The Lake Lothing (Lowestoft) Third Crossing Order 201[*]

Document ~~7.2: Transport Assessment~~SCC/LLTC/EX/24: Transport Assessment – Track Changes

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Acronyms

AADF	Annual Average Daily Flows
AADT	Annual Average Daily Traffic
AAP	Area Action Plan
ABP	Associated British Ports
AMA	Active Mode Appraisal
ATC	Automatic Traffic Counter
CftS	Case for the Scheme
COBALT	Cost Benefit to Accidents - Light Touch
COCP	Code of Construction Practice
CORE	Centres for Offshore Renewable Engineering
DR	Design Report
DCO	Development Consent Order
DfT	Department for Transport
DM	Do Minimum
DMRB	Design Manual for Roads and Bridges
DoS	Degree of Saturation
DS	Do Something
EB	Eastbound
ES	Environmental Statement
GRT	Ghosted Right Turn
HAT	Highest Astronomical Tide
HGV	Heavy Goods Vehicle
LDF	Local Development Framework
LEP	Local Enterprise Partnership
LGV	Lights Goods Vehicle
LinSig	Lincolnshire Signals
LMVR	Local Model Validation Report
LNSR	Lowestoft Northern Spine Road
LSTM	Lowestoft SATURN Traffic Model
LTP	Local Transport Plan
MCC	Manual Classified Count

MMQ	Mean Maximum Queue
MND	Mobile Network Data
NB	Northbound
NCN	National Cycle Network
NMUA	Non-Motorised User Audit
NNNPS	National Policy Statement for National Networks
NPPF	National Planning Policy Framework
NSIP	Nationally Significant Infrastructure Project
OBC	Outline Business Case
OD	Origin-destination
PCU	Passenger Car Units
PNPS	National Policy Statement for Ports
RCN	Regional Cycle Network
RFC	Ration of Flow to Capacity
RSA	Road Safety Audit
SATURN	Strategic Assignment of Traffic to Urban Road Networks
SB	Southbound
SCC	Suffolk County Council
SCTM	Suffolk County Traffic Model
SEP	Strategic Economic Plan
SLRR	South Lowestoft Relief Road
SoS	Secretary of State
SRN	Strategic Road Network
TA	Transport Assessment
TEMPRO	Trip End Model Presentation Program
TDCR	Traffic Data Collection Report
VISSIM	Traffic in Cities Simulation Model
WB	Westbound
WDC	Waveney District Council

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Foreword

This Transport Assessment (TA) relates to an application ('the Application') submitted by Suffolk County Council ('the Applicant') to the Secretary of State (through the Planning Inspectorate) for a Development Consent Order ('DCO') under the Planning Act 2008.

If made by the Secretary of State, the DCO would grant development consent for the Applicant to construct, operate and maintain a new bascule bridge highway crossing, which would link the areas north and south of Lake Lothing in Lowestoft, and which is referred to in the Application as the Lake Lothing Third Crossing (or 'the Scheme').

This TA has been prepared in accordance with the requirements of section 37(3)(d) of the Planning Act 2008 and regulation 5(2)(q) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009, and in compliance with relevant guidance.

This version of the Transport Assessment is an update to the original version published in July 2018 (Document reference 7.2/PINS document reference APP-093).

The changes contained within this document can be summarised as follows:

Item	Reasons for update
Para 1.7.1	Correct for Chapter reference (typographical error)
Section 3.14	Updated to include additional plots from VISSIM base year model to show conditions under 3 different scenarios for lifting of A47 Bascule Bridge at 3 locations. Also noted that the assumptions related to bridge lifts was not clear in original TA. This has now been rectified by the inclusion of the additional plots. Text also updated to include commentary on additional plots.
Figures 3.27 to 3.44	Additional plots included as noted above. Original TA contained 11 plots (Figures 3.27 to 3.38) now expanded to include 18 plots.
Figures 3.45 to 3.66	Figures re-numbered from Figures 3.38 to 3.59 in original TA due to inclusion of additional Figures in section 3.14
Para 4.8.1	Clarification with regards submission of RSA.
Para 4.10.5	Clarification relating to submission of preliminary scheme of operation.
Para 6.3.2	Clarification relating to journey time variations between VISSIM and SATURN models.
Para 7.3.2	Correction relating to average lifting times of A47 Bascule Bridge based upon Vessel survey.
Para 7.4.10	Correction to description of queue length (Do Minimum with 10 min lift of A47 Bascule Bridge) in order to align with Figure 7.9.
Section 7.5	Updated to include plots of the 2022 Do Something Scenario to demonstrate the impacts of different scenarios for the lifting of both the Scheme and A47 Bascule Bridge. (Note that in the original TA, plots were only included for the Do Minimum scenarios). Text added to provide narrative to accompany new plots.

Figures 7.12 to 7.23	Additional plots (as noted above) to demonstrate AM and PM peak traffic conditions at A47 Bascule Bridge for 2022 Do Something Scenarios 5 to 10.
Tables 7.4, 7.5,7.6 and7.7	Column 3 of Tables 7.4 to 7.7 inclusive has been amended to show that DM scenario assumes a 5 minute lift of Bascule Bridge lift (the original version of the TA was incorrectly labelled as a 10 minute lift for Bascule Bridge)
Para 7.6.4	Correction. Figure of 5.46mph replaces 4.88pmh which was incorrect. The revised speed is now consistent with Figure 7.39.
Chapter 8	Updated to include the results of revised junction capacity assessments prepared for 14 of the 23 junctions. These take into account comments raised by Suffolk County Council (SCC) in its capacity as the highway authority following its audit of the outputs of the original junction models. Tables 8.1, 8.2, 8.5, 8.7, 8.12, 8.16, 8.17, 8.21, 8.22, 8.24, 8.26, 8.27 have been updated with results of latest capacity assessments.
Paras 8.19.5 and 8.19.6	Paragraphs 8.19.5 and 8.19.6 in the original TA made reference to a sensitivity test carried out for Junction 18 to determine the change in width that would be required for the eastbound approach from Waveney Drive to operate within capacity (i.e. RFC of 0.85). This sensitivity tests is no longer applicable since, based upon the latest capacity assessment, the RFC for Wavenery Drive eastbound approach has increased from 0.85 to 0.99. Paragraphs 8.19.5 and 8.19.6 have therefore been withdrawn.
Para 9.3.10	Corrected from Victoria Drive to Waveney Drive.
Section 9.5	Updated to include results of revised capacity assessment for Junction 14 (with mitigation proposal) following audit of models by SCC. Table 9.3 updated with revised results.
Section 9.6	Updated to include results of revised capacity assessment for Junction 121 (with mitigation proposal) following audit of models by SCC. Table 9.4 updated with revised results.
Appendix I.	The detailed model outputs based upon the revised capacity assessments presented in Chapters 8 and sections 9.5 and 9.6.

None of the revisions contained within the updated document have any material effect on the findings and conclusions presented in the original Transport Assessment.

Executive Summary

E.S.1. The Scheme involves the construction, operation and maintenance of a new bascule bridge highway crossing linking the areas north and south of Lake Lothing in Lowestoft. The Scheme will be approximately one kilometre long and will be able to accommodate all types of vehicular traffic as well as non-motorised users, such as cyclists and pedestrians.

E.S.2. The Scheme is needed to reduce community severance, improve accessibility, support economic growth and regeneration, and encourage inward investment. In transport terms, the Scheme will also reduce congestion and delay on the existing bridges over the Lake, helping to ease congestion in the town centre and improve accessibility.

E.S.3. The Scheme aligns closely with national, sub-national and local planning policies and strategies. It will address congestion problems on the A47, part of the Strategic Road Network (SRN), by reducing traffic, especially at the A47 Bascule Bridge which has been identified by Highways England as a bottleneck. The Scheme also satisfies the strategies and objectives of Suffolk County Council (SCC) and the Local Enterprise Partnership (LEP) by reducing severance and congestion on local roads and helping stimulate growth by improving access to the key regeneration areas around the Lake identified in local planning policy. It will benefit all terrestrial modes of transport.

E.S.4. Because Lowestoft is divided by the Lake, the opportunities to cross from the north to the south of the town are limited, making some cycling and walking journeys much longer than they would otherwise be and making these sustainable modes of travel less attractive.

E.S.5. Historic traffic data obtained from the Department for Transport (DfT) has demonstrated an increase in traffic of 11.5% on A47 Bascule Bridge between 2011 and 2015. North of Mutford Bridge the network is operating significantly above its theoretical capacity, and traffic flows south of Mutford Bridge are also relatively high. The Base 2016 Traffic in Cities Simulation Model (VISSIM) shows extensive queuing and delays across the existing network in the vicinity of the Scheme.

E.S.6. Analysis of historic injury collision data highlights noticeable groups of collisions across the network, particularly on the busy routes leading to and from the existing crossings. A total of 89 injury collisions were recorded during the 5-year study period across the junctions covered by the scope of this TA. There were no fatal collisions at any of the junctions in the study area.

E.S.7. The Scheme will cross at a central location of the Lake, which is a navigable waterway and operational Port. The impact of the Scheme on the ability of vessels to safely navigate through the waterway and to the adjacent operational berth was assessed, utilising a real-time, pilot operated, navigation simulation.

E.S.8. The Scheme is categorised as a nationally significant infrastructure project (NSIP), meaning that it is nationally significant. As such, modelling has been completed at three different levels to ensure that the strategic and local impacts of the Scheme are fully understood:

- Strategic traffic modelling (wide area)
- Microsimulation modelling (local network)
- Operational modelling (junctions)

E.S.9. Overall, the Scheme provides significant benefits by improving journey time and link speeds, and reducing congestion on the key route corridors through the town. The reduced journey times will in turn have a beneficial effect on businesses and local residents, boosting the local economy and achieving the aims and objectives of the Scheme.

E.S.10. Operational modelling was undertaken using JUNCTIONS8 and LinSig (Lincolnshire Signals) 3 software, and the majority of the junctions assessed using operational models operate well within capacity in the 2022 and 2037 with the Scheme in place.

E.S.11. The Scheme can be considered as mitigation for existing traffic problems within Lowestoft. The Scheme will open up a third crossing of the Lake, offering a wider variety of route choice and thereby reducing traffic on existing routes including the SRN. The implementation of the Scheme will therefore reduce congestion in the town, provide greater journey time reliability for public transport, and increase connectivity for pedestrians and cyclists.

E.S.12. Nevertheless, a small number of junctions require some improvements to mitigate the impact of the Scheme, generally on the main approaches to the Scheme where additional traffic is to be expected. Junction 7 and Junction 14 require mitigation with the implementation of the Scheme in 2022, whilst Junction 8 and 21 would not, following monitoring to confirm that this is the case at the time, require mitigation until 2037, although in the case of Junction 8, the addition of technology to adapt traffic signals with implementation of the Scheme in 2022 is suggested.

E.S.13. Other suggested measures are the introduction of parking restrictions on Kimberley Road, Kirkley Run, Durban Road and the access to Waveney Gymnastics Club; and monitoring of traffic flows on Rotterdam Road.

E.S.14. Traffic impacts associated with the Scheme will be mitigated through highway improvements, where assessments have indicated the need for intervention. This will ensure that the impact of the Scheme is not unacceptably detrimental to the operation of the junctions within the local and strategic highway networks.

E.S.15. There will be an impact on the local highway network during construction, as a result of the movement of vehicles delivering/removing goods and people. The impact will be for a duration of approximately two years.

E.S.16. An Active Mode Appraisal (AMA) is a DfT-approved economic appraisal tool which details the monetary changes resulting from a transport intervention, in terms of quantitative impacts on active modes. An AMA was carried out as a component of the economic analysis within the Outline Business Case (OBC) for the Scheme and has been updated within this TA. The appraisal suggests that the number of pedestrians and cyclists that could be anticipated to use the Scheme per day could be 4,726 and 1,420 respectively. The Scheme can also be seen to significantly reduce journey times for pedestrians, with reductions of up to 20 minutes depending on the route.

E.S.17. Within this TA it has been assumed that bus routes and train services will remain as existing. Nevertheless, existing bus services will however benefit from reduced congestion around the south of Lowestoft, especially around the A47 Bascule Bridge. The bus operators will be able to provide an enhanced service to passengers through greater journey time reliability.

E.S.18. On the basis of the assessment set out within this TA, it is demonstrated that the Scheme will have a considerable positive impact on the local highway network. Journey times along key routes both north-south and east-west across Lowestoft will be improved, along with an improvement in journey times for more strategic routes on the SRN.

E.S.19. Traffic flows on the A47 through the east of the town will also reduce, thereby relieving congestion on the SRN. The forecast flow across the A47 Bascule Bridge following implementation of the Scheme will be circa 13,000 vehicles per day lower than in the future Do Minimum (DM) scenario.

E.S.20. The operation of most junctions will remain within practical capacity and will operate well, with many junctions operating with greater residual capacity as a result of the Scheme. Only four junctions of the 22 assessed require improvements as a result of the increased traffic along the approaches to the Scheme which will ensure that any negative impacts of the Scheme on junction operation are mitigated.

E.S.21. The transport benefits created through the implementation of the Scheme will act as a catalyst for regeneration and economic growth within the town, as set out within the Case for the Scheme and associated DCO documents.

E.S.22. The Scheme is supported by Waveney District Council (WDC), Highways England, the New Anglia LEP and the DfT; the latter without prejudice to any decision by the Secretary of State (SoS) on a DCO application. The Scheme and related assessments comply with the requirements of the NNNPS.

1 Introduction

1.1 Purpose of the TA

1.1.1 This document is the TA[1] for the Lake Lothing Third Crossing ('the Scheme') which has been prepared on behalf of Suffolk County Council ('the Applicant'). It provides an assessment of the expected terrestrial transport impacts of the Scheme, and describes how any adverse impacts will be mitigated. Impacts on vessel movements are dealt with separately within the Environmental Statement (ES)

1.1.2 The TA also helps to demonstrate the case for the Scheme by identifying existing traffic and transport problems in Lowestoft, and showing how the Scheme will address these.

1.1.3 The TA will be submitted to the Planning Inspectorate in support of an application for a DCO for the Scheme.

1.2 Background

1.2.1 The provision of a third crossing of Lake Lothing has been an objective of SCC for many years. Following submission of an OBC in January 2016, the Prime Minister announced support for the Scheme on 15 March 2016. The government subsequently confirmed an investment package of £73.39m.

1.2.2 Following the submission of a request to the SoS for Transport for a direction under section 35 of the PA 2008, the SoS directed that the Scheme is a NSIP[2], and is to be treated as development for which development consent is required.

1.2.3 Planning and other statutory consents for any development categorised as an NSIP are subject to an application to the Planning Inspectorate for a DCO. This TA is one of several documents that support the DCO application.

1.2.4 The TA has been prepared in the light of the National Policy Statement for National Networks (NNNPS) 2015[3], which highlights the need to develop the national road network and sets out the principles of assessment to be followed for NSIP applications, the National Planning Policy Framework (NPPF)[4], to the extent relevant, and other national and local standards and guidance as appropriate. Section 2 of this TA shows how the Scheme aligns with the aims and objectives of the NNNPS, and with other relevant plans and policies.

1.3 Scope of the TA

1.3.1 A scoping meeting was held with SCC's Transport Policy and Development Manager on 26th January 2017 to confirm the required content of the TA. The draft scoping note is included as Appendix A along with SCC's response. Highways England has also confirmed to the Applicant that the scope of the TA is acceptable.

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[1] *A TA is the comprehensive and systematic process that sets out transport issues relating to a proposed development. The NNNPS (paragraph 5.206) states that "For road and rail developments, if a development is subject to EIA and is likely to have significant environmental impacts arising from impacts on transport networks, the applicant's environmental statement should describe those impacts and mitigating commitments."*

[2] There is no material difference in substantive or procedural terms between a DCO for a scheme for which a direction has been given by the SoS under section 35 of the PA 2008 and a DCO for a NSIP that meets that thresholds for national significance as set out in the PA 2008. Thus, for convenience, the Scheme will be referred to as an NSIP in this document.

[3] Department for Transport, January 2015, *National Policy Statement for National Networks*

[4] DCLG, March 2012, *National Policy Planning Framework*

1.3.2 The TA incorporates the comments made by SCC, which raised the following minor issues:

- Include the junction of Denmark Road / Katwijk Road in the scope, as it is likely the new bridge will have an impact at this junction;
- Include reference to seasonable variability of traffic volumes.

1.3.3 These items have been picked up within the TA:

- Denmark Road / Katwijk Road forms Junction 19 within the TA assessments;
- The Traffic Data Collection Report (TDCR) provided in Appendix D discusses seasonality at Section 6.4.

1.3.4 In addition to the above, since the scope was agreed the assessment years for the TA have changed from 2021 to 2022 (Opening Year) and from 2036 to 2037 (Design Year to reflect changes in the Scheme delivery programme since the scope was first discussed.

1.3.5 The TA also incorporates updates to the Scheme design and supporting transport models completed since publication of the Preliminary Environmental Information Report and Preliminary TA in September 2017. Comments made in SCC's Section 42 response have also informed the content of the TA.

1.4 The Scheme

1.4.1 The Scheme involves the construction, operation and maintenance of a new bascule bridge highway crossing linking the areas north and south of Lake Lothing in Lowestoft, hereafter referred to as the Lake Lothing Third Crossing ("the Scheme").

1.4.2 The Scheme would provide a new single-carriageway road crossing of Lake Lothing, consisting of a multi-span bridge with associated approach roads, and would comprise:

- an opening bascule bridge over the Port of Lowestoft, in Lake Lothing;
- on the north side of Lake Lothing, a bridge over Network Rail's East Suffolk Line, and a reinforced earth embankment joining that bridge, via a new roundabout junction, to the C970 Peto Way, between Rotterdam Road and Barnards Way; and
- on the south side of Lake Lothing, a bridge over the northern end of Riverside Road including the existing access to commercial property (Nexen Lift Trucks) and a reinforced earth embankment (following the alignment of Riverside Road) joining this bridge to a new roundabout junction with the B1531 Waveney Drive.

1.4.3 The Scheme would be approximately 1 kilometre long and would be able to accommodate all types of vehicular traffic as well as non-motorised users, such as cyclists and pedestrians.

1.4.4 The opening bascule bridge design would allow large vessels to continue to use the Port of Lowestoft.

1.4.5 A new control tower building would be located immediately to the south of Lake Lothing, on the west side of the new highway crossing, to facilitate the operation of the opening section of the new bascule bridge.

~~1.4.6~~ The Scheme would also entail~~:~~

~~1.4.7~~1.4.6 the following changes to the existing highway network:

- the closure of Durban Road to vehicular traffic at its junction with Waveney Drive;
- the closure of Canning Road at its junction with Riverside Road, and the construction of a replacement road between Riverside Road and Canning Road to the west of the Registry Office; and
- a new access road from Waveney Drive west of Riverside Road, to provide access to property at Riverside Business Park;
- the provision of a pontoon for use by recreational vessels, located to the east of the new highway crossing, within the Inner Harbour of Lake Lothing; and
- works to facilitate the construction, operation and maintenance of the Scheme, including the installation of road drainage systems; landscaping and lighting; accommodation works for accesses to premises; the diversion and installation of utility services; and temporary construction sites and access routes.

~~1.4.8~~1.4.7 The works required for the delivery of the Scheme are set out in Schedule 1 to the draft DCO (application document reference 3.1), where they are referred to as "the authorised development", with their key component parts being allocated reference numbers, which correspond to the layout of the numbered works as shown on the Works Plans (application document reference 2.4). The General Arrangement Plans (application document reference 2.2) illustrate the key features of the Scheme.

~~1.4.9~~1.4.8 Figure 1.1~~Figure 1.1~~ provides a diagrammatic representation of the Scheme.

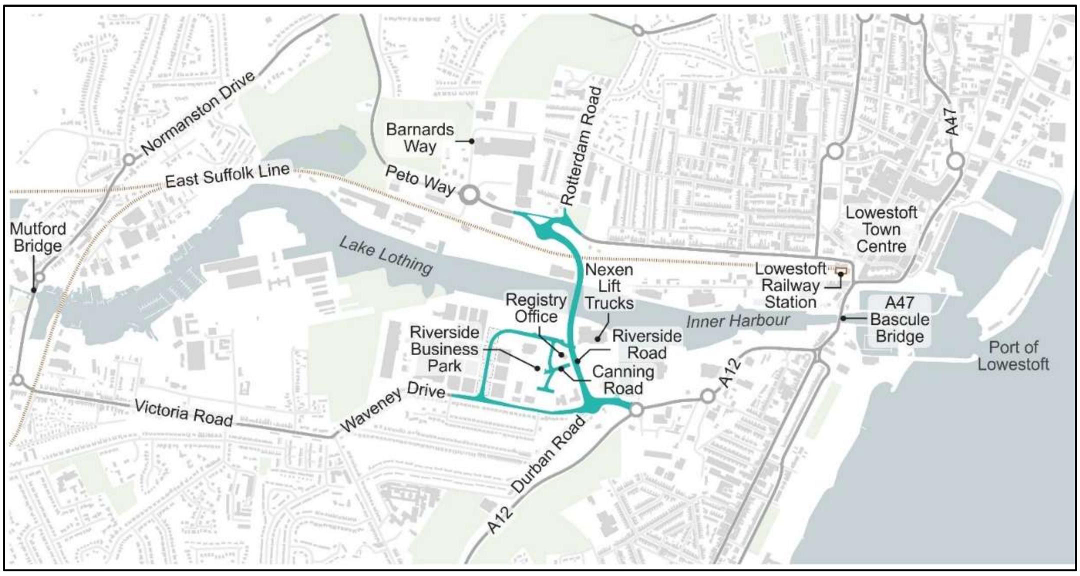


Figure 1.1: Location of the Scheme in Lowestoft

1.5 The need for the Scheme

1.5.1 The need for the Scheme is set out in detail in another DCO application document, the 'Case for the Scheme' (CftS), and is briefly summarised below.

1.5.2 The Scheme is needed in order to:

- reduce congestion
- reduce community severance
- improve accessibility
- support economic growth and regeneration, and encourage inward investment.

Congestion

1.5.3 Congestion occurs when traffic demand exceeds the capacity of the local highway network. The Applicant has concluded that the existing highway infrastructure in Lowestoft is inadequate to support current traffic demand. This has been demonstrated by means of strategic traffic modelling using a Strategic Assignment of Traffic to Urban Road Networks (SATURN) model, microsimulation assessments of the local road network using a VISSIM Traffic Model and detailed junction modelling. More detail is given in Section 5. The assessments show that congestion in Lowestoft:

- is a significant problem on key routes, including routes which form part of the SRN
- becomes worse when the existing opening bridges are closed to traffic, leading to increased queuing and delay.

1.5.4 Congestion is exacerbated when the existing A47 Bascule Bridge at the eastern end of the Lake is raised to allow ships and boats to pass into and out of the inner harbour, temporarily closing the important A47 – A12 route to road traffic and causing delays and a build-up of queues, which take up to 15 minutes to dissipate during the peak hours. Similarly, congestion occurs when the A146 / A1117 Mutford Bridge at the western end of the Lake is closed to traffic to allow boats to enter Oulton Broad. The road network on the A1117 at the western side of the Lake also suffers regular congestion due to the operation of at-grade rail crossings at Oulton Broad North and Oulton Broad South, where vehicles often queue back affecting nearby junctions.

Severance

1.5.5 Community severance is a serious problem in Lowestoft. Lake Lothing and The East Suffolk Line act as major barriers to movement between the north and south sides of the town. This north/south divide is made worse by traffic congestion. Severance restricts economic growth and business development, and discourages new business from moving into the area. The Scheme is needed to allow the road network to operate more efficiently and provide extra capacity.

Accessibility

1.5.6 The Scheme is needed to improve the accessibility of key areas around the Lake, including Kirkley Waterfront. At present, the poor accessibility of potential development makes it more difficult to achieve regeneration in this area, which has suffered from the loss of traditional industry and related unemployment. Congestion and limitations of the highway infrastructure also cause problems for local bus services, further reducing accessibility. The Scheme will address this and will also improve accessibility for pedestrians and cyclists.

Economic growth, regeneration and inward investment

1.5.7 Lowestoft is identified in the New Anglia Strategic Economic Plan (SEP) as part of a larger economic sub-region with a strong base in manufacturing. The main opportunities for growth are the energy sector. Lowestoft has been designated by the government as one of six 'Centres for Offshore Renewable Engineering' (CORE) and is eligible for a comprehensive package of business support. Building on this, and on the wider connection to the wind turbine industry, the New Anglia LEP defines Lowestoft as a growth location with potential for at least 1,000 new jobs and 1,000 new dwellings up to 2022, in addition to those proposed in the Local Development Framework Core Strategy (See paragraphs 2.4.2 to 2.4.6 below).

1.5.8 The Scheme will help to support economic growth and stimulate the regeneration of Lowestoft. By reducing traffic congestion and enhancing accessibility, especially in the area around the Lake, it is expected to help attract inward investment and encourage business growth.

1.6 Transport-related Scheme Objectives

1.6.1 The transport related objectives of the Scheme, are:

- To reduce congestion and delay on the existing bridges over the Lake;
- To reduce congestion in the town centre and improve accessibility;
- To reduce community severance between north and south Lowestoft;
- To encourage more people to walk and cycle, and reduce conflict between cycles, pedestrians and other traffic;
- To improve bus journey times and reliability; and
- To reduce collisions.

1.6.2 The CftS describes how Scheme options were appraised against the objectives to identify the preferred option.

1.7 Structure of the TA

1.7.1 The rest of the TA comprises:

- Section 2: Policy context
  Summarises the national, sub-national and local policy and plans relevant to the delivery of the Scheme;
- **Section 3: Existing conditions**
  Describes the current transport network and current travel patterns in Lowestoft, covering all terrestrial modes of transport;
- **Section 4: The Scheme**
  Describes the Scheme in detail;

- Section 5: Assessment methodology
  Outlines the methodology for assessing the traffic impacts of the Scheme;
- **Sections 6-~~12~~11 Scheme impacts**
  Describes the Scheme's impacts on journey times and junction operation, strategic benefits, construction impacts and other impacts of the Scheme;
  Proposes a package of mitigation measures to ensure that the residual cumulative impacts are not severe
- **Section 12: Residual and cumulative impacts**
  Addresses the residual cumulative impacts of the Scheme in line with NPPF;
- Section 13: Summary, conclusions and recommendations.
- References, Bibliography and Appendices

2 Policy Context

2.1 Introduction

2.1.1 This Section describes how the Scheme aligns with relevant national, sub-national and local plans and policies.

2.1.2 There are clear links between the Scheme and the relevant plans and policies, as summarised in the following sections. More detail can be found in the CftS.

2.2 National Policy

2.2.1 The following documents are relevant to the Scheme and are considered more fully below:

- National Policy Statement for National Networks 2015
- National Policy Statement for Ports 2012
- National Planning Policy Framework 2012
- The National Infrastructure Delivery Plan 2016-2021

NNNPS 2015

2.2.2 The NNNPS was designated by the SoS in January 2015 and sets out the need for, and Government's policies to deliver, development of NSIPs on the national road (and rail) networks in England. The vision and strategic objectives for the national road network are set out in Section 2 of the NNNPS and are as follows[5]:

> *"The Government will deliver national networks that meet the country's long term needs; supporting a prosperous and competitive economy and improving overall quality of life, as part of a wider transport system. This means:*

- Networks with the capacity and connectivity and resilience to support national and local economic activity and facilitate growth and create jobs;
- Networks which support and improve journey quality, reliability and safety;
- Networks which support the delivery of environmental goals and the move to a low carbon economy; and
- Networks which join up our communities and link effectively to each other".

2.2.3 The NNNPS highlights the need for development of the national road network and delivers the above aims in the context of Government policy for economic performance, environment, safety, technology, sustainable transport, accessibility and journey reliability. The national road network connects cities, regions and international gateways and there is a critical need to address congestion issues to provide safe and resilient networks. The pressure on this network is predicted to increase as the long -term drivers for demand to travel, Gross Domestic Product and population, are also forecast to increase. The Government has concluded that at a strategic level there is a compelling need for development of the national networks

[5] Department for Transport (January 2015), *National Policy Statement for National Networks*, page 9, paragraph 2

2.2.4 Paragraph 1.18 of the NNNPS recognises that the National Planning Policy Framework is likely to be an important and relevant consideration in NSIP decisions, to the extent it is relevant to the particular project. However, it is the NNNPS that provides the specific transport policies for NSIPs. This is reflected in Paragraph 1.19 of the NNNPS which sets out that the NPPF makes clear that it is not intended to contain specific polices for NSIPs and that the NNNPS will assume that function and provide transport policy which guides individual transport schemes brought under it. The NNNPS is the primary basis for making decisions for applications for such NSIPS. The Scheme strategically aligns with the aims and objectives outlined in the NNNPS by increasing capacity on Lowestoft's local highway network to accommodate future growth, facilitating economic growth through improved journey reliability, and reducing severance in the town by providing an additional north-south link across Lake Lothing.

2.2.5 Section 4 of the NNNPS sets out the principles of assessment to be followed by NSIP applications. Paragraph 4.3 sets out that the Examining Authority and the SoS should take into account:

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

2.2.6 Paragraph 5.203 of the NNNPS onwards set out the requirements of an applicant's assessment for schemes involving national networks. With regard to road schemes, NNNPS requires assessments to:

- 5.203: have regard to the policies set out in local plans;
- 5.204: consult the relevant highway authority, and local planning authority, as appropriate, on the assessment of transport impacts;
- 5.205: consider reasonable opportunities to support other transport modes in developing infrastructure;
- 5.206: if a development is subject to EIA and is likely to have significant environmental impacts arising from impacts on transport networks, the applicant's environmental statement should describe those impacts and mitigating commitments;
- 5.209: have regard to DfT Circular 02/2013[6] The Strategic Road Network and the delivery of sustainable development (or prevailing policy) which sets out the way in which the highway authority for the Strategic Road Network, will engage with communities and the development industry to deliver sustainable

[6] Department for Transport, September 2013, *Strategic Road Network and The Delivery of Sustainable Development*

development and, thus, economic growth, whilst safeguarding the primary function and purpose of the Strategic Road Network.;

- 5.217: refers to mitigation measures for road developments stating that this may relate to design, lay-out or operation of the scheme.

2.2.7 The detailed assessment of the Scheme is provided in Section 5.2 of this TA onwards which covers the requirements as set out above. The benefits of the Scheme are set out alongside specific proposed mitigation to reduce or avoid adverse impacts occurring.

2.2.8 DfT Circular 02/2013[7] expects there to be engagement with Highways England if a scheme is to have an impact on the SRN. Highways England recognises and welcomes the benefit of the Scheme for the SRN.

2.2.9 The Case for the Scheme (Document 7.1) submitted with the DCO application includes at Appendix A a 'NPS Compliance Table' detailing how this TA (and the DCO application overall) accords with the requirements of the NNNPS.

National Policy Statement for Ports (PNPS)

2.2.10 The PNPS, which was designated by the SoS in January 2012, sets out the framework for making decisions on proposals for new port development, recognising the essential role they play in the UK economy and the wider economic benefits that they can bring. In addition, it sets out the vital role that UK ports play in the energy sector in terms of import and export of energy supplies and in the construction and servicing of offshore energy installations and in supporting oil and gas pipelines. It is also noted that port handling needs to energy may change as renewables play an increasingly important part as an energy source.

2.2.11 The PNPS provides the framework for NSIP proposals for new port development and any associated development promoted alongside new port development. Whilst the application does not propose new port development, the Scheme does cross Lake Lothing and interfaces with the Port of Lowestoft. Therefore, where relevant, reference is made to the PNPS within the assessment of the Scheme against the NNNPS below.

2.2.12 In relation to TAs, the PNPS states at paragraphs 5.4.4, 5.4.5, and 5.4.8:

> *"If a project is likely to have significant transport implications, the applicant's ES… should include a transport assessment, using the WebTAG methodology stipulated in Department for Transport guidance…. Applicants should consult the Highways Agency and/or the relevant highway authority, as appropriate, on the assessment and mitigation. The assessment should distinguish between the construction, operation and decommissioning project stages as appropriate.*

[7] Department for Transport, September 2013, *Strategic Road Network and The Delivery of Sustainable Development*

> *…The applicant should also provide details of proposed measures to improve access by public transport, walking and cycling, to reduce the need for parking associated with the proposal and to mitigate transport impacts.*
>
> *…Transport assessment should include private traffic accessing and leaving the port, where significant, even where not generated by the development under application."*

2.2.13 The PNPS encourages improvements to the connectivity and access to ports. The Scheme aims to ease congestion within Lowestoft, to increase journey time reliability, and to reduce severance across Lake Lothing, which will result in improved connectivity and access to the Port of Lowestoft by all modes of transport. The DfT has also recently (April 2018) released the Ports Connectivity Study which refer to the funding for the Scheme as an example of the overall strategy for improving connectivity to ports.

NPPF 2012

2.2.14 The NPPF was published in March 2012[8] and sets out the Government's planning policies for England and how these are expected to be applied. At the heart of the framework is the presumption in favour of sustainable development. The framework has been drafted to reflect the law following the implementation of the Localism Act 2011.

2.2.15 Paragraph 32 of the NPPF states:

> *"All developments that generate significant amounts* of *movement should be supported by a Transport Statement or Transport Assessment."*

2.2.16 Paragraph 32 also goes on to state:

> *"Development should only be prevented or refused on transport grounds where the residual cumulative impacts of development are severe"*

2.2.17 Whilst the Scheme will not in itself generate significant amounts of movement, the Scheme will lead to the re-assignment of existing movements on a large scale, both on the immediate approaches to the Scheme and more widely across the town. It is therefore important to review the impacts of these traffic changes against relevant policies in the NPPF. These include the 'severe' test in paragraph 32 of the NPPF for any residual impacts.

2.2.18 NPPF is supported by the Planning Practice Guidance of March 2014.

2.2.19 In line with the above, the Scheme aligns with the guidance provided in the NPPF. The Scheme does not generate any traffic in its own right; however, it provides alternative options for route choice for strategic and local traffic in Lowestoft and incorporates new infrastructure for sustainable travel modes. The assessment set out in this TA

[8] In February 2018 the Ministry of Housing, Communities & Local Government issued a draft revised NPPF for consultation. This proposes some updates to the current guidance in the NPPF but the final version has not yet been published. The Applicant will review the final version of the revised NPPF once available and provide any updates as appropriate.

demonstrates that the Scheme has beneficial effects for movements across the town, and residual impacts on the network are not severe.

The National Infrastructure Delivery Plan 2016-2021

2.2.20 The NIDP was published in March 2016 and is based on the principle that high quality infrastructure boosts productivity and competitiveness, allowing businesses to grow and enabling them to reach suppliers, deepen labour and product markets, collaborate and innovate, and attract inward investment.

2.2.21 The NIDP states that local roads which are not a component of the SRN are also crucial to the successful operation of the transport system. Whilst local authorities are responsible for managing, maintaining and improving the overall local road network, the Government provides financial support for road maintenance and renewal schemes, and supports investment in new local transport schemes through Growth Deals, allocating the Local Growth Fund through Local Enterprise Partnerships.

2.2.22 The NIDP details the key Budget announcements from 2016, including £73.39m funding for the Scheme in Lowestoft.

2.2.23 Based on the information above, the construction of the Scheme aligns with the key principles of the NIDP. The Scheme will relieve congestion on Lowestoft's strategic and local highway network by adding a new north-south link across the Lake, with the wider aim to facilitate regeneration and economic growth by attracting inward investment. The Scheme will also have a beneficial effect on journey times along strategic routes across the region.

2.3 Sub-National Context

2.3.1 Lowestoft has an important role at a sub-national level principally due to its growing role in the energy sector which provides significant potential for economic growth. Lowestoft forms part of the Norfolk and Suffolk Energy Coast, which is part of the East of England Energy Zone. New Anglia's Economic Strategy (published in 2017) acknowledges the importance of Lowestoft to this growing sector and states that *"Great Yarmouth and Lowestoft form the centre of the area's energy industry"*. It is therefore important that there is strong connectivity between these two towns, via the A47 (part of the SRN), particularly as the Economic Strategy recognises that they "*draw on many of the same labour markets and supply chains"*. Improved reliability and resilience is therefore important at a sub-national level.

2.3.2 In the DfT publication Action for Roads[9] (2013) which identified capacity issues of increasing severity on the A12 south of Great Yarmouth into Lowestoft (including the A47 Bascule Bridge), congestion is predicted to be 'severe' on most of that section by 2040. This is further illustrated in Annex A of the NNNPS.

2.3.3 Consequently, Highways England's 2015 Route Strategy for the East of England[10] identifies river crossing capacity on the A12, now the A47, at Lowestoft to be a key challenge in the region. Evidence prepared to support the Route Strategy in 2014, records that the *"bascule bridge significantly influences capacity, speed and reliability of the route in Lowestoft"*[11] and is the least reliable section of the SRN in the east of England, recording

[9] Department for Transport (July 2013), Action for Roads, A Network for the 21st Century
[10] Highways England (April 2015), East of England Route Strategy
[11] Highways Agency (April 2014), East of England Route Strategy Evidence Report

average peak (defined as Monday to Friday 7-10am and 4-7pm) speeds of less than 20mph and in the top 10% for vehicle hours delay. (See Appendix C of that document).

2.3.4 Relevant to the Scheme is therefore the following:

- New Anglia Strategic Economic Plan 2014
- Lowestoft-Great Yarmouth Enterprise Zone

New Anglia Strategic Economic Plan 2014

2.3.5 The New Anglia SEP was published by the New Anglia LEP in 2014 and outlines the LEP's ambition to transform the economies of Norfolk and Suffolk which will establish the 'New Anglia' area as a centre of global business excellence. It seeks to deliver more jobs, new businesses, new housing, and increased productivity by 2026.

