
Broad Transport Budget	266037	*(10) = (7) + (8)*				
Wider Public Finances	-7081	*(11) = (9)*				

Notes: Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.
All entries are discounted present values in 2010 prices and values.

Analysis of Monetised Costs and Benefits

15.8.2 The TEE benefits and Public Accounts information are combined to produce an initial benefit to cost ratio (BCR), which includes all Level 1 benefits. The results of this analysis are presented in the Analysis of Monetised Costs and Benefits (AMCB) table which is included below as Table 15-11. The benefits combine the results for all periods assessed for weekdays and weekends across the whole 60-year appraisal period.

Table 15-11: Analysis of Monetised Costs and Benefits (2010 prices and discounted to 2010, Values, £,000)

Analysis of Monetised Costs and Benefits

Noise	5106	*(12)*
Local Air Quality	-1747	*(13)*
Greenhouse Gases	-56416	*(14)*
Journey Quality		*(15)*
Physical Activity		*(16)*
Accidents	29296	*(17)*
Economic Efficiency: Consumer Users (Commuting)	22536	*(1a)*
Economic Efficiency: Consumer Users (Other)	50366	*(1b)*
Economic Efficiency: Business Users and Providers	175566	*(5)*
Construction Impacts	-9909	(a)
Wider Public Finances (Indirect Taxation Revenues)	7081	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	221879	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)+(a)*
Broad Transport Budget	266037	*(10)*
Present Value of Costs (see notes) (PVC)	266037	*(PVC) = (10)*
OVERALL IMPACTS		
Net Present Value (NPV)	-44158	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)	0.83	BCR=PVB/PVC

Note : This table includes costs and benefits which are regularly or occasionally presented in monetised form in transport appraisals, together with some where monetisation is in prospect. There may also be other significant costs and benefits, some of which cannot be presented in monetised form. Where this is the case, the analysis presented above does NOT provide a good measure of value for money and should not be used as the sole basis for decisions.

15.8.3 Level 2 benefits, including reliability impacts and wider economic impacts are subsequently considered in an Adjusted BCR as set out in Table 15-12 below.

Table 15-12: Adjusted BCR – Core Scenario (2010 prices and discounted to 2010, values £000's

Present Value Benefits (PVB)	**221,879**
Present Value Costs (PVC)	266,037
Initial BCR	0.83
Journey Time Reliability Benefits	29,368
Wider Benefits	67,467

Present Value Benefits (PVB)	**221,879**
Adjusted PVB	318,714
Adjusted BCR	1.20

15.9 Sensitivity tests

15.9.1 Sensitivity tests have been undertaken to understand the impact of variations in outturn traffic growth on the forecast level of benefits. Forecasting was carried out for the Low Economy and High Economy scenarios from the Common Analytical Scenarios. For the economic appraisal only transport user benefits (TUBA) and accident benefits (COBALT) have been calculated, along with increased outputs in imperfectly competitive markets. All other impacts have taken the results from the Core scenario.

15.9.2 Table 15-13 presents the Transport Economic Efficiency (TEE) user costs and benefits calculated by TUBA for the Low Economy scenario.

Table 15-13: Economic Efficiency of the Transport System (TEE) – Low Economy Scenario (2010 prices, discounted to 2010, £,000s)

Non-business: Commuting	ALL MODES		ROAD	BUS and COACH	RAIL	OTHER
User benefits	TOTAL		Private Cars and LGVs	Passengers	Passengers	
Travel time	20541		20541			
Vehicle operating costs	4702		4702			
User charges	0		0			
During Construction & Maintenance	0		0			
NET NON-BUSINESS BENEFITS: COMMUTING	15839	(1a)	15839			

Non-business: Other	ALL MODES		ROAD	BUS and COACH	RAIL	OTHER
User benefits	TOTAL		Private Cars and LGVs	Passengers	Passengers	
Travel time	53102		53102			
Vehicle operating costs	-24207		-24207			
User charges	0		0			
During Construction & Maintenance	0		0			
NET NON-BUSINESS BENEFITS: OTHER	28895	(1b)	28895			

Business			Goods Vehicles	Business Cars & LGVs	Passengers	Freight	Passengers	
User benefits								
Travel time	124143		65072	59071				
Vehicle operating costs	13197		9614	3582				
User charges	0		0	0				
During Construction & Maintenance	0		0	0				
Subtotal	137339	(2)	74687	62653				
Private sector provider impacts						Freight	Passengers	
Revenue	0							
Operating costs	0							
Investment costs	0							
Grant/subsidy	0							
Subtotal	0	(3)						
Other business impacts								
Developer contributions	0	(4)						
NET BUSINESS IMPACT	137339	(5) = (2) + (3) + (4)						
TOTAL								
Present Value of Transport Economic Efficiency Benefits (TEE)	182073	(6) = (1a) + (1b) + (5)						

Notes: Benefits appear as positive numbers, while costs appear as negative numbers. prices and values

15.9.3 Table 15-14 presents the Transport Economic Efficiency (TEE) user costs and benefits calculated by TUBA for the High Economy scenario.

Table 15-14: Economic Efficiency of the Transport System (TEE) – High Economy Scenario

Economic Efficiency of the Transport System (TEE)								
Non-business: Commuting	ALL MODES		ROAD		BUS and COACH	RAIL		OTHER
User benefits	TOTAL		Private Cars and LGVs		Passengers	Passengers		
Travel time	43106		43106					
Vehicle operating costs	-4806		-4806					
User charges	0		0					
During Construction & Maintenance	0		0					
NET NON-BUSINESS BENEFITS: COMMUTING	38300	(1a)	38300					
Non-business: Other	MODES		ROAD		COACH	RAIL		OTHER
User benefits	TOTAL		Private Cars and LGVs		Passengers	Passengers		
Travel time	97058		97058					
Vehicle operating costs	-21154		-21154					
User charges	0		0					
During Construction & Maintenance	0		0					
NET NON-BUSINESS BENEFITS: OTHER	75904	(1b)	75904					
Business								
User benefits			Goods Vehicles	Business Cars & LGVs	Passengers	Freight	Passengers	
Travel time	227666		140594	87072				
Vehicle operating costs	26135		20668	5468				
User charges	0		0	0				
During Construction & Maintenance	0		0	0				
Subtotal	253801	(2)	161261	92540				
Private sector provider impacts						Freight	Passengers	
Revenue	0							
Operating costs	0							
Investment costs	0							
Grant/subsidy	0							
Subtotal	0	(3)						
Other business impacts								
Developer contributions	0	(4)						
NET BUSINESS IMPACT	253801	(5) = (2) + (3) + (4)						
TOTAL								
Present Value of Transport Economic Efficiency Benefits (TEE)	368005	(6) = (1a) + (1b) + (5)						

Notes: Benefits appear as positive numbers, while costs appear as negative numbers.
2010 prices and values

15.9.4 Table 15-15 shows the economic assessment results for the sensitivity tests and the core scenario.

Table 15-15: Analysis of Monetised Costs and Benefits – Sensitivity tests and Core results (2010 prices, discounted to 2010, £,000s)

Analysis of Monetised Costs and Benefits

	Low Economy	Core	High Economy	
Noise	5106	5106	5106	(12)
Local Air Quality	-1747	-1747	-1747	(13)
Greenhouse Gases	-56416	-56416	-56416	(14)
Journey Quality				(15)
Physical Activity				(16)
Accidents	19914	29296	50666	(17)
Economic Efficiency: Consumer Users (Commuting)	15839	22536	38300	(1a)
Economic Efficiency: Consumer Users (Other)	28895	50366	75904	(1b)
Economic Efficiency: Business Users and Providers	137339	175566	253801	(5)
Construction Impacts	-9909	-9909	-9909	(a)
Wider Public Finances (Indirect Taxation Revenues)	12333	7081	8709	- (11) - sign changed from PA table, as PA table represents costs, not benefits
Present Value of Benefits (see notes) (PVB)	151354	221879	364414	(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)+(a)
Broad Transport Budget	266037	266037	266037	(10)
Present Value of Costs (see notes) (PVC)	266037	266037	266037	(PVC) = (10)
OVERALL IMPACTS				
Net Present Value (NPV)	-114683	-44158	98377	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)	0.57	0.83	1.37	BCR=PVB/PVC

Note : This table includes costs and benefits which are regularly or occasionally presented in monetised form in transport appraisals, together with some where monetisation is in prospect. There may also be other significant costs and benefits, some of which cannot be presented in monetised form. Where this is the case, the analysis presented above does NOT provide a good measure of value for money and should not be used as the sole basis for decisions.

15.9.5 Level 2 benefits, including reliability impacts and wider economic impacts are subsequently considered in an Adjusted BCR as set out in Table 15-16 below.

Table 15-16: Adjusted BCR – Sensitivity tests and Core Scenario (2010 prices and discounted to 2010, values £000's)

	Low Economy	**Core**	**High Economy**
Present Value Benefits (PVB)	151,354	221,879	364,414
Present Value Costs (PVC)	266,037	266,037	266,037
Initial BCR	0.57	0.83	1.37
Journey Time Reliability Benefits	29,368	29,368	29,368
Wider Benefits	63,644	67,467	75,291
Adjusted PVB	244,366	318,714	496,073
Adjusted BCR	0.92	1.20	1.76

15.9.6 The sensitivity tests of high and low economic growth scenarios indicate a range of outcomes either side of the Core. In the High Economy scenario the level of traffic on the highway network is forecast to be increased in relation to the Core. With higher traffic flows the problems on the existing network around Newark, in terms of congestion and road safety, are exacerbated. As a result, the benefits of the proposed A46 Newark Bypass become magnified, leading to an improvement in both the initial and adjusted BCR. Conversely, in the Low Economy scenario the effect is reversed and the BCR is reduced compared to the Core.

15.9.7 It is notable that the while the Core scenario benefits fall within the upper and lower bounds of the High Economy and Low Economy results, they are not central to this range and lie closer to low than high. The High Economy scenario leads to a 48% increase in the adjusted PVB compared to the Core, while the Low Economy scenario sees an equivalent fall of 24%. The adjusted BCR for the lower bound "Low Economy" scenario is close to unity suggesting a break-even position where costs and benefits are similar. Overall, the results from the sensitivity tests indicate that the appraisal of the Scheme is robust against a range of economic growth scenarios.

15.10 Common Analytical Scenarios

15.10.1 The TAG Uncertainty Toolkit sets out a series of seven Common Analytical Scenarios (CAS) to cover key areas of national transport uncertainty. At PCF Stage 3 the A46 Newark Bypass is considered to be a "medium impact" scheme and as such the quantitative analysis of CAS have been limited to the High Economy and Low Economy scenarios. The results from these scenarios are reported above and essentially provide an upper and lower bound either side of the Core.

15.10.2 The CAS scenarios that have not been assessed quantitatively are outlined in Table 15-17 along with a qualitative assessment of their likely impact on the outcome of the scheme appraisal.

Table 15-17: Assessment of non-modelled Common Analytical Scenarios

Scenario	Qualitative assessment
Regional	Trip end growth in the Regional CAS for the East Midlands is very close to the Core (i.e. the redistribution of economic activity away from the South East has a neutral impact in this region). As a consequence of this it would be expected that the results of an appraisal based on the Regional CAS would closely mirror the Core scenario.
Behavioural Change	In this CAS there are forecasts to be fewer trips overall. LGV trips would be assumed to continue to increase but most car trips would reduce. With demand reducing in future years when compared to current levels the existing congestion problems on the network that the A46 Newark Bypass seeks to address would likely plateau, rather than deteriorating (as in the Core). As a result of this the benefits of the Scheme would be expected to be significantly reduced compared to the Core, and would likely fall below the levels of benefit calculated for the Low Economy CAS.
Technology	In this CAS there is assumed to be an increase in vehicle trips due to Connected Autonomous Vehicles (CAVs) and the improved accessibility they would create. Vehicle occupancy would be reduced due to some empty running of CAVs and user's value of time would be decreased for some trip purposes as drivers are able to multi-task. A greater take up of

Scenario	Qualitative assessment
	electric vehicles (EVs) would also be expected to reduce tailpipe emissions. With traffic levels higher than the Core the congestion reduction benefits of the Scheme would be increased but this would be offset by reduced occupancy and a reduced value of time. Fewer vehicle emissions would also reduce the disbenefits associated with these. On balance it would be expected that this scenario would lead to an improved appraisal result compared to the Core but fall below the High Economy outcome.
Vehicle-led Decarbonisation	The Vehicle-Led Decarbonisation (VLD) CAS is assumed to have the same reference highway trips as the Core. However, the high proportion of EVs in this CAS is expected to reduce overall vehicle operating costs and lead to mode shift from public transport to car. With more traffic on the highway network it would be expected that journey time savings attributable to the Scheme would be further improved when compared against the Core. The reduction in vehicle operating costs might also be expected to reduce the TEE disbenefits that are associated with vehicle operating costs. In addition, the high take-up of EVs would reduce vehicle emissions leading to a corresponding improvement in the greenhouse gases impacts. On balance the VLD CAS would be expected to show an improvement in the appraisal over the Core scenario but fall below the High Economy CAS.
Mode-balanced Decarbonisation	As with the VLD CAS the Mode-balanced decarbonisation (MBD) CAS shares reference demand with the Core scenario but savings in vehicle operating costs resulting from high EV uptake are artificially controlled to maintain modal share between highway and public transport. Resulting levels of traffic in this CAS are expected to be similar to the Core and give rise to similar levels of user benefit. High EV uptake should improve disbenefits associated with vehicle emissions leading to a slight improvement over the Core scenario overall.

15.11 Distributional Impacts results

15.11.1 The DI appraisal of user benefits has shown that there are significant user benefits for all five income quintiles. However, the distribution of these benefits demonstrates a slight skew towards higher income groups. This is not uncommon for strategic road schemes of this nature, as more affluent groups tend to have higher levels of car ownership and drive more often and further than more income deprived groups.

15.11.2 The DI appraisal of noise has indicated that the noise impacts are unequally distributed by income. The ‘losers’ are mostly located in the second most income deprived quintile, with 75% of all net ‘losers’ in terms of increased noise levels compared to 37% of the total population in this quintile. Conversely, the middle quintile sees a disproportionate noise benefit. There are also a number of educational facilities and care homes in the study area which experience a noise disbenefit.

15.11.3 The DI appraisal of air quality also shows an unequal distribution of impacts by income. Here, it is the least income deprived quintile which experiences disproportionate disbenefits for both NO2 and PM2.5. The most income deprived quintile, on the other hand, sees disproportionate benefits. It should be noted that the analysis of air quality is limited to selected properties included in the air quality modelling in the environmental appraisal only, and therefore the results cannot be readily extrapolated to residents.

15.11.4 The DI appraisal of accidents has been limited by the fine-grained nature of the COBALT model used in the economic appraisal, which means that very few links and nodes have more than 50 casualties over a 5-year period – the minimum sample size required for DI analysis. Nevertheless, the DI appraisal results in a summary score of slight beneficial, consistent with the slight positive monetised COBALT benefits in the economic appraisal, and the slight beneficial score in the social appraisal.

15.11.5 The DI appraisal of severance is limited due to the relatively low population in the study areas surrounding the proposed interventions. While the proposed junction improvements will bring about net beneficial impacts, the distributional impact of these across the vulnerable population groups are slight. The population groups who would see the largest benefits are older people as there is a comparatively higher proportion in the study area.

15.11.6 Finally, the DI appraisal of affordability shows that there are cost disbenefits for all five income quintiles, although for all income quintiles these are offset by larger time savings, and therefore positive user benefits overall. As the distribution of changes in vehicle operating costs generally follows the inverse pattern of the distribution of user benefits, there is a slight skew towards higher income groups.

15.12 Social Impact results

15.12.1 This assessment of the effects, and their significance, of the scheme as it applies to population and human health has been carried out based on the information currently available.

15.12.2 The assessment considers the potential impact of the construction and operation of the scheme on population, employment, residential properties, businesses, community facilities, open spaces and recreational areas and human health outcomes.

15.12.3 The assessment has drawn upon guidance and requirements presented within DMRB LA 112 Population and Human Health, IEMA-Health in Environmental Impact Assessment, and IEMA- Determining significance for human health in Environmental Impact Assessment, and professional judgement, as well as national and local policy.

15.12.4 The construction of the scheme is likely to have an overall adverse impact on development land and businesses, agricultural land, and WCH provision as a result of both permanent and temporary land take and reduced access during construction. Compensation will be provided to land and business owners if considered due under the Compensation Code.

15.12.5 The operation of the proposed scheme is expected to have a beneficial impact on access to private property and housing; development land and businesses; community land and assets; green space, recreation and physical activity due to the reduced congestion and improved journey times that the scheme will deliver.

16 Operational Model

16.1.1 This chapter provides an overview of the operational model, including the development of the base year model and the development of future year forecasts.

16.2 Background

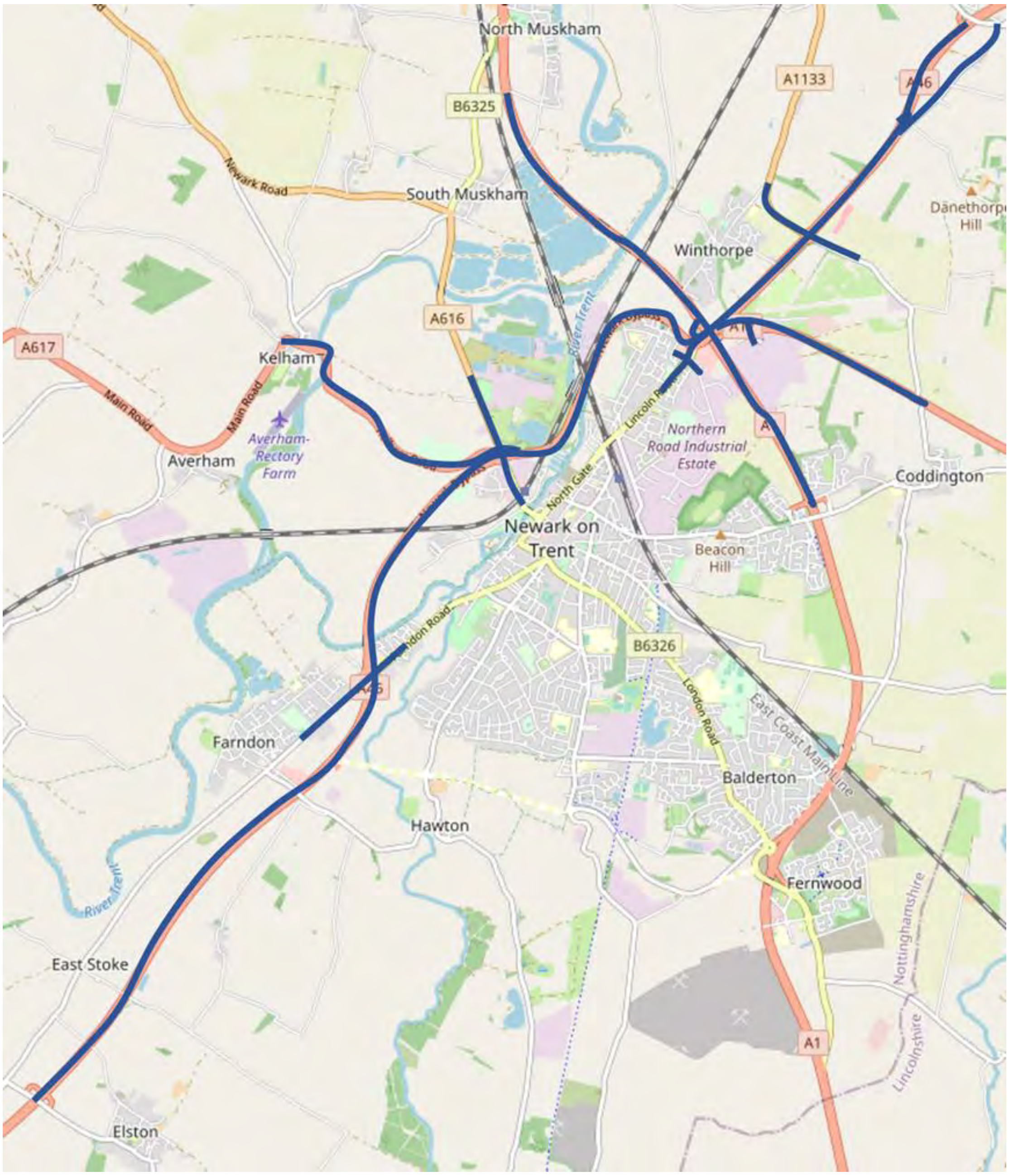
16.2.1 A microsimulation model has been developed, the model is to be used in the operational assessment of the scheme on the local surrounding network. The model is based upon the PTV VISSIM microsimulation software.

16.2.2 VISSIM enables complex geometry to be modelled, permits different traffic controls (signal, give way or stop) and is also capable of modelling vehicle actuation traffic control utilising the Vehicle Automated Programming (VAP) module. Therefore, it is the most appropriate tool for the modelling of complex geometry and traffic controls operating within the study area.

16.3 Model Extent

16.3.1 The model extents are shown Figure 16-1 and extends from the A46 junction with Lodge Lane in the southwest up to the A46 junction with Brough Lane in the northeast as well as the junction of Lincoln Road / Harvest Drive. The model covers eight junctions, and parts of Fosse Road, Farndon Road, A416 Kelham Road, Great North Road, Lincoln Road, A1, A17 and A1133 are included in the model.

Figure 16-1: VISSIM model extent



16.4 Data Inputs

16.4.1 Data inputs that have been used to develop the microsimulation model include Automatic Traffic Count (ATC) and Manual Classified Turning Count (MCTC) surveys as well as public transport timetables, journey time measurements and traffic signal data. Details of the data collection exercise are presented in Chapter 6.

Manual classified turning counts

16.4.2 The location of the MCTCs used in the development of the operational model are shown in Figure 6-2. The MCTCs were used to validate the model.

Automatic traffic counts

16.4.3 ATC data from three locations was used to calibrate speed distributions for the VISSIM model. Figure 16-2 illustrates the locations of the three ATCs, which are located on 30mph, 60mph and 70mph roads.

- ATC26 – B6166
- ATC27 – A46
- ATC32 – A1

Figure 16-2: ATC locations for speed distribution calibration

Pedestrian and Cycle Counts

16.4.4 Pedestrian and cyclist crossing count data was provided for the dual toucan crossing east of Cattle Market roundabout. In addition, pedestrians were counted crossing the different arms at Lincoln Road / Harvest Drive junction.

Traffic Signal Data

16.4.5 Traffic signal setup data for the junction of Lincoln Road / Brunel Drive and the dual toucan crossing east of Cattle Market roundabout was provided by the local highway authority.

Public Transport and Train Data

16.4.6 Bus stop locations were added to the model, using online sources like Google Maps and OpenStreetMap, and bus routes were verified and updated. The bus schedules were taken from online timetables on the websites of the service providers.

16.4.7 Level Crossing data (closure and opening times of the barriers) for Newark Castle train station was surveyed between 06:00 and 22:00 on Tuesday 5th July 2022. This includes passenger and freight trains on this day. This data was verified by the train schedules obtained from the 2022 online timetable for passenger trains.

Journey Time Data and Speed

16.4.8 Journey time data was used to validate the operational model. Details of the journey time surveys are presented in Section 6.6.

Queue Length Data

16.4.9 Queue length surveys were undertaken at the same time as the MCTC surveys. The surveys recorded the length in metres and the number of vehicles of each queue in 5 minutes intervals at each of the MCTC survey locations. (see Figure 6-2).

16.5 Model Development

16.5.1 The VISSIM model is comprised of five basic components:

- Highway network
- Traffic control systems
- Traffic inputs
- Vehicle types and compositions
- Vehicle routes

16.5.2 The latest version of VISSIM at the time of calibration, version 2022.00- 06 has been used to construct and run the model.

Highway Network

16.5.3 The base road network was constructed based upon the PCF Stage 2 model, which was based upon electronic drawings from the Ordnance Survey.

16.5.4 The links and connectors in the Stage 2 model were updated by removing any parallel connectors and correcting the link structure in the A46/A1 area The link behaviour types were updated to include roundabout and merge behaviour types and to ensure links were consistent throughout the network. The network was extended to cover the timing points for the journey time data.

16.5.5 The desired speed distribution for the model was updated using the ATC data for free-flowing traffic. For speeds where ATC data was not available, the standard speed distribution from VISSIM was used and adjusted accordingly. Desired speed decisions were updated and added using Google Street View. Reduced speed areas were added in places such as bends, slopes and approaches to and within roundabouts, to reflect real life driver behaviour.

Network Peak

16.5.6 The peak hours have been identified by calculating the rolling hour by using the 15-minute count data at each junction. The simulations run from 07:00–09:00 and 16:00-18:00 for the AM and PM respectively, including 30 minute warm up and cool down periods. These result in the core modelled hours of 07:30-08:30 and 16:30-17:30.

Pedestrians

16.5.7 The pedestrian and cycle count data has been used for the double toucan crossing at Cattle Market roundabout to represent an average demand. Video survey data has been used to calculate a demand for pedestrians and cyclists at Lincoln Road Junction.

Vehicle Types and Classes

16.5.8 VISSIM groups individual vehicles into vehicle types, which are then grouped into vehicle classes. The vehicle classes for the model are Car, HGV, LGV, Bus and Tram (to replicate the train).

Vehicle Input and Composition

16.5.9 The vehicle compositions were derived from the survey data within the peak hours. For AM peak the Car class was formed by 77% car and 23% LGV and the HGV class was formed by 34% OGV1 and 66% OGV2. In the PM peak, the Car class was formed by 84% car and 16% LGV and the HGV class was formed by 24% OGV1 and 76% OGV2.

Vehicle Routes

16.5.10 Dynamic assignment was used for the model. All non-logical routes were closed to improve the convergence performance and to replicate realistic traffic routing. There are 18 zones in the model located at the entry and exit points of the network.

Public Transport Lines

16.5.11 Bus stops and bus routes were included in the model In the AM peak there are 22 bus routes within the network and in the PM peak there are 18 bus routes.

16.5.12 The number of rail services together with the average closure time at the level crossing were taken from the video surveys and verified using online timetable information. Table 16-1 shows the number of trains approaching and departing the station within the AM and PM peaks as well as the average closure times.

Table 16-1: Level Crossing Closure

		Approaching	Departing	Freight
AM	Warm Up	1	1	0
	Peak	2	2	1
	Cool Down	1	1	0
PM	Warm Up	1	0	0
	Peak	2	1	1
	Cool Down	1	1	0
Average Closure time barriers		**00:02:34**	**00:01:38**	**00:03:00**

Random Seeds

16.5.13 Depending on the random seed, the results differ slightly as random seeds allow for stochastic variations. This can be thought to replicate variations in real world traffic conditions. The model was simulated ten times with different random seeds, to obtain accurate results. The final result is an average of these the runs.

Simulation Resolution

16.5.14 The simulation resolution used is ten time steps per simulation second.

Traffic Signal Control

16.5.15 Traffic signals were coded using VisVAP for the Lincoln Road junction, the puffin crossing east of Cattle Market roundabout and the level crossing. Lincoln Road junction is coded as demand dependant, as is the puffin crossing. The signalised junctions are modelled using the phase, stage, intergreen, stream and phase delay data taken from the signal specifications.

Unsignalised Traffic Control

16.5.16 Priority rules were coded at all roundabouts and separate priority rules for HGVs were coded with longer gap time. In addition, priority rules were coded for the keep clear area on the Cattle Market gyratory and for the opposing left turners at Lincoln Road junction. A small number of conflict areas have been implemented to improve vehicle behaviour.

Traffic Demand

16.5.17 Since dynamic assignment is used to develop the model, traffic demand is defined via origin-destination matrices in VISSIM. The base model used the PCF Stage 2 2017 matrices, which were updated using the VISSIM inbuilt Matrix Correction procedure as well as manual adjustments using the 2022 turning count data. Since the AM and PM peaks have an even distribution of demand there was no splitting of the peak matrices into 15-minute matrices. However, the AM warmup demand has been split as 47% in 07:00-07:15 and 53% in 07:15-07:30 to reflect observed traffic counts.

Convergence

16.5.18 The model converges with 100% for travel time differences on paths to be within 10%.

16.6 VISSIM Model Calibration and Validation

Overview

16.6.1 The calibration process involves changing the network set up and behavioural characteristics to achieve a good match between observed and modelled data. The validation of the model assesses the accuracy of the results by comparing the modelled and observed data.

16.6.2 The GEH statistic has been used to compare the modelled and observed flows and turning movements for the calibration of the model. The calibration criteria for flows as defined in Transport Analysis Guidance (TAG) Unit M3.1 has been used to assess model calibration based upon observed and modelled turning movements.

To calibrate the turning counts, the VISSIM inbuilt Matrix Correction procedure was used as well as manual manipulation of the matrices.

Calibration- Priority Rules

16.6.3 The gap times have been used to calibrate the model to the observed journey times and queues and to make sure that vehicles do not overlap.

Calibration- Speed Distribution

16.6.4 The speed distributions in the model were derived from observed ATC data, which were then adjusted during calibration against the observed journey times.

Calibration – Lane Change Distances

16.6.5 The lane change distance defines where vehicles will start attempting to change lanes and the emergency stop distance defines the point where vehicles stop to make a lane change. In the calibration of the model these distances were increased from the default length to the appropriate length to allow vehicles to change lanes in time.

Calibration – Acceleration

16.6.6 During calibration, the acceleration and deceleration were adjusted to reflect realistic driving behaviour (as observed in video footage). On links with long queues slow recovery parameters have been used.

16.6.7 Calibration – Driving Behaviour

16.6.8 Different driving behaviours have been used on different links depending on their location in the network (e.g. roundabout behaviour, merge behaviour etc).

Calibration – Speed

16.6.9 Reduced speed areas were added on the circulatory carriageway of roundabouts to reflect realistic driving speed. Additional reduced speed areas were also added on Kelham Road and other links where curves affect vehicle speed.

Validation – Journey Times

16.6.10 The modelled journey times were compared to the observed journey times, excluding any outliers from the observed journey times. For journey time validation, the modelled times are satisfactory if they are within 15% of the observed times as defined in Transport Analysis Guidance (TAG) Unit 3.1 section 3.3.15.

Validation – Queues

16.6.11 Since the queue survey data is derived from the video surveys but was restricted by the field of view of the camera, it was not used in the validation of the model, but is presented.

16.7 Calibration Results

Turning Movement Calibration

16.7.1 Modelled and observed turning movements have been assessed against the TAG criteria. Table 16-2 and Table 16-3 show the modelled and observed turning movements as well as the GEH and flow criteria for each turning movement for the AM and PM peak respectively. The percentage of turning movements which meet the GEH and flow criteria is 100% in both time periods.

Table 16-2: AM Turning Movement Calibration Results

Junction	From	To	Vehicle Count Surveyed	Vehicle Count Modelled	Difference [veh]	GEH	Count condition
Farndon roundabout	A46(S)	Fosse Road	8	11	3	1.0	PASS
		A46(N)	961	1021	60	1.9	PASS
		Farndon Road	390	404	14	0.7	PASS
	Fosse Road	A46(N)	78	59	-19	2.3	PASS
		Farndon Road	114	109	-5	0.5	PASS
		A46(S)	19	5	-14	4.0	PASS
	A46(N)	Farndon Road	89	84	-5	0.5	PASS
		A46(S)	1068	1037	-31	1.0	PASS
		Fosse Road	55	68	13	1.7	PASS
	Farndon Road	A46(S)	377	414	37	1.9	PASS
		Fosse Road	85	123	38	3.7	PASS
		A46(N)	59	66	7	0.9	PASS
Cattle Market roundabout	A46 (W)	Kelham Road	64	91	27	3.1	PASS
		Great North Road (N)	240	228	-12	0.8	PASS
		A46 (E)	717	779	62	2.3	PASS
		Great North Road (S)	83	54	-29	3.5	PASS
	Kelham Road	Great North Road (N)	7	19	12	3.3	PASS
		A46 (E)	352	371	19	1.0	PASS
		Great North Road (S)	267	265	-2	0.1	PASS
		A46 (W)	85	54	-31	3.7	PASS
	Great North Road	A46 (E)	72	67	-5	0.6	PASS
		Great North Road (S)	183	208	25	1.8	PASS

Junction	From	To	Vehicle Count Surveyed	Vehicle Count Modelled	Difference [veh]	GEH	Count condition
	(N)	A46 (W)	247	273	26	1.6	PASS
		Kelham Road	8	14	6	1.8	PASS
	A46 (E)	Great North Road (S)	42	46	4	0.6	PASS
		A46 (W)	787	786	-1	0.0	PASS
		Kelham Road	325	294	-31	1.8	PASS
		Great North Road (N)	78	85	7	0.8	PASS
	Great North Road (S)	A46 (W)	74	78	4	0.5	PASS
		Kelham Road	184	179	-5	0.4	PASS
		Great North Road (N)	129	177	48	3.9	PASS
		A46 (E)	73	59	-14	1.7	PASS
Brownhills roundabout	A46 (W)	A1 (N)	46	63	17	2.3	PASS
		A46 (E)	1034	1073	39	1.2	PASS
		Lincoln Road	132	132	0	0.0	PASS
	A1 (N)	A46 (E)	455	430	-25	1.2	PASS
		Lincoln Road	75	87	12	1.3	PASS
		A46 (W)	52	35	-17	2.6	PASS
	A46 (E)	Lincoln Road	578	608	30	1.2	PASS
		A46 (W)	1062	1079	17	0.5	PASS
		A1 (N)	230	264	34	2.2	PASS
	Lincoln Road	A46 (W)	117	114	-3	0.3	PASS
		A1 (N)	87	91	4	0.4	PASS
		A46 (E)	419	400	-19	0.9	PASS
Friendly Farmer roundabout	A46 (W)	A46 (E)	1408	1389	-19	0.5	PASS
		A17	375	358	-17	0.9	PASS
		A1 (S)	136	155	19	1.6	PASS
	A46 (E)	A17	57	29	-28	4.3	PASS
		A1 (S)	450	426	-24	1.1	PASS
		A46 (W)	1312	1273	-39	1.1	PASS
	A17	A1 (S)	23	29	6	1.2	PASS
		A46 (W)	469	477	8	0.4	PASS
		A46 (E)	35	29	-6	1.1	PASS
	A1 (S)	A46 (W)	188	199	11	0.8	PASS
		A46 (E)	143	135	-8	0.7	PASS
		A17	191	193	2	0.1	PASS
Long Hollow Way roundabout	A17 (W)	A17 (E)	476	462	-14	0.6	PASS
		Long Hollow Way	117	117	0	0.0	PASS
	A17 (E)	Long Hollow Way	15	15	0	0.0	PASS
		A17 (W)	376	455	79	3.9	PASS
	Long Hollow Way	A17 (W)	55	77	22	2.7	PASS
		A17 (E)	4	0	-4	2.8	PASS
Winthorpe roundabout	A46 (W)	A1133	222	211	-11	0.7	PASS
		A46 (E)	1275	1325	50	1.4	PASS
		Drove Lane	6	19	13	3.7	PASS
	A1133	A46 (E)	15	3	-12	4.0	PASS
		Drove Lane	104	76	-28	3.0	PASS
		A46 (W)	297	297	0	0.0	PASS
	A46 (E)	Drove Lane	72	54	-18	2.3	PASS

Junction	From	To	Vehicle Count Surveyed	Vehicle Count Modelled	Difference [veh]	GEH	Count condition
		A46 (W)	1418	1542	124	3.2	PASS
		A1133	3	3	0	0.0	PASS
	Drove Lane	A46 (W)	7	9	2	0.7	PASS
		A1133	29	33	4	0.7	PASS
		A46 (E)	64	56	-8	1.0	PASS
Lincoln Road Junction	Lincoln Road (N)	Brunel Drive	335	345	10	0.5	PASS
		Lincoln Road (S)	354	378	24	1.3	PASS
		Harvest Drive	92	98	6	0.6	PASS
	Harvest Drive	Lincoln Road (N)	132	121	-11	1.0	PASS
		Brunel Drive	27	29	2	0.4	PASS
		Lincoln Road (S)	40	39	-1	0.2	PASS
	Lincoln Road (S)	Harvest Drive	31	33	2	0.4	PASS
		Lincoln Road (N)	351	342	-9	0.5	PASS
		Brunel Drive	55	58	3	0.4	PASS
	Brunel Drive	Lincoln Road (S)	39	38	-1	0.2	PASS
		Harvest Drive	11	12	1	0.3	PASS
		Lincoln Road (N)	151	141	-10	0.8	PASS

Table 16-3: PM Turning Movement Calibration Results

Junction	From	To	Vehicle Count Surveyed	Vehicle Count Modelled	Difference [veh]	GEH	Count condition
Farndon roundabout	A46(S)	Fosse Road	19	21	2	0.4	PASS
		A46(N)	882	913	31	1.0	PASS
		Farndon Road	533	549	16	0.7	PASS
	Fosse Road	A46(N)	71	100	29	3.1	PASS
		Farndon Road	152	144	-8	0.7	PASS
		A46(S)	15	7	-8	2.4	PASS
	A46(N)	Farndon Road	119	118	-1	0.1	PASS
		A46(S)	839	799	-40	1.4	PASS
		Fosse Road	77	110	33	3.4	PASS
	Farndon Road	A46(S)	262	334	72	4.2	PASS
		Fosse Road	167	192	25	1.9	PASS
		A46(N)	95	113	18	1.8	PASS
Cattle Market roundabout	A46 (W)	Kelham Road	60	51	-9	1.2	PASS
		Great North Road (N)	257	222	-35	2.3	PASS
		A46 (E)	614	663	49	1.9	PASS
		Great North Road (S)	126	101	-25	2.3	PASS
	Kelham	Great North	10	11	1	0.3	PASS

Junction	From	To	Vehicle Count Surveyed	Vehicle Count Modelled	Difference [veh]	GEH	Count condition
	Road	Road (N)					
		A46 (E)	291	284	-7	0.4	PASS
		Great North Road (S)	188	191	3	0.2	PASS
		A46 (W)	89	80	-9	1.0	PASS
	Great North Road (N)	A46 (E)	63	68	5	0.6	PASS
		Great North Road (S)	163	172	9	0.7	PASS
		A46 (W)	166	208	42	3.1	PASS
		Kelham Road	15	12	-3	0.8	PASS
	A46 (E)	Great North Road (S)	63	77	14	1.7	PASS
		A46 (W)	627	613	-14	0.6	PASS
		Kelham Road	392	389	-3	0.2	PASS
		Great North Road (N)	61	78	17	2.0	PASS
	Great North Road (S)	A46 (W)	122	122	0	0.0	PASS
		Kelham Road	245	256	11	0.7	PASS
		Great North Road (N)	206	199	-7	0.5	PASS
		A46 (E)	116	124	8	0.7	PASS
Brownhills roundabout	A46 (W)	A1 (N)	25	35	10	1.8	PASS
		A46 (E)	1035	918	-117	3.7	PASS
		Lincoln Road	54	83	29	3.5	PASS
	A1 (N)	A46 (E)	464	456	-8	0.4	PASS
		Lincoln Road	102	76	-26	2.8	PASS
		A46 (W)	63	84	21	2.4	PASS
	A46 (E)	Lincoln Road	446	458	12	0.6	PASS
		A46 (W)	926	903	-23	0.8	PASS
		A1 (N)	351	387	36	1.9	PASS
	Lincoln Road	A46 (W)	170	168	-2	0.2	PASS
		A1 (N)	156	122	-34	2.9	PASS
		A46 (E)	625	641	16	0.6	PASS
Friendly Farmer roundabout	A46 (W)	A46 (E)	1639	1615	-24	0.6	PASS
		A17	335	284	-51	2.9	PASS
		A1 (S)	140	116	-24	2.1	PASS
	A46 (E)	A17	35	21	-14	2.6	PASS
		A1 (S)	392	383	-9	0.5	PASS
		A46 (W)	1078	1049	-29	0.9	PASS
	A17	A1 (S)	46	53	7	1.0	PASS
		A46 (W)	550	562	12	0.5	PASS
		A46 (E)	45	22	-23	4.0	PASS
	A1 (S)	A46 (W)	144	134	-10	0.8	PASS
		A46 (E)	113	129	16	1.5	PASS
		A17	174	174	0	0.0	PASS
Long Hollow Way roundabout	A17 (W)	A17 (E)	426	436	10	0.5	PASS
		Long Hollow Way	43	43	0	0.0	PASS

Junction	From	To	Vehicle Count Surveyed	Vehicle Count Modelled	Difference [veh]	GEH	Count condition
	A17 (E)	Long Hollow Way	2	3	1	0.6	PASS
		A17 (W)	494	509	15	0.7	PASS
	Long Hollow Way	A17 (W)	112	125	13	1.2	PASS
		A17 (E)	14	5	-9	2.9	PASS
Winthorpe roundabout	A46 (W)	A1133	331	274	-57	3.3	PASS
		A46 (E)	1536	1476	-60	1.5	PASS
		Drove Lane	2	11	9	3.5	PASS
	A1133	A46 (E)	6	1	-5	2.7	PASS
		Drove Lane	44	27	-17	2.9	PASS
		A46 (W)	206	224	18	1.2	PASS
	A46 (E)	Drove Lane	65	57	-8	1.0	PASS
		A46 (W)	1139	1204	65	1.9	PASS
		A1133	10	2	-8	3.3	PASS
	Drove Lane	A46 (W)	42	23	-19	3.3	PASS
		A1133	65	93	28	3.2	PASS
		A46 (E)	83	92	9	1.0	PASS
Lincoln Road Junction	Lincoln Road (N)	Brunel Drive	121	119	-2	0.2	PASS
		Lincoln Road (S)	402	405	3	0.1	PASS
		Harvest Drive	91	92	1	0.1	PASS
	Harvest Drive	Lincoln Road (N)	108	93	-15	1.5	PASS
		Brunel Drive	14	13	-1	0.3	PASS
		Lincoln Road (S)	50	51	1	0.1	PASS
	Lincoln Road (S)	Harvest Drive	61	62	1	0.1	PASS
		Lincoln Road (N)	526	503	-23	1.0	PASS
		Brunel Drive	28	26	-2	0.4	PASS
	Brunel Drive	Lincoln Road (S)	73	69	-4	0.5	PASS
		Harvest Drive	17	19	2	0.5	PASS
		Lincoln Road (N)	335	334	-1	0.1	PASS

Journey Time Validation

16.7.2 The modelled and surveyed times for each route and whether they pass the TAG criteria is shown in Table 16-4 and Table 16-5 for the AM and PM peak time periods.

Table 16-4: AM Journey Time Validation Results

Direction	From	To	Time surveyed [sec]	Time modelled [sec]	Difference [sec]	Difference [%]	Within 15%
Northbound	Lodge Lane	Brough	868	782	-86	-10	Yes
Southbound	Brough	Lodge Lane	1034	1007	-27	-3	Yes
Eastbound	Ollerton Road	Drove Lane	564	540	-24	-4	Yes
Westbound	Drove Lane	Ollerton Road	591	543	-48	-8	Yes

Table 16-5: PM Journey Time Validation Results

	From	To	Time surveyed [sec]	Time modelled [sec]	Difference [sec]	Difference [%]	Within 15%
Northbound	Lodge Lane	Brough	1164	1168	4	0	Yes
Southbound	Brough	Lodge Lane	787	731	-56	-7	Yes
Eastbound	Ollerton Road	Drove Lane	656	724	68	10	Yes
Westbound	Drove Lane	Ollerton Road	493	500	8	2	Yes

16.7.3 The results show a good match between the modelled and observed journey times for all routes and result in modelled journey times being within the TAG requirement of 15% (all below 10%) of the observed data in all of the cases in both time periods.

Queue Results

16.7.4 The mean and maximum modelled queue lengths are presented below in Table 16-6 and Table 16-7. The queues in VISSIM are defined by speed and clearance and start when speed is less than 3.1mph and end when speed is 6.2mph with a maximum clearance of 20m.

Table 16-6: AM Queue Results

Junction	Approach	Mean Queue [m]	Max Queue [m]
Farndon roundabout	A46(S)	10	133
	Fosse Road	1	28
	A46(N)	10	135
	Farndon Road	3	51
Cattle Market roundabout	A46 (W)	47	349
	Kelham Road	58	310
	Great North Road (N)	238	531
	A46 (E)	160	736
	Great North Road (S)	47	360
Brownhills roundabout	A46 (W)	64	513
	A1 (N)	14	140

Junction	Approach	Mean Queue [m]	Max Queue [m]
	A46 (E)	2	67
	Lincoln Road	10	76
Friendly Farmer roundabout	A46 (W)	0	39
	A46 (E)	429	571
	A17	15	97
	A1 (S)	111	495
Long Hollow Way roundabout	A17 (W)	0	20
	A17 (E)	0	20
	Long Hollow Way	0	15
Winthorpe roundabout	A46 (W)	11	109
	A1133	8	88
	A46 (E)	55	323
	Drove Lane	3	41
Lincoln Road Junction	Lincoln Road (N)	24	137
	Harvest Drive	8	53
	Lincoln Road (S)	12	67
	Brunel Drive	22	112

16.7.5 The key observations from the AM are:

- At Cattle Market roundabout long queues can be found on the Great North Road (N) approach and eastern approach of the A46. However, the queue on the A46 approach varies heavily and is party impacted by queueing back from the level crossing. All other approaches show short mean queues.
- At Brownhills roundabout a maximum queue of half a kilometre can be found on the western approach of the A46.
- At Friendly Farmer roundabout a consistent queue can be found on the A46 (E) approach. It can also be seen in the model, that there is a maximum queue of 495m on the A1 (S) Slip Road approach. This indicates that occasionally queues are likely to extend back onto the A1 mainline in the model. Although the observed survey data does not verify this issue due to the location of the camera, based on stakeholder knowledge, queues do reach back onto the A1 southbound mainline. The model may be overestimating this impact.

Table 16-7: PM Queue Results

Junction	Approach	Mean Queue [m]	Max Queue [m]
Farndon roundabout	A46(S)	34	196
	Fosse Road	1	28
	A46(N)	17	182
	Farndon Road	2	38
Cattle Market roundabout	A46 (W)	697	1706
	Kelham Road	24	142
	Great North Road (N)	20	165
	A46 (E)	42	337
	Great North Road (S)	102	486
Brownhills roundabout	A46 (W)	775	1408
	A1 (N)	10	102
	A46 (E)	1	54
	Lincoln Road	33	137

Junction	Approach	Mean Queue [m]	Max Queue [m]
Friendly Farmer roundabout	A46 (W)	0	35
	A46 (E)	12	104
	A17	14	96
	A1 (S)	20	119
Long Hollow Way roundabout	A17 (W)	0	23
	A17 (E)	0	17
	Long Hollow Way	0	14
Winthorpe roundabout	A46 (W)	15	126
	A1133	4	63
	A46 (E)	2	60
	Drove Lane	1	35
Lincoln Road Junction	Lincoln Road (N)	17	91
	Harvest Drive	7	42
	Lincoln Road (S)	24	97
	Brunel Drive	90	255

16.7.6 The key observations from the PM are:

- At the Cattle Market roundabout very long mean and maximum queues can be seen on the A46 (W) approach. The eastern approach and the Great North Road (S) approach show longer maximum queues but rather short mean queues.
- At Brownhills roundabout again a consistently long queue can be seen on the western approach. It is also noted that occasionally the queue on Lincoln Road reaches back into Lincoln Road junction which leads to disruptions. This has been observed on the video.
- At Lincoln Road junction a longer maximum queue can be observed on Brunel Drive.

Model Development Summary

16.7.7 The model has been calibrated against turning movement counts, using several parameters, including priority rules and lane change distances. The model has been validated against journey time data and the observed travel times have been compared to the modelled travel times. The model is not validated against queues due the quality of available surveyed queues (camera positions restrict the collection of data). However, they have been used as an indication of where model congestion should be. In summary, the model has been calibrated and validated to criteria set out in TAG and DMRB and is therefore deemed suitable and can be used for future evaluations of proposed schemes.

16.8 Forecast Year Operational Model Development

Introduction

16.8.1 Using the fully calibrated and validated base model, Do-Minimum (DM) and Do-Something (DS) models have been developed for the

AM and PM peak periods for two forecast years: 2028 and 2043. The DM scenario includes committed infrastructure changes, changes to signal timings and demand changes. The DS includes the infrastructure changes from the DM as well as changes from the proposed scheme, demand changes and signal timing changes.

Do-Minimum Infrastructure changes

16.8.2 The DM scenario contains the introduction of the Southern Link Road roundabout, south of Farndon roundabout, which is signalised at A46 North and A46 South arms.

Do-Minimum demand changes

16.8.3 To account for the traffic growth from the base year to the forecast years of 2028 and 2043, flows from the SATURN strategic model were used. The absolute difference between the SATURN base year flows and the SATURN DM flows was applied to the VISSIM base year flows, resulting in the VISSIM DM flows. In cases where the VISSIM DM flows would be negative, the percentage decrease from the SATURN base flows to the SATURN DM flows was used instead. The pedestrian demand at Cattle Market and Lincoln Road remains unchanged.

16.8.4 In the AM the demand increases by 8% in 2028 and by 26% in 2043 when comparing DM to Base. The HGV percentage decreases from 14% in the Base to 11% in 2028 and 10% in 2043.

16.8.5 In the PM the demand increases by 11% in 2028 and by 28% in 2043. The HGV percentage reduces from 9% to 7% in both reference years.

Do-Minimum signal timings changes

16.8.6 LinSig was used to generate the initial signal timings for Southern Link Road roundabout and Lincoln Road junction in the 2028 and 2043 DM networks. During the testing phase in VISSIM these signal timings were checked and altered based on observations of variable capacity and queuing. In VISSIM the signals operate with fixed timings and cycle times, without demand dependency. Lincoln Road junction and the pedestrian crossings are demand dependent and the same applies for the train level crossing.

Do-Something networks

16.8.7 The DS models include all the proposed DM changes as well as changes associated with the proposed scheme.

Do-Something demand changes

16.8.8 The demand change has been applied to the DS model using the same methodology as the DM model. Whilst the DM demand was calculated using the base and DM SATURN flows, the DS demand change was calculated using the difference between the SATURN DM and DS flows and applying this to the VISSIM DM flows. The pedestrian demand at Cattle Market and Lincoln Road remains unchanged. For the new pedestrian crossings at the A46 off slip at Brownhills and the one between Friendly Farmer and Brownhills a demand of 10 pedestrians per hour at each of the location has been assumed.