2.3.6 The area's main growth opportunity is in the energy sector, for which it has been designated one of six CORE[12] and will receive a comprehensive package of business support. The Port of Lowestoft (herein referred to as 'the Port') is important to the offshore energy industry. It also has an established reputation as a centre for servicing the offshore oil and gas industry, and more recently for the construction, operation and maintenance of North Sea wind farms.

2.3.7 The SEP identifies eight growth locations – areas which are expected to grow by at least 1,000 jobs and 1,000 dwellings over the relevant Local Plan period above and beyond those identified in the Local Plan itself[13] - including Lowestoft and Great Yarmouth. Transport performs a pivotal role in connecting and accessing these growth locations, and a programme for New Anglia's strategic transport infrastructure investment is essential to deliver the objectives of the SEP. For this reason, most of the strategic interventions in the SEP are transport-related, and include:

- Improvements on national trunk roads in the area;
- Schemes to directly unlock employment or housing growth; and
- Sustainable urban transport packages – public transport, walking and cycling schemes, network management measures and maintenance schemes.

2.3.8 The SEP's transport priorities will directly support development and help prevent transport constraints from being a barrier to growth. The SEP notes[14] that the limited opportunities to cross Lake Lothing force traffic onto a few congested routes, and specifically identifies the A47 Bascule Bridge as a bottleneck causing traffic congestion.

2.3.9 Lack of connectivity between the northern and southern parts of Lowestoft makes it more difficult to access potential employment sites and is one of the barriers to growth that needs to be tackled in the SEP infrastructure programme. The SEP therefore highlighted the Scheme as a priority for 2015.

Lowestoft-Great Yarmouth Enterprise Zone

[12] Department for Business, Innovation & Skills, November 2011, *Energy for New Anglia - Great Yarmouth and Lowestoft. Centre for Offshore Renewable Engineering*

[13] As part of the Local Plan growth forecasts.

[14] New Anglia Strategic Economic Plan, page 57, paragraph 6.39 (March 2014)

2.3.10 The Lowestoft-Great Yarmouth Enterprise Zone is one of 24 such zones created in England since 2011 to stimulate growth by providing a portfolio of strategic sites, with concessions/incentives offered to businesses locating there. It has been estimated[15] that the zone as a whole will create up to 9,000 direct jobs and 4,500 indirect jobs by 2025.

2.3.11 The Enterprise Zone comprises of six sites, two in Great Yarmouth and four sites in and around Lowestoft (South Lowestoft Industrial Estate extension, Mobbs Way, Riverside and Ellough). The sites in Lowestoft total over 46 hectares and are designated for activities related to energy, offshore engineering, and ports and logistics. The Enterprise Zone status came into force in 2012, and continues henceforth. Of particular relevance to the Scheme is the Riverside site, a 4.5 hectare brownfield site beside Lowestoft Inner Harbour, shown in 'red' in Figure 2.1.

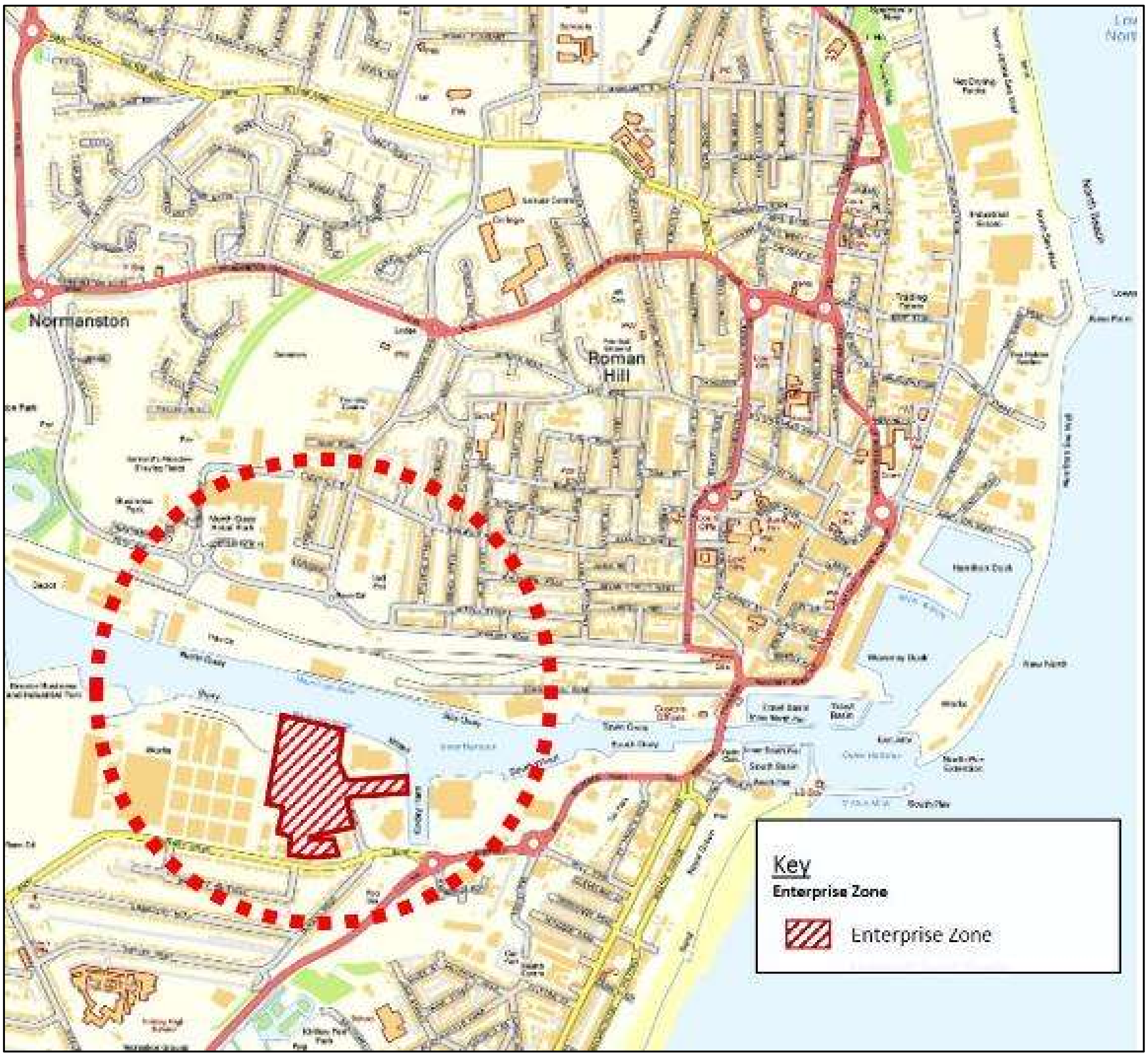


Figure 2.1: Riverside Road Enterprise Zone Site

2.3.12 The Riverside Road site has been allocated for B1 (light industrial / business), B2 (general industrial), or B8 (storage and distribution uses). The land forms part of the wider mixed-use allocation known as the Sustainable Urban Neighbourhood and Kirkley Waterfront.

[15] Suffolk County Council, 2013, *Suffolk Growth Strategy*

2.3.13 The Scheme will support economic growth in Lowestoft and the wider sub-region by delivering improved journey times and network resilience on the SRN, which connects Lowestoft and Great Yarmouth, and by strategically aligning with the aims of the Enterprise Zone.

2.4 Local Policy and Context

2.4.1 The following local planning and transport policy and priorities are relevant to the Scheme:

- Waveney District Council Core Strategy (2009)
- New Waveney Local Plan – Final Draft (March 2018)
- Lake Lothing and Outer Harbour Area Action Plan (January 2012)
- Sustainable Urban Neighbourhood and Kirkley Waterfront Development Brief Supplementary Planning Document, adopted May 2013
- Suffolk Local Transport Plan 2011-2031
- Lowestoft Transport Strategy (2011)

Waveney District Council Local Development Framework Core Strategy 2009

2.4.2 The Local Development Framework (LDF) covers Lowestoft and the whole of the administrative area of Waveney District[16]. The LDF includes the Core Strategy and Proposals Map, Site-Specific Allocations and Policies, as well as Development Management Policies.

2.4.3 The Core Strategy sets out a long-term spatial vision for the district indicating where development should take place and the factors that will be taken into account when considering proposals. Consultation was undertaken on the vision, objectives and options for the Core Strategy in mid-2006. The strategy was submitted for examination by an independent planning inspector in 2008, and adopted in 2009.

2.4.4 The Core Strategy envisages that Lowestoft will accommodate 70-80% of the housing growth planned for Waveney (Policies CS01 and CS11), and a net growth of 5,000 jobs in the district, both up to 2022, providing an alignment between employment and housing growth. Most of this employment growth will take place in land adjacent to Lake Lothing and the outer harbour area of Lowestoft (Policy CS07), supporting port expansion, regeneration and economic diversification. An Area Action Plan has been prepared to help achieve the objectives, including the long-held ambition to provide a third crossing over the Lake (as per Policy CS05).

2.4.5 The Core Strategy identifies a range of transport measures (Policy CS15) which are integral to the regeneration of Lowestoft and the wider sub-region with Great Yarmouth. These include measures to reduce congestion, improve safety and enhance connectivity between north and south Lowestoft and with Great Yarmouth. Policy CS15 also states:

> *"The District Council will continue to promote the creation of a third road crossing of Lake Lothing, as an integral part of dealing with transport problems and issues in Lowestoft and the sub-region."*

[16] except the part lying within the 'Broads Executive Area'

2.4.6 Based on the above review, the Scheme will be a key component in achieving the aims and objectives of the Core Strategy to provide good access to jobs, services and facilities. The Scheme provides the additional infrastructure required to support an improved, less congested transport network, which will lay the foundations for regeneration and future economic growth.

New Waveney Local Plan – Final Draft Plan (March 2018)

2.4.7 The final draft of the new Waveney Local Plan (issued for Regulation 19 consultation in spring 2018) provides the overarching policy framework for planned long-term growth to be delivered in the area for the period 2014 to 2036.

2.4.8 The plan recognises that traffic congestion in the town is an issue which currently inhibits economic growth, and notes that a third crossing over the Lake will help alleviate this congestion, as well as improve connectivity and assist in the delivery of regeneration sites.

2.4.9 Policy WLP1.4 (Infrastructure) states that WDC will work with partners to ensure that the growth outlined in the Local Plan Final Draft is supported by necessary infrastructure as well as to ensure the timely delivery and the success of the Lake Lothing Third Crossing.

2.4.10 It is considered that the Scheme complements the vision, principles and policies detailed within the Waveney Local Plan Final Draft by providing the third crossing, relieving traffic congestion in Lowestoft town centre and supporting the regeneration of specific sites around Lake Lothing.

2.4.11 WDC as planning authority reflect SCC's aspirations for an improved highway network (including new links such as the third crossing) within their Local Plan documents. However, as highway authority, SCC does not require WDC to include schemes within policy in order for those schemes to be implementable.

Lake Lothing and Outer Harbour Area Action Plan (AAP) January 2012

2.4.12 The AAP provides a detailed spatial policy framework for the regeneration of The Lake and the Outer Harbour. The area covered by the AAP is also identified as a 'Strategic Employment Location', in support of port development, employment-led regeneration and economic diversification.

2.4.13 Lake Lothing creates a significant barrier to movement within the AAP area and across the wider town. It splits the town in two, with the main employment area located to the northern side and a sizeable residential population to the south. Crossing Lake Lothing constrains the transport options within the town, with two lifting bridges at the eastern and western ends which form bottlenecks where several roads merge into one.

2.4.14 The AAP acknowledges that it is a long-term ambition for the town to provide a further vehicular connection across the Lake, as part of a wider objective to implement road improvements to facilitate development. The AAP states in paragraph 3.5.22 that *"it will be expected that developers will work with the Council to ensure that proposals will not restrict the future potential for a new road crossing".*

2.4.15 The AAP also demonstrates a desire to promote pedestrian and cycle connectivity in Lowestoft, and strives for significant and defined networks linking the north and south, east and west, and opening up the waterfront on the southern bank of Lake Lothing.

2.4.16 The Scheme complements the policies detailed within the AAP by providing an additional transport connection across the Lake. There is a clear long-term vision for the Lake and

Outer Harbour area. The enhanced connectivity and reduced severance provided as a result of the Scheme will assist in achieving that vision.

Sustainable Urban Neighbourhood and Kirkley Waterfront Development Brief Supplementary Planning Document, adopted May 2013

2.4.17 The most significant strategic site within the AAP in relation to the Scheme is the Kirkley Waterfront and Sustainable Urban Neighbourhood which is approximately 60 hectares comprising of mostly underused or unoccupied brownfield land on the south bank of Lake Lothing. The site stretches from the Riverside Road Business Park in the east to Nelson's Wharf in the west, including the former Jeld Wen and former Sanyo sites. The AAP anticipates a new mixed use community that integrates with the surrounding land uses and is supported by the necessary infrastructure, including new access arrangements.

2.4.18 The Kirkley Waterfront and Sustainable Urban Neighbourhood site has not yet come forward for development but Waveney District Council consider that:

> *"the separate access road proposed* [as part of the scheme] *for the existing businesses will also help directly support the development of the new employment uses and housing on the former Jeld Wen Site"*[17].

2.4.19 Furthermore, the necessary infrastructure needs to be in place when development occurs to avoid exacerbating the current congestion issues as a result of the additional traffic and movement of people and goods in and out of Lowestoft that would be generated by development on this scale.

Suffolk Local Transport Plan 2011-2031

2.4.20 DfT guidance on Local Transport Plans (LTPs) required local authorities to develop strategies and implement programmes to achieve the five goals originally developed in the DfT's discussion document, 'Towards a Sustainable Transport System'[18]:

- Maximising economic growth through competitiveness and productivity;
- Tackling climate change;
- Protecting people's safety, security and health;
- Improving quality of life; and
- Promoting greater equality of opportunity.

2.4.21 In response, SCC adopted a strategy intended to deliver first class transport infrastructure in the county. LTP3[19] sets out the authority's transport objectives, strategies and policies for the period 2011-2031. It shows how transport will play its part in supporting and facilitating future sustainable economic growth by:

[17] Report to Waveney District Council Planning Committee on 10 October 2017, Item 11, Application Number DC/17/3902/CCC, The Lake Lothing Third Crossing public consultation
[18] DfT, October 2007, *Towards a Sustainable Transport System*, page 8-10, paragraphs 11-16
[19] Suffolk County Council, 2011, *Suffolk Local Transport Plan 2011-2031 (Part 1 – Transport Strategy and Part 2 – Implementation Plan)*

- Maintaining (and in future, improving) transport networks;
- Tackling congestion;
- Improving access to jobs and markets; and
- Encouraging a shift towards more sustainable travel patterns.

2.4.22 The LTP identifies 11 key transport issues for Waveney District. These include:

- Access to development sites south of The Lake in Lowestoft;
- Lack of pedestrian / cycle bridges over The Lake; and
- Pinch points for northbound / southbound traffic in Lowestoft.

2.4.23 The LTP describes a number of long-standing aspirations for highway improvements in Lowestoft, including additional pedestrian / cycle bridges across the Lake and, in the longer term, a third vehicular bridge across the Lake.

2.4.24 The Scheme would contribute to LTP3 goals and would address the specific transport issues identified in the plan by reducing congestion and improving connectivity, access to jobs, and journey time reliability for customers, commuters and freight. It would provide an improved crossing for cycles and pedestrians as well as for cars and freight vehicles. The LTP identified the Scheme as:

> *"much needed improvement for which there is a very strong desire in the local community but with, at present, no clear delivery mechanism".*

2.4.25 The construction of the Scheme is, therefore, in line with the aims for transport in Suffolk to improve future transport networks, reduce congestion, improve access to development sites south of the Lake, and provide better access across the Lake for pedestrians and cyclists.

Lowestoft Transport Strategy 2011

2.4.26 The Lowestoft Transport Strategy, produced by SCC in 2011, complements the LTP and the AAP. It acknowledges that plans for growth in the town will add to congestion if current travel trends continue. The focus for growth is around the Lake, and could lead to long-term changes in the area and its land uses. However, the constricted nature of the two opening bridges often create congestion, especially when the A47 Bascule Bridge is opened to allow access to the quayside. The congestion is exacerbated when the level crossing near Oulton Broad North railway station is closed to traffic.

2.4.27 The strategy defines three key objectives for Lowestoft, which are:

- Reducing demand for car travel;
- Developing an efficient use of transport networks; and
- Improving infrastructure.

2.4.28 The construction of the Scheme is considered to align with those objectives of the Lowestoft Transport Strategy noted above. It will alleviate congestion at the two existing crossings by providing an alternative route of travel for road users between the north and south of Lowestoft. It improves the local highway network and will encourage regeneration around The Lake.

2.5 Summary of Policy Context

2.5.1 It is important that the Scheme aligns with plans and policies at all levels to show that it can achieve the aims and objectives of various national and local authorities. This Section demonstrates that the Scheme aligns closely with national, sub-national and local planning policies and strategies. It will address congestion problems on the A47, part of the SRN, by reducing traffic, especially at the A47 Bascule Bridge which has been identified by Highways England as a bottleneck.

2.5.2 The TA demonstrates that the Scheme satisfies the strategies and objectives of SCC, Highways England and the LEP. It will reduce severance and congestion on local roads, and is expected to stimulate growth by improving access to the key regeneration areas around the Lake identified in local planning policy. It will benefit all modes of terrestrial transport.

3 Existing Conditions

3.1 Introduction

3.1.1 This Section examines existing transport conditions in the vicinity of the Scheme.

3.1.2 It describes:

- the strategic and local transport networks (highways, public transport, pedestrian and cycle), highlighting existing problems with these;
- the existing crossings of Lake Lothing and how they interact with the Port of Lowestoft.
- the existing and planned land-uses (which give rise to travel demand); and
- the traffic surveys undertaken to assess the existing conditions.

3.1.3 It presents the results of surveys of queuing and journey time studies, and describes the number and types of collisions, on the existing network.

3.1.4 As demonstrated by the assessments presented in this TA, the local highway network is considered inadequate to support the current level of demand from traffic. This gives rise to problems of:

- **Congestion** - at key junctions throughout the town, leading to an inefficient network, poor journey times and a lack of journey time reliability;
- **Community severance** - caused by the Lake and the East Suffolk Line/Wherry Line, especially when existing bridges are lifted to allow shipping movements, or the level crossing is closed to allow train movements; and
- **Poor accessibility** - for all modes, including pedestrians and cyclists.

3.1.5 All of these transport-related problems are associated with the limited opportunities to cross the Lake which divides Lowestoft in two. There are only two road crossing points, both lifting bridges, one at each end of the Lake:

- The A47 Bascule Bridge at the entrance to the inner harbour, at the eastern end of the Lake; and
- The A1117 Mutford Bridge, at the western end of the Lake.

3.1.6 The railway lines also create congestion and add to problems of journey time reliability when the level crossings are closed to traffic. The East Suffolk Line crosses the Lake on a swing bridge, parallel to the Mutford Bridge with a level crossing to the south of the Lake on Waveney Drive. The A1117 crosses the Wherry Line at a level crossing on the north side of the Lake.

3.1.7 These problems are explored in further detail within this TA as follows:

- Congestion and journey time reliability - Section 7
- Community severance and poor accessibility - Section 11

3.1.8 The transport networks and existing problems are described in more detail below.

3.2 The Port of Lowestoft

3.2.1 The Port is the most easterly harbour in the United Kingdom and has direct access to the North Sea. It is owned and operated by Associated British Ports (ABP) and is supervised by a Harbour Master. Situated directly opposite major Continental ports, the Port serves the busy sea routes between the UK, Europe, Scandinavia, and the Baltic States. The Port is linked by the A12 to London, the A47 to Great Yarmouth and Norwich, whilst the A146 also links to Norwich and has quayside rail links.

3.2.2 The harbour is made up of two sections, the Outer Harbour and Inner Harbour, divided by the A47 Bascule Bridge. On the west side, Mutford Bridge gives access to the Suffolk Broads. Both bridges can be raised if vessels need to pass through the harbour and the Lake, although this causes congestion in the town and routes can become gridlocked.

3.2.3 The Inner Harbour is formed by the Lake and has a total quay length of 2,100 metres on the northern side, whilst the Outer Harbour is constructed from breakwaters and has a total quay length of 1,400 metres. The Port's main entrance can accommodate vessels up to 35 metres in width, with vessels 22 metres wide being able to access the Inner Harbour through the A47 Bascule Bridge.

3.2.4 The harbour is able to service vessels up to 125 metres in length. Figure 3.1 illustrates the harbour layout and minimum travel times for vessels, between the three bridges. According to the maximum speed limit of the harbour (4 knots or 7.4km/hour) and allowing for slower movements around bends/bridges, the travel time between Mutford Bridge and the Scheme would be 16 minutes; whilst the travel time between the A47 Bascule Bridge and the Scheme would be 7 minutes.

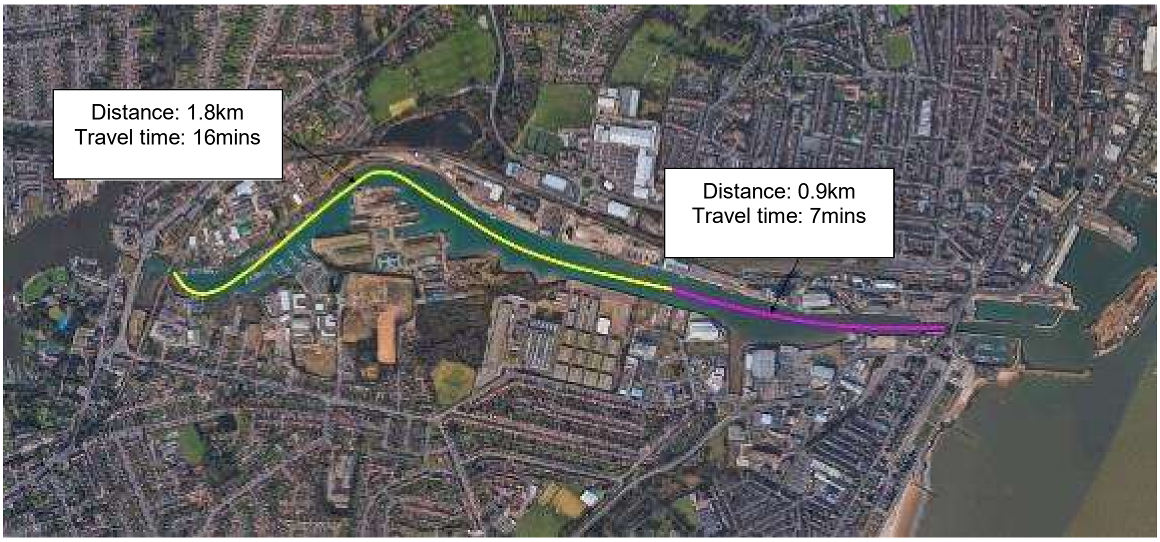


Figure 3.1: Harbour Layout and Travel Times between Bridges

3.3 Port Industry

3.3.1 The Port serves as a major centre for servicing the North Sea offshore oil and gas industry. A large number of SME based supply chain companies exist in the Port area with transferable skills and products linked to the existing offshore industry (gas and oil). The Port has been actively involved in development, construction and operations and maintenance of the offshore wind farms. Modern transit sheds and a 14,000 tonne silo are available with a range of cranes and other facilities including a container terminal. There still remains a small amount of fishing activity with fishing vessels being run from the Outer Harbour. There are significant developments in the marine leisure industry, with Royal Norfolk and Suffolk Yacht Club Marina in the Outer Harbour, while ABP Marina, Lowestoft Cruising Club, and Lowestoft Marina are located in the Lake.

3.3.2 There are also facilities for ship repairs, including Lowestoft Dry Dock, located on Commercial Road, alongside the Inner Harbour, and a number of slipways into the Lake.

3.4 Existing Port Crossings

A47 Bascule Bridge

3.4.1 The A47 Bascule Bridge has scheduled opening times, though vessels need to give 20 minutes notice when requiring an opening. Table 3.1 shows the scheduled opening times. No lifts are scheduled for weekday AM and PM peak road traffic times (between 0700 – 0945 and 1600 – 1900).

Monday - Friday	**0300**	**0500**	**0700**	**0945**	**1115**	**1430**	**1600**	**-**	**1900**	**2100**	**2400**
Weekends and Bank Holidays	0300	0500	0700	0945	1115	1430	1600	1800	1900	2100	2400

Table 3.1: A47 Bascule Bridge - Current Opening Periods

3.4.2 The A47 Bascule Bridge opens on demand outside these hours for commercial shipping over 50 gross register tonnage. Commercial shipping is discouraged from passage during the periods 0815 – 0900, 1230 – 1300, and 1700 – 1745. Notice of one hour is required for commercial openings.

3.4.3 Small craft and yachts may use an on-demand bridge opening for commercial shipping provided that prior arrangement has been made with Lowestoft Harbour Control, subject to opening time. The existing A47 Bascule Bridge operates as follows:

- System user logs in and starts the pumps (takes c.30 seconds for sequence to commence);
- traffic wig wag signals waits for the bridge to clear;
- traffic and pedestrian barriers are closed. (traffic barriers cannot be closed until pedestrian gates are closed; pedestrian barriers close individually; traffic barriers can be closed in pairs);
- bridge opening sequence (about 1 minute 30 seconds);
- vessel traffic lights set to green while vessel(s) transit, (30 seconds to 5 minutes)

- closing sequence (approx. 1 minute 30 seconds); and
- once the bridge is locked in position, barriers are opened (usually simultaneously).

3.4.4 The full sequence is usually between five and ten minutes and is initiated an average of 14 times per day. The opening time of the Bascule Bridge varies depending on the type of vessel that is passing underneath and the speed at which it is travelling. On occasion, there may be two or more vessels passing under the bridge in one opening which requires a longer opening time than a single vessel.

3.4.5 The bridge has a clearance of 2.16m above the highest astronomical tide of the Lake.

3.4.6 The vessel surveys show that of 1,200 bridge openings, 190 (16%) included vessels passing in both directions. Of those 190 openings, only 13 (1% overall) included vessels higher than the proposed clear height of the Scheme.

3.4.7 Further information on the vessel activity within the Port is provided within the ES, including details of the active vessel survey undertaken and actual bridge opening records.

Mutford Bridge

3.4.8 Mutford Bridge opens on request for small vessels during the scheduled periods shown in Table 3.2.

3.4.9 Pre-booking is currently advised rather than required; the bridge may open on immediate request for vessels that have not given notice, but effort is made to coordinate opening times so several vessels can pass through in a single lift. Lifts are also coordinated with the A47 Bascule Bridge's scheduled lift times, with a 30 minute gap assumed for an average leisure craft to travel between the two bridges.

3.4.10 Opening can be disrupted by stationary traffic on the bridge stretching back from the Oulton Broad level crossing. Full sequence from starting wig wags to re-opening road is usually between two and four minutes, but can be more. At present, Mutford Bridge typically opens two to four times per day. The bridge has a clearance of 2m above the Lake.

April - October	0800 - 1800	-	-
November - March	0800-1100	-	-
Restrictions	Before 0900	1200-1300	1700-1800

Table 3.2: Mutford Bridge Opening Times

3.5 Strategic Road Network

3.5.1 The SRN is managed by Highways England and comprises A47, with Lowestoft the most easterly point on the SRN. The A47 runs in an east-west corridor from Peterborough, through King's Lynn and Norwich to Great Yarmouth. From Great Yarmouth it runs in a north-south corridor to Lowestoft, terminating just south of the existing Bascule Bridge at the eastern end of the Lake.

3.5.2 The A47 Bascule Bridge consists of three lanes which operate to accommodate tidal flow conditions, with two lanes northbound/one lane southbound in the AM peak and one lane northbound/two lanes southbound in the PM peak.

3.5.3 Within Lowestoft, the A47 provides a circuit around the town centre utilising both A47 Battery Green Road and A47 Katwijk Way. The layout of the Station Square junction just north of the Bascule Bridge on A47 was amended in the early 2000s. Previously, A47 Katwijk Way was northbound only, with the southern section of A47 Battery Green Road southbound only into the junction with Station Square and onto the Bascule Bridge. The layout was amended to provide traffic in both directions onto the bridge from both Station Square and Battery Green Road. The amended layout is one example of how less significant interventions have been already been undertaken by SCC to try to improve connectivity and reduce congestion in Lowestoft.

3.5.4 Until spring 2017, this section of the SRN was designated A12. The East of England Route Strategy (Highways England, March 2017) notes that the region is highly dependent on this section of the SRN, as it is the only major access route north and south for commuters and freight companies transporting goods to and from the port of Lowestoft.

3.5.5 The A47 between Peterborough and Great Yarmouth is also part of the 'comprehensive' Trans European Network for Transport, providing connected freight routes for the transport of goods across Europe.

3.5.6 The A47 connects Lowestoft to the international airport at Norwich, and to the rest of the SRN, including the A11 / A14 to Cambridge. The Route Strategy notes that the local economy of Lowestoft is highly dependent on this route, because of its strategic importance in connecting the region to the rest of the East of England.

3.5.7 The SRN does not continue south of the A47 Bascule Bridge towards Ipswich. The main route south from Lowestoft is via the present A12, which was reclassified as a local road in 2001, and is managed by SCC.

3.5.8 The Route Strategy highlights problems of congestion and lack of capacity on the A47. Over time, the route has been developed to widely inconsistent standards, and there is a lack of viable alternatives routes. This means that when incidents occur, motorists have only limited opportunity to avoid congestion and delay. This is especially true in Lowestoft, where the route strategy identifies the existing Bascule Bridge as a bottleneck causing congestion and delays.

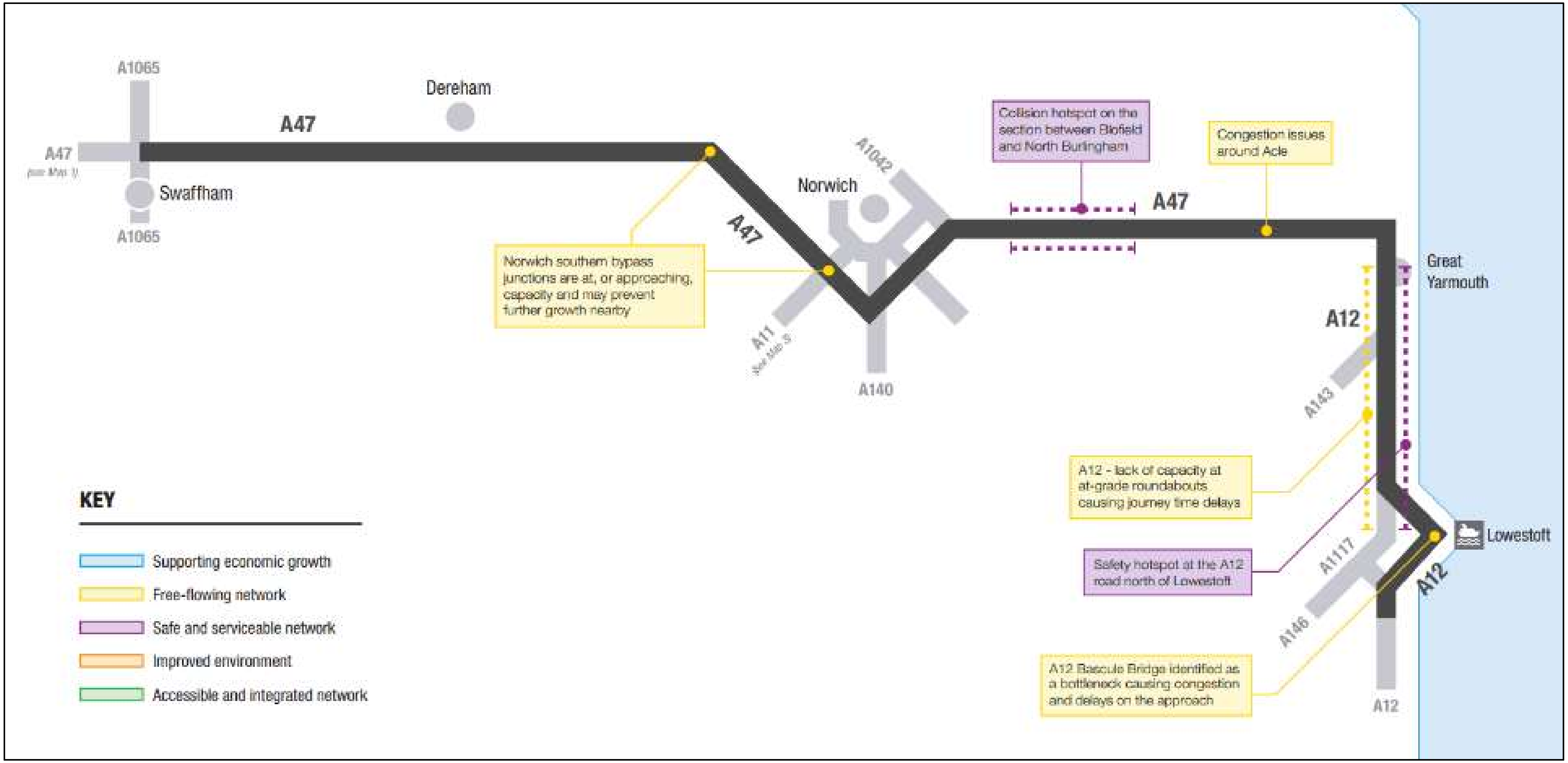


Figure 3.2: Key challenges A47/A12 (From East of England Route Strategy, Highways England, March 2017[20])

[20] Plan pre-dates re-numbering of A12 to A47 north of Lowestoft

3.6 Local Highway Network

3.6.1 The local highway network consists of 'A' and 'B' classified roads and unclassified residential and rural roads in the vicinity of the Scheme which are maintained by SCC. It is illustrated in Figure 3.3 along with the SRN (A47) and detailed further in Appendix B. The area is constrained to the east by the North Sea and to the west by the Broads.

3.6.2 The B1531 (Waveney Drive) runs along the southern boundary of the Scheme, and feeds into the B1531 (Victoria Road) approximately 1km to the west, at the junction with Kirkley Run. Together, these form the main east-west route on the south side of the Lake. They are both wide single carriageway roads with good forward visibility, and are subject to a 30mph speed limit. Waveney Drive will become part of the new southern roundabout junction.

3.6.3 The C909 (Denmark Road) runs along the northern boundary of the Scheme and forms one of the main east-west routes on the north side of the Lake. It feeds into the C970 (Peto Way) at the North Quay Retail Park to the west, and the A47 to the east, adjacent to Lowestoft Station. The carriageway is narrow where residential parking exists on the eastbound side of Denmark Road (between Hervey Street and Trafalgar Street). Accessibility from the Scheme will be via a new northern junction, which will tie into the existing roundabout at Rotterdam Road / Denmark Road.

3.6.4 The A146 is a main distributor road which runs into Lowestoft from Norwich and terminates at the junction with the A1117 (Cotmer Road), adjacent to Oulton Broad South Station. It connects with other 'A' and 'B' roads to provide access to other parts of Suffolk and Norfolk. The A146 also connects to routes onwards to Norwich Airport. From the location of the Scheme, this north-south corridor through the western periphery of Lowestoft is accessible via the B1531 Waveney Drive / Victoria Road and is subjected to a 30mph speed limit within the boundaries of the town.

3.6.5 The A1117 is a main distributor road which provides a direct connection between the A12 / A1117 / A1445 junction (Bloodmoor Roundabout), Mutford Bridge and the Northern Spine Road at Millennium Way. This provides an onward connection to the A47 Yarmouth Road towards Great Yarmouth. From the location of the Scheme, this north-south corridor through the western periphery of Lowestoft is accessible via the B1531 (Waveney Drive and Victoria Road). It is subject to a 30mph speed limit from Mutford Bridge to the A1117 (Peto Way), and a 40mph limit from there to its terminus at the A47 Yarmouth Road.

3.6.6 The A1144 is a main urban secondary distributor road and connects the C970 Peto Way to the A47 on the north side of the Lake. Access to this route from the Scheme is provided by the C970 (Peto Way). It is subject to a 30mph speed limit.

3.6.7 The A1145 is an urban secondary distributor road and connects the A146 from Beccles Road to the A12 at Tom Crisp Way in an east-west corridor on the south side of the Lake. The route is of a good quality with a wide carriageway, and is subject to a 40mph speed limit.

3.6.8 B1532 London Road South and B1532 Marine Parade/Kirkley Cliff Road operate a one-way system just south of the A47 Bascule Bridge. London Road South provides a northbound route whilst Marine Parade/Kirkley Cliff Road provides a southbound route, connecting to a two-way arrangement at Kensington Road.

Figure 3.3: Lowestoft Highway Network/SRN and the Scheme location
(Contains OS data © Crown copyright and database right: 2017)

3.6.9 The South Lowestoft Relief Road (SLRR) (now A12 Tom Crisp Way) and Lowestoft Northern Spine Road (LNSR) (now A1117 Peto Way/Millennium Way) were part of an overall transport strategy for Lowestoft which envisaged a third crossing of Lake Lothing.

The SLRR was promoted, constructed and part-funded by Suffolk County Council, and opened to traffic in 2006. The final phase of the LNSR opened in 2015. There is a central gap of less than 650m between these two roads, as the crow flies, but the actual driving distance (via the A47 Bascule Bridge) is approximately 2km. A new crossing of Lake Lothing, effectively linking these highway schemes, is a crucial piece of the highway network needed to address congestion, reliability and resilience issues in Lowestoft.

3.6.10 Feedback from the consultation events completed for the DCO suggests that driver behaviour regarding following road markings/traffic management may cause delays and collisions on some part of the local and strategic highway networks. Further information can be found in the Consultation Report submitted with the DCO application.

3.6.11 Within this TA, the terminology in Table 3.3 is used when referring to parts of the network.

Terminology	Description	Routes Included
SRN	Strategic Road Network, managed by Highways England	A47
Local highway network	Local highways in Lowestoft, managed by SCC	The roads described in section 3.6 above and all other highways in Lowestoft that do not form part of the SRN.
Lowestoft highway network	The highway network in Lowestoft, including the SRN and the Local Highway Network	The Local Highways Network and the SRN
Strategic Routes	Route across/through Lowestoft of wider importance to the region	A47 - A12 and the A1117
Key Routes	Key Routes in the Lowestoft Highways Network for assessment within this TA	Route 1 - A146-Fairfield Rd Jn to A47~~12~~ Katwijk Way / A1144 St Peter's St Jn Route 2 - A~~12~~47 St Peters St / Jubilee Way Jn to A12 Tom Crisp Way / Blackheath Rd Jn Route 3 – A1117 / Victoria Rd Jn to A 12 Tom Crisp Way / B1531 Waveney Drive Route 4 - A1117 Normanston Drive / Peto Way Jn to A~~12~~47 Waveney Rd / Station Square Jn
Key Movements	Movements to/from various points around the highway network around the east of Lowestoft, with no specific routing (i.e. vehicles can travel on any route between the points)	A – A12 Tom Crisp Way (south of Blackheath Road) B – A47 Jubilee Way (at St. Peter's Street) C – B1532 London Road South (at St. Peter's Road)

Table 3.3: Route/Movement Descriptions

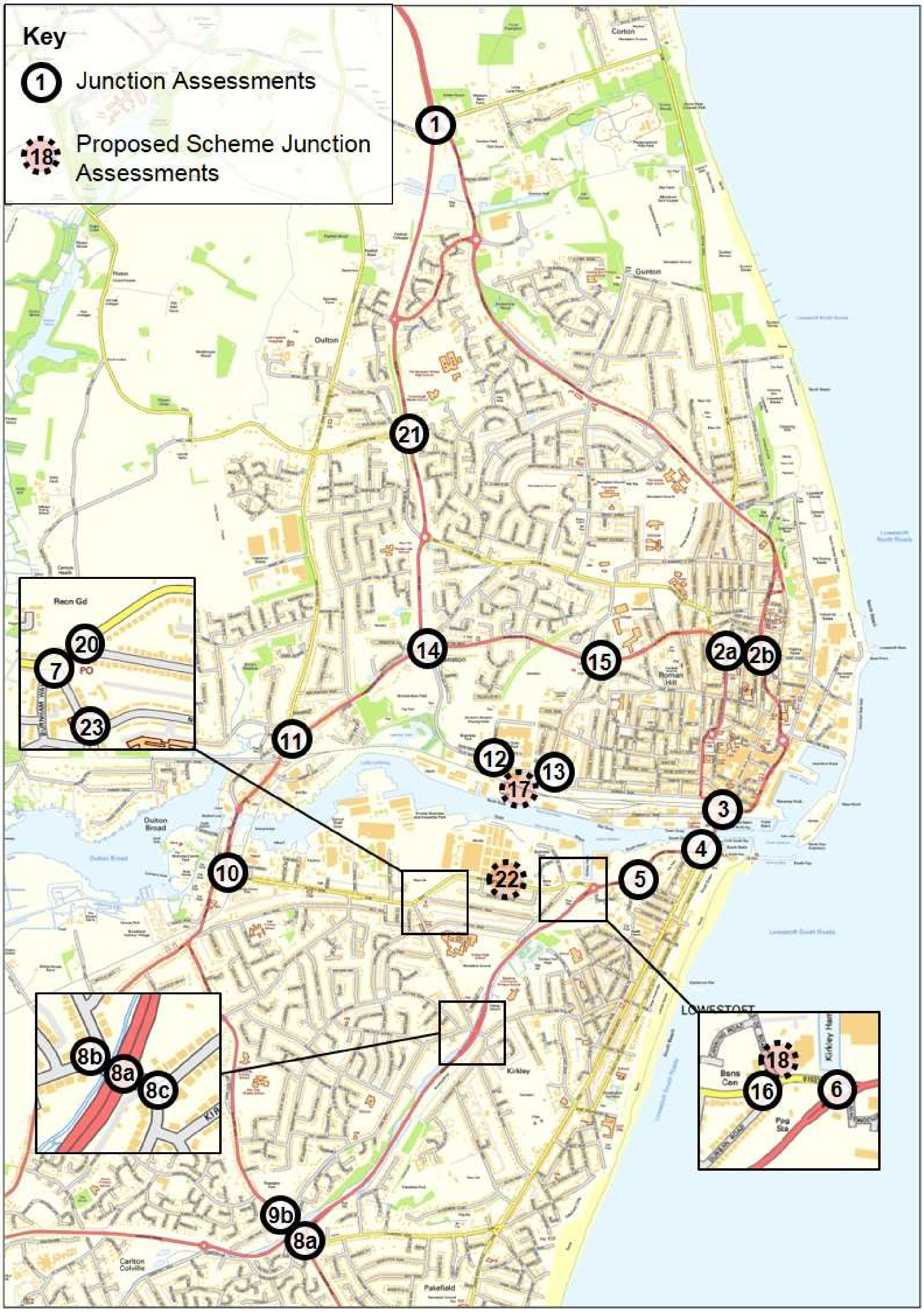
3.7 Lowestoft Highway Network - Key Junctions

3.7.1 The re-routing of traffic because of the Scheme could affect junctions on the network described above. A list of key junctions has therefore been agreed with SCC:

1. A47 Yarmouth Road / A1117 Millennium Way;
2a. A47 Katwijk Way / A1144 St Peter's Street;
2b. A47 Artillery Way / A47 Jubilee Way / A47 St Peter's Street;
3. A47 Waveney Road / Station Square / Commercial Road;
4. A12 Pier Terrace / B1532 London Road South;
5. A12 Belvedere Road / Mill Road / Kirkley Rise;
6. A12 Tom Crisp Way / A12 Horn Hill / B1531 Waveney Drive / Maconochie Way;
7. B1531 Victoria Road / B1531 Waveney Drive / Kirkley Run;
8a. A12 Tom Crisp Way / Blackheath Road;
8b. Kirkley Run / Blackheath Road / Long Road;
8c. Blackheath Road / Carlton Road;
9a. A12 Tom Crisp Way / Bloodmoor Road / A1145 / Castleton Avenue;
9b. A1117 Elm Tree Road / Long Road / A117 Bloodmoor Road;
10. A1117 Bridge Road / A1117 Saltwater Way / B1531 Victoria Road;
11. A1117 Normanston Drive / B1375 Gorleston Road;
12. Peto Way / Denmark Road / Barnards Way;
13. Denmark Road / Rotterdam Road;
14. A1117 Normanston Drive / A1117 Peto Way;
15. A1144 Normanston Drive / Rotterdam Road;
16. B1531 Waveney Drive / Riverside Road / Durban Road;
17. New roundabout north of Lake;
18. New roundabout south of Lake;
19. Denmark Road / Katwijk Way;
20. B1531 Waveney Drive / Kimberley Road;
21. A1117 Millennium Way / B1074 Somerleyton Road;
22. B1531 Waveney Drive / Riverside Road; and
23. Kirkley Run / Notley Road

3.7.2 Figure 3.4 shows the locations of these junctions.

3.7.3 The new junctions (No. 17, 18 and 22 above) form part of the Scheme and are described in more detail in Section 4 of the TA. A detailed description of the layout and characteristics of the existing junctions is provided in Section 8, together with a detailed assessment of the impact of the Scheme on each junction.


Key
1 Junction Assessments
18 Proposed Scheme Junction Assessments
1
21
14
15
2a
2b
11
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8b
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18
16
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Corton
Gunton
Oulton
Oulton Broad
Kirkley
LOWESTOFT
Carlton Colville
Pakefield
Recn Gd
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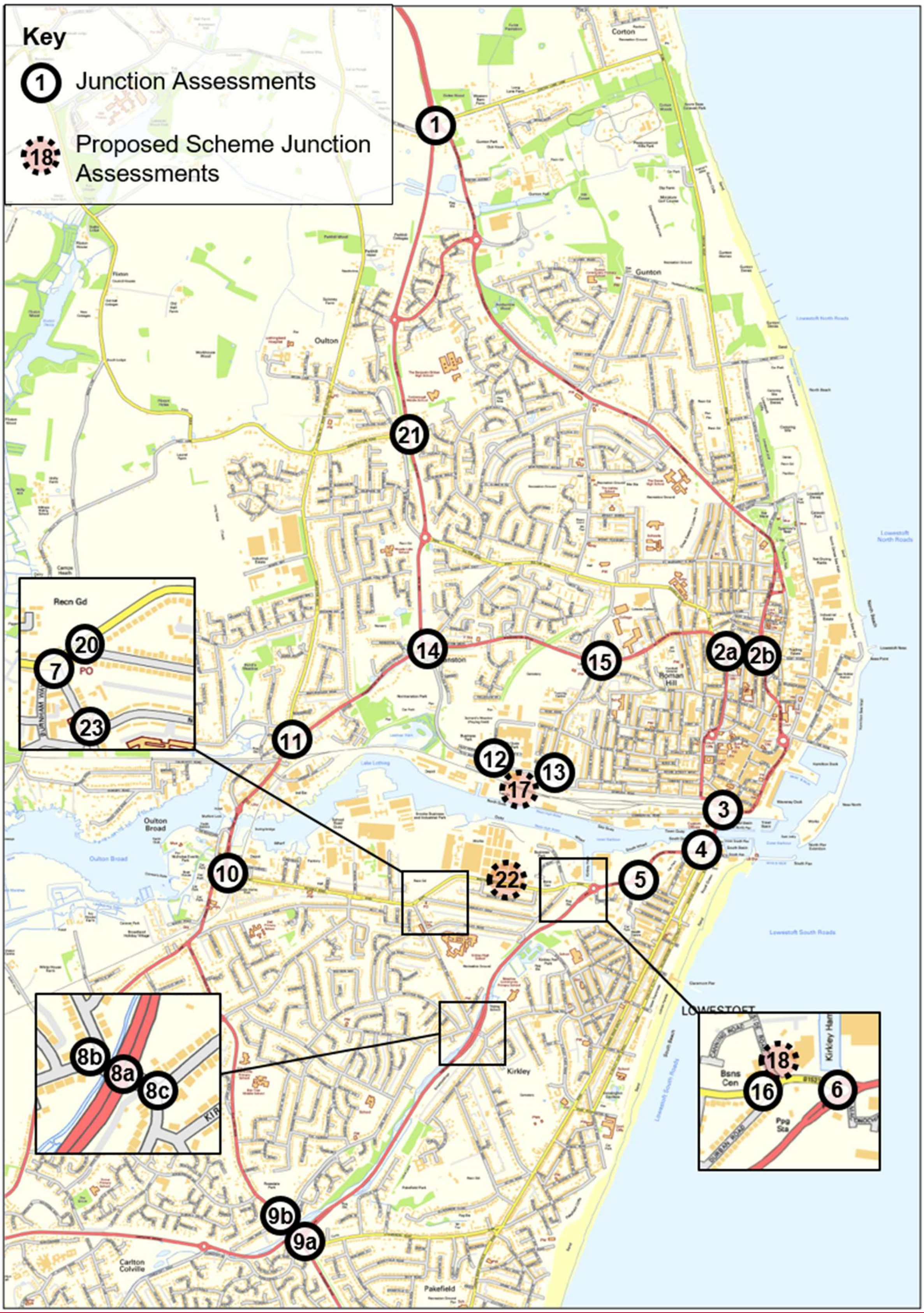


Figure 3.4: Location of Junctions to be Assessed
(Contains OS data © Crown copyright and database right: 2017)

3.8 Public transport network - buses

3.8.1 As a key regional service centre, Lowestoft is well-served by bus services. These cover the main corridors through the town, linking the town centre with outlying areas.

3.8.2 Lowestoft Bus Station is located in the town centre on Gordon Road, approximately 1.5km from the Scheme. There is also a bus interchange located approximately 1km east of the Scheme, at Lowestoft Station.

3.8.3 The bus stops and the bus routes in the vicinity of the Scheme are shown in Figure 3.5 and in Appendix C.

Figure 3.5: Lowestoft Bus Routes and Bus Stops in the Vicinity of the Scheme [21]
(Contains OS data © Crown copyright and database right: 2017)

3.8.4 The severance caused by the Lake and the East Suffolk Line constrains bus movement and accessibility between the north and south sides of the town. North-south services are obliged to use the existing, congested, crossing points.

3.8.5 A large number of bus routes serve the north of the town, but fewer serve the south side. Six routes cross the Lake at the Bascule Bridge. Only one route (route 106) uses Mutford Bridge to cross the Lake. With the exception of route 101, none of the routes servicing the south of the town travel further north into Lowestoft than the bus station. Again, with the exception of route 101, the routes serving the north of the town remain on the north side of the Lake. The current routing strategy developed by the bus operators is likely to

[21] https://www.suffolkonboard.com/buses/bus-timetables-by-area/lowestoft-surrounding-area/ [accessed 29/11/2017]

be influenced by the poor journey time reliability and congestion between the two sides of the Lake.

3.8.6 The existing services in the vicinity of the Scheme are described below:

Bus Route 101

3.8.7 Operated by First in Norfolk and Suffolk, route 101 provides services between Weston Road/Stoven Close in Gunton, and Cowslip Crescent/Periwinkle Close in Hollow Grove. This service has stops at Horn Hill/Asda, on the southern side of the lake (less than 100m from the Scheme) and Lowestoft Town Centre. Services are provided at 20-minute intervals, Monday to Saturday, during the day and then hourly during the evenings. Sunday services operates at an hourly frequency, between the hours of approximately 09:00 and 18:00. The timetable information detailed is valid from 03/09/2017 to 05/05/2018.

Bus Route 106

3.8.8 Also operated by First in Norfolk & Suffolk, route 106 provides services between the Lowestoft Bus Station, and can be accessed at the North Quay Retail Park on Peto Way. The service operates on a circular route, starting and finishing at Lowestoft Bus Station. A service departs the bus station between 0930 hours and 1430 hours, hourly, Monday to Friday, and between 0830 hours and 1530 hours on a Saturday. There is no Sunday service. The timetable information detailed is valid from 03/09/2017 to 05/05/2018.

Bus Route SJL2

3.8.9 Operated by Borderbus, route SJL2 provides one daily service for local schools in each direction from the North Quay Retail Park bus stops on a circular route in North Lowestoft. It operates on school days only, from Normanston Drive at 0733 hours to Sir John Leman HS at 0820 hours, and returning from Sir John Leman HS at 1525 hours to North Quay Retail Park at 1612 hours.

Bus Route SJL3

3.8.10 Also operated by Borderbus, route SJL3 provides one daily service for local schools in each direction from the Riverside Road bus stops on a circular route in Lowestoft between Oulton Broad and Beccles. It operates on school days only.

3.8.11 Table 3.4 below summarises the key weekday information relating to the bus routes presented above. Table 3.5 and Table 3.6 summarise the key information for Saturday and Sunday services.

Route	Bus Stop	Route	Total Buses per Day	First Arrival	Last Departure
101	Asda Horn Hill	Gunton - Town Centre - Hollow Grove	40	07:43	23:03
		Hollow Grove - Town Centre - Gunton	40	06:55	22:28
106	North Quay Retail Park, Peto Way	Towards Oulton Broad	6	09:35	14:35
		Towards Town	6	10:00	14:00
SJL2	North Quay Retail Park	Beccles, Sir John Leman HS, Beccles	1	07:50	
		North Quay Retail Park	1	16:12	
SJL3	Riverside Road / Waveney Crescent	Beccles, Sir John Leman HS, Beccles	1	07:43	
		Oulton Broad	1	15:58	

Table 3.4: Bus Services in the Vicinity of the Scheme - Monday to Friday

Route	Bus Stop	Direction	Total Buses per Day	First Arrival	Last Departure
101	Asda Horn Hill	Gunton - Town Centre - Hollow Grove	40	08:03	23:03
		Hollow Grove - Town Centre - Gunton	40	07:15	22:28
106	North Quay Retail Park, Peto Way	Towards Oulton Broad	8	08:35	15:35
		Towards Town	8	09:00	16:00

Table 3.5: Saturday Bus Services in the Vicinity of the Scheme

Route	Bus Stop	Direction	Total Buses per Day	First Arrival	Last Departure
101	Asda Horn Hill	Gunton - Town Centre - Hollow Grove	10	09:03	18:03
		Hollow Grove - Town Centre - Gunton	10	09:28	18:28

Table 3.6: Sunday Bus Services in the Vicinity of the Scheme

3.8.12 The bus interchange at Lowestoft Station is also a significant component of the bus network in Lowestoft. There are several bus routes, in addition to Bus Route 101, which utilise the interchange. The routes do not, however, include those bus stops in close vicinity of the Scheme, which are analysed above. The bus routes which use the bus interchange at Lowestoft Station are summarised in Table 3.7 along with the total daily frequency of services.

Route	Route Journey	Total No. of Buses per Day *(Both Directions)*		
		Monday-Friday	Saturday	Sunday
61	Kessingland – Lowestoft – Great Yarmouth	45	45	18
99	Lowestoft – Kessingland - Southwold	54	63	16
101	Gunton – Lowestoft – Carlton Colville	78	73	20
103	Lowestoft – Pakefield – Carlton Colville	12	16	0
X2	Lowestoft – Beccles – Loddon – Norwich	52	49	21
X22	Lowestoft – Beccles – Loddon – Norwich	46	44	0

Table 3.7: Summary of Bus Routes Using the Bus Interchange at Lowestoft Station

3.9 Public transport network – rail

3.9.1 Lowestoft Station is located approximately 850m, or a 10-minute walk, from the main northern access to the Scheme. It is the terminus of the Wherry Line from Norwich and the East Suffolk Line from Ipswich, Services are operated by Abellio Greater Anglia. In 2015-2016, Lowestoft was the fourth-busiest railway station in Suffolk, after Ipswich, Stowmarket and Bury St. Edmunds[22].

3.9.2 In 2013, the station was redeveloped to create a more modern, welcoming and efficient transport interchange. The redevelopment integrated the station with the local bus network, including the erection of new bus shelters with real-time bus information in the station forecourt, new car parking spaces and facilities, and a redesigned taxi rank.

3.9.3 The majority of services from Lowestoft Station are stopping services, calling at all intermediate stations. The journey to Norwich takes about 45 minutes, and the journey to Ipswich takes about 1 hour 30 minutes. In the AM peak period (0700-1000), there are four services to Norwich, and two services to Ipswich. In the PM peak period (1600-1900), there are three services to Norwich, and three to Ipswich. The Monday to Friday services on both lines are summarised in Table 3.8.

Destination	Weekday Frequency (trains/hr)						Total Daily No. of Trains	First to Depart	Last to Depart
	AM Peak			PM Peak					
	0700-0800	0800-0900	0900-1000	1600-1700	1700-1800	1800-1900			
Norwich	2	1	1	1	1	1	20	05:42	23:30
Ipswich	1	0	1	1	1	1	17	05:25	21:07

Table 3.8: Summary of Weekday services from Lowestoft to Norwich and Ipswich

3.9.4 The Saturday timetables to both Norwich and Ipswich operate similarly to weekdays. There are, however, fewer Sunday services with services operating only every other hour to Norwich and Ipswich. Weekend rail services on both lines are summarised in Table 3.9.

Destination	Saturday			Sunday		
	Total Daily No. of Trains	First to Depart	Last to Depart	Total Daily No. of Trains	First to Depart	Last to Depart
Norwich	18	06:38	23:30	8	09:46	23:35
Ipswich	16	06:07	21:07	8	08:05	20:05

Table 3.9: Summary of Weekend Rail Services from Lowestoft to Norwich and Ipswich

Oulton Broad North Level Crossing

3.9.5 The level crossing at Oulton Broad North typically takes three minutes to close and re-open during each cycle, with vehicles on A1117 Bridge Road stopped. The cycle is instigated automatically by trains passing on the Wherry line. Trains are scheduled to pass Monday – Friday broadly at the times shown in Table 3.10.

[22] Office of Rail Regulation, Station Usage 2015-16 Data. Available at: http://orr.gov.uk/statistics/published-stats/station-usage-estimates

Lowestoft - Norwich	0547	0639	0740	0753	**0855**	0953	1102	1153	1302	1353
	1502	1553	1653	**1753**	1853	2000	2102	2153	2253	2335
Norwich - Lowestoft	0614	0659	0722	**0833**	0924	1042	1127	1242	1327	1442
	1527	1627	**1735**	1827	1942	2042	2142	2242	2317	

Table 3.10: Oulton Broad North Level Crossing Opening Times (those within the peak hours in bold)

Oulton Broad South Level Crossing

3.9.6 The level crossing at Oulton Broad South is instigated automatically by trains passing on the East Suffolk line, with vehicles on B1531 Victoria Road (and surrounding roads) stopped. Trains are scheduled to pass Monday – Friday at the times shown in Table 3.11.

Lowestoft - Ipswich	0530	0619	0646	0732	0912	1012	1112	1212	1312	1415
	1512	1612	**1707**	1812	1912	2012	2112			
Ipswich - Lowestoft	**0827**	**0857**	1036	1136	1236	1336	1436	1536	1636	**1729**
	1836	1936	2036	2136	2236	2336				

Table 3.11: Oulton Broad South Level Crossing Opening Times (those within the peak hours in bold)

3.10 Pedestrian Network

3.10.1 Because Lowestoft is divided by the Lake, the opportunities to cross from the north to the south of the town are limited. The existing bridges, Mutford Bridge and the A47 Bascule Bridge, are about 3km apart, and this makes some cycling and walking journeys much longer than they would otherwise be, making these sustainable modes of travel less attractive. This is especially problematic for people walking between the central part of south Lowestoft and the town centre/ residential areas in north Lowestoft.

3.10.2 An example is shown in Figure 3.6. A resident of Burnham Way, south of the Lake, wanting to travel to the North Quay Retail Park, north of the Lake, would have to travel 3.5km via the Bascule Bridge, even though the distance “as the crow flies” is only about 1km. The journey would take about 9 minutes by car or 44 minutes on foot. Further analysis on the severance caused by the Lake is contained within the Economics Report which is appended to this document.

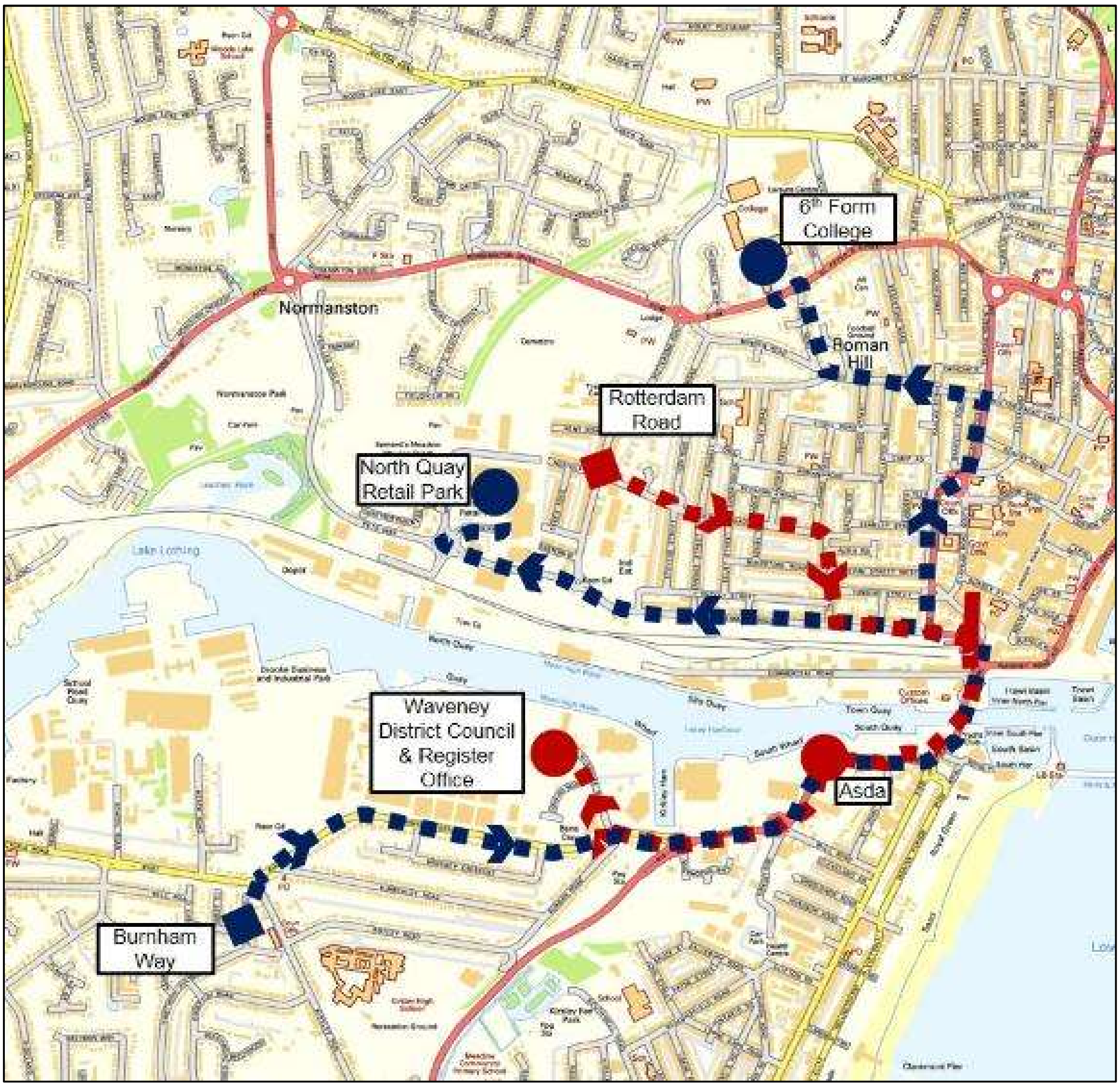


Figure 3.6: Examples of How the Lake Separates the Town and Increases Journey Length for Local Trips

3.10.3 The existing journey times for pedestrians between various locations both north and south of the Lake are shown in Table 3.12.

Origin	Destination	Existing Route	
		Distance	Time
Burnham Way (south of Lake)	North Quay Retail Park	3.5km	44mins
	Lowestoft 6th Form College	3.4km	43mins
Rotterdam Road (north of Lake)	Waveney District Council	2.5km	31mins
	Asda	2.0km	25mins

Table 3.12: Pedestrian Distances to Key Destinations

3.10.4 The pedestrian network around the Lake is generally adequate, with footways on both sides of the road, apart from a stretch along Peto Way adjacent to Normanston Park where no footways exist. There is evidence of pedestrian use of Peto Way, demonstrated by informal worn grass footways along the verges, as shown in Figure 3.7.

Figure 3.7: Peto Way Informal Footways (Source: Google Maps Streetview)

3.10.5 The existing crossing points at the Lake both have footways on both sides of the carriageway. These are shown in Figure 3.8 and Figure 3.9. In addition, there is a separate shared foot / cycle bridge directly to the west of Mutford Bridge, as shown in Figure 3.10.

Figure 3.8: The A47 Bascule Bridge footpaths (Source: Google Maps Streetview)

Figure 3.9: Mutford Bridge Segregated Footway / Cycleway (Source: Google Maps Streetview)

Figure 3.10: Pedestrian and Cycle Bridge West of Mutford Bridge: (Source: Google Maps Streetview)

3.10.6 Riverside Road is where the southern access of the Scheme will link into the existing highway network. There are footways along both sides of the road (Figure 3.11) for the entire length of the road. On the northbound side of the section of Riverside Road from Waveney Drive to Canning Road, there is a segregated footway / cycleway (Figure 3.12).

Figure 3.11: Riverside Road Footway (Source: Google Maps Streetview)

Figure 3.12: Riverside Road Segregated Footway / Cycleway (Source: Google Maps Streetview)

3.10.7 The northern end of the Scheme will link to a new roundabout connecting to Denmark Road, east of the existing Peto Way / Denmark Road roundabout. The section of Denmark Road between Peto Way and Rotterdam Road, has a segregated footway / cycleway on the eastbound side of the road only, as shown on Figure 3.13.

Figure 3.13: Denmark Road Segregated Footway / Cycleway (Source: Google Maps Streetview)

Non-Motorised User Audit (NMUA) – Pedestrian Desire Lines

3.10.8 Surveys undertaken as part of the NMUA at the OBC stage for the Scheme, to establish reasons for vehicular journeys in Lowestoft, found that 80% of economically active people who live in Lowestoft, also work in the town. As a result, approximately a third of all journeys to work within Lowestoft are less than one mile and two thirds are less than three miles. A large proportion of the journeys within the town are therefore short trips from home to work destinations undertaken at morning peak times with return journeys at evening peak times. Many of these journeys could be made by walking or cycling rather than by vehicle, hence their importance to the NMUA.

3.10.9 At present the main desire lines for these journeys to work trips include one of the existing Lake crossings. Table 3.13 shows the existing number and percentage of pedestrian movements over the two crossings for a typical weekday and weekend day, measured for a 12 hour period 7am to 7pm.

Week Day	Mutford Bridge	A47 Bascule Bridge	Combined	Mutford Bridge	A47 Bascule Bridge
	Pedestrians	Pedestrians	Pedestrians	Percentage	Percentage
Northbound	741	3,107	3,848	19%	81%
Southbound	786	3,058	3,844	20%	80%
Total	1,527	6,165	7,692	20%	80%
Weekend Day	Pedestrians	Pedestrians	Pedestrians	Percentage	Percentage
Northbound	768	3,864	4,632	17%	83%
Southbound	824	3,719	4,543	18%	82%
Total	1,592	7,583	9,175	17%	83%

Table 3.13: Weekday and weekend pedestrian movements over existing crossings

3.10.10 In the west there is a separate bridge for pedestrians and cycles only, which is located directly adjacent to a road bridge with footpaths. For this review these two crossings have been considered together as ‘Mutford Bridge’.

3.10.11 More pedestrians use the A47 Bascule Bridge than Mutford Bridge because it is closer to the town centre and beach. On weekdays, 7,692 pedestrian movements were observed on the A47 Bascule Bridge. This represents 80% of the total pedestrian movements across the Lake. At weekends, 9,175 pedestrian movements were observed, representing 83% of the total pedestrian movements across the Lake.

3.10.12 At Mutford Bridge, pedestrian flows are only slightly higher at weekends than on weekdays, whereas at the A47 Bascule Bridge there is a 23% increase in pedestrian flows at weekends. This suggests that pedestrian usage of Mutford Bridge is based on local demand for access to work and journeys to local amenities rather than on leisure trips. The A47 Bascule Bridge, by contrast, is greatly influenced by leisure trips with an increase in combined north and south pedestrian use of at the weekend.

3.10.13 Table 3.14 shows the number and percentage of pedestrian movements over the two crossings for typical weekday peak times of 7am to 9am and 4pm to 6pm. On a typical weekday morning peak the A47 Bascule Bridge is used by 79% of pedestrian crossings. On a typical weekday evening peak the A47 Bascule Bridge is used by 74% of pedestrian crossings.

Week Day	Mutford Bridge	A47 Bascule Bridge	Combined	Mutford Bridge	A47 Bascule Bridge
	Pedestrians	Pedestrians	Pedestrians	Percentage	Percentage
07:00-09:00	81	308	389	21%	79%
16:00-18:00	327	950	1,277	26%	74%

Table 3.14: Weekday pedestrian movements over existing crossings

3.11 Cycle Network

3.11.1 Lowestoft's cycle network is shown in Figure 3.14. It comprises sections of National Cycle Network (NCN) Route 517 and the Regional Cycle Network (RCN), as well as other signposted on-road cycle routes, advisory cycling routes and some traffic free cycle routes.

Figure 3.14: Local cycle network
(Contains OS data © Crown copyright and database right: 2017)

3.11.2 The crossing at Mutford Bridge has adequate off-road provision for cyclists, with a segregated footway / cycleway adjacent to the southbound carriageway and a shared footway / cycleway bridge directly to the west of Mutford Bridge, as illustrated in Figure 3.9 and Figure 3.10.

3.11.3 The A47 Bascule Bridge to the east has very little space for cyclists to use the carriageway safely due to the narrow three lane tidal system. To improve cycle safety the footways have been changed to allow shared use, although the width is below standard.

3.11.4 The existing national, regional and local cycle routes in the vicinity of the Scheme are illustrated in Figure 3.15.

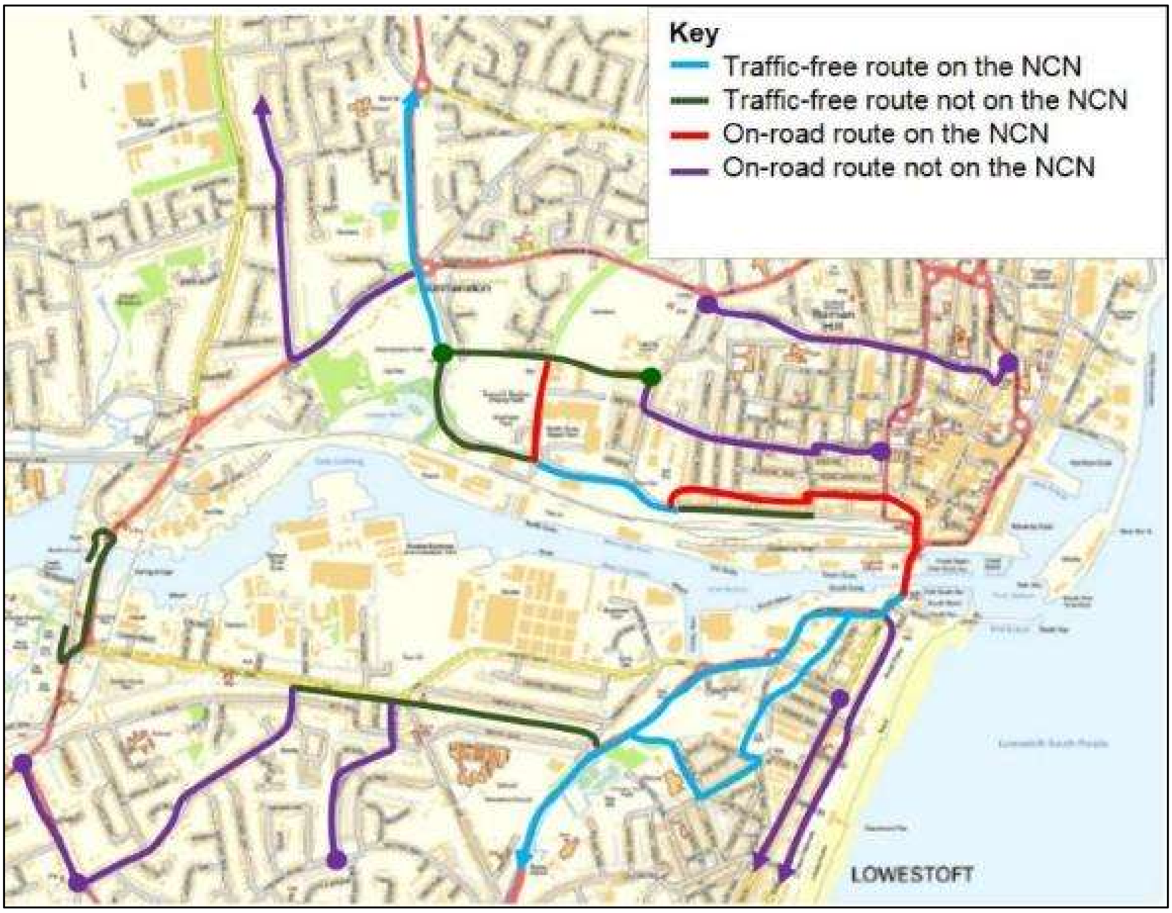


Figure 3.15: Existing National, Regional and Local Cycle Routes
(Contains OS data © Crown copyright and database right: 2017)

3.11.5 NCN Route 517 is located to the east where it links Beccles and Great Yarmouth. From the south, Route 517 passes through Lowestoft following the A12, via an off-road route adjacent to the A12 Tom Crisp Way, A12 Horn Hill, and A12 Belvedere Road before crossing over the ~~eastern~~ A47 bascule bridge. The route then follows Station Square before leaving the A12 to follow Bevan Street, Tonning Street and Hervey Street on-road, joining the western end of Denmark Road where the route turns north up Barnards Way to join an east-west section of local traffic-free cycleway called Princes Walk.

3.11.6 RCN Route 30 is located to the south of the A47 Bascule Bridge and follows an off-road, traffic-free cycle route from the A12 Belvedere Road to join Salisbury Road, Beaconsfield Road, John Street, which are all on-road routes. It then connects to Kirkley Ham which is an off-road footway / cycleway. Kirkley Ham joins the off-road NCN Route 517 on the A12 Tom Crisp Way.

North of Lake Lothing

3.11.7 There is a segregated off-road footway/cycleway along Peto Way within the northern verge from a point approximately 300m south of the Normanston Drive roundabout, where the route connects via a toucan crossing with other off-road footways and cycleways toward Oulton Broad and Lowestoft Town Centre. The route continues eastwards along Peto Way, around the roundabout at Rotterdam Road and to a point approximately 80m east of the Denmark Road / Rotterdam Road. The route then continues within the southern verge to the junction of Denmark Road / Trafalgar Street.

3.11.8 On-road cycling lanes exist in both directions of Normanston Drive, between the Peto Way roundabout and approximately 50m east of the junction with Higher Drive. From this point until the junction with the A1117 Bridge Road, there is no provision for cyclists.

South of Lake Lothing

3.11.9 At Mutford Bridge, there is a segregated footway / cycleway in the southbound direction, which continues until the junction with the A1117 Saltwater Way and B1531 Victoria Road. To the west there is a shared footway / cycleway bridge crossing the Lake. This continues as a segregated footway / cycleway that terminates approximately 50m north of The Boulevard and resumes from the Nicholas Everitt Park crescent car park where it connects to the A1117 Saltwater Way / B1531 Victoria Road roundabout.

3.11.10 On Victoria Road there is a segregated footway / cycleway on the south side at the junction with Nelson Wharf, which diverts south of Victoria Road after the junction with School Road and follows a segregated parallel route until it meets A12 Tom Crisp Way (shown in Figure 3.16).