16.8.9 When comparing the DS with the DM – in the AM the demand increases by 7% in 2028 and by 8% in 2043. The HGV percentage stays the same (11%) in 2028 and increases by 1 percentage point in 2043.

16.8.10 In the PM total demand increases by 7% in 2028 and by 9% in 2043. The HGV percentage remains the same (7%).

Do-Something signal timings changes

16.8.11 LinSig was used to generate the initial signal timings for Farndon roundabout, Southern Link Road roundabout, Winthorpe roundabout, and the signalised part of Cattle Market roundabout in the 2028 and 2043 DS networks. During VISSIM simulation runs these signal timings were further optimised. The signals operate with fixed timings and cycle times without demand dependency. Lincoln Road junction and the pedestrian crossings are demand dependent and the same applies for the train level crossing.

16.9 Forecast Model Results – Do-Minimum

Introduction

16.9.1 Results for the DM scenarios in 2028 and 2043 for the AM and PM peak periods are presented below, compared against the same Base scenarios. These include turning counts, queue lengths and journey times.

Turning Counts Comparison

16.9.2 Turning flow comparisons have been carried out between the Base and DM scenarios (2028 and 2043) for both peaks.

16.9.3 The decreases of flow at the junctions, especially Farndon roundabout and Long Hollow Way roundabout, are caused by an alternation in route choice between the Base and the DM in the strategic model. This means that due to delay in the strategic model vehicles choose different routes and to a degree bypass the microsimulation study area. For example, traffic that travels from Farndon Road to the A46 South decreases and reroutes through the Southern Link Road, whilst traffic from the A1 North to the A17 also uses the Southern Link Road.

16.9.4 Southern Link Road roundabout is not present in the Base model and therefore no comparison is possible.

16.9.5 Table 16-8 to Table 16-11 contains the total number of vehicles per junction in the base and DM scenarios for the AM and PM periods in 2028 and 2043.

Table 16-8: Turning Counts Summary 2028 AM DM - Base

Junction	Base [veh]	DM [veh]	Diff [veh]
Southern Link Rd Roundabout	-	3556	-
Farndon Roundabout	3401	3017	-384
Cattle Market Roundabout	4127	4094	-33
Brownhills Roundabout	4376	4486	+110
Friendly Farmer Roundabout	4692	4674	-18
Long Hollow Way Roundabout	1126	831	-295
Winthorpe Roundabout	3628	3823	+195
Lincoln Rd Junction	1634	1733	+99

Table 16-9: Turning Counts Summary 2028 PM – DM - Base

Junction	Base [veh]	DM [veh]	Diff [veh]
Southern Link Rd Roundabout	-	3364	-
Farndon Roundabout	3400	2984	-416
Cattle Market Roundabout	3921	3973	+52
Brownhills Roundabout	4331	4478	+147
Friendly Farmer Roundabout	4542	4597	+55
Long Hollow Way Roundabout	1121	855	-266
Winthorpe Roundabout	3484	3919	+435
Lincoln Rd Junction	1786	1850	+64

Table 16-10: Turning Counts Summary 2028 AM DM - Base

Junction	Base [veh]	DM [veh]	Diff [veh]
Southern Link Rd Roundabout	-	4326	-
Farndon Roundabout	3401	3401	0
Cattle Market Roundabout	4127	4314	+187

Junction	Base [veh]	DM [veh]	Diff [veh]
Brownhills Roundabout	4376	4762	+386
Friendly Farmer Roundabout	4692	5064	+372
Long Hollow Way Roundabout	1126	855	-271
Winthorpe Roundabout	3628	4202	+574
Lincoln Rd Junction	1634	1758	+124

Table 16-11: Turning Counts Summary 2043 PM DM - Base

Junction	Base [veh]	DM [veh]	Diff [veh]
Southern Link Rd Roundabout	-	4123	-
Farndon Roundabout	3400	3399	-1
Cattle Market Roundabout	3921	4260	+339
Brownhills Roundabout	4331	4748	+417
Friendly Farmer Roundabout	4542	4841	+299
Long Hollow Way Roundabout	1121	891	-230
Winthorpe Roundabout	3484	4211	+727
Lincoln Rd Junction	1786	1672	-114

Queue Comparison

16.9.6 The queue comparisons indicate where the DM model performs significantly worse compared to the Base year model. At locations with very long queues traffic is held back and can therefore not complete its desired route. If, in theory, this traffic would be released, issues could arise somewhere else. This suggests that junctions that do not show any queueing issues in the DM, could have issues if traffic would not be held back further upstream. Additionally, the Base model was susceptible to the unpredictability of the level crossing and temporary blocking of Cattle Market roundabout, as well as the long queue on the A46 (E) approach to Friendly Farmer roundabout. A summary of the key findings is presented below.

2028 AM DM - Base

16.9.7 At Cattle Market roundabout a reduction in queue lengths can be found at Great North Road (N) approach and at the A46 (E) approach.

16.9.8 A decrease in queue can be found on the A46 (W) approach at Brownhills roundabout.

16.9.9 The increase of traffic that crosses Friendly Farmer roundabout along the A46 in eastbound direction leads to a decrease of queue at the A46 (E) approach (along with the A1 approach).

16.9.10 The increase of traffic that crosses Winthorpe roundabout along the A46 in eastbound direction leads to less gaps for the A1133 approach. This, therefore, causes slight increase in queues but also to an improvement on the A46 (E) approach.

2028 PM DM - Base

16.9.11 The reduction of traffic at Farndon roundabout is mirrored in the slight decrease in queues on the A46 approaches.

16.9.12 At Cattle Market roundabout the very long queue in the Base on the A46 (W) approach is slightly shorter in the DM while at the same time the queue on Great North Road (S) increases.

16.9.13 Similar to Cattle Market roundabout the long queue on the A46 (W) approach at Brownhills roundabout also reduces.

16.9.14 A slight increase in queues can be found on the A46 (W) approach to Winthorpe roundabout.

2043 AM DM - Base

16.9.15 The slight increase along the A46 through Farndon roundabout in both directions leads to slightly longer queues on these approaches.

16.9.16 Cattle Market roundabout experiences a significant increase in queues on the A46 (W) approach. Additionally, queues on Kelham Road extend further than in the Base.

16.9.17 The A1 approach at Brownhills sees a queue extending onto the A1 mainline.

16.9.18 As the significant increase of traffic along the A46 in eastbound direction uses a free flow turn at Friendly Farmer roundabout the queue on the A46 (E) approach decreases as vehicles can use more available gaps. This then leads to an increase of queue lengths on the A1 approach and major blocking of the A1 mainline and traffic blocking back.

16.9.19 The increase of traffic in the eastbound direction along the A46 through Winthorpe roundabout leads to an increase of queues on the A46 (W) approach and due to the reduction of sufficient gaps also to very long queues on the A1133 approach. This in turn enables vehicles on the A46 (E) approach to enter the roundabout more easily and a reduction of the queue.

2043 PM DM - Base

16.9.20 Cattle Market roundabout sees major increases in queue on the A46 (E) and the Great North Road (S) approaches. Additionally, the long queues on the A46 (W) approach decrease slightly.

16.9.21 The long queue on the A46 (W) approach to Brownhills roundabout reduces slightly. The queue on the A1 approach increases but does not reach the main line.

16.9.22 The A46 (W) approach to Winthorpe roundabout experiences a significantly longer queue in the DM.

Journey Time Comparison

16.9.23 The journey time comparison tables for the Base and DM scenarios in 2028 and 2043 for both peaks are shown below. The journey time routes are shown in Figure 16-3. Table 16-12 to Table 16-15 shows the comparison between journey times for base and DM in the morning and evening peaks for 2028 and 2043.

Figure 16-3: Do-Minimum Journey time routes

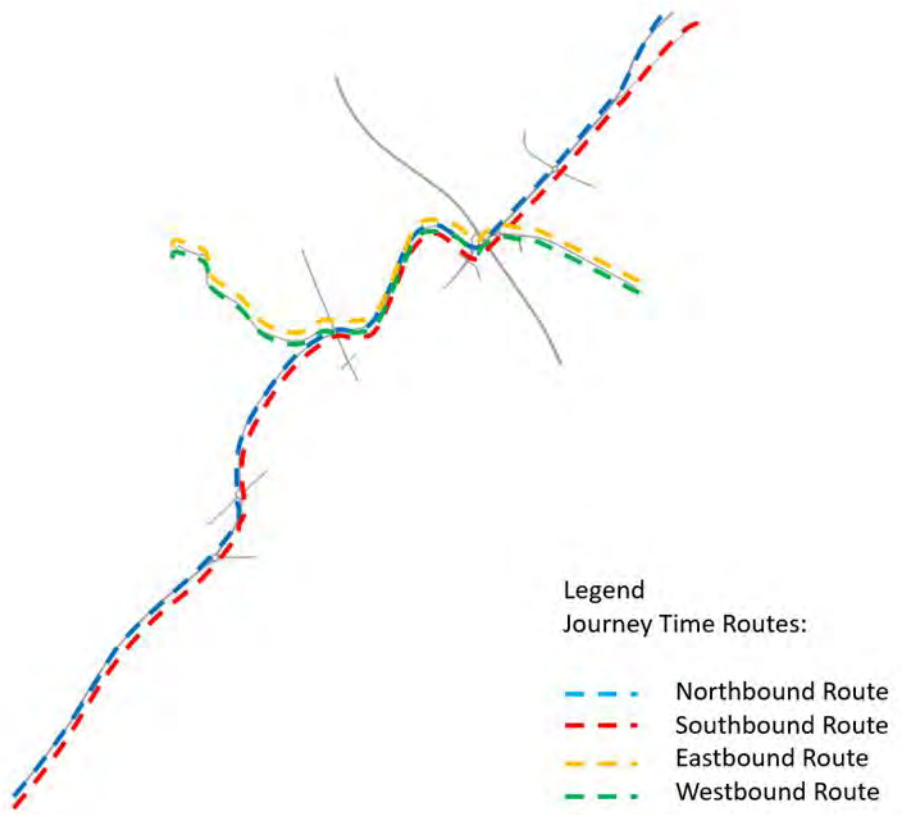


Table 16-12: Journey Time Comparison 2028 AM DM - Base

Direction	From	To	Base Time [sec]	DM Time [sec]	Diff (DM-Base) [sec]
Northbound	Lodge Lane	Brough	782	777	-5
Southbound	Brough	Lodge Lane	1007	786	-221
Eastbound	Ollerton Rd	Drove Lane	540	519	-21
Westbound	Drove Lane	Ollerton Rd	543	524	-19

16.9.24 Results for the 2028 morning peak are shown above in Table 16-12. The journey times along the northbound, eastbound and westbound routes remains similar to the base year. However, the journey time in southbound direction reduces significantly due to the presence of more gaps at Friendly Farmer Roundabout.

Table 16-13: Journey Time Comparison 2028 PM DM - Base

Direction	From	To	Base Time [sec]	DM Time [sec]	Diff (DM-Base) [sec]
Northbound	Lodge Lane	Brough	1168	972	-197
Southbound	Brough	Lodge Lane	731	757	+26
Eastbound	Ollerton Rd	Drove Lane	724	561	-162
Westbound	Drove Lane	Ollerton Rd	500	507	+6

16.9.25 In the 2028 evening peak (shown in Table 16-13) the Southern Link Road roundabout causes a slight delay to southbound traffic. Otherwise, the southbound journey time in the DM is similar to the Base.

16.9.26 The northbound journey time experiences a significant decrease between Cattle Market roundabout and Brownhills roundabout. This issue is also seen in the queues section above, which shows that the queue on the A46 (W) approach reduces.

16.9.27 As the journey time route in the eastbound direction crosses the same part of the network its journey time also decreases significantly.

Table 16-14: Journey Time Comparison 2043 AM DM - Base

Direction	From	To	Base Time [sec]	DM Time [sec]	Diff (DM-Base) [sec]
Northbound	Lodge Lane	Brough	782	865	+83
Southbound	Brough	Lodge Lane	1007	810	-197
Eastbound	Ollerton Rd	Drove Lane	540	604	+64
Westbound	Drove Lane	Ollerton Rd	543	546	+3

16.9.28 Table 16-14 presents journey time comparisons for the 2043 morning peak. The journey time in the northbound direction increases mainly at Southern Link Road roundabout, between Farndon roundabout and Cattle Market roundabout and between Friendly Farmer roundabout and Winthorpe roundabout.

16.9.29 The opposite direction also experiences an increase in journey time at Southern Link Road roundabout. The journey time between Winthorpe roundabout and Friendly Farmer roundabout decreases due to increased gaps in the traffic at the Friendly Farmer roundabout as per the 2028 AM comparison above.

16.9.30 The eastbound journey time route has an increase in journey time on Kelham Road approaching Cattle Market roundabout.

Table 16-15: Journey Time Comparison 2043 PM DM - Base

Direction	From	To	Base Time [sec]	DM Time [sec]	Diff (DM-Base) [sec]
Northbound	Lodge Lane	Brough	1168	1116	-52
Southbound	Brough	Lodge Lane	731	899	+168
Eastbound	Ollerton Rd	Drove Lane	724	617	-106
Westbound	Drove Lane	Ollerton Rd	500	640	+140

16.9.31 The evening peak journey time comparisons for 2043 are provided in Table 16-15. In this model the traffic in the northbound direction has delays between Friendly Farmer roundabout and Winthorpe Roundabout. It also has journey time decreases between Farndon roundabout and Cattle Market and on the next section to Brownhills roundabout. This results in a total time saving of nearly one minute on that route.

16.9.32 As the eastbound route includes the journey time section between Cattle Market roundabout and Brownhills roundabout and does not experience any significant changes in journey time in the other sections, the route saves a substantial amount of time.

16.9.33 The southbound direction experiences major additional delays between Brownhills roundabout and Cattle Market roundabout and at Southern Link Road roundabout.

Network Performance Comparison

16.9.34 Overall network performance statistics for the AM and PM periods in 2028 and 2043 are presented in Table 16-16 and Table 16-17.

Table 16-16: Network Performance Comparison 2028 AM / PM Base DM

2028	**AM**		**PM**	
Measure	Base	DM	Base	DM
Average Delay [sec]	103	60	92	76
Average Number of Stops	8	3	6	4
Average Network Speed [mph]	36	40	36	38
Average Stopped Delay [sec]	25	16	23	22
Total Distance Travelled [mi]	42,722	45,383	40,746	44,389
Total Travel Time [sec]	4,334,928	4,049,651	4,062,248	4,215,768
Total Delay [sec]	1,243,913	776,725	1,115,881	1,012,801
Total Number of Stops	100,371	34,457	77,425	52,903
Total Stopped Delay [sec]	303,182	203,699	276,816	288,565
Remaining Vehicles in Network	1,355	1,201	1,249	1,251

2028	AM		PM	
Processed Vehicles	10,725	11,726	10,882	12,130
Latent Demand Delay [sec]	2,115	1,663	5,011	10,460
Latent Demand [vehs]	0	1	3	4

16.9.35 The above network performance statistics show an improvement in the DM in 2028 compared to the Base AM and PM. This is due to a redistribution in traffic (and changes in conflicting movements) as can be seen in the turning counts. As in the Base some roundabouts experienced longer queues, with slight changes in traffic on opposing arms causing increased or decreased gaps for emerging traffic. However, it can also be seen that the latent demand delay more than doubles in the PM. This indicates that vehicles are delayed outside the network. The traffic queueing outside the network is then released later in the simulation. Therefore, queues and delay appear better and turning counts over one hour do not appear lower.

Table 16-17: Network Performance Comparison 2043 AM / PM Base DM

2043	AM		PM	
Measure	Base	DM	Base	DM
Average Delay [sec]	103	92	92	111
Average Number of Stops	8	7	6	7
Average Network Speed [mph]	36	37	36	35
Average Stopped Delay [sec]	25	23	23	25
Total Distance Travelled [mi]	42,722	52,586	40,746	51,425
Total Travel Time [sec]	4,334,928	5,144,017	4,062,248	5,371,671
Total Delay [sec]	1,243,913	1,391,634	1,115,881	1,708,364
Total Number of Stops	100,371	109,440	77,425	108,247
Total Stopped Delay [sec]	303,182	343,206	276,816	387,728
Remaining Vehicles in Network	1,355	1,596	1,249	1,713
Processed Vehicles	10,725	13,488	10,882	13,717
Latent Demand Delay [sec]	2,115	3,578	5,011	11,314
Latent Demand [vehs]	0	4	3	11

16.9.36 The average delay in the DM AM is lower in 2043 than in the Base AM. However, the average delay in the DM PM is higher in 2043 than in the Base PM. In both AM and PM it can also be seen that the latent demand delay increases significantly. This indicates that vehicles are delayed outside the network. The traffic queueing outside the network is then released later in the simulation, which explains why the latent demand remains low.

Forecast Model Performance Summary Do-Minimum

16.9.37 The DM models have been developed using the calibrated and validated base model. Modelled years are 2028 and 2043. The only infrastructure change in these two years is the addition of Southern Link Road roundabout and the access road just south of Farndon roundabout. The demand has been derived using demand differences between the DM models and the base model in the cordoned strategic model (SATURN). The total demand has increased while the HGV percentage decreased slightly.

16.9.38 As the network is already very congested in parts of the base model (A46 between Winthorpe roundabout and Friendly Farmer roundabout), or has occasional issues (train level crossing), slight changes in demand can cause issues in delay and queueing. A higher flow on one turn through a roundabout can increase the number of gaps for another approach to the same roundabout and this then can cause a queue on a third approach. Therefore, as in 2028, it can be seen that some queues decrease while others increase.

16.9.39 In 2043, Cattle Market roundabout and Winthorpe roundabout struggle with the modelled future demand. Also, traffic on the A1 slip roads causes queues onto the mainline and disrupts through traffic. These issues mean that not all traffic can complete its desired routes as it is held in other sections of the model. This could mask potential issues at other locations in the network.

16.9.40 In summary, in 2028 the network is able to operate with some issues. In the 2043 model, demand is higher and long queues form. Rerouting and diversion effects cannot be evaluated in the operational model.

16.10 Forecast Model Results – Do-Something

Introduction

16.10.1 Results for the DS scenarios in 2028 and 2043 for the AM and PM peak periods are presented below, compared against the same DM scenarios. These include turning counts, queue lengths and journey times.

Turning Counts Comparison

16.10.2 Turning flow comparison tables for the DM scenarios and DS scenarios (2028 and 2043) for both peaks are presented in Table 16-18 to Table 16-21. The summary tables below combine all approaches for each junction, with text summarising the most significant changes in flows. All values in the sections below are by peak hour.

Table 16-18: Turning Count Comparison Summary 2028 AM DS - DM

Junction	DM [veh]	DS [veh]	Diff [veh]
Southern Link Rd Roundabout	3556	4309	+753
Farndon Roundabout	3017	4072	+1055
Cattle Market Roundabout	4094	6021	+1927
Kennel Roundabout	-	679	-
Brownhills Roundabout	4486	3537	-949
Friendly Farmer Roundabout	4926	4532	-394
Long Hollow Way Roundabout	579	1067	+488
Winthorpe Roundabout	3823	4209	+386
Lincoln Rd Junction	1733	1740	+7

Table 16-19: Turning Count Comparison Summary 2028 PM DS - DM

Junction	DM [veh]	DS [veh]	Diff [veh]
Southern Link Rd Roundabout	3364	4243	+879
Farndon Roundabout	2984	4178	+1194
Cattle Market Roundabout	3973	5690	+1717
Kennel Roundabout	-	566	-
Brownhills Roundabout	4478	3629	-849
Friendly Farmer Roundabout	4878	4403	-475
Long Hollow Way Roundabout	574	951	+377
Winthorpe Roundabout	3919	4358	+439
Lincoln Rd Junction	1850	1931	+81

Table 16-20: Turning Count Comparison Summary 2043 AM DS - DM

Junction	DM [veh]	DS [veh]	Diff [veh]
Southern Link Rd Roundabout	4326	5459	+1133
Farndon Roundabout	3401	4930	+1529
Cattle Market Roundabout	4314	6869	+2555
Kennel Roundabout	-	751	-
Brownhills Roundabout	4762	3910	-852
Friendly Farmer Roundabout	5313	5117	-196
Long Hollow Way Roundabout	606	1132	+526
Winthorpe Roundabout	4202	4857	+655
Lincoln Rd Junction	1758	1837	+79

Table 16-21: Turning Count Comparison Summary 2043 PM DS - DM

Junction	DM [veh]	DS [veh]	Diff [veh]
Southern Link Rd Roundabout	4123	5405	+1282
Farndon Roundabout	3399	5103	+1704
Cattle Market Roundabout	4260	6744	+2484
Kennel Roundabout	-	639	-
Brownhills Roundabout	4748	4043	-705
Friendly Farmer Roundabout	5136	4905	-231
Long Hollow Way Roundabout	596	1087	+491
Winthorpe Roundabout	4211	5087	+876
Lincoln Rd Junction	1672	2021	+349

16.10.3 The above tables show that there is a similar pattern in flow changes between the different years and time periods. The general pattern is that the A46 sections attract more flow in the Do-Something when compared to the Do-Minimum. The Brownhills and Friendly Farmer

Roundabouts see decreases due to being bypassed by the new section of the A46. However, at Brownhills Roundabout there is an increase in flows to/from Lincoln Road. At Friendly Farmer there is an increase in flow to/from the A17 arm.

Comparison of queues

16.10.4 Key findings from the comparison of queues between the DM and DS scenarios are presented below for the AM and PM periods in 2028 and 2043.

2028 AM DS – DM

16.10.5 Due to the increased traffic flow along the A46 in both directions in the DS, the maximum queues increase on all arms of Southern Link Road roundabout. Although the total traffic flow on the Southern Link Road approach decreases in the DS, vehicles have a lower number of gaps compared to the DM, and therefore the maximum queues stay the same while the mean queues increase slightly.

16.10.6 The increase of traffic along the A46 leads to an increase of the maximum queues on the A46 (S) approach at Farndon roundabout.

16.10.7 The new roundabout north of Brownhills roundabout does not show any delay. The maximum queues shown on the A46 (W) approach result from pedestrians using the signalised crossing.

16.10.8 Due to the new A46 bypassing Brownhills roundabout, queues decrease significantly on the A46 (W) approach.

16.10.9 The new bypass reduces traffic on the A46 approaches at Friendly Farmer roundabout. However, this is not reflected in the queues. On the A46 (E) approach there is a reduction of lanes between Winthorpe roundabout and Friendly Farmer roundabout, as well as an increase in traffic between DM and DS from the A46 (W) and the A1 to the A17 crossing the A46 (E) approach. Additionally, traffic from the A46 (E) to the A1 increases and, due to the layout of the junction, can only queue on the left lane. These are mitigated by the signal gate on the A46 (W) approach creating a longer but controllable queue on that approach. Between DM and DS, demand from the A1 to the A17 increases by approximately 300% in 2028. However, it has been observed that the queue is unlikely to reach back onto the A1.

16.10.10 The demand dependent signals at Lincoln Road junction operate very well in the DM and DS and there are minimal differences between the scenarios.

2028 PM DS – DM

16.10.11 In the PM traffic along the A46 increases significantly in the DS. The signal optimisation results in a similar queue pattern as in the AM.

16.10.12 In the PM the increase in traffic at Farndon roundabout from south to north is higher than in the AM. Comparing DM and DS it more than doubles which results in longer queues.

16.10.13 At Cattle Market roundabout the long queues on the A46 approaches and on the Great North Road (S) approach in the DM are eliminated in the DS.

16.10.14 At Brownhills roundabout in the DM very long queues have formed on the A46 (W) approach. Although traffic on the A46 bypasses the roundabout in the DS more traffic turns from the A46 (E) onto the A1 than in the DM, creating a longer queue on the A46 (W) approach.

16.10.15 There is no issue at Friendly Farmer roundabout in 2028 in the DS. The signals between Brownhills and Friendly Farmer roundabouts are not required as much due to there being less issues than in the AM but improve the general operation of the roundabout.

16.10.16 Long queues can only be seen on the old A46 approach at Winthorpe roundabout in the DM. However, due to the signalisation the delay is reduced as can be seen in the journey times.

16.10.17 The higher DS demand at Lincoln Road junction leads to a slight increase of queueing on Lincoln Road (N). This is caused by the signal optimisation assigning more green time to the other approaches to balance the delays.

2043 AM DS – DM

16.10.18 Due to the increased traffic flow along the A46 in both directions at Southern Link Road roundabout in the DS, the maximum queues increase on all arms when compared to DM. Although the total traffic flow on the Southern Link Road approach decreases in the DS, vehicles have a lower number of gaps compared to the DM, and therefore the maximum queues stay the same while the mean queues increase slightly.

16.10.19 The maximum queues on the A46 (S) approach at Farndon roundabout increase in the DS due to the increase of traffic along the A46. A significant reduction of traffic from the south into Farndon Road leads to more green time assigned to the A46 (N) approach and therefore to a reduction of delay.

16.10.20 Cattle Market roundabout struggles with the predicted traffic and long queues form on all arms. In the DS scenarios 50% more traffic than in the DM passes through Cattle Market roundabout. However, the new grade separated layout and part signalisation reduces the queues significantly. An exception is Great North Road (N). Vehicles do not find enough sufficient gaps to enter the roundabout. However, as a third of these vehicles desire to go south into Great North Road (S) a release of these vehicles could lead to longer queues when the train crossing is closed and could potentially lead to blocking of the roundabout. However, drivers may change their route via the A1 to reach Newark. This possible re-routing cannot be represented in the operational model as the decision point is outside the modelled area.

16.10.21 At Kennel roundabout, since the only conflicting traffic for vehicles exiting the A46 would be traffic going into the kennels, the roundabout does not show any delay itself. The maximum queues shown on the A46 (W) approach result from pedestrians using the signalised crossing.

16.10.22 Due to the new A46 bypassing Brownhills roundabout, queues decrease significantly on the A46 (W) approach. The maximum modelled queue on the A1 slip road does not reach back onto the A1 main line, remaining significantly less than the DM. The increased queue lengths in the DS on the A46 (E) approach are likely to be caused by the increased number of vehicles the strategic model assigns onto the movement from the A46 (W) to Lincoln Road which leads to more conflicting movements and less gaps.

16.10.23 The new bypass reduces traffic on the A46 approaches at Friendly Farmer roundabout. However, this is not reflected in the queues. On the A46 (E) approach there is a reduction of lanes between Winthorpe Roundabout and Friendly Farmer roundabout, as well as an increase in traffic between DM and DS from the A46 (W) and the A1 to the A17 crossing the A46 (E) approach. Additionally, traffic from the A46 (E) to the A1 increases and, due to the layout of the junction, can only queue on the left lane. These are mitigated by the signal gate on the A46 (W) approach creating a longer but controllable queue on that approach. Between DM and DS, demand from the A1 to the A17 increases by approximately 500% in 2043. However, it has been observed that the queue is unlikely to reach back onto the A1 as opposed to the DM model where the A1 mainline is completely blocked. However, there is an increase of queues on the A17 approach.

16.10.24 The signal gate is crucial for the operation of Friendly Farmer roundabout, but also Winthorpe roundabout, Brownhills roundabout, Long Hollow Way roundabout and the A1 southbound mainline. Without the signals queues reach back into Winthorpe roundabout causing gridlock and cars not being able to use the bypass. Tests with different green times show that with the current setting the roundabout is balanced.

16.10.25 In the model queues are only occasionally reaching Winthorpe roundabout but do not cause major disruption. The numerical value of the queue is underestimated as in a long queue on a single lane, short sections are moving forward to close a gap created by cars entering the roundabout. This queue travels upstream along the link. If this queue was reduced, it would require holding more vehicles back on the A46 (W) approach which leads to blocking of Brownhills and potentially long queues on the A46 bypass slip road and the A1 slip road. Also, more traffic from the A17 would be released leading to less gaps for the A1 slip road entering Friendly Farmer roundabout and potential queues back onto the mainline.

16.10.26 In the DS the queue from Friendly Farmer reaches back into Long Hollow Way roundabout.

16.10.27 With the current layout, traffic on the A1133 is not able to enter Winthorpe roundabout. The upgraded roundabout design with signalisation creates enough gaps for traffic on the A1133 to enter the roundabout. All other approaches experience a slight increase in queues.

16.10.28 The demand dependent signals operate very well in the DM and DS and there are minimal differences between the scenarios. However, in the DM not all demand reaches the junction due to queues on the A1 and the A1133. But it is expected that the signalisation would adapt appropriately, and no major issues would occur. No increase in pedestrian demand is assumed.

2043 PM DS – DM

16.10.29 At Southern Link Road roundabout traffic along the A46 increases significantly in the DS. The signal optimisation results in a similar queue pattern as in the AM.

16.10.30 At Farndon roundabout, the increase in traffic from south to north is higher in the PM than in the AM. Comparing DM and DS it more than doubles which results in longer queues.

16.10.31 At Cattle Market roundabout it can be seen that the long queues on the A46 approaches and on the Great North Road (S) approach in the DM are eliminated in the DS. Other than in the DS in the 2043 AM scenario the part signalisation of the roundabout does not solve any previous issues but improves the operation of the roundabout.

16.10.32 At Kennel roundabout a comparatively long queue can be seen on the A46 (W) approach. However, this queue is not caused by traffic going into the Kennels or pedestrians crossing but by a queue blocking back from Brownhills roundabout.

16.10.33 At Brownhills Roundabout in the DM very long queues have formed on the A46 (W) approach. Although traffic on the A46 bypasses the roundabout in the DS more traffic turns from the A46 (E) onto the A1 than in the DM, creating a longer queue on the A46 (W) approach. The numerical value of the queue is underestimated as in a long queue on a single lane, short sections are moving forward to close a gap created by cars entering the roundabout. This gap travels upstream along the queue. An indicator for the real length of the queue is the queue at the Kennel roundabout.

16.10.34 There is no issue at Friendly Farmer roundabout in 2043 in DM and DS. The signals between Brownhills and Friendly Farmer roundabouts are not required as much due to there being less issues than in the AM but improve the general operation of the roundabout.

16.10.35 At Winthorpe roundabout long queues can only be seen on the old A46 approach. However, due to the signalisation the delay is reduced as can be seen in the journey times.

16.10.36 The higher DS demand at Lincoln Road junction leads to a slight increase of queueing on Lincoln Road (N). This is caused by the signal optimisation assigning more green time to the other approaches to balance the delays.

Journey Time Comparison

16.10.37 The journey time comparison tables for the DM and DS scenarios in 2028 and 2043 for both peaks are shown in Table 16-22 to Table 16-25. Figure 16-4 shows the routes in the DS scenario. It can be seen that in the DS the northbound and southbound routes follow the new bypass while in the DM they route via Brownhills roundabout and Friendly Farmer roundabout.

Figure 16-4: Do-Something

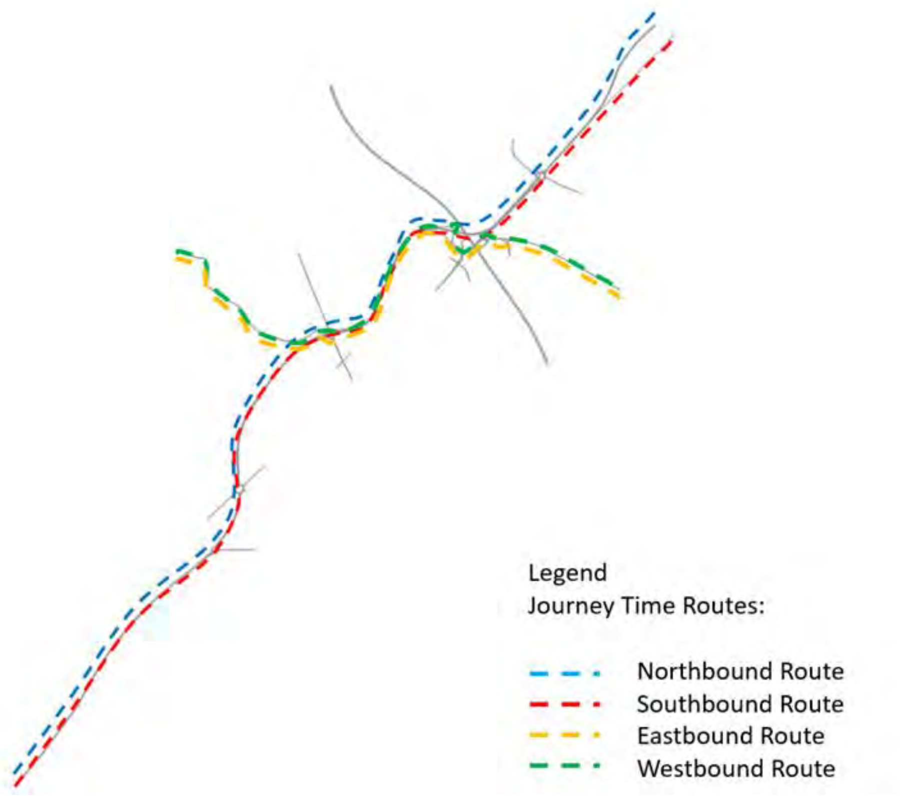


Table 16-22: Journey Time Comparison 2028 AM DS - DM

Direction	From	To	DM Time [sec]	DS Time [sec]	Diff (DS-DM) [sec]
Northbound	Lodge Lane	Brough	777	681	-96
Southbound	Brough	Lodge Lane	786	677	-109
Eastbound	Ollerton Road	Drove Lane	519	531	+12
Westbound	Drove Lane	Ollerton Road	524	532	+8

16.10.38 Forecast journey time comparisons for the morning peak in 2028 are shown in Table 16-22 above. In the northbound direction the bypass saves one minute between Cattle Market and Winthorpe in 2028. The delay approaching Cattle Market roundabout from Farndon roundabout has been eliminated as traffic passes Cattle Market grade separated.

16.10.39 Since the time between Brough and Winthorpe is the same between DM and DS, the queue from Friendly Farmer roundabout does not impact operation at Winthorpe roundabout as opposed to the test without the signalised gate between Brownhills and Friendly Farmer.

16.10.40 In 2028 vehicles can enter Cattle Market roundabout around half a minute quicker when coming from Kelham Road but this time is lost when travelling from Cattle Market to Brownhills. Between Brownhills roundabout and Friendly Farmer, the new signal gate (among other factors) adds to the addition of 10s to the journey time. The journey time in the westbound direction does not vary significantly between the DM and DS.

Table 16-23: Journey Time Comparison 2028 PM DS - DM

Direction	From	To	DM Time [sec]	DS Time [sec]	Diff (DS-DM) [sec]
Northbound	Lodge Lane	Brough	972	686	-285
Southbound	Brough	Lodge Lane	757	666	-92
Eastbound	Ollerton Road	Drove Lane	561	548	-13
Westbound	Drove Lane	Ollerton Road	507	497	-9

16.10.41 The equivalent evening peak comparison for 2028 is shown in Table 16-23. Between Farndon roundabout and Cattle Market roundabout vehicles are travelling nearly three minutes faster in the DS than in the DM.

16.10.42 From the one and a half minutes improvement along the southbound route 30% is saved between Cattle Market roundabout and Farndon roundabout and 60% between Winthorpe roundabout and Cattle Market roundabout.

16.10.43 In the eastbound direction the journey time is very similar between the DM and DS scenarios.

16.10.44 In the westbound direction, there is very little difference in the journey time comparison between DS and DM.

Table 16-24: Journey Time Comparison 2043 AM DS - DM

Direction	From	To	DM Time [sec]	DS Time [sec]	Diff (DS-DM) [sec]
Northbound	Lodge Lane	Brough	865	703	-162
Southbound	Brough	Lodge Lane	810	688	-122
Eastbound	Ollerton Road	Drove Lane	604	585	-19
Westbound	Drove Lane	Ollerton Road	546	593	+47

16.10.45 Table 16-24 presents the journey time comparison for the 2043 morning peak. The Scheme saves nearly one and half minutes between Cattle Market and Winthorpe when comparing DS and DM. Also, the delay approaching Cattle Market roundabout from Farndon roundabout has been eliminated due to the grade separation of Cattle Market roundabout.

16.10.46 The issue between Winthorpe and Friendly Farmer roundabouts can be seen in the journey time results as the time increases from 73s to 218 between the DM and DS.

16.10.47 In the eastbound direction more than one and a half minutes are saved at the Kelham Road approach to the Cattle Market roundabout. However, 77 seconds are lost between Cattle Market roundabout and Friendly Farmer roundabout leading to a total time saving of 19 seconds on the full route between the timing points Ollerton Road and Drove Lane (A17).

16.10.48 In the westbound direction the queues produce a nearly one-minute delay on the A17 approach to Friendly Farmer roundabout. The additional signalisation at Cattle Market roundabout improves how traffic on the A46 off slip road can enter Cattle Market roundabout. A 30 second improvement can be seen in 2043 between Brownhills roundabout and Cattle Market roundabout when comparing DM and DS.

Table 16-25: Journey Time Comparison 2043 PM DS - DM

Direction	From	To	DM Time [sec]	DS Time [sec]	Diff [sec]
Northbound	Lodge Lane	Brough	1116	701	-415
Southbound	Brough	Lodge Lane	899	478	-221
Eastbound	Ollerton Road	Drove Lane	617	706	+89
Westbound	Drove Lane	Ollerton Road	640	535	-105

16.10.49 The evening peak comparison for 2043 is given in Table 16-25. Between Farndon roundabout and Cattle Market roundabout there is a reduction in journey times of two and a half minutes in the DS than in the DM. Additionally, the delay in the 2043 DM from Friendly Farmer to Winthorpe Roundabout which has been reduced in the DS from 171s to 73s.

16.10.50 Between Cattle Market roundabout and Farndon roundabout half a minute is saved and vehicles travel three minutes faster between Winthorpe roundabout and Cattle Market roundabout.

16.10.51 In total the journey along the eastbound route takes one and a half minutes longer in the DS. As already shown in the queue comparison, the A46 (W) approach to Brownhills roundabout experiences delays in the 2043 DS scenario which lead all the way back through the roundabout at the Kennels onto the A46 off slip road. This is reflected in the journey time between Cattle Market roundabout and Brownhills roundabout. While in the DM the journey time is shown as 279 seconds it rises to 354 seconds in the DS. Additionally, vehicles experience 20 seconds additional delay between Brownhills and Friendly Farmer roundabouts.

16.10.52 Along the westbound route the substantial delay at the Cattle Market roundabout is eliminated. The grade separation including the off-slip lanes and the signalisation at the entry to the roundabout reduce 142 seconds of journey time in the DS. In total vehicles cross the total route 105 seconds faster in the DS than they do in the DM.

Network Performance Comparison

16.10.53 A summary of network performance indicators between the Do-Minimum and Do-Something scenarios for the AM and PM periods in 2028 and 2043 are shown in Table 16-26 and Table 16-27.

Table 16-26: Network Performance Comparison 2028 AM/PM and DM/DS

2028	AM		PM	
Measure	DM	DS	DM	DS
Average Delay [sec]	60	55	76	53
Average Number of Stops	3	2	4	1
Average Network Speed [mph]	40	41	38	42
Average Stopped Delay [sec]	16	19	22	20
Total Distance Travelled [mi]	45,383	54,223	44,389	54,030
Total Travel Time [sec]	4,049,651	4,710,490	4,215,768	4,676,764
Total Delay [sec]	776,725	765,789	1,012,801	761,132
Total Number of Stops	34,457	23,647	52,903	21,213
Total Stopped Delay [sec]	203,699	259,467	288,565	293,704
Remaining Vehicles in Network	1,201	1,347	1,251	1,343
Processed Vehicles	11,726	12,621	12,130	13,115
Latent Demand Delay [sec]	1,663	2,787	10,460	7,928
Latent Demand [vehs]	1	0	4	6

16.10.54 The average delay reduces in the DS in the 2028 AM period. There is a significant drop, not only in the average delay, but also in the latent delay when comparing the DS and the DM in the 2028 PM time period. The number of processed vehicles increases which means that there is a higher demand compared to the DM. This leads to an increase in the latent delay in the AM. However, it can be seen, that the Scheme leads to a significant reduction of the number of stops.

Table 16-27: Network Performance Comparison 2043 AM/PM and DM/DS

2043	AM		PM	
Measure	DM	DS	DM	DS
Average Delay [sec]	92	81	111	70
Average Number of Stops	7	3	7	3
Average Network Speed [mph]	37	39	35	40
Average Stopped Delay [sec]	23	26	25	25
Total Distance Travelled [mi]	52,586	64,935	51,425	65,313
Total Travel Time [sec]	5,144,017	6,016,152	5,371,671	5,874,072
Total Delay [sec]	1,391,634	1,336,848	1,708,364	1,184,142
Total Number of Stops	109,440	53,810	108,247	42,697
Total Stopped Delay [sec]	343,206	435,127	387,728	432,415
Remaining Vehicles in Network	1,596	1,789	1,713	1,700
Processed Vehicles	13,488	14,701	13,717	15,288
Latent Demand Delay [sec]	3,578	3,619	11,314	8,981
Latent Demand [vehs]	4	1	11	10

16.10.55 There is a drop in the average delay, but a slight increase in latent delay when comparing the DS and the DM in the 2043 AM time period. The DS in 2043 in the PM shows a significant reduction of delay and latent delay. The significant reduction in the number of stops and the higher number of processed vehicles shows that the bypass and the junction upgrades improve the network significantly.

Forecast Model Performance Summary – Do-Something

16.10.56 The new designs improve the traffic flow through the network and assist with the higher demand. Journey times along the A46 benefit from the bypassing of Brownhills roundabout and Friendly Farmer roundabout as well as from the free flow through Cattle Market roundabout.

16.10.57 The newly designed merge and diverge areas for the on and off slip roads at Cattle Market roundabout, northwest of Brownhills roundabout and at Winthorpe roundabout do not cause issues in the VISSIM model.

16.10.58 In 2028 no issues can be seen in the model. Only the level crossing causes occasional disruption at Cattle Market roundabout. The signals at Cattle Market and between Brownhills roundabout and Friendly Farmer roundabout are not critical for the network operation but help improve the performance.

16.10.59 In 2043 the A46 operates well. However, Great North Road (N) shows a long queue. As this VISSIM model does not show rerouting outside the study area possible changes in route choice are not accounted for (e.g., use of the A1 instead). However, any release of this queue could cause issues at the level crossing as the queue there could increase and disruptions due to blocking back into Cattle Market roundabout could be more critical than they are in the model. Another longer queue can be found on the A17 approach to Friendly Farmer roundabout. This is due to the balancing of queues on all 4 approaches with the help of the signal between Brownhills roundabout and Friendly Farmer roundabout. The signals at Cattle Market roundabout are crucial for the operation, especially in the AM as otherwise the A46 mainline would be blocked.