Figure 3.16: Kirkley Run Segregated Footway / Cycleway (Source: Google Maps Streetview)

3.11.11 There is no cycle provision along B1531 Waveney Drive until the east of Riverside Road where the footway becomes shared use. The shared use facility continues on the north side of Waveney Drive until Horn Hill, where the route diverts off the Highway behind the Asda along the south quay, re-joining the Highway at A12 Belvedere Road. The shared use facility continues north over the A47 Bascule Bridge. On Riverside Road, there is a shared footway / cycleway between the B1531 Waveney Drive and Canning Road on the eastern side, shown in Figure 3.17.

Figure 3.17: Riverside Road Segregated Footway / Cycleway (Source: Google Maps Streetview)

Non-Motorised User Audit - Cyclist Desire Lines

3.11.12 Surveys undertaken as part of the NMUA at the OBC stage for the Scheme investigated current cycling trends on the two existing crossings over the Lake.

3.11.13 The main cycle desire lines include the two existing Lake crossings, as people cycle to and from work. Table 3.15 shows the number and percentage of cycle movements over the two crossings for a typical week day and weekend day measured over a 12 hour period from 7am to 7pm. On a typical weekday there were 2,245 cycle movements (both bridges, combined directions). 70% of these used the A47 Bascule Bridge. On a typical weekend day there were 1,949 cycle movements (both bridges, combined directions). 69% of these used the A47 Bascule Bridge.

Week Day	Mutford Bridge	A47 Bascule Bridge	Combined	Mutford Bridge	A47 Bascule Bridge
	Cycles	Cycles	Cycles	Percentage	Percentage
Northbound	325	780	1,105	29%	71%
Southbound	349	791	1,140	31%	69%
Total	674	1,571	2,245	30%	70%
Weekend Day	Cycles	Cycles	Cycles	Percentage	Percentage
Northbound	281	699	980	29%	71%
Southbound	315	654	969	33%	67%
Total	596	1,353	1,949	31%	69%

Table 3.15: Week Day and Weekend Day Cyclist Movements over Existing Crossings

3.11.14 There were 296 fewer cycling movements at weekends than on weekdays. This suggests that the cycle usage of the crossings is based more on journeys to work and local amenities rather than on leisure trips.

3.11.15 Table 3.16 looks closer at the survey information, in order to capture the morning and evening cycle commuter journeys. It shows the number and percentage of cycle movements over the two crossings for typical week day and weekend day peak times of 7am to 9am and 4pm to 6pm. In a typical weekday morning peak the A47 Bascule Bridge is used by 70% of cycle crossings. On a typical weekday evening peak the A47 Bascule Bridge is used by 69% of cycle crossings.

Week Day	Mutford Bridge	A47 Bascule Bridge	Combined	Mutford Bridge	A47 Bascule Bridge
	Cycles	Cycles	Cycles	Percentage	Percentage
07:00-09:00	115	267	382	30%	70%
16:00-18:00	168	369	537	31%	69%

Table 3.16: Week Day Cycle Movements over Existing Crossings for Morning and Evening Peak

3.12 Land Use

3.12.1 The existing land uses in the area surrounding the Lake are predominantly business, shopping, maritime, industrial, and brownfield sites, extending from Oulton Broad in the west to the Outer Harbour in the east, as shown in Figure 3.18.

3.12.2 Many of the sites in the vicinity of the Scheme are committed for regeneration, or have development potential. These are identified in the following sections.

3.12.3 It is important to understand the additional trips that could be generated by potential or committed regeneration sites for the purposes of the assessment. This underpins the need for the Scheme and highlights the enhanced opportunities for regeneration that should follow the completion of the new crossing.

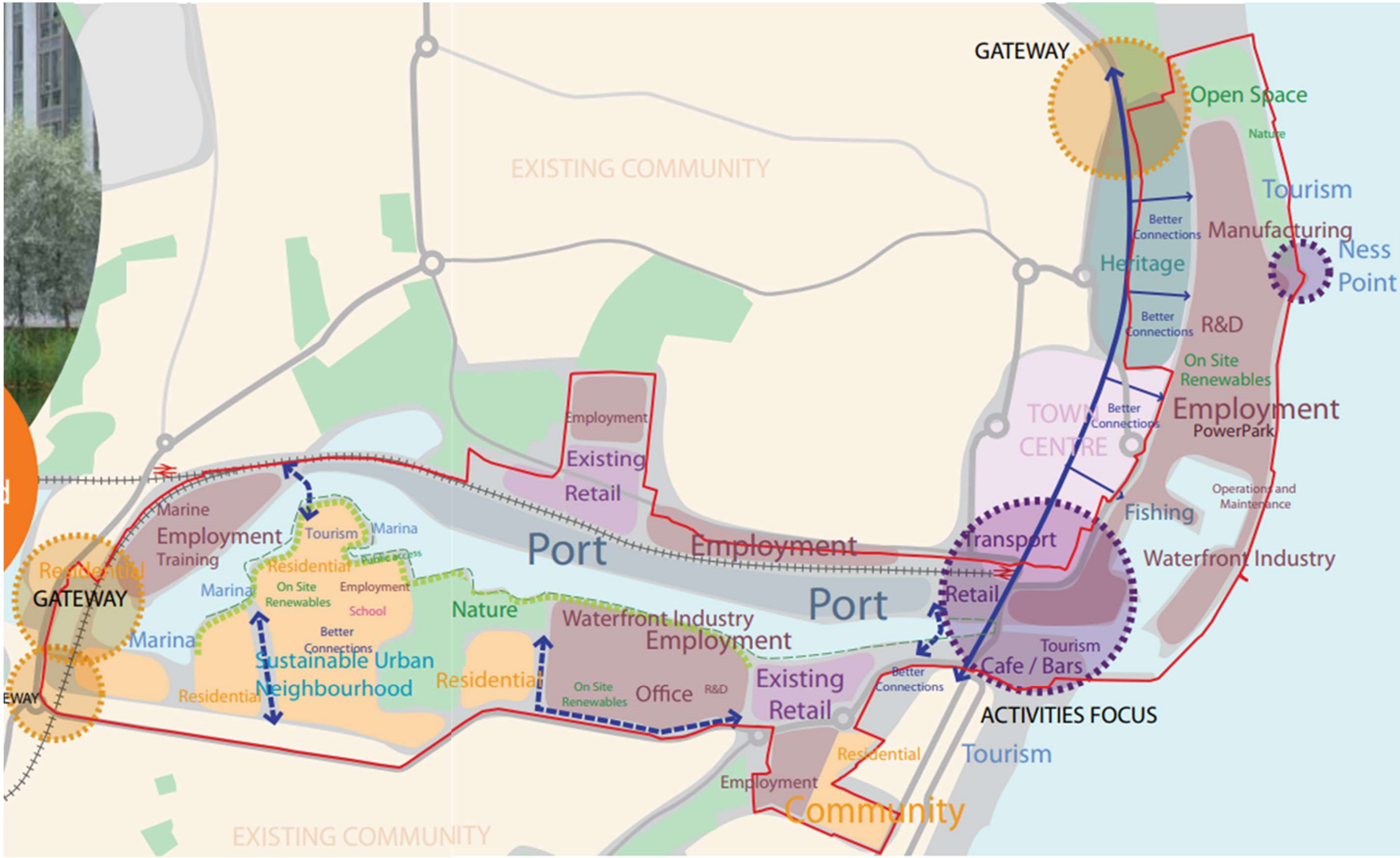


Figure 3.18: Land uses around Lake Lothing (Source: Lowestoft Lake Lothing and Outer Harbour Area Action Plan January 2012)

3.12.4 The northern edge of the Lake is flanked by The East Suffolk Line, which separates a prominent industrial Lake margin from the residential and retail fringes of north Lowestoft. To the south of the Lake is a mix of maritime engineering industries on the Brooke Peninsula (central projection of the Lake), large tracts of vacant land and areas of new retail and commercial development.

3.12.5 The western end of the Lake is largely characterised by maritime (recreational) activity where numerous pontoons provide moorings for leisure craft. In contrast, the eastern end on the north bank of the Lake has a more industrial character. Larger scale seafaring ships routinely dock along the waterside, and industrial, railway and large scale commercial development dominates.

3.12.6 Beyond the immediate area around the Lake, residential development extends to the north and south. To the north in particular, the townscape consists of tightly knit, small scale housing on a regular street pattern. This breaks down to the north east where older properties on a more irregular layout interrupt this pattern. To the south of the Lake the land use is again characterised by a dense housing pattern which becomes more open toward the west, with larger gardens and less regular street patterns.

3.13 Traffic Surveys

3.13.1 This section describes the traffic data which has been used to undertake an assessment of the existing conditions in Lowestoft and to assess the impact of the Scheme on the local highway network.

3.13.2 The traffic assessment methodology is described in further detail in Section 5.

Manual Classified Counts

3.13.3 MCCs were undertaken on Thursday 15th January 2015 between 0700 and 1900 hours at the following junctions:

- Site A: A1117 Normanston Drive / A1117 Peto Way; and
- Site B: A47 Artillery Way / A47 Jubilee Way / A47 St Peter's Street.

3.13.4 A second set of MCCs was undertaken on Wednesday 15th April 2015 between 0700 and 1900 hours at the following junctions:

- Site C: A47 Katwijk Way / A1144 St Peter's Street;
- Site D: A47 Waveney Road / Station Square;
- Site E: Station Square / Commercial Road;
- Site F: A12 Pier Terrace / B1532 London Road South;
- Site G: A12 Belvedere Road / Mill Road / Kirkley Rise;
- Site H: A12 Tom Crisp Way / Blackheath Road;
- Site I: A1117 Bridge Road / A1117 Saltwater Way / B1531 Victoria Road;
- Site J: Denmark Road / A47 Katwijk Way; and
- Site K: A1117 Bridge Road / A1117 Normanston Drive.

3.13.5 Both of these surveys included:

- Classified manual turning counts at all junctions;

- Saturation flow measurements for all stop line lanes at all signalised junctions;
- Video surveys at all signalised junctions; and
- Manual queue length surveys at selected junctions.

3.13.6 A third set of MCCs was undertaken on Tuesday 14th July 2015 between 0700 and 1900 hours at the following junctions:

- Site L: A47 Yarmouth Road / A1117 Millennium Way;
- Site M: A12 Tom Crisp Way / A12 Bloodmoor Road / A1145 Castleton Avenue; and
- Site N: A12 Tom Crisp Way / A12 Horn Hill / B1531 Waveney Drive / Maconochie Way.

3.13.7 Additional data was collected in 2017 to ensure the assessments required within this TA could be completed. Data was collected on Wednesday 14th June 2017 between 0700 and 1900 hours at the following junctions:

- Site O: A1144 Normanston Drive / Rotterdam Road;
- Site P: B1531 Waveney Drive / Kirkley Run;
- Site Q: Long Road / A1117 Elm Tree Road;

3.13.8 Finally, data was collected on Saturday 17th June 2017 between 0700 and 1900 hours at the following junctions:

- Site A: A1117 Normanston Drive / A1117 Peto Way.
- Site J: Denmark Road / A12 Katwijk Way;
- Site R: Denmark Road / Rotterdam Road; and
- Site S: Peto Way / Barnards Way / N Quay Retail Park/Denmark Road

3.13.9 These surveys included the following additional information:

- Classified manual turning counts at all junctions; and
- Video surveillance at all junctions.

3.13.10 The TDCR provided in Appendix D discusses seasonality at Section 6.4, illustrating how flows varied month to month during 2016. The majority of data used in the latest version of the SATURN model (October 2017) is from July, where traffic flows are above the yearly average given the tourism in the town, and all surveys were undertaken under 'normal' network conditions, outside of school holiday periods, in accordance with DMRB guidance. The count data has been corrected to a base year of 2016 using district level National Trip End Model 7.2 for the car observed value and National Road Traffic Forecasts factors for the Light Good Vehicles (LGV) / Heavy Goods Vehicles (HGV) observed values.

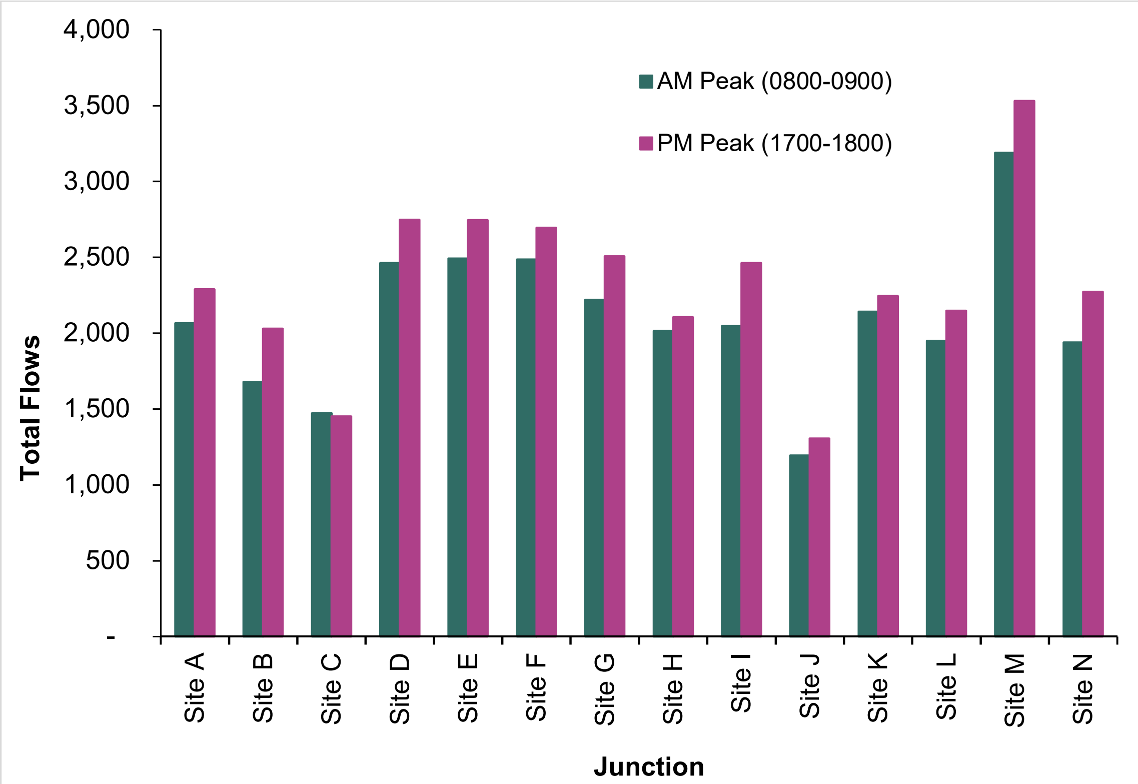
3.13.11 A location map of the MCCs referred to above is provided in Figure 3.19.

Figure 3.19: Locations of MCCs Carried Out in Lowestoft
(Contains OS data © Crown copyright and database right: 2017)

3.13.12 The MCC data provides a more detailed review of traffic on the highway network in Lowestoft. Turning movements and vehicle classes were recorded at each junction surveyed, allowing assessment of those junctions to understand any current constraints on the network capacity, particularly in areas close to the Scheme.

3.13.13 The 2015 surveys have been analysed to determine the total volume of traffic in the AM peak hour (0800-0900) and PM peak hour (1700-1800) at each of the junction sites (A to N) listed above. The results are shown in Figure 3.20.

3.13.14 The highest flows during the surveys were observed at Site M, at the junction of the A12 Tom Crisp Way, A12 Bloodmoor Road and the A1145 Castleton Avenue. A total of 3,189 turning movements were recorded during the AM peak period. This increased to 3,531 movements in the PM peak period.



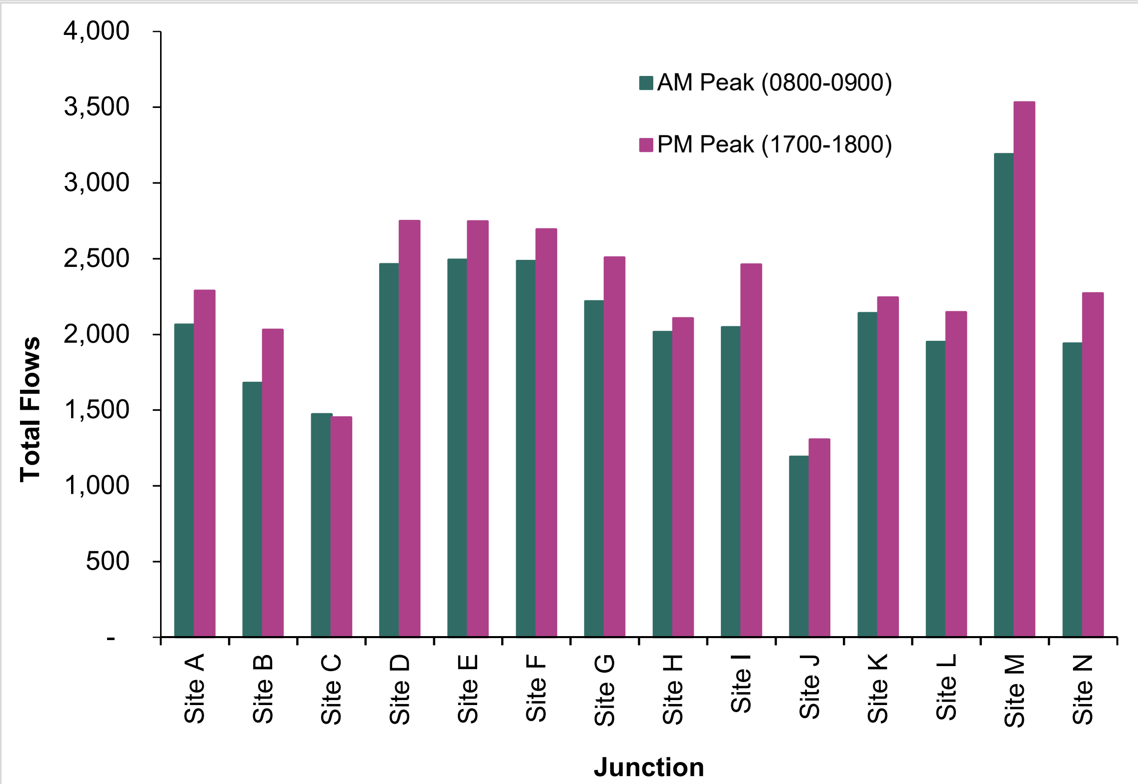


Figure 3.20: Total Volumes of Traffic at each Junction during the Peak Periods

3.13.15 The list of key junctions in Section 3.7 differs from the list of junctions surveyed using manual classified counts (MCCs) as detailed above. The MCCs feed into the SATURN model (described later) to assist in the model creation and for validation purposes. The model then synthesises matrices for the whole model area, with the resulting flows at the key junctions used for the junction assessments. For this reason, it is not necessary to have a traffic survey of each of the key junctions when using traffic flows output from a strategic model such as SATURN.

3.13.16 The MCC count data itself does not provide information regarding congestion on the highway network, however the key junctions are assessed in Section 8 of this TA about the capacity and congestion issues of the network as existing and in the future scenarios.

Automatic Traffic Counts

3.13.17 An Automatic Traffic Counter survey (ATC) was carried out between 0000 hours on Monday ~~13~~29th Ju~~ly~~ne 2015 and 2359 hours on ~~Thursday~~Monday ~~16~~27th July 2015, on the following links as illustrated in Figure 3.21:

- Site 1: Mutfordwood Lane (Chapel Road and Priory Lane);
- Site 2: Rushmere Road (Blower’s Lane and Gisleham Road);
- Site 3: Gisleham Road (Snab Hill and Church Road);
- Site 4: A146 Beccles Road (Sidings Road and Marsh Lane);
- Site 5: A1145 Castleton Avenue (Chapel Road and Lowestoft Road);
- Site 6: A12 London Road (Romany Lane and Tower Road);
- Site 7: London Road South (B1384 Pakefield Street and Walmer Road);
- Site 8: A12 Tom Crisp Way (A1117 Elm Tree Road and Blackheath Road);
- Site 9: A1117 Elm Tree Road (Clifford Drive and Colville Road);
- Site 10: A146 Beccles Road (Clarkes Lane and Burnt Hill Way);
- Site 11: Kirkley Run (Birds Lane and Edgerton Road);
- Site 12: A146 Waveney Drive (Kimberley Road and Waveney Crescent);
- Site 13: A1117 Saltwater Way (A146 Victoria Road and Commodore Road);
- Site 15: A47 Katwijk Way (Denmark Road and Raglan Street);
- Site 16: A47 Battery Green Road (Beach Road and Grove Road);
- Site 17: A47 Old Nelson Street (Whapload Road and London Road);
- Site 18: A47 St Peter’s Street (A47 Katwijk Way and A47 Jubilee Way);
- Site 19: Denmark Road (Clemence Street and Trafalgar Street);
- Site 20: Rotterdam Road (Kent Road and Amy Court);
- Site 21: Peto Way (A1117 Normanston Drive and Denmark Road);
- Site 22: A1117 Normanston Drive (Higher Drive and Monckton Crescent);
- Site 23: A1144 Normanston Drive (Garden Close and Rotterdam Road);
- Site 24: Oulton Road (Hollingsworth Road and Rotterdam Road);
- Site 25: B1375 Gorleston Road (Mobbs Way and Gloucester Avenue);
- Site 26: A1117 Millennium Way (Oulton Road and B1074 Somerleyton Road);
- Site 27: A47 Yarmouth Road (Harris Avenue and Gunton St Peter’s Avenue);
- Site 28: B1385 Corton Road (Hubbard’s Loke and Corton Long Lane);

- Site 29: A47 Yarmouth Road (Blundeston Road and B1385 Corton Long Lane);
- Site 30: B1375 Parkhill (Union Lane and B1375 Oulton Road);
- Site 31: B1074 Blundeston Road (Green Lane and The Street);
- Site 32: Fixton Road (Lound Road and Green Lane); and
- Site 33: Coast Road (Church Lane and Longfulans Lane).

3.13.18 A further ATC was undertaken at sites 19, 20, 21 and 23 between 12th June 2017 and 18th June 2017, to cover the same period as the MCCs completed on a Saturday.

Figure 3.21: ATC Locations
(Contains OS data © Crown copyright and database right: 2017)

3.13.19 The ATC data is used to provide variability data across various days and weeks to inform the SATURN and VISSIM models and to provide an additional validation method for the models on selected links across the model extents. The ATC data is also used to provide additional analysis on vehicle speeds around Lowestoft.

3.13.20 Vehicular speeds were recorded, in addition to traffic volumes by direction, at each count site. An analysis of the vehicular speeds on the approaches to the existing western and eastern bridge crossing, Mutford Bridge and the A47 Bascule Bridge, respectively, has been undertaken. The ATCs used in the analysis are listed below:

- Mutford Bridge Approaches:
  - South of the Lake: Site 10 – A146 Beccles Road.
  - North of the Lake: Site 22 – A1117 Normanston Drive; and
- A47 Bascule Bridge Approaches:
  - South of the Lake: Site 8 – A12 Tom Crisp Way.
  - North of the Lake: Site 15 – A47 Katwijk Way;
  - North of the Lake: Site 16 – A47 Battery Green Road; and

3.13.21 The mean vehicular speeds during the survey period in 2015 are set out in Table 3.17. Mean speeds in the AM and PM peak hours are shown against average 'night-time' speeds (0000-0600). This highlights the lower mean speeds observed during the peak periods, indicative of the build-up of traffic on the approaches to each existing crossing.

3.13.22 The largest difference between the peak period and 'night-time' speeds can be observed on the A47 Battery Green Road southbound approach to the A47 Bascule Bridge. On average, speeds decrease by 27% in the AM peak and 32% in the PM peak. On the A146 Beccles Road northbound approach to Mutford Bridge, mean vehicular speeds decrease by 17% and 16% in the AM peak and PM peak, respectively.

Location (speed limit)	Direction	Mean Speed (mph)		
		AM Peak (0800-0900)	PM Peak (1700-1800)	Night (0000-0600)
Mutford Bridge Approaches				
A146 Beccles Road (30mph)	Northbound	30.4	30.8	36.6
	Southbound	30.2	30.6	36.7
A1117 Normanston Drive (30mph)	Northbound	28.7	29.0	32.2
	Southbound	27.6	23.5	32.1
A47 Bascule Bridge Approaches				
A12 Tom Crisp Way (40mph)	Northbound	35.9	37.6	42.2
	Southbound	37.9	35.7	44.0
A47 Katwijk Way (30mph)	Northbound	25.9	26.3	32.7
	Southbound	27.3	26.7	30.3
A47 Battery Green Road (30mph)	Northbound	24.1	26.4	29.6
	Southbound	22.7	21.1	31.2

Table 3.17: Selected ATC Data Summary

3.13.23 It should be noted that the ATC data is collected in the middle of a link, away from junctions, where traffic is flowing well. This is in order to prevent the ATC equipment double counting or miss counting vehicles as a result of slow moving traffic. As such, the speeds shown in Table 3.16 are reflective of the mid-link traffic and not the speed of traffic in congested locations or at junctions.

3.13.24 The ATC data collected has been reviewed and used to create conversion factors for the purposes of calculating 2015 AADT flows on selected areas of the highway network in Lowestoft.

Historical Trends

3.13.25 The DfT maintains a database of traffic counts to derive estimated traffic volumes for major routes. Different count sources are combined to estimate the annual average daily flow at various sites around the highway network for information purposes. The DfT Traffic Count database also provides a historical insight of traffic volumes for several sites in close proximity to the location of the Scheme. These are illustrated in Figure 3.22 and listed below:

1. A1117 Bridge Road (S);
2. A1117 Bridge Road (N) (adjacent to Mutford Bridge);
3. A1144 Normanston Drive;
4. A47 St Peter's Street; and
5. A47 Yarmouth Road.

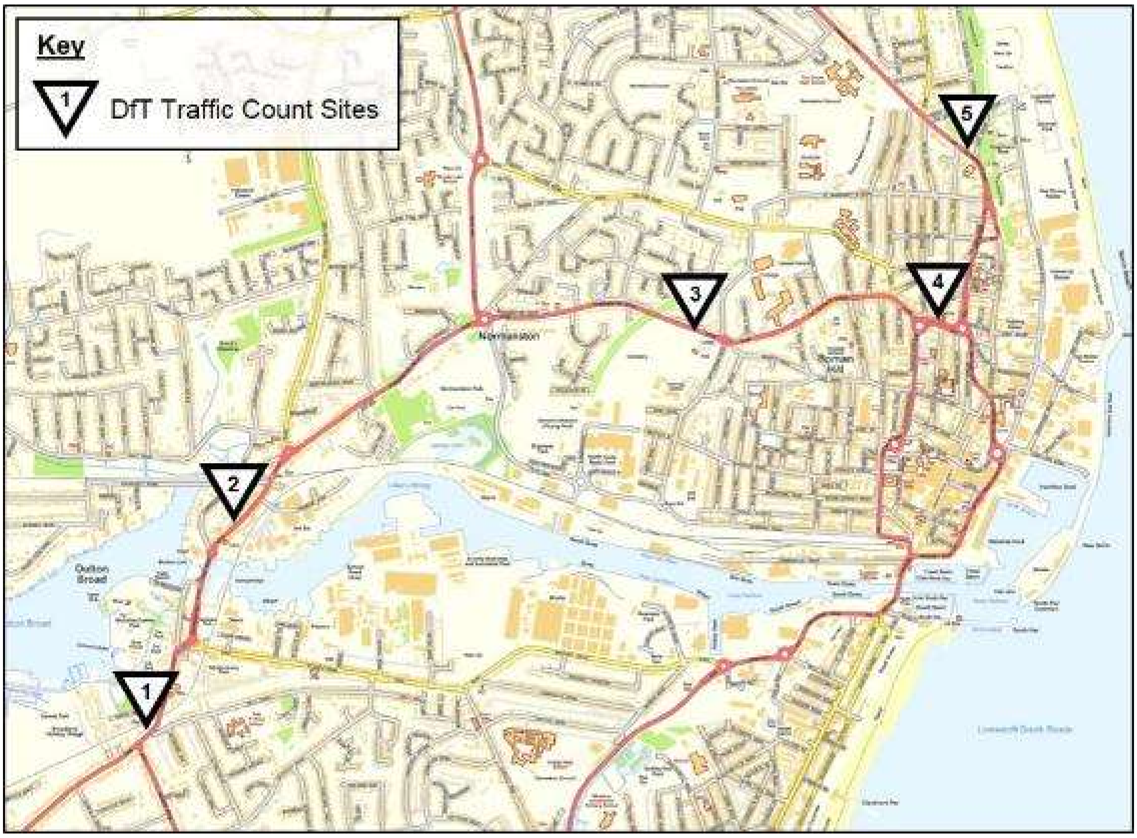


Figure 3.22: DfT Traffic Count Sites on Major Routes in the Scheme Area (Contains OS data © Crown copyright and database right: 2017)

3.13.26 The two-way Annual Average Daily Flows (AADF) have been recorded by the DfT between 2000 and 2015, for all sites except the A47 Katwijk Way where data was unavailable. The historical two-way AADF flow data is illustrated in Figure 3.23.

3.13.27 On the A47 Bascule Bridge, the long-term trend demonstrates that there has been minimal change to traffic flows, however, in the last five years of recorded data between 2011 and 2015, an 11.5% increase has occurred.

3.13.28 A downward trend in flows has been recorded in the last five years on the northern and southern approaches to Mutford Bridge. However, the figures also demonstrate that DfT Traffic Count Site 2, north of Mutford Bridge, with two-way AADF flows of 25,194, is operating significantly above its congestion reference flow (an estimate of the AADT flow at which the carriageway is likely to be congested in the peak periods on an average day) which is circa 22,000-23,000[23]. Traffic flows south of Mutford Bridge, at DfT Traffic Count Site 1, are also relatively high, but operate at their theoretical capacity and have demonstrated a 3% decrease in volumes between 2011 and 2015.

DfT Traffic Count Site	Average Annual Daily Flow					
	2011	2012	2013	2014	2015	2016
1 – A1117 Bridge Road (S)	20,501	20,251	20,177	20,031	19,853	20433
2 – A1117 Bridge Road (N)	26,146	25,844	25,734	25,912	25,645	25194
3 – A1144 Normanston Drive	7,892	7,807	7,804	8,035	8,214	8453
4 – A47 St Peter's Street	14,421	14,267	14,269	14,709	15,044	15,502
5 – A47 Yarmouth Road	14,638	14,477	14,478	14,913	15,224	15,682

Table 3.18: DfT Traffic Count Two-Way AADF Data, 2011-2016 (Source: DfT)

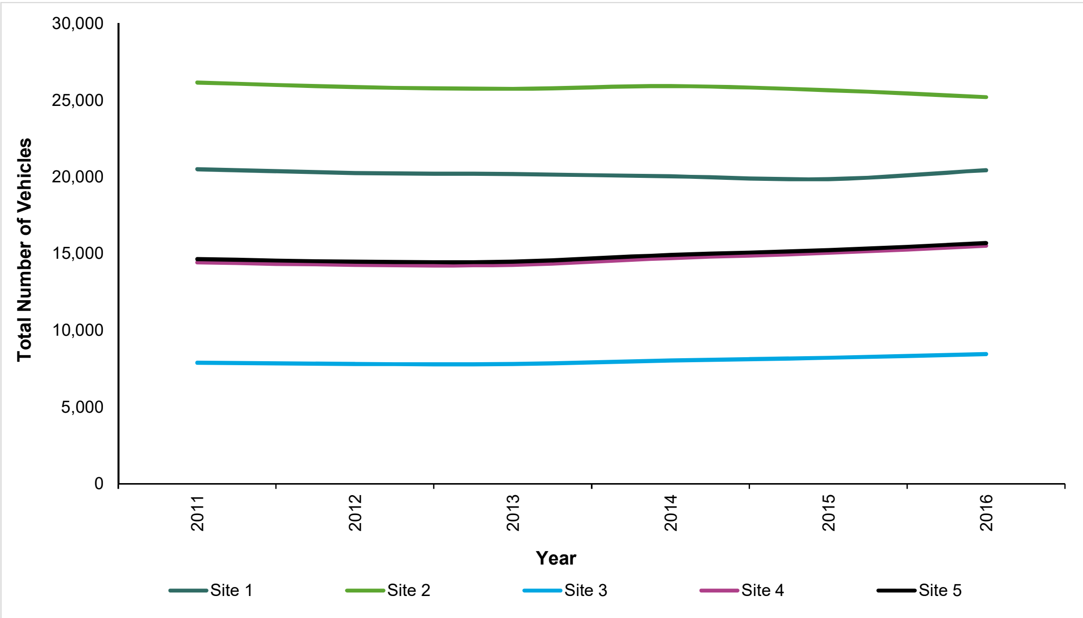


Figure 3.23: Historical Trends of Two-Way AADF Flows in the Vicinity of the Scheme (Source: DfT)

[23] Standards for Highways, 1997, *Design Manual for Roads and Bridges, Volume 5, Section 1, Part 3, TA64/97, Table D/2*

3.13.29 The limited traffic growth in Lowestoft shown by Figure 3.23 may be in part as a result of socio-economic conditions and in part due to a perception of congestion and unreliable journey times.

Saturday Peaks

3.13.30 Following discussion with the SCC, an assessment was completed of the traffic data for 2015 to determine the Saturday peak hour within Lowestoft. The traffic flows for the Saturday peak hour were then compared to the weekday peak hour flows to determine whether the weekday or weekend peak was the greater.

3.13.31 When averaged across all ATC sites, the PM peak hour presents higher traffic flows than the Saturday peak hour (shown in Figure 3.24).

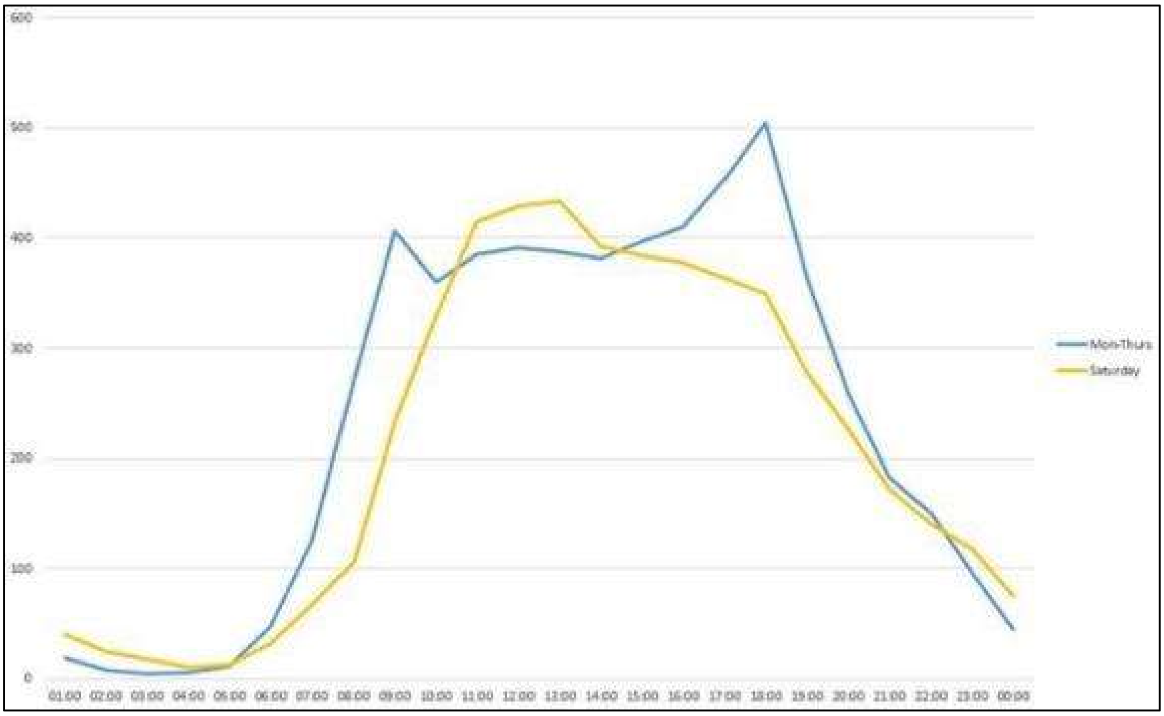


Figure 3.24: Average Weekday and Saturday Peaks

3.13.32 However, at four locations, the Saturday peak hour presents higher flows than the weekday peak hour, as shown in Figure 3.25:

- Site 19: Denmark Road (Clemence Street and Trafalgar Street);
- Site 20: Rotterdam Road (Kent Road and Amy Court);
- Site 21: Peto Way (A1117 Normanston Drive and Denmark Road); and
- Site 22: A1117 Normanston Drive (Higher Drive and Monckton Crescent).

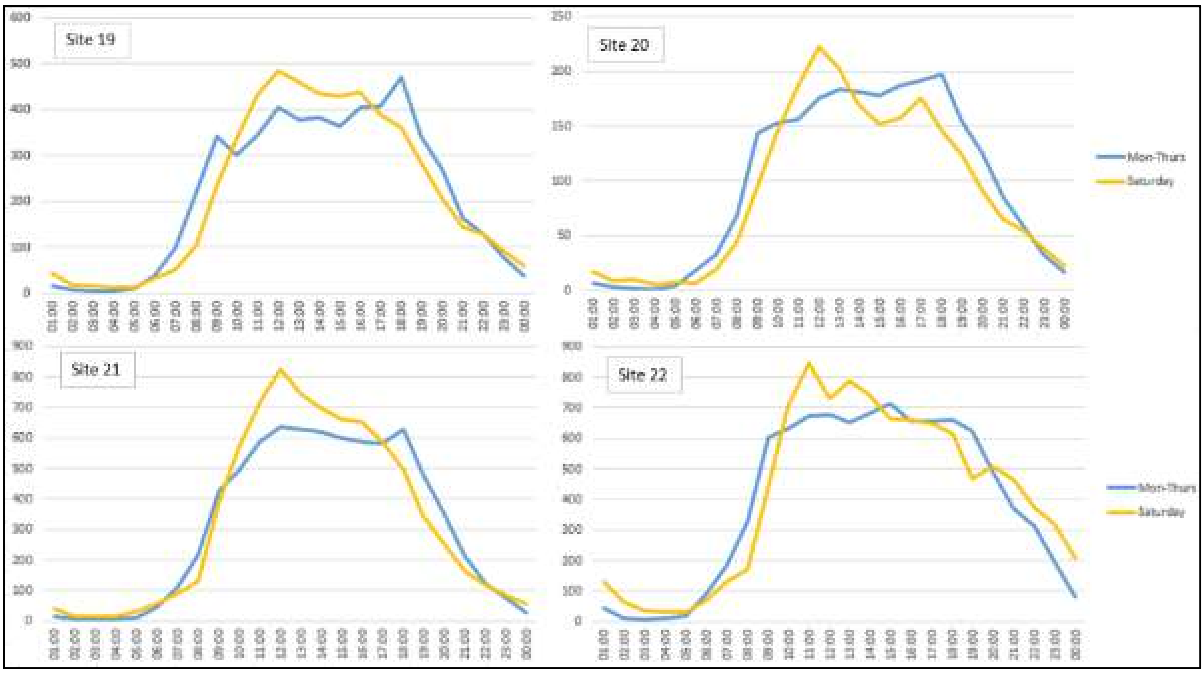


Figure 3.25: Average Weekday and Saturday Peaks, Sites 19-22

3.13.33 Site 21 is adjacent to North Quay Retail Park, hence it is expected that a Saturday peak would be higher than a weekday peak. Sites 19, 20 and 22 are all on major routes to the retail park, hence may also be affected by Saturday shopping peaks.

3.14 Queuing and Journey Times

3.14.1 A microsimulation model using VISSIM has been developed to represent the existing traffic conditions on the Lowestoft highway network and to further understand the congestion issues within the town. The VISSIM provides analysis of journey times and delay information. Further detail of the assessment methodology of the VISSIM model is included within Section 5 of this TA.

Model Extent

3.14.2 The model study area, as shown in Figure 3.26, encompasses sections of the A12/A47 corridor to the east, the A146/A1117 corridor to the west and the A1144 to the north of Lowestoft Town Centre.

Figure 3.26: VISSIM Model Study Area

~~Existing~~ ~~-~~VISSIM 2016 Base ~~2016~~Model

3.14.3 The 2016 Base VISSIM model represents the existing level of congestion and delays on the highway network in Lowestoft. Key routes and movements through the town were assessed to understand the extent of existing queuing and delays.

3.14.4 The evaluation ~~of~~was carried out to demonstrate the extent of ~~queuing in the base model reported in the following sections assumes that the~~ queues for 3 scenarios. The first is based upon the A47 Bascule Bridge ~~gets lifted~~ remaining open to traffic in both the AM and PM ~~and~~peak. The second and third scenarios assumed that the A47 Bridge is lifted for periods of 5 minutes and 10 minutes respectively. In all 3 scenarios, it has been assumed that Oulton Broad North level crossing is closed in accordance with the published rail timetable and that the Mutford Bridge remains open for traffic. ~~A comparison~~

~~3.14.4~~3.14.5 Details of ~~journey time and delays along important existing corridors has also been made in Table 3.18 and Table 3.19 to show the difference in delays caused by the A47 Bascule Bridge lifting for 5 minutes or 10 minutes in the Base scenario.~~the queuing and congestion on the local network during the AM and PM peak periods is presented in the following sections, based upon no A47 Bascule ~~b~~Bridge lift, five minute lift and ten minute lift scenarios.

~~3.14.5 The dominant traffic flow on the strategic A47/A12corridor is northbound in the AM peak and southbound in the PM peak. Consequently, the VISSIM model shows that the impact of A47 Bascule Bridge closures and delays at traffic signals along this corridor is more extensive in the northbound direction in the AM peak and in the southbound direction in the PM peak.~~

~~3.14.6 On the A1117 Normanston Drive/Bridge Road, the traffic levels in the AM and PM peaks are similar. The closure of the Oulton Broad North level crossing to traffic (compounded with the Mutford Bridge lift during the off-peak) results in severe delays on this link.~~

~~3.14.7 The impact of existing queuing and congestion on strategic routes, key routes and key north south movements is detailed in the section below.~~

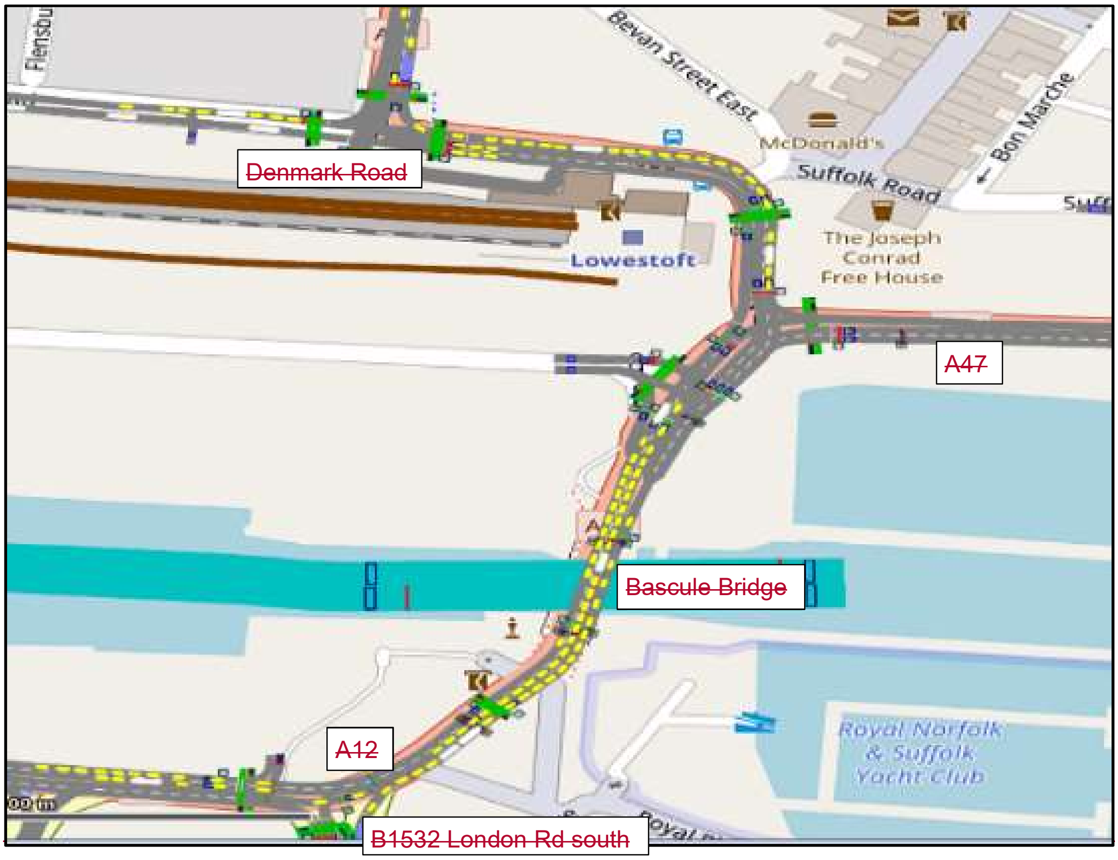
Base 2016 AM Peak

The conditions during the AM peak assuming the A47 Bascule Bridge remains open to traffic are presented in a series of ~~*Base 2016 AM Peak*~~

3.14.6 ~~The following figures are~~ screenshots from the VISSIM model ~~video of the peak hours.~~at 3 locations; Bascule Bridge, Normanston Drive/Gorleston Road and Bridge Road Oulton Broad North level crossing.

~~3.14.8~~3.14.7 The screenshots for Bascule Bridge for a no lift, 5 minutes and 10 minute lift are presented in Figures 3.27 to 3.29 respectively. The yellow shapes represent cars and LGVs, the white shapes are HGVs and the blue shapes are buses.

~~3.14.9 Figure 3.27 shows a significant queue of around 200m on A47 Bascule Bridge in the northbound direction during the Base 2016 AM Peak scenario which includes the aforementioned assumptions regarding bridge lifts and railway level crossing closures. London Road South, northbound approach, has a shorter green signal time compared to the strategic route of A12 which can result in significant queuing on the B1532 corridor.~~



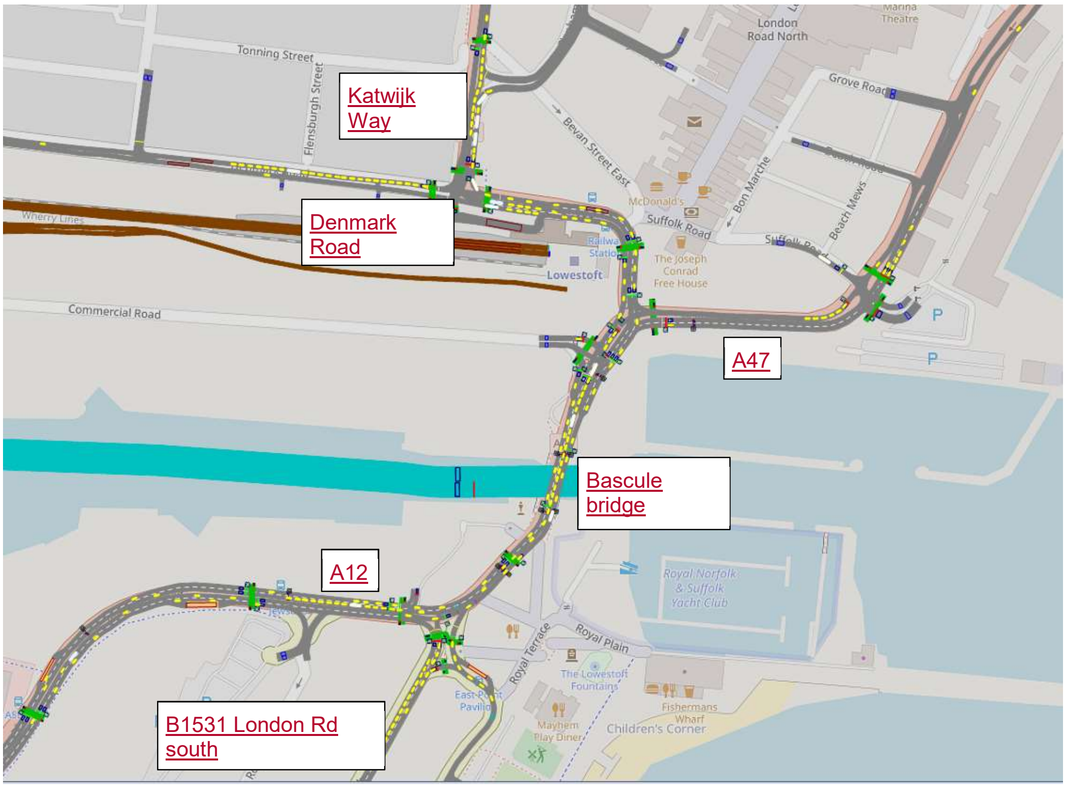


Figure 3.27~~:~~ – Base AM ~~Congestion at A47~~Peak Bascule Bridge (No - lift 08;30)

~~3.14.10 Figure 3.28 shows that traffic queuing on A1117 (Normanston Drive/ Bridge Road) makes it difficult for traffic from B1375 Gorleston Road to enter the roundabout, generating a queue of around 400m. Furthermore, the short flare for left turners on B1375 delays traffic waiting to turn left.~~

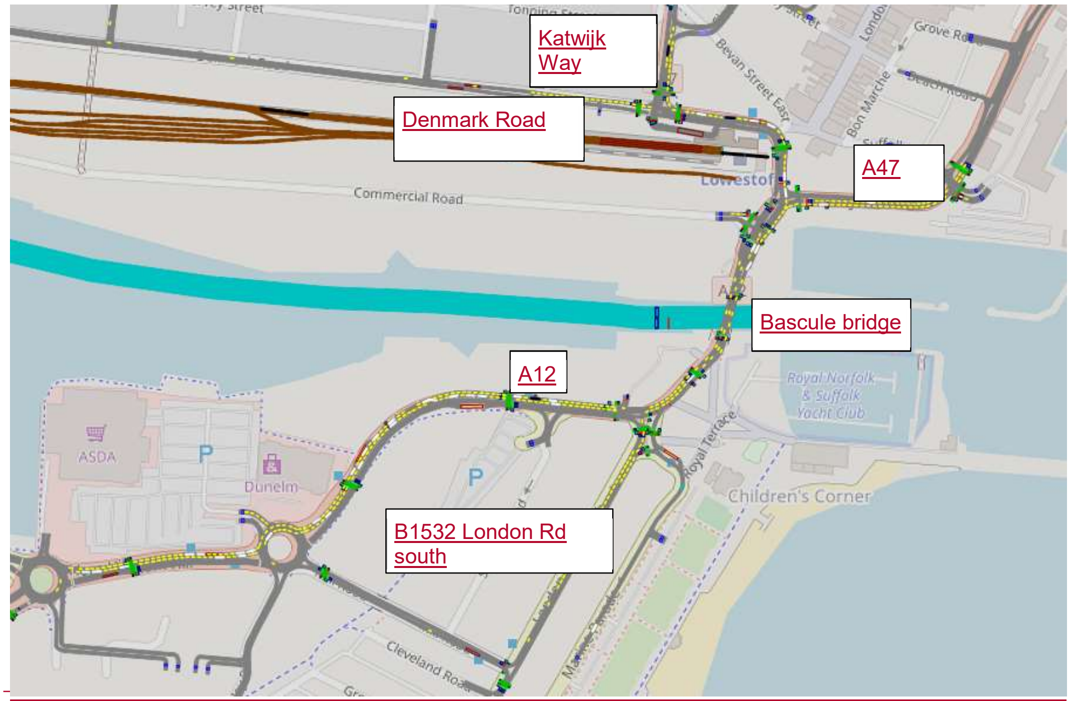
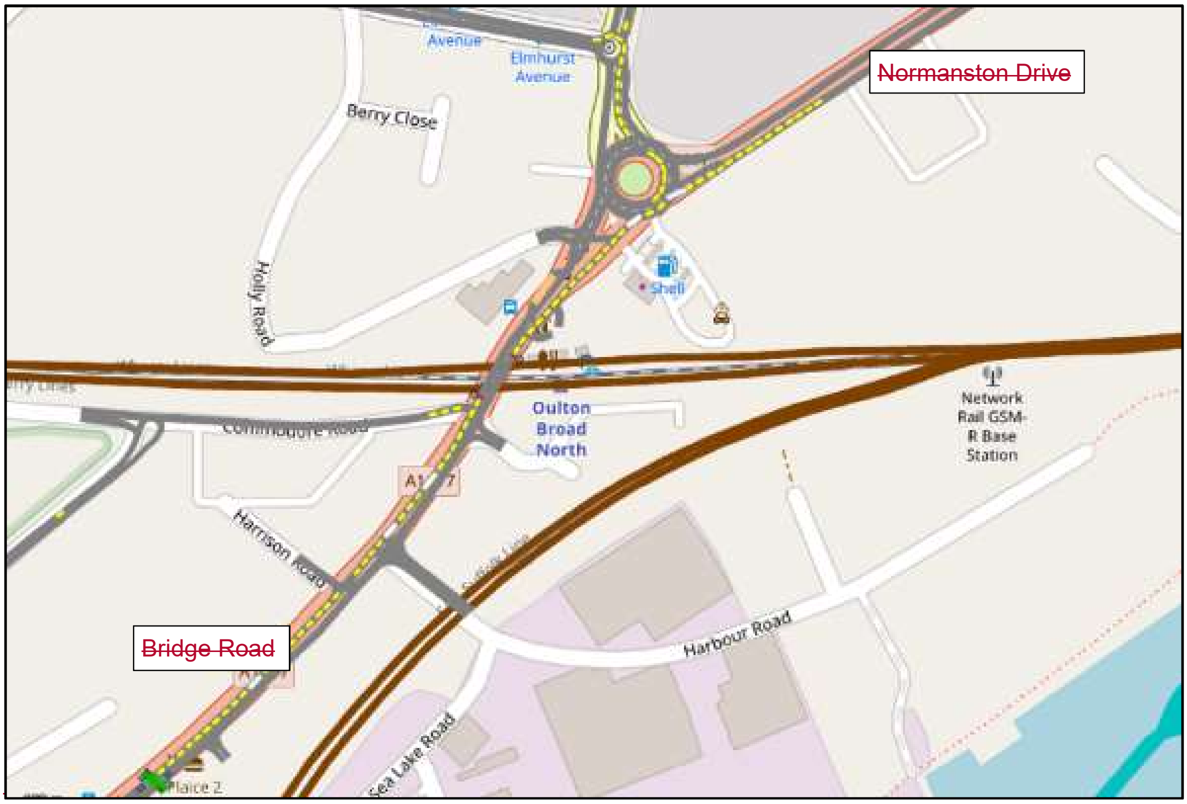


Figure 3.28~~: Base AM Congestion at Normanston Drive / Gorleston Road~~ – Base AM Peak Bascule Bridge (5 min lift - 08:36 after reopening to vehicular traffic)

~~3.14.11 Figure 3.29 shows extensive queuing on Bridge Road of around 200m in both the southbound and northbound directions when the level crossing is in operation. However, from watching the VISSIM model in operation, the queue disperses within one to two minutes once the level crossing is open to road traffic.~~



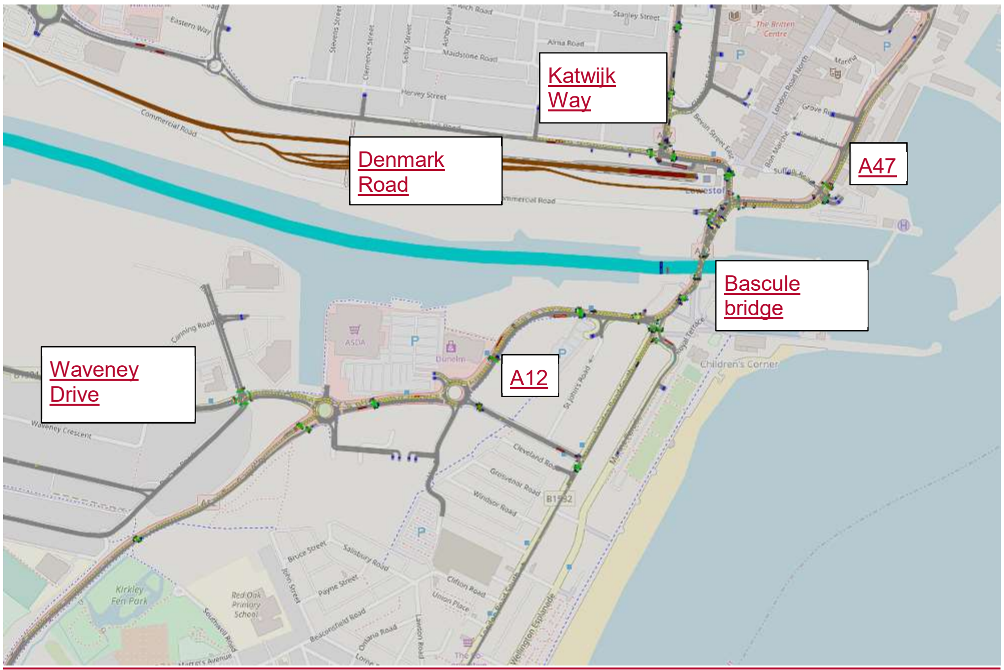


Figure 3.29~~29: –~~ Base AM ~~congestion at Bridge Road Oulton Broad North level crossing~~

~~The Bascule Bridge opening during peak times does affect traffic to the west of the town and across Mutford Bridge. In the scenario with no~~Peak Bascule Bridge ~~lift, traffic generally flows well across Mutford Bridge, with some queuing at the roundabouts to the north and south. The queuing from the north roundabout can impact on the bridge itself. The northern approach can become busy when the Oulton Broad North level crossing closes for a train, and this queue can reach the bridge, especially if it is combined with a bus stopping on A1117 Bridge Road. Figure 3.30 shows the queue as it dissipates after the level crossing reopened, with the end of the queue at the bridge.~~(10 min lift – 08:41 after reopening to vehicular traffic)

3.14.8 Figure 3.27 shows that with no bridge closure there are modest queues for northbound traffic approaching the bridge at the junction on A12 Belvedere Road and B1531 London Road South. Figure 3.28 demonstrates that following a bridge lift of 5 minutes, there are significant queues for northbound traffic on A12 and B1531, with queues on the A12 extending as far as the junction of Tom Crisp Way/Waveney Drive. There are also modest queues for southbound vehicles on A12 Waveney Road and Denmark Road.

3.14.9 Figure 3.29 shows that following a 10 minute lift of the Bascule Bridge, queues are more extensive, particularly for northbound traffic, where queues extend into Waveney Drive and A12 Tom Crisp Way. There are also significant queues southbound on A47 Waveney Road.

3.14.10 The screenshots for Normanston Drive/Bridge Road for a no lift, 5 minutes and 10 minute lift of A47 Bascule Bridge (Mutford Bridge remaining open to traffic), are presented in Figures 3.30 to 3.32 respectively.

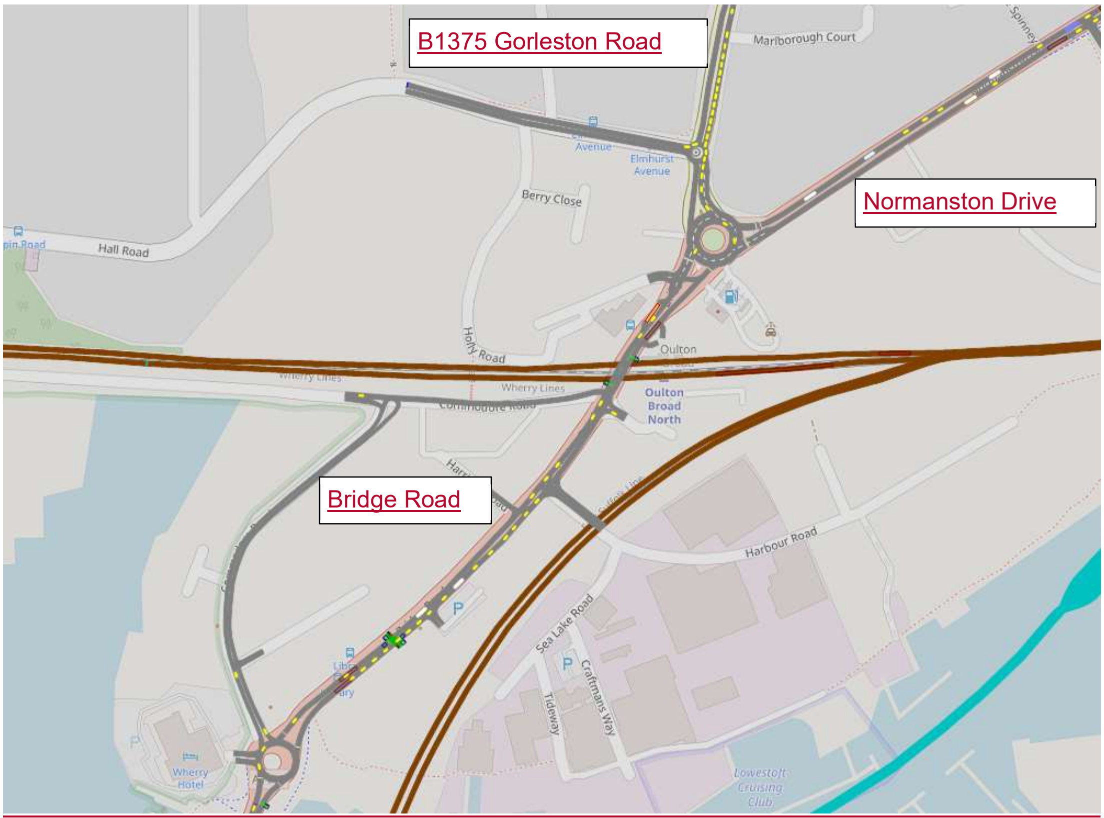


Figure 3.30~~:~~ – Base AM Peak Normanston Drive/Bridge Road (No - lift 08;30)

Figure 3.31 – Base AM Peak Normanston Drive/Bridge Road (5 min lift - 08:36 after reopening to vehicular traffic)

Figure 3.~~.~~32 – Base AM ~~congestion at Mutford~~ Peak Normanston Drive/Bridge ~~(no Bascule Bridge~~Road (10 min lift – 08:41 after reopening to vehicular traffic)

3.14.11 Figure 3.~~31~~30 shows ~~queuing at around 08:40 following a 5 minute lift of the~~that with Bascule Bridge ~~at 08:30 and just~~fully open there are queues for southbound traffic on the approach from B1375 Gorleston Road. There are no queues on either Bridge Road or A1117 Normanston Drive.

3.14.12 Figure 3.31 demonstrates that following a bridge lift of 5 minutes, in addition to the queues on Gorleston Road, modest queues form on Bridge Road in both directions. Figure 3.32 demonstrates that following a 10 minute closure of Bascule Bridge, conditions are similar to a 5 minute bridge lift, with significant queues for southbound traffic on Gorleston Road and modest queues on Bridge Road.

3.14.13 The screenshots showing traffic conditions on Mutford Bridge based upon a no lift, 5 minutes and 10 minute lift of A47 Bascule Bridge (Mutford Bridge remaining open to traffic) are presented in Figures 3.33 to 3.35 respectively.

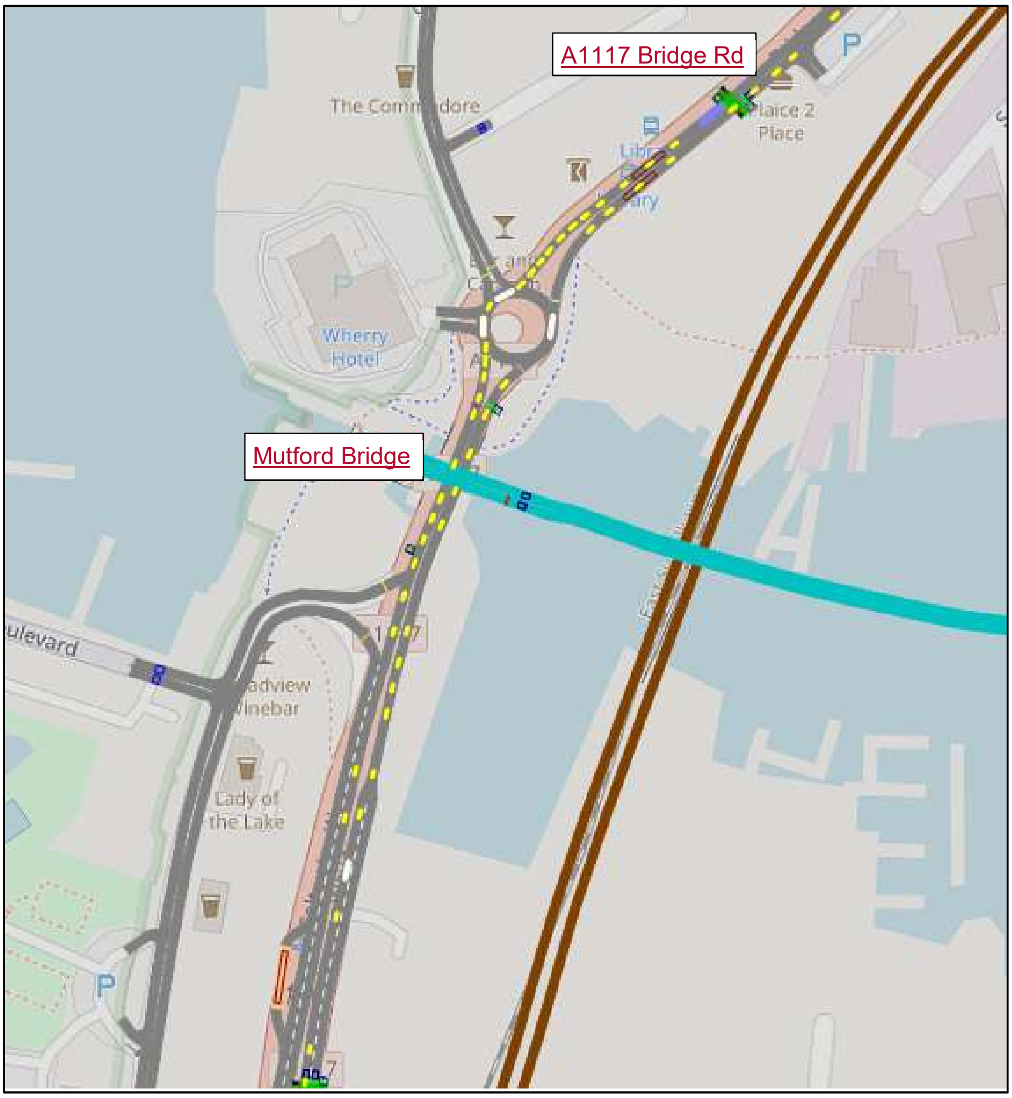


Figure 3.33 – Base AM Peak Mutford Bridge (No - lift 08;30)

Figure 3.34 – Base AM Peak Mutford Bridge (5 min lift - 08:36 after reopening to vehicular traffic)

Figure 3.35 – Base AM Peak Mutford Bridge (10 min lift – 08:41 after reopening to vehicular traffic)

3.14.14 Figure 3.33 shows that with no Bascule Bridge lift, traffic moves freely across Mutford Bridge, with some modest queues at the roundabout immediately north of Mutford Bridge. Queues at the junction were shown to increase when the Oulton Broad North level crossing closes for a train, when queues can extend to the bridge. The queues dissipate after the level crossing reopens. ~~It shows~~

~~3.14.12~~3.14.15 Figure 3.34 demonstrates that following a ~~greater level of traffic than in the scenario with no~~ lift of ~~the~~ Bascule Bridge~~.~~ for 5 minutes volumes of traffic on Mutford Bridge are higher. The additional traffic using Mutford Bridge ~~in this scenario causes more~~results in queueing in both directions, with a northbound queue of about 300m stretching back to the southern roundabout. The southbound queue at the southern roundabout is also greater than with no lift of the Bascule Bridge. ~~The effect of the Bascule Bridge lift dissipates by around 08:50.~~

Figure ~~3.31: Base AM congestion at Mutford Bridge (5min~~3.35 demonstrates that following a lift of Bascule Bridge ~~lift)~~

~~3.14.13~~3.14.16 ~~Figure 3.32 shows traffic in the AM peak when the Bascule Bridge is lifted~~ for 10 minutes~~. Again, traffic on the Mutford Bridge is affected most noticeably when the level crossing closes at a similar time to the Bascule Bridge. The queuing~~ queues increase over Mutford Bridge ~~is greater than in the five minute lift scenario~~ with traffic queuing in two lanes northbound~~, most likely~~ . The increase in volumes is due to ~~more~~additional traffic rerouting ~~over a greater period~~ to avoid ~~the~~ Bascule Bridge and the associated congestion.

~~Figure 3.32: Base AM congestion at Mutford Bridge (10min Bascule Bridge lift)~~

Base 2016 PM Peak

~~3.14.14 Base 2016 PM Peak (Figure 3.33) shows extensive traffic queuing of around 300m at the Station Square/A47 junction, which blocks back to the north all the way to the Denmark Road/A47 junction. The consequence of this is traffic cannot exit Katwijk Way due to the queuing along Denmark Road. The southern section also blocks back across the Bascule Bridge from the Station Square junction with a queue of around 200m, impacting upon the Pier Terrace/Belvedere Road junction.~~

3.14.17 The conditions during the PM peak assuming ~~a~~ no lift, 5 minute and 10 minute lift of the A47 Bascule Bridge ~~remains open to traffic~~ are presented in a series of screenshots from the VISSIM model.

3.14.18 The screenshots for A47 Bascule Bridge for a no lift, 5 minutes and 10 minute lift are presented in Figures 3.36 to 3.38 respectively.

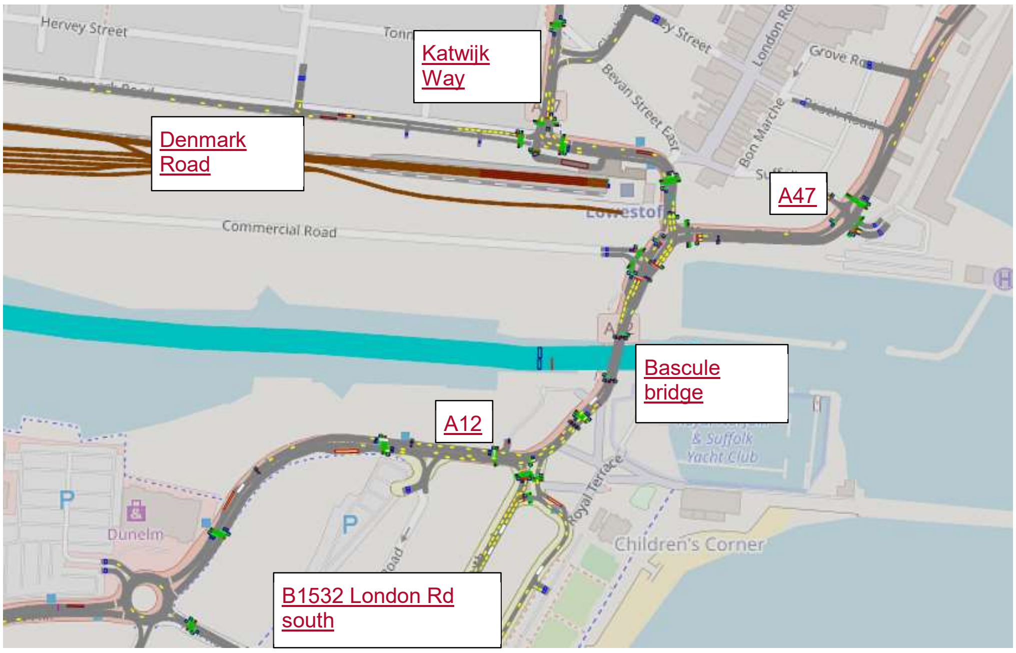
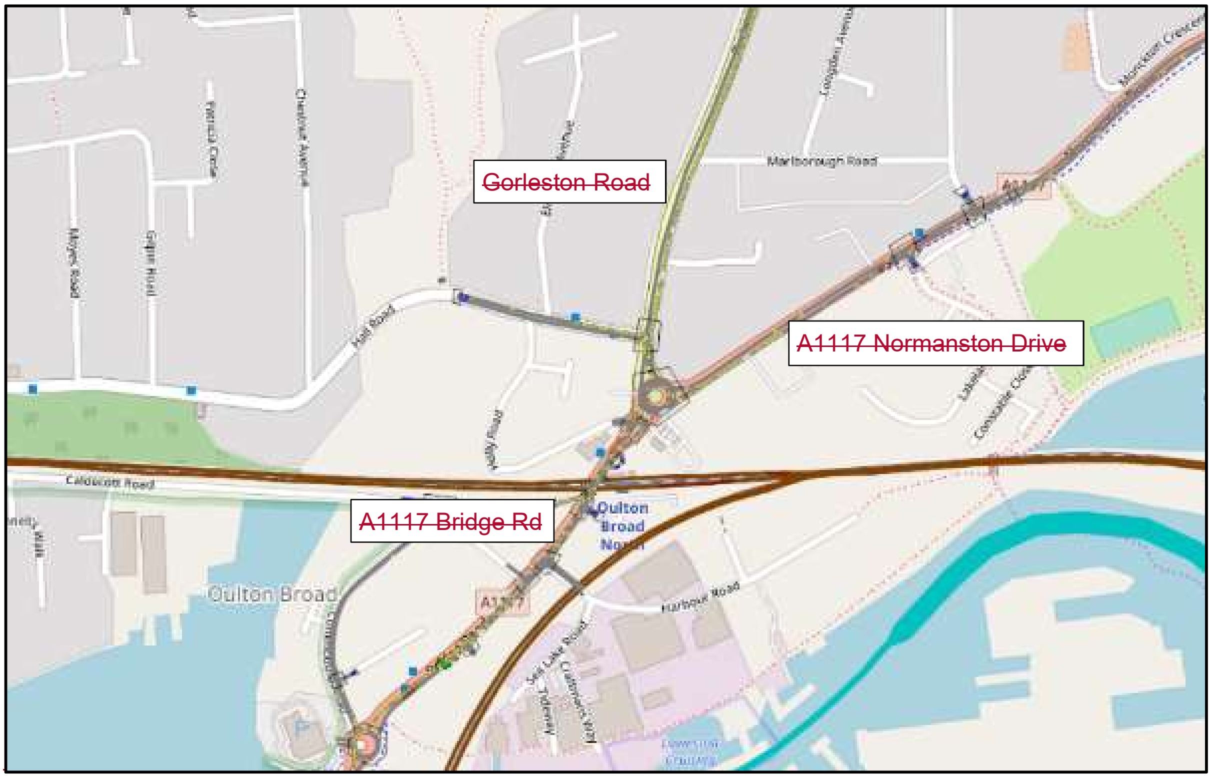


Figure 3.36~~33~~36~~:~~ – Base PM ~~Congestion at~~Peak Bascule Bridge (No - lift 17;30)

~~3.14.15 Figure 3.34 shows significant queueing along Bridge Road, across multiple junctions which is exacerbated by the closure of the railway level crossing during the peak hour. This creates problems for the southbound Gorleston Road entry arm, with a queue over 600m long. The entry onto A1117 Bridge Road/Normanston Drive roundabout queues along the entire length of Bridge Road due to the amount of opposing traffic leading to very few available gaps within which to join the roundabout.~~