17 Data Annex

17.1 Scheme costs

Table 17-1: Scheme investment cost profile in 2010 prices (£000s)

Year	2010 factor prices (not discounted)	2010 market prices (discounted)
2023	541	412
2024	5,063	3,722
2025	32,392	23,008
2026	98,352	67,497
2027	123,309	81,763
2028	95,642	61,273
2029	19,762	12,232
2030	372	223
2031	33	19
2032	32	18
2033	31	17
2034	11	6
Total	375,539	250,189

Table 17-2: Scheme O&M cost profile in 2010 prices (£000s)

Year	2010 factor prices (not discounted)	2010 market prices (discounted)
2028	0	0
2029	497	308
2030	497	297
2031	496	287
2032	496	277
2033	-218	-118
2034	-218	-114
2035	217	109
2036	149	73
2037	426	200
2038	357	162
2039	2,432	1,067
2040	2,429	1,030
2041	491	201
2042	491	194
2043	69	26
2044	-637	-235
2045	-216	-77
2046	489	169
2047	489	163
2048	354	114
2049	86	27
2050	4,579	1,376
2051	4,459	1,295
2052	415	117
2053	480	131
2054	480	127
2055	-211	-54
2056	-211	-53

Year	2010 factor prices (not discounted)	2010 market prices (discounted)
2057	479	116
2058	4,687	1,101
2059	4,814	1,098
2060	477	106
2061	2,354	506
2062	2,352	491
2063	476	96
2064	475	94
2065	208	40
2066	-540	-100
2067	-273	-49
2068	6,492	1,135
2069	6,226	1,057
2070	473	78
2071	472	76
2072	4,698	730
2073	4,288	647
2074	66	10
2075	470	67
2076	470	65
2077	-207	-28
2078	-335	-44
2079	468	59
2080	205	25
2081	142	17
2082	403	47
2083	2,304	259
2084	2,302	251
2085	466	49
2086	465	48
2087	465	46
2088	6,792	658
Total	71,803	15,848

17.2 Scheme benefits / disbenefits

Journey times

Table 17-3: Average journey times during construction period along route by phase (minutes)

	All Phases
Without scheme	12:13
With scheme	14:07

[Farndon roundabout to Winthorpe roundabout]

Table 17-4: Average journey times along route (minutes)

	Opening year	Design year	Change (%)
Without scheme	09:56	11:34	16.4%
With scheme	06:48	06:55	1.7%

[Farndon roundabout to Winthorpe roundabout]

Safety

Table 17-5: Number of accidents by year

Year	Without scheme	With scheme	Difference (reduction with scheme)
2028	3026.2	3008.9	17.2
2029	2994.6	2977.3	17.3
2030	2994.7	2977.1	17.6
2031	2995	2977.1	17.8
2032	2994.9	2976.7	18.1
2033	2994.4	2976	18.4
2034	2993.6	2975	18.6
2035	2992.4	2973.6	18.8
2036	2990.9	2971.8	19.1
2037	2989.1	2969.8	19.3
2038	2987	2967.5	19.5
2039	2984.6	2964.8	19.7
2040	3013.5	2993.4	20.2
2041	3042.5	3021.9	20.6
2042	3071.4	3050.4	21
2043	3100.1	3078.5	21.6
2044	3111.2	3090.9	20.4
2045	3122.4	3103.2	19.2
2046	3133.5	3115.5	18
2047	3144.7	3127.8	16.8
2048	3155.8	3140.2	15.6
2049	3167	3152.5	14.5
2050	3178.1	3164.8	13.3
2051	3189.3	3177.2	12.1
2052	3200.4	3189.5	10.9
2053	3211.6	3201.8	9.7
2054	3222.7	3214.1	8.6
2055	3233.9	3226.5	7.4
2056	3245	3238.8	6.2
2057	3256.2	3251.2	5
2058	3267.3	3263.5	3.8
2059	3278.5	3275.8	2.6
2060	3289.6	3288.2	1.4
2061	3300.6	3300.5	0.1
2062	3300.6	3300.5	0.1
2063	3300.6	3300.5	0.1
2064	3300.6	3300.5	0.1
2065	3300.6	3300.5	0.1
2066	3300.6	3300.5	0.1
2067	3300.6	3300.5	0.1
2068	3300.6	3300.5	0.1
2069	3300.6	3300.5	0.1
2070	3300.6	3300.5	0.1
2071	3300.6	3300.5	0.1
2072	3300.6	3300.5	0.1
2073	3300.6	3300.5	0.1
2074	3300.6	3300.5	0.1
2075	3300.6	3300.5	0.1
2076	3300.6	3300.5	0.1

Year	Without scheme	With scheme	Difference (reduction with scheme)
2077	3300.6	3300.5	0.1
2078	3300.6	3300.5	0.1
2079	3300.6	3300.5	0.1
2080	3300.6	3300.5	0.1
2081	3300.6	3300.5	0.1
2082	3300.6	3300.5	0.1
2083	3300.6	3300.5	0.1
2084	3300.6	3300.5	0.1
2085	3300.6	3300.5	0.1
2086	3300.6	3300.5	0.1
2087	3300.6	3300.5	0.1

Table 17-6: Number of Fatal casualties by year

Year	Without scheme	With scheme	Difference (reduction with scheme)
2028	46.5	46.2	0.3
2029	46	45.7	0.3
2030	46	45.7	0.3
2031	46.1	45.8	0.3
2032	46.1	45.8	0.3
2033	46.1	45.8	0.3
2034	46.2	45.8	0.3
2035	46.2	45.8	0.3
2036	46.2	45.8	0.3
2037	46.2	45.8	0.4
2038	46.2	45.8	0.4
2039	46.2	45.8	0.4
2040	46.7	46.3	0.4
2041	47.1	46.8	0.4
2042	47.6	47.3	0.4
2043	48.1	47.7	0.4
2044	48.3	47.9	0.4
2045	48.5	48.2	0.4
2046	48.7	48.4	0.3
2047	48.9	48.6	0.3
2048	49.1	48.8	0.3
2049	49.3	49	0.3
2050	49.5	49.2	0.2
2051	49.7	49.4	0.2
2052	49.9	49.7	0.2
2053	50	49.9	0.2
2054	50.2	50.1	0.1
2055	50.4	50.3	0.1
2056	50.6	50.5	0.1
2057	50.8	50.7	0.1
2058	51	50.9	0.1
2059	51.2	51.2	0
2060	51.4	51.4	0
2061	51.6	51.6	0
2062	51.6	51.6	0
2063	51.6	51.6	0
2064	51.6	51.6	0
2065	51.6	51.6	0
2066	51.6	51.6	0

Year	Without scheme	With scheme	Difference (reduction with scheme)
2067	51.6	51.6	0
2068	51.6	51.6	0
2069	51.6	51.6	0
2070	51.6	51.6	0
2071	51.6	51.6	0
2072	51.6	51.6	0
2073	51.6	51.6	0
2074	51.6	51.6	0
2075	51.6	51.6	0
2076	51.6	51.6	0
2077	51.6	51.6	0
2078	51.6	51.6	0
2079	51.6	51.6	0
2080	51.6	51.6	0
2081	51.6	51.6	0
2082	51.6	51.6	0
2083	51.6	51.6	0
2084	51.6	51.6	0
2085	51.6	51.6	0
2086	51.6	51.6	0
2087	51.6	51.6	0

Table 17-7: Number of Serious casualties by year

Year	Without scheme	With scheme	Difference (reduction with scheme)
2028	419.9	417.3	2.6
2029	415.5	412.9	2.7
2030	415.6	412.9	2.7
2031	415.7	413	2.7
2032	415.8	413	2.8
2033	415.8	412.9	2.8
2034	415.7	412.8	2.9
2035	415.6	412.7	2.9
2036	415.4	412.5	2.9
2037	415.2	412.2	3
2038	414.9	411.9	3
2039	414.6	411.6	3
2040	418.8	415.7	3.1
2041	422.9	419.7	3.2
2042	427.1	423.8	3.2
2043	431.2	427.8	3.3
2044	432.8	429.6	3.2
2045	434.4	431.4	3
2046	436.1	433.2	2.8
2047	437.7	435	2.6
2048	439.3	436.8	2.5
2049	440.9	438.6	2.3
2050	442.6	440.4	2.1
2051	444.2	442.2	1.9
2052	445.8	444	1.8
2053	447.4	445.8	1.6
2054	449.1	447.6	1.4
2055	450.7	449.4	1.2
2056	452.3	451.2	1.1

Year	Without scheme	With scheme	Difference (reduction with scheme)
2057	453.9	453	0.9
2058	455.6	454.8	0.7
2059	457.2	456.6	0.5
2060	458.8	458.4	0.4
2061	460.4	460.2	0.2
2062	460.4	460.2	0.2
2063	460.4	460.2	0.2
2064	460.4	460.2	0.2
2065	460.4	460.2	0.2
2066	460.4	460.2	0.2
2067	460.4	460.2	0.2
2068	460.4	460.2	0.2
2069	460.4	460.2	0.2
2070	460.4	460.2	0.2
2071	460.4	460.2	0.2
2072	460.4	460.2	0.2
2073	460.4	460.2	0.2
2074	460.4	460.2	0.2
2075	460.4	460.2	0.2
2076	460.4	460.2	0.2
2077	460.4	460.2	0.2
2078	460.4	460.2	0.2
2079	460.4	460.2	0.2
2080	460.4	460.2	0.2
2081	460.4	460.2	0.2
2082	460.4	460.2	0.2
2083	460.4	460.2	0.2
2084	460.4	460.2	0.2
2085	460.4	460.2	0.2
2086	460.4	460.2	0.2
2087	460.4	460.2	0.2

Table 17-8: Number of Slight casualties by year

Year	Without scheme	With scheme	Difference (reduction with scheme)
2028	3790.9	3769.9	21.1
2029	3751.8	3730.6	21.2
2030	3752.2	3730.7	21.5
2031	3752.8	3731	21.8
2032	3752.9	3730.8	22.2
2033	3752.6	3730.1	22.5
2034	3751.8	3729.1	22.8
2035	3750.7	3727.6	23.1
2036	3749.1	3725.7	23.3
2037	3747.1	3723.5	23.6
2038	3744.7	3720.8	23.9
2039	3742	3717.8	24.2
2040	3778.3	3753.6	24.7
2041	3814.6	3789.4	25.2
2042	3851	3825.3	25.7
2043	3887	3860.6	26.5
2044	3901	3876	25
2045	3915	3891.5	23.5
2046	3929	3906.9	22.1

Year	Without scheme	With scheme	Difference (reduction with scheme)
2047	3943	3922.4	20.6
2048	3956.9	3937.8	19.1
2049	3970.9	3953.3	17.7
2050	3984.9	3968.7	16.2
2051	3998.9	3984.2	14.7
2052	4012.9	3999.6	13.3
2053	4026.8	4015	11.8
2054	4040.8	4030.5	10.3
2055	4054.8	4045.9	8.9
2056	4068.8	4061.4	7.4
2057	4082.8	4076.8	5.9
2058	4096.8	4092.3	4.5
2059	4110.8	4107.8	3
2060	4124.7	4123.2	1.5
2061	4138.5	4138.7	-0.2
2062	4138.5	4138.7	-0.2
2063	4138.5	4138.7	-0.2
2064	4138.5	4138.7	-0.2
2065	4138.5	4138.7	-0.2
2066	4138.5	4138.7	-0.2
2067	4138.5	4138.7	-0.2
2068	4138.5	4138.7	-0.2
2069	4138.5	4138.7	-0.2
2070	4138.5	4138.7	-0.2
2071	4138.5	4138.7	-0.2
2072	4138.5	4138.7	-0.2
2073	4138.5	4138.7	-0.2
2074	4138.5	4138.7	-0.2
2075	4138.5	4138.7	-0.2
2076	4138.5	4138.7	-0.2
2077	4138.5	4138.7	-0.2
2078	4138.5	4138.7	-0.2
2079	4138.5	4138.7	-0.2
2080	4138.5	4138.7	-0.2
2081	4138.5	4138.7	-0.2
2082	4138.5	4138.7	-0.2
2083	4138.5	4138.7	-0.2
2084	4138.5	4138.7	-0.2
2085	4138.5	4138.7	-0.2
2086	4138.5	4138.7	-0.2
2087	4138.5	4138.7	-0.2

Environment

Table 17-9: NOx emissions (tonnes)

Year	Without scheme	With scheme	Difference
2028	111.42	117.73	6.31
2029	109.44	115.86	6.43
2030	107.45	113.99	6.54
2031	105.46	112.12	6.66
2032	103.48	110.25	6.77
2033	101.49	108.38	6.89

Year	Without scheme	With scheme	Difference
2034	99.51	106.51	7.01
2035	97.52	104.64	7.12
2036	95.53	102.78	7.24
2037	93.55	100.91	7.36
2038	91.56	99.04	7.47
2039	89.58	97.17	7.59
2040	87.59	95.30	7.71
2041	85.61	93.43	7.82
2042	83.62	91.56	7.94
2043	81.63	89.69	8.06
2044	81.63	89.69	8.06
2045	81.63	89.69	8.06
2046	81.63	89.69	8.06
2047	81.63	89.69	8.06
2048	81.63	89.69	8.06
2049	81.63	89.69	8.06
2050	81.63	89.69	8.06
2051	81.63	89.69	8.06
2052	81.63	89.69	8.06
2053	81.63	89.69	8.06
2054	81.63	89.69	8.06
2055	81.63	89.69	8.06
2056	81.63	89.69	8.06
2057	81.63	89.69	8.06
2058	81.63	89.69	8.06
2059	81.63	89.69	8.06
2060	81.63	89.69	8.06
2061	81.63	89.69	8.06
2062	81.63	89.69	8.06
2063	81.63	89.69	8.06
2064	81.63	89.69	8.06
2065	81.63	89.69	8.06
2066	81.63	89.69	8.06
2067	81.63	89.69	8.06
2068	81.63	89.69	8.06
2069	81.63	89.69	8.06
2070	81.63	89.69	8.06
2071	81.63	89.69	8.06
2072	81.63	89.69	8.06
2073	81.63	89.69	8.06
2074	81.63	89.69	8.06
2075	81.63	89.69	8.06
2076	81.63	89.69	8.06
2077	81.63	89.69	8.06
2078	81.63	89.69	8.06
2079	81.63	89.69	8.06
2080	81.63	89.69	8.06
2081	81.63	89.69	8.06
2082	81.63	89.69	8.06
2083	81.63	89.69	8.06
2084	81.63	89.69	8.06
2085	81.63	89.69	8.06
2086	81.63	89.69	8.06
2087	81.63	89.69	8.06

Table 17-10: PM2.5 emissions (tonnes)

Year	Without scheme	With scheme	Difference
2028	16.24	17.16	0.92
2029	16.34	17.31	0.97
2030	16.45	17.46	1.02
2031	16.55	17.62	1.07
2032	16.65	17.77	1.12
2033	16.76	17.92	1.17
2034	16.86	18.08	1.22
2035	16.97	18.23	1.26
2036	17.07	18.38	1.31
2037	17.17	18.54	1.36
2038	17.28	18.69	1.41
2039	17.38	18.84	1.46
2040	17.49	19.00	1.51
2041	17.59	19.15	1.56
2042	17.69	19.30	1.61
2043	17.80	19.46	1.66
2044	17.80	19.46	1.66
2045	17.80	19.46	1.66
2046	17.80	19.46	1.66
2047	17.80	19.46	1.66
2048	17.80	19.46	1.66
2049	17.80	19.46	1.66
2050	17.80	19.46	1.66
2051	17.80	19.46	1.66
2052	17.80	19.46	1.66
2053	17.80	19.46	1.66
2054	17.80	19.46	1.66
2055	17.80	19.46	1.66
2056	17.80	19.46	1.66
2057	17.80	19.46	1.66
2058	17.80	19.46	1.66
2059	17.80	19.46	1.66
2060	17.80	19.46	1.66
2061	17.80	19.46	1.66
2062	17.80	19.46	1.66
2063	17.80	19.46	1.66
2064	17.80	19.46	1.66
2065	17.80	19.46	1.66
2066	17.80	19.46	1.66
2067	17.80	19.46	1.66
2068	17.80	19.46	1.66
2069	17.80	19.46	1.66
2070	17.80	19.46	1.66
2071	17.80	19.46	1.66
2072	17.80	19.46	1.66
2073	17.80	19.46	1.66
2074	17.80	19.46	1.66
2075	17.80	19.46	1.66
2076	17.80	19.46	1.66
2077	17.80	19.46	1.66
2078	17.80	19.46	1.66
2079	17.80	19.46	1.66
2080	17.80	19.46	1.66

Year	Without scheme	With scheme	Difference
2081	17.80	19.46	1.66
2082	17.80	19.46	1.66
2083	17.80	19.46	1.66
2084	17.80	19.46	1.66
2085	17.80	19.46	1.66
2086	17.80	19.46	1.66
2087	17.80	19.46	1.66

Table 17-11: Greenhouse gas emissions (tonnes CO2e)

Year	Without scheme	With scheme	Difference
2028	174,546	326,442	151,896
2029	176,240	184,305	8,064
2030	177,934	186,054	8,120
2031	179,627	187,803	8,176
2032	181,321	189,552	8,231
2033	183,015	191,302	8,287
2034	184,709	193,051	8,342
2035	186,402	194,800	8,398
2036	188,096	196,549	8,453
2037	189,790	198,299	8,509
2038	191,483	200,048	8,565
2039	193,177	202,722	9,545
2040	194,871	203,547	8,676
2041	196,564	205,296	8,731
2042	198,258	207,045	8,787
2043	199,952	208,794	8,842
2044	199,952	208,794	8,842
2045	199,952	208,794	8,842
2046	199,952	208,794	8,842
2047	199,952	212,066	12,114
2048	199,952	208,794	8,842
2049	199,952	208,794	8,842
2050	199,952	208,794	8,842
2051	199,952	209,719	9,767
2052	199,952	208,794	8,842
2053	199,952	208,794	8,842
2054	199,952	208,794	8,842
2055	199,952	208,794	8,842
2056	199,952	208,794	8,842
2057	199,952	209,026	9,074
2058	199,952	208,794	8,842
2059	199,952	208,794	8,842
2060	199,952	208,794	8,842
2061	199,952	208,794	8,842
2062	199,952	208,794	8,842
2063	199,952	209,719	9,767
2064	199,952	208,794	8,842
2065	199,952	208,794	8,842
2066	199,952	208,794	8,842
2067	199,952	212,574	12,622
2068	199,952	208,794	8,842
2069	199,952	208,794	8,842
2070	199,952	208,794	8,842
2071	199,952	208,794	8,842
2072	199,952	208,794	8,842

Year	Without scheme	With scheme	Difference
2073	199,952	208,794	8,842
2074	199,952	208,794	8,842
2075	199,952	209,719	9,767
2076	199,952	208,794	8,842
2077	199,952	208,794	8,842
2078	199,952	208,794	8,842
2079	199,952	208,794	8,842
2080	199,952	208,794	8,842
2081	199,952	208,794	8,842
2082	199,952	208,794	8,842
2083	199,952	208,794	8,842
2084	199,952	208,794	8,842
2085	199,952	208,794	8,842
2086	199,952	208,795	8,843

Appendix B: Road Safety Audit & Designer's Response

Contents

1 Introduction

This report describes a Stage 1 Road Safety Audit undertaken on the preliminary design proposals to upgrade and dual the existing A46 highway corridor between Farndon and Winthorpe, near Newark-on-Trent, in Nottinghamshire. The scheme comprises proposed works in two highway network areas, the strategic road network and local highway network, which are operated by National Highways and Nottinghamshire County Council, respectively.

The Road Safety Audit (RSA) has been carried out at the request of Mott MacDonald / Skanska (the Design Organisation) and National Highways (the Overseeing Organisation).

A Road Safety Audit Brief was prepared by [redacted] (Design Organisation representative). The RSA Brief and composition of the Audit Team was approved by [redacted] (Overseeing Organisation representative) and issued to the Audit Te[redacted]

The Audit Team membership was as follows:

[redacted] CMILT, MCIHT, MSoRSA, RegRSA (IHE)
Audit Team Leader, Mott MacDonald HTS
(Holder of a Certificate of Competency in Road Safety Audit)

[redacted] MCIHT, MSoRSA
Audit Team Member, Mott MacDonald HTS
(Holder of a Certificate of Competency in Road Safety Audit)

It is confirmed that this Stage 1 Road Safety Audit has been undertaken during the preliminary design stage of the scheme (at PCF Stage 3). The terms of reference for this audit are the National Highways (formerly, Highways England) departmental standard, DMRB GG 119 ‘Road safety audit’, revision 2.

Direct communication between the Audit Team and the Design Organisation was permitted, with the Overseeing Organisation representative included on all email exchanges (in accordance with DMRB GG 119 paras 4.23 and 4.23.1).

The RSA took place at the Southampton office of Mott MacDonald during May 2023, and comprised an examination of the submitted documentation and drawings listed in **Appendix A**.

The Audit Team visited the site of the proposed works on Thursday 04/05/2023 between 09:00hrs and 12:00hrs (in daylight). During the site visit the weather was fine / overcast and the road surface was dry. Traffic conditions were light / moderate, and free flowing. Pedestrian and cycling activity were observed on existing footways adjacent to the A46.

The Audit Team has examined and reported only on the road safety implications of the scheme as presented and has not examined or verified the compliance of the designs to any other criteria.

The comments and suggestions for road safety improvements made in this report seek to address matters that might have an adverse effect on road safety in the context of the chosen design. No attempt has been made to comment on the justification of the scheme. Consequently, the auditors accept no responsibility for the design or construction of this scheme.

The problems and recommendations identified in this report are referenced to the design drawings and the locations have been indicated on the key plans at **Appendix B**.

All of the issues raised in this report are considered to be required for action. The comments contained in the report are based on safety related concerns and as such a design engineer will need to consider carefully how to respond to each of the issues.

A Road Safety Audit Response Report should be produced collaboratively by the Design Organisation and the Overseeing Organisation and kept on file for future reference (refer to DMRB GG 119, Chapter 4.11 to 4.19 and Appendix F). The response report should be produced and finalised within one month of the issue of the RSA report. A copy of the final response report should be issued to the Audit Team for information.

Information provided for this audit

Following a request for additional information to support this RSA1, the Design Organisation made the Audit Team aware (by email, on 24/04/2023) that the full scheme information was not yet available, due to the project being at an early stage of its lifecycle (at time of writing, PCF Stage 3).

For some elements, the Audit Team were directed to the ‘Highways Road Project’ YouTube channel to view the A46 Newark Bypass fly-through video (at: https://www.youtube.com/watch?v=fyCs6CmPdUo, accessed in May 2023) which gave an indictive overview of the proposed highway layout. It should be noted that some elements of the scheme layout presented in this video appeared to differ from other scheme information provided for audit.

A Safety Risk Assessment (Document re.: HE551478-SKAG-HGN-CONWI_CONW-RA-CH-00001_P01_S2) relating to the proposed design of Winthorpe Junction (a ‘through-about’ arrangement) was provided. It is not clear at this stage if the document had been accepted by the project Safety Control Review Group (SCRG).

The Audit Team were asked to include a draft design proposal for a revised junction layout on the Great North Road, which is associated with a new lorry park access. This drawing was not listed in the RSA Brief but was supplied by the Design Organisation by email on 24/04/2023.

The Audit Team has reviewed the scheme information provided and compared it with the road safety audit checklist for a Stage 1 RSA, as set out in DMRB GG 119 (Appendix B).

Table 1.1 overleaf, provides commentary on the level of scheme detail provided for this RSA1, as confirmed by the Overseeing Organisation representative. This includes items that could not be fully assessed at this stage (in accordance with DMRB GG 119, paras 4.5 and 4.5.1):

Table 1.1: Checklist of information provided for this RSA1

RSA1 checklist item	Description
	4.20.2 Subsequent actions (Previous RSAs)
Interim Stage 1 RSA Response Report	A copy of the Response Report and Action Log from the previous Interim RSA1 has been provided for information (Document ref.: Document ref.: HE551478-SKAG-HGN-CONWI_CONW-RP-CH-00014_P02). Note that there is no requirement for the RSA1 Team to review or comment on this document at this stage.
	B.1 Local Alignment
Visibility	Departures / relaxations from standards (DfS), relating to horizontal and vertical alignments have been identified - refer to DfS Checklist, Document ref: HE551478-MOTG-GEN-CONWI_CONW-TK-CH-00002_P02_S3, 10/02/2022).
New/existing road interface	Highway tie-in details between the new and existing road interfaces is shown. These are limited to the General Arrangement drawings and the Plan and Profile drawings.
Vertical alignment	Plan and Profile drawings (suitable for information, P01) are provided. Some Departures / relaxations from standards (DfS) relating to vertical alignment have been identified but are not yet approved - DfS Checklist, Document ref: HE551478-MOTG-GEN-CONWI_CONW-TK-CH-00002_P02_S3, 10/02/2022).
	B.2 General
Departures from standards	Departures / relaxations from standards (DfS) for the scheme have been identified but are not yet approved – refer to DfS Checklist, Document ref: HE551478-MOTG-GEN-CONWI_CONW-TK-CH-00002_P02_S3, 10/02/2022. It should be noted that no details of any 'strategic decisions' were provided in the scope / RSA Brief.
Cross sections and cross-sectional variation	Typical cross-sectional information has been provided. Where shown, the typical highway cross-section drawings indicate drainage, fencing, and slopes / earthworks.
Landscaping	Unable to assess fully at this stage. Outline landscaping design was provided as draft Indicative Environmental Masterplan drawings. The Audit Team was also directed to the 'A46 Newark Bypass fly-through video' (on YouTube), although this lacked sufficient detail for a Stage 1 RSA.
Drainage	Unable to assess fully at this stage. Some highway drainage information was provided but limited to the typical cross-section drawings.
Lay-bys	The RSA1 Team noted several existing lay-bys on the A46 which are well used. It is understood (from the General Arrangement and Plan & Profile drawings) that all existing lay-by facilities will be removed (not retained) and one new lay-by is proposed.
Public utilities/service apparatus	Not assessed. A request for further information was made on 24/04/23, but no information on utilities / apparatus provided, as this is not available for this stage of the design.
Access	Accesses are indicated - but direct access detail is limited to the General Arrangement drawings only.
Emergency vehicles	Unable to assess fully at this stage. It is unclear what (if any) provision has been made for safe access and egress by emergency vehicles
Future widening	Unable to assess fully at this stage. It is understood that some single carriageway roads will become dual carriageway (as indicated on the General Arrangement drawings). However, at this stage, it is not clear how this change will be presented / communicated to road users.
Adjacent development	It is understood that highway boundary fencing (which may include screening and environmental barriers) is not included at this stage of design.
Basic design principles	The standards used to undertake the design and minor departures from standard are summarised within the 'Implementation Report for New Standards'.
Specific road users	Not assessed. At this stage, it is not clear from the information provided if specific provision is required for vulnerable groups (i.e., the young, older users, mobility and visually impaired, motorcyclists.).

RSA1 checklist item	Description
	The RSA1 Team has not sighted any assessment work / technical notes relating to vulnerable user groups, including the WCHAR assessment report.
	B.3 Junctions
Layout	Unable to assess fully at this stage. A request for further information was made on 24/04/23, but no information on Vehicle swept path analysis results have been provided, as this is not available for this stage of the design.
Visibility	Unable to assess fully at this stage. It is understood that no junction sight lines / visibility splays have been produced for this stage of the design.
	B.4 Walking, Cycling and Horse Riding
Adjacent Land	Unable to assess fully at this stage. It is difficult to ascertain where the scheme may have an adverse effect on safe use of adjacent land, as information about fencing and gates (boundary) are not included at this stage of design.
Pedestrians	Unable to assess fully at this stage. New / diverted pedestrian routes and crossings are shown indicatively at this stage of the design. Detail of new features such as verge strips, tactile paving, flush kerbs and guard railing are not shown. It is unclear if existing (retained) features (i.e., signposts, lamp columns, vegetation) will pose an obstruction / impediment to pedestrians, as this level of detail is not yet available. It is understood that the WCHAR assessment report is currently in progress, and not yet available for this RSA1 at the time of writing.
Cyclists	Unable to assess fully at this stage. New / diverted cycle routes and crossings are shown indicatively at this stage of the design. Details of new features such as verge strips, tactile paving, flush kerbs and guard railing are not shown. It is unclear if existing (retained) features (i.e., signposts, lamp columns, vegetation) will pose an obstruction / impediment to cyclists, as this level of detail is not yet available. Proposed cycle routes are not always shown to connect with existing provision and the locations of highway transitions for cyclists are not indicated in the design. Parapet details (including heights of parapets) adjacent to cycle routes are not stated in the design. It is understood that the WCHAR assessment report is currently in progress, and not yet available for this RSA1, at the time of writing.
Equestrians	Not assessed. Information not provided. It is unclear if there is any provision being made specifically for horse-riders at this stage. It is understood that the WCHAR assessment report is currently in progress, and not yet available for this RSA1, at the time of writing.
	B.5 Traffic Signs, Carriageway Markings and Lighting
Signs	Unable to assess fully at this stage. Some limited information showing the provision, retention and removal of traffic signs was provided in a preliminary signing schedule (refer to Drawing ref.: HE551478-SKAG-HSN-CONWI_CONW-SH-CH-00001_P01_S3). However, this is limited to directional signing only. It was not clear if gantry / overhead signing will be provided. An assessment of traffic signing locations (e.g., assessment of signs at high-risk strikes) has not been sighted.
Variable message signs (VMS)	Not assessed. No indication on the potential requirements for VMS at this stage. The RSA1 Team noted existing active VMS on the A46 (both directions) during the site visit, but it is not clear if these are being retained.
Lighting	Not assessed. No lighting assessments provided as part of this RSA1. It is not clear whether road lighting is being considered / retained at this stage, as no detailed information has been provided. The Audit Team was directed to the 'A46 Newark Bypass fly-through video' (on YouTube), although this lacked sufficient detail for a Stage 1 RSA.

RSA1 checklist item	Description
Pole/columns	Not assessed. Unable to establish the locations of any new poles / columns (including type, number and sizes of posts) and if these can be appropriately located and protected in the corridor verges / highway boundary.
Carriageway markings	Unable to assess fully at this stage. Road markings are only shown indicatively at this stage (and limited to the General Arrangement drawings)

Source: Mott MacDonald, information provided for audit compared to the 'Road safety audit checklists' for Stage 1, in DMRB GG 119 Appendix B

Information provided in the RSA Brief

The following scheme information was provided in the RSA1 Brief:

General description

The existing A46 around Newark-on-Trent is the only remaining single carriageway section of the 'Trans-Midlands Trade Corridor' between the M5 and Humber Ports.

Congestion on this single carriageway section means that journey times are unreliable and take longer than they should. This is expected to worsen as more people are expected to use the road in the future.

The Scheme will create a reliable, high-quality route between the Farndon and Winthorpe junctions. The Scheme principally comprises of:

a) *Widening the A46 to a 6.5 kilometre dual carriageway between Farndon and Winthorpe junctions. This is to be done mainly through on-line widening apart from a section crossing the A1.*
b) *Adding an additional lane and partially signalising Farndon roundabout. This will be done within the junctions existing footprint and will help improve the flow of traffic at the junction.*
c) *A new structure will be built parallel to the existing Windmill Viaduct, Eastern railway crossing, Nether Lock Viaduct and the ECML crossing to accommodate the additional carriageway. This will be built at an offset from the existing structure to allow for better buildability and maintenance.*
d) *A new pair of single span structures will be constructed over an improved Cattle Market roundabout to create a new grade separated junction. Cattle Market roundabout has been enlarged and developed to accommodate the dualling of the A46. This development of the junction and new two span structure for the through traffic will improve the flow of traffic around Cattle Market.*
e) *The existing Nottingham to Lincoln railway line east crossing structure will be widened to the north. Widening this structure is necessary to both accommodate the additional carriageway and retain the railway headroom requirements.*
f) *New slip roads at Brownhills will give access to both the existing Brownhills roundabout and the newly proposed Brownhills junction. This junction improvement will provide improved access to Newark-on-Trent to the south of the A46 as well as the businesses and properties to the north.*
g) *A new skewed structure crossing the A1 to accommodate the offline section of the scheme. This ties back in to the existing A46 before Winthorpe and allows the retention of the Esso service station.*

h) *A new Friendly Farmer link parallel to the mainline. This new link road ties into the Friendly Farmer roundabout and will provide provisions for pedestrians/cyclists, access to businesses to the south and a new access for the Shell service station.*
i) *Winthorpe Junction has been redesigned as a through-about. This means that two additional lanes for through traffic have been provided as well as the gyratory. The junction will be signalised to help control traffic around the junction and reduce congestion.*
j) *Improvements to Non-Motorised Users (NMU) facilities through safer, enhanced routes for walkers, cyclists, and horse-riders.*
k) *Creation of new pond and wetland areas.*

Speed limits

National Highways Mainline and Junctions:

- *Design speed 120kph on mainline between Farndon and Cattle Market and 85kph on mainline between Cattle Market and Winthorpe.*
- *[Posted] speed 70mph on mainline between Farndon and Cattle Market and 50mph on mainline between Cattle Market and Winthorpe*

Local Roads:

Road Name	***Highway Authority***	***Schedule 3: Classification***	***Schedule 3: Speed Limit (mph)***	***Design speed (kph)***	***Link type***
Fosse Road	*NCC*	*Proposed unclassified road*	*40*	*70*	*Single carriageway*
Farndon Road	*NCC*	*Proposed unclassified road*	*30*	*60*	*Single carriageway*
A617 Kellam Road	*NCC*	*Proposed unclassified road*	*50*	*70*	*Single carriageway*
A616 Great North Road North	*NCC*	*Proposed unclassified road*	*50*	*85*	*Single carriageway*
A616 Great North Road South	*NCC*	*Proposed unclassified road*	*30*	*50*	*Single carriageway*
Friendly Farmers Link	*NCC*	*Proposed unclassified road*	*50*	*85*	*Single carriageway*
Drove Lane	*NCC*	*Proposed unclassified road*	*60*	*85*	*Single carriageway*
Realigned A1133	*NCC*	*Proposed unclassified road*	*60*	*85*	*Single carriageway*

Source: RSA1 Brief, Appendix A - Schedule of local roads

Forecast and existing traffic flows/queues

Provided in RSA1 Brief, Appendix B - Forecast and Existing Traffic Flows.

Collision data

An overview of the recent collision history for the scheme extents was provided in a Technical Note (TN1) produced by Mott MacDonald / Skanska in December 2022 (Document ref: HE551478-SKAG-GHS-CONWI_CONW-RP-ZS-00010_P01_S4). This comprised a summary of personal injury collision (PIC) records for the strategic road network (SRN) over a five-year period between 01/01/2017 and 31/12/2021.

The dataset was summarised as follows:

- *There was a total of 107 collisions, resulting in 148 casualties.*
- *This equates to an average of 21.4 PICs per year*
- *Fridays exhibit the highest number of recorded collisions (22 PICs), accounting for 21% of the total*
- *The largest proportion of collisions recorded (16 PICs) occurred between the hours of 18:00-19:00, representing 15.9% of the total*
- *Collisions by month are generally spread evenly across the year, with August and October accounting for the highest total (13 PICs, 12.1% of the total respectively)*
- *13 PICs (12%) involved vehicles that skidded*
- *Collisions on a wet road surface (18 PICs) accounted for 17% of the total*
- *Vehicle involvement (233 vehicles in total) in collisions was recorded as follows:*
  - *Cars – 162 vehicles (69.5%)*
  - *Motorcycles – 17 vehicle (7.3%)*
  - *Heavy Goods Vehicles – 22 vehicles (9.4%)*
  - *Light Goods Vehicles – 26 vehicles (11.2.%)*
  - *Other/ Unknown – 3 vehicles (1.3%) Pedal Cycle – 3 vehicles (1.3%)*
- *The following Vulnerable Road User (VRU) casualties were recorded:*
  - *Motorcycle Riders – 16 casualties (10.8%)*
  - *Pedestrians – 0 casualties (0.0%)*
  - *Pedal Cyclists – 3 casualties (2.0%)*

The analysis has suggested that there are six main collision cluster site areas, detailed as follows:

Ref	***Location***	***OSGR***	***Diameter (meters)***	***Collisions***			
				Fatal	*Serious*	*Slight*	*Total*
001	*Cattle Market Roundabout*	*479368 / 354655*	*183*	*0*	*3*	*19*	*22*
002	*Brownhills Roundabout*	*481206 / 355778*	*139*	*0*	*3*	*10*	*13*
003	*Winthorpe Interchange*	*481543 / 355959*	*133*	*0*	*2*	*10*	*12*
004	*Farndon Roundabout*	*478120 / 352440*	*80*	*0*	*0*	*5*	*5*
005	*A46 Mainline - 1560m southwest of Brownhills Roundabout*	*480141 / 355313*	*69*	*0*	*0*	*4*	*4*
006	*Winthorpe Roundabout*	*482289 / 356855*	*69*	*0*	*0*	*4*	*4*

Source: Mott MacDonald/Skanska, A46 Newark Bypass Technical Note (TN1), PIC Overview (Table 3-3)

Additional cluster site analysis was carried out using National Highways' cluster site criteria (2000m diameter, minimum 2 Killed or Seriously Injured PICs). Using these criteria, four cluster sites were identified. One of these had not been identified previously (referred to as Cluster site 007), which is located on the A46 southbound mainline carriageway 500 metres south of Winthorpe Roundabout.

Departures and relaxations

Identified departures and relaxations from standards (DfS) were provided in a 'DfS Checklist' (Document ref: HE551478-MOTG-GEN-CONWI_CONW-TK-CH-00002_P02_S2, 10/02/2023) and a 'Departures Locations' drawing (Document ref: HE551478-SKAG-HGN-CONWI_CONW-DR-CH-00002_P01_S3, 15/11/2022).

The Audit Team has extracted the following pertinent information relating to Departures from Standard (DfS) for the scheme, which is presented in **Table 1.2** below:

Table 1.2: Notable DfS information provided for this audit

Ref	Location	Chainage	Description	DfS Summary
M-2	*Trent River Bridge, north of Farndon Junction*	*Northbound 90-490*	*Non-permitted combination of SSD and vertical alignment tying into the existing bridge structure over the River Trent on NB carriageway*	*Combination of 2 step relaxation of vertical alignment and 2 step relaxation in SSD. Where coincident, the combination of these relaxations is not permitted under CD 109 clause 2.12.* *The vertical curvature may be constrained by the structure spanning the River Trent. The existing structure on the SB carriageway is to standard since the A46 is single carriageway (assumed 100kph design speed). This will be upgraded to dual carriageway through the scheme proposals.*
M-3	*Trent River Bridge, north of Farndon Junction*	*Southbound 90-490*	*Non-permitted combination of SSD and vertical alignment tying into the existing bridge structure over the River Trent on NB carriageway*	*Combination of 2 step relaxation of vertical alignment and 1 step relaxation in SSD. Where coincident, the combination of these relaxations is not permitted under CD 109 clause 2.12.* *The vertical curvature is constrained by the existing bridge structure. The existing structure is to standard since the A46 is single carriageway assumed 100kph design speed). This will be upgraded to dual carriageway through the scheme proposals.*
M-4	*South of Cattle Market*	*Northbound 1770-2200*	*Below desirable minimum Stopping Sight Distance (SSD) on the approach to Cattle market junction on the NB side*	*SSD is 1 step below desirable minimum on approach to the Cattle Market junction slip.* *Relaxations in SSD are not permitted within 1.5 times the SSD to the start of the diverge taper through to the back of the nose (CD 109, clause 2.13).*
M-5	*South of Cattle Market*	*Southbound 2050-2600*	*Below desirable minimum Stopping Sight Distance (SSD) on the approach to the merge from Cattle market junction on the SB side*	*SSD is 1 step below desirable minimum on approach to the Cattle Market junction slip.* *Relaxations in SSD are not permitted within 1.5 times the SSD to the back of the nose through to the end of the merge taper (CD 109, clause 2.13).*
M-6	*South of the Trent River Viaduct, north of Cattle Market*	*Northbound 0930-3075*	*Below desirable minimum Stopping Sight Distance (SSD) on the approach to the merge from Cattle market junction on the NB side*	*Horizontal alignment is 1 step below desirable minimum; SSD achieved is 1 step below desirable minimum.* *Relaxations in SSD are not permitted within 1.5 times the SSD to the back of the nose through to the end of the merge taper (CD 109, clause 2.13).*
M-6	*South of the Trent River Viaduct, north of Cattle Market*	*Southbound 3050-3300*	*Below desirable minimum Stopping Sight Distance (SSD) on the approach to Cattle market junction on the SB side*	*Horizontal alignment is 1 step below desirable minimum; SSD achieved is 1 step below desirable minimum.* *Relaxations in SSD are not permitted within 1.5 times the SSD to the back of the nose through to the end of the merge taper (CD 109, clause 2.13).*

Ref	Location	Chainage	Description	DfS Summary
M-10	*Mainline Carriageway*	*Northbound 5200-5570*	*Below desirable minimum SSD on approach to ESSO garage junction on the NB side*	*SSD 1 step below desirable minimum on approach to ESSO garage. Relaxations in SSD are not permitted within 1.5 times the SSD to the start of the diverge taper through to the back of the nose (CD 109, clause 2.13).* *Combination in relaxation of horizontal alignment and SSD is permitted as per CD 109.*
M-16	*Mainline Carriageway*	*Southbound 5410-5480*	*Below desirable minimum SSD on approach to layby*	*SSD 1 step below desirable minimum on approach to layby. Relaxations in SSD are not permitted within 1.5 times the SSD to the back of the nose through to the end of the merge taper (CD 109, clause 2.13*
M-17	*Cattle Market, Eastbound OnSlip*	*Northbound*	*Cattle Market NB onslip having a Type A merge*	*3.15 Parallel merges (Layout B) shall be used instead of taper merges (Layout A) if one or more of the following apply: 1) the mainline horizontal radius is less than desirable minimum in a left hand curve direction; (CD122)*
C-1	*Farndon to Cattle Market*	*North and Southbound*	*Reduction in Cross Section*	*Options to be explored include:* *1. SWC in hard strip with reduced verge width* *2. Reduced hard strip (300mm or 500mm)* *3. Hard strip within central reserve*
C-2	*Cattle Market to Winthorpe*	*North and Southbound*	*Reduction in Cross Section*	*Options to be explored include:* *1. SWC in hard strip with reduced verge width* *2. Reduced hard strip (300mm or 500mm)* *3. Hard strip within central reserve*
J-1	*Cattle Market A617 Kelham Road*	*Kelham Road Northbound*	*Deflection from A617 Kelham Road to Cattle Market roundabout*	*Deflection calculation from A617 to Cattle Market junction does not meet the maximum desired value of 100m radius. The deflection achieved is 166.8m. This is taken from the offside lane on approach to the junction, crosses the 3 lanes at the junction and returns to the offside lane once on the roundabout - an unlikely route for any car to take.*

Source: Mott Macdonald. Extracted from the ‘DfS Checklist’ (Doc ref: HE551478-MOTG-GEN-CONWI_CONW-TK-CH-00002_P02_S2, 10/02/2023

The information presented in the DfS Checklist did not correspond with the Departures Location drawing. For example, item reference M-17 was not shown on the drawing.

It was noted that there were no DfS listed for the proposed through-about arrangement at Winthorpe Junction. Furthermore, the corresponding Departures Location drawing indicated that the configuration of Winthorpe Junction was different to other scheme information provided for this audit (i.e. the A46 dual carriageway shown as major through-about route through the junction).

The DfS Checklist did not indicate any appropriate mitigations measures to improve road safety at the locations identified.

It is understood that none of the items shown in the DfS Checklist had yet been approved / endorsed by National Highways, Safety Engineering Standards (SES).

Factors affecting road safety

Two potential factors that may impact on road safety were highlighted in the RSA1 Brief:

1. *Winthorpe through-about - GG104 Assessment comparing the Preferred Route Announcement (PRA) layout and the Design Fix 3C layout can be found HE551478-SKAG-HGN-CONWI_CONW-RA-CH-00001_P01_S2.*
2. *The A46 crosses the Nottingham to Lincoln railway line at two locations and the East Coast Mainline.*

Strategic decisions

No strategic scheme decisions were indicated in the RSA1 Brief.

Items raised at previous road safety audits

Whilst there is no requirement to review these documents at Stage 1 RSA, the Audit Team is aware of a previous Interim RSA1 being undertaken, resulting in the following two reports being produced:

1. **Interim Stage 1 Road Safety Audit**
   This was conducted by Mott MacDonald in November 2022 (Document ref.: 406395GK-TPN-HTS-200-A) and identified 17 problems and recommendations. It is understood that full scheme information was not available at the time of writing, due to the project being at an early stage of its lifecycle (PCF Stage 3; frozen for consultation at Preliminary Design). The design comprised two scheme option layouts for Winthorpe Junction (an at-grade roundabout and an at-grade roundabout serving 'through-about' movements for the A46 mainline carriageway).
2. **Interim Stage 1 RSA Response Report**
   A response report, containing a Road Safety Audit Decision Log, was produced by the Design Organisation (Mott MacDonald / Skanska) in collaboration with the Overseeing Organisation (National Highways) in March 2023 (Document ref.: HE551478-SKAG-HGN-CONWI_CONW-RP-CH-00014_P02).
   The Design Organisation 'accepted' 10 of the items raised, 'accepted the RSA problem raised, but suggest an alternative solution' for five of the items, and 'disagreed' with two of the problems / recommendations raised in the audit.
   It is understood that the Overseeing Organisation generally agreed with the Design Organisation's responses and appropriate RSA actions were listed in the Decision Log.

2 Items Raised at this Stage 1 Audit

This section describes the road safety related issues identified by the Audit Team during this Stage 1 Road Safety Audit. A reference key plan is shown at **Appendix B**.

General, scheme extents

2.1 Problem 001

Location: *Throughout scheme, at various locations.*

Summary: *Absence of information relating to the provision of road lighting.*

The Audit Team has not sighted any technical information relating to road lighting, and therefore where street lighting will be provided, removed, or retained throughout the scheme.

There is a concern that at new junctions, modified alignments and where the scheme joins the existing road network, highway lighting may be required to reduce the risk of collisions and injury occurring at night or in poor weather conditions.

Recommendation

It is recommended that an assessment of road lighting is undertaken for the entire scheme extents, and the decisions regarding road lighting provision / removal are included in the preliminary design proposals.

2.2 Problem 002

Location: *Throughout scheme, at various locations.*

Summary: *Absence of information relating to lay-bys and other places of relative safety.*

During the site visit, it was evident that existing roadside lay-bys / parking areas were well used, by goods vehicles in particular. The Audit Team has established that there are currently four lay-by parking areas provided on the A46 mainline within the scheme extents.

However, the proposals indicate that all of the existing lay-bys will be removed due to carriageway widening. Two new lay-bys are proposed on the A46 southbound carriageway at approximate Ch.1200 and Ch.5100, however the Audit Team has not sighted any assessment work which support the decision to reduce the current lay-by provision.

In the absence of places of relative safety (such as a hard shoulder or refuge areas), the removal of lay-bys is likely to result in more instances of stranded / broken-down vehicles, which could be susceptible to rear-end impact collisions and subsequent injury to vehicle occupants.

Recommendation

It is recommended that the requirement for lay-bys / parking area provision is assessed and, as a minimum, retained throughout the scheme extents.

Any changes to lay-by provision may be subject to a Repeat RSA1, if deemed necessary by the Overseeing Organisation.

2.3 Problem 003

Location: *Throughout scheme, on various footway / cycleway routes.*

Summary: *Risk of injury due to insufficient cross-sectional width for pedestrians / cyclists adjacent to highways.*

The Audit Team is aware that a number of footways and shared use pedestrian / cycle routes are to be provided adjacent to high-speed highways (often with speed limits of 50mph or more).

The Typical Cross Section drawings indicate that there will be a lack of verge separation between the non-motorised user route and vehicles on adjacent routes. Where verge separation is shown, this is stated as being only 0.5m in most instances.

Without a sufficient buffer or verge separation between these two route types, users on the adjacent footways and shared use routes may be susceptible to the air turbulence created by passing motor traffic and from debris thrown up from the carriageway. There may also be a risk of pedestrian / cyclist injury from ‘glancing’ collisions or because of trips, slips, skids and falls into the carriageway.

Recommendation

It is recommended that appropriate verge separation (typically 1.5m minimum) is provided between footways / shared-use routes when adjacent to highways with traffic speeds of 40 mph or above.

2.4 Problem 004

Location: *Throughout scheme, at various proposed crossing points near to roundabouts.*

Summary: *Appropriateness of uncontrolled crossing points for pedestrians / cyclists at / near roundabouts.*

The Audit Team has identified a number of proposed uncontrolled crossing points near to roundabouts, namely at Cattle Market, Brownhills, Friendly Farmer and Winthorpe.

This may present a level of crossing difficulty and a risk of injury to pedestrians and cyclists alike, due to (list not exhaustive):

- The requirement for users to cross multiple traffic lanes, uncontrolled.
- Absence of refuge islands in between traffic streams (users are expected to cross and anticipate traffic from either direction).
- Propensity for accelerating traffic when exiting a roundabout and drivers not anticipating crossing movements.
- Users attempting to cross in between vehicles during slow moving / stationary traffic queues.

Recommendation

It is recommended that an appropriate assessment of each crossing point is undertaken, in order to determine the most suitable type and location of facility. This may include providing controlled crossing facilities, which could be incorporated with proposed traffic signal-controlled systems.

The assessment would need to consider the type, frequency, speed and crossing distance of pedestrians and cyclists, compared with the predicted speed and volume of motorised traffic.

2.5 Problem 005

Location: *Throughout scheme, at proposed overbridges and structures.*

Summary: *Risk of injury from suicide / self-harm incidents.*

The Audit Team has reviewed the scheme proposals taking into consideration the National Highways Suicide Prevention Site Assessment Guidance. Information related to recent reported suicide / self-harm incidents for the scheme extents has not been provided for this audit.

The Audit Team is of the opinion that that there may be a risk of opportunities for suicide / self-harm incidents at new overbridge structures, due to their location and accessibility.

Recommendation

It is recommended that design of structures includes reasonable steps to reduce the likelihood of suicide / self-harm injuries at all overbridge sites, following an appropriate assessment and application of nationally recognised guidance, such as the National Highways Suicide Prevention Toolkit.

A46 mainline, new dualled section

2.6 Problem 006

Location: *Between Cattle Market Junction roundabout and Winthorpe Junction, between approx. Ch.2500 and Ch.6700.*

Summary: *Collisions due to poor speed limit compliance within the proposed (lower) 50mph limit.*

The Audit Team understands that the proposed A46 mainline dualled carriageway section between Cattle Market Roundabout and Winthorpe Junction will be subject to a reduced posted speed limit of 50mph in both directions. However, it is not clear at this stage how appropriate traffic speeds will be encouraged / enforced throughout this section.

There is a concern that with traffic signing alone, speed limit compliance may be poor. This could lead to an increased risk of traffic collisions; particularly where horizontal and vertical highway alignments will not afford motorists with the sufficient stopping sight distance (SSD) to slow moving / stationary traffic queues or objects in the carriageway.

Without appropriate measures to encourage / enforce the reduced 50mph speed limit, there remains a risk of injury from collisions resulting from sudden braking and loss of control throughout this section.

Recommendation

It is recommended that measures to encourage appropriate traffic speeds and to enforce the proposed 50mph speed limit are identified and included in the preliminary scheme design.

A46 River Trent overbridge

2.7 Problem 007

Location: *A46 southbound, River Trent overbridge, approach to Farndon Roundabout junction.*

Summary: *Increased risk of rear-end shunts and overshoot collisions at / on approach to the roundabout.*

The proposed speed limit plan (Drawing ref.: HE551478-SKAG-HSN-CONWI_CONW-DR-CH-01226_P02_S3) indicates that there will be a new posted speed limit, reducing from the national speed limit (NSL) to 40mph, on the southbound approach to Farndon Roundabout, approximately 90m before the junction.

The Audit Team has reviewed the traffic flow and queue information provided for this RSA1 but has been unable to establish what the anticipated traffic queue lengths will be for this junction configuration. It is understood that there may be other risks relating to reduced Stopping Site Distance (SSD) due to engineering constraints on the Trent River overbridge, as highlighted in the DfS checklist (ref.: M-3).

There is a concern that over 90m, motorists at this location will not be afforded sufficient time to adjust (reduce) their approach speed appropriately, in advance of the junction or to the back of potential traffic queues. This in turn may increase the risk of collisions with other vehicles (rear end shunts) and / or loss of control type incidents (overshooting) at the roundabout.

Recommendation

It is recommended that the reduction in speed limit (to 40mph) is relocated northwards so that it commences further in advance of the junction.

The appropriate distance may be commensurate with the predicted / anticipated traffic queue lengths determined for this design

2.8 Problem 008

Location: *A46 northbound, River Trent overbridge.*

Summary: *Increased risk of rear-end shunts / collisions at the structure.*

The Audit Team is aware of a potential DfS (ref: M-2) required on the new dualled northbound carriageway over the Trent River Bridge, due to the vertical curvature of the structure. The proposed speed limit for the section is NSL (assumed 70mph).

Due to the likely reduction in SSD motorists may be afforded less time to slow / react to potential traffic or objects in the carriageway at this location. This could result in an increased risk of rear-end shunt type collisions or sudden (evasive) manoeuvres on the overbridge.

Recommendation

It is recommended the northbound speed limit on the River Trent overbridge is reduced to alleviate late braking and sudden manoeuvres.

Cattle Market Junction

2.9 Problem 009

Location: *A4617 Kelham Road, eastbound approach to A46 Cattle Market Junction roundabout, at approx. Ch.2500.*

Summary: *Risk of increased entry speeds due to highway widening and reduced deflection.*

On Kelham Road eastbound approach to Cattle Market Junction roundabout (a posted 50mph speed limit), the entry flare will be increased to three traffic lanes. It is understood that engineering constraints, presented by a nearby Grade II listed structure, limit the options for highway realignment at this location.

The cross-sectional width of the approach arm is likely to reduce entry deflection curvature into the roundabout, as highlighted in the DFS Checklist (ref.: J-1). As a consequence, motorists may be encouraged to enter the roundabout at inappropriate (higher) traffic speeds, increasing the risk of loss of control, overshooting and side impact type collisions on the roundabout.

The Audit Team has not sighted any accompanying collision mitigation measures for this identified risk.

Recommendation

It is recommended that mitigation measures are provided to warn and seek to reduce traffic approach speeds to the roundabout from Kelham Road.

2.10 Problem 010

Location: *Cattle Market Junction, crossing on the A46 northbound entry slip road, at approx. Ch.2750.*

Summary: *Proposed pedestrian / cycle crossing located away from desire line.*

On the northern and western sides of the Cattle Market Junction roundabout, the proposals indicate that new traffic signal-controlled crossings will be provided for pedestrians and cyclists.

The crossing area on the A46 northbound entry slip road results in a significant deviation from the proposed pedestrian / cycle route, away from the likely desire line. It is understood that the siting of this crossing area has been selected due to concerns about traffic queuing back onto Cattle Market Roundabout, although no crossing assessment has been sighted by the Audit Team (as raised previously in **Problem 004**).

There is concern that pedestrians and cyclists may instead choose to cross uncontrolled, away from the crossing area. This, in turn, could increase risk of conflicts and collisions with motorised traffic exiting the roundabout from Cattle Market Junction.

This issue maybe pertinent as the collision analysis provided for this audit has indicated that there have been two recent PICs involving cyclists at the Cattle Market Junction.

Recommendation

It is recommended that the location of the proposed shared-use crossing is assessed to determine the most suitable type and distance from the roundabout, in order to accommodate pedestrian / cycle desire lines safely.

2.11 Problem 011

Location: *A46 mainline (northbound) and entry / merge from Cattle Market Junction, at approx. Ch.3000.*

Summary: *Risk of collision / conflicts at the merge.*

The Audit Team is aware of the potential for reduced SSD due the horizontal alignment of the northbound carriageway approach to the entry slip road merge from Cattle Market Junction, which is one step below desirable minimum, as indicated in the DfS Checklist (ref.: M-6).

It is understood that the merge cannot be provided as a parallel merge with auxiliary lane (Layout B) due to engineering constraints presented by the nearby River Trent viaduct, although it is unclear at this stage how the risk of related collisions / conflicts due to reduced SSD will be mitigated.

The reduction in SSD may result in an increased risk of collisions from late breaking and sudden lane changing (rear-end shunt and side swipe type collisions).

Recommendation

It is recommended that motorists on the A46 northbound carriageway are provided with advanced warning of the potential for traffic merging at this location, with appropriate signing and road markings on the approach.

Great North Road

2.12 Problem 012

Location: *Great North Road, proposed traffic signal-controlled junction for lorry park.*

Summary: *Risk of collision / conflicts between two-way traffic.*

The Audit Team were asked to include some supplementary draft design proposals for a revised junction layout on the Great North Road, which is associated with a new lorry park access.

The drawing (Drawing ref.: B027614-TTE-00-XX-SK-O-0012 Rev P01) does not show any vehicle tracking or swept path analysis for the various manoeuvres at this traffic-signal controlled junction. Furthermore, the proposals do not include any on-road cycling facilities, such as cycle lanes or advanced stop-lines.