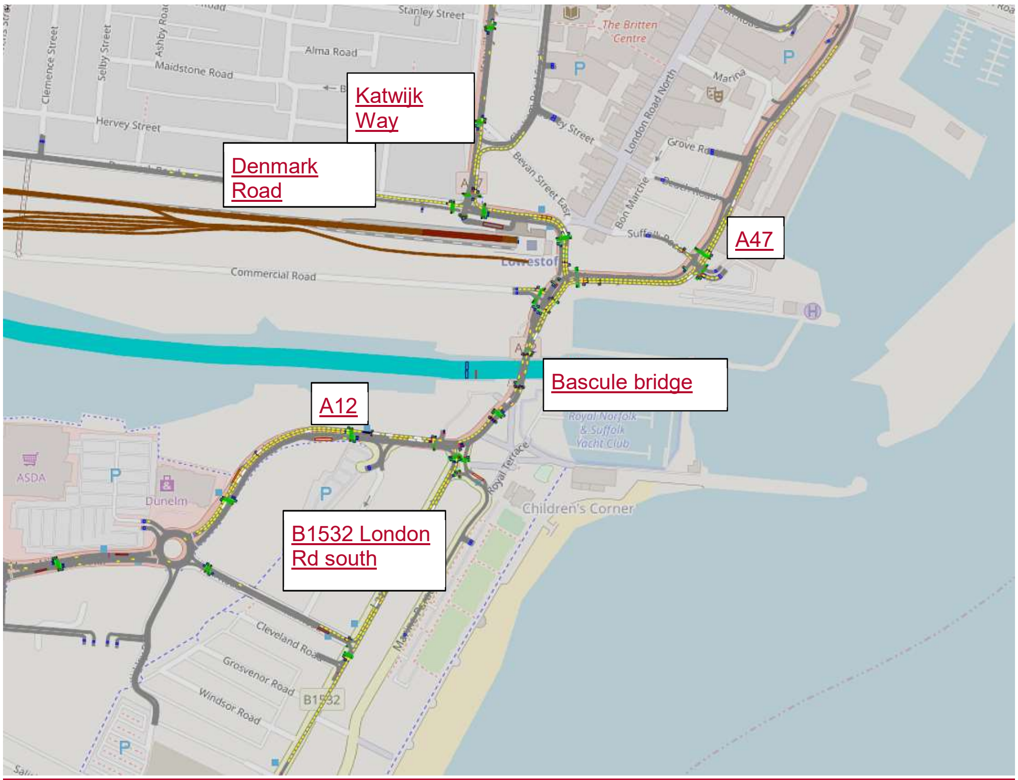


Figure 3.37~~3437:~~ – Base PM ~~Congestion at A1117 Normanston Drive / Gorleston Road~~

~~3.14.16 The Bridge Road section on A1117 experiences delays during the PM peak. However, the queues are generally low during 'normal' operational network conditions. Within the VISSIM modelling, the queuing is exacerbated significantly when the railway level crossing at Oulton Broad North is closed to traffic, or when the Lake crossings are lifted preventing the free flow of traffic.~~

~~As with the AM peak, the closure of the~~Peak Bascule Bridge ~~affects traffic at Mutford Bridge in the PM peak. With no~~(5 min lift ~~of the Bascule Bridge, traffic flows generally well across Mutford Bridge throughout the peak, however when the level crossing closes the queue can extend across the bridge to around 450m long, as shown in Figure 3.35.~~ - 17:36 after reopening to vehicular traffic)


A1117 Bridge Rd
Mutford Bridge
The Boulevard
Bridge Road
Broadview Winebar
Lady of the Lake
Wherry Hotel
The Commodore
The Mermaid
South Elmham Terrace
Sea Lake Rd
Tideway
Craftmans

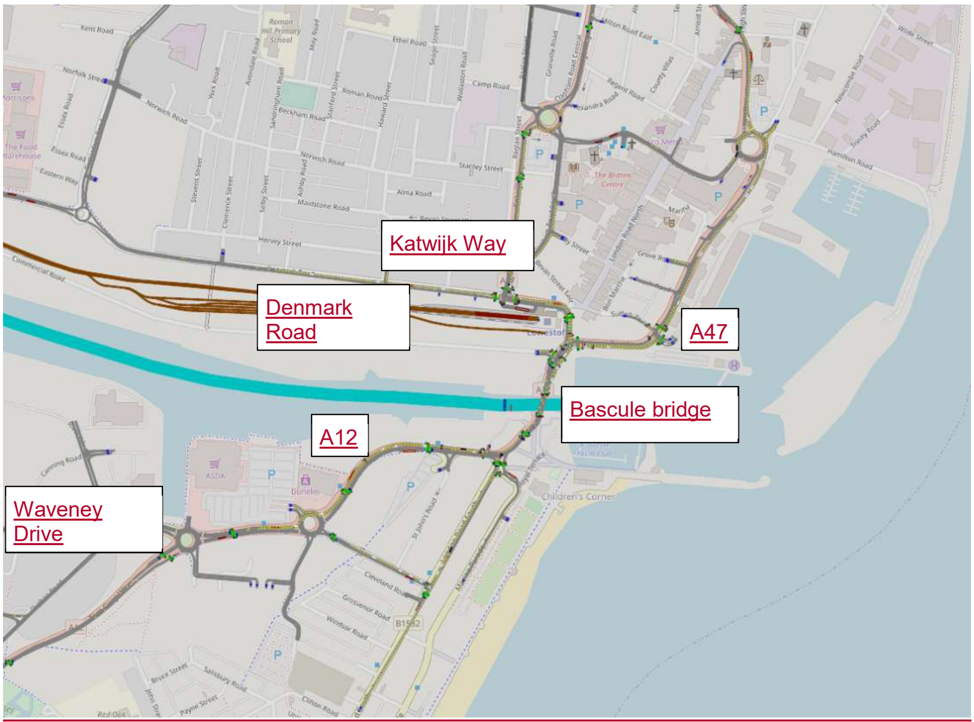

Katwijk Way
Denmark Road
A47
Bascule bridge
A12
Waveney Drive

Figure 3.38~~35~~38~~:~~ – Base ~~PM congestion at Mutford Bridge (no~~M Peak Bascule Bridge (10 min lift - 17:41 after reopening to vehicular traffic)

3.14.19 ~~In the period~~Figure 3.3~~7~~6 shows that with no bridge lift ~~closure~~ traffic is free flowing with minimal queueing at the junctions to the north and south of the Bridge. Figure 3.37 demonstrates that following a ~~5~~bridge lift of 5 minutes, queues develop for southbound traffic on Denmark Road and A12 Waveney Road, with modest queues for northbound traffic across the bridge.

3.14.20 Figure 3.38 shows that following a 10 minute lift of the Bascule Bridge, ~~Mutford~~ there are significant queues for southbound traffic on A~~12~~47 Waveney Road and Denmark Road with queues for northbound traffic extending as far as Belvedere Road on A12.

~~3.14.17~~3.14.21 The screenshots for Normanston Drive/Bridge ~~is more heavily congested. As~~Road for a no lift, 5 minute~~s~~ and 10 minute lift of the A47 Bascule Bridge (Mutford Bridge remaining open for traffic) are presented in ~~the AM peak, the effect is most prevalent when the level crossing also closes. Northbound queueing can extend back across the bridge to the southern roundabout (around 700m).~~Figures 3.39 to 3.41 respectively.

Figure 3.39 – Base PM Peak Normanston Drive/Bridge Road (No - lift 08;30)

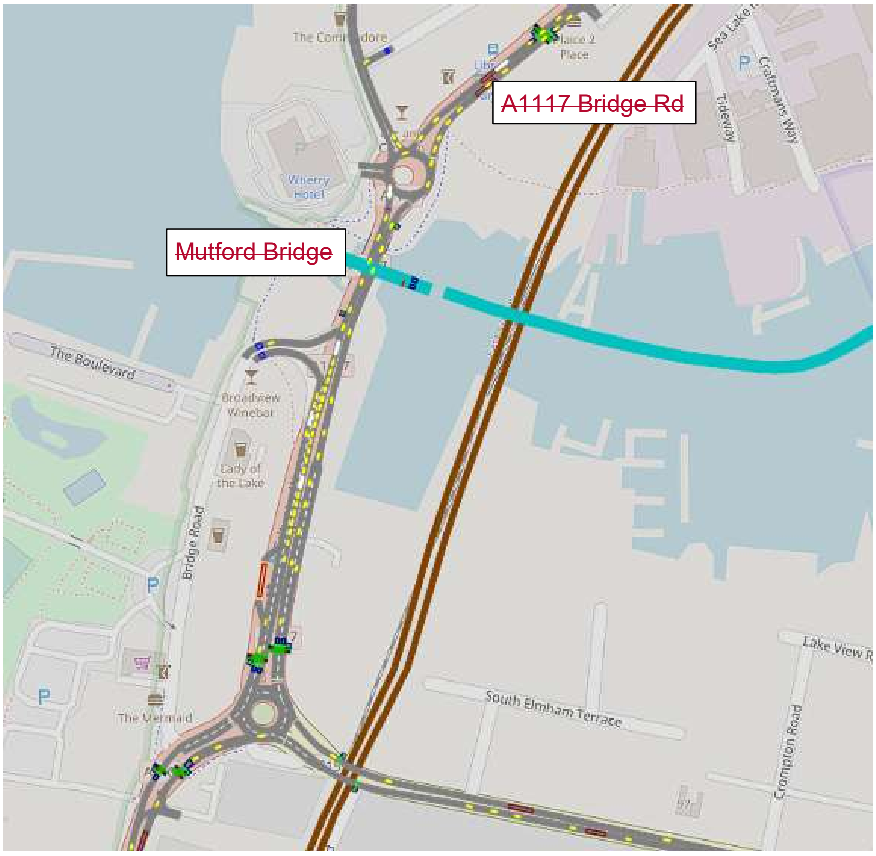
Figure 3.40 – Base PM Peak Normanston Drive/Bridge Road (5 min lift - 08:36 after reopening to vehicular traffic)

Figure 3.41~~3641:~~ – Base PM ~~congestion at Mutford~~ Peak Normanston Drive/Bridge ~~(5min Bascule Bridge~~Road (10 min lift – 08:41 after reopening to vehicular traffic)

3.14.22 ~~With the~~ Figure 3.39 shows that with no lift of A47 Bascule Bridge ~~liftedopen~~ there are queues for ~~10 minutes, the effect on~~ southbound traffic ~~across Mutford Bridge looks broadly similar to the five minute~~ on the approach from A1375 Gorleston Road. There are no queues on either Bridge Road or A1117 Normanston Drive.

3.14.23 Figure 3.40 demonstrates that following a bridge lift ~~scenario. This is due to the tidality~~ of ~~the traffic flow, with less concentration~~5 minutes, in addition to the queues on Gorleston Road, there are modest queues on Bridge Road in a northbound direction.

~~3.14.18~~3.14.24 Figure 3.41 shows that following a 10 minute lift ~~closure~~ of A47 ~~vehicles travelling south to north with potential to reroute. This tidal effect is also seen at the~~ Bascule Bridge, conditions are similar to a 5 minute closure with significant queues for southbound traffic on Gorleston Road and modest queues for northbound traffic on Bridge Road.



3.14.25 The screenshots showing PM peak traffic conditions on Mutford Bridge based upon a no lift, 5 minutes and 10 minute lift of A47 Bascule Bridge (Mutford Bridge remaining opening to traffic) -are presented in Figures 3.42 to 3.44 respectively.

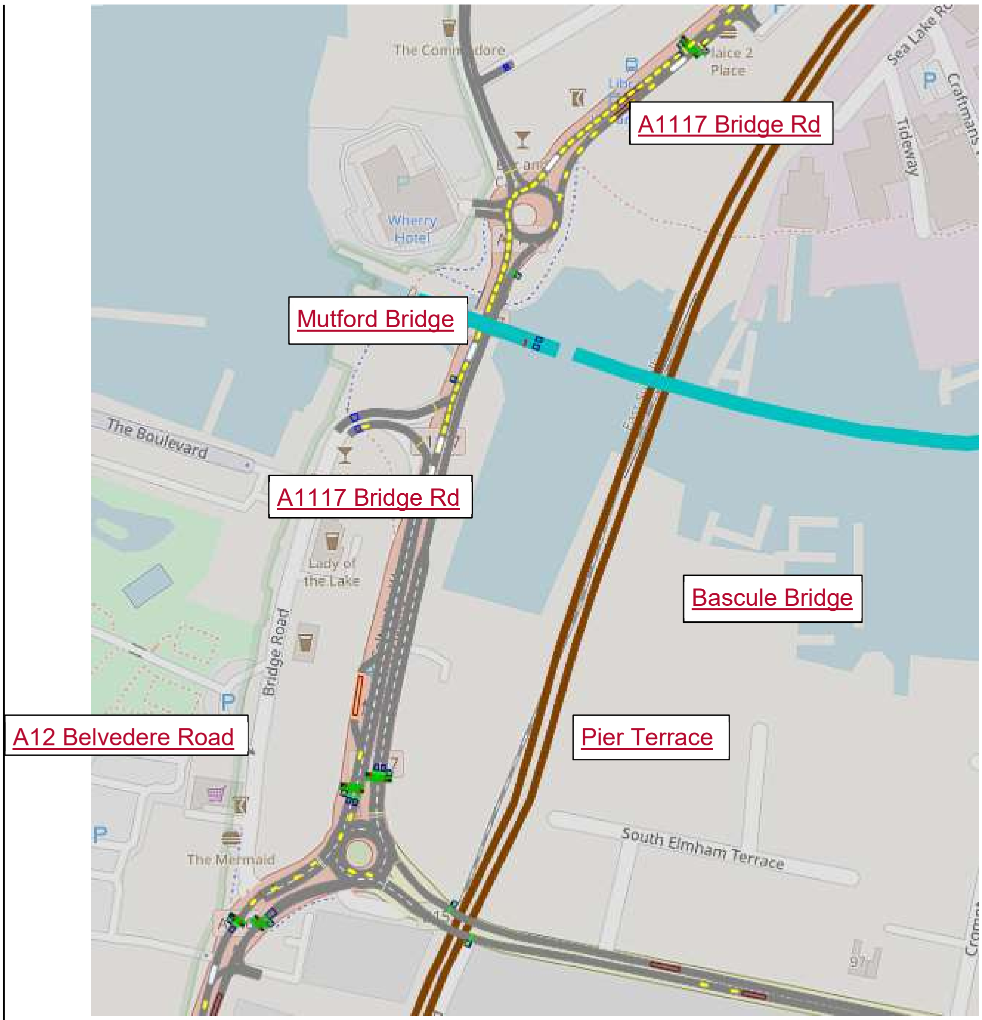


Figure 3.42~~37~~42~~:~~ – Base PM Peak Mutford Bridge (No - lift 08;30)

Figure 3.43 – Base PM ~~congestion at~~Peak Mutford Bridge (5 min lift - 08:36 after reopening to vehicular traffic)

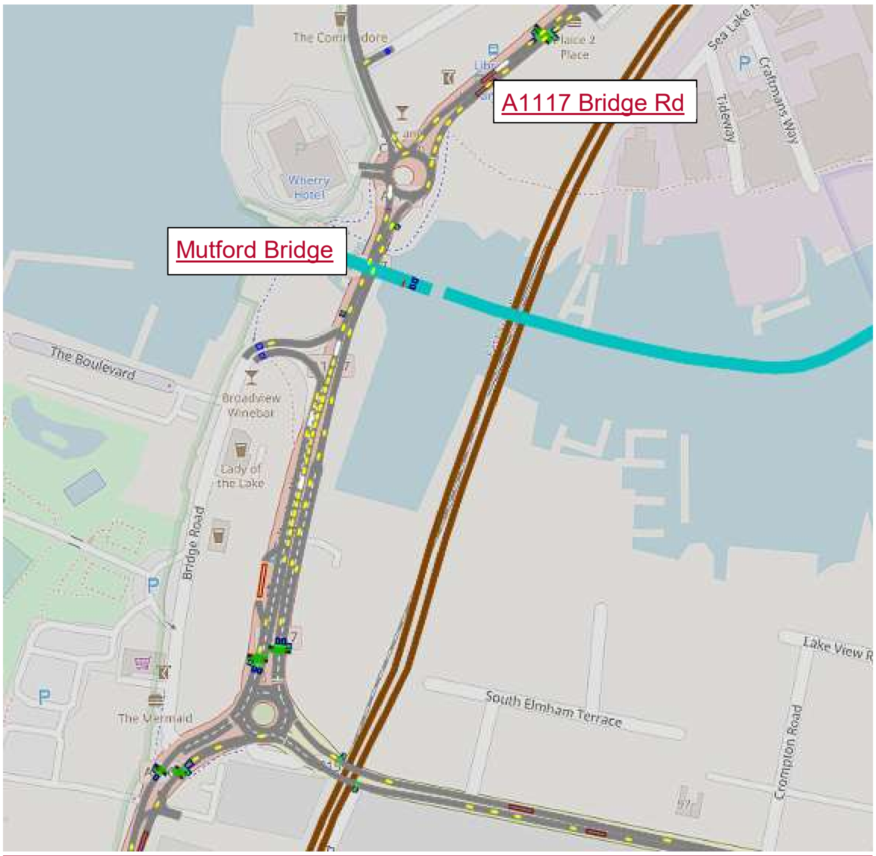


Figure 3.44 – Base PM Peak Mutford Bridge (10 min lift – 08:41 after reopening to vehicular traffic)

3.14.26 Figure 3.42 shows that with no Bascule Bridge lift, there are modest queues on Bridge road northbound, at the roundabout immediately north of Mutford Bridge

~~3.14.19~~ Figure 3.43 demonstrates that following a lift of Bascule Bridge for 5 minutes volumes of traffic on Mutford Bridge ~~(10min~~ are higher although there are no queues. Figure 3.44 demonstrates that following a lift of Bascule Bridge ~~lift)~~for 10 minutes modest queues form in a northbound direction across Mutford Bridge. ~~It is noted that with both 5 minute and 10 minute bridge lifts, conditions on Mutford Bridge in the PM peak are significantly better than the AM peak~~

3.14.27 Key Journey Time Routes and Movements

~~3.14.20~~3.14.28 Table 3.~~18~~19 and Table 3.~~19~~20 show the journey time for the AM and ~~delay~~PM peak on key routes and movements within the ~~VISSIM~~ study area~~, as identified in Figure 3.26.~~ for the 3 bridge lift scenarios. The ~~delay is calculated by comparing the actual modelled~~ journey time ~~to the freeflow modelled journey time on that route without a bridge lift. The tables show the average journey time and delay over the entire modelled hour. Due to changing traffic conditions, some vehicles will experience a lower journey time and some a higher journey time within the modelled hour.~~routes are presented in Figure 3.45.

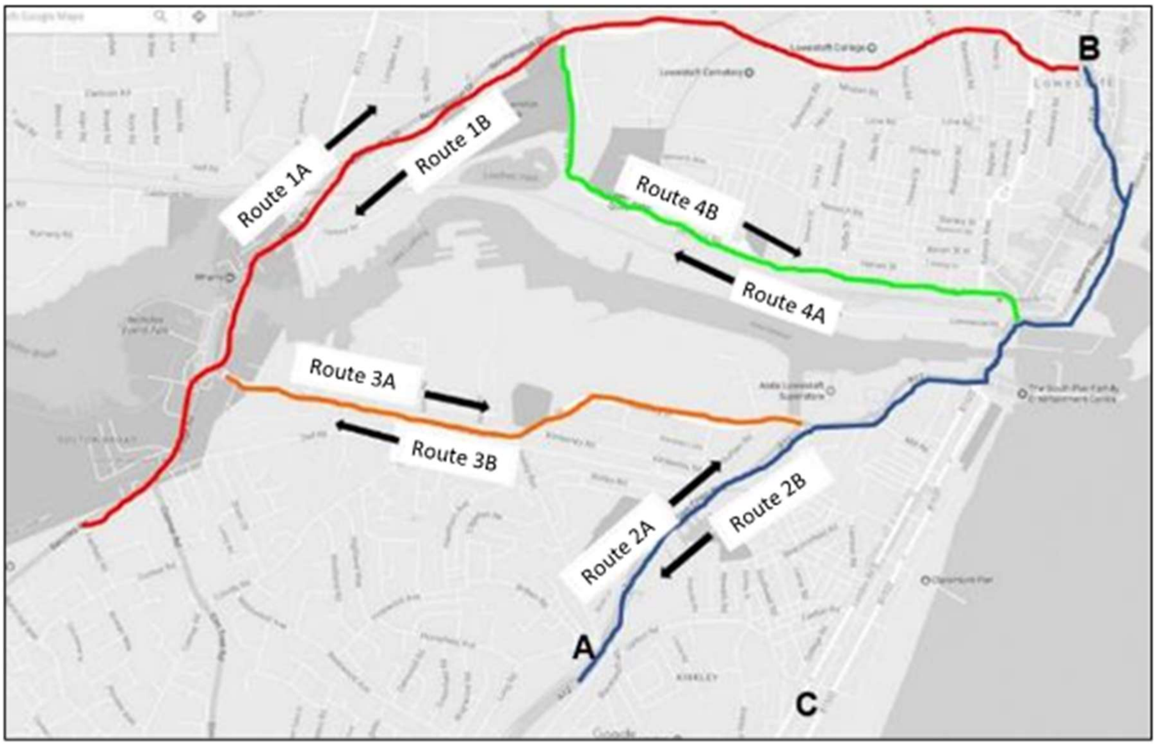


Figure 3.45~~38~~45: Key Routes for Journey Time Assessment

~~3.14.21~~3.14.29 ~~An assessment of journey times for key north-south movements with different bridge lift scenarios is provided in Tables 3.19 and 3.20. The~~The journey time analysis provides journey times between points A and C to the south and point B to the north, with a dynamic route choice for vehicles within the model, and multiple options are available.

~~3.14.22~~3.14.30 To the south of Lowestoft, there is a one-way system in operation on B1532 with London Road South providing the northbound route and Marine Parade providing the southbound route. For this reason, the routing of traffic between points B to C and C to B will be different.

Route	Description	No Lifts	With 5 minute Lift	With 10 minute Lift
A to B	A12 Tom Crisp Way to A47 Jubilee Way	482	539	691
B to A	A47 Jubilee Way Jn to A12 Tom Crisp Way	402	450	539
C to B	London Rd South to A47 Jubilee Way	413	508	674
B to C	A47 Jubilee Way to B1532 Marine Parade	220	265	351

Table 3.19: Comparison of Journey time (sec) between key N-S movements – Base 2016 AM

Route	Description	No Lifts	With 5 minute Lift	With 10 minute Lift
A to B	A12 Tom Crisp Way to A47 Jubilee Way	448	521	655
B to A	A47 Jubilee Way Jn to A12 Tom Crisp Way	460	570	721
C to B	London Rd South to A47 Jubilee Way	367	551	739
B to C	A47 Jubilee Way to B1532 Marine Parade	245	339	533

Table 3.20: Comparison of Journey time (sec) between key N-S movements – Base 2016 PM

~~3.14.23~~3.14.31 The analysis of journey times of key movements shows that the average journey time is noticeably longer with a five-minute bridge lift of A47 Bascule Bridge, with journey times rising between 12% and 23% in the AM, and between 16% and 50% in the PM, depending on the origin and destination. This is around 45 seconds to a minute and a half extra for each journey on average.

~~3.14.24~~3.14.32 The effect is even more noticeable with a ten-minute bridge lift. In the AM, journey times increase by between 44% and 63%, or between over two minutes and over four minutes. As with the five-minute lift scenario, the PM is significantly worse with journey times between points B and C around twice as long as the scenario with no lift.

3.14.33 The delays for the 4 routes shown in Figure 3.4~~6~~5 are presented in Tables 3.21 and 3.22 for the AM and PM peak respectively.

3.14.34 The delays are calculated by comparing the actual modelled journey time to the free-flow modelled journey time on that route without a ~~bridge~~ lift of A47 Bascule Bridge over the entire modelled hour. Due to changing traffic conditions, and the time of bridge opening within the modelled hour (as discussed further below), some vehicles will experience a lower journey time and some a higher journey time within the modelled hour

Route	Description	No Lifts		With 5 minute Lift		With 10 minute Lift	
		Journey Time	**Delay**	**Journey Time**	**Delay**	**Journey Time**	**Delay**
Route 1 A	A146-Fairfield Rd/ Normanston Dr (NB)	08:12	00:24	09:27	01:39	09:17	01:29
Route 1 B	A146-Fairfield Rd/ Normanston Dr (SB)	09:07	00:56	10:00	01:49	09:22	01:11
Route 2 A	A12 (NB)	07:50	02:38	08:34	03:22	10:55	05:43
Route 2 B	A12 (SB)	06:38	01:14	07:21	01:57	08:45	03:21
Route 3 A	Waveney Drive (EB)	03:29	00:42	03:27	00:40	03:53	01:06
Route 3 B	Waveney Drive (WB)	03:32	00:28	03:27	00:23	03:29	00:25
Route 4 A	Denmark Road (WB)	04:01	00:52	04:32	01:23	03:53	00:44
Route 4 B	Denmark Road (EB)	04:54	01:18	05:46	02:10	06:56	03:20

Table 3.21: Comparison of Journey time and Delay (mm:ss) on key routes in Base 2016 AM with and without lifts of the A47 Bascule Bridge

Route	Description	No Lifts		With 5 minute Lift		With 10 minute Lift	
		Journey Time	Delay	Journey Time	Delay	Journey Time	**Delay**
Route 1 A	A146-Fairfield Rd/ Normanston Dr (NB)	09:15	01:06	09:05	00:56	09:11	01:02
Route 1 B	A146-Fairfield Rd/ Normanston Dr (SB)	09:21	01:08	09:20	01:07	09:15	01:02
Route 2 A	A12 (NB)	06:58	01:38	08:08	02:48	10:17	04:57
Route 2 B	A12 (SB)	07:20	02:10	09:14	04:04	12:20	07:10
Route 3 A	Waveney Drive (EB)	03:14	00:24	03:17	00:27	03:14	00:24
Route 3 B	Waveney Drive (WB)	03:50	00:46	04:03	00:59	03:55	00:51
Route 4 A	Denmark Road (WB)	04:02	00:50	03:50	00:38	04:06	00:54
Route 4 B	Denmark Road (EB)	04:35	00:59	06:41	03:05	08:17	04:41

Table 3.22: Comparison of Journey time and Delay (mm:ss) on key routes in Base 2016 PM with and without lifts of the A47 Bascule Bridge

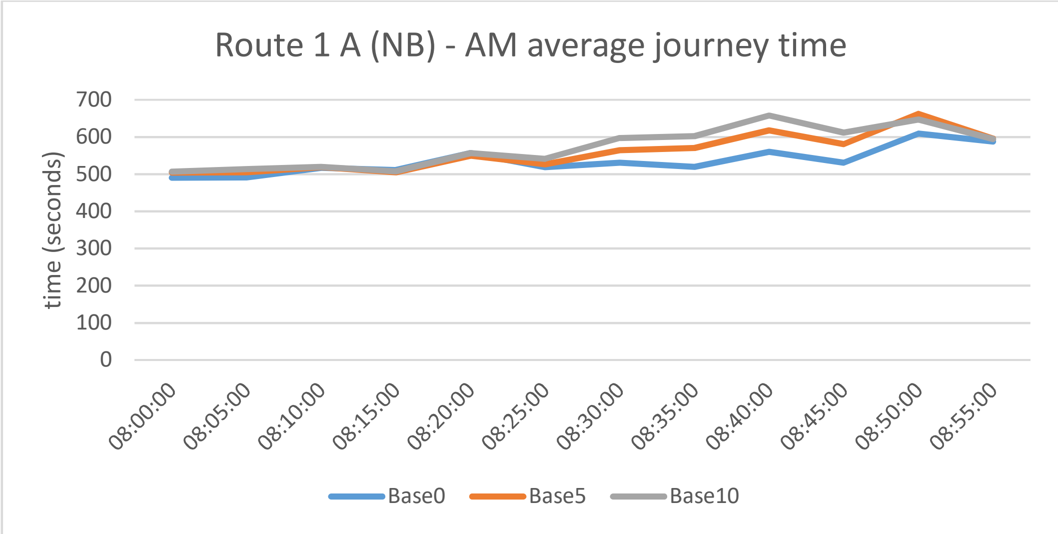
~~3.14.25~~3.14.35 The above tables show that the average delay between A12 Tom Crisp Way/Blackheath Rd Junction and A47 St Peters St / Jubilee Way Junction (route 2A) in the Base 2016 scenario is around three minutes in both time periods when the A47 Bascule Bridge is lifted and around two minutes when the bridge remains open to traffic throughout the peak hour i.e. a typical five minute lift of the A47 Bascule Bridge in the peak hour adds one minute on top of the average two minute delay (i.e. a 50% increase).

~~3.14.26~~3.14.36 The VISSIM model uses dynamic assignment which means that vehicles will change their route based on current delay and routing information. Therefore, if certain routes become overly congested, vehicles can switch to a different route, lessening or increasing congestion. This is likely to be the case for routes 3A and 3B, and 4A and 4B where some traffic diverts to alternative routes, reducing the journey time for those vehicles that remain on the route. It is also possible that the lifted bridge prevents some traffic from reaching routes 3A and 3B, thereby lessening congestion on this route and contributing to a lower delay. As the A47 Bascule Bridge is lifted and closed to traffic this will affect the network in the vicinity of the bridge, possibly increasing congestion and thus delay on routes 4A and 4B.

~~3.14.27~~3.14.37 There are significant delays at the junction of Denmark Road and A47/A12 in the Base 2016 particularly when the bridge is lifted and the road is closed to traffic. The average delay on Denmark Road eastbound (Route 4B) is around a minute and a half in the AM and three minutes in the PM when the A47 Bascule Bridge is lifted. This delay reduces to around one minute in the Base 2016 scenario without the A47 Bascule Bridge lifting to allow vessels to pass through to the inner harbour.

~~3.14.28~~3.14.38 The average delay shown is across the whole peak hour, however within the VISSIM model the bridge is scheduled to lift mid-way through the hour. There are vehicles that are therefore not delayed by the bridge lift as they pass through the network prior to the lift occurring. Conversely there are vehicles that will arrive at the Bascule Bridge as it begins to lift, with the delay being the largest across all vehicles in the hour. The average delay times shown in the peak hour take account of all vehicles, therefore the results do not represent the worst delays that can be experienced as a result of the existing bridge lifting.

~~3.14.29~~3.14.39 Journey time graphs are shown in ~~Figure 3.39~~Figure 3.46 to ~~Figure 3.46~~Figure 3.53 for the AM peak and ~~Figure 3.47~~Figure 3.54 to ~~Figure 3.54~~Figure 3.61 for the PM peak. The graphs show how the average journey time on each route changes across the modelled hour. In each graph, times are shown for each of the three base scenarios (bridge remains open to traffic, bridge lifts for five minutes, bridge lifts for ten minutes).



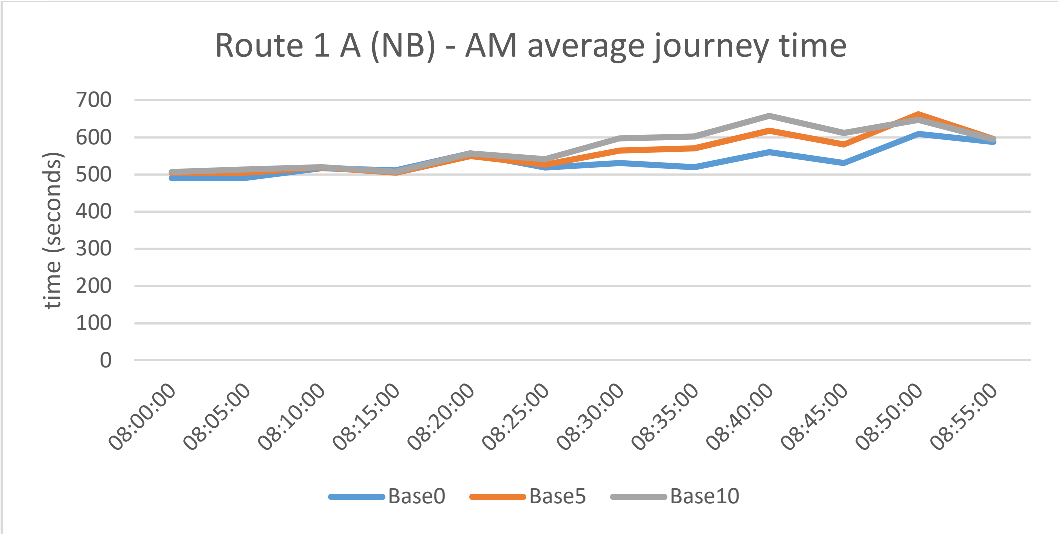
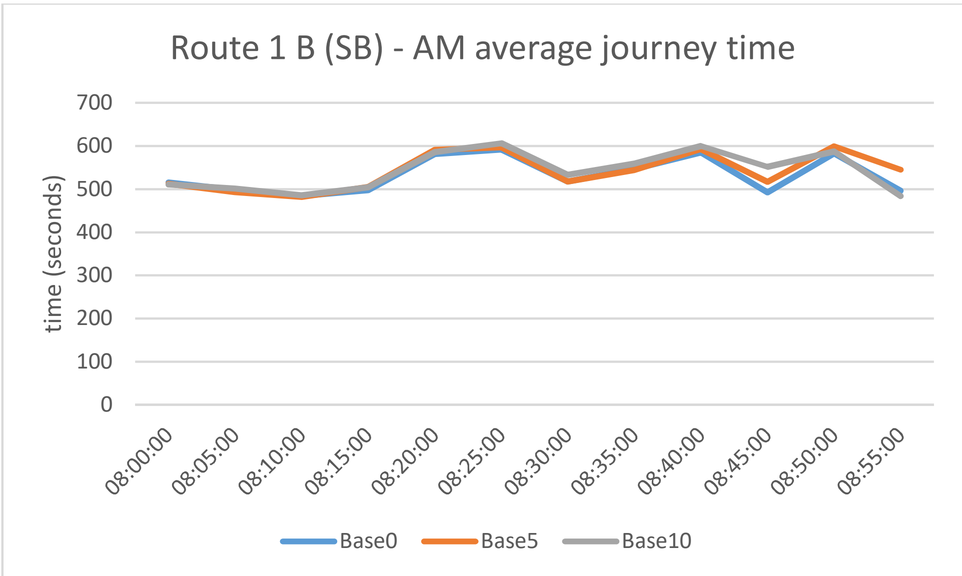


Figure 3.463946 - Route 1A - AM average journey time



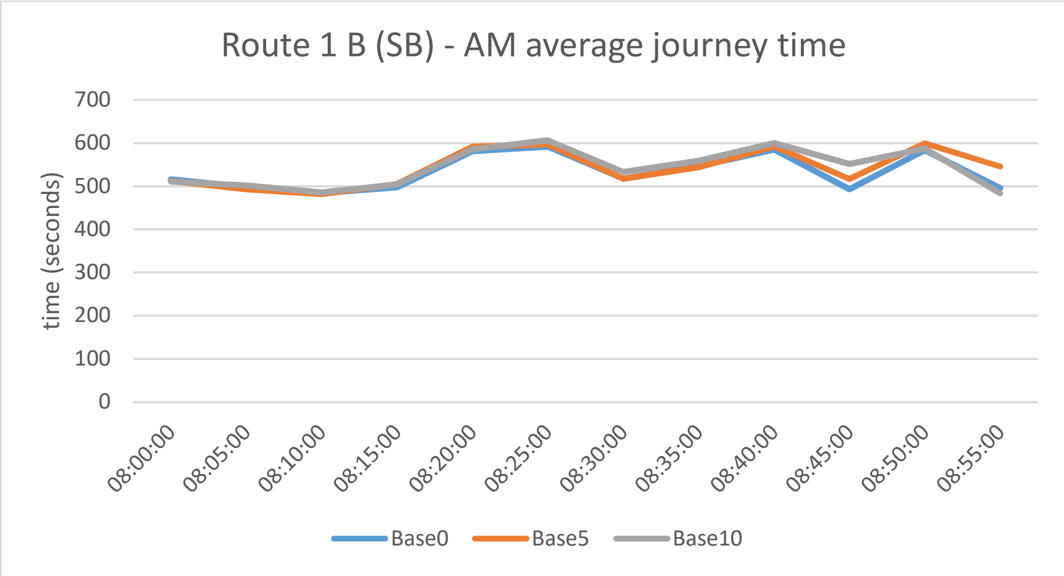
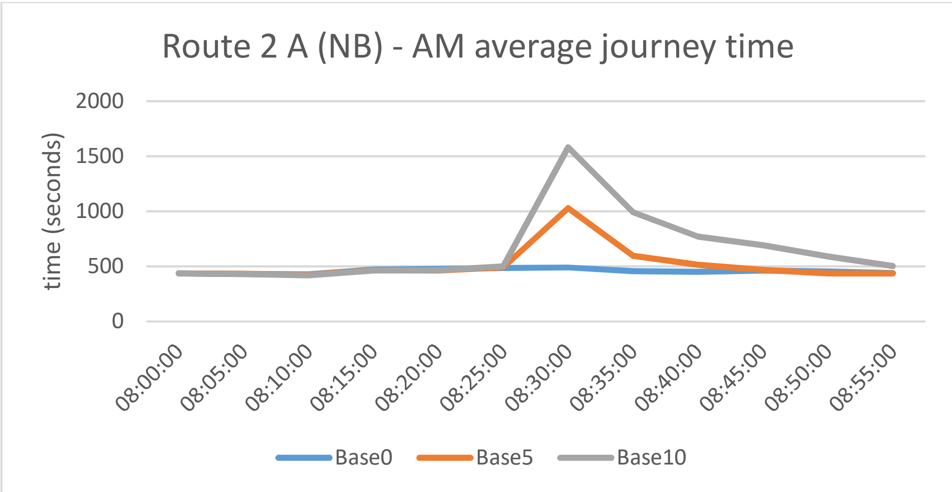


Figure 3.47~~4047~~ - Route 1B - AM average journey time



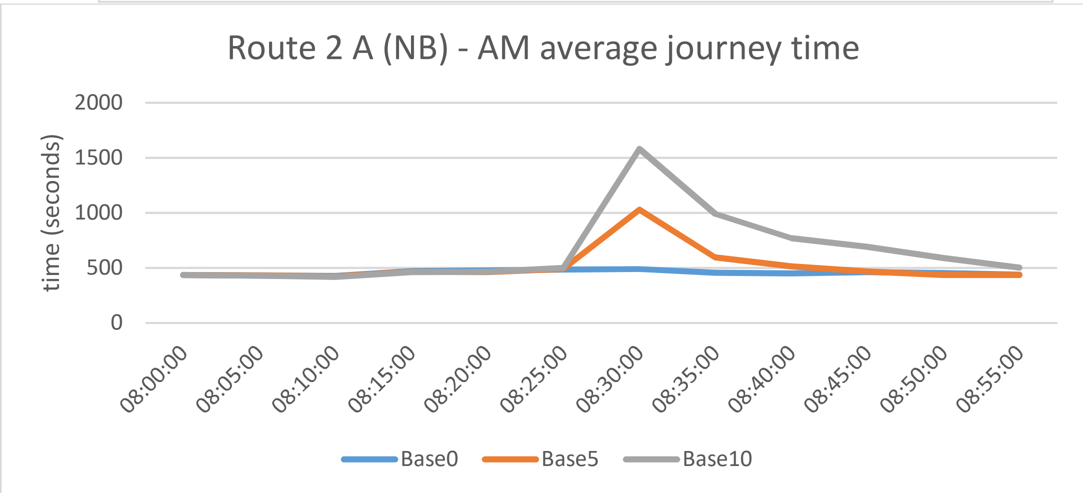
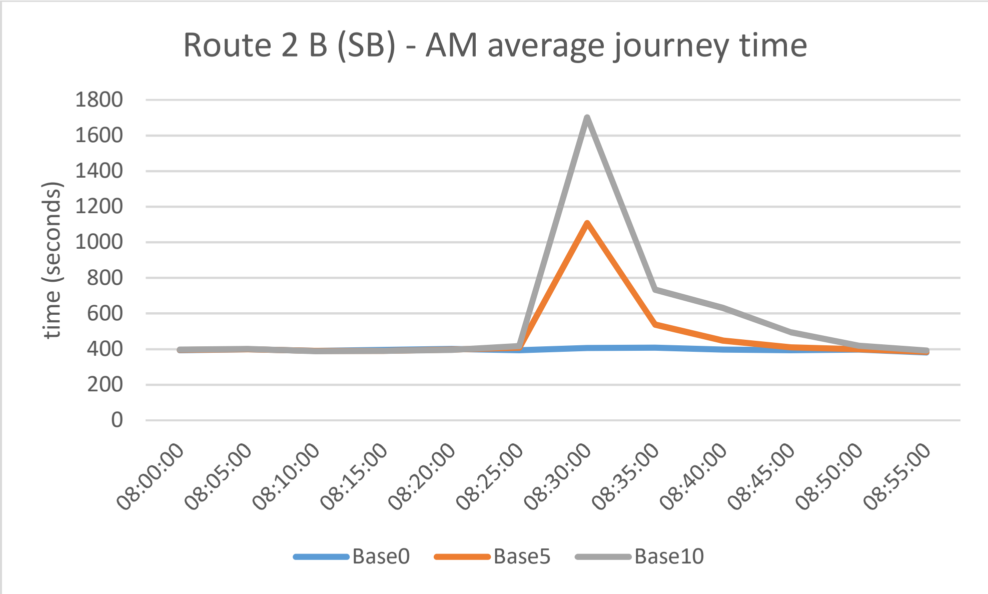


Figure 3.48~~4148~~ - Route 2A - AM average journey time



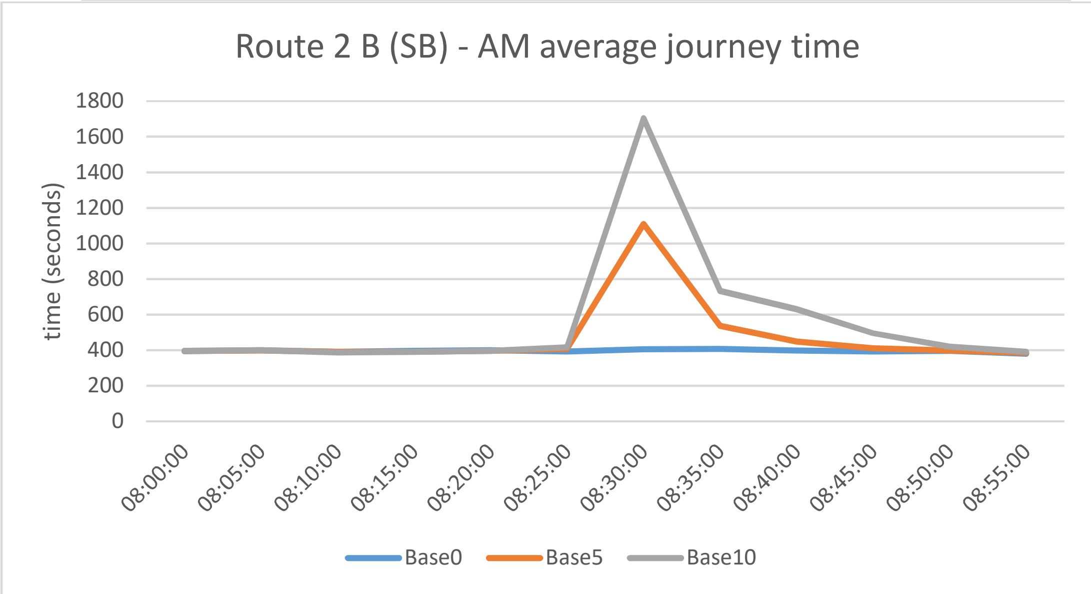
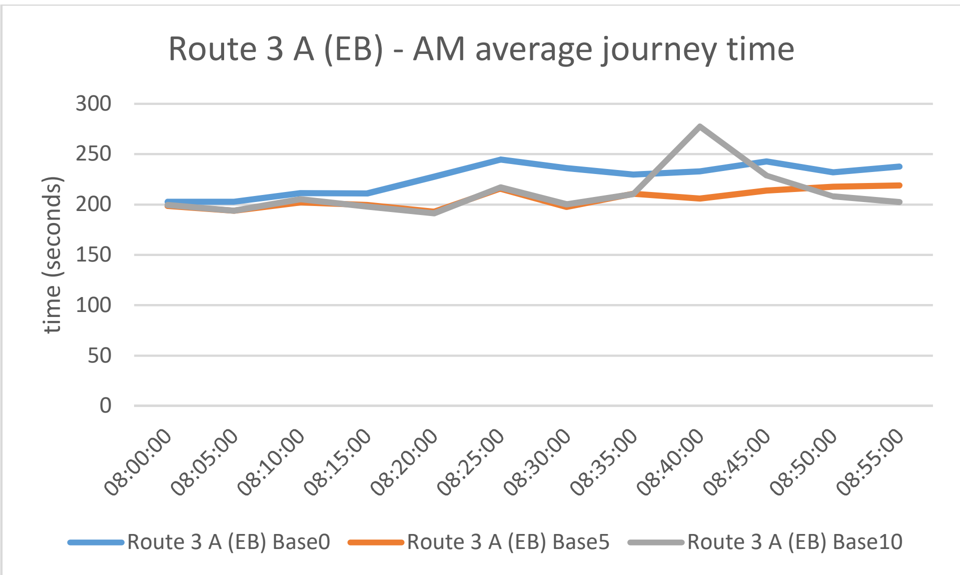


Figure 3.494249 - Route 2B - AM average journey time



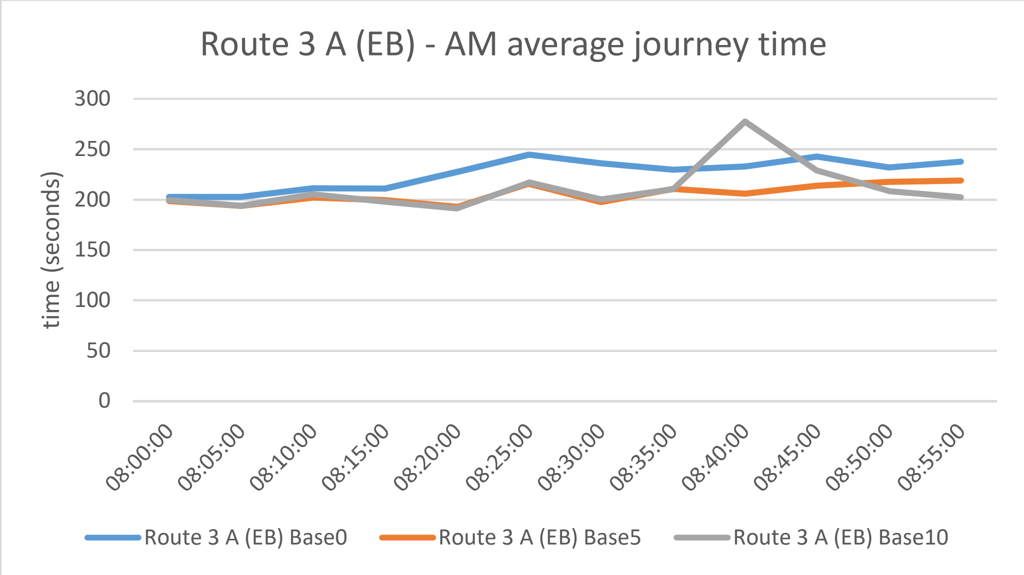
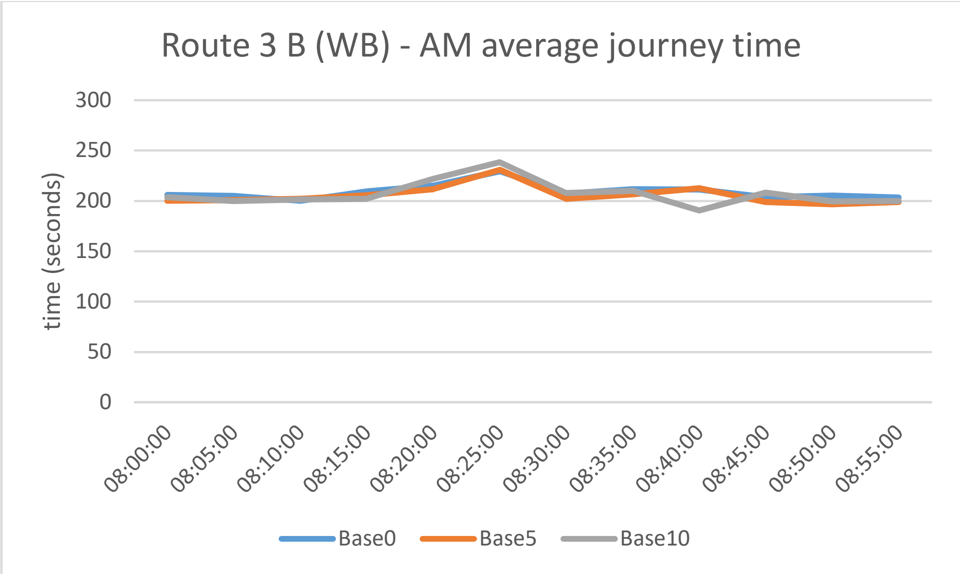


Figure 3.50~~43~~50 - Route 3A - AM average journey time



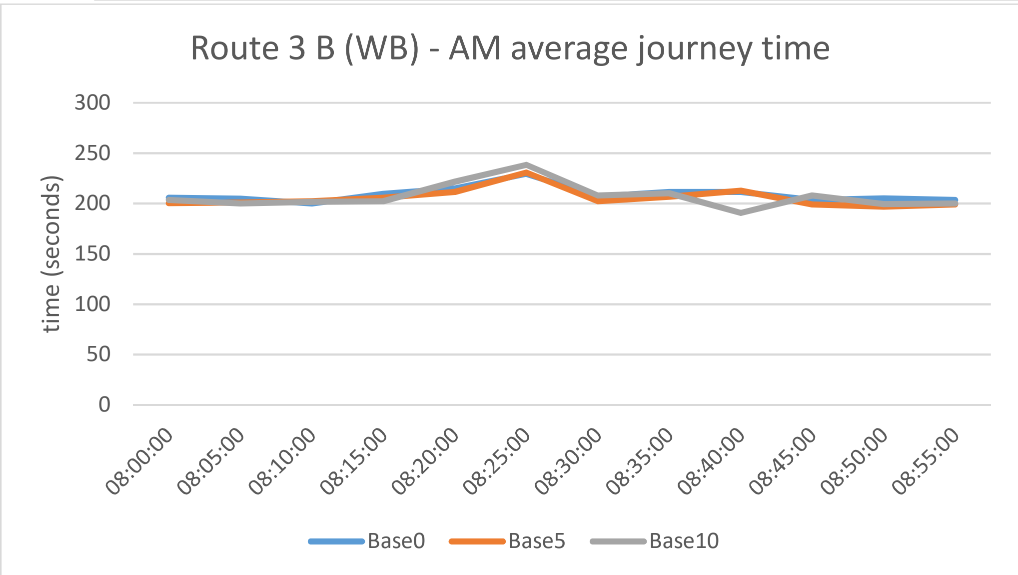
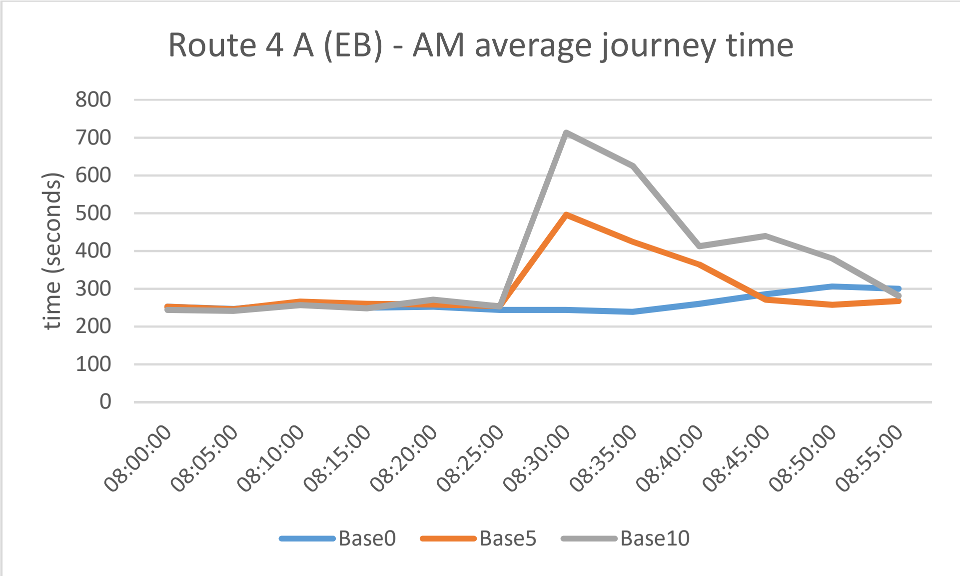


Figure 3.51~~44~~51 - Route 3B - AM average journey time



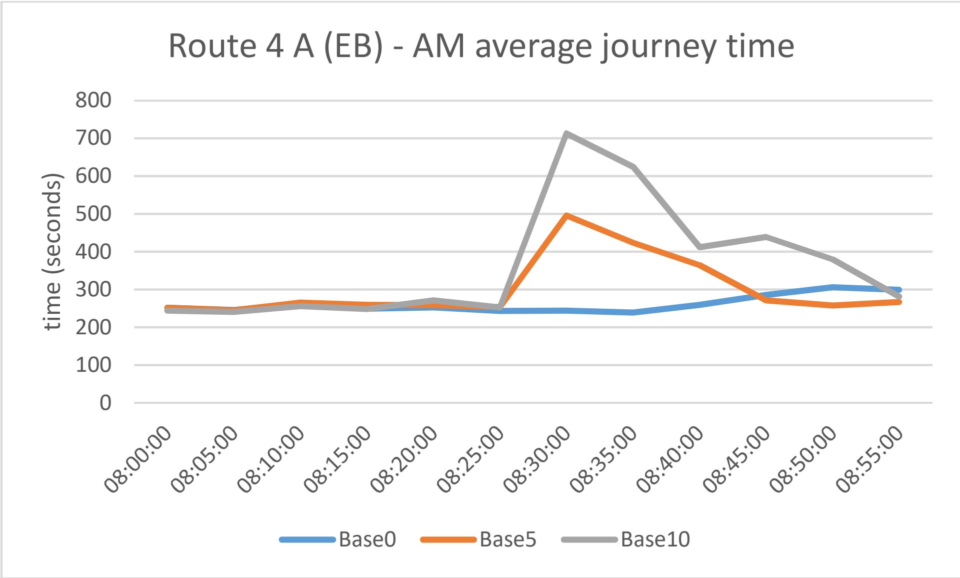
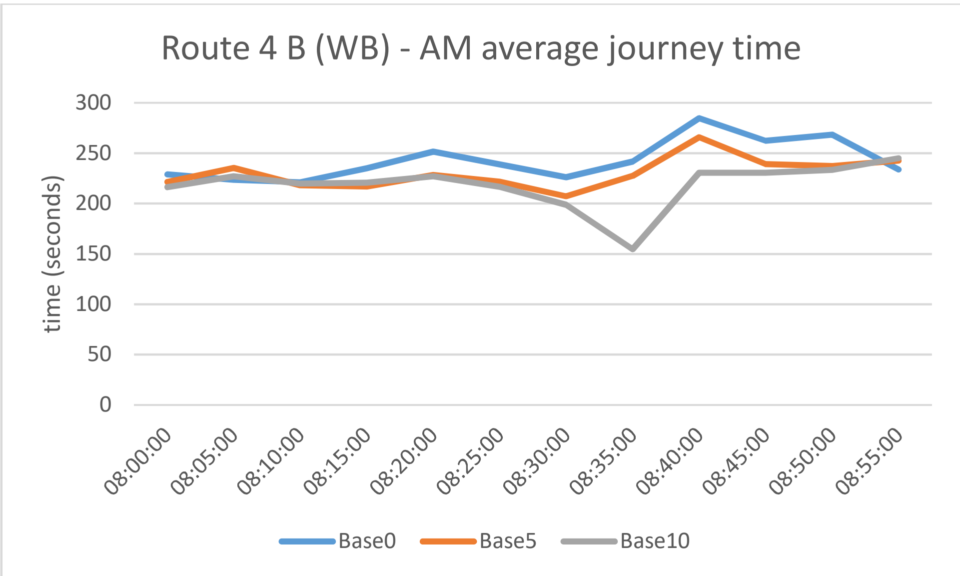


Figure 3.52~~45~~52 - Route 4A - AM average journey time



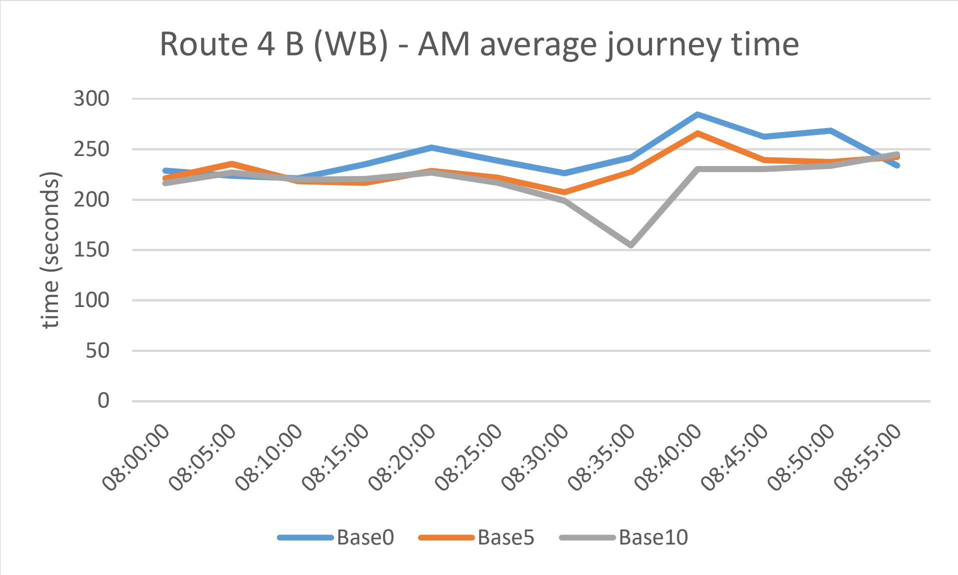
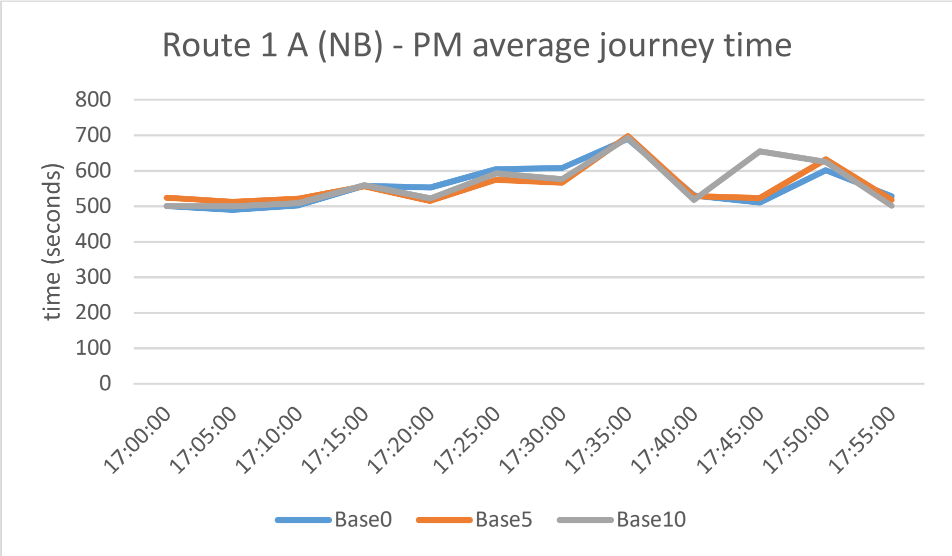


Figure 3.53~~46~~53 - Route 4B - AM average journey time

~~3.14.30~~3.14.40 It is clear from the graphs that the lifting of the A47 Bascule Bridge (at around 08:30) has a large impact on the average journey time on key routes. Routes 2A and 2B are directly affected as they cross the A47 Bascule Bridge. On route 2A (northbound), average journey time increases from around 500 seconds (8 minutes, 20 seconds) and peaks at 1000 seconds (16 minutes 40 seconds) when there is a five minute lift, and 1500 seconds (25 minutes) when there is a ten minute lift. After the bridge re-opens to traffic, journey time decreases to normal by 08:45 with a five minute lift. With a ten minute lift, journey time decreases but is still higher than normal at the end of the modelled period. A similar pattern is seen on route 2B (southbound). Normal journey time is around 400 seconds (6 minutes 40 seconds), whereas peak journey time is around 1100 seconds (18 minutes 20 seconds) with a five minute lift and over 1600 seconds (26 minutes 40 seconds) with a ten minute lift. In the ten minute lift scenario, journey time does decrease back to normal by around 08:50.

~~3.14.31~~3.14.41 Route 1A and 1B cross the Mutford Bridge in the northbound and southbound direction respectively. ~~, with the bridge remaining open to traffic throughout the modelled peak hours.~~ Although not directly crossing the lifted bridge, the northbound route does experience some journey time delay as a result of the A47 Bascule ~~b~~Bridge lift. This is likely due to delay experienced right at the end of the route, as the queue extends back from the bridge and affects upstream junctions. On the southbound route crossing the Mutford Bridge, there is a very small effect towards the end of the hour, but it is minimal.

~~3.14.32~~3.14.42 Route 4B has a higher average journey time in the base scenario than the two scenarios where the A47 Bascule ~~b~~Bridge lifts. Looking further at the route sections, it can be seen that the difference occurs at the roundabout where Denmark Road meets the journey time route. This suggests that the A47 Bascule ~~b~~Bridge lift is preventing traffic from travelling along Denmark Road and joining the journey time route at the roundabout, leading to less congestion and a lower journey time on that route.



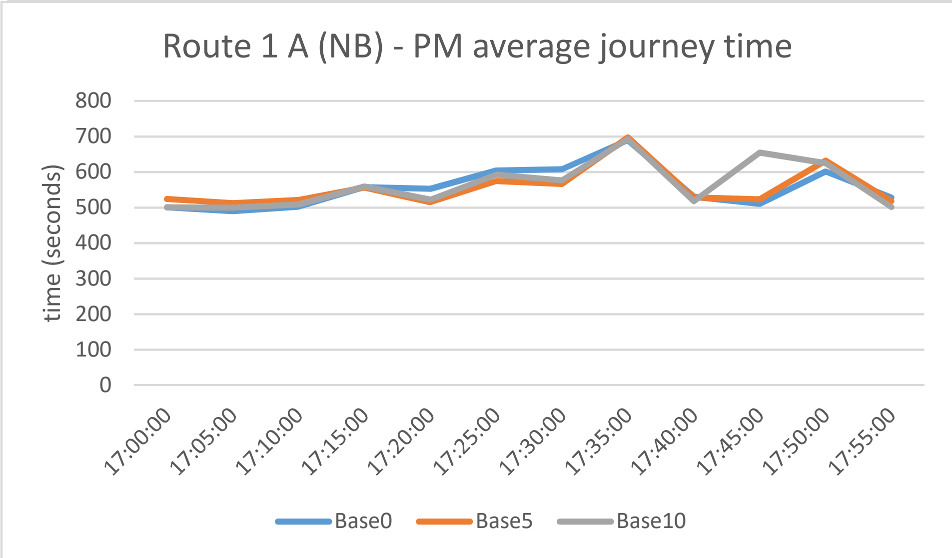
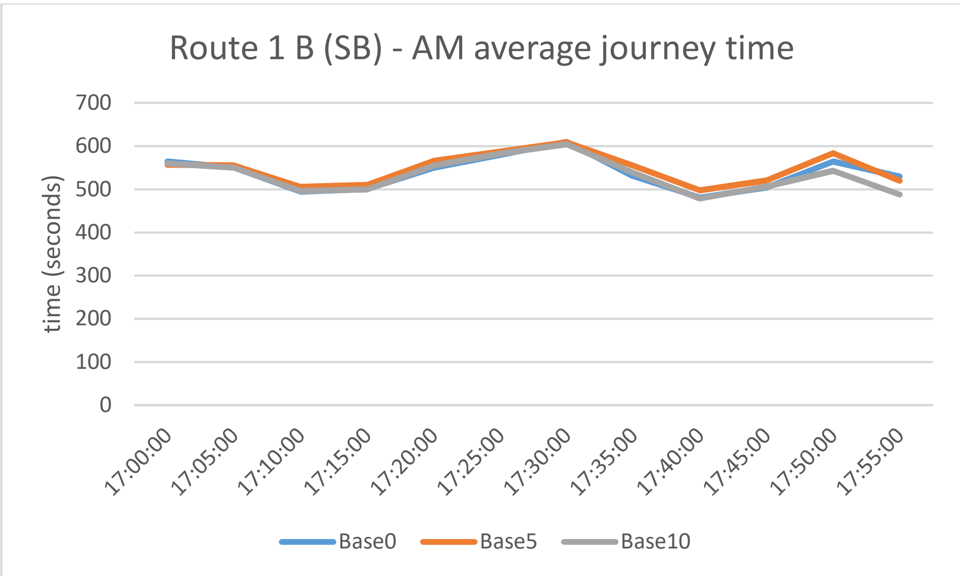


Figure 3.544~~754~~ - Route 1A - PM average journey time



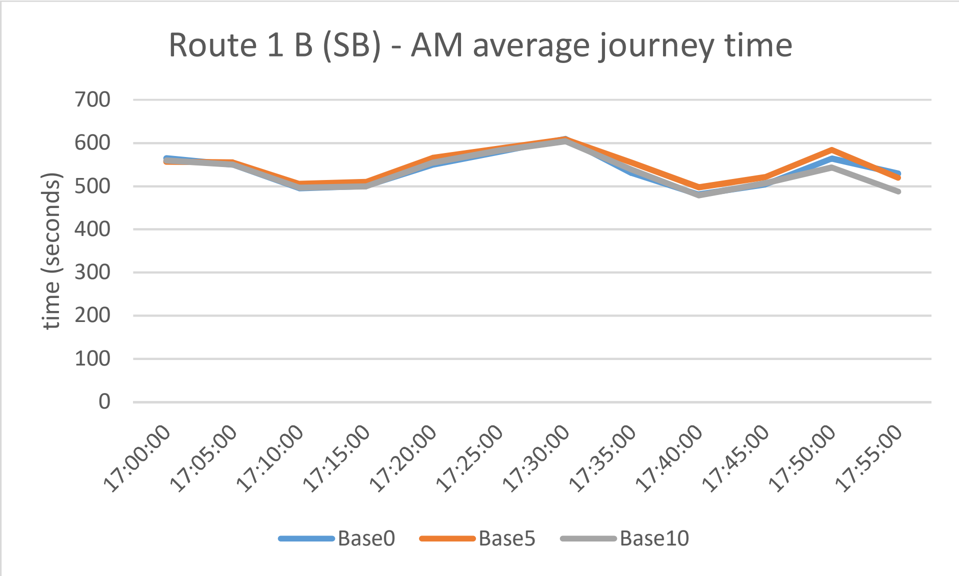
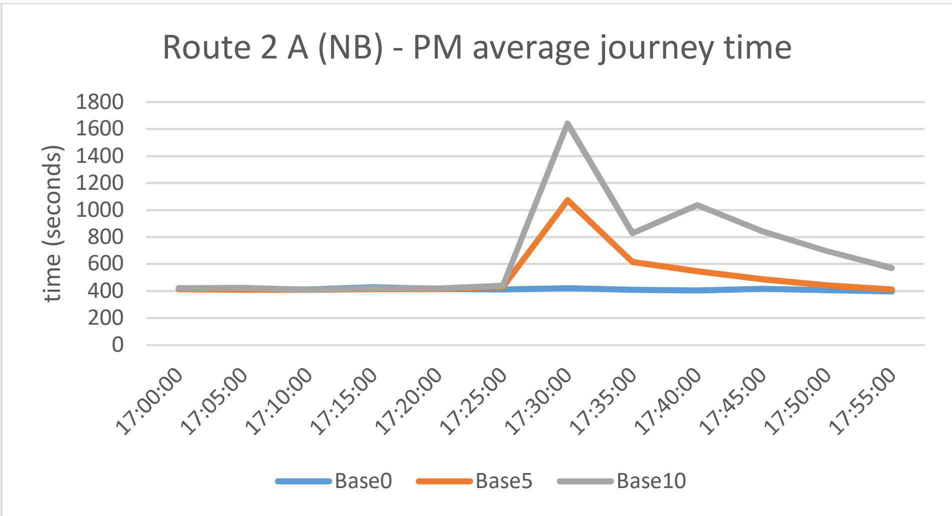


Figure 3.55~~48~~55 - Route 1B - PM average journey time



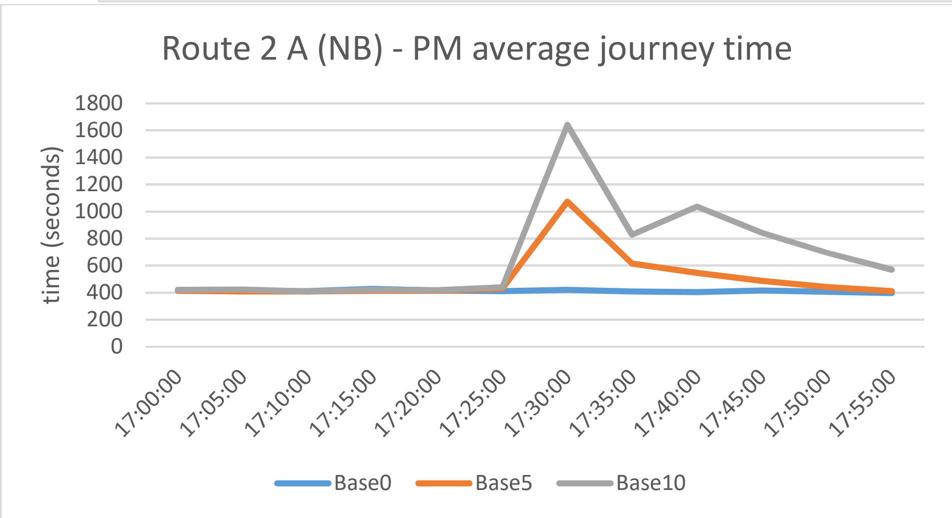
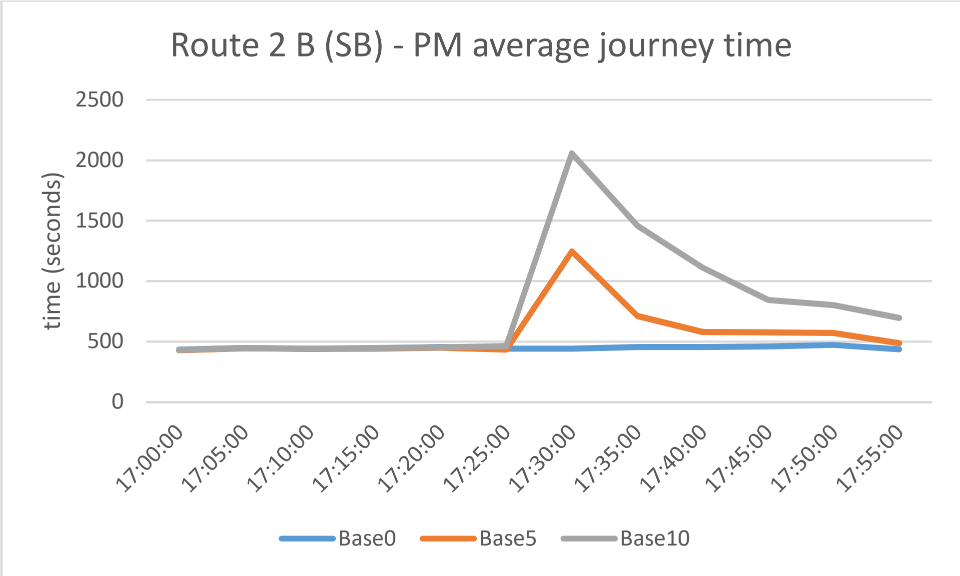


Figure 3.56~~49~~56 - Route 2A - PM average journey time



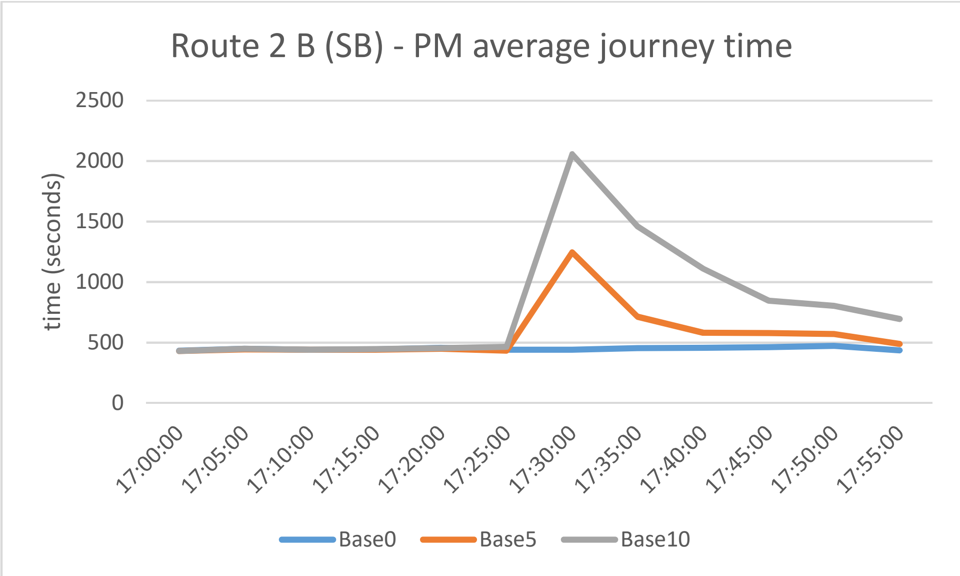
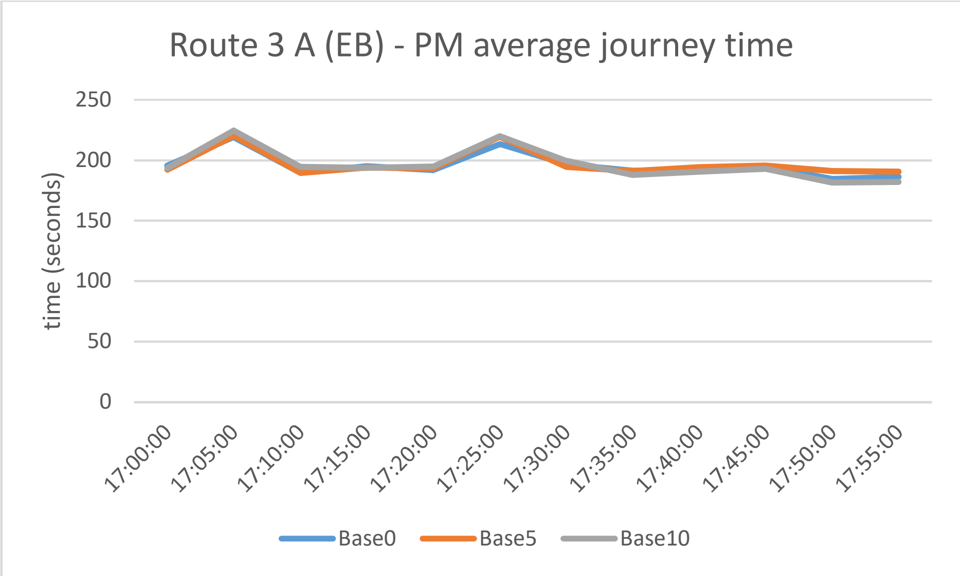