There is a concern that larger vehicles (such HGVs) turning in / out from the lorry park access will be at risk of collisions and injury with:

- other road traffic, in adjacent lanes (including cyclists)
- pedestrians, should overrunning of footways, crossing areas and kerbed refuges occur
- traffic islands and other roadside infrastructure
- debris (secondary collisions), in places that become susceptible to persistent vehicle overrunning

Recommendation

It is recommended that vehicle swept path analysis is undertaken for this junction design as part of the preliminary design proposals, using appropriate vehicle types and tracking speeds.

Any changes to, or introduction of, key junction design features (such as kerb radii, footways, traffic islands and roadside furniture) may be subject to a repeat RSA1, if deemed necessary by the Overseeing Organisation.

Brownhills Junction

2.13 Problem 013

Location: *New link road between the existing Brownhills Roundabout and the proposed Brownhills Junction, at approx. Ch.5250.*

Summary: *Risk of collision / conflicts between two-way traffic.*

The General Arrangement drawing indicates that motorists leaving Brownhills Roundabout (seeking the A46 southbound and the new Brownhills Junction) are provided with a two-lane exit.

The road narrows abruptly to a single lane after approximately 75m, requiring two streams of traffic to merge (from offside to nearside).

A proposed right turn lane with hatched ghost island (for motorists seeking the new Brownhills Junction) then develops after approximately 60m.

There is a concern that the requirement for traffic to merge (into a single lane) and then diverge (to reach the right turn facility) will not be intuitive. The arrangement may result in an increased risk of side swipe collisions, rear end shunts and inappropriate overtaking manoeuvres (overrunning of the ghost island markings).

The Audit Team also noted the short deceleration length provided for the right turn lane, which may exacerbate the highlighted issues - although this unusual layout is not indicated in the DfS information provided for audit.

Recommendation

It is recommended that the right turn lane (with ghost island) facility is provided with the appropriate lead in taper and deceleration length.

This may require a single lane exit being provided for traffic leaving the Brownhills Roundabout for the layout to operate safely.

Friendly Farmer Roundabout

2.14 Problem 014

Location: *Friendly Farmer Roundabout, near Winthorpe Service areas (both sides of the carriageway, between approx. Ch.5500 and Ch.5700.*

Summary: *Absence of appropriate routes and crossing facilities for non-vehicular users.*

The proposals show that the new A46 dualling will sever an existing footpath route, which runs north-south, on the west side of Winthorpe Service areas. The highway amendments near to the existing Friendly Farmer Roundabout, indicate that there will be no formalised routes or crossing areas for pedestrians and cyclists at the junction.

The absence of appropriate facilities for non-vehicular users in this area may result in an increased risk of injury, including collisions with motor traffic (from users crossing uncontrolled) and trips, slips and falls when walking on unmade routes / in verges.

It is understood that this previously identified risk (at iRSA1) would be highlighted to the assessment team conducting the WCHAR process.

Recommendation

It is recommended that provision for pedestrians and cyclists at this location is reviewed and appropriate facilities are provided.

Consideration should be given to how users may reach their intended destinations safely, by showing onward connectivity to existing / new routes and the wider public rights of way network.

Winthorpe Services (South)

2.15 Problem 015

Location: *Exit from Service Area (South) on to the proposed Two-Way Link Road, between Friendly Farmer Roundabout and Winthorpe Junction, at approx. Ch.5700.*

Summary: *Risk of turning movement conflicts and collisions with traffic on the new two-way link road.*

The proposed main access to / from this service area is to be located on the A17, on the southern side of the site.

North of the service area, at the proposed Two-Way Link Road, exit movements will be permitted (i.e. 'left and right out only' turning movements) - although this is not clearly shown on the drawings provided for audit.

The Audit Team is concerned that if 'right turn out' manoeuvres are permitted from the service area on to the two-way link road, then there may be an increased risk of conflicts and side-impact collisions at this location.

Recommendation

It is recommended that the junction, for the service area at the two-way link road, only permits left in / left out traffic movements.

Prohibited right turn in / out movements may be deterred with a constructed central island median / feature.

New two-way link road (between Friendly Farmer Roundabout and Winthorpe Junction)

2.16 Problem 016

Location: *Proposed A46 and two-way link road, between Friendly Farmer Roundabout and Winthorpe Junction, between approx. Ch.5550 and Ch.6580.*

Summary: *Risk of headlight glare between adjacent carriageways.*

The proposal drawings indicate that the new two-way link road and the adjacent A46 southbound carriageway will be in close proximity to one another. The amount of separation between the two highway routes is difficult to ascertain at this stage (is this shown in the typical cross section drawings?).

The typical cross sections drawings indicate that a 'safety barrier with anti-dazzle louvres' will be provided between Ch.6080 and Ch.6375. However, this results in approximately 500m of carriageway (to the south-west) where traffic may be susceptible to headlight glare between the two carriageways, during the hours of darkness.

Over this section, there may be a risk of drivers becoming dazzled / distracted oncoming vehicles, resulting in sudden braking and / or loss of control type collisions.

Recommendation

It is recommended that sufficient segregation between the two highways is provided, throughout the new two-way link road section, with appropriate screening where required.

This detail would be a requirement at detailed design (at RSA2).

2.17 Problem 017

Location: *Proposed two-way link road, northbound approach to A46 Winthorpe Junction.*

Summary: *Provision of Advance Direction Sign (ADS) and road markings on approach to Winthorpe Junction, at approx. Ch.6470.*

There is a proposal to provide a stack type ADS on the offside of the two-way link road (Sign ref.: SEC4-A46-ADS-FFNB-P-001). It is not clear at this stage what the dimensions of the sign assembly will be, and therefore, how much verge width is required to erect and position it safely.

The design of the sign face does not adequately convey the layout of the proposed junction (which is a through-about arrangement) and its location (in the offside verge) may not be seen easily and / or may mislead to motorists into moving right, into the oncoming traffic lane.

The proposed design and siting of the ADS is likely to cause driver confusion / hesitation resulting in collisions relating to late braking, sudden lane changing and wrong way driving.

Recommendation

It is recommended that for northbound motorists approaching Winthorpe Junction, an appropriate map-type ADS is provided in the nearside verge.

2.18 Problem 018

Location: *Proposed two-way link road, immediate vicinity of A46 Winthorpe Junction.*

Summary: *Risk of 'wrong way' driving and head-on collision / conflicts between two-way traffic.*

The proposals show that the on approach and exit arms at Winthorpe Junction roundabout, two traffic streams will converge to form the new two-way link road.

Allied to the concerns raised previously in **Problem 017**, the Audit Team is of the opinion that the proposed layout is likely to result in conflicts / collisions resulting from vehicles travelling in the wrong direction (head-on collisions), as there will be a lack of physical segregation between the traffic streams at this location.

Recommendation

It is recommended that the highway layout is reviewed and amended, so as to reduce the risk of vehicles travelling in the wrong direction / on the wrong side of the two-way link road.

This may include the provision of a constructed central median (between the two traffic streams) with appropriate traffic signing and road markings.

Winthorpe Junction

2.19 Problem 019

Location: *A46 Winthorpe Junction, 'through-about' junction layout.*

Summary: *Risk of collisions associated with the provision of this 'through-about' junction layout.*

The proposed through-about arrangement at Winthorpe Junction shows that:

- The existing 4-arm roundabout will be redesigned to include a throughout arrangement, under traffic signal control.
- The roundabout circulatory carriageway will be repositioned, and its inscribed circular diameter (ICD) will be increased / enlarged
- A46 mainline (dual carriageway) traffic will travel around the roundabout circulatory carriageway
- Northbound traffic from the new two-way link road will pass through the roundabout, to reach the A46 northbound carriageway.

As stated in the introduction of this report, the Audit Team has been unable to determine a number of key design features relating to this proposed layout as the full scheme information, typically expected for a Stage 1 RSA.

The absence of full / complete preliminary design information and assessment for this junction layout work may result in a number of road safety risks to all users. These are currently unquantifiable and cannot be identified by the RSA1 Audit Team at this stage.

Recommendation

It is recommended that the preliminary design and assessment work for Winthorpe Junction is completed and made available for a repeat RSA1.

The repeat audit may only be necessary for the scheme elements that have changed (in accordance with DMRB GG 119, paras 4.21 & 4.22).

2.20 Problem 020

Location: *A46 Winthorpe Junction, at various locations.*

Summary: *Risk of collisions with traffic islands and equipment on the roundabout circulatory carriageway.*

The General Arrangement and Plan & Profile drawings indicate that kerbed traffic splitter islands will be provided on the circulatory carriageway, in the southern and eastern quadrants of the roundabout.

The Audit Team has not sighted any cross-sectional information for these locations, and no vehicle swept path analysis for movements either side of these islands was provided.

The presence of constructed kerbed traffic islands on the roundabout circulatory may not be readily anticipated by motorists This could result in an increased risk of collisions with the islands and equipment (signs, traffic signals, cabinets etc) located on them.

Recommendation

It is recommended that the constructed kerbed traffic islands are omitted from the proposals.

Traffic movements on the circulatory carriageway maybe better served / guided with appropriate roundabout road markings (lane lines and hatching), depending on the type of layout selected.

2.21 Problem 021

Location: *A46 Winthorpe Junction, northern side, uncontrolled at-grade crossing facilities.*

Summary: *Risk of injury to pedestrians, cyclists and horse-riders seeking to cross at-grade and uncontrolled.*

The Audit Team has reviewed a Safety Risk Assessment (Document ref.: HE551478-SKAG-HGN-CONWI_CONW-RA-CH-00001_P01_S2') which does not appear to consider the specific risks to pedestrian, cycle and horse-riding users that require to cross at Winthorpe Junction. Furthermore, no WCHAR Assessment Report has been provided / sighted for this audit.

The proposals indicate that there will be uncontrolled at-grade provision for pedestrians and cyclists crossing the A46 (north to south) on the north-east side of Winthorpe Junction.

This facility may present a level of difficulty for all users attempting to cross the highway in a safe manner, particularly as they will be expected to cross four separate high-speed carriageways in succession, without any traffic control.

The requirement to cross each highway at-grade, may increase the risk of pedestrian and cyclist collisions with motorised traffic. Furthermore, the provision of uncontrolled crossings may result in users attempting to cross in between slowing / stationary traffic queueing for the traffic signal-controlled roundabout (and being unsighted by motorists in other lanes).

Recommendation

Whist it is accepted that the provision of a pedestrian / cycleway overbridge may not be possible due to engineering and environmental constraints, it is recommended that crossing requirements and demands are first assessed in terms of safety and suitability, to determine the best crossing solution for walking, cycling and / or horse-riding.

The complexities presented to more vulnerable populations, such as children, the elderly, sight / hearing / mobility impaired, cyclists, e-scooter riders, wheelchair and pushchair users will also need to be considered.

2.22 Problem 022

Location: *A46 Winthorpe Junction, proposed gantry structure across the eastern quadrant of the roundabout circulatory carriageway.*

Summary: *Risk of collisions from motorists being unable to identify destinations / select traffic lanes presented on gantry signing (due to positioning / angle).*

Across the eastern quadrant of the roundabout circulatory carriageway, there is a proposed gantry sign spanning four traffic lanes (Sign ref.: SE64-A46-ADS-SB-P-003).

Due to the positioning the gantry structure, it is possible that the destinations (shown on the gantry sign) may not be obvious to motorists on all approaches. For example, for circulatory traffic travelling around the northern quadrant, the angle of gantry is likely to result in difficulty when attempting to locate destinations and select lanes.

This in turn could result in sideswipe and / or rear end shunt type collisions from sudden lane changing and braking.

Recommendation

It is recommended that the positioning of the gantry structure / signing is reviewed, to ensure that all destinations can be seen by motorists at appropriate distances.

2.23 Problem 023

Location: *Drove Lane, south of A46 Winthorpe Junction, at approx. Ch.6700.*

Summary: *No crossing facilities for pedestrians / cyclists between new and existing networks.*

The proposals for Winthorpe Junction indicate that a pedestrian and cycling route will be provided for users seeking / travelling from Drove Lane. However, it is not clear how crossing movements across Drove Lane will be managed, as no crossing facilities are shown on this two-way road, which is subject to a posted NSL (assumed 60mph speed limit).

There is a concern that the absence of a suitable crossing area between the existing and proposed facilities may result in an increased risk of collisions and injury to pedestrians and cyclists seeking to cross Drove Lane.

Recommendation

It is recommended that the proposals carefully consider the needs of all non-motorised user requirements to and from Drove Lane, providing appropriate crossing facilities and / or highway cycle transitions where required.

These may first be identified through an assessment of the existing walking, cycling and horse-riding infrastructure and liaison with public user groups, undertaken through the WCHAR process.

3 Audit Team Statement

We certify that this audit has been carried out in accordance with National Highways (formerly, Highway England) standard DMRB GG 119, revision 2.

Road Safety Audit Team Leader

[redacted] MILT, MCIHT, MSoRSA, RegRSA (IHE) Signed:

Certificate of Competency in Road Safety Audit, gained in Sep 2012

Principal Road Safety Engineer
Mott MacDonald Date: 26th May 2023
Highways and Intelligent Transport Systems
4th Floor
Mountbatten House
Grosvenor Square
Southampton SO15 2JU

Road Safety Audit Team Member

[redacted] CIHT, MSoRSA Signed:

Certificate of Competency in Road Safety Audit, gained in June 2019

Principal Civil Engineer
Mott MacDonald Date: 26h May 2023
Highways and Intelligent Transport Systems
4th Floor
Mountbatten House
Grosvenor Square
Southampton SO15 2JU

Others Involved

(Such as an observer, Police/Network Management representative or specialist advisor)

None

Appendices

A. Drawings and Documents Examined

The following drawings and documents were provided and examined as part of this Road Safety Audit.

A.1 Drawings

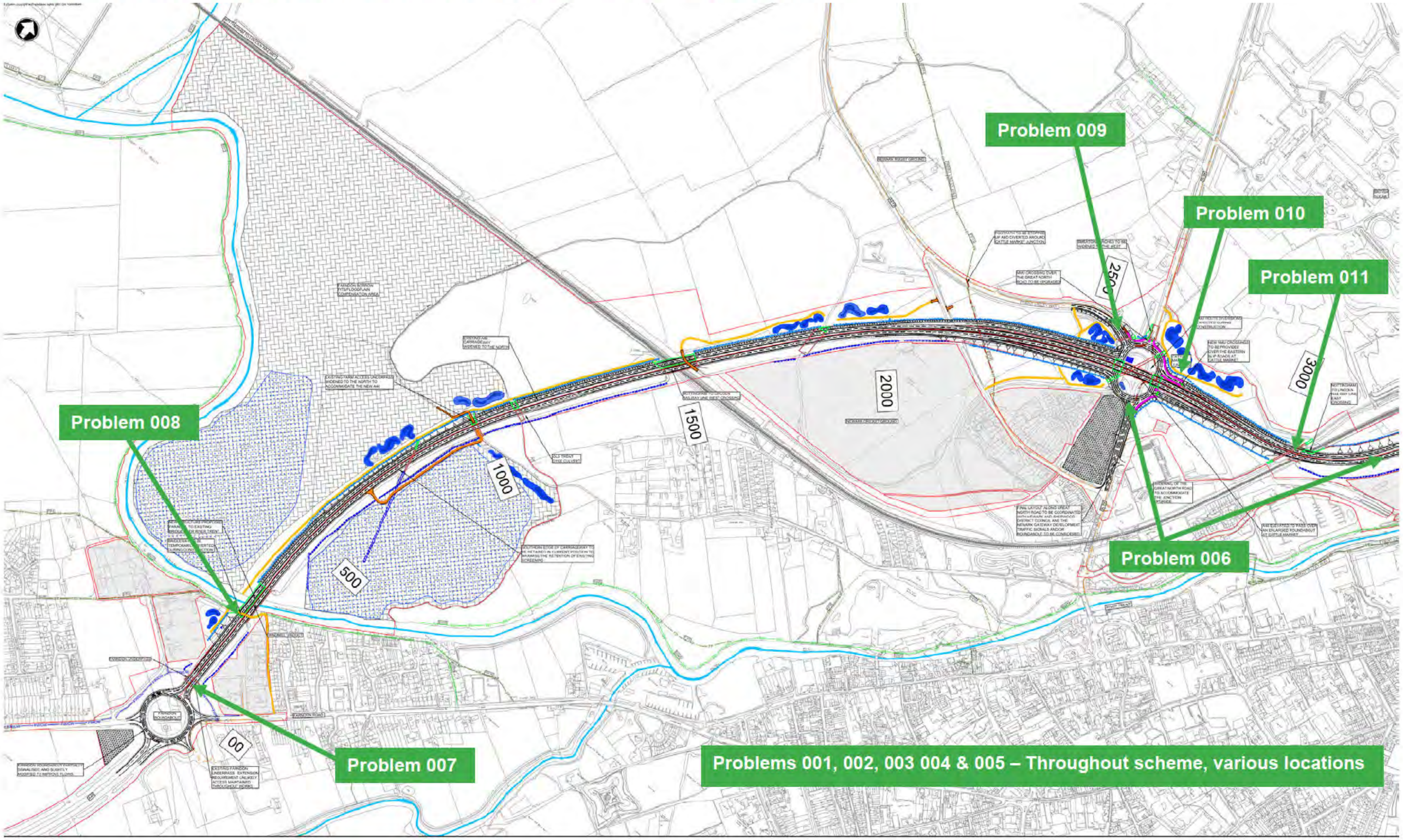
Drawing number	Rev	Drawing title
HE551478-SKAG-HGN-CONWI_CONW-DR-CH-00100_P01_S2	P01	General Arrangement Overview
HE551478-SKAG-HGN-CONWI_CONW-DR-CH-00002_P01_S3	P01	Departure Locations - Scheme Wide
HE551478-SKAG-GEN-CONWI_CONW-DR-CH-00004_P01_S3	P01	A46 Typical Cross Sections - Sheet 1 of 4
HE551478-SKAG-GEN-CONWI_CONW-DR-CH-00005_P01_S3	P01	A46 Typical Cross Sections - Sheet 2 of 4
HE551478-SKAG-GEN-CONWI_CONW-DR-CH-00006_P01_S3	P01	A46 Typical Cross Sections - Sheet 3 of 4
HE551478-SKAG-GEN-CONWI_CONW-DR-CH-00007_P01_S3	P01	A46 Typical Cross Sections - Sheet 4 of 4
HE551478-SKAG-HGN-CONWI_CONW-DR-CH-00051_P01_S2	P01	Southbound Plan and Profile Sheet 1 of 5
HE551478-SKAG-HGN-CONWI_CONW-DR-CH-00052_P01_S2	P01	Southbound Plan and Profile Sheet 2 of 5
HE551478-SKAG-HGN-CONWI_CONW-DR-CH-00053_P01_S2	P01	Southbound Plan and Profile Sheet 3 of 5
HE551478-SKAG-HGN-CONWI_CONW-DR-CH-00054_P01_S2	P01	Southbound Plan and Profile Sheet 4 of 5
HE551478-SKAG-HGN-CONWI_CONW-DR-CH-00055_P01_S2	P01	Southbound Plan and Profile Sheet 5 of 5
HE551478-SKAG-HGN-CONWI_CONW-DR-CH-00151_P01_S2	P01	Northbound Plan and Profile Sheet 1 of 5
HE551478-SKAG-HGN-CONWI_CONW-DR-CH-00152_P01_S2	P01	Northbound Plan and Profile Sheet 2 of 5
HE551478-SKAG-HGN-CONWI_CONW-DR-CH-00153_P01_S2	P01	Northbound Plan and Profile Sheet 3 of 5
HE551478-SKAG-HGN-CONWI_CONW-DR-CH-00154_P01_S2	P01	Northbound Plan and Profile Sheet 4 of 5
HE551478-SKAG-HGN-CONWI_CONW-DR-CH-00155_P01_S2	P01	Northbound Plan and Profile Sheet 5 of 5
HE551478-MOTG-EGN-CONWI_CONW-DR-LE-00002	P07	A46 Environmental Constraints Plan
B027614-TTE-00-XX-SK-O-0012	P01	Great North Road Layout (Received 24/04/2023)
Other		
https://www.youtube.com/watch?v=fyCs6CmPdUo	-	'Highways Road Project' YouTube channel, 'A46 Newark Bypass fly-through video' for indictive scheme information (accessed May 2023)

A.2 Documents

Document reference	Rev	Document title
HE551478-SKAG-HGN-CONWI_CONW-RP-CH-00017	P01	Stage 1 Road Safety Audit Brief (approved 19/04/2023) Confirmation of clarifications received on 26/04/2023, by email.
406395GK-TPN-HTS-200-A	A	Interim Stage 1 Road Safety Audit, Mott MacDonald (Nov 2022)
HE551478-SKAG-HGN-CONWI_CONW-RP-CH-00014	P02	Interim Stage 1 RSA Response Report, Mott MacDonald / Skanska (Mar 2023) *Contained Decision Log
HE551478-MOTG-HGN-CONWI_CONW-RP-CH-00003	P02	Implementation Report for New Standards
HE551478-MOTG-GEN-CONWI_CONW-RP-TR-00002_P02_S3	P02	A46 Initial Traffic Modelling Report
HE551478-SKAG-GHS-CONWI_CONW-RP-ZS-00010_P01_S4	P01	A46 Newark Bypass (Technical Note 1) Personal Injury Collision Overview
HE551478-SKAG-HGN-CONWI_CONW-TK-CH-00002_P02_S2	P02	Departure from Standards Checklist, A46 Newark Bypass (NH PIN: HE551478), Reporting date: 10/02/2023
HE551478-SKAG-HGN-CONWI_CONW-RA-CH-00001_P01_S2	P01	Winthorpe VE Layout - GG104 Risk Assessment
HE551478-SKAG-GEN-CONWI_CONW-RP-CH-00004_P01_S2	P01	A46 Signal Costing Assumptions Note

B. Reference Key Plans

B.1: Key Plan 1 – Proposed A46 Newark Bypass scheme (General Arrangement - Chainage 0000 -3000)



Source: Mott MacDonald, based on General Arrangement drawing no. HE551478-SKAG-HGN-CONWI_CONW-DR-CH-00100_P01_S2 (Chainage 0000 – 3000) (Not to scale)

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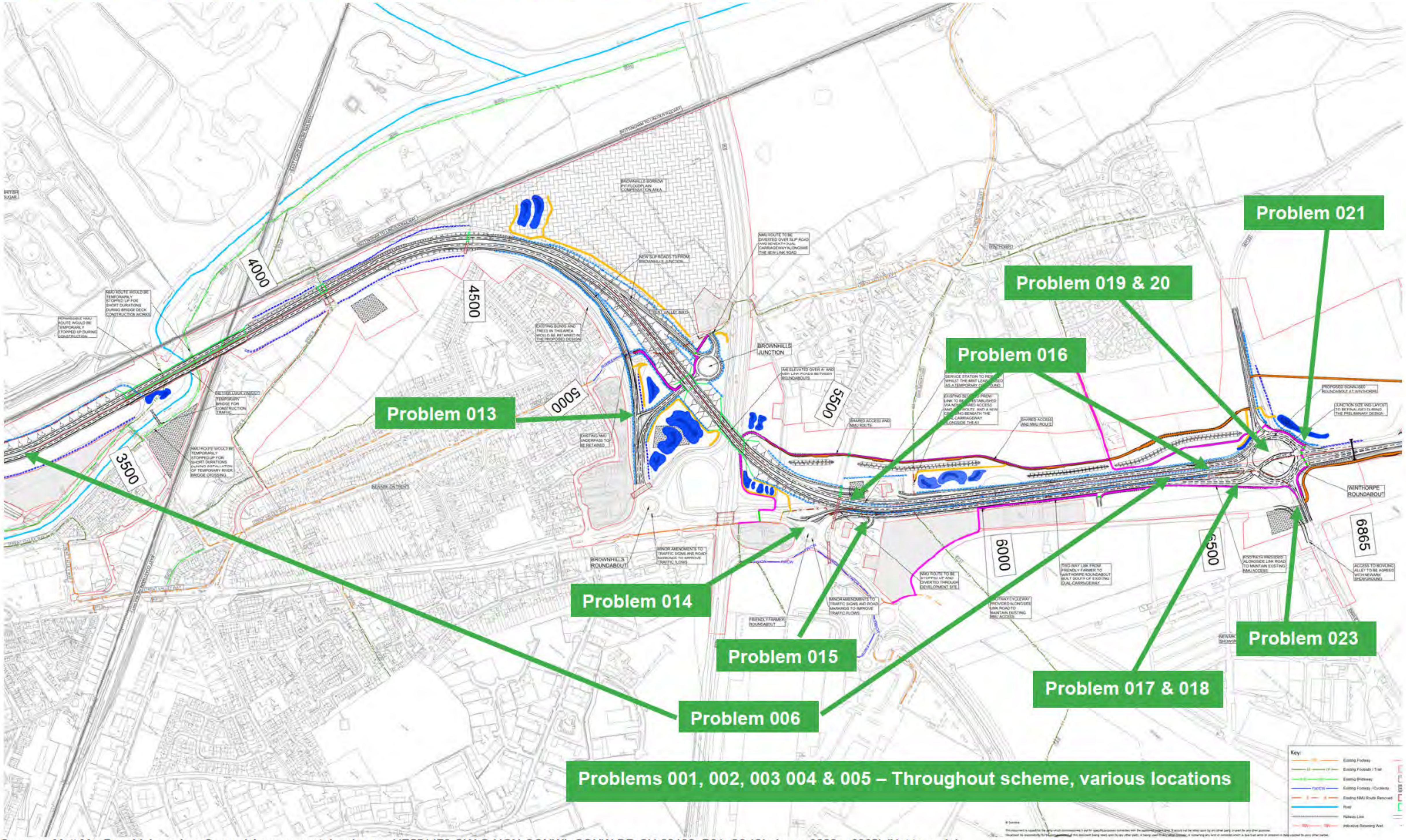
B.2: Key Plan 2 – Proposed A46 Newark Bypass scheme (General Arrangement - Chainage 3000 -6865)



Source: Mott MacDonald, based on General Arrangement drawing no. HE551478-SKAG-HGN-CONWI_CONW-DR-CH-00100_P01_S2 (Chainage 3000 – 6865) (Not to scale)

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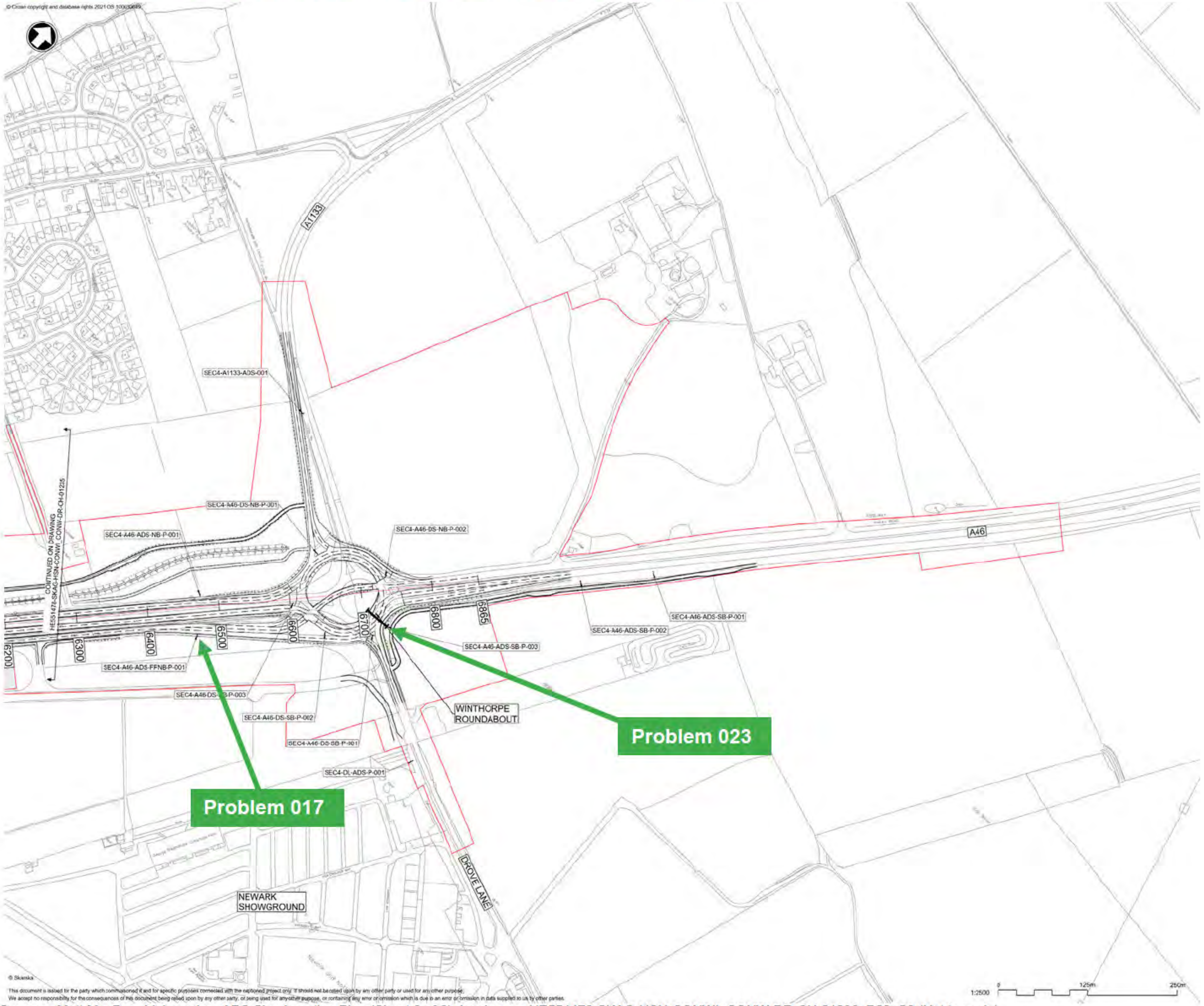
B.3: Key Plan 3 – Proposed A46 Newark Bypass scheme (ADS Sign Location Plan)



Source: Mott MacDonald, based on ADS Sign Location Plan (Sheet 6 of 6) drawing no. HE551478-SKAG-HSN-CONWI_CONW-DR-CH-01236_P02_S3 (Not to scale)

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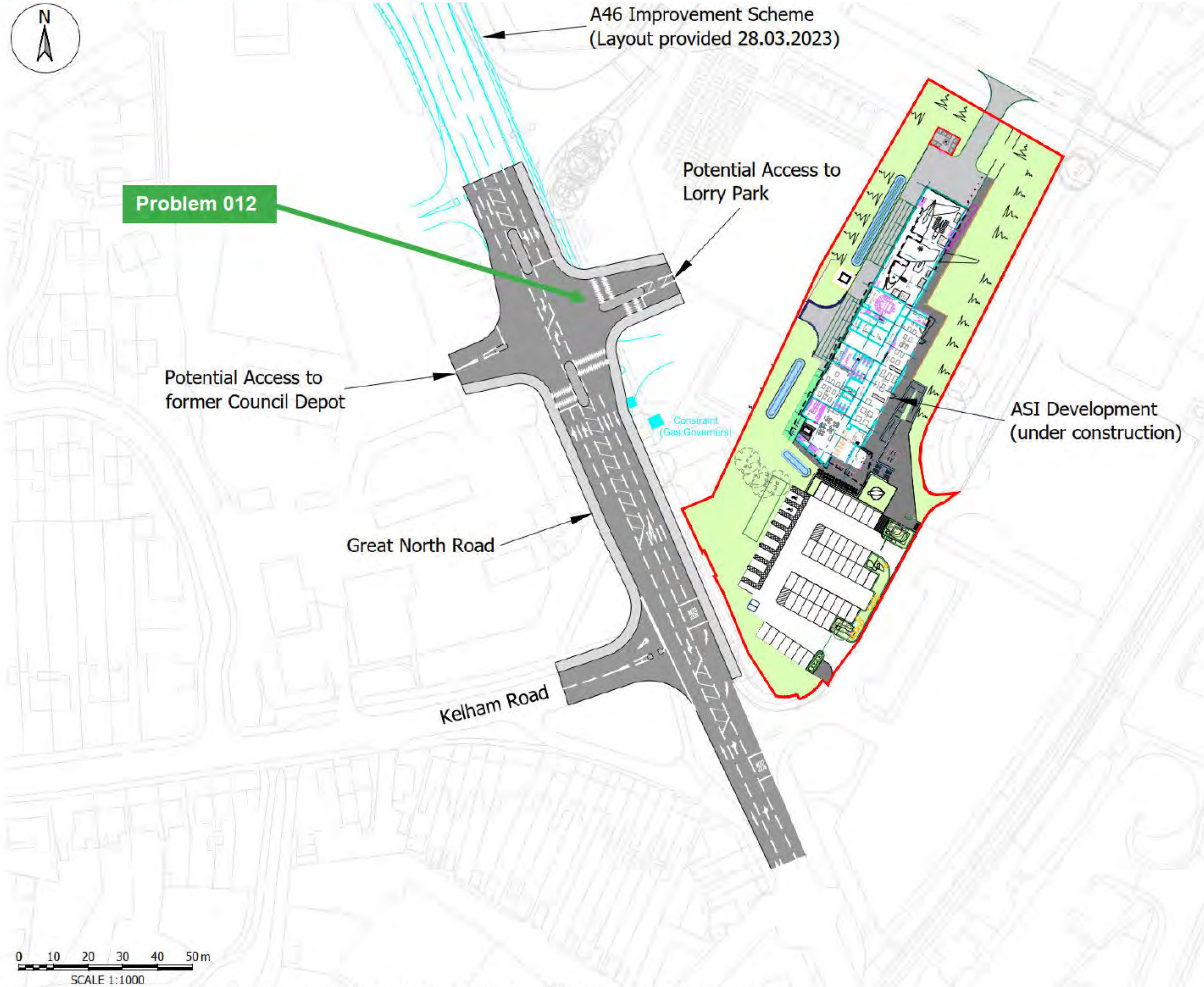
B.4: Key Plan 4 – Great North Road junction layout



Source: Mott MacDonald, based on Tetra Tech drawing no. B027614-TTE-00-XX-SK-O-0012 Rev P01– 14/04/2023 (Not to scale)

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Contents

Figures

Tables

1 Project Details

Table 2. Project details

Report title:	A46 Newark Bypass: Stage 1 RSA Response
Date:	25 August 2023
Document reference and revision:	HE551478-SKAG-HGN-CONWI_CONW-RP-CH-00025 P01
Prepared by:	Skanska Mott MacDonald
On behalf of:	National Highways

Table 3. Authorisation sheet

Project:	**A46 Newark Bypass**
Report title:	Stage 1 RSA Response
Prepared by:	
Name:	[redacted]
Position:	Civil Engineer
Signed:	
Organisation:	Mott MacDonald
Date:	25 August 2023
Approved by:	
Name:	[redacted]
Position:	Highways Design Lead
Signed:	
Organisation	Mott MacDonald
Date:	25 August 2023

2 Introduction

2.1 Scheme context

The A46 forms part of the strategic Trans-Midlands Trade Corridor between the M5 in the southwest and the Humber Ports in the northeast. The improvements to the A46 corridor are detailed within the Department for Transport's (DfT) second Road Investment Strategy (RIS2) as a mechanism for underpinning the wider economic transformation of the country. RIS2 makes a commitment to create a continuous dual carriageway from Lincoln to Warwick.

The stretch of A46 between the Farndon Junction, to the west of Newark-on-Trent and the A1 to the east of Newark-on-Trent, is the last remaining stretch of single carriageway between the M1 and A1 and consequently queuing traffic is a regular occurrence, often impacting journey time reliability.

2.2 Scheme location

The scheme would provide a dual carriageway on the A46 between Farndon and Winthorpe in Nottinghamshire. The Farndon roundabout is located at the southern extent of the scheme where the B6166 Farndon Road joins the A46.

The Winthorpe junction is located at the northern extent where the A1133 joins the A46. Along its route, it crosses the A617 and the B6326, at the Cattle Market junction, and the A1 between the Friendly Farmer and Brownhills roundabouts. Figure 1 below shows the location of the scheme.

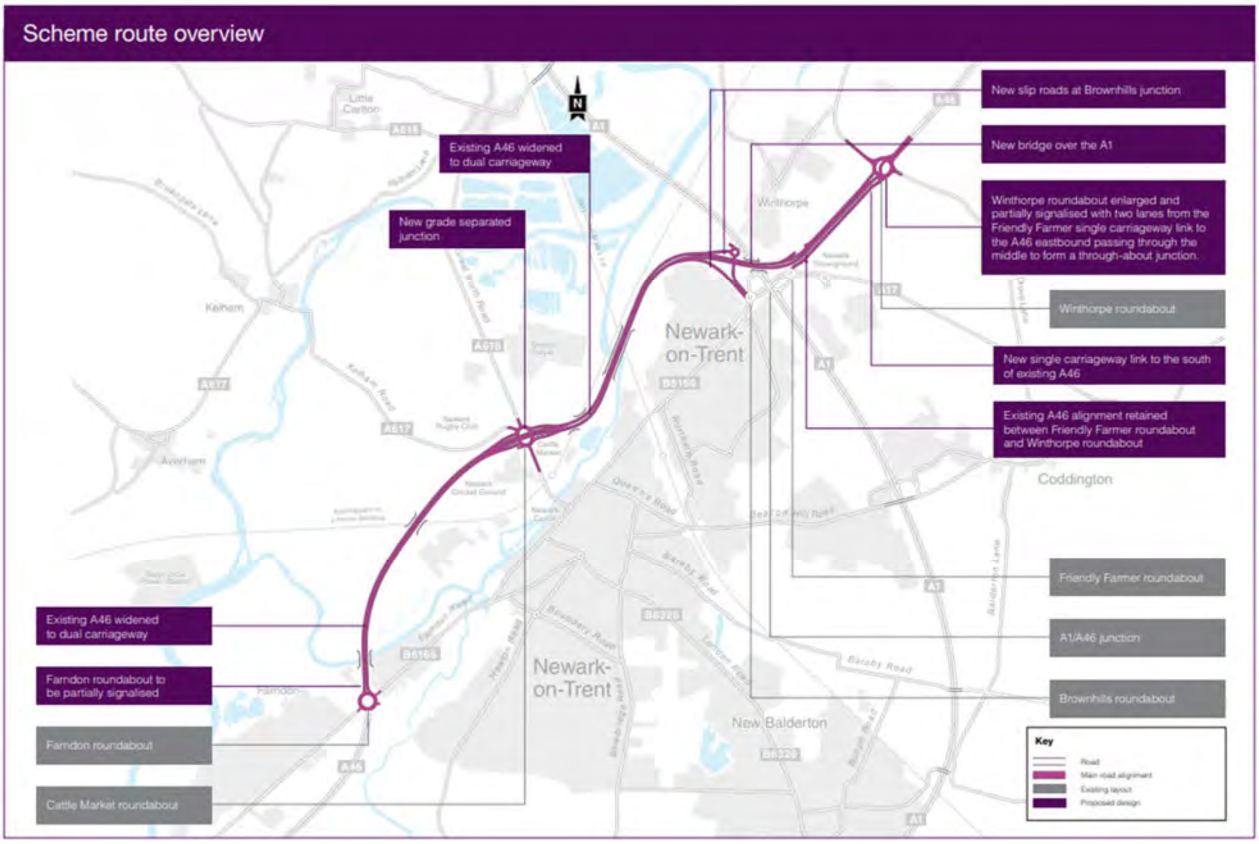

Figure 1. Scheme route overview

The scheme would be situated within the county boundary of Nottinghamshire County Council and within the administrative boundary of Newark and Sherwood District Council.

The scheme crosses the River Trent twice, the Nottingham to Lincoln railway line twice, and the East Coast Main Line once.

The existing A46, currently a single carriageway, is elevated on embankments due to the low-lying floodplain of the River Trent. This floodplain is located to the west of the A46 for the majority of the affected length, along with a section at the southern end on the eastern side of the A46. Several roundabouts form key junctions along the route, linking local A roads. Road infrastructure is softened by roadside vegetation in places and the River Trent is a strong natural influence within an otherwise built-up landscape. To the north of the A46, farmland dominates, interspersed with small-scale settlements. To the south of the A46, the town of Newark-on-Trent forms a notable urban settlement.

2.3 Scheme aims and objectives

The aim of the proposed scheme is to increase capacity and reduce traffic congestion on the A46 around Newark. This will directly contribute to the UK, regional and local Government's transport and economic growth plans by improving connectivity from Lincolnshire to the national motorway network, and improving route standard consistency for the A46, providing a consistent high standard dual carriageway between the Midlands and Lincoln.

Scheme-specific objectives have been used to develop the proposed scheme design which are set out below:

Safety	Improving safety through scheme design to reduce collisions for all users of the A46 scheme.
Congestion	Improve journey time and journey time reliability along the A46 and its junctions between Farndon and Winthorpe, including all approaches and A1 slip roads.
Connectivity	Accommodate economic growth in Newark-on-Trent and the wider area by improving its strategic and local connectivity.
Environment	Deliver better environmental outcomes by achieving a net gain in biodiversity and improve noise levels at Noise Important Areas along the A46 between Farndon and Winthorpe junctions.
Customer	Build an inclusive scheme which improves facilities for cyclists, walkers and other vulnerable users where existing routes are affected.

2.4 Scheme description

The section of the A46 that is to be upgraded is approximately 6.5 kilometres in length. The scheme comprises on-line widening for the majority of its length between Farndon roundabout and the A1. A new section of offline dual carriageway is proposed between the western and eastern sides of the A1 before the new dual carriageway ties into the existing A46 to the west of Winthorpe roundabout. The widening works include earthwork widening along the existing embankments, and new structures where the route crosses the railway lines, River Trent, the A1 and local roads.

The scheme consists of the following principal elements:

- Widening of the existing A46 to a dual carriageway for a distance of 6.5 kilometres to provide two traffic lanes in both directions.
- Partial signalisation of Farndon roundabout at the southern extents of the scheme.
- A new grade-separated junction at Cattle Market junction with the A46 elevated to pass over the roundabout. A larger roundabout beneath the A46 to provide increased capacity.
- A new off-line section to bypass the existing Brownhills roundabout and Friendly Farmer roundabout.
- A new grade separated northbound off slip to a new roundabout providing local access, with a two-way link road on the southern arm to connect with the existing Brownhills roundabout.
- A two-way parallel link road from Friendly Farmer to Winthorpe roundabout to the southern side of the existing dual carriageway.
- A new bridge structure across the existing A1, located to the north of the existing bridge
- An upgraded roundabout with partial signal controls at Winthorpe roundabout.
- Improvements to Walking, Cycling and Horse Riding (WCHAR) facilities through safer, enhanced routes.
- Three areas have been identified for floodplain compensation which are being referred to as the Kelham and Averham Floodplain Compensation Area (FCA), Farndon West and Farndon East. In addition, the Farndon East FCA will also be used as a borrow pit to support the creation of embankments required for the scheme.
- Drainage features including attenuation ponds.
- Environmental mitigation including landscape planting.
- Associated accommodation works and maintenance access tracks.

2.5 Purpose of this document

This document is a Road Safety Audit (RSA) Response Report that details the agreed actions following a review of the Stage 1 RSA (document reference: 406395GQ-TPN-HTS-208-A) undertaken on 04/05/23, and discussions between the Design Organisation (Skanska Mott MacDonald) and the Overseeing Organisation (National Highways). The Stage 1 RSA response log (HE551478-SKAG-HGN-CONWI_CONW-RP-CH-00024) is shown in Appendix A.

The involved parties have carefully considered all the problems and recommendations raised during the RSA, in accordance with Appendix F of the Design Manual for Roads and Bridges (DMRB) GG 119 Revision 2.

3 Key personnel

Table 4. key personnel

Overseeing Organisation:	[redacted] ational Highways
RSA team:	MCIHT, MSoRSA (Certificate of Competency in Road Safety Audit) Audit Team Leader, Mott MacDonald [redacted] MCIHT, MSoRSA (Certificate of Competency in Road Safety Audit) [redacted] ber, Mott MacDonald
Design organisation:	[redacted] MEng CEng MICE Highways Design Lead, Mott MacDonald

4 Organisation statements

Table 5. Design organisation statement

On behalf of the design organisation I certify that: 1. The RSA actions identified in response to the road safety audit problems in this road safety audit have been discussed and agreed with the Overseeing Organisation.	
Name:	[redacted]
Signed:	
Position:	Highways Lead
Organisation:	Mott MacDonald
Date:	25 August 2023

Table 6. Overseeing organisation statement

On behalf of the Overseeing Organisation I certify that: 1. The RSA actions identified in response to the road safety audit problems in this road safety audit have been discussed and agreed with the design organisation; and 2. The agreed RSA actions will be progressed.	
Name:	[redacted]
Signed:	
Position:	Project Manager
Organisation:	National Highways
Date:	25 August 2023

APPENDIX A. Road Safety Audit Decision Log

Reference: HE551478-SKAG-HGN-CONWI_CONW-RP-CH-00024

Problem Ref	Location	Summary	Issue	Recommendation	Design Organisation Response (either 'Accepted', 'Accepted with alterative solution' or 'Disagree')	TA Response	Overseeing Organisation Response	Agreed RSA Action (between Designer and Overseeing Organisation)
2.1/001	Throughout scheme, at various locations.	Absence of information relating to the provision of road lighting.	The Audit Team has not sighted any technical information relating to road lighting, and therefore where street lighting will be provided, removed, or retained throughout the scheme. There is a concern that at new junctions, modified alignments and where the scheme joins the existing road network, highway lighting may be required to reduce the risk of collisions and injury occurring at night or in poor weather conditions.	It is recommended that an assessment of road lighting is undertaken for the entire scheme extents, and the decisions regarding road lighting provision / removal are included in the preliminary design proposals.	Accepted with alternative solution - During Stage 3, a lighting appraisal has been conducted for pricing purposes and to give an idea of the lighting extents. The current proposed solution is to provide lighting at all junctions and approaches. Certain walking and cycling routes will also be lit accordingly. A detailed design will be carried out at Stage 5.	The TA agree with the proposed action, however the designer is reminded of the potential impact on the Environmental Statement of providing more street lighting than considered at DCO.	Accept	Detailed lighting design to be carried out at Stage 5. All junctions and approaches to be lit, as well as certain walking and cycling routes.
2.2 /002	Throughout scheme, at various locations.	Absence of information relating to lay-bys and other places of relative safety.	During the site visit, it was evident that existing roadside lay-bys / parking areas were well used, by goods vehicles in particular. The Audit Team has established that there are currently four lay-by parking areas provided on the A46 mainline within the scheme extents. However, the proposals indicate that all of the existing lay-bys will be removed due to carriageway widening. Two new lay-bys are proposed on the A46 southbound carriageway at approximate Ch.1200 and Ch.5100, however the Audit Team has not sighted any assessment work which support the decision to reduce the current lay-by provision. In the absence of places of relative safety (such as a hard shoulder or refuge areas), the removal of lay-bys is likely to result in more instances of stranded / broken-down vehicles, which could be susceptible to rear-end impact collisions and subsequent injury to vehicle occupants.	It is recommended that the requirement for lay-bys / parking area provision is assessed and, as a minimum, retained throughout the scheme extents. Any changes to lay-by provision may be subject to a Repeat RSA1, if deemed necessary by the Overseeing Organisation.	Disagree - According to CD 169, Table 2.2.4, the recommended spacing for non-emergency stopping provision for a dual carriageway is 2.5km. The only section of the scheme that exceeds this distance between junctions is between Cattle Market Roundabout and Winthorpe Junction in the Southbound direction. A lay-by was therefore provided along this section at approximately Chainage 5050. Due to the nature of the scheme having a constrained alignment and being on an embankment within a floodplain, providing additional lay-bys would present potential environmental and safety concerns. It is therefore not considered appropriate to provide additional lay-bys within the scheme. It is not possible to increase the length of the existing parking layby as extending it to the west would move it too close to the Brownhills southbound merge, and extending it to the east would extend it over the Brownhills Junction overbridge.	The TA provided a view on the lay-bys based on comments from OD and broadly agreed with the frequency of lay-by's based on the design standards and availability of junctions to other places of relative safety off the trunk route. The concern we had that needs to be considered is providing the appropriate parking capacity within the proposed lay-by to meet the recommendation of CD 169. The TA are not aware of an extra lay-by noted at Ch. 1200 by the audit team.	Accept-see TA comments	Additional parking lay-bys are not to be provided within the scheme extents. This approach is to be discussed with National Highways OD.
2.3/003	Throughout scheme, on various footway / cycleway routes.	Risk of injury due to insufficient cross-sectional width for pedestrians / cyclists adjacent to highways.	The Audit Team is aware that a number of footways and shared use pedestrian / cycle routes are to be provided adjacent to high-speed highways (often with speed limits of 50mph or more). The Typical Cross Section drawings indicate that there will be a lack of verge separation between the non-motorised user route and vehicles on adjacent routes. Where verge separation is shown, this is stated as being only 0.5m in most instances. Without a sufficient buffer or verge separation between these two route types, users on the adjacent footways and shared use routes may be susceptible to the air turbulence created by passing motor traffic and from debris thrown up from the carriageway. There may also be a risk of pedestrian / cyclist injury from 'glancing' collisions or because of trips, slips, skids and falls into the carriageway.	It is recommended that appropriate verge separation (typically 1.5m minimum) is provided between footways / shared-use routes when adjacent to highways with traffic speeds of 40 mph or above.	Accepted with alternative solution - A 0.5m separation has generally been provided between the highway and adjacent footways / shared-use routes, there is also a 1.0m hard strip along carriageways that provides further separation. This will be reviewed in Stage 5 where the speed limit is in excess of 40mph, and a greater separation will be provided if possible and deemed appropriate. It should be noted however that this will not be possible throughout the scheme due to space constraints. We will also look to reduce the 1.0m verge to the footway / cycleway offside in order to increase the separation.	The TA would remind the designer of the requirements contained within CD 143 and its associated England National Application Annex, including the note that a hard strip can be considered as part of the separation distance. However the TA agree that the required separation distance is a minimum and should be maximised where possible. If narrower verges are considered beyond the routes, edge-shyness to boundary fencing or vegetation should be considered and allowed for.	Accept-see TA comments	The separation between the edge of highway and footways / shared-use routes will be reviewed in Stage 5 to increase it where possible when taking into account other constraints.
2.4/004	Throughout scheme, at various proposed crossing points near to roundabouts.	Appropriateness of uncontrolled crossing points for pedestrians / cyclists at / near roundabouts.	The Audit Team has identified a number of proposed uncontrolled crossing points near to roundabouts, namely at Cattle Market, Brownhills, Friendly Farmer and Winthorpe. This may present a level of crossing difficulty and a risk of injury to pedestrians and cyclists alike, due to (list not exhaustive): • The requirement for users to cross multiple traffic lanes, uncontrolled. • Absence of refuge islands in between traffic streams (users are expected to cross and anticipate traffic from either direction). • Propensity for accelerating traffic when exiting a roundabout and drivers not anticipating crossing movements. • Users attempting to cross in between vehicles during slow moving / stationary traffic queues.	It is recommended that an appropriate assessment of each crossing point is undertaken, in order to determine the most suitable type and location of facility. This may include providing controlled crossing facilities, which could be incorporated with proposed traffic signal-controlled systems.	Accepted - All crossings have been assessed as part of the process of producing the WCHAR report. The vast majority of crossing points at / near roundabouts will be signalised. This includes: - All crossings at Cattle Market roundabout - The crossing near Brownhills Junction roundabout - The crossing between the existing Brownhills and Friendly Farmer roundabouts - The crossings to the east of Winthorpe Roundabout The only two crossings at / near roundabouts that will not be signalised is the crossing of the A1133 and the crossing of Drove Lane to the north and south of Winthorpe Roundabout respectively. This is because the traffic signal timings on Winthorpe Roundabout will create natural gaps for pedestrians / cyclists to cross the roads at these locations. A traffic island is provided for both crossings to reduce the number of traffic lanes being crossed in one movement.	The TA agrees with the designer's response.	Accept	Assessment has been undertaken as part of the WCHAR report. All crossings to be signalised other than the crossing of the A1133 and Drove Lane (north and south of Winthorpe Roundabout).
2.5/005	Throughout scheme, at proposed overbridges and structures.	Risk of injury from suicide / self-harm incidents.	The Audit Team has reviewed the scheme proposals taking into consideration the National Highways Suicide Prevention Site Assessment Guidance. Information related to recent reported suicide / self-harm incidents for the scheme extents has not been provided for this audit. The Audit Team is of the opinion that that there may be a risk of opportunities for suicide / self harm incidents at new overbridge structures, due to their location and accessibility.	It is recommended that design of structures includes reasonable steps to reduce the likelihood of suicide / self-harm injuries at all overbridge sites, following an appropriate assessment and application of nationally recognised guidance, such as the National Highways Suicide Prevention Toolkit.	Accepted - The National Highways Suicide Prevention Site Assessment Guidance will be used in the Stage 5 design.	The TA agrees with the designer's response.	Accept	The National Highways Suicide Prevention Site Assessment Guidance will be used in the Stage 5 design.
2.6/006	Between Cattle Market Junction roundabout and Winthorpe Junction, between approx. Ch.2500 and Ch.6700.	Collisions due to poor speed limit compliance within the proposed (lower) 50mph limit.	The Audit Team understands that the proposed A46 mainline dualled carriageway section between Cattle Market Roundabout and Winthorpe Junction will be subject to a reduced posted speed limit of 50mph in both directions. However, it is not clear at this stage how appropriate traffic speeds will be encouraged / enforced throughout this section. There is a concern that with traffic signing alone, speed limit compliance may be poor. This could lead to an increased risk of traffic collisions; particularly where horizontal and vertical highway alignments will not afford motorists with the sufficient stopping sight distance (SSD) to slow moving / stationary traffic queues or objects in the carriageway. Without appropriate measures to encourage / enforce the reduced 50mph speed limit, there remains a risk of injury from collisions resulting from sudden braking and loss of control throughout this section.	It is recommended that measures to encourage appropriate traffic speeds and to enforce the proposed 50mph speed limit are identified and included in the preliminary scheme design.	Accepted - Speed enforcement is being considered and is currently included within the design for this stretch of road following discussions with Nottinghamshire Police to encourage compliance with the 50mph speed limit. The installation of an average speed enforcement system was endorsed by SCRG at meeting No3 held on 6th June 2023.	The TA agrees with the designer's response.	Accept	Speed enforcement is to be included within the design to encourage compliance with the 50mph speed limit.

Problem Ref	Location	Summary	Issue	Recommendation	Design Organisation Response (either 'Accepted', 'Accepted with alterative solution' or 'Disagree')	TA Response	Overseeing Organisation Response	Agreed RSA Action (between Designer and Overseeing Organisation)
2.7/007	A46 southbound, River Trent overbridge, approach to Farndon Roundabout junction.	Increased risk of rear-end shunts and overshoot collisions at / on approach to the roundabout.	The proposed speed limit plan (Drawing ref.: HE551478-SKAG-HSN-CONWI_CONW-DR-CH_01226_P02_S3) indicates that there will be a new posted speed limit, reducing from the national speed limit (NSL) to 40mph, on the southbound approach to Farndon Roundabout, approximately 90m before the junction. The Audit Team has reviewed the traffic flow and queue information provided for this RSA1 but has been unable to establish what the anticipated traffic queue lengths will be for this junction configuration. It is understood that there may be other risks relating to reduced Stopping Site Distance (SSD) due to engineering constraints on the Trent River overbridge, as highlighted in the DfS checklist (ref.: M-3). There is a concern that over 90m, motorists at this location will not be afforded sufficient time to adjust (reduce) their approach speed appropriately, in advance of the junction or to the back of potential traffic queues. This in turn may increase the risk of collisions with other vehicles (rear end shunts) and / or loss of control type incidents (overshooting) at the roundabout.	It is recommended that the reduction in speed limit (to 40mph) is relocated northwards so that it commences further in advance of the junction. The appropriate distance may be commensurate with the predicted / anticipated traffic queue lengths determined for this design.	**Accepted with alternative solution** - The 40mph speed limit is proposed to match the existing. There were only three accidents on this stretch of road between January 2017 to December 2021, each of which was slight and caused by reckless driving or driving error, not poor visibility. Appropriate advance signage and road markings will be provided to warn drivers of upcoming roundabout to allow them to adjust their speed accordingly. Additionally the traffic signals will be on raised poles so that they are visible from a greater distance. The details of this will be produced at Stage 5.	The TA agrees with the designer's response, on the proviso that the anticipated maximum queue length is shorter than 90m.Any movement further north would be associated with potential enforcement issues on an otherwise national speed limit dual carriageway.	Accept - see TA comments	Appropriate advance signage, road markings and traffic signals on raised poles will be provided to warn drivers of the upcoming roundabout to allow them to adjust their speed accordingly. The length of queue will also be reviewed to inform this design.
2.8/008	A46 northbound, River Trent overbridge.	Increased risk of rear-end shunts / collisions at the structure.	The Audit Team is aware of a potential DfS (ref: M-2) required on the new dualled northbound carriageway over the Trent River Bridge, due to the vertical curvature of the structure. The proposed speed limit for the section is NSL (assumed 70mph). Due to the likely reduction in SSD motorists may be afforded less time to slow / react to potential traffic or objects in the carriageway at this location. This could result in an increased risk of rear-end shunt type collisions or sudden (evasive) manoeuvres on the overbridge.	It is recommended the northbound speed limit on the River Trent overbridge is reduced to alleviate late braking and sudden manoeuvres.	**Accepted with alternative solution** - A 40mph speed limit is proposed immediately north of the roundabout to match the existing. There were only three accidents on this stretch of road between January 2017 to December 2021, each of which was slight and caused by reckless driving or driving error, not poor visibility. As drivers will be exiting the roundabout and the 40mph speed limit zone when travelling over the River Trent Bridge they are unlikely to be travelling at 70mph, thus reducing the risk of collisions. As the road has been dualled, this also reduces the likelihood on encountering queuing traffic in this location. Appropriate signage and road markings will be considered at Stage 5 to ensure risks are as low as reasonably practicable.	The TA agrees with the designer's response, although the designer is reminded that the departure submission should demonstrate how much of a reduction in visibility there is associated to both the high object and low object heights. (For example, the impact of 280m achieved vs required 295m is different to 215m vs 295m but both are 1 step departures.)	Accept	Departure from Standards application to demonstrate the visibility reduction and any proposed mitigation measures.
2.9/009	A4617 Kelham Road, eastbound approach to A46 Cattle Market Junction roundabout, at approx. Ch.2500.	Risk of increased entry speeds due to highway widening and reduced deflection.	On Kelham Road eastbound approach to Cattle Market Junction roundabout (a posted 50mph speed limit), the entry flare will be increased to three traffic lanes. It is understood that engineering constraints, presented by a nearby Grade II listed structure, limit the options for highway realignment at this location. The cross-sectional width of the approach arm is likely to reduce entry deflection curvature into the roundabout, as highlighted in the DFS Checklist (ref.: J-1). As a consequence, motorists may be encouraged to enter the roundabout at inappropriate (higher) traffic speeds, increasing the risk of loss of control, overshooting and side impact type collisions on the roundabout. The Audit Team has not sighted any accompanying collision mitigation measures for this identified risk.	It is recommended that mitigation measures are provided to warn and seek to reduce traffic approach speeds to the roundabout from Kelham Road.	**Accepted with alternative solution** - The entry to the roundabout at this point has been redesigned following conclusion of the traffic modelling to only provide 2 lanes on the approach. This provides compliant deflection, removing the need for a departure and reducing the risk of vehicles entering the roundabout at excessive speeds.	The TA agrees with the designer's response.	Accept	Departure from Standards has been designed out - no further action.
2.10/010	Cattle Market Junction, crossing on the A46 northbound entry slip road, at approx. Ch.2750.	Proposed pedestrian / cycle crossing located away from desire line.	On the northern and western sides of the Cattle Market Junction roundabout, the proposals indicate that new traffic signal-controlled crossings will be provided for pedestrians and cyclists. The crossing area on the A46 northbound entry slip road results in a significant deviation from the proposed pedestrian / cycle route, away from the likely desire line. It is understood that the siting of this crossing area has been selected due to concerns about traffic queuing back onto Cattle Market Roundabout, although no crossing assessment has been sighted by the Audit Team (as raised previously in Problem 004). There is concern that pedestrians and cyclists may instead choose to cross uncontrolled, away from the crossing area. This, in turn, could increase risk of conflicts and collisions with motorised traffic exiting the roundabout from Cattle Market Junction. This issue maybe pertinent as the collision analysis provided for this audit has indicated that there have been two recent PICs involving cyclists at the Cattle Market Junction.	It is recommended that the location of the proposed shared-use crossing is assessed to determine the most suitable type and distance from the roundabout, in order to accommodate pedestrian / cycle desire lines safely.	**Accepted with alternative solution** - The traffic model indicates that moving the location of the crossing point closer to the exit from the roundabout would cause traffic to back onto the roundabout, increasing the risk of vehicle collisions. An assessment will be undertaken at Stage 5 to determine whether the addition of a pedestrian barrier would be appropriate to segregate traffic and guide pedestrians to the controlled crossing point.	The TA agrees with the designer's response.	Accept	The crossing point will not be moved, but an assessment will be undertaken at Stage 5 to determine whether the addition of a pedestrian barrier would be appropriate.
2.11/011	A46 mainline (northbound) and entry / merge from Cattle Market Junction, at approx. Ch.3000.	Risk of collision / conflicts at the merge.	The Audit Team is aware of the potential for reduced SSD due the horizontal alignment of the northbound carriageway approach to the entry slip road merge from Cattle Market Junction, which is one step below desirable minimum, as indicated in the DfS Checklist (ref.: M-6). It is understood that the merge cannot be provided as a parallel merge with auxiliary lane (Layout B) due to engineering constraints presented by the nearby River Trent viaduct, although it is unclear at this stage how the risk of related collisions / conflicts due to reduced SSD will be mitigated. The reduction in SSD may result in an increased risk of collisions from late breaking and sudden lane changing (rear-end shunt and side swipe type collisions).	It is recommended that motorists on the A46 northbound carriageway are provided with advanced warning of the potential for traffic merging at this location, with appropriate signing and road markings on the approach.	**Accepted** - Appropriate advance signage and road markings warning drivers of the potential for traffic merging will be provided in the detailed design.	The TA agrees with the designer's response.	Accept	Appropriate advance signage and road markings warning drivers of the potential for traffic merging will be provided in the detailed design.
2.12/012	Great North Road, proposed traffic signal-controlled junction for lorry park.	Risk of collision / conflicts between two-way traffic.	The Audit Team were asked to include some supplementary draft design proposals for a revised junction layout on the Great North Road, which is associated with a new lorry park access. The drawing (Drawing ref.: B027614-TTE-00-XX-SK-O-0012 Rev P01) does not show any vehicle tracking or swept path analysis for the various manoeuvres at this traffic-signal controlled junction. Furthermore, the proposals do not include any on-road cycling facilities, such as cycle lanes or advanced stop-lines. There is a concern that larger vehicles (such HGVs) turning in / out from the lorry park access will be at risk of collisions and injury with: • other road traffic, in adjacent lanes (including cyclists) • pedestrians, should overrunning of footways, crossing areas and kerbed refuges occur • traffic islands and other roadside infrastructure • debris (secondary collisions), in places that become susceptible to persistent vehicle overrunning	It is recommended that vehicle swept path analysis is undertaken for this junction design as part of the preliminary design proposals, using appropriate vehicle types and tracking speeds.	**Accepted** - Vehicle tracking has already been undertaken as part of the design of this junction which shows that large vehicles can safely navigate the junction. This will be reviewed again at Stage 5 and drawings will be provided.	The TA requests that this vehicle tracking is provided to confirm the current design but agrees with this in principle.	Accept	Vehicle tracking to be reviewed and provided to the TA.

Problem Ref	Location	Summary	Issue	Recommendation	Design Organisation Response (either 'Accepted', 'Accepted with alterative solution' or 'Disagree')	TA Response	Overseeing Organisation Response	Agreed RSA Action (between Designer and Overseeing Organisation)
2.13/013	New link road between the existing Brownhills Roundabout and the proposed Brownhills Junction, at approx. Ch.5250.	Risk of collision / conflicts between two-way traffic.	The General Arrangement drawing indicates that motorists leaving Brownhills Roundabout (seeking the A46 southbound and the new Brownhills Junction) are provided with a two-lane exit. The road narrows abruptly to a single lane after approximately 75m, requiring two streams of traffic to merge (from offside to nearside). A proposed right turn lane with hatched ghost island (for motorists seeking the new Brownhills Junction) then develops after approximately 60m. There is a concern that the requirement for traffic to merge (into a single lane) and then diverge (to reach the right turn facility) will not be intuitive. The arrangement may result in an increased risk of side swipe collisions, rear end shunts and inappropriate overtaking manoeuvres (overrunning of the ghost island markings). The Audit Team also noted the short deceleration length provided for the right turn lane, which may exacerbate the highlighted issues - although this unusual layout is not indicated in the DfS information provided for audit.	It is recommended that the right turn lane (with ghost island) facility is provided with the appropriate lead in taper and deceleration length. This may require a single lane exit being provided for traffic leaving the Brownhills Roundabout for the layout to operate safely.	**Accepted with alternative solution** - Two Lanes are required on exit from Brownhills roundabout to accommodate the traffic flows. Not providing two lanes could cause queues to develop on Brownhills Roundabout and lead to traffic queuing back onto the A1 mainline, which is considered a greater safety risk. It is accepted that this layout is not standard and the deceleration length is short. Vehicle speeds however will be low after exiting Brownhills roundabout, reducing the risk of having a shorter deceleration length. It is a small number of vehicles turning per day (single figures) and these users should be regular users who will be familiar with the junction layout. The design of this layout will be reviewed at Stage 5 to determine if it can be improved. It is possible a DfS will be required due to the non-standard layout. This would be sought in Stage 5 and appropriate signage and road markings provided to ensure layout risks are as low as reasonably practicable.	The TA agrees with the designer's response. The designer is requested to confirm what any departures from standards would be departing from.	Accept	The design of this layout will be reviewed at Stage 5 to see if it can be improved whilst retaining the two lanes on exit of Brownhills Roundabout that are required for traffic flow purposes.
2.14/014	Friendly Farmer Roundabout, near Winthorpe Service areas (both sides of the carriageway, between approx. Ch.5500 and Ch.5700.	Absence of appropriate routes and crossing facilities for non-vehicular users.	The proposals show that the new A46 dualling will sever an existing footpath route, which runs north-south, on the west side of Winthorpe Service areas. The highway amendments near to the existing Friendly Farmer Roundabout, indicate that there will be no formalised routes or crossing areas for pedestrians and cyclists at the junction. The absence of appropriate facilities for non-vehicular users in this area may result in an increased risk of injury, including collisions with motor traffic (from users crossing uncontrolled) and trips, slips and falls when walking on unmade routes / in verges. It is understood that this previously identified risk (at iRSA1) would be highlighted to the assessment team conducting the WCHAR process.	It is recommended that provision for pedestrians and cyclists at this location is reviewed and appropriate facilities are provided. Consideration should be given to how users may reach their intended destinations safely, by showing onward connectivity to existing / new routes and the wider public rights of way network.	**Accepted** - The route being severed has low usage and is currently considered unsafe as it is uncontrolled with poor visibility. There is an additional route which was historically severed by the existing road (as confirmed by the Nottinghamshire County Council definitive Right of Way Map). This severance is being addressed by the scheme by providing an alternative route that passes beneath the overbridge alongside the A1. This provides appropriate alternative access from the north to south sides of the A46. An at-grade crossing at this location would not be safe and the low predicted usage would not justify the cost and environmental impact of providing a grade-separated solution.	The TA agrees with the designer's response.	Accept	Walking and Cycling access to be provided between the north and south sides of the A46 as per the current design proposals.
2.15/015	Exit from Service Area (South) on to the proposed Two-Way Link Road, between Friendly Farmer Roundabout and Winthorpe Junction, at approx. Ch.5700.	Risk of turning movement conflicts and collisions with traffic on the new two-way link road.	The proposed main access to / from this service area is to be located on the A17, on the southern side of the site. North of the service area, at the proposed Two-Way Link Road, exit movements will be permitted (i.e. 'left and right out only' turning movements) - although this is not clearly shown on the drawings provided for audit. The Audit Team is concerned that if 'right turn out' manoeuvres are permitted from the service area on to the two-way link road, then there may be an increased risk of conflicts and side impact collisions at this location.	It is recommended that the junction, for the service area at the two-way link road, only permits left in / left out traffic movements. Prohibited right turn in / out movements may be deterred with a constructed central island median / feature.	**Accepted with alternative solution** - Only left-out movements will be permitted from this junction. No central island will be provided (there is also no space for this due to the space between the two service stations, but appropriate signage no-entry signage and layout will be provided to discourage any other movements.	The TA agrees with the designer's response.	Accept	Only left-out traffic movements will be permitted from this junction.
2.16/016	Proposed A46 and two-way link road, between Friendly Farmer Roundabout and Winthorpe Junction, between approx. Ch.5550 and Ch.6580.	Risk of headlight glare between adjacent carriageways.	The proposal drawings indicate that the new two-way link road and the adjacent A46 southbound carriageway will be in close proximity to one another. The amount of separation between the two highway routes is difficult to ascertain at this stage (is this shown in the typical cross section drawings?). The typical cross sections drawings indicate that a 'safety barrier with anti-dazzle louvres' will be provided between Ch.6080 and Ch.6375. However, this results in approximately 500m of carriageway (to the south-west) where traffic may be susceptible to headlight glare between the two carriageways, during the hours of darkness. Over this section, there may be a risk of drivers becoming dazzled / distracted oncoming vehicles, resulting in sudden braking and / or loss of control type collisions.	It is recommended that sufficient segregation between the two highways is provided, throughout the new two-way link road section, with appropriate screening where required. This detail would be a requirement at detailed design (at RSA2).	**Accepted** - The separation between the two carriageways will be 4m with a concrete barrier and anti-dazzle louvres between to prevent headlight glare from the opposing carriageways.	The TA agrees with the designer's response.	Accept	The separation between the two carriageways will be 4m with a concrete barrier and anti-dazzle louvres.
2.17/017	Proposed two-way link road, northbound approach to A46 Winthorpe Junction.	Provision of Advance Direction Sign (ADS) and road markings on approach to Winthorpe Junction, at approx. Ch.6470.	There is a proposal to provide a stack type ADS on the offside of the two-way link road (Sign ref.: SEC4-A46-ADS-FFNB-P-001). It is not clear at this stage what the dimensions of the sign assembly will be, and therefore, how much verge width is required to erect and position it safely. The design of the sign face does not adequately convey the layout of the proposed junction (which is a through-about arrangement) and its location (in the offside verge) may not be seen easily and / or may mislead to motorists into moving right, into the oncoming traffic lane. The proposed design and siting of the ADS is likely to cause driver confusion / hesitation resulting in collisions relating to late braking, sudden lane changing and wrong way driving.	It is recommended that for northbound motorists approaching Winthorpe Junction, an appropriate map-type ADS is provided in the nearside verge.	**Accepted** - All signage will be reviewed at Stage 5.	The TA agrees with the designer's response.	Accept	All signage for Winthorpe roundabout will be reviewed at Stage 5.
2.18/018	Proposed two-way link road, immediate vicinity of A46 Winthorpe Junction.	Risk of 'wrong way' driving and head-on collision / conflicts between two-way traffic.	The proposals show that the on approach and exit arms at Winthorpe Junction roundabout, two traffic streams will converge to form the new two-way link road. Allied to the concerns raised previously in Problem 017, the Audit Team is of the opinion that the proposed layout is likely to result in conflicts / collisions resulting from vehicles travelling in the wrong direction (head-on collisions), as there will be a lack of physical segregation between the traffic streams at this location.	It is recommended that the highway layout is reviewed and amended, so as to reduce the risk of vehicles travelling in the wrong direction / on the wrong side of the two-way link road. This may include the provision of a constructed central median (between the two traffic streams) with appropriate traffic signing and road markings.	**Accepted** - Appropriate signage, road markings and highway layout will be provided as the design is developed in Stage 5 to reduce the risk of wrong-way driving. This could include a constructed central median if deemed appropriate.	The TA agrees with the designer's response.	Accept	Appropriate signage, road markings and highway layout will be provided as the design is developed in Stage 5 to reduce the risk of wrong-way driving.

APPENDIX A - Road Safety Audit Decision Log

Problem Ref	Location	Summary	Issue	Recommendation	Design Organisation Response (either 'Accepted', 'Accepted with alterative solution' or 'Disagree')	TA Response	Overseeing Organisation Response	Agreed RSA Action (between Designer and Overseeing Organisation)
2.19/019	A46 Winthorpe Junction, 'through-about' junction layout.	Risk of collisions associated with the provision of this 'through-about' junction layout.	The proposed through-about arrangement at Winthorpe Junction shows that: • The existing 4-arm roundabout will be redesigned to include a throughout arrangement, under traffic signal control. • The roundabout circulatory carriageway will be repositioned, and its inscribed circular diameter (ICD) will be increased / enlarged • A46 mainline (dual carriageway) traffic will travel around the roundabout circulatory carriageway • Northbound traffic from the new two-way link road will pass through the roundabout, to reach the A46 northbound carriageway. As stated in the introduction of this report, the Audit Team has been unable to determine a number of key design features relating to this proposed layout as the full scheme information, typically expected for a Stage 1 RSA. The absence of full / complete preliminary design information and assessment for this junction layout work may result in a number of road safety risks to all users. These are currently unquantifiable and cannot be identified by the RSA1 Audit Team at this stage.	It is recommended that the preliminary design and assessment work for Winthorpe Junction is completed and made available for a repeat RSA1. The repeat audit may only be necessary for the scheme elements that have changed (in accordance with DMRB GG 119, paras 4.21 & 4.22).	**Rejected** - following a discussion between the design team and the overseeing organisation, it has been agreed that a repeat Stage 1 RSA is not required. The level of detail shown on the sketch issued for Winthorpe junction which shows the Design Fix 3C layout provides a similar level of detail to the General Arrangement drawing issued which showed the Design Fix 3B layout. This was also discussed and agreed with SCRG members at the meeting on 02/08/2023.	The TA is aware of the discussions held between the Designer and Overseeing Organisation at SCRG for Winthorpe junction and is therefore satisfied that overall safety governance is being followed. However, we also highly recommend that this is reviewed with more detail at the Stage 2 RSA such that the auditors are satisfied with the information provided and that they can make the appropriate assessment at that stage.	Accept	Following a discussion between the design team and the overseeing organisation, it has been agreed that a repeat Stage 1 RSA is not required. The level of detail shown on the sketch issued for Winthorpe junction which shows the Design Fix 3C layout provides a similar level of detail to the General Arrangement drawing issued which showed the Design Fix 3B layout. This was also discussed and agreed with SCRG members at the meeting on 02/08/2023.
2.20/020	A46 Winthorpe Junction, at various locations.	Risk of collisions with traffic islands and equipment on the roundabout circulatory carriageway.	The General Arrangement and Plan & Profile drawings indicate that kerbed traffic splitter islands will be provided on the circulatory carriageway, in the southern and eastern quadrants of the roundabout. The Audit Team has not sighted any cross-sectional information for these locations, and no vehicle swept path analysis for movements either side of these islands was provided. The presence of constructed kerbed traffic islands on the roundabout circulatory may not be readily anticipated by motorists This could result in an increased risk of collisions with the islands and equipment (signs, traffic signals, cabinets etc) located on them.	It is recommended that the constructed kerbed traffic islands are omitted from the proposals. Traffic movements on the circulatory carriageway maybe better served / guided with appropriate roundabout road markings (lane lines and hatching), depending on the type of layout selected.	**Accepted** - Hatched road markings will be considered at detailed design in place of kerbed traffic islands, if deemed appropriate.	The TA agrees with the designer's response.	Accept	Hatched road markings will be considered at detailed design in place of kerbed traffic islands, if deemed appropriate.
2.21/021	A46 Winthorpe Junction, northern side, uncontrolled at-grade crossing facilities.	Risk of injury to pedestrians, cyclists and horse-riders seeking to cross at-grade and uncontrolled.	The Audit Team has reviewed a Safety Risk Assessment (Document ref.: HE551478-SKAG HGN-CONWI_CONW-RA-CH-00001_P01_S2') which does not appear to consider the specific risks to pedestrian, cycle and horse-riding users that require to cross at Winthorpe Junction. Furthermore, no WCHAR Assessment Report has been provided / sighted for this audit. The proposals indicate that there will be uncontrolled at-grade provision for pedestrians and cyclists crossing the A46 (north to south) on the north-east side of Winthorpe Junction. This facility may present a level of difficulty for all users attempting to cross the highway in a safe manner, particularly as they will be expected to cross four separate high-speed carriageways in succession, without any traffic control. The requirement to cross each highway at-grade, may increase the risk of pedestrian and cyclist collisions with motorised traffic. Furthermore, the provision of uncontrolled crossings may result in users attempting to cross in between slowing / stationary traffic queueing for the traffic signal controlled roundabout (and being unsighted by motorists in other lanes).	Whist it is accepted that the provision of a pedestrian / cycleway overbridge may not be possible due to engineering and environmental constraints, it is recommended that crossing requirements and demands are first assessed in terms of safety and suitability, to determine the best crossing solution for walking, cycling and / or horse-riding. The complexities presented to more vulnerable populations, such as children, the elderly, sight / hearing / mobility impaired, cyclists, e-scooter riders, wheelchair and pushchair users will also need to be considered.	**Accepted** - The crossings to the east of Winthorpe Roundabout will be signal controlled. The crossings over the A1133 and Drove Lane to the north and south of Winthorpe Roundabout respectively will not be signal controlled. This is because the traffic signal timings on Winthorpe Roundabout will create natural gaps for pedestrians / cyclists to cross the roads at these locations. A traffic island will be provided for both crossings to reduce the number of traffic lanes being crossed in one movement.	The TA agrees with the designer's response.	Accept	The crossings to the east of Winthorpe Roundabout will be signal controlled. The crossings over the A1133 and Drove Lane to the north and south of Winthorpe Roundabout respectively will not be signal controlled.
2.22/022	A46 Winthorpe Junction, proposed gantry structure across the eastern quadrant of the roundabout circulatory carriageway.	Risk of collisions from motorists being unable to identify destinations / select traffic lanes presented on gantry signing (due to positioning / angle).	Across the eastern quadrant of the roundabout circulatory carriageway, there is a proposed gantry sign spanning four traffic lanes (Sign ref.: SE64-A46-ADS-SB-P-003). Due to the positioning the gantry structure, it is possible that the destinations (shown on the gantry sign) may not be obvious to motorists on all approaches. For example, for circulatory traffic travelling around the northern quadrant, the angle of gantry is likely to result in difficulty when attempting to locate destinations and select lanes. This in turn could result in sideswipe and / or rear end shunt type collisions from sudden lane changing and braking.	It is recommended that the positioning of the gantry structure / signing is reviewed, to ensure that all destinations can be seen by motorists at appropriate distances.	**Accepted** - All signage will be reviewed at Stage 5.	The TA agrees with the designer's response.	Accept	All signage will be reviewed at Stage 5.
2.23/023	Drove Lane, south of A46 Winthorpe Junction, at approx. Ch.6700.	No crossing facilities for pedestrians / cyclists between new and existing networks.	The proposals for Winthorpe Junction indicate that a pedestrian and cycling route will be provided for users seeking / travelling from Drove Lane. However, it is not clear how crossing movements across Drove Lane will be managed, as no crossing facilities are shown on this two-way road, which is subject to a posted NSL (assumed 60mph speed limit). There is a concern that the absence of a suitable crossing area between the existing and proposed facilities may result in an increased risk of collisions and injury to pedestrians and cyclists seeking to cross Drove Lane.	It is recommended that the proposals carefully consider the needs of all non-motorised user requirements to and from Drove Lane, providing appropriate crossing facilities and / or highway cycle transitions where required. These may first be identified through an assessment of the existing walking, cycling and horse-riding infrastructure and liaison with public user groups, undertaken through the WCHAR process	**Accepted** - The design has since developed so that pedestrians / cyclists will cross Drove lane at the exit from the roundabout. The crossing will not be signal controlled as the traffic signal timings on Winthorpe Roundabout will create natural gaps for pedestrians / cyclists to cross the roads at these locations. A traffic island will be provided for to reduce the number of traffic lanes being crossed in one movement.	The TA agrees with the designer's response.	Accept	The crossing of Drove Lane is to be at the exit from the roundabout.

C: Walking, Cycling and Horse-Riding Assessment & Review

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1. Introduction

1.1 Overview

This walking, cycling and horse-riding assessment and review (WCHAR) has been developed to support the application for Development Consent for the A46 Newark Bypass Scheme (the Scheme).

The Applicant has developed the WCHAR in support of the Development Consent Order (DCO) application for the A46 Newark Bypass Scheme (hereafter referred to as the 'Scheme') in accordance with the requirements of the National Policy Statement for National Networks (NPSNN) (Department for Transport, 2014) and the National Planning Policy Framework (Department for Levelling Up, Housing and Communities, 2023).

1.2 Document purpose

The proposed Scheme is a highway improvement Scheme that would have a permanent impact on the trunk road and local highway networks. Therefore, the GG 142[1] WCHAR is applicable to this Scheme. The GG 142 is a standard within the Design Manual for Roads and Bridges (DMRB) which sets out the WCHAR process for highway schemes on motorways and all-purpose trunk roads.

In accordance with GG 142, the scale of the Scheme has been assessed and is considered as a 'large' scheme for the purposes of this assessment. This Scheme was subject to a WCHAR during the options stage and an accompanying report was produced in 2018.

GG 142 states that a review report must be done within twelve months of the original assessment, therefore as the original assessment report is outdated, it was required to be reviewed and updated in the current preliminary design of the Scheme as outlined in this report.

Non-Motorised Users (NMU) considered in this report are:

- Pedestrians – including mobility impaired and vulnerable pedestrians
- Cyclists – including mobility impaired and vulnerable cyclists
- Equestrians – Including mobility impaired and vulnerable equestrians.

This WCHAR will constitute a combined assessment and review report. A proportion of the original assessment report will be re-used and reviewed here.

[1] National Highways (November 2019) DMRB GG 142 - Walking, cycling and horse-riding assessment and review [online].

2. The scheme

2.1 Scheme context

The A46 forms part of the strategic Trans-Midlands Trade Corridor between the M5 in the south-west and the Humber Ports in the north-east. The improvements to the A46 corridor are detailed within the Department for Transport's (DfT) second Road Investment Strategy (RIS2) as a mechanism for underpinning the wider economic transformation of the country. RIS2 makes a commitment to create a continuous dual carriageway from Lincoln to Warwick.

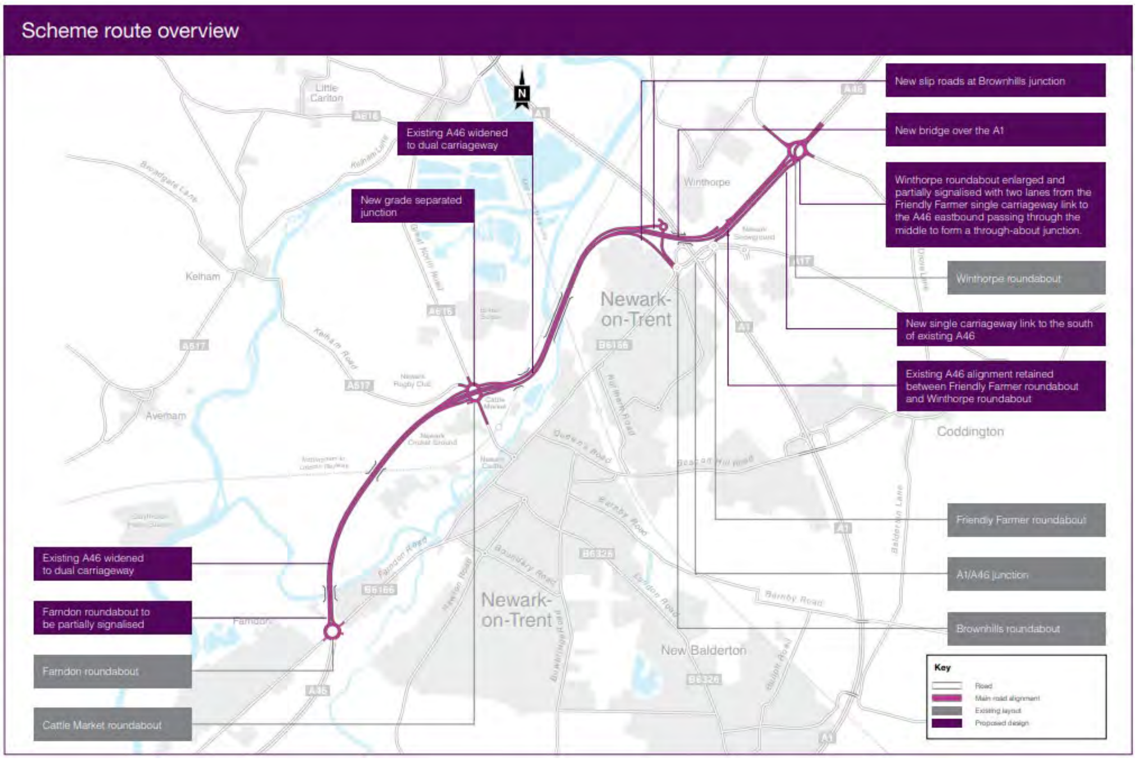
The stretch of the A46 between the Farndon roundabout, to the west of Newark-on-Trent and the A1, to the east of Newark-on-Trent, is the last remaining stretch of single carriageway between the M1 and A1 and consequently queuing traffic is a regular occurrence, often impacting journey time reliability.

2.2 Scheme location

The Scheme would provide a dual carriageway on the A46 between Farndon and Winthorpe in Nottinghamshire. The Farndon roundabout is located at the southern extent of the Scheme where the B6166 Farndon Road joins the A46.

The Winthorpe roundabout is located at the northern extent where the A1133 joins the A46. Along its route, it crosses the A617 and the B6326, at the Cattle Market junction, and the A1 between the Friendly Farmer and Brownhills roundabouts. Figure 1 below shows the location of the Scheme.

Figure 1. Scheme location



The Scheme would be situated within the county boundary of Nottinghamshire County Council and within the administrative boundary of Newark & Sherwood District Council. The Scheme crosses the River Trent twice, the Nottingham to Lincoln railway line twice, and the East Coast Main Line once.

The existing A46, currently a single carriageway, is elevated on embankments due to the low-lying floodplain of the River Trent. This floodplain is located to the west of the A46 for the majority of the affected length, along with a section at the southern end on the eastern side of the A46. Several roundabouts form key junctions along the route, linking local A roads. Road infrastructure is softened by roadside vegetation in places and the River Trent is a strong natural influence within an otherwise built-up landscape. To the north of the A46, farmland dominates, interspersed with small-scale settlements. To the south of the A46, the town of Newark-on-Trent forms a notable urban settlement.

2.3 Scheme aims and objectives

The aim of the proposed Scheme is to increase capacity and reduce traffic congestion on the A46 around Newark-on-Trent. This will directly contribute to the UK, regional and local Government's transport and economic growth plans by improving connectivity from Lincolnshire to the national motorway network, and improving route standard consistency for the A46, providing a consistent high standard dual carriageway between the Midlands and Lincoln.

Scheme-specific objectives have been used to develop the proposed Scheme design which are set out below:

Safety	2.3.1	Improving safety through scheme design to reduce collisions for all users of the A46 Scheme.
Congestion	2.3.2	Improve journey time and journey time reliability along the A46 and its junctions between Farndon and Winthorpe, including all approaches and A1 slip roads.
Connectivity	2.3.3	Accommodate economic growth in Newark-on-Trent and the wider area by improving its strategic and local connectivity.
Environment	2.3.4	Deliver better environmental outcomes by achieving a net gain in biodiversity and improve noise levels at Noise Important Areas along the A46 between Farndon and Winthorpe roundabouts.

Customer	2.3.5	Build an inclusive scheme which improves facilities for cyclists, walkers and other vulnerable users where existing routes are affected.

2.4 Scheme description

The section of the A46 that is to be upgraded is approximately 6.5 kilometres in length. The Scheme comprises on-line widening for the majority of its length between Farndon roundabout and the A1. A new section of offline dual carriageway is proposed between the western and eastern sides of the A1, before the new dual carriageway ties into the existing A46 to the west of Winthorpe roundabout. The widening works include earthwork widening along the existing embankments, and new structures where the route crosses the railway lines, River Trent, the A1 and local roads.

The Scheme consists of the following principal elements:

- Widening of the existing A46 to a dual carriageway for a distance of 6.5 kilometres to provide two traffic lanes in both directions.
- Partial signalisation of Farndon roundabout at the southern extents of the Scheme.
- A new grade-separated junction at Cattle Market junction with the A46 elevated to pass over the roundabout. A larger roundabout beneath the A46 to provide increased capacity.
- A new off-line section to bypass the existing Brownhills roundabout and Friendly Farmer roundabout.
- A new grade separated northbound exit slip to a new roundabout providing local access, with a two-way link road on the southern arm to connect with the existing Brownhills roundabout.
- A two-way parallel link road from Friendly Farmer to Winthorpe roundabout to the southern side of the existing dual carriageway.
- A new bridge structure across the existing A1, located to the north of the existing bridge.
- An upgraded roundabout with partial signal controls at Winthorpe Roundabout.
- Improvements to Walking, Cycling and Horse Riding (WCHAR) facilities through safer, enhanced routes.
- Three areas have been identified for floodplain compensation which are being referred to as the Kelham and Averham Floodplain Compensation Area (FCA), Farndon West FCA and Farndon East FCA. In addition, the

Farndon East FCA and Farndon West FCA will also be used as borrow pits to support the creation of embankments required for the Scheme.

- Drainage features including attenuation ponds.
- Environmental mitigation including landscape planting.
- Associated accommodation works and maintenance access tracks.

2.5 Assessment and review team

The review team is comprised of:

Lead Assessor Name	[redacted]
Position	Highway Engineer
Organisation	Mott MacDonald

Design Team Leader	[redacted]
Position	Highways Team Lead
Organisation	Mott MacDonald

2.6 Client Scheme Requirements

Safety

- Improve safety of the A46 and its junctions, reducing the frequency and severity of incidents along the A46.

Congestion

- Reduce congestion along the A46 and its junctions.
- Improve links to the A1 by removing A46 through-traffic from the A1/A46 junction.
- Improve journey times and journey time reliability along the A46 and its junctions between Farndon and Winthorpe.

Resilience

- Increase resilience of the A46 by providing two lanes in each direction separated by a central reserve barrier.
- Increase resilience of the wider Strategic Road Network (e.g., A1 and M1) by providing a more suitable alternative route when incidents occur.

Environment

- Seek to improve noise levels in Noise Important Areas ('noise hotspots') affected by improvements to the A46.
- Deliver better environmental outcomes through mitigation, protection, and enhancement, and contribute to biodiversity.

Customer

- Improve the customer experience and satisfaction of all customers affected by the Scheme.
- Maintain and improve facilities for cyclists, walkers and horse riders where existing facilities are affected.

2.7 Walking Cycling Horse-Riding objectives

The proposed Scheme would improve connections for people between communities and create a safer road network. Walking, cycling and horse-riding (WCH) routes would be incorporated as part of the Scheme to improve cycle links and allow safer movement for NMUs between the different urban and rural areas.

In-line with the Client Scheme Requirements above, broader objectives for WCH access provision to identify possible mitigation measures are listed below:

- Create safe and attractive routes.
- Reduce severance of communities.
- Retain as much existing infrastructure as reasonably practicable and minimise diversions.
- The integrity and sensitivity of existing WCH routes will be considered in the design development process.
- Maintain existing levels of WCH routes connectivity and, where possible improve for all types of users, including vulnerable users.
- Identify opportunities to integrate the proposed Scheme with existing WCH routes, public transport facilities and local communities within the corridor.
- Incorporate WCH requirements and provisions into the design of side roads and access diversions.

3. Walking, cycling & horse-riding assessment

3.1 Overview

A WCHAR Assessment Report was produced during the non-statutory consultation stage in 2018. Although the initial assessment document is now outdated in respect of GG 142 guidance, and the effects on WCH usage and habits following the Covid-19 pandemic, a large proportion of the initial assessment such as trip generators and opportunities are still relevant and will be considered here.

Updated WCH surveys have been undertaken in 2023. The results of these surveys, along with an assessment and review of collision data will also be presented as part of this report.

3.2 WCHAR study area

The approximate study area for Scheme is shown in Figure 2. The Scheme would be classified as a large scheme, therefore the overall study area covers a 5km buffer zone around the Scheme, which includes the whole of Newark-on-Trent, as well as many surrounding villages and settlements.

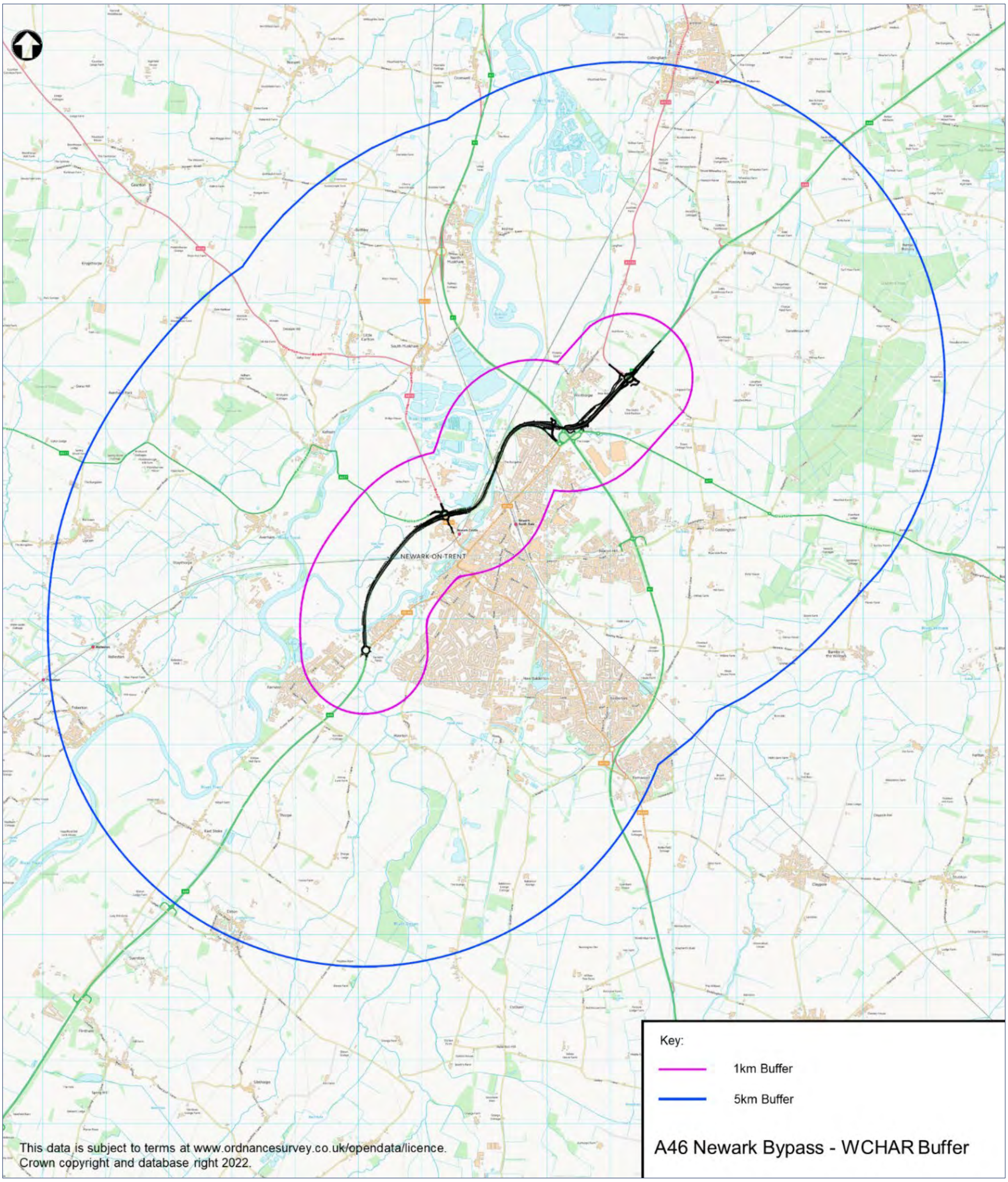
Looking ahead to the detailed design of this Scheme, the area within 1km of the Scheme alignment would comprise the vast majority of any WCH proposals and will therefore be the primary focus area.

Various public and private assets would be affected by the proposed Scheme, primarily agricultural land and the associated farming businesses which rely on that land.

There are likely to be both beneficial and adverse impacts upon people’s journey patterns and amenity from the Scheme. These impacts would include some diversions of Public Rights of Way (PRoW), but there would also be opportunities to improve conditions for WCH’s through new routes and improved crossings.

The Scheme would adopt construction and traffic management methods which, as far as possible, would maintain access to existing WCH routes for all road users during construction periods.

Figure 2: A46 study area



3.3 Policies and strategies

Relevant policies and strategies have been reviewed as part of this evaluation. These include:

a) Nottinghamshire Local Transport Plan 3, Nottinghamshire County Council, 2011-2026[2].
b) Newark & Sherwood District-Wide Transport Study, Newark & Sherwood District Council, 2010[3].
c) Newark & Sherwood Amended Core Strategy, Newark & Sherwood District Council, 2019[4].
d) Nottinghamshire Cycling Strategy Delivery Plan, Nottinghamshire County Council, 2016[5].
e) Newark & Sherwood Local Development Framework, Newark & Sherwood District Council, 2013[6].
f) D2N2 Local Cycling and Walking Infrastructure Plan, Nottinghamshire County Council, 2021[7].

The key points from these documents that relate to the A46 in Newark-on-Trent with regard to walking, cycling and horse-riding have been summarised as follows:

a) Nottinghamshire Local Transport Plan 3, Nottinghamshire County Council, 2011 – 2026

The Local Transport Plan 3 highlights the primary pedestrian routes in Newark-on-Trent as shown in Figure 3 below.

[2] Nottinghamshire Local Transport Plan 3 2011-2026, Nottinghamshire County Council [online].

[3] District-Wide Transport Study, Newark & Sherwood District Council, 2010 [online].

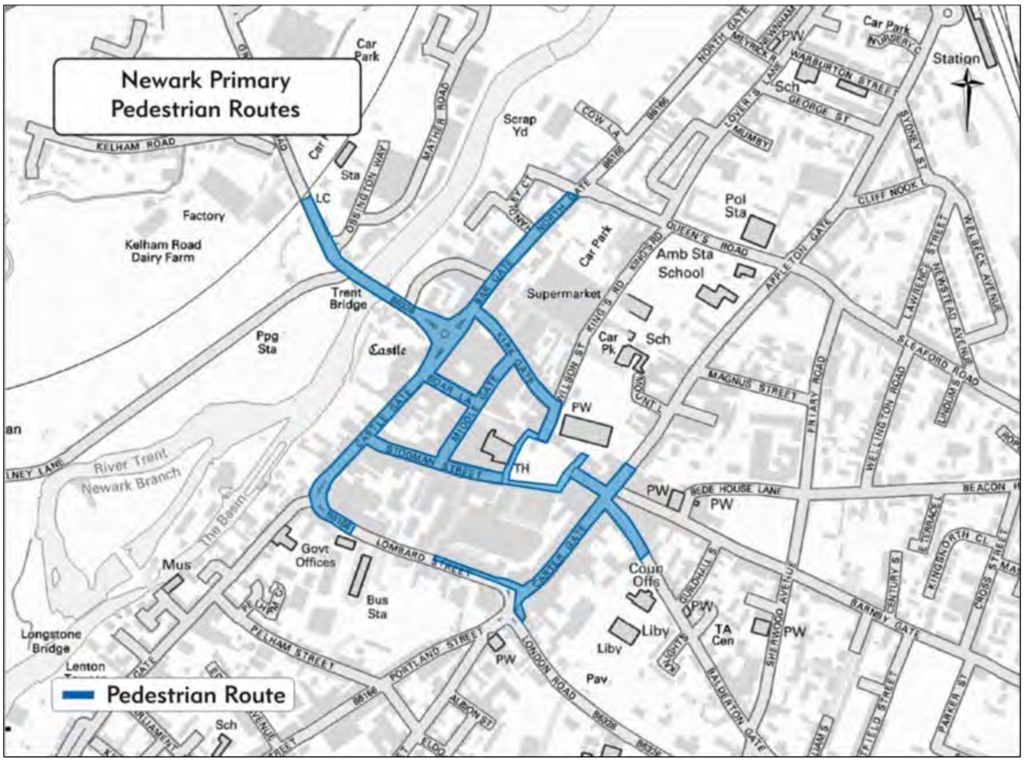
[4] Newark & Sherwood Amended Core Strategy, Newark & Sherwood District Council, 2019 [online].

[5] Nottinghamshire Cycling Strategy Delivery Plan, Nottinghamshire County Council, 2016 [online].

[6] Newark & Sherwood Local Development Framework, Newark & Sherwood District Council, 2013 [online].

[7] D2N2 Local Cycling and Walking Infrastructure Plan (LCWIP), Nottinghamshire County Council, 2021 [online].

Figure 3: Newark-on-Trent primary pedestrian routes (source: Nottinghamshire County Council)



This suggests that the onward route towards the A46 on Great North Road is likely to provide a vital connection for a large number of pedestrians to the town centre, as well as North Gate / Lincoln Road from north Newark-on-Trent.

The document also recognises the route that goes under the A46 and A1 at the northern point as a primary cycle route, as well as the Farndon Road and Fosse Road route.

b) Newark & Sherwood District-Wide Transport Study, Newark & Sherwood District Council, 2010

The Transport Study found that Newark-on-Trent has the second highest level of cycling and walking trips in the county, and cycling is particularly prevalent in and around Newark-on-Trent town centre.

It is highlighted however that “there is a lack of river crossing opportunities suitable for non-motorised users available between Newark-on-Trent and Gunthorpe”.

The Transport Study references national policy: “National, regional and local policy all encourages access to new residential and employment developments to be made by foot and cycling.”

The A1/A46 Brownhills roundabout is recognised as an “accident problem site” for vehicle collisions.

c) Newark & Sherwood Core Strategy, Newark & Sherwood District Council, 2011

The Core Strategy proposes a pedestrian and cycle link from Farndon to Farndon Road across the A46 – this has since been realised by the introduction of shared use paths on Fosse Road and Farndon Road, and the subway system at the A46/Fosse Road roundabout.

The Core Strategy states: “High quality, safe, cycle, footpath and bridleway networks will be safeguarded and extended to provide opportunities to reduce the number of short car journeys and for cycling, walking and horse riding for recreation in the countryside. Disused railway lines will be protected from other forms of development, to safeguard their potential to be reinstated to their former use for commercial or leisure purposes, or to extend the cycling or footpath networks.”

Furthermore, new strategic development sites in Newark-on-Trent will ensure that “safe, convenient pedestrian and cycle routes within and adjoining the development” are provided.

d) Nottinghamshire Cycling Strategy Delivery Plan, Nottinghamshire County Council, 2016

The Delivery Plan states: “There are over 400km of cycle route in Nottinghamshire of which 17% is lit.”

It also recognises that: “whilst Nottinghamshire has cycle networks in most of its towns and some rural areas, the existing network is often fragmented and does not serve all of the destinations people would like to travel to.” Therefore, it is essential that new routes link up to the existing network effectively.

e) Allocations and Development Management Plan Document – Newark & Sherwood Local Development Framework, Newark & Sherwood District Council, 2013

This document sets out the locations and details of the developments for Newark & Sherwood, as defined in the Newark & Sherwood Core Strategy. Figure 4 and Figure 5 are taken from said document and map the locations of the proposed developments.

The area planned to have the most development is the southern fringe of Newark-on-Trent, which will extend the extent of the town southwards significantly.

f) D2N2 Local Cycling and Walking Infrastructure Plan, 2021.

The D2N2 (Derby, Derbyshire, Nottingham, Nottinghamshire) LCWIP aims to deliver a sub-regional strategic network of cycling routes – including internal and external cross-boundary links and focussed interventions for walking at key locations.

Figure 4: Development proposals plan for North Newark (courtesy Newark & Sherwood DC)

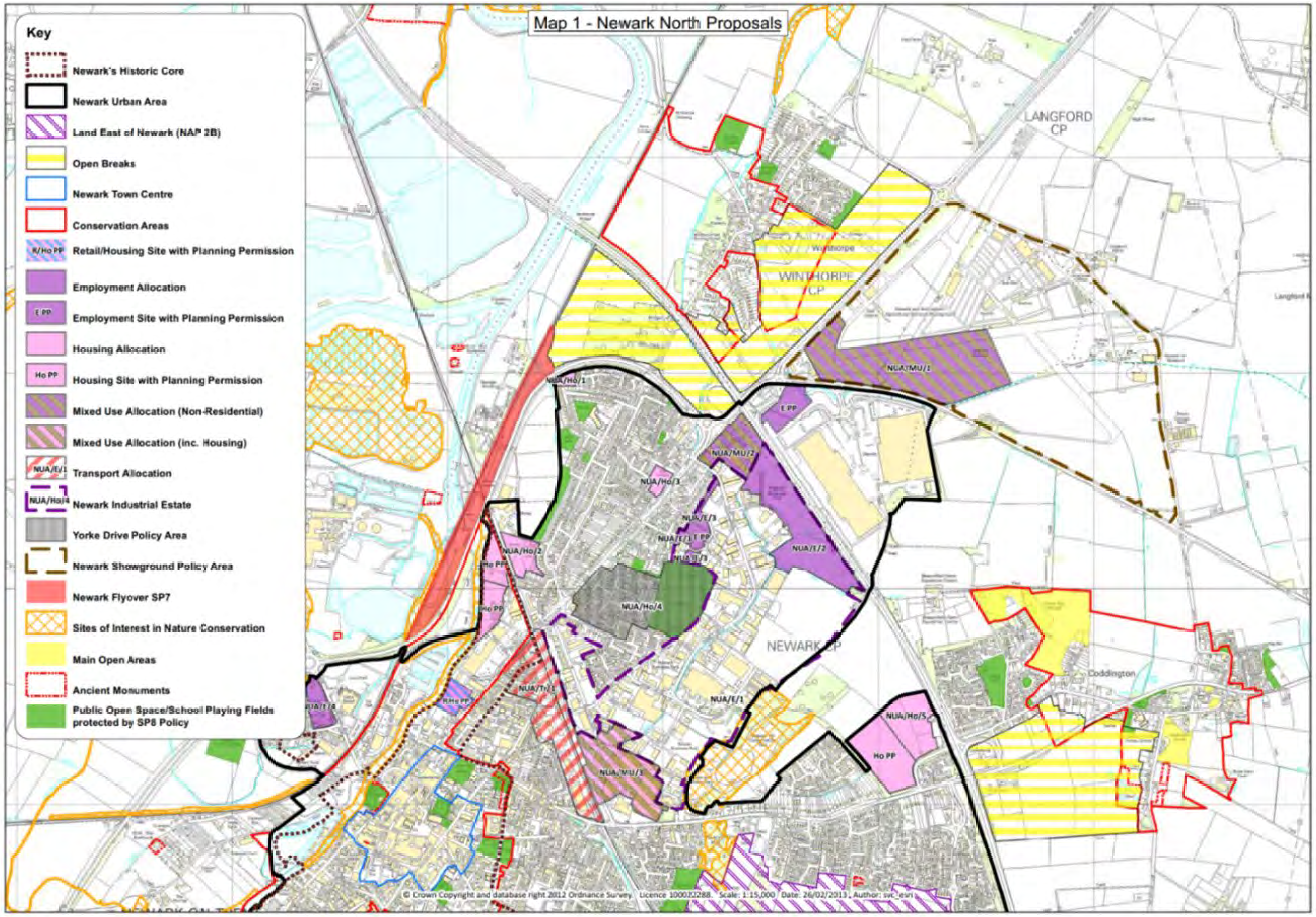
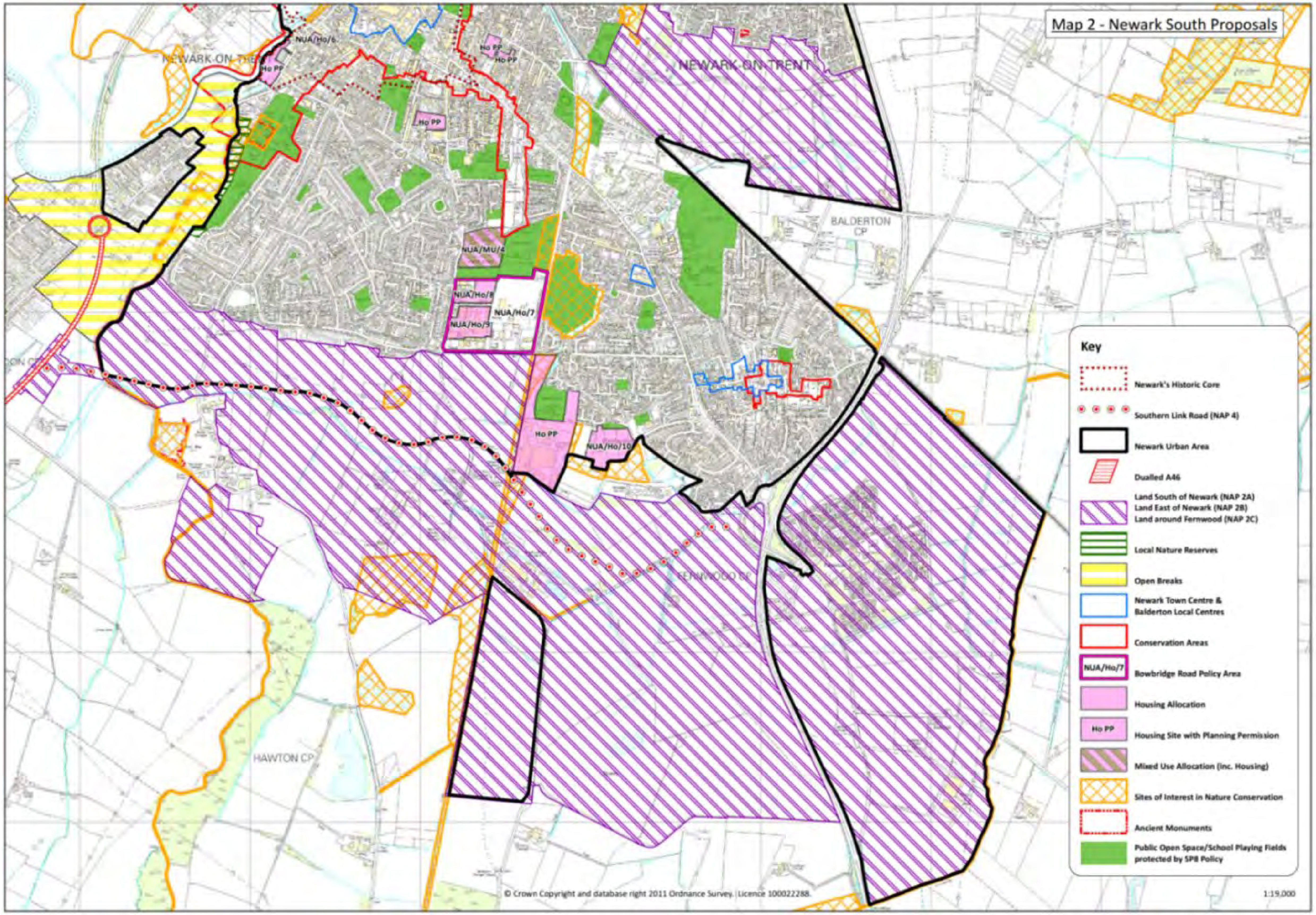


Figure 5: Development proposals plan for South Newark (courtesy Newark & Sherwood DC)



3.4 Collision data

A review of the collisions and casualties within the five-year data set has been extracted from the aforementioned report and is summarised below:

- There was a total of 107 collisions, resulting in 148 casualties.
- This equates to an average of 21.4 PICs per year
- Fridays exhibit the highest number of recorded collisions (22 PICs), accounting for 21% of the total
- The largest proportion of collisions recorded (16 PICs) occurred between the hours of 18:00-19:00, representing 15.9% of the total
- Collisions by month are spread evenly across the year, with August and October accounting for the highest total (13 PICs, 12.1% of the total respectively)
- 13 PICs (12%) involved vehicles that skidded
- Collisions on a wet road surface (18 PICs) accounted for 17% of the total
- Vehicle involvement (233 vehicles in total) in collisions was recorded as follows:
    - Cars – 162 vehicles (69.5%)
    - Motorcycles – 17 vehicle (7.3%)
    - Heavy Goods Vehicles – 22 vehicles (9.4%)
    - Light Goods Vehicles – 26 vehicles (11.2.%)
    - Other/ Unknown – 3 vehicles (1.3%)
    - Pedal Cycle – 3 vehicles (1.3%)
- The following Vulnerable Road User (VRU) casualties were recorded:
    - Motorcycle Riders – 16 casualties (10.8%)
    - Pedestrians – 0 casualties (0.0%)
    - Pedal Cyclists – 4 casualties (3.7%)

3.4.1 Collisions involving WCH Users

The four collisions involving WCH users are located at two sites: three collisions at Cattle Market roundabout and one at Brownhills junction. All four collisions involved pedal cyclists. The main contributory factors of the collisions were failing to look properly or due to poor turning manoeuvres.

3.5 Public transport services and interchange information

Newark-on-Trent is served by two train stations which are approximately 1km apart on separate train lines, near to the centre of the town:

- Newark Northgate Station serving the East Coast Mainline; and
- Newark Castle Station serving the Nottingham to Lincoln Line.

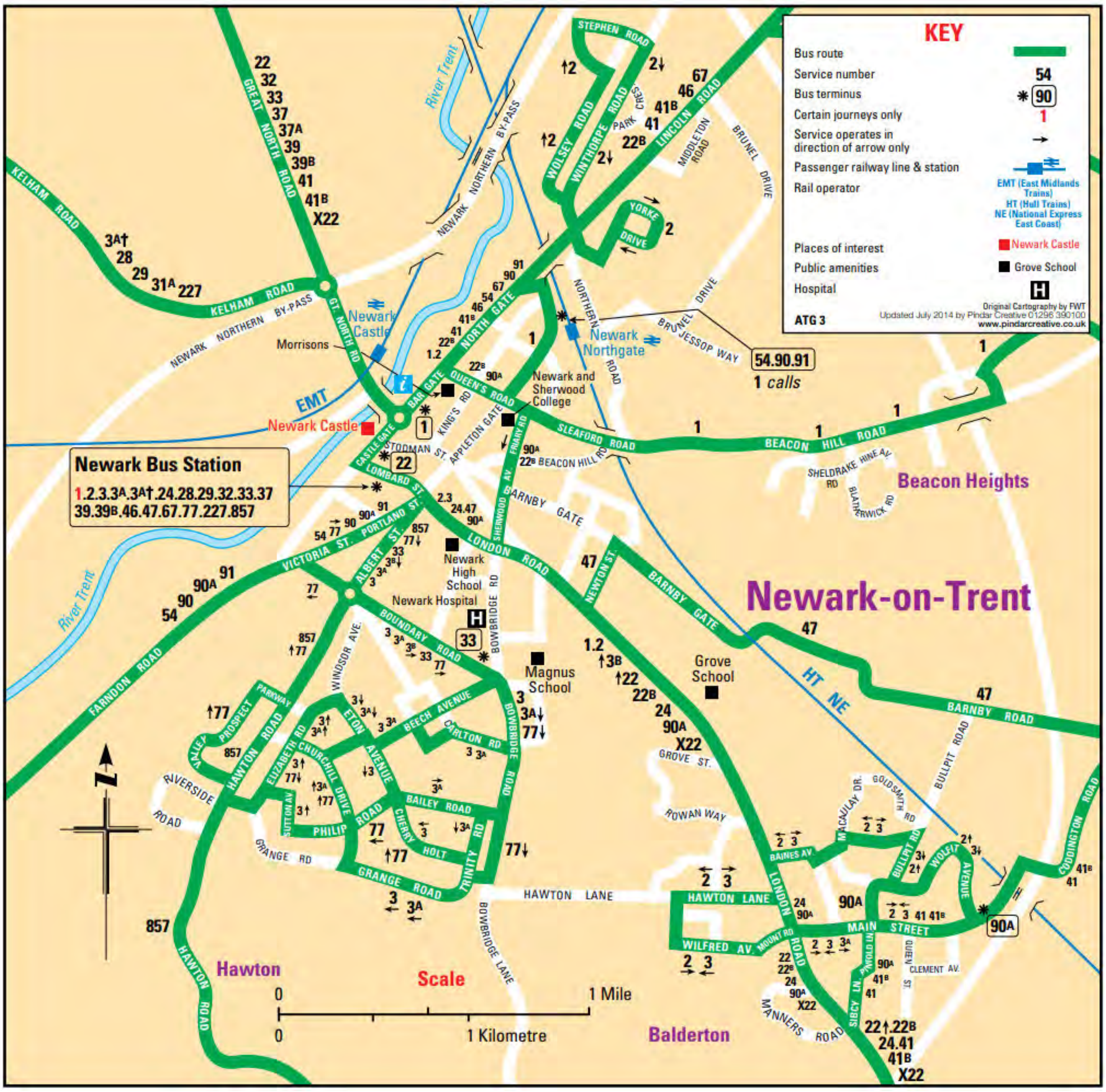
Newark Northgate Station is served on average by two trains per hour southbound to London King's Cross, and approximately three trains per hour northbound to destinations such as Newcastle, Glasgow and York.

Approximately one train per hour serves Newark Castle Station northbound, terminating at Lincoln. Southbound, the station is served by two trains per hour, most commonly continuing to Matlock and Leicester.

Figure 6 below shows the local bus network within Newark-on-Trent. The main hub for buses is the bus station, which is located off Lombard Street. This is an approximate 11-minute walk from Newark Castle station, and 17 minutes from Northgate. As seen in Figure 6, bus services stop on various roads across the town, providing opportunities for interchange with the rail stations.

There are multiple local bus services that serve Newark-on-Trent from nearby villages, and some long-distance bus services from Lincoln, Nottingham, and Mansfield.

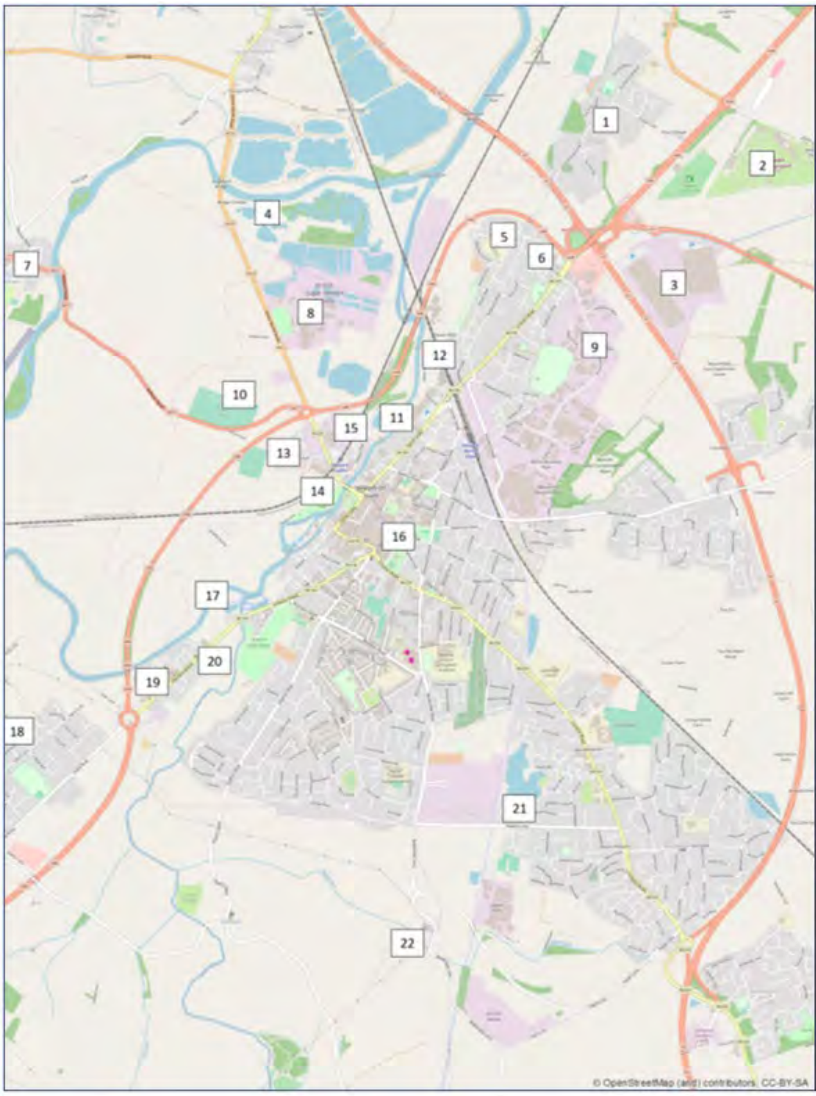
Figure 6: Local bus network within Newark-on-Trent (courtesy Nottinghamshire County Council)



3.6 Trip generators

Newark-on-Trent is a large town with many trip generators. Some of the key trip generators which could influence WCH movements across the Scheme area have been identified in Figure 7 below.

Figure 7: Trip generators

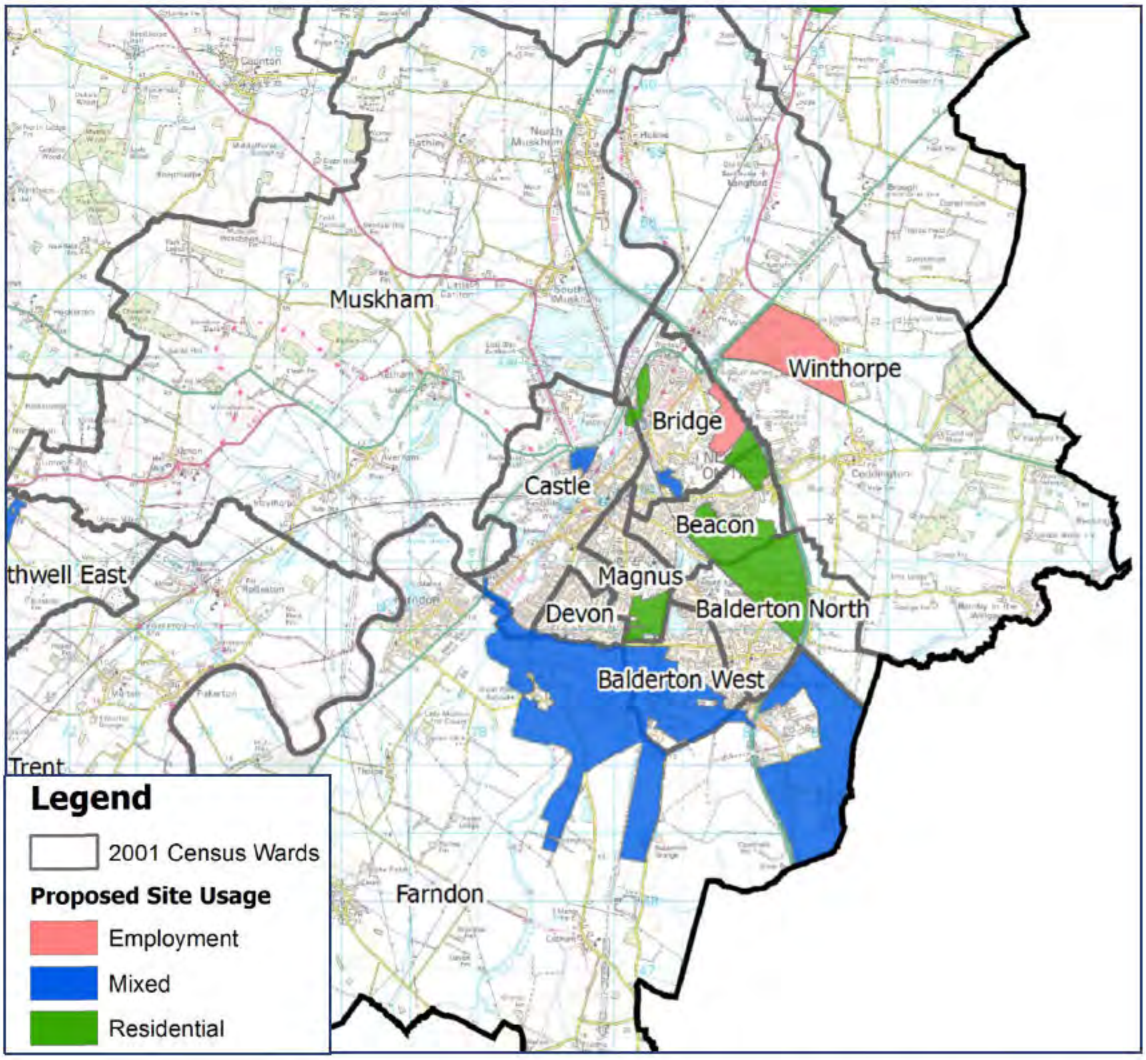


1 Winthorpe village – primary school, public house, church
2 Newark Showground – Former airfield, indoor bowls, driving range, antiques fair.
3 Newark Motor Auctions, DHL – Team Knowhow Depot
4 Smeatons Lakes Campsite
5 Bishop Alexander Primary School
6 Beefeater/Premier Inn/McDonalds/KFC
7 Kelham village - public house, Kelham Hall & Country Park
8 British Sugar Factory
9 Brunel Drive/Telford Drive/Jessop Way
10 Newark Rugby Club
11 King's Marina
12 Northgate Retail Park
13 Newark Ransome and Marles Cricket Club
14 Riverside Park car park, play area
15 Livestock Market
16 Newark town centre - Newark & Sherwood District Council, rail station, bus station, Newark Castle, various supermarkets (Aldi, Waitrose, Morrisons) primary, secondary schools and colleges, churches, cinema, hospital, sports & leisure centre
17 Newark Marina
18 Farndon Marina
19 Lord Ted Pub & Carvery
20 Farndon Road International Logistics Centre
21 Balderton Lake
22 Flowserve & Saint Gobain Works

3.7 Future development in the area

In terms of committed future development, information available from Newark & Sherwood District Council is provided in Figure 8 below.

Figure 8: Future developments (Source: Newark & Sherwood District Council Transport Study, 2009)



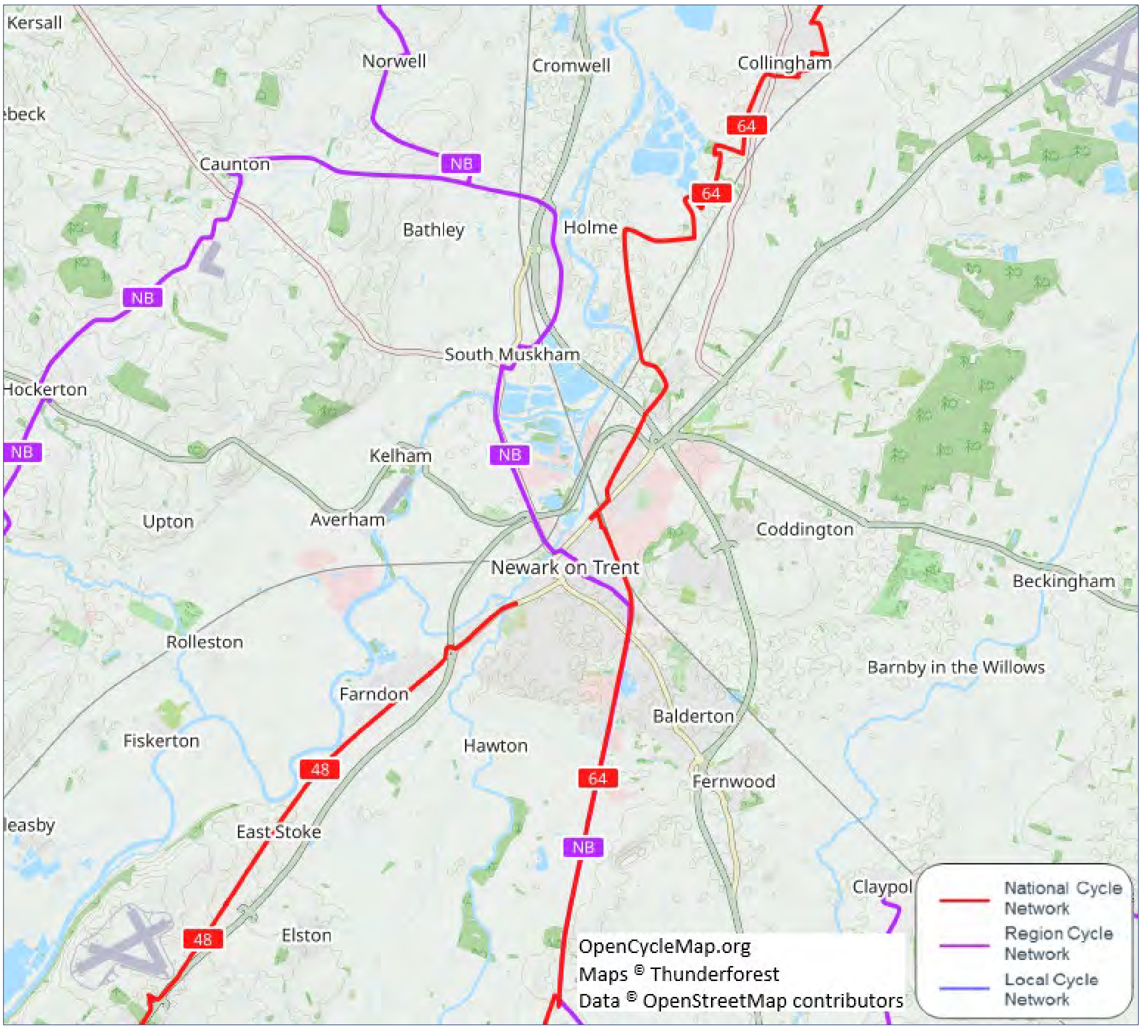
3.8 Existing WCH facilities beyond scheme extents and links to county / strategic networks

This section is intended to provide a high-level overview of the strategic routes in the locality of this Scheme.

3.8.1 Cycling Routes

The strategic cycle network is presented in Figure 9. This is the network of long-distance cycle routes within Newark-on-Trent.

Figure 9: The strategic cycle network



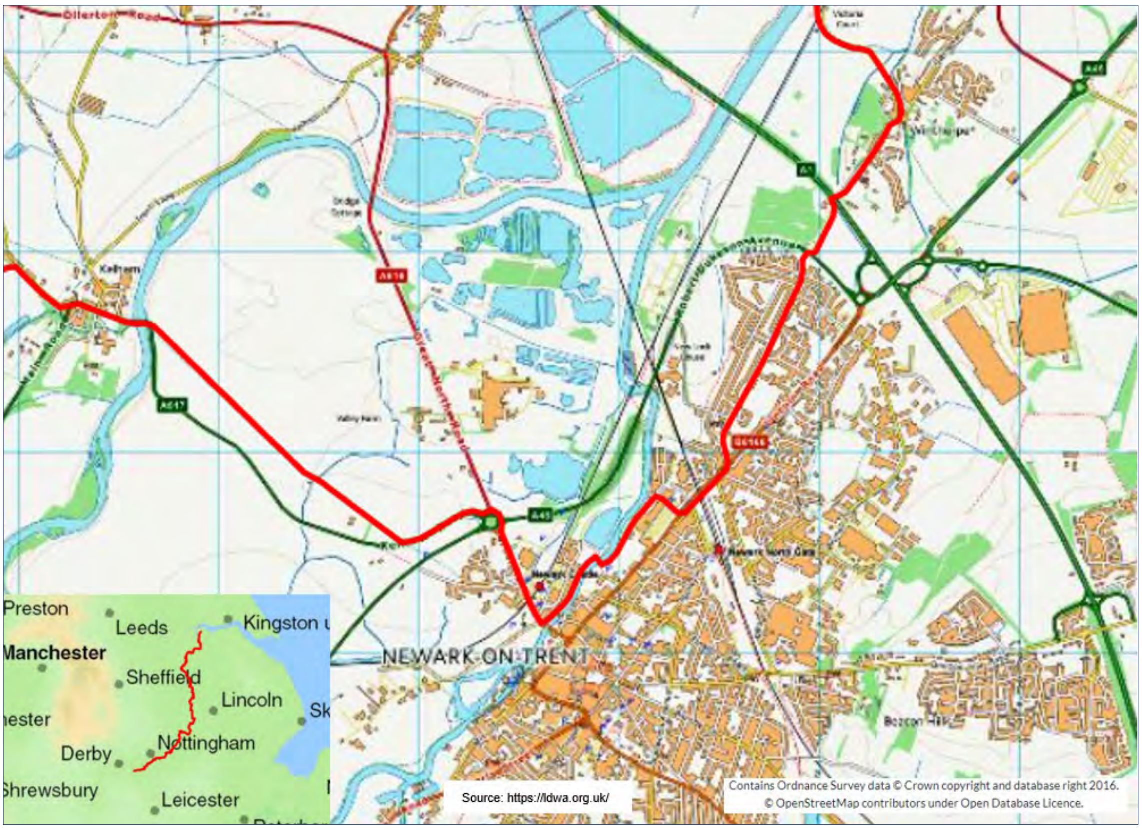
NCN 48 and NCN 64 provide routes to Nottingham and Leicester in the south, and NCN 64 links to Lincoln in the north. All three of these long-distance routes regularly link into other national routes, as well as into the regional and local cycle networks.

3.8.2 Walking Routes

Trent Valley Way

The Trent Valley Way is a long-distance walking route which follows the direction of the river Trent from its source to estuary. In the vicinity of this Scheme, the Trent Valley Way intersects the A46 at two locations. The first crossing is through Cattle Market junction, which is currently partially signalised. The second crossing is grade-separated, and under the A46, northwest of Brownhills roundabout. Figure 10 below provides a high-level overview of the route and its interaction with the A46.

Figure 10: Trent Valley Way



This route is highlighted in further detail on drawing HE551478-SKAG-GEN-CONWI_CONW-DR-CH-01001, which can be found in Appendix C.

3.8.3 Equestrian Routes

No strategic routes were identified for horse-riders, recognising that equestrians are permitted to ride on all highways except motorways and roads with specific restrictions.

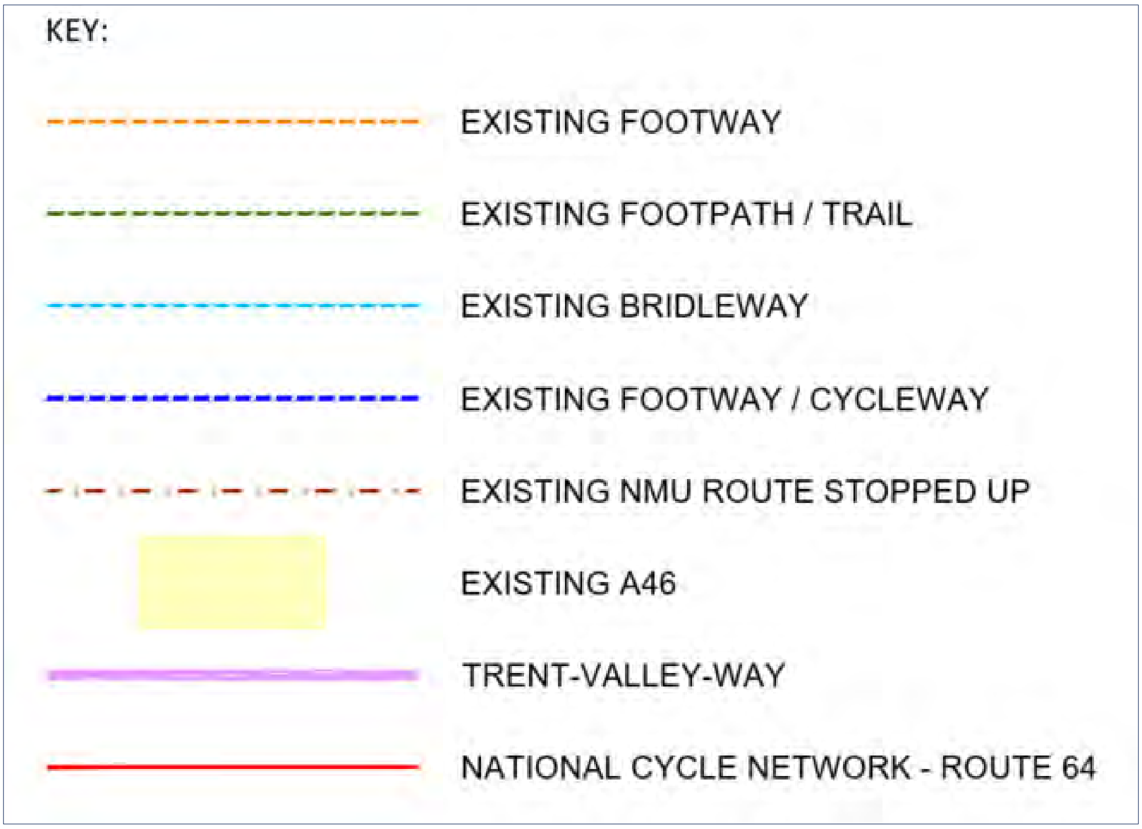
3.9 Existing WCH within the local area

An overview of existing WCH infrastructure in the vicinity of the A46, can be found on drawing HE551478-SKAG-GEN-CONWI_CONW-DR-CH-01001 in Appendix C. For improved clarity, this section of the report should be reviewed in conjunction with the drawing in Appendix C.

Screenshots from this drawing, highlighting the four junctions, as well as the other crossing points along the Scheme have been provided below for ease of discussion.

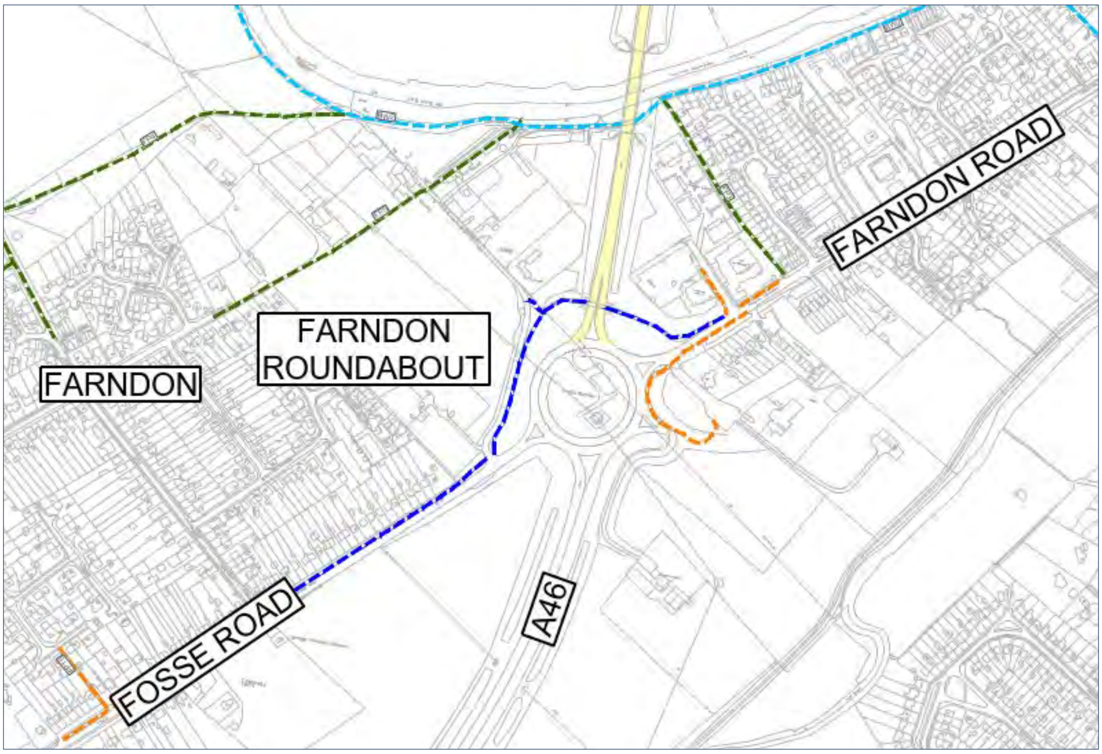
To facilitate interpretation of the screenshots in this section, the drawing key has been extracted in Figure 11 below:

Figure 11: Appendix C drawing key



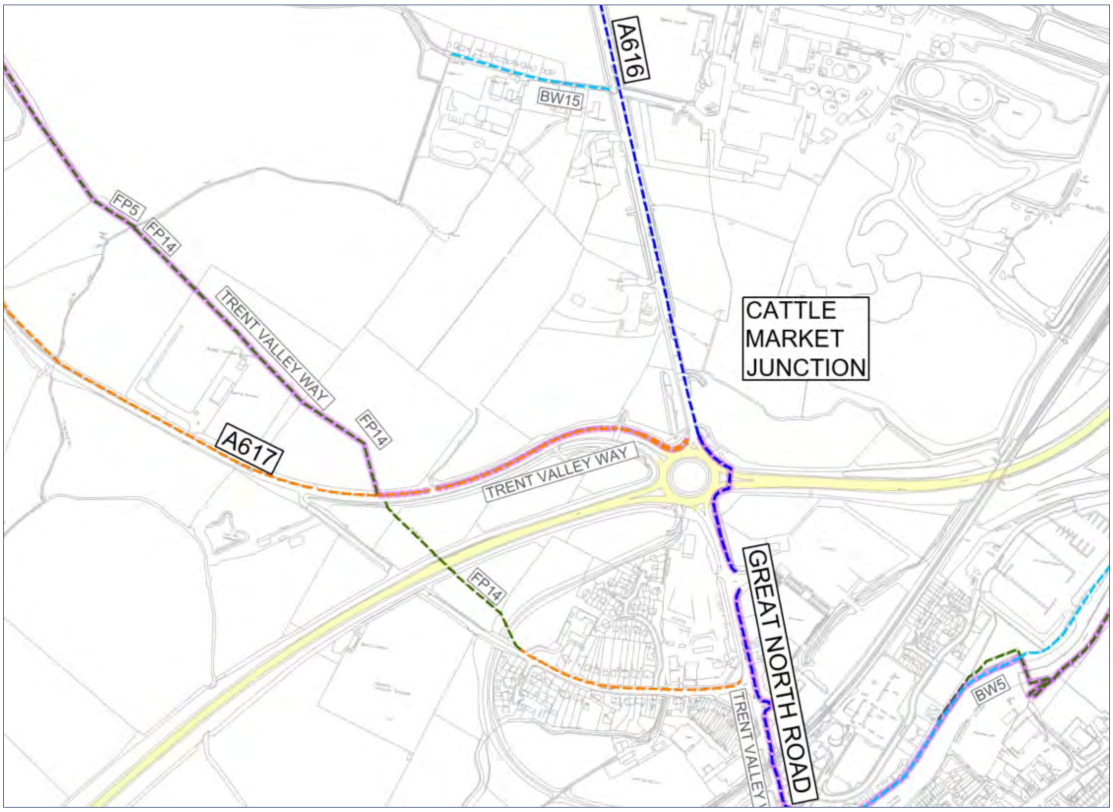
At Farndon roundabout there is a shared use footway/cycleway passing under the A46. Similarly, Bridleway BW2 passes underneath the A46 adjacent to the River Trent.

Figure 12: Farndon Roundabout existing NMU routes



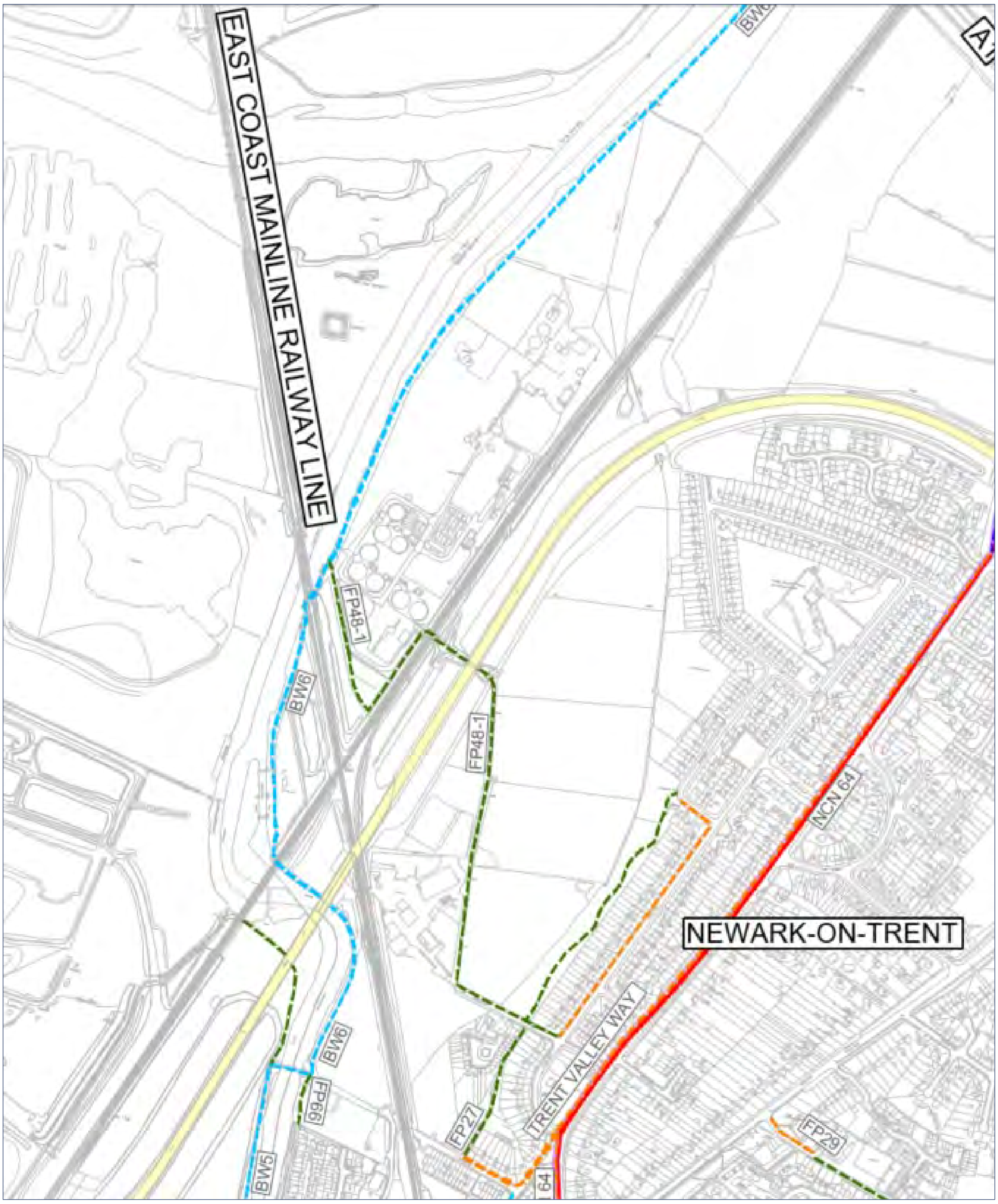
The Trent Valley Way passes through Cattle Market junction using the existing footways and crossing points around the eastern side of Cattle Market Junction. These crossings also provide a link to the footpath that continues alongside the A617 to Kelham, and between the footway/cycleway that sits alongside the A616 and Great North Road to the north and south of Cattle Market. Footpath FP14 crosses through fields and over the A46 to the west of Cattle Market junction via an uncontrolled crossing which is considered to be unsafe. This route provides a link between Newark Cricket Ground to the south of the A46 and Newark Rugby Ground to the north, as well as providing a link to the footpath situated alongside the A617 that continues up to Kelham.

Figure 13: Cattle Market junction existing NMU routes



Bridleway BW6 travels alongside the River Trent, passing beneath the A46 under the Nether Lock Viaduct. Footpath FP48-1 travels underneath the A46, adjacent to the Sewage Works and then joins Bridleway BW6 on the northern side of the Nottingham-Lincoln railway line.

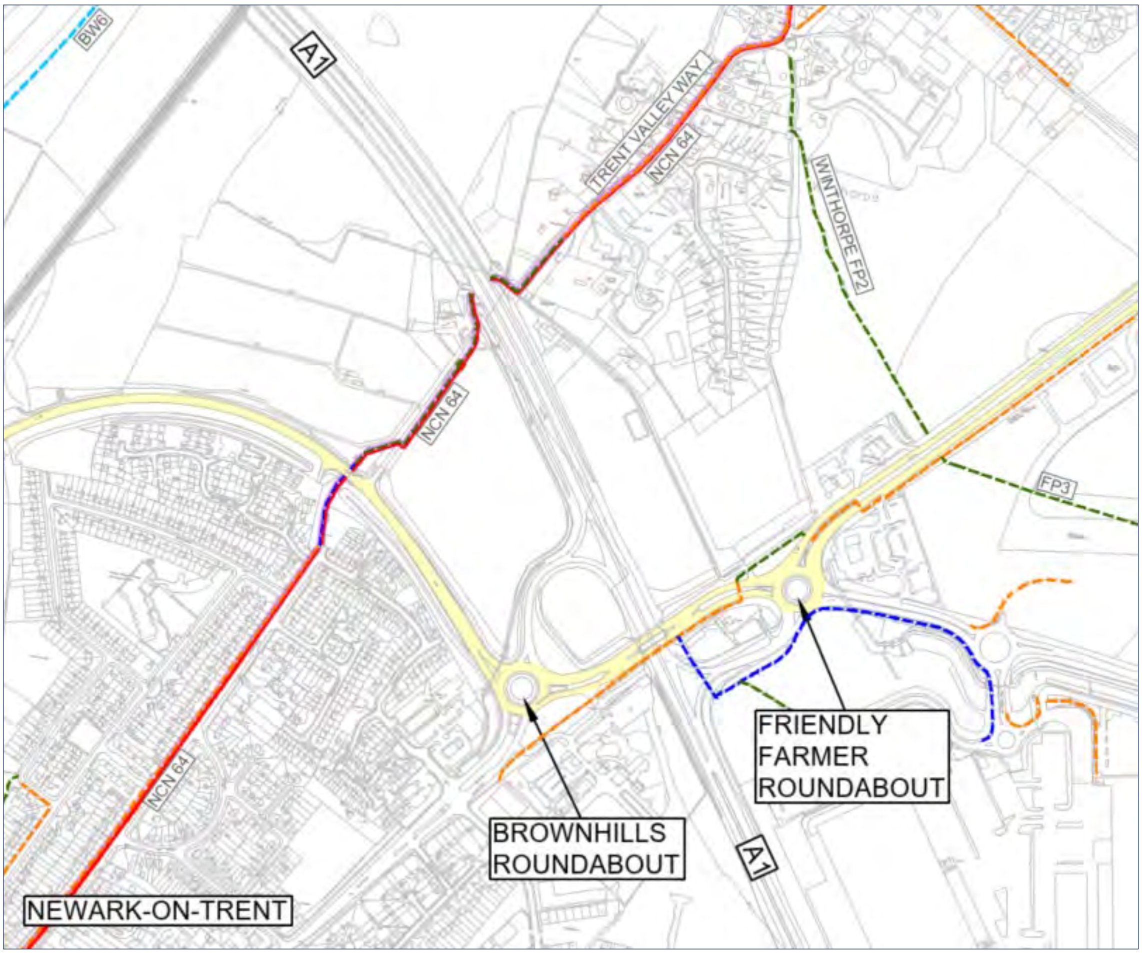
Figure 14: Nether Lock Viaduct existing NMU routes



A walking/cycling route crosses underneath the A46 to the west of Brownhills Roundabout and travels northbound where it passes underneath the A1 and onwards through Winthorpe village. This route forms part of the Trent Valley Way and the National Cycle Network Route 64.

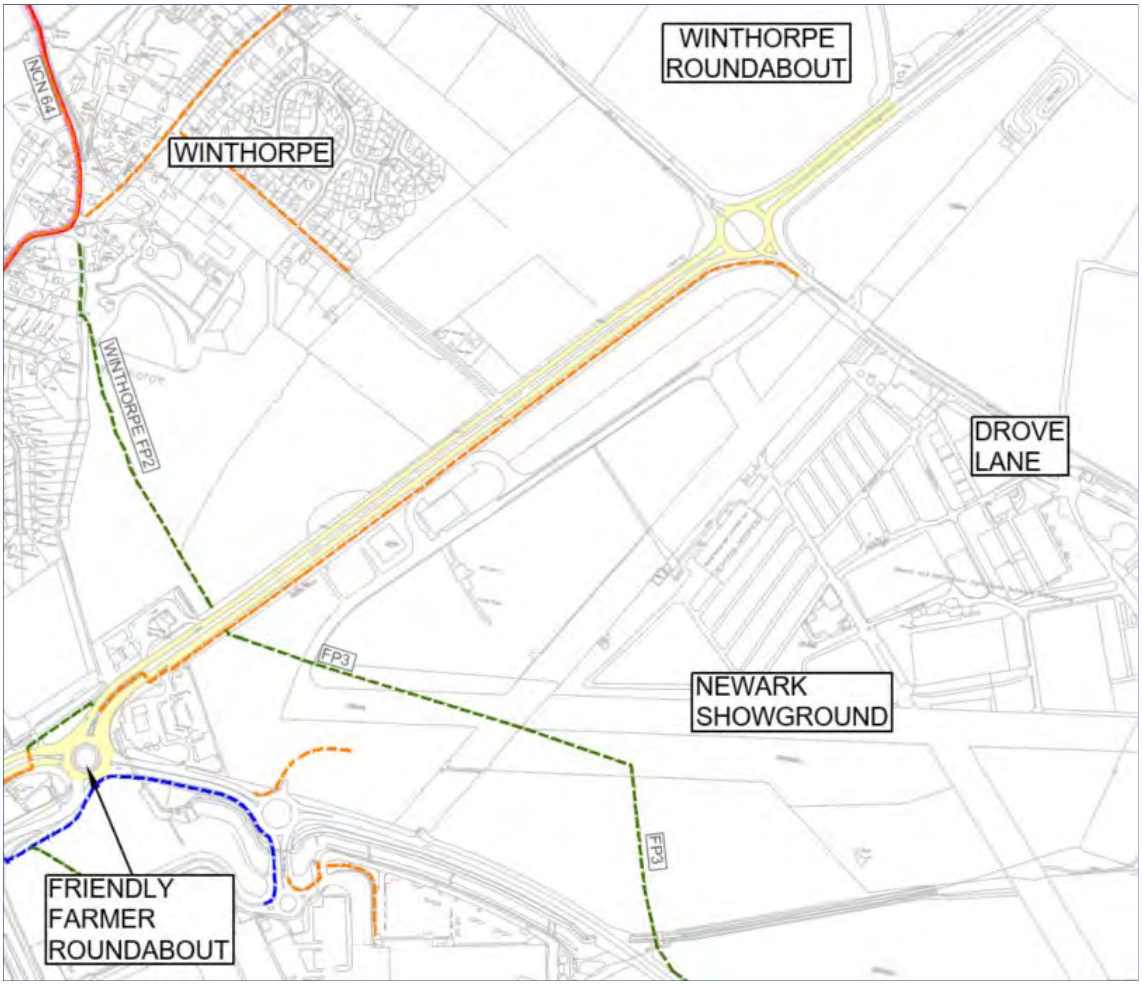
Footpath FP2 and FP3 historically connected Winthorpe to Newark Showground but is currently severed by a vehicle restraint barrier on the A46. There is evidence of pedestrians still using this route, although it is formally stopped-up.

Figure 15: Brownhills and Friendly Farmer Roundabouts existing NMU routes



An existing footway travels adjacent to the existing A46 from Winthorpe roundabout in a south westerly direction, past the two existing service stations either side of the A46, to the east of Friendly Farmer roundabout. This footway then connects with Lincoln Road and forms a continuous route onwards to Newark-on-Trent.

Figure 16: Winthorpe Roundabout existing NMU routes



3.10 May 2018 site visit

During the options stage, a site visit was conducted by the Lead Assessor and Assessors during daytime and night-time on 9 May 2018, in order to gain an appreciation of existing usage at different times of the day.

During the site visit, a number of observations were recorded. These site observations can be found in Table 1 below.

Table 1: May 2018 site observations

Scheme location	Options stage site observations
A46/B6166 Farndon Road /Fosse Road Roundabout Shared Use Path.	On Farndon Road the Shared Use Path (SUP) surface is sealed and in poor condition.
BW2 – River Trent Path	Bridleway, BW2 stopped up

Scheme location	Options stage site observations
(FP3/FP5 providing links to Farndon Road/Marsh Lane)	Footpath, FP5 overgrown
FP14 Kelham Road to Kelham	Little use and overgrown in places
A46 / A616 / B6236 Great North Road Shared Use Path	Worn signage, narrow unsegregated crossing
BW5/BW6 – River Trent Path	BW6, limited evidence of use north of the footbridge. Does not serve equestrians well, being relatively narrow, high, with inadequate parapets.
FP11 – Hatchet Lane to BW6 – River Trent Path	The path was suspended and gates to access the railway permanently closed. It is presumed there is an aspiration to permanently stop-up this ROW across the railway.
FP48 Quibell's Lane to BW6	Route as a whole does not provide a convenient link for users. West of Nottingham-Lincoln Railway line – route is narrow and partially overgrown.
Gainsborough Road/Farm Access / Shared Use Path (Winthorpe-Newark-on-Trent)	A1 underpass is narrow and constrained with poor forward visibility.
A46/A1 footway/Shared Use Path (Lincoln Road to Long Hollow Way)	At crossing, limited visibility and high traffic volumes and speeds.
FP2 (Winthorpe to Newark Showground)	Route severed to VRS in central reserve. Southern side, access to the A46 is overgrown and blocked by vegetation.
Winthorpe to airfield A46 crossing	A grade separated crossing of the A46.
A17 Roundabout	Safe access to the developing business park
A17 Overbridge	Upgrading of the current connection to Coddington & Beacon Hill
A46 Winthorpe WCH tie-in	Provide safe access to the right of way links to Danethorpe & Brough i.e. between the Friendly Farmer and

Scheme location	Options stage site observations
	Winthorpe roundabouts.
Beacon Hill Road / A1 Underpass	Make use of the Beacon Hill underpass under the A1.

The site observations outlined in Table 1 will be reviewed as opportunities in Section 4 of this report.

3.11 Summer 2022 site visits

Site walkovers were also undertaken during Summer 2022 where the following observations were made:

1. Overgrown vegetation on the shared use route alongside the A17 and down to the A1.
2. Low hanging vegetation will hinder the use of footpath FP5 as a temporary equestrian route. There are numerous gaps in the existing fence line where FP5 this goes down the side of Crees Lane, which allow the opportunity for unauthorised access onto Crees Lane which is a private road.
3. Low hanging trees were observed along Kelham Road to the rugby club, and overgrown grass edging back to rear of the existing footway.

3.12 Preliminary design WCH surveys

Survey data used in the original options stage assessment is now outdated and no longer suitable for use as per the requirements of GG 142 paragraph 4.19. Therefore, new WCH surveys at 17 sites along the Scheme were commissioned in late 2022, the first of which commenced in January 2023. The survey sites encompass existing bridleway and PRoW routes that interact with or intersect the A46.

Surveys using camera technology were initially setup to capture one week of data at each site. Unfortunately, the equipment at a number of initial sites was either vandalised or stolen, and therefore only survey information from five sites could be obtained using this method, with only one site successfully collecting a full week of data.

In the absence of camera surveys, manual count surveys were commissioned for the remaining 12 sites. Manual surveys commenced in March 2023 and were completed in early April 2023. These 12 sites were manually surveyed from 6am to 10pm on both a weekday and a weekend day.

All WCH surveys categorised counts into pedestrians, pedestrians with dogs, pedestrians with a pram or pushchair, mobility impaired users, wheelchair users, joggers, cyclists, and equestrians.

Figure 17 below highlights the 17 survey sites. Figure 17 should be read in conjunction with Table 2.

Figure 17: January – April 2023 WCH survey locations

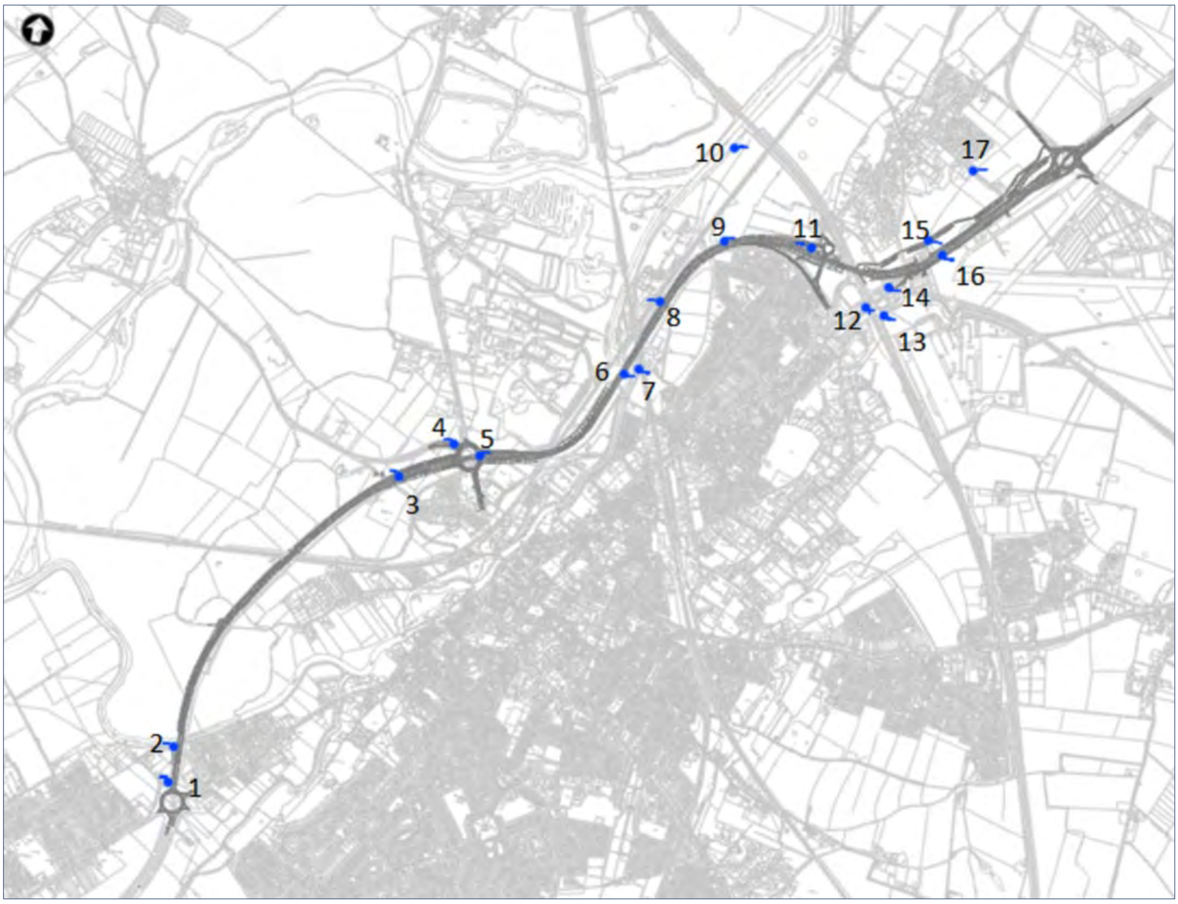


Table 2: WCH survey counts (January – April 2023)

Site	Day	Date	Pedestrian	Pedestrian with Dog	Pushchair	Mobility Impaired	Wheelchair	Jogger	Cyclist	Equestrian	Other	TOTAL
1	Thu	12.01.2023	16	3	0	0	0	3	0	0	0	22
1	Fri	13.01.2023	13	3	0	0	0	0	2	0	0	18
1	Sat	14.01.2023	7	2	0	0	0	0	1	0	0	10
1	Sun	15.01.2023	10	2	0	0	0	0	1	0	0	13
1	Mon	16.01.2023	7	1	0	0	0	0	3	0	0	11
2	Fri	03.03.2023	48	76	0	0	0	6	19	1	0	150
2	Sat	04.03.2023	50	95	0	0	0	6	11	0	0	162
3	Sun	05.03.2023	4	0	0	0	0	0	0	0	0	4
3	Mon	06.03.2023	0	11	0	0	0	0	0	0	0	11
4	Thu	12.01.2023	10	6	0	0	0	0	1	0	0	17
4	Fri	13.01.2023	10	6	0	0	0	0	1	0	0	17
5	Thu	12.01.2023	19	1	0	0	0	0	5	0	0	25
5	Fri	13.01.2023	18	1	0	0	0	0	3	0	0	22
5	Sat	14.01.2023	18	3	0	0	0	1	7	0	0	29
5	Sun	15.01.2023	14	2	0	0	0	0	3	0	0	19
5	Mon	16.01.2023	15	2	0	0	0	1	5	0	0	23
6	Sat	01.04.2023	31	7	0	0	0	2	0	0	1	41
6	Fri	31.03.2023	1	5	0	0	0	0	0	0	1	7
7	Fri	31.03.2023	3	4	0	0	0	0	2	0	4	13
7	Sat	01.04.2023	27	19	0	0	0	0	2	0	0	48
8	Fri	10.03.2023	5	18	0	0	0	0	0	0	0	23
8	Sat	11.03.2023	0	27	0	0	0	0	0	0	0	27
9	Sun	12.03.2023	14	52	0	0	0	0	17	0	0	83
9	Mon	13.03.2023	6	7	0	0	0	0	0	0	0	13
10	Mon	16.01.2023	3	1	0	0	0	0	0	0	0	4

Site	Day	Date	Pedestrian	Pedestrian with Dog	Pushchair	Mobility Impaired	Wheelchair	Jogger	Cyclist	Equestrian	Other	TOTAL
10	Tue	17.01.2023	7	3	0	0	0	0	1	0	0	11
10	Wed	18.01.2023	4	2	0	0	0	0	2	0	0	8
10	Thu	19.01.2023	26	6	2	0	1	0	3	0	0	38
10	Fri	20.01.2023	34	8	6	0	0	0	5	0	0	53
10	Sat	21.01.2023	37	10	2	1	0	0	3	1	0	54
10	Sun	22.01.2023	6	3	0	0	0	0	2	0	0	11
11	Mon	16.01.2023	45	17	0	0		0	8	0	0	70
11	Tue	17.01.2023	49	10	4	0	0	0	10	0	0	73
11	Wed	18.01.2023	45	10	4	0	0	0	7	0	0	66
11	Thu	19.01.2023	35	4	1	0	1	1	5	0	0	47
11	Fri	20.01.2023	53	5	0	0	3	1	10	0	0	72
11	Sat	21.01.2023	25	1	1	0	1	0	4	0	0	32
11	Sun	22.01.2023	33	9	3	0	0	3	12	1	0	61
12	Fri	17.03.2023	167	5	0	0	0	2	87	0	0	261
12	Sat	18.03.2023	108	11	0	0	0	3	79	0	0	201
13	Sun	19.03.2023	106	0	0	0	0	0	85	0	0	191
13	Mon	20.03.2023	142	3	0	0	0	0	88	0	0	233
14	Fri	24.03.2023	1	0	0	0	0	0	0	0	0	1
14	Sat	25.03.2023	6	4	0	0	0	0	0	0	0	10
15	Sun	26.03.2023	1	0	0	0	0	0	0	0	0	1
15	Mon	27.03.2023	1	1	0	0	0	0	0	0	0	2
16	Sun	26.03.2023	2	0	0	0	0	0	0	0	0	2
16	Mon	27.03.2023	4	0	0	0	0	1	0	0	0	5
17	Mon	03.04.2023	6	26	0	0	0	0	0	0	0	32
17	Sun	02.04.2023	8	26	0	0	0	0	0	0	0	34

3.13 Options stage WCH surveys

For comparison purposes, the three sites surveyed during the options stage will be summarised here in a format that can be compared to the preliminary design stage surveys. The sites surveyed during the options stage are as follows:

- A46/B6166 Farndon Roundabout and Crees Lane.
- A46/A616 Cattle Market junction
- Winthorpe Road underpass.

Each site was surveyed for one typical weekday (13 September 2018), and one typical Saturday (15 September 2018), over a 12-hour period; 0700hrs – 1900hrs.

The three sites surveyed at options stage contained three sub-sites (A, B and C as per the original options stage report, HE551478-ATK-HGN-XX-RP-CH-000012). For the purposes of this report the sub-sites which can be compared against the preliminary design stage surveys have been extracted in Table 3 and referenced to align with the preliminary design stage survey location identifiers (‘site 4’ etc.)

Table 3: WCH survey counts (options stage)

Options stage 1 site	Individual sub-site extracted for preliminary design stage comparison	Day	Date	Pedestrian	Cyclist	Equestrian	TOTAL	File reference
1. A46/B6166 Farndon Roundabout and Crees Lane	Site 1 Farndon Underpass	Thursday	13 Sept 2018	126	107	0	233	HE551478-ATK-HGN-XX-RP-CH-000012
1. A46/B6166 Farndon Roundabout and Crees Lane	Site 1 Farndon Underpass	Saturday	15 Sept 2018	143	117	0	260	HE551478-ATK-HGN-XX-RP-CH-000012
2. A46/A616 Cattle Market junction	Site 4 A617 Kelham Road	Thursday	13 Sept 2018	14	26	0	40	HE551478-ATK-HGN-XX-RP-CH-000012
2. A46/A616 Cattle Market junction	Site 4 A617 Kelham Road	Saturday	15 Sept 2018	4	6	0	10	HE551478-ATK-HGN-XX-RP-CH-000012
2. A46/A616 Cattle Market junction	Site 5 A46 Cattle Market junction east crossing	Thursday	13 Sept 2018	75	138	0	213	HE551478-ATK-HGN-XX-RP-CH-000012
2. A46/A616 Cattle Market junction	Site 5 A46 Cattle Market junction east crossing	Saturday	15 Sept 2018	59	99	0	158	HE551478-ATK-HGN-XX-RP-CH-000012

Options stage 1 site	Individual sub-site extracted for preliminary design stage comparison	Day	Date	Pedestrian	Cyclist	Equestrian	TOTAL	File reference
3. Winthorpe Road underpass	Site 11 Using Winthorpe Road	Thursday	13 Sept 2018	109	85	0	194	HE551478-ATK-HGN-XX-RP-CH-000012
3. Winthorpe Road underpass	Site 11 Using Winthorpe Road	Saturday	15 Sept 2018	129	94		223	HE551478-ATK-HGN-XX-RP-CH-000012

3.14 Impaired user and mobility assessment

In accordance with the design guidelines set out in *Department for Transports Inclusive Mobility - A Guide to Best Practice on Access to Pedestrian and Transport* Infrastructure, this Scheme will incorporate the needs of all users as far as reasonably practicable.

New non-motorised routes will be a minimum of 2m wide, and gradients will be no greater than 5%. Stepped access only solutions will be avoided and crossing points will have suitable dropped kerbing and tactile paving. Signing will be sized appropriately, sensibly positioned and will provide clear and concise information.

3.15 North-south severance assessment

Concerns surrounding the lack of existing connectivity between the northern and southern sides of the A46 have been raised. The existing north-south connectivity will be assessed here and will be reviewed as part of the opportunities in Section 4 of this report.

- Users can cross the A46 at Cattle Market Junction, but it is only partially signalised and currently is not suitable for mobility impaired users.
- Footpath FP14 connecting Kelham and crossing over the existing A46 via an uncontrolled crossing is not safe and also unsuitable for mobility impaired users.
- On the northern side of the A46, the village of Winthorpe is linked to the A46 by two existing routes, footpath FP2, and the existing footway along Gainsborough Road, which travels under the A1 and connects with Winthorpe Road. Historically, footpath FP2 provided a direct link from Winthorpe to Newark Showground. However, it was then severed by the construction of the current A46 carriageway and a vehicle restraint system. Nottinghamshire County Council have confirmed that this is formally shown as being stopped up on the definitive map. There are however visual signs that some pedestrians still use this route, presenting significant safety concerns. Without the connectivity FP2 provides, there is currently no direct access from Winthorpe to Newark Showground without a substantial diversion along Gainsborough Road and to the west of the existing Brownhills Roundabout.
- There are a number of places where routes pass beneath the existing A46. These are:
    - BW2 beneath Windmill Viaduct
    - BW6 beneath Nether Lock Viaduct

- FP48-1 beneath the existing underpass serving the sewage treatment works
- The route that forms part of Trent Valley Way and National Cycle Network Route 64 which crosses beneath the A46 to the west of Brownhills Roundabout.

3.16 Consultation with stakeholders

3.16.1 National Highways Studies Team

Liaison with the Applicant's Studies Team, within the East Midlands Asset Team was undertaken at options stage. The feedback identified the following locations as being of highest priority:

- The pedestrian crossings adjacent to Cattle Market crossing the A46, A617 and A616
- Sustrans National Cycle Network Route 64 which goes under both the A46 and A1 in this area
- Existing cycle facilities alongside the A46.

The key priority was highlighted as: "we should be looking to reduce the existing severance effects currently experienced by non-motorised users. Safe, attractive and direct grade separated crossings should be considered to meet the needs of WCH's".

3.16.2 National Highways Operation Directorate Workshop – 26.01.2023

During preliminary design stage a workshop was held with the Applicant regarding maintenance access, signing and WCHAR. A number of minor changes and additions were requested during this workshop. Meeting minutes can be found in document HE551478-SKAG-GEN-CONWI_CONW-MI-ZH-00048, which is attached to this report in Appendix B.

3.16.3 Nottinghamshire County Council – 09.09.2022

An introductory meeting was held with the Countryside Access Team Manager at Nottinghamshire County Council whereby the Scheme was introduced and the proposals for WCH routes were presented. No concerns were raised at this meeting with the proposed strategy, and it was agreed that a representative of the design team would be invited to future meetings with the Nottinghamshire Local Access Forum that Nottinghamshire Council chair.

3.16.4 Active Travel Group – 06.10.2022

This meeting was an introductory call with representatives of the local active travel groups (including horse riders, cyclists, and ramblers) to present the current proposals in advance of public consultation. No specific actions were recorded as a result of this meeting.

3.16.5 Definitive Map Review – 31.10.2022

A face-to-face meeting between Skanska and NCC at County Hall, West Bridgford, to review the definitive map and confirm the routes shown on the drawings were correct. Specifically this confirmed that the footpaths FP2 and FP3 do not cross the A46 and are formally stopped up.

3.16.6 Local Access Forum – 03.11.2022

Local Access Forum meeting at County Hall with local councillors, NCC and members of the active travel groups. No specific actions were recorded.

3.16.7 Active Travel Group – 15.11.2022

Face to face meeting in the Skanska Newark-on-Trent Office with the active travel group representatives. No specific actions were recorded.

3.16.8 Active Travel England – 29.11.2022

Presentation of the A46 case study to Active Travel England as part of an introductory meeting between Active Travel England and the Applicant. No specific actions were recorded.

3.16.9 Active Travel Working Group – 13.12.2022

Face to face meeting with NCC and members of the active travel group. No specific actions were recorded.

3.16.10 Local Access Group – 11.05.2023

No issues raised over proposals to date, the key focus was on designated funds / social value funds opportunities. Three opportunities were identified. These are situated at locations P, S and T on HE551478-SKAG-GEN-CONWI_CONW-DR-CH-00100 in Appendix A.

Further information on designated funds can be found in Section 4.1 below.

3.17 Consultation with local user groups

3.17.1 Newark Active Travel Partnership Submission

During options stage the Active Travel Partnership produced a four-page document whereby local user groups provided their concerns, approvals, and recommendations for the Scheme. This submission is supported by:

- Newark Sports Association and Castle Cycling Club
- Newark Riding Group, Nottinghamshire CTC, Cycling UK.
- British Horse Society Access Field Officer, East and West Midlands

- Coddington Parish Council
- The Winthorpe Residents' A46 Consultation Group

A copy of this document, HE551478-SKAG-GEN-CONWI_CONW-RP-ZH-00038, can be found attached in Appendix B.

A further meeting was held with the A46 Active Travel Partnership on 6 October 2022 to introduce the Scheme and provide the updates since the preferred route announcement.

3.17.2 Think Again Report – Response to Statutory Consultation

The 'Think Again' group was formed following the release of proposals by the Applicant for improvements to the A46 in Newark-on-Trent, Nottinghamshire. The group is founded by Winthorpe Village residents with the purpose of protecting the interests of the Winthorpe community, where it would be affected by the A46 road development.

A report titled 'Response to National Highways Statutory Consultation on the proposed Newark A46 Bypass' was prepared following the A46 public consultation events in late 2022, with the purpose to "negotiate with National Highways and their appointed agents to get the best outcome for Winthorpe in the design and construction of the A46 Bypass." A summary of this report in respect to Non-Motorised User concerns only is provided below:

- Concerns regarding how the Winthorpe Footpaths 2 and 3 will continue from Long Hollow Way towards Coddington.
- Crossing detail for the at-grade crossing points of the Trent Valley Way on the proposed north-bound slip road and the at-grade crossing of the re-routed Winthorpe footpaths 2 and 3 on the remaining dual carriageway connector between Friendly Farmer and Brownhills.
- The Trent Valley Way, the Trent Vale Trail and Sustrans National Route 64 are significantly re-routed in the latest design. We are overly concerned that this might deter users, especially as the proposed pathway is very close to trafficked roads, both in the slip road bridge and at the at-grade crossing.
- WCH Access from Winthorpe to the retained Esso Service Station and its associated shop.
- A cycling route via Hargon Lane to connect Sustrans National Route 64 to the showground side of the new road.
- An extension of the current cycle / walking route from Newark-on-Trent to the Mastercare location up to the Showground entrance.

- Protection against degradation of the Sustrans National Route 64, Trent Valley Way and Trent Vale Trail between Newark and Winthorpe.

3.18 Statutory consultation

Statutory Consultation events were held in numerous venues across Newark-on-Trent from October 2022 to December 2022. Consultation comments and public feedback from these events was provided in late 2022. Responses in respect to design concerns related to the WCH infrastructure have been summarised in Section 5 of this report.

3.19 Further consultation

During options stage, the British Horse Society (BHS) and Sustrans were approached, as the two primary non-statutory stakeholders/representative bodies for equestrians and for walking/cycling. Further liaison with both organisations and others will take place as the project develops.

The local BHS Access Officer for the Newark-on-Trent area provided feedback relating to existing issues and opportunities in the area. The key points highlighted were:

- River Trent path (BW2) south of Newark-on-Trent is navigable by equestrians, although there are a number of inappropriate gates and bridges with low parapets which could be improved.
- The River Trent Path south of the town centre (BW5) has a number of sections that are un-navigable by equestrians due to gates and lock bridges, although demand may be low.
- The BHS are investigating evidence of an historical route between the northern extent of the River Trent path at the A1 (BW6), and Holme Lane at the level-crossing. Completing this missing link would open-up a network north to Holme.
- Danethorpe and Stapleford Woods to the north-east of the study area are centres of equestrian activity, and any links through to that area would be beneficial.
- A suitable river crossing allowing the development of links to join existing networks at South/North Muskham would be beneficial.

4. Review of assessment opportunities

Throughout Section 4 of this report identified opportunities have been tabulated for ease of reference. Designated funds opportunities are highlighted by *** adjacent to the opportunity reference.

4.1 Designated funds opportunities

Designated funds opportunities are highlighted by *** adjacent to the opportunity reference in the various opportunity tables throughout Sections 4 and 5 of this report. Designated funds opportunities will be reviewed in further detail during subsequent design stages.

In order to bring forward integrated design solutions, as part of the Roads Investment Strategy (RIS) there are a series of 'designated funds' which are reserved for key aspects of National Highway's activity. These funds are used to bring forward small-scale interventions to address issues identified with stakeholders and can include improving the non-motorised users' facilities. Further details are available in the Government's Road Investment Strategy RIS 2 (pages 107 – 112).

Designated funds are however separate to National Highways core work of operating, maintaining and improving the Strategic Road Network (SRN). They provide ring-fenced funding that can be used to invest in and support initiatives that deliver lasting benefits for road users, the environment and communities across the country, under four designated fund plans:

- Safety and congestion
- Environment and wellbeing
- Users and communities
- Innovation and modernisation

Designated funds are however not guaranteed for any major National Highways project. They are reviewed at the time that each RIS is produced for each road period and they are not guaranteed to be available when a scheme is built.

Therefore, designated funds are not a commitment to a proposal, they are an opportunity should the required funding become available which can be accessed in addition to the Scheme funding. The proposed A46 Scheme's functionality and its feasibility in integrating with the non-motorised facilities are not dependent on the opportunities identified as subject to designated funds in this report.

4.2 Review of general opportunities

General opportunities have been extracted from the options stage assessment report. These opportunities, as well as the preliminary design stage identified opportunities are provided in Table 4 below. The following table should be reviewed in conjunction with layout plan HE551478-SKAG-GEN-CONWI_CONW-DR-CH-00100, which can be found in Appendix A.

Table 4: General opportunities

Ref.	Scheme location	Options stage general opportunity	Preliminary design stage review
1	A46/B6166 Farndon Road /Fosse Road Roundabout Shared Use Path.	On Farndon Road the Shared Use Path (SUP) surface is sealed and in poor condition.	The surfacing will be improved in the vicinity of the design intervention (new overpass for A46 widening). An on-site condition assessment will be conducted in the later stages of this Scheme.
2	BW2 – River Trent Path	Bridleway, BW2 (potentially BW5) stopped up	This comment is potentially in reference to Bridleway 'BW5', rather than 'BW2'. Bridleway BW5 does not form a circular route and ends adjacent to the river Trent, whereby users have to then turn around. To continue the bridleway would require a new bridge over the River Trent which would be prohibitively expensive and would not provide good value for money.
3	(FP3/FP5 providing links to Farndon Road/Marsh Lane)	Footpath, FP5 overgrown	A condition assessment will be undertaken at detailed design stage. Some localised vegetation pruning/clearance may be required.

Ref.	Scheme location	Options stage general opportunity	Preliminary design stage review
4	FP14 Kelham Road to Kelham	Little use and overgrown in places	A condition assessment will be undertaken at detailed design stage. Some localised vegetation pruning/clearance may be required.
5	A46 / A616 / B6236 Great North Road Shared Use Path	Worn signage, narrow unsegregated crossing	New WCH signs will be incorporated where existing routes have been diverted. New pedestrian/cyclist crossings will be provided at Cattle Market junction.
6***	BW5/BW6 – River Trent Path	BW6, limited evidence of use north of the footbridge. Does not serve equestrians well, being narrow, high, with inadequate parapets.	The route adjacent to the River Trent is currently under review as part of a designated funds opportunity. Existing footbridge near Hatchets Lanes is outside the scope of this Scheme.
7	FP11 – Hatchet Lane to BW6 – River Trent Path	The path was suspended and gates to access the railway permanently closed. It is presumed there is an aspiration to permanently stop-up this ROW across the railway.	This path was likely closed due to safety concerns as a result of crossing a live railway. The local council will be advised of the status.
8	FP48 Quibell's Lane to BW6	Route as a whole does not provide a convenient link for users. West of Nottingham-Lincoln Railway line – route is narrow and partially overgrown.	This route is not being modified as part of the Scheme. This will be addressed if and when grade separation works take place. The local council will be advised of the maintenance issues.

Ref.	Scheme location	Options stage general opportunity	Preliminary design stage review
9***	Gainsborough Road/Farm Access / Shared Use Path (Winthorpe-Newark-on-Trent)	A1 underpass is narrow and constrained with poor forward visibility.	The A1 underpass at this location will not be modified as part of this Scheme. The local council will be notified of visibility issues.
10	A46/A1 footway/Shared Use Path (Lincoln Road to Long Hollow Way)	At-grade crossing, limited visibility and high traffic volumes and speeds.	A new WCH crossing will be provided as part of the Scheme. The new crossing will be signalised and further from the existing junction, in a location of improved visibility.
11***	FP2 (Winthorpe to Newark Showground)	Route severed by VRS in central reserve. Southern side, access to the A46 is overgrown and blocked by vegetation.	This route will remain closed. A new shared-use cycleway footway will be provided which will connect into FP2 and provide a link south of the A46 to Newark-on-Trent and the showground.
12	Winthorpe to airfield A46 crossing	A grade separated crossing of the A46.	A new grade separated crossing will not be provided due to visual impact and the required length of the crossing making it prohibitively expensive and not good value for money. A new shared-use cycleway footway will be provided which will connect into FP2 and provide a link south of the A46 to Newark-on-Trent and the showground.
13	A17 Roundabout	Safe access to the developing business park	A new combined footway/cycleway will be constructed at this location,

Ref.	Scheme location	Options stage general opportunity	Preliminary design stage review
			which will provide safer access.
14	A17 Overbridge	Upgrading of the current connection to Coddington & Beacon Hill	This bridge structure is outside of the project extents and will not be improved as part of this Scheme. The Applicant and the local council will be advised of the issues.
15	A46 Winthorpe WCH tie-in	Provide safe access to the right of way links to Danethorpe & Brough i.e. between the Friendly Farmer and Winthorpe roundabouts.	A new combined footway/cycleway adjacent to the A46 will provide a link between the Friendly Farmer and Winthorpe roundabouts.
16	Beacon Hill Road / A1 Underpass	Make use of the Beacon Hill underpass under the A1.	This bridge structure is approximately 2km away from the Scheme order limits and will not be reviewed as part of this Scheme.

4.3 Review of strategic opportunities

Strategic opportunities have been extracted from the options stage assessment report. These opportunities, as well as the preliminary design stage identified opportunities are provided in Table 5 below. Table 5 should be reviewed in conjunction with layout plan HE551478-SKAG-GEN-CONWI_CONW-DR-CH-00100, which can be found in Appendix A.

Table 5: Strategic & priority opportunities

Ref.	Scheme location	Options stage strategic opportunity	Preliminary design stage designers review
S1	Pedestrian crossings A46/A617/A616 island;	"We should be looking to reduce the existing severance effects currently experienced by non-motorised users.	This feedback has been considered within the design of the NMU crossings. Where grade separated crossing are not

Ref.	Scheme location	Options stage strategic opportunity	Preliminary design stage designers review
		Safe, attractive, and direct grade separated crossings should be considered to meet the needs of WCH's".	possible, safe at-grade crossings are provided that will be suitable for mobility impaired customers.
S2	Sustrans Route 64 under both the A46 and A1	"We should be looking to reduce the existing severance effects currently experienced by non-motorised users. Safe, attractive, and direct grade separated crossings should be considered to meet the needs of WCH's".	A new combined footway-cycleway will be provided alongside the new Brownhills roundabout and connecting arm. This will replace the severed footway on Winthorpe Road and will preserve the Tent-Valley-Way connection from Winthorpe to Newark-on-Trent. Where the new A46 alignment crosses over the existing A1, a new combined footway-cycleway will be provided adjacent to the A1. This new route will be part of the broader WCH provisions which will link existing WCH routes from Winthorpe, such as Hargon Lane and Winthorpe footpath FP2, to the southern side of the A46.
S3	Existing cycle facilities alongside the A46	"we should be looking to reduce the existing severance effects currently experienced by non-motorised users. Safe, attractive, and	A new combined footway cycleway will be provided between Winthorpe and Brownhills junctions. This new WCH provision will link existing WCH route

Ref.	Scheme location	Options stage strategic opportunity	Preliminary design stage designers review
		direct grade separated crossings should be considered to meet the needs of WCH's."	and form a 'circular' WCH route in the area, linking Newark Showground, Winthorpe, and Newark-on-Trent. New at grade pedestrian and cycle facilities will be provided at Farndon, Cattle Market, Brownhills and Winthorpe junctions.

4.4 Review of pedestrian specific opportunities

Pedestrian opportunities have been extracted from the options stage assessment report. These opportunities, as well as the preliminary design stage identified opportunities are provided in Table 6 below. The following table should be reviewed in conjunction with layout plan HE551478-SKAG-GEN-CONWI_CONW-DR-CH-00100, which can be found in Appendix A.

Table 6: Pedestrian opportunities

Ref.	Opportunity type	Options stage opportunity	Preliminary design stage designers review
P1***	Pedestrian	Improve the Shared-Use Path (SUP) on Farndon Road. Cyclists and pedestrians are separated by a white line, and the pedestrian side is narrow in places – less than 1m.	Widening is not possible on Farndon Road due to existing physical constraints such as property boundaries and existing infrastructure. As per general opportunity (Ref. 1), the surfacing will be improved in the vicinity of the design intervention (new overpass for A46 widening). An on-site condition assessment will be conducted in the later stages of this Scheme.

Ref.	Opportunity type	Options stage opportunity	Preliminary design stage designers review
P2***	Pedestrian	Retain the shared use subway system at the A46/Fosse Road roundabout, ensuring subways are well maintained and lit.	This will be retained and will accommodate the A46 dual carriageway overhead.
P3***	Pedestrian	Upgrade the crossing on Great North Road (north) on the Great North Road/A46 roundabout. This could involve the introduction of signals.	This crossing will be signalised to provide a safer crossing for non-motorised users.
P4	Pedestrian	Ensure the footpath from Newark Castle to Kelham (part of the Trent Valley Way) is maintained and improve the quality and safety of the un-signalised A617 and A46 crossings just west of Great North Road. This could involve the diversion of the footpath to the Cattle Market roundabout, if an improved crossing facility is provided there.	This opportunity has been considered and has been incorporated into the design.
P5	Pedestrian	Widen the shared use paths on the Great North Road/A46 roundabout, which are currently narrow and below minimum DMRB standards.	In several locations, shared use path is narrow due to debris and vegetation. Debris and vegetation would need to be removed and the routes cleaned. The Scheme will clean the existing route only within the order limits. An on-site condition assessment will be conducted in the later stages of this Scheme.

Ref.	Opportunity type	Options stage opportunity	Preliminary design stage designers review
P6***	Pedestrian	Ensure the A46 and A1 underpass route from Winthorpe Road to Winthorpe is retained, and preferably remains grade separated.	Route will be diverted underneath the new A46 alignment and will connect back into the old Winthorpe Road. There will be a signalised at grade crossing of the slip road, however this was viewed as preferable to multiple long underpasses that would not be attractive for users.
P7***	Pedestrian	Maintain the footbridge parallel to the A1 which provides access from the A46 to the industrial park to the north of the A1.	This will be retained but will not be 'maintained' as part of the Scheme.
P8***	Pedestrian	Improve facilities and safety of minor access crossings from Newark-on-Trent town centre to north Newark-on-Trent for both cyclists and pedestrians (via Northgate, Lincoln Road and Winthorpe Road).	A new shared-use crossing will be provided over the existing A46 carriageway between Brownhills and Friendly Farmer junctions, just east of the A1. A new combined footway cycleway will be provided between Winthorpe and Brownhills junctions. This new WCH provision will link existing WCH route and form a 'circular' WCH route in the area, linking Newark Showground, Winthorpe, and Newark-on-Trent.

4.5 Review of cyclist specific opportunities

Cyclist opportunities have been extracted from the options stage assessment report. These opportunities, as well as the preliminary design stage identified opportunities are provided in Table 7 below. The following table should be reviewed in conjunction with layout plan HE551478-SKAG-GEN-CONWI_CONW-DR-CH-00100, which can be found in Appendix A.

Table 7: Cyclist opportunities

Ref.	**Opportunity type**	**Options stage opportunity**	**Preliminary design stage designers review**
C1***	Cyclist	Introduce facilities for cyclists on Fosse Road, south of Long Lane. This route is part of the National Cycle Network, NCN42, however no cyclist facilities are provided again until Syerston.	This opportunity is outside the Scheme extents and will not be progressed as part of this Scheme. However, the local council will be made aware of the issues.
C2***	Cyclist	Retain the shared use subway system at the A46/Fosse Road roundabout, ensuring subways are well maintained and lit.	As per general opportunity (Ref. 1), the surfacing will be improved in the vicinity of the design intervention (new overpass for A46 widening). An on-site condition assessment will be conducted in the later stages of this Scheme.
C3***	Cyclist	Improve the SUP on Farndon Road. Reduce the number of minor accesses which have priority over the SUP (the SUP has give-way markings). A number of cyclists were seen using the road instead of the SUP during the site visit.	Detailed design interventions to Farndon Road are outside the scope of this Scheme. Widening of the existing shared use route is not possible on Farndon Road due to existing physical constraints such as property boundaries and existing infrastructure.

Ref.	Opportunity type	Options stage opportunity	Preliminary design stage designers review
			Existing minor roads will continue to have priority over the shared use route. The local council will be advised of issues.
C4***	Cyclist	Improve the existing toucan crossing on the A46 at the Cattle Market junction. This could include increasing the available waiting space, introducing more skid resistant materials on the approach to the crossing for cyclists, and introducing more signage/markings to warn road users of the upcoming crossing.	This opportunity has been incorporated within the Scheme design.
C5***	Cyclist	Widen the SUP on Great North Road (A616) from South Muskham / Little Carlton into Newark-on-Trent.	This opportunity is outside the scope of this Scheme. The local council will be advised of this opportunity.
C6***	Cyclist	Improve SUP on Great North Road (south) from Great North Road / A46 roundabout into Newark-on-Trent. SUP is currently quite narrow, and surface is poor quality in places.	This has been incorporated within Scheme design.
C7***	Cyclist	Ensure the A46 and A1 underpass route from Winthorpe Road to Winthorpe is retained, and preferably remains grade separated.	Route will be diverted over slip road via a signalised crossing, underneath the new A46 carriageway alignment, and alongside the new Brownhills link road.

Ref.	Opportunity type	Options stage opportunity	Preliminary design stage designers review
C8***	Cyclist	Maintain the footbridge parallel to the A1 which provides access from the A46 to the industrial park to the north of the A1. Consider improving the sharp right-angled turn that is required to access the bridge from the A46, to reduce likelihood of collisions.	This will be retained but will not be 'maintained' as part of the Scheme. A significant proportion of the bridge is outside the Scheme order limits and will not be improved as part of this Scheme. Without substantial, costly realignment and structural re-design, it is not possible to reduce the "sharp right-angled turn that is required to access the bridge from the A46"
C9***	Cyclist	Provide improved cyclist facilities on Lincoln Road (B6166) and Winthorpe Road. Collision analysis showed that several cyclist collisions occurred on these roads.	These locations are outside the Scheme Order Limits and will not be improved as part of the Scheme. This may be a designated funds opportunity.
C10***	Cyclist	Improve facilities and safety of minor access crossings from Newark-on-Trent town centre to north Newark-on-Trent for both cyclists and pedestrians (via North Gate, Lincoln Road and Winthorpe Road).	These locations are outside the Scheme Draft Order Limits and will not be improved as part of the Scheme. This may be a designated funds opportunity.

4.6 Review of equestrian specific opportunities

Equestrian opportunities have been extracted from the options stage assessment report. These opportunities, as well as the preliminary design stage identified opportunities are provided in Table 8 below. The following table should be reviewed in conjunction with layout plan HE551478-SKAG-GEN-CONWI_CONW-DR-CH-00100, which can be found in Appendix A.

Table 8: Equestrian opportunities

Ref.	Opportunity Type	Options stage opportunity	Preliminary design stage designers review
E1***	Equestrian	Complete the riverside bridleway route north of Newark-on-Trent (BW6) between the A1 and Holme Lane to provide a connected network.	The route adjacent to the river Trent is currently under review as part of a designated funds opportunity.
E2***	Equestrian	Consider an appropriate river crossing opportunity to open up links between BW6 and the western side of the River Trent, Muskham and Kelham.	This opportunity is not being considered as part of this Scheme, due to its distance from the Scheme, as well as the significant design and construction challenges, as well as the cost associated with a new crossing over the river Trent.
E3***	Equestrian	Consider connections across the A46 between Winthorpe and Danethorpe.	This opportunity is not being considered due to its distance from the Scheme and low user demand.

4.7 Identified localised maintenance

The below have been identified as possible opportunities for localised maintenance, the full extents of which will be determined in detailed design stage:

1. Shared use route alongside the A17 and down to the A1 will require vegetation trimming and maintenance.
2. Footpath, FP5 will require trimming at a higher level to allow use as a temporary equestrian route. At the location where FP5 this goes down the side of Crees Lane, the gaps in the existing fence line will need to be filled to prevent access onto Crees Lane which is a private road.

3. Localised trimming required to overhanging trees along Kelham Road to the rugby club, and overgrown grass edging back to rear of existing footway.

4.8 Review of survey data

As discussed previously in Section 3.12, the survey data used in the original options stage assessment is now outdated and no longer suitable for use. WCH surveys at the 17 sites outlined in Section 3.12 of this report will be reviewed here.

Since the Stage 1 surveys were carried out in late 2018, the coronavirus pandemic has occurred and has had an impact on leisure and commuting routines throughout the United Kingdom. This impact should be accounted for during the review of survey data.

Table 9 below cross references the count data provided in Table 2 and Table 3.

Table 9: Survey observations and actions

Site	Description	Detail of observation and proposed action following review
Site 1	Farndon Roundabout Underpass. Combined cycleway/footway.	User count for Farndon underpass was surprisingly low, at a maximum of 22 users per day for the surveyed period. The options stage survey count indicated a significantly larger user count of 260. Despite the low preliminary design stage count, this is a prominent route for north-south travel from Newark-on-Trent to Farndon and beyond. The existing underpass will be retained and will accommodate carriageway widening without the need for lengthening.
Site 2	Bridleway BW2 under the A46 and adjacent the river Trent.	This is a well-used route with over 150 users per day counted during the preliminary design survey and will be maintained.
Site 3	Footpath FP14 (and the 'Trent Valley Way'), passing through the rugby club, crossing	This is currently a low usage path at 11 users per day during the survey period. This route will be diverted along Kelham

Site	Description	Detail of observation and proposed action following review
	Kelham Road, and crossing over the existing A46.	Road to Cattle Market junction using the existing footway on Kelham Road.
Site 4	Footway along Kelham Road	This is currently a low usage footway (17 users per day). This footway will be retained.
Site 5	Crossing at Cattle Market junction and across the A46	This footway is low usage (29 users per day). However, the options stage survey in September 2018, counted 158 users. A new, at-grade, combined footway/cycleway and signalisation will be provided at Cattle Market junction to ensure safer travels for users. Particularly vulnerable users and children travelling to and from the rugby club and sports fields.
Site 6	Path under Windmill Viaduct	This path is moderately used at a user count of 41. This path will be retained but may be temporarily closed during the new overbridge construction.
Site 7	Bridleway BW6 adjacent the river Trent	This bridleway is moderately used based on the preliminary design stage user count of 48. This route will be retained but may be temporarily closed during the new overbridge construction.
Site 8	Footpath FP48-1 underneath Nottingham to Lincoln Railway line	This route is moderately used at a user count of 27. This route is an important NMU link to the sewage treatment plant from Newark-on-Trent.
Site 9	Permissive path through agricultural land	This route is well-used, particularly on the weekend, with a user count of 83. There is currently no plan to formalise this route as part of the Scheme due to the future grade separation of the

Site	Description	Detail of observation and proposed action following review
		railway, but it will be reviewed in detailed design stage.
Site 10	Bridleway BW6 adjacent the river Trent and just west of the A1	This route is moderately used at a user count of 54. This route will be retained but may be temporarily closed during the new overbridge construction at Windmill viaduct.
Site 11	Winthorpe Road	This route is well used, with a user count of 73, and forms an important connection from Winthorpe to Newark-on-Trent. Due to the proposed alignment of the new A46, this route will be diverted adjacent the new Brownhills junction and under the new overpass which will carry the A46 mainline. It will then connect back into the existing route just north of the existing A46 slip road.
Site 12	A46 footway between Brownhills and Friendly Farmer junctions.	This route is well used with a user count of 261, which will likely get higher with the future development in the area. This route will be retained and will connect into a new signalised crossing to the east of the A1.
Site 13	Shared use bridge over link road between the A1 and Friendly Farmer roundabout.	This route is well used with a user count of 233, which will likely get higher with the future development in the area. This route and bridge structure will be retained.
Site 14	Crossing on A46 to the west of Friendly Farmer junction	This route has a low user count of 10 which is likely down to the unsafe nature of the existing crossing. Due to the alignment of the new A46, this route and road crossing will be stopped up. A new

Site	Description	Detail of observation and proposed action following review
		shared use route and crossing will be provided west of the current location.
Site 15	Footpath, Winthorpe FP2	Historically, this route provided a connection between Winthorpe and Newark Showground but was severed during the construction of the A46 and the vehicle restraint system. As a result, this route has a very small user count of just 2 users per day. A new shared use path will be provided which will connect into footpath FP2 and will maintain connectivity to the southern side of the A46, via the new route adjacent to the A1.
Site 16	Footway adjacent to A46 between Friendly Farmer and Winthorpe junctions	This route has a low user count of 5 which is likely due to it currently being difficult to access. Due to the proposed alignment of the new A46 this route will be formally stopped up. A new shared use route will be provided adjacent the new A46 alignment and will serve the connection between Winthorpe and Friendly Farmer junctions.
Site 17	Hargon Lane	This route has a moderate user count of 34. This route will be retained and will connect into the new shared use route which will provide access to Newark Showground, and north-south connectivity via Winthorpe junction, and the new route adjacent to the A1.

5. Review of consultation, stakeholder and user group feedback.

In addition to the assessment opportunities identified in the options stage, feedback from stakeholders, user groups and public consultation acquired throughout the options and preliminary design stages has been reviewed. These groups have been identified in sections 3.16 to 3.19 of this report.

Feedback from the user groups deemed to have a direct influence on the design strategy has been summarised and reviewed in Table 10 below. Table 10 should be reviewed in conjunction with drawing HE551478-SKAG-GEN-CONWI_CONW-DR-CH-00100 in Appendix A.

This section only reviews feedback which has a potential for design change to the walking, cycling or horse-riding infrastructure on the Scheme. Should the complete feedback be required then reference should be made to the complete schedule of statutory consultation feedback. Due to its size this is not attached to this report.

Designated funds opportunities are highlighted by *** adjacent to the opportunity reference.

Table 10: Stakeholder, user groups & public consultation review

Ref.	Source	Detail of feedback / request	Preliminary design designers review
A	Statutory Public Consultation	Stat Con - Row 366: Proposal to close path 14, for example, triple the length of time taken to walk from the Cricket ground to the rugby club (currently a 10-minute walk would become a 30-minute walk).	This crossing is unsafe due to the 70mph speed limit and dualling of the existing A46 at this location. This route will be re-routed through Cattle Market junction. A grade separated crossing is not viable due to low user demand supported by recent WCH surveys.
B	Statutory Consultation	Stat Con - Row 51: Once I have crossed under the new A46 bridge, how is one able to cross slip road N, just before the new roundabout & return onto	A new footway will be provided adjacent to the new Brownhills roundabout and link roads. This will cross the slip road via a new signalised crossing. This will preserve the Trent Valley Way

Ref.	Source	Detail of feedback / request	Preliminary design designers review
		the existing route/ A1 underpass up to Winthorpe?	Connection from Winthorpe to Newark-on-Trent.
C	Statutory Public Consultation	Stat Con - Row 389: The cycling infrastructure proposed at the Cattle Market is inadequate, there is no way a cyclist on the road can access it when coming from Newark-on-Trent, without becoming a pedestrian, waiting for a clear moment in the traffic to cross the road, to join the cycle path, then at the other end become a pedestrian again to cross the road to continue the journey on the road (you don't design like this for motor vehicles, it is not appropriate to design like this for other road users, who have the same right to use the road).	Signalised crossings are to be provided for pedestrians and cyclists at Cattle Market Junction.
D	Statutory Public Consultation	General: Numerous public consultation comments relate to the lack of cycling route proposals across the Scheme, a circular cycle walking route, and a North-South Cycle Route	A shared-use footway will be provided between Winthorpe and Brownhills junctions. This new WCH provision will link existing routes and form a 'circular' route in the area, linking Newark Showground, Winthorpe, and Newark-on-Trent. New at grade Toucan crossings will be provided at Farndon, Cattle Market,

Ref.	Source	Detail of feedback / request	Preliminary design designers review
			Brownhills and Winthorpe junctions, which will allow safe crossings and connectivity for vulnerable road users.
E	Newark Sports Association	Consideration should take place for access and footpaths around the rugby club. There is not a suitable footpath or route for people to walk on, or access available for those who do not own a vehicle. It would be good to see some provision made along this route for WCH's	Similar to pedestrian opportunity, P4, some of the suggestions raised here have been considered and incorporated into the design. This route will be re-routed through Cattle Market junction, whereby new signalised crossings will allow safer connectivity to Newark-on-Trent and nearby locations.
F	Think Again	We would like to ensure re-routed sections of FP2 and FP3 are available to cyclists and horse riders.	The route will be available for cyclists. It is not feasible for equestrians due to the at-grade crossing of the A46 which would be unsafe as an equestrian and is not considered a desirable route due to there being no equestrian facilities for the route to tie into. The route adjacent to the river Trent will be reviewed as part of designated funds.
G	Think Again	Dedicated combined footway cycleway between Godfrey Drive and Drove Lane	A new shared-use footway will be provided.
H	Think Again	WCH access to services from proposed WCH route	Esso to be consulted about potential link. A potential access would cross the

Ref.	Source	Detail of feedback / request	Preliminary design designers review
		would allow the shop to serve Winthorpe	forecourt so Esso would need to review and upgrade pedestrian infrastructure due to current suitability and safety concerns.
I	Think Again	Need to understand how Footpaths 2 and 3 will continue from Long Hollow Way towards Coddington.	This Does link to Coddington however the route will not be upgraded as part of this Scheme. Discussions are to take place with the developers about moving the footpath onto Godfrey Drive. Newark Showgrounds' preference is to use Godfrey Drive.
J	National Highways Workshop	Review impact of D2N2LCWIP (D2N2 Local Cycling and Walking Infrastructure Plan) on the Scheme.	Proposals do not preclude those projects identified in the LCWIP consultation documents.
K	National Highways Workshop	Provide options for existing routes to and from Showground/Airfield. Showground had no interest in using temporary construction route as a permanent feature.	Connections have been improved with current design proposals. There is future opportunity for the Showground to further improve connections during the showground development, utilising the proposed WCH route to the southern side of the A46.
L	National Highways Workshop	Signalised crossing requested on A17.	A signalised crossing is not being proposed due to the 60mph speed limit. It is beyond this projects scope to amend the speed limit of local

Ref.	Source	Detail of feedback / request	Preliminary design designers review
			authority roads. Also see response to opportunity N. The local Council will be made aware, to review in line with future use.
M***	National Highways Workshop	Confirm signalisation requirements for crossing at Cattle Market (Great North Road North - Not signalised)	This has been reviewed and it has been deemed necessary to provide a signalised crossing in this location, due to a number of safety reasons, in particular for children to have safer access to the sports fields nearby.
N	Operations Directorate – National Highways	Upgrade of Crossing at Long Hollow Way.	Signalisation not feasible due to lack of capacity. Existing crossing is new with new tactile paving. Nottinghamshire Council to review in line with future use. Also see response to opportunity L.
O	Operations Directorate – National Highways	Provisions for safe access to A17 roundabout and business park.	A new, share-use footway will be provided adjacent to Godfrey Drive. This will link into the existing shared use route adjacent to the A17, which also connects the business park, via the existing at-grade crossing The existing Shell garage and café/restaurant is not designed for pedestrian access, only vehicles. Pedestrian infrastructure would need to be reviewed

Ref.	Source	Detail of feedback / request	Preliminary design designers review
			separately by Shell due to suitability and safety concerns.
P***	Nottinghamshire Council – PRoW Officer	“There is some history to the route mentioned. South-west of the A1 there is some proposed development, which requested a corridor for non-motorised users which we were happy to look at.”	This is under review as a potential designated funds opportunity but is not considered a part of the core Scheme.
Q	British Horse Society	River Trent path (BW2) south of Newark-on-Trent is navigable by equestrians, although there are a number of inappropriate gates and bridges with low parapets which could be improved.	This is outside the scope of the Scheme but will be raised as a user issue.
R	British Horse Society	The River Trent Path south of the town centre (BW5) has a number of sections that are un-navigable by equestrians due to gates and lock bridges, although demand may be low.	This is outside the scope of the Scheme but will be flagged as a user issue.
S***	British Horse Society	The BHS are investigating evidence of an historical route between the northern extent of the River Trent path at the A1 (BW6), and Holme Lane at the level-crossing. Completing this missing link would open-up a network north to Holme.	This is outside the scope of the Scheme but will be highlighted as a potential designated funds opportunity.

Ref.	Source	Detail of feedback / request	Preliminary design designers review
T***	British Horse Society	Danethorpe and Stapleford Woods to the north-east of the study area are centres of equestrian activity, and any links through to that area would be beneficial.	These woodlands are a significant distance from the Scheme and are therefore deemed outside of scope of the Scheme.
U***	Sustrans	A suitable river crossing allowing the development of links to join existing networks at South/North Muskham would be beneficial.	The route adjacent to the River Trent is currently under review as part of a designated funds opportunity.

6. Summary

The options stage assessment report has been reviewed and a number of the identified opportunities have been incorporated within the preliminary design. The opportunities identified are tabulated in Sections 4 and 5 above. These will be reviewed in further detail with Nottinghamshire Council and National Highways in planning and detailed design stages.

Following feedback from statutory public consultations, stakeholders, various user groups, and a review of site surveys and user counts, the proposed WCH design has been revised in a number of locations across the Scheme. The primary design improvements are summarised as follows:

- Improved connectivity from Winthorpe to Newark-on-Trent, across the A46 via new, at-grade crossing points at Brownhills junction and Winthorpe Roundabout.
- Creation of a combined footway/cycleway 'circular' route between Brownhills junction and Winthorpe roundabout which also provides improved access to Newark Showground.
- Signalisation of additional crossing points on a number of junctions, including Cattle Market and Winthorpe junctions.
- Reduction of the north-south severance by providing a new crossing west of Friendly Farmer roundabout.
- Retention of existing routes where possible. Where it is unsafe to retain a route, a suitable diversion will be provided.
- Localised maintenance and lighting improvements on existing routes.
- New shared-use route adjacent to A46 allowing improved connectivity to Newark Showground, as well as the opportunity for future development.

Additionally, a number of potential designated fund opportunities have been identified for further enhancements to be reviewed in more detail in the planning and detailed design stages. These are however subject to confirmation and are not impacting the Scheme's functionality as currently developed. Advanced discussions regarding further design and maintenance interventions will also take place during these stages.

As Lead Assessor, I confirm that this walking, cycling and horse-riding assessment and review report has been compiled in accordance with DMRB GG 142 and thus records all design team deliberations and decisions relating to walking, cycling and horse-riding issues and opportunities.

The walking, cycling and horse-riding assessment and review was undertaken by the following team:

WCHAR Lead assessor

Name	[redacted]
Position	Highways Engineer
Organisation	Mott MacDonald Ltd
Signed	[redacted]
Date	30/05/2023

WCHAR assessor (where appointed)

Name	N/A
Position	N/A
Organisation	N/A

As design manager, I confirm that the assessment and review has been undertaken at the appropriate stage of the highway Scheme development.

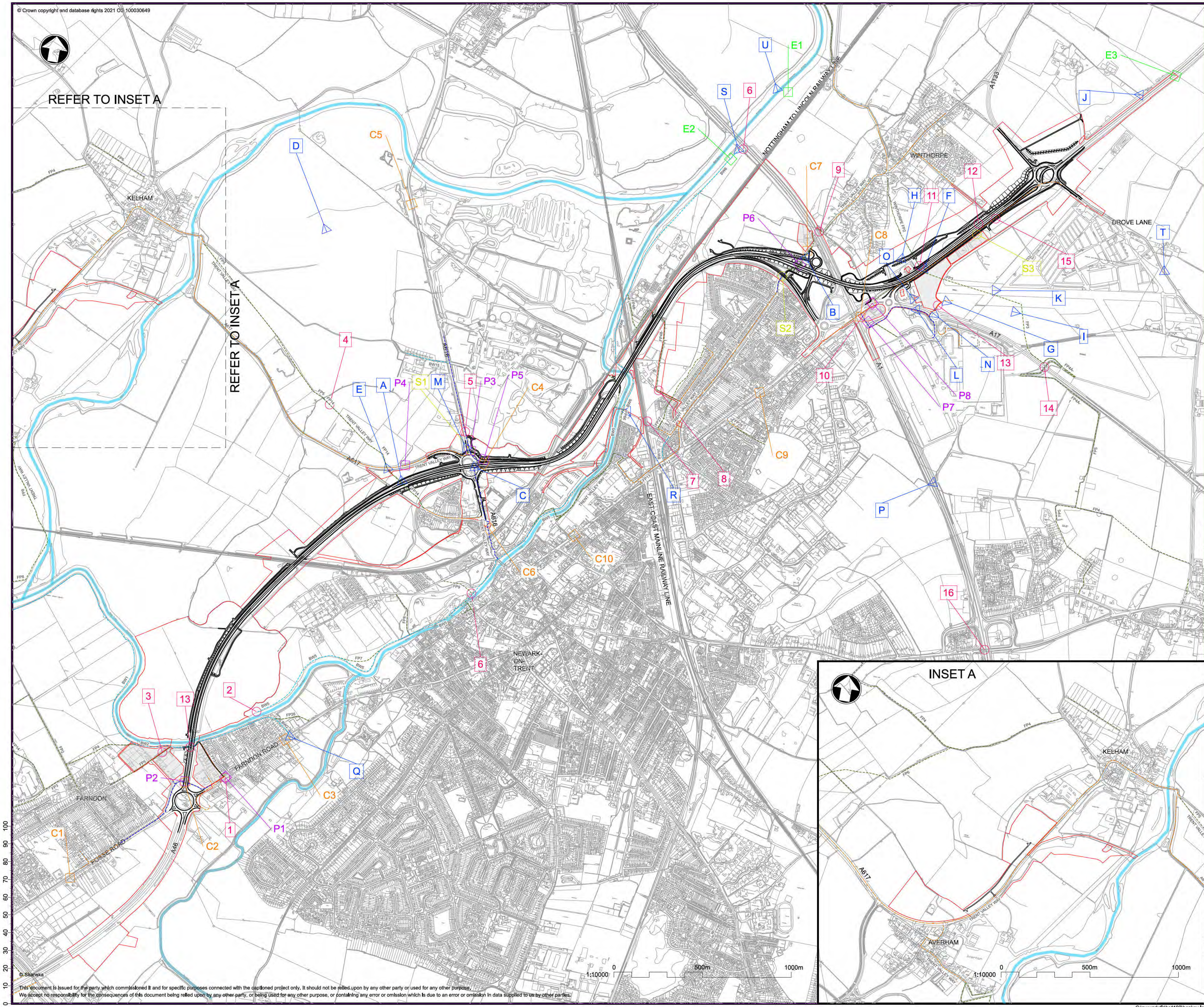
I confirm that in my professional opinion the appointed Lead Assessor has the appropriate experience for the role making reference to the expected competencies contained in DMRB GG 142.

Design team leader

Name	[redacted]
Position	Design Manager
Organisation	Mott MacDonald Ltd
Signed	[redacted]
Date	30/05/2023

Appendix A – opportunities layout drawing

The opportunities layout drawing: HE551478-SKAG-GEN-CONWI_CONW-DR-CH-00100.



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Notes

1. This drawing is for information only.
2. This drawing and key should be reviewed in conjunction with WCHAR Report: HE551478-SKAG-GEN-CONWI_CONW-RP-CH-00001.

Key:

- Existing Footway
- Existing Footpath / Trail
- Existing Bridleway
- Existing Footway / Cycleway
- Preliminary Design
- Order Limits
- Order Limits - Exclusion Zone
- River
- 4 — General Opportunity
- P1 — Pedestrian Opportunity
- C1 — Cycling Opportunity
- E1 — Equestrian Opportunity
- S1 — Strategic Opportunity
- D — Stakeholder / Consultation feedback

REV.	DATE	AMENDMENT DETAILS	ORIG	CHK'D	APP'D
C01	19/02/24	FIRST ISSUE	[redacted]		

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Client
national highways

Drawing Status: Accepted as Stage Complete – Stage 3
Status: A3

Project Title: A46 Newark Bypass

Drawing Title: A46 - WCHAR Opportunity Locations

Scale	Designed	Drawn	Checked	Approved
1:10000		M.Hardiman	J.Sarjant	M.Sutton
Original Size: N/A	Date: 19/05/23	Date: 19/05/23	Date: 19/05/23	Date: 07/06/23

Drawing Number: HE PIN HE551478 - Originator SKAG - Volume GEN - Location CONWI_CONW - Type DR - Role CH - Number 00100

Project Ref. No. HE551478
Revision C01

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Appendix B – stakeholder feedback

OD workshop

Meeting minutes for the workshop with the OD are appended separately with the reference: HE551478-SKAG-GEN-CONWI_CONW-MI-ZH-00048.

Active Travel Partnership options stage submission

Meeting minutes for the workshop with the Active Travel Partnership are appended separately with the reference: HE551478-SKAG-GEN-CONWI_CONW-RP-ZH-00038.

Public consultation responses (WCHAR specific)

WCHAR specific consultation responses received as part of the Statutory Consultation and Targeted Non-Statutory Consultation are detailed within Annex N of the Consultation Report Annexes TR010065/APP/5.2.

A46 Newark Bypass – Maintenance Access, Signing & WCHAR – Workshop			
Document Reference No.	HE551478-SKAG-GEN-CONWI_CONW-MI-ZH-00048	**Location**	Microsoft Teams (Online)
Discipline	General	**Meeting Description**	Engagement with National Highways for Maintenance Access, Signing & WCHAR.

Meeting Date	26/01/2023	**Venue**	National Highways, Stirling House, Nottingham NG15 0DS.
Meeting Number	1		
Distribution			

Attendees / Role	Company
[redacted] ject Manager	National Highways
[redacted] Route Manager	National Highways
[redacted] D Integration	National Highways
[redacted] HAR Lead	National Highways
[redacted] echnical Assurance Lead	Jacobs
[redacted] ign Integration Manager	Skanska
[redacted] ineer	Mott MacDonald
[redacted] ay Lead	Mott MacDonald
[redacted] neer	Mott MacDonald
[redacted] ign Integration Manager	Mott MacDonald
Absent	**Company**
[redacted] gency Diversion Routes (EDRs)), [redacted] sset Lead – Signs), [redacted] very Manager Maintenance).	National Highways

Item	Discussion / Issues / Actions	Owner	Due Date	Open / Closed
i	Meeting started at 09.30.	--	--	--
ii	JS introduced the scheme and the primary design elements on screen.	--	--	--
ii	JB introduced the latest Winthorpe Junction layout proposal on screen.	--	--	--
iv	SW queried the queuing effect on Showground entrance. JS mentioned that the design team are still working out pinch points and suggested that the showground entrance may fall under the maintenance repair statement.	--	--	--
A	**Maintenance and access**			
A1	JD said the first strategy should be to ensure access to assets off network. JS agreed that this was the strategy used. JD said some activities need daylight and that the strategy should be about worst-case scenarios.	--	--	--
A2	JS presented the work in progress maintenance and access plans on screen.	--	--	--
A3	JD sai[redacted] will be the contact for maintenance access. **JD to notify** [redacted]	JD	--	--
A4	MW queried the width of access tracks. **JD to email JS with 'principles of access' e.g. details of maintenance vehicles**	JD	--	--
A5	JB mentioned that edge of the pond would be reinforced. **JB to send summary of A428 maintenance access details to JD so he can discuss with appropriate team.**	JB	--	--
A6	JD stated that access to maintenance track near Crees Lanes needs to be accessible 24/7, and with appropriate rights.	--	--	--
A7	JD said there shouldn't be a need to close a bridleway to do an inspection, anything to mitigate that would be preferable.	--	--	--
A8	**JD to query/action expansion joint and waterproofing at Windmill Viaduct.** Expansion joint is very noisy.	JD	--	--
A9	JS mentioned that the only access in the vicinity of project chainage 1000m, is directly off the A46, due to it not being possible to use Tonley Lane. Mott MacDonald have concluded that a formal access off the A46 is required for farm and maintenance access. JB said a short merge and diverge taper, with an area to open the gates from would be proposed. The gates would be lockable. JD sai[redacted]would be the appropriate person to have this discussion with. AW said access is normal practice for low usage access points.	--	--	--
A10	JB shared the landscape plans on screen and said the new ponds will be National Highway assets.	--	--	--
A11	JB said access will be required where there are swales at the bottom of batter. Access to catchpits at carriageway level for ease of access.	--	--	--

Item	Discussion / Issues / Actions	Owner	Due Date	Open / Closed
A12	AW queried if there would need to be any 'ad-hoc' parking for swales etc. JB said not currently proposing this as it encourages people to park. JB said that current proposals would be to access from the bottom side, and gain access via access tracks.	--	--	--
A13	JD queried the strategy on litter picking, inspections of trees etc. which are an hours of daylight activity. JB said he would expect these teams to start at the bottom of the embankments but will further review access for litter picking which would need to be at road level.	--	--	--
A14	JD said there is an issue on the A38 where some of the existing culverts are full of rubbish. AW said there is a question of whether the culvert at 800m can be eliminated altogether but JB confirmed it is conveying a watercourse. AW questioned if there was an opportunity to minimise maintenance requirements. JD said a discussion on this point needs to be taken forward. **JD to discuss within National Highways and Mark Sutton.**	JD	--	--
A15	JD queried the Old Kelham Road access and rights. JD said that there is a need to know what will be operational land, and what will be non-operational land, as operational land is maintained by OD and non-operational land is maintained by the 'Lands Division'. JB said the principle would be to take non-operational land away from National Highways and give to the local council or the landowner. **Action for MM – review ownership of Old Kelham Road**	JS	--	--
A16	JB said a maintenance layby would be needed on the centre of the Cattle Market junction. JD agreed. JB said there will be a barrier in front of the bridge abutments, so it is possible to walk around**. Action – add maintenance layby to centre of Cattle Market junction.**	--	--	--
A17	JD said that thought must be given to the south exit of Cattle Market junction and potential no entry signage. JD says [redacted] ay have knowledge on this access and its usage**. Action – JS to look at options to move access and JD to contac** [redacted]	JS, JD	--	--
A18	JD queried the visibility A617 arm of Cattle Market junction to the existing track. JS it is an existing track, but a visibility check is needed. **Action - JS to review visibility**	JS	--	--
A19	AW said there is an existing nearby headwall and culvert which interacts with the verge. JB agreed this will need to be extended. **Action – JS/JB to include culvert extension on drawings**	JS, JB	--	--
A20	JB said there will be a permanent strip of land along the toe of batter adjacent to the lorry park which will always be retained as a right of access for maintenance.	--	--	--
A21	JB commented on the proposal of tree planting near to the carriageway would have the effect of confinement and thus reducing speed. JD queried visibility splays and interactions with canopies of trees and	RC	--	--

Item	Discussion / Issues / Actions	Owner	Due Date	Open / Closed
	shrubs. JD also said it is 'difficult' to pick litte[redacted]orn trees and similar species. **RC to share issue with** [redacted]			
A22	15min break	--	--	--
A23	JB said surface water will outfall into the watercourse/river from viaduct. JB said the principle is to attenuate the outfall and discharge at a rate according to standards. JB said an outfall penstock for pollutants will be incorporated.	--	--	--
A24	JS said Atkins have provided the model at the Lincoln railway / A46 intersection for which Motts will produce a cross section. **JS to action with appropriate design team.**	JS	--	--
A25	JB said that a departure from standard is required to add in oil separators, as nowadays green solutions are proposed as the starting point.	--	--	--
A26	AW said there is potential for a safety audit issue with the new roundabout at Brownhills (5200m). "If it was a bit more perpendicular than smooth" it may work better. JB suggested making the roundabout a demand only point. JB said it was agreed at design panel to put pedestrian route straight across.	--	--	--
A27	It was agreed that the Brownhills right turn is to be more pronounced. **JS to action with modelling team.**	JS	--	--
A28	It was agreed that automatic signalisation at the A46 eastbound diverge at Brownhills could be a preferable solution. **JB to review with traffic modelling team.**	JB	--	--
A29	JB said the small pond at 5200m is to be removed. **JB to pass action to drainage and landscape teams.**	JB	--	--
A30	JS said that existing crossing at 5500m potentially needs to be moved. **JS to review in more detail.**	JS	--	--
A31	JS said consideration needed on how to gain access to gullies on single carriageways. JB said this is an off-peak road maintenance activity. JS said that thought is needed for the worst-case scenario. **JS and JB to review.**	JS, JB	--	--
A32	JD queried access to centre of new Winthorpe junction layout. JB said the safest place for maintenance layby, and signal controllers is the centre. **JB to send through overview of layby and maintenance parking at Winthorpe to JD for further discussion with maintenance teams.** JD queried existing utilities within carriageway, as access chambers in the carriageway are a weak point.	JB, JD	--	--
	JD said he is attempting to setup an internal OD meeting to review what technology National Highways might want and where. Following this **JD will communicate the meeting outcome with the project**	JD	--	--

Item	Discussion / Issues / Actions	Owner	Due Date	Open / Closed
	team. AW mentioned the GD300 assessment, and the level of agreement closed out when possible.			
A33	**MW to forward meeting minutes regarding cameras to JD.**	MW	--	--
A34	Access points either side of balancing ponds. **JS to review relocation of both accesses.**	JS	--	--
B	**Signs**			
B1	De-trunking plans shared by JS at approx. 12.15pm	--	--	--
B2	JD said ODs preference is that the existing Brownhills roundabouts and link road, remains with National Highways as a trunk road. AW raised the point of the need to avoid the potential for two exits next to each other on Winthorpe junction both displaying the A46. **EG to review signing strategy and road numbering. JS to change drawing colour to green on Brownhills link.**	EG, JS	--	--
B3	JS shared plans for speed limits on screen.	--	--	--
B4	JD highlighted that the location of change of A46 speed limit on the Nottingham side of Farndon junction is wrong on the drawing. **EG to amend.**	EG	--	--
B5	**EG to outline national 60mph and a national 70mph in key and layouts.**	EG	--	--
B6	The location of where to switch from 50mph to 70mph on the mainline northbound and southbound was discussed. JB mentioned that the journey times in the traffic model are setup based on the current location of the proposed speed limit colouring extents and moving them would impact the BCR. **JS to further review proposals and seek road safety advice about best location for the change.**	JS	--	--
B7	The short section of national speed limit on Great North Road south of Cattle Market was discussed and it was agreed it would be preferable to reduce it to 30mph. **Potential discussion required with Nottingham Council about how Cattle market will be split. JS to review.**	JS	--	--
B8	It was generally agreed that the existing Brownhills roundabouts and link between them will be 50mph. **JS to update plans and confirm with wider team**	JS	--	--
B9	Lunch 12.45-13.25pm	--	--	--
B10	JD said a route needs to be agreed on the strategy of electronic flap signs. **EG to contac [redacted] o set up detailed discussion.**	JS	--	--
B11	**JD to send through diversion route cards.**	JD	--	--

Item	Discussion / Issues / Actions	Owner	Due Date	Open / Closed
B12	JD mentioned whether the proposed Newark Southern Li [redacted] could be used as part of an EDR(s). **JD to follow up wit [redacted] and NCC.**	JD	--	--
B13	JD to provide example marker post where there are overhead lines to EG.	--	--	--
B14	JD said Section 6 agreement used by Notts to put in HGV signs near Winthorpe village EG said the strategy there would be to relocate the same sign.	--	--	--
B15	**JS action to email abnormal and high loads to [redacted] nd abnormal load team from National Highways.**	JS	--	--
B16	JD suggested to review the strategy of taking abnormal loads up to Winthorpe and back, if MS3 sign was not relocated. **JB / EG to review.** JD feels the existing MS3 needs to be moved to before Winthorpe roundabout. JB confirmed that was the proposal.	EG, JB	--	--
B17	JD said length and width of abnormal loads goes to the police / authorities.	JD	--	--
B18	JD said National Highways need to contac [redacted] Birmingham regarding orders for clearways etc. **JD to email details to Mott MacDonald.**	JD	--	--
B19	JD mentioned the need to name the new Brownhills roundabout. General consensus to refer to it as 'Brownhills Junction'.	--	--	--
B20	JD said he had no comments on the meeting agenda section regarding 'notable features' (signing).	--	--	--
B21	**JD will confirm marker post number locations and references.** JS said it is a detailed deign element but will be helpful to know.	JD	--	--
B22	EG highlighted that 'Humber Bridge' is referenced on sign a just after Cattle Market on the Northbound and queried if the reference should be removed as it isn't on any of the sign previous. The consensus was it doesn't make sense and should not be signed in proposed strategy.	--	--	--
B23	The sign strategy for Newark was discussed. It was largely agreed that it would be signed from each junction, but this will need to be further reviewed. **EG to update report and issue.**	EG	--	--
B24	Finger point sign required on new Brownhills roundabout. **EG to add farm access to sign proposals.**	EG	--	--
B25	JD queried where the services' signing is to be positioned. **EG and JS to review.**	EG, JS	--	--
B26	**EG to check tourism numbers for brown signs.**	EG	--	--
B27	JD shared an email pdf with EG of an example sign layout plan showing sign faces. **EG to action proposed layouts going forward.**	JD	--	--

Item	Discussion / Issues / Actions	Owner	Due Date	Open / Closed
B28	JB said Skanska may benefit from obtaining two lightweight gantries. **MW to review and consider. EG to review whether gantries need to be lit.**	MW, EG	--	--
B29	JD mentioned that as a group, the strategy for signs should be agreed between Motts/NH/Skanska before involving other stakeholders such as Nottingham/Newark Councils etc. This approach was agreed.	--	--	--
B30	**JB to email JD regarding potential pump station at the A1 underpass. JD to check who is responsible.**	JD	--	--
C	**WCHAR**			
C1	JB provided an update on the current NMU situation around the Brownhills and Winthorpe junctions. JS said there is a formal stop up to the crossing of the A46 near the service station at Ch 5600m as confirmed by the NCC PROW Officer.	--	--	--
C2	TC raised a concern regarding the route through the showground, and if it would become adopted highway? JB said it is already in the development planning drawings and the A46 scheme would be joining on to a constructed footway cycleway, should the area be developed according to the current proposals. JS mentioned there should be potentially two options proposed depending on what is accepted. **JS to provide further feedback and two different options for the potential decision outcomes.**	JS	--	--
C3	TC said there used to be a gap at the services in the hedge and people used to walk along the verge to the showground. AW mentioned that speed limits would need to be reviewed, and a 50mph proposed, if a new signalised crossing was to be added.	--	--	--
C4	SW mentioned that the showground was happy to have an entrance at Godfrey drive following a discussion with them in 2021-2022.	--	--	--
C5	TC said there is a document out for public consultation showing proposed routes. 'D2N2LCWIP' www.lcwipeatmids.consultation.ai. **JS to review impact on scheme**	JS	--	--
C6	Desire raised by OD that there is a signalised crossing on the A17. **JS to progress.**	JS	--	--
C7	**RC to remove pink hatch for NMU route at approximately 6300m**, as it is only fa[redacted]he remainder of the way, a decision which was made by [redacted] Skanska).	RC	--	--
C8	**JS and JD to have further discussion of ownership of access track at 5400m to 6000m.**	JS, JD	--	--
C9	Proposed footway to be updated at 5100m to follow desire line. **JS/RC to action.**	JS, RC	--	--

Item	Discussion / Issues / Actions	Owner	Due Date	Open / Closed
C10	JB said the client scheme requirements was to maintain existing routes.	--	--	--
C11	JB said the WCHR will be updated following the feedback and why the proposals or suggestions, can or cannot be done.	--	--	--
C12	**JB to review proposed crossing point on Cattle Market Junction with Skanska, and to confirm signalisation requirements.**	JB	--	--
C13	JB mentioned that the entrance to the lorry park is a potential risk for further development. JB said that currently there is nothing being proposed by the A46 scheme for this location.	--	--	--
C14	SW asked about current proposed parking laybys. JB confirmed there is one at Brownhills so that the scheme complies with standards. This is a reduction from three existing parking laybys. JB said if there was a need for ANPR, there would be a need for maintenance laybys. **JB and JS to review usage of laybys on the scheme and potential displacement.**	JB, JS	--	--
C15	**JD and WS to provide policy information and designated funds via email links to attendees of today's meeting.**	JD, WS	--	--
C16	Meeting finish at 16.30.	--	--	--

Newark Active Travel Partnership Submission

Things we approve of

The opportunity to improve provision on Farndon Road for non-motor vehicle users.
The use of the pathway alongside the current A617 to replace the part of Newark FP1 that currently crosses the A46.

Things we are concerned about

The existing 4 crossings of the A46 need to remain accessible during the construction phase, by that we mean if diversions are needed that they need to be of similar length, safe and accessible to all. The NCN 64 route under the A1 and A46 is of particular concern because there is no obvious suitable alternative available at the moment, and many users will find the combined length of the proposed tunnels intimidating, especially at night and will need alternative routes. Whilst the A46 crossing east of A1 is not well used because it is too dangerous, provision still needs to be made for the current users to have some sort of access because of the lack of suitable alternatives.

Things we consider essential

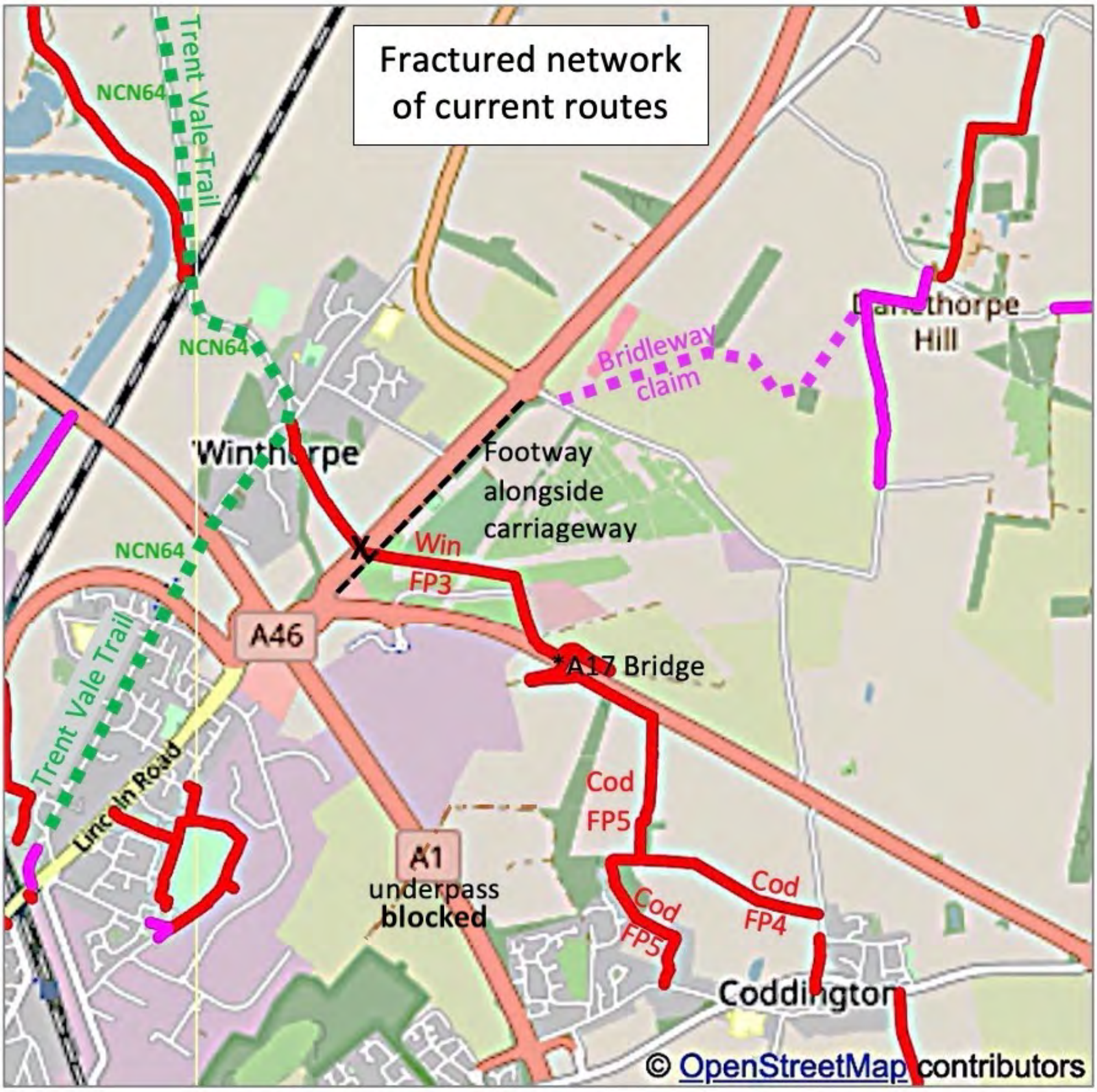
The provision of active travel routes linking the Newark Showground site to the existing Trent Vale Trail(NCN 64) in Winthorpe, and to upgraded routes to Coddington, Beacon Hill and Lincoln Road (west of the A1) as well as to the rights of way network in the countryside northeast of Drove Lane. An active travel network would connect local communities not only for leisure and exercise, but also for active travel to the growing number of jobs being created as the airfield site is developed.

We are not going to rehearse in detail the cost benefit analysis of providing proper infrastructure for those on foot, cycle and horse to allow active travel with minimum carbon footprint, because the health, welfare and environmental benefits are now so widely accepted. Nor the gains of replacing local motor vehicles journeys by Active Travel journeys in terms of reducing congestion and the increase in employment opportunities provided by low cost travel options.

What local communities need to keep Newark a liveable community are high quality routes available for all non-motor-vehicle users. In the past the problem has been that road schemes often ignore the needs of this group of users or judge the provision in terms of engineering and motor vehicles. The current A1, A17 & A46 between them act as formidable barrier to active travel on the eastern side of Newark. Length of the route and safety are often thought of at the design stage, but not the environment that the users of the active travel routes will be subjected to in terms of pollution, both chemical and noise. Sometimes thing go well. An excellent example being the A46 dualling near Cotgrave and East Bridgford where bridleways have been created alongside the road, but behind hedges & fences and sufficiently distanced from the road to diminish both noise and air pollution levels, as well has hazardous buffeting turbulence from motor vehicle travelling at high speed too close to them.

So we welcome the following statement in the Consultation Document

4.5.2 Wherever possible, the intention would be to reduce overall severance in comparison with the effect of the existing A46. In addition, the safety of pedestrians, cyclists and equestrians would be expected to improve with higher quality facilities. Design decisions related to the needs of pedestrians, cyclists and equestrians will be recorded as the design progresses and will be presented in Walking, Cycling and Horse-Riding Review Reports at the Preliminary and Detailed Design stages of the scheme.



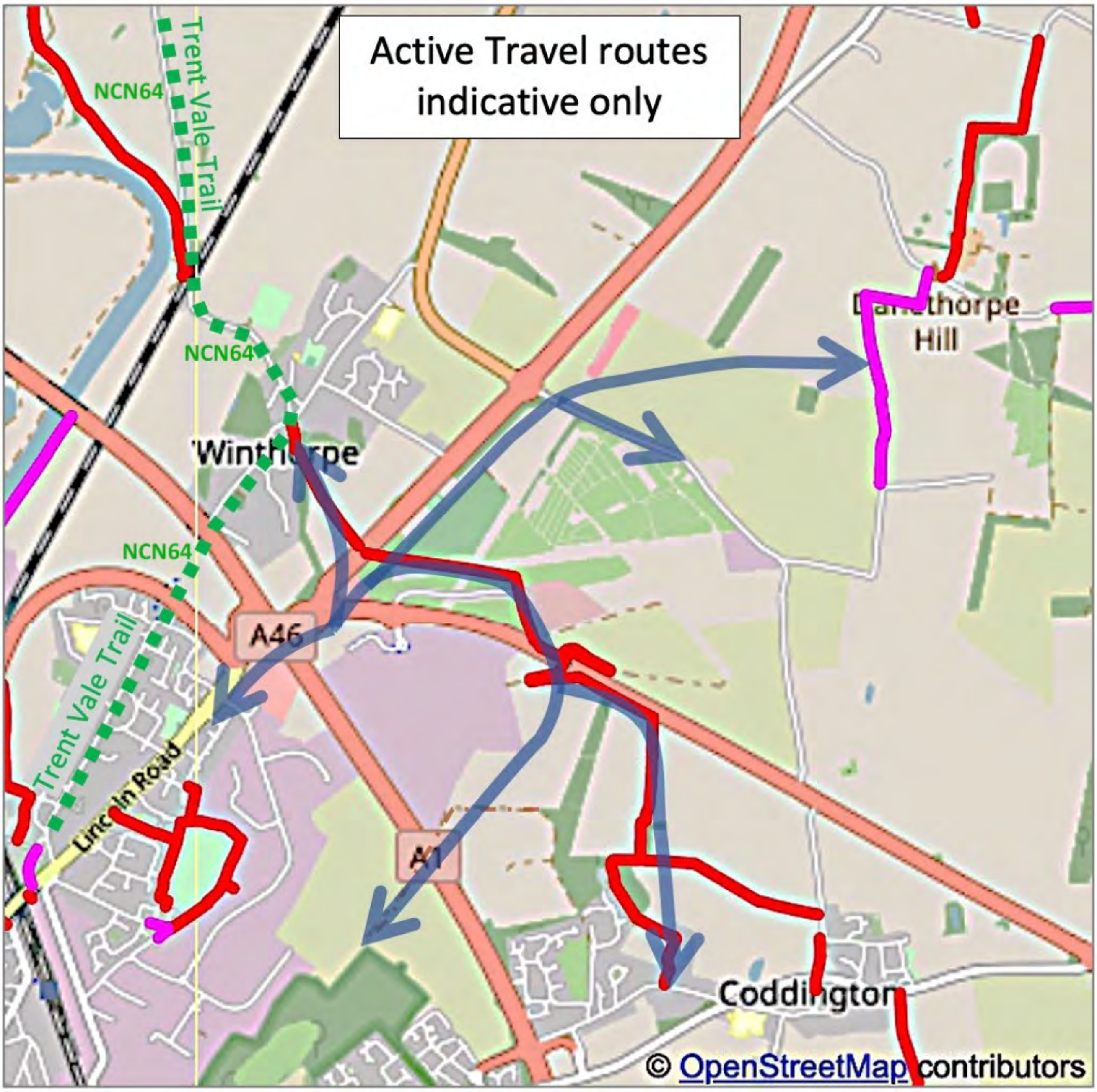
The current active travel links and potential

Key - Public footpaths - Public bridleways - Roadside footway – NCN 64

Quote from Coddington Parish Council - very local users.

'The A1 Underpass has been blocked by the current landowner. Opening up this route would enable access from the Coddington/Winthorpe footpath network to the nature reserve and to the industrial estate which provides access to Newark. It also provides a route onto Beacon Hill directly linking Newark.

The footpath that runs alongside the Showground needs to be extended to the Old Fosse Way (Brough). Biking on the hard shoulder or using the dual carriage way to Winthorpe roundabout from Brough is hazardous.'



Active Travel routes indicative only
NCN64
Trent Vale Trail
NCN64
Winthorpe
NCN64
Trent Vale Trail
A46
Lincoln Road
A1
Hill
Coddington
© OpenStreetMap contributors

Our priorities are

- A grade separated crossing of the A46 from the former airfield site to Winthorpe using the proposed flyover, which would be safer for active travel users and cause much less interruption to motor vehicle traffic flow.
- The existing route over the A1 south access road gives good access to the Know How site, but there is no safe access to the developing business park.
- Upgrading of the current connection to Coddington & Beacon Hill utilising the existing bridge over the A17.
- Creation of a behind the hedge route to replace the existing footway, which is too close to the A46 carriageway, to provide safe access to the right of way links to Danethorpe & Brough i.e. between the Friendly Farmer and Winthorpe roundabouts.
- Use made of the Beacon Hill underpass under the A1 marked on the first map.

All these need to be safe and user friendly, with careful planning to ensure environmentally acceptable routes to limit exposure to traffic pollution, both chemical and noise.

We would be happy to discuss this further with you.

Contact Details

[redacted]ights of Way Secretary Nottinghamshire Area Ramblers

[redacted]ewark Sustrans Group

This submission is supported by

[redacted]rk Sports Association and Castle Cycling Club

k Riding Group, Nottinghamshire CTC, Cycling UK.

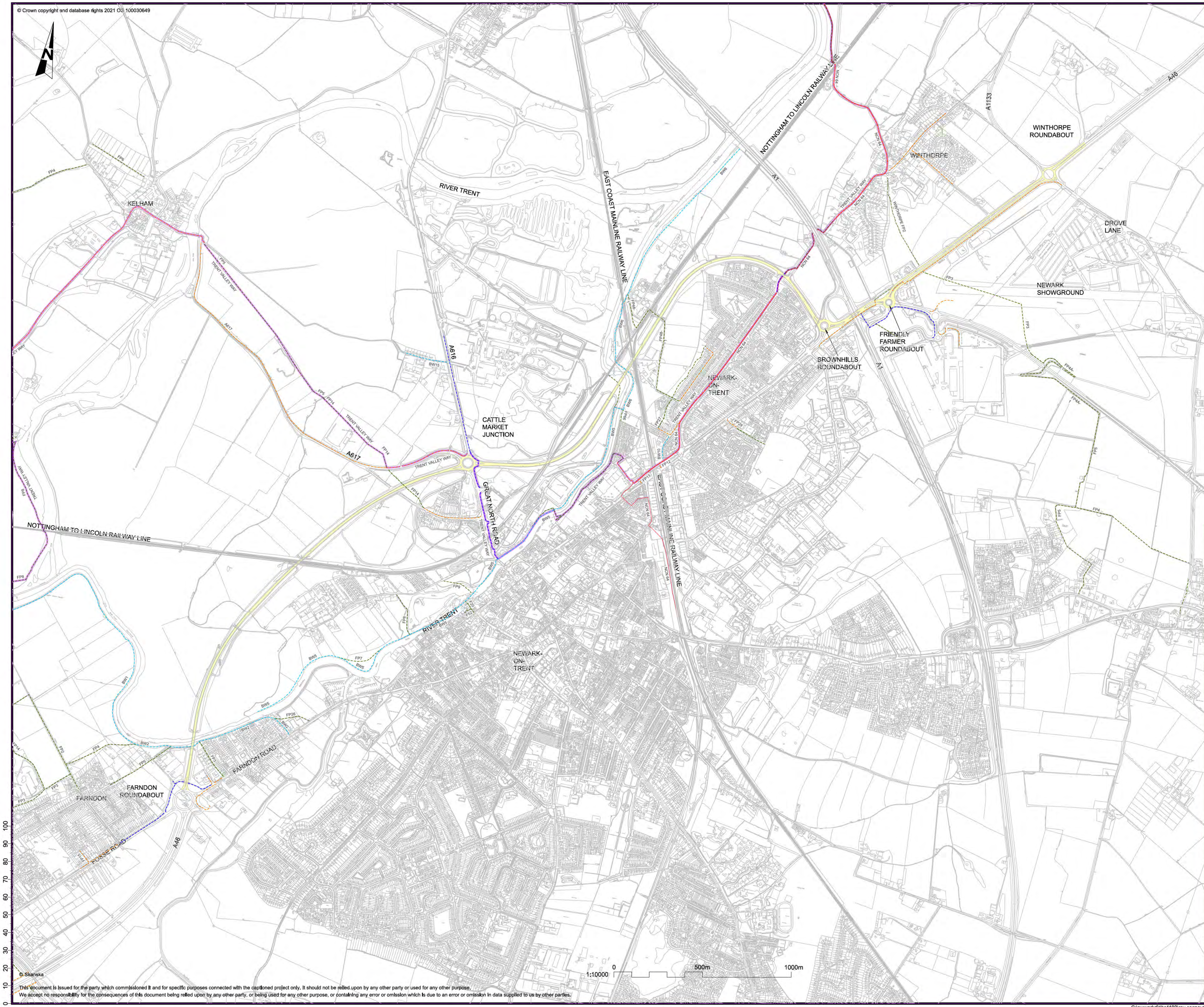
ritish Horse Society Access Field Officer, East and West Midlands

Coddington Parish Council [redacted]

[redacted]he Winthorpe Residents' A46 Consultation Group

Appendix C: Walking, Cycling and Horse-Riding Assessment & Review

A drawing showing the existing WCH routes is appended separately with the reference: HE551478-SKAG-GEN-CONWI_CONW-DR-CH-01001.



Notes

1. THIS DRAWING IS INTENDED TO SUPPLEMENT THE A46 WALKING CYCLING HORSE-RIDING ASSESSMENT AND REVIEW (WCHAR) REPORT ONLY, AND PROVIDES INFORMATION ON THE EXISTING NON-MOTORISED USER (NMU) ROUTES.

KEY:

- EXISTING FOOTWAY
- EXISTING FOOTPATH / TRAIL
- EXISTING BRIDLEWAY
- EXISTING FOOTWAY / CYCLEWAY
- EXISTING NMU ROUTE STOPPED UP
- EXISTING A46
- TRENT-VALLEY-WAY
- NATIONAL CYCLE NETWORK - ROUTE 64

REV.	DATE	AMENDMENT DETAILS	ORIG	CHK'D	APP'D
P01	30/05/23	FIRST ISSUE	MH	JS	---
C01	19/02/24	For Review and Comment	RC	DL	HF

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Client
national highways

Drawing Status	Status
Accepted as Stage Complete – Stage 3	A3

Project Title
A46 Newark Bypass

Drawing Title
A46 - Existing Non-Motorised User Routes
WCHAR Report Only

Scale	Designed	Drawn	Checked	Approved
N/A		R.Cagney	D.Legakis	M.Sutton

Original Size	Date	Date	Date	Date
N/A	30/05/23	30/05/23	30/05/23	07/06/23

Drawing Number: HE PIN | Originator | Volume
HE551478 - SKAG - GEN -
CONWI_CONW - DR - CH - 01001
Location | Type | Role | Number

Project Ref. No.: HE551478
Revision: C01

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