Figure 3.57~~50~~57 - Route 2B - PM average journey time



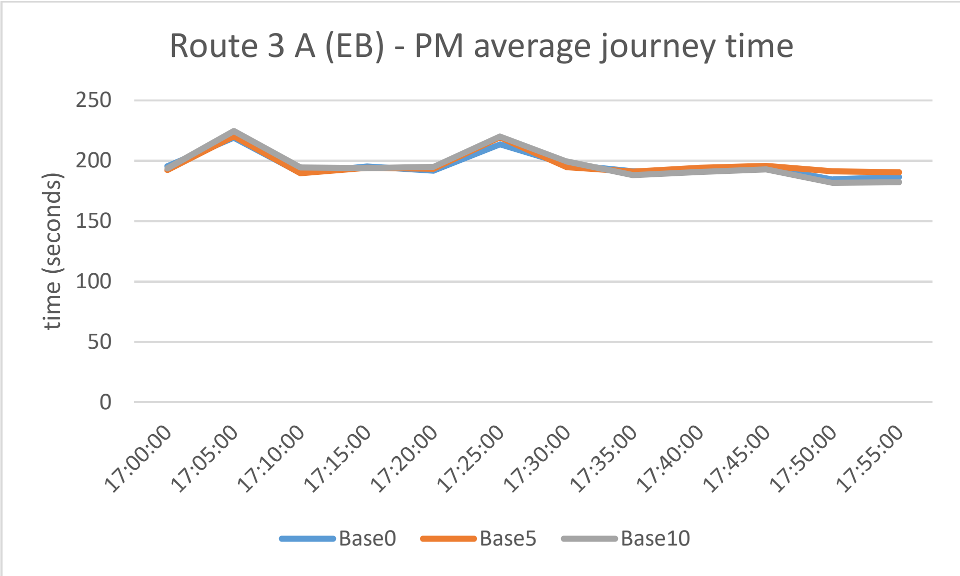
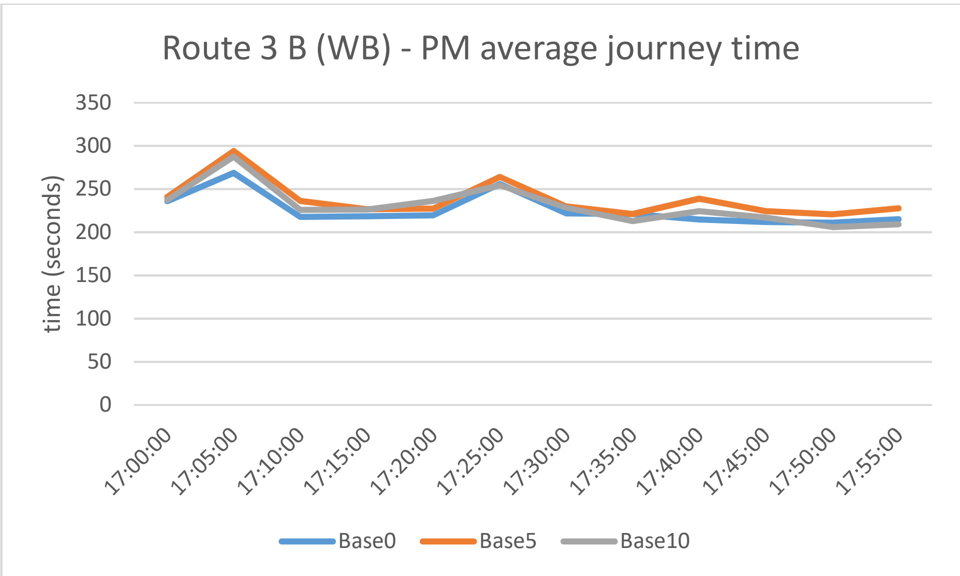


Figure 3.58~~51~~58 - Route 3A - PM average journey time



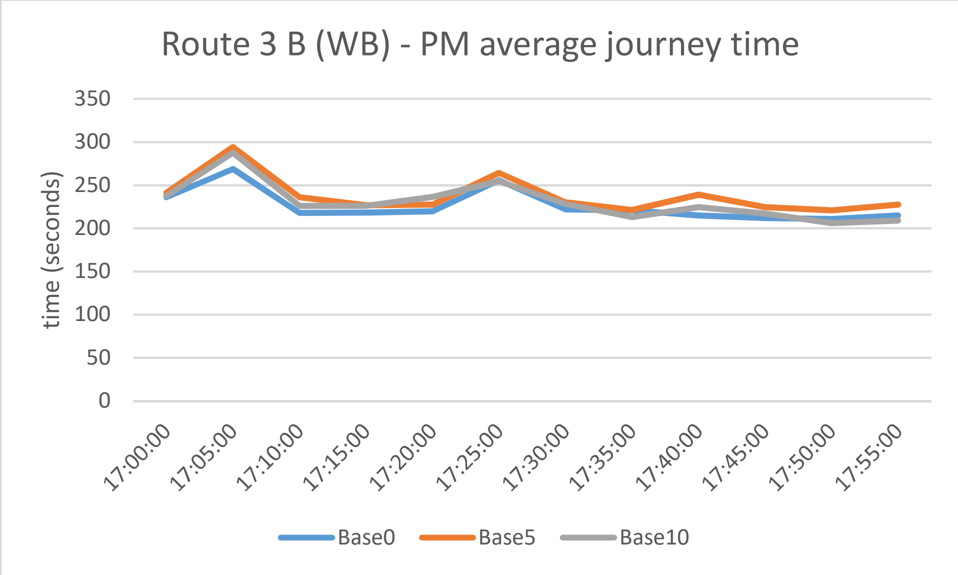
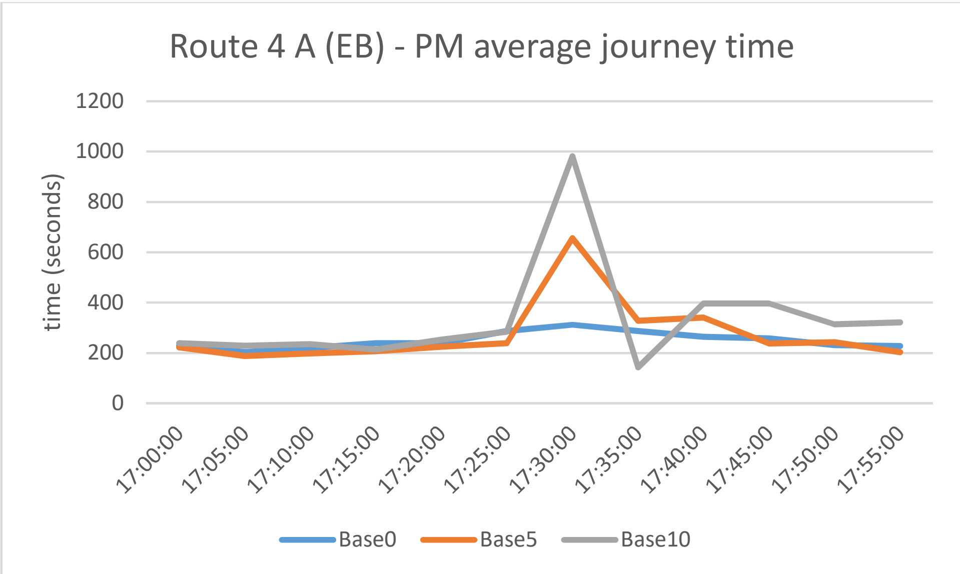


Figure 3.59~~52~~59 - Route 3B - PM average journey time



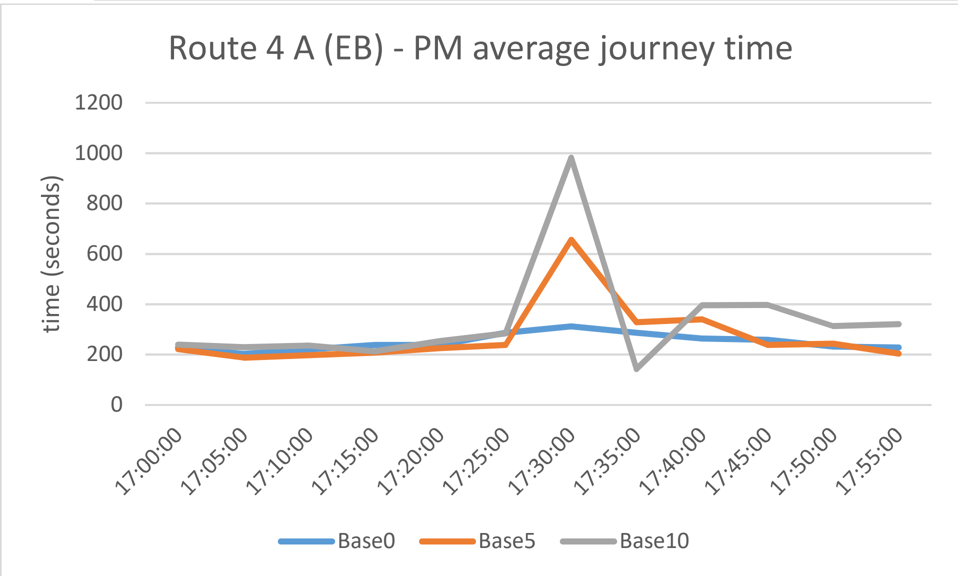
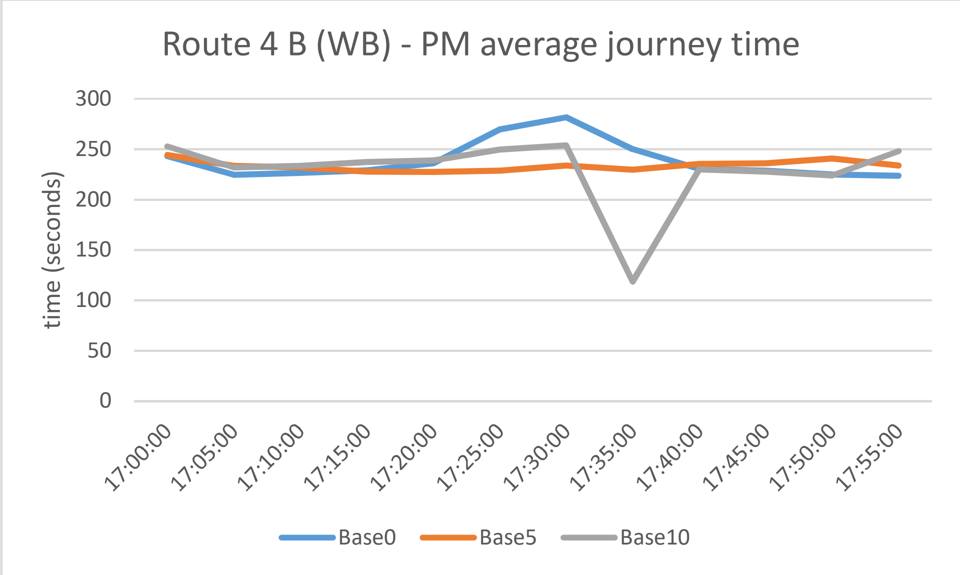


Figure 3.60~~53~~60 - Route 4A - PM average journey time



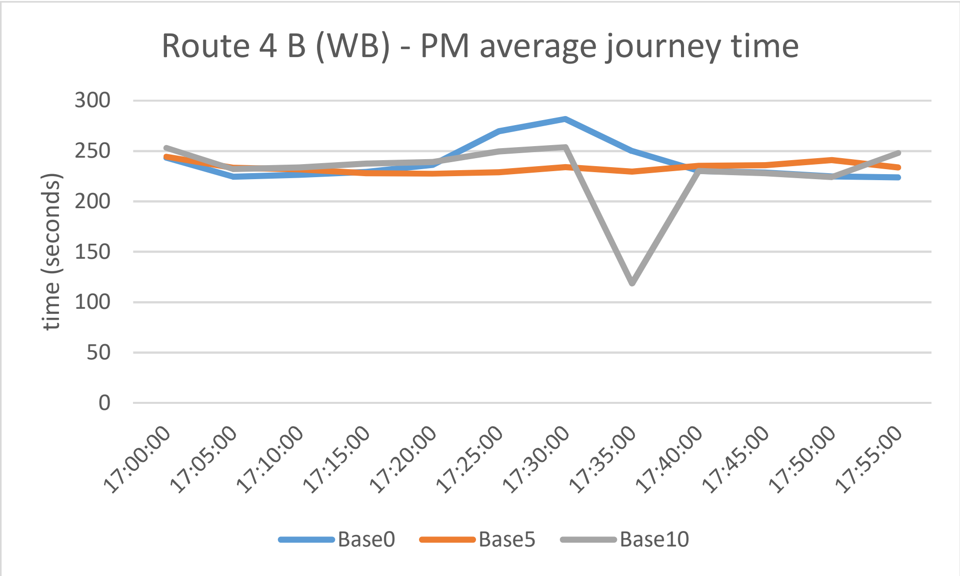


Figure 3.61~~5461~~ - Route 4B - PM average journey time

~~3.14.33~~3.14.43 A similar pattern can be seen in the PM on the key north-south routes as in the AM (with at ~~bridge~~ lift of A47 Bascule Bridge at around 17:30). Journey time increases to a peak of four times the normal value in the ten minute lift scenario: 400 seconds (6 minutes 40 seconds) to 1600 seconds (26 minutes 40 seconds) on the northbound route, and 500 seconds (8 minutes, 20 seconds) to 2000 seconds (33 minutes 20 seconds) on the southbound route. In the five minute lift scenario, journey time on both routes more than doubles at the time of the lift. Journey time decreases gradually and in the five minute lift scenario is back to normal on both routes by the end of the modelled hour. In the ten minute lift scenario, journey time is around 50% higher than normal at the end of the modelled hour, meaning the lift affects traffic across the entire latter half hour

~~3.14.34~~3.14.44 Journey times across the Mutford Bridge on routes 1A and 1B are similar in all three scenarios for much of the modelled hour. There is a small effect in the 10 minute A47 Bascule Bridge lift scenario on both the northbound and southbound routes. For the northbound route, this is right at the end and likely to represent the queuing back from the bridge at the very end of the route. On the southbound route, journey time actually decreases slightly in the ten minute lift scenario. This is possibly because the bridge lift stops traffic from getting to the route, thereby lessening congestion and thus journey time.

~~3.14.35~~3.14.45 Similarly, to the AM peak, Route 4B has a higher average journey time in the base scenario than the two scenarios where the bridge lifts. Again, this suggests that the A47 Bascule ~~b~~Bridge lift is preventing traffic from travelling along Denmark Road and joining the journey time route at the roundabout, resulting in less congestion and a lower journey time for that route.

~~3.14.36~~3.14.46 The analysis of the journey times across the various routes through the town show that there is considerable variability in journey times depending on whether the A47 Bascule Bridge is lifted (whether for five or ten minutes) or is open to traffic. The result of this for local residents and businesses across Lowestoft is that there is little certainty around journey time reliability, with journeys potentially taking up to four times longer than average if the A47 Bascule Bridge is lifted.

3.15 Collisions

3.15.1 Figure 3.~~55~~62 shows the locations of all injury collisions in the study area in the five-year period July 2012 to August 2017[24]. There are noticeable groups of collisions focused on:

- A47 Bascule Bridge and its approaches;
- A12 Tom Crisp Way / Bloodmoor Road / A1145 / Castleton Avenue;
- A47 Yarmouth Road / Millennium Way
- A12 at Horn Hill; and
- A1117 Bridge Road (the northern approach to Mutford Bridge).

[24] STATS 19 data, July 2012 – December 2014, Data from January 2015 – August 2017 provided by Suffolk County Council

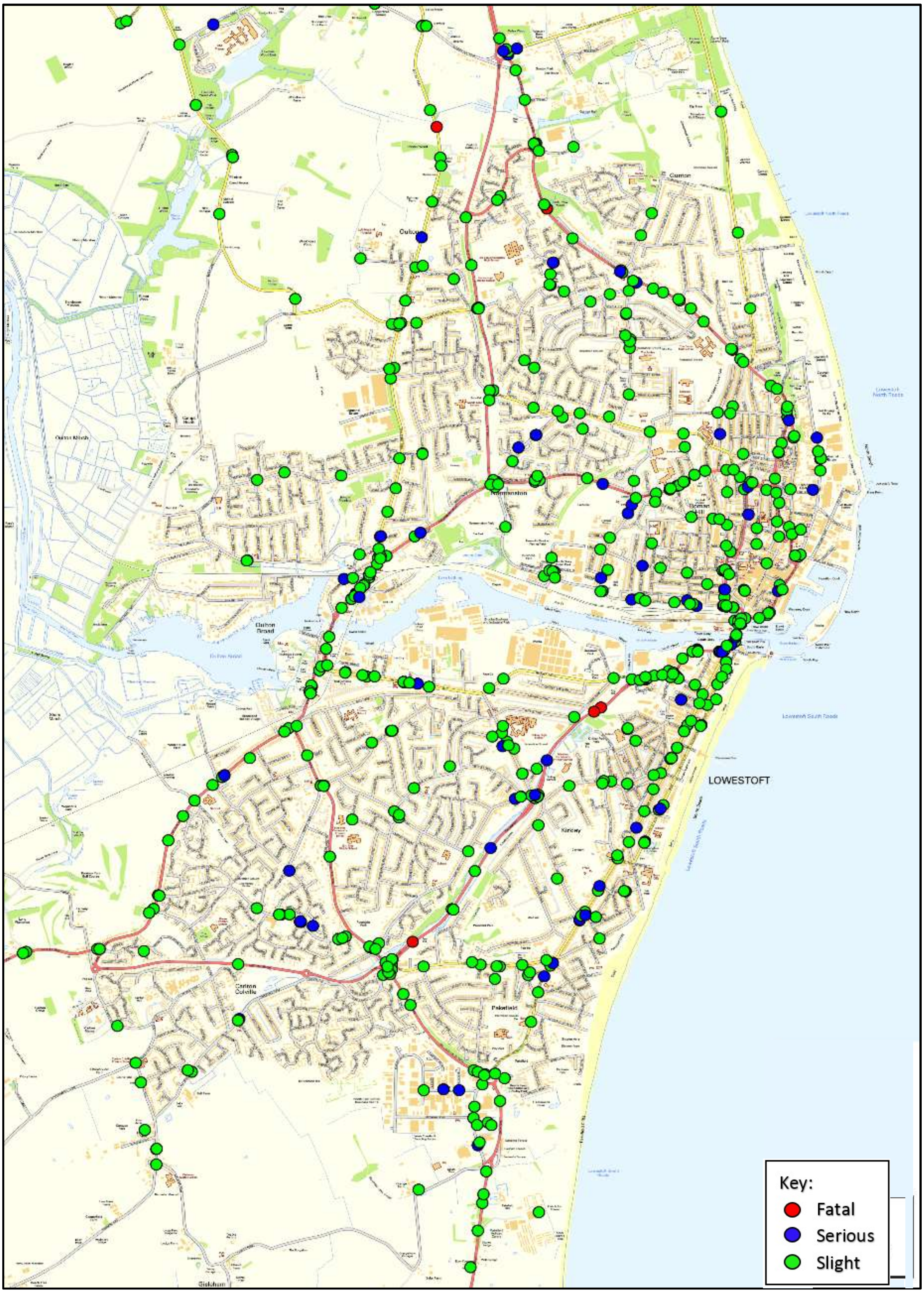


Figure 3.62~~5562~~: Collisions by Severity in Lowestoft, between 2012 and 2017 (Contains OS data © Crown copyright and database right: 2017)

3.15.2 There are also significant numbers of collisions on the busy routes leading to and from the existing crossings, especially on the A12 via the A47 Bascule Bridge, which is a major through route within Lowestoft. Figure 3.~~56~~63 shows collisions in the Lake Lothing area. Figure 3.~~57~~64 and Figure 3.~~58~~65 show the collisions around the existing bridges.

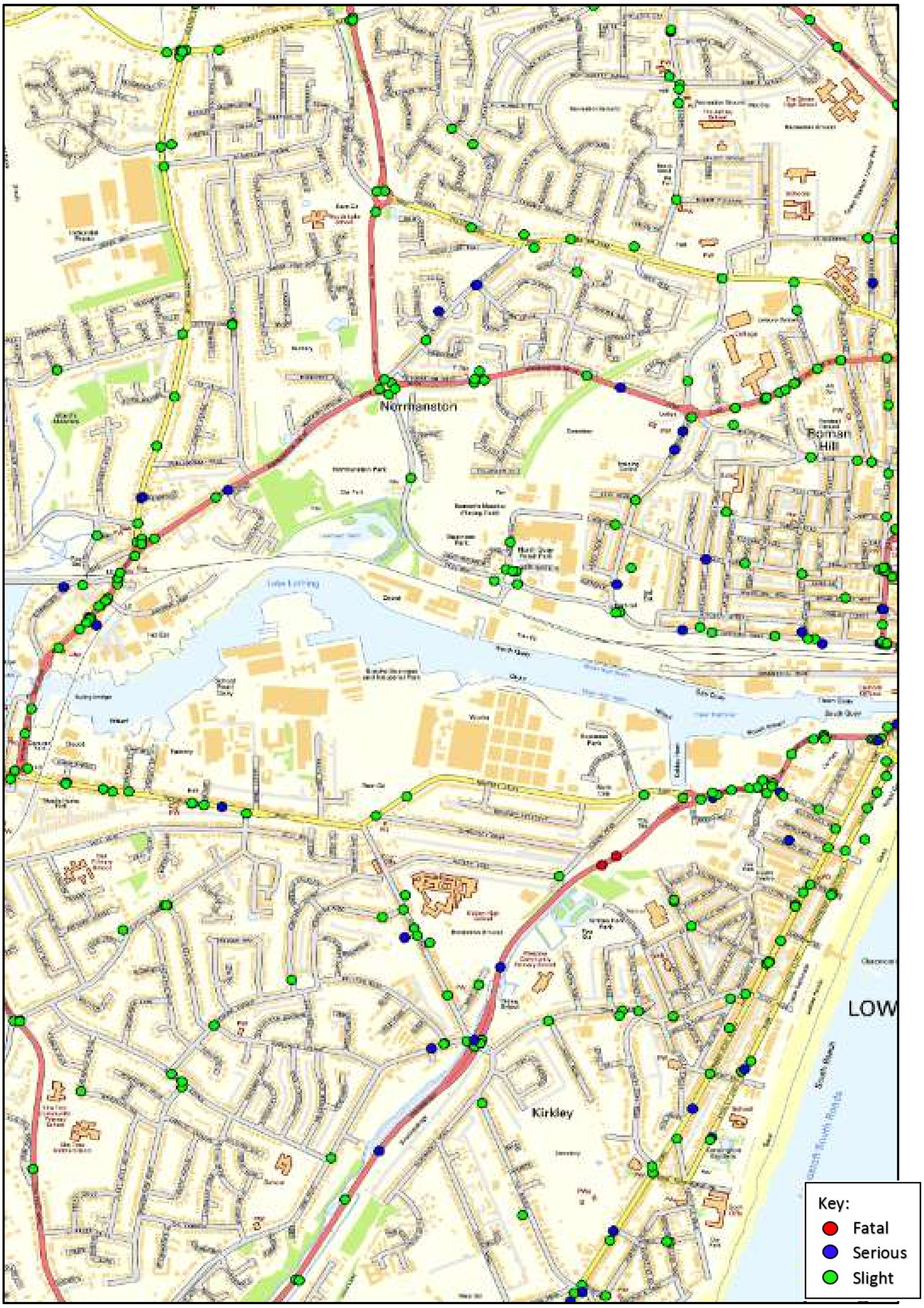


Figure 3.63~~56~~63: Collisions by Severity at Lake Lothing, between 2012 and 2017 (Contains OS data © Crown copyright and database right: 2017)

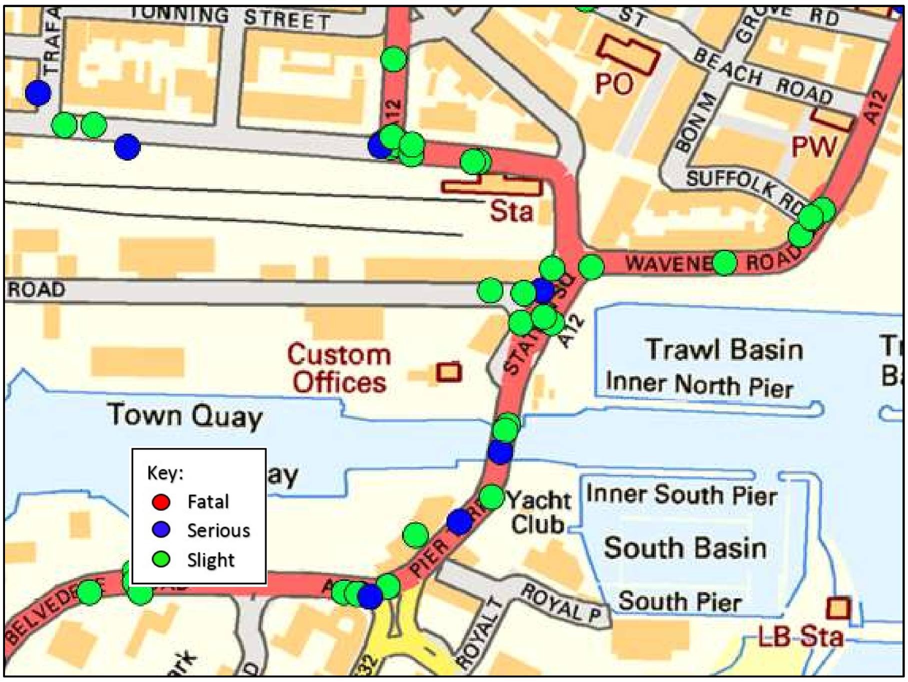


Figure 3.64~~57~~64: Collisions by Severity at A47 Bascule Bridge, between 2012 and 2017 (Contains OS data © Crown copyright and database right: 2017)

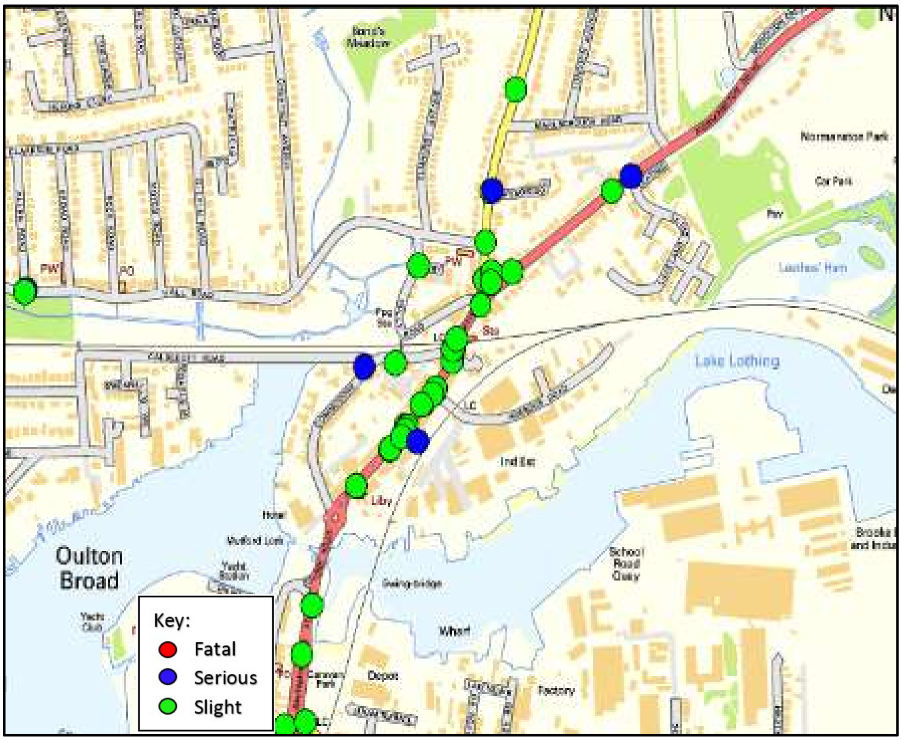


Figure 3.65~~58~~65: Collisions by Severity at Mutford Bridge, between 2012 and 2017 (Contains OS data © Crown copyright and database right: 2017)

3.15.3 Table 3.23 summarises the injury collision data for the junctions included within the TA scope (listed in Paragraph 3.7.1) between July 2012 and August 2017.

Junction	No. of Collisions	Slight	Severe	Fatal
1. A47 Yarmouth Road / A1117 Millennium Way	8	8	0	0
2a. A47 Katwijk Way / A1144 St Peter's Street	4	3	1	0
2b. A47 Artillery Way / A47 Jubilee Way / A47 St Peter's Street	2	2	0	0
3. A47 Waveney Road / Station Square / Commercial Road	6	5	1	0
4. A12 Pier Terrace / B1532 London Road South	5	4	1	0
5. A12 Belvedere Road / Mill Road / Kirkley Rise	9	8	1	0
6. A12 Tom Crisp Way / A12 Horn Hill / B1531 Waveney Drive	4	3	1	0
7. B1531 Victoria Road / B1531 Waveney Drive / Kirkley Run	0	0	0	0
8a. A12 Tom Crisp Way / Blackheath Road	4	3	1	0
8b. Kirkley Run / Blackheath Road / Long Road	0	0	0	0
8c. Blackheath Road / Carlton Road.	1	1	0	0
9a. A12 Tom Crisp Way / Bloodmoor Road / A1145 / Castleton Avenue	13	10	3	0
9b. A1117 Elm Tree Road / Long Road / A117 Bloodmoor Road	5	5	0	0
10. A1117 Bridge Road / A1117 Saltwater Way / B1531 Victoria Road	2	2	0	0
11. A1117 Normanston Drive / B1375 Gorleston Road	4	4	0	0
12. Peto Way / Denmark Road / Barnards Way	5	5	0	0
13. Denmark Road / Rotterdam Road	2	2	0	0
14. A1117 Normanston Drive / A1117 Peto Way	5	5	0	0
15. A1144 Normanton Drive / Rotterdam Road	1	1	0	0
16. B1531 Waveney Drive / Riverside Road / Durban Road;	1	1	0	0
19. A47 Katwijk Way / Denmark Road	8	7	1	0
20. B1351 Waveney Drive / Kimberley Road	1	1	0	0
Total	**89**	**79**	**10**	**0**

Table 3.23: Summary of Injury Collisions at Junctions to be assessed between 2012 and 2017

3.15.4 There was a total of 89 injury collisions at the above junctions. The highest number was at the A12 Tom Crisp Way / Bloodmoor Road / A1145 / Castleton Avenue junction where there were 13 collisions during the 5 year period. There were no fatal collisions at any of the junctions in the study area.

3.15.5 The number of collisions across the network is not overly excessive, with on average 4.5 collisions per junction over the 5 year period, or broadly an average of one collision per junction per year. Of the collisions recorded at the junctions, 0% were fatal, 11% were serious and the overwhelming majority of 89% were collisions resulting in slight injuries to casualties.

3.15.6 The incidence of killed or seriously injured collisions within the study area is proportionally lower than the national statistics for road collisions[25] in 2016, which show fatal collisions

[25] Table RAS10004, Reported accidents by severity, number of casualties involved, built-up and non-built-up roads and road class, Great Britain, 2016

comprising 1% of all collisions, serious injury collisions at 16% and slight injury collisions at 83%.

3.15.7 Feedback from the consultation events completed for the DCO suggests that one potential cause of collisions on Horn Hill relates to drivers not 'respecting the merge lane', and using the outside lane to drive up to the front of the queue rather than wait in the nearside lane. Whilst this is an acceptable (and designed) use of road space, drivers may not be expecting merging vehicles and hence collisions can occur.

3.16 Parking

Waveney District Residents Parking Scheme

3.16.1 A residents' parking scheme is in place by WDC to help residents in Lowestoft park close to their homes. It only applies to residents of certain streets and designated areas in the town centre. Permits are provided for an annual fee, with only one permit allowed per household. In residents' parking areas where there is no provision for parking on the street, a permit is available for a designated car park.

3.16.2 These residents' parking and permit schemes are located in:

- Belvedere Road (Mill Road and St. Johns Road);
- Pakefield Road (Pakefield Road);
- Pakefield Street (Pakefield Street);
- Nicholas Everitt Park, Oulton Broad (Bridge Road, Lowestoft); and
- Clifton Road (Beaconsfield Road and Clifton Road).

Parking Restrictions

3.16.3 Neither parking nor stopping is allowed on Peto Way. This prohibition is enforced with the presence of 'Clearway' signs.

3.16.4 There are double yellow lines on Riverside Road starting from the B1531 Waveney Drive and ending at the junction with Canning Road. On the southbound side the double yellow lines stop approximately 10 metres before the junction, while on the northbound side they continue for another 10 metres after the junction.

3.16.5 Starting from the A12 roundabout and moving west, there are double yellow lines on either side of Waveney Drive. These lines end approximately 10 metres after the signalled junction with Riverside Road.

Access to Employment

3.16.6 The land in the southern vicinity of the Scheme is characterised by employment use, including that within the Riverside Business Park. The main access to businesses located on this land is provided by Riverside Road, via the B1531 Waveney Drive, which connects onwards to Canning Road. The current businesses served directly by Riverside Road include:

- Nexen Lift Trucks; and
- Riverside, the shared offices of SCC and WDC.
- MotorLings and its tenant, Enterprise

3.16.7 Riverside has a staff and visitor car park, which is accessible via Riverside Road or Canning Road. A total of 208 car parking spaces are provided for users of the Riverside; including 166 staff spaces, 26 visitor spaces, 9 disabled spaces, 4 electric vehicle spaces and 3 spaces for staff with heavy items which are used for work purposes. However, demand for parking is greater than supply which results in daily 'overspill' with vehicles parking on Riverside Road

3.16.8 Nexen Lift Trucks does not allow staff parking on site, so they park on Riverside Road. An image of the parking showing on-site parking and parking along Canning Road/Riverside Road is provided in Figure 3.~~59~~66 below.

Figure 3.~~66~~~~59~~66 Riverside Road/Canning Road Parking Provision

3.16.9 Parking surveys completed over a week[26] in May 2018 recorded between 46 and 77 vehicles parked on Riverside Road and Canning Road in the AM and PM peak hours. The average number of vehicles parked on-street was 59 vehicles.

3.16.10 The current premises served by Canning Road include:

- Essex & Suffolk Water;
- NWES Property Services Ltd's Riverside Business Centre;
- Riverside (see above);
- Riverside Children and Families' Centre; and

[26] Weekdays only 04/05/2018-11/05/218

- Registry Office (Lowestoft).

3.16.11 The land in the northern vicinity of the Scheme is severed by The East Suffolk Line and therefore can be split into two distinct areas: land north of The East Suffolk Line, and land south of The East Suffolk Line.

3.16.12 Access to land north of The East Suffolk Line is provided by a gated access road on the southern arm of the Denmark Road / Rotterdam Road roundabout. This land is currently vacant and is bordered by Wickes to the west and 'David's Trade Cars' to the east.

3.16.13 Access to the land south of The East Suffolk Line, on the northern lakefront which is also used for employment, is provided by Commercial Road, which connects directly to the A47 approximately 700 metres to the east.

3.16.14 The current businesses in the northern vicinity of the Scheme, located south of the East Suffolk Line and served by Commercial Road include Associated British Ports, AFS Ltd, and ACN Marine.

4 The Scheme

4.1 Introduction

4.1.1 As previously stated, the Scheme is to deliver the third vehicular crossing over the Lake, providing an alternative route of travel for traffic in a north-south direction through Lowestoft. A study of options for the design of the Scheme was undertaken prior to determining the preferred solution for the Scheme. The CftS sets out the assumptions and options analysed as alternatives to the Scheme, presented within this Section of the TA.

4.1.2 The crossing will include:

- A new single carriageway road crossing of the Lake, consisting of a multi-span bridge which comprises:
- an opening bascule bridge over the Lake;
- a bridge over the East Suffolk Line, and reinforced earth embankment joining that bridge to the C970 Peto Way between Rotterdam Road and Barnards Way;
- a bridge over the northern end of Riverside Road providing access to existing commercial property;
- a reinforced earth embankment following the alignment of Riverside Road to a remodelled junction with the B1531 Waveney Drive;
- the closure of Durban Road at its junction with Waveney Drive;
- a new access road from Waveney Drive west of Riverside Road to provide access to existing property at Riverside Business Park that would otherwise become inaccessible due to changes in level on Riverside Road; and
- dedicated provision for cyclists and pedestrians which ties into existing networks.

4.1.3 It is proposed as part of the DCO that the route of the A12 will be reclassified to include the Scheme and to link to the A47 at the new roundabout in the north of Lowestoft at B1385 Corton Long Lane. A ‘Classification of Road Plan’ (document reference 2.7(is submitted with the DCO application and presents the proposals for road numbering and classification.

4.2 Location

4.2.1 The Lake, which is tidal and flows into the North Sea, divides Lowestoft into two parts. This area has suffered greatly from the decline of shipbuilding and traditional industries, and is in need of regeneration. The Scheme will support regeneration by improving access to the Lake area and the Port, and by relieving congestion in the town.

4.2.2 The approximate location of the Scheme is illustrated in Figure 4.1, with a more detailed Scheme drawing shown in Figure 4.2.

Figure 4.1: Location of the Scheme, in the context of Lowestoft [27]
(Contains OS data © Crown copyright and database right: 2017)

[27] The figure shows the Scheme outline for illustrative purposes only. A detailed overview of the Scheme design is included in the ES and other submitted as part of the DCO application.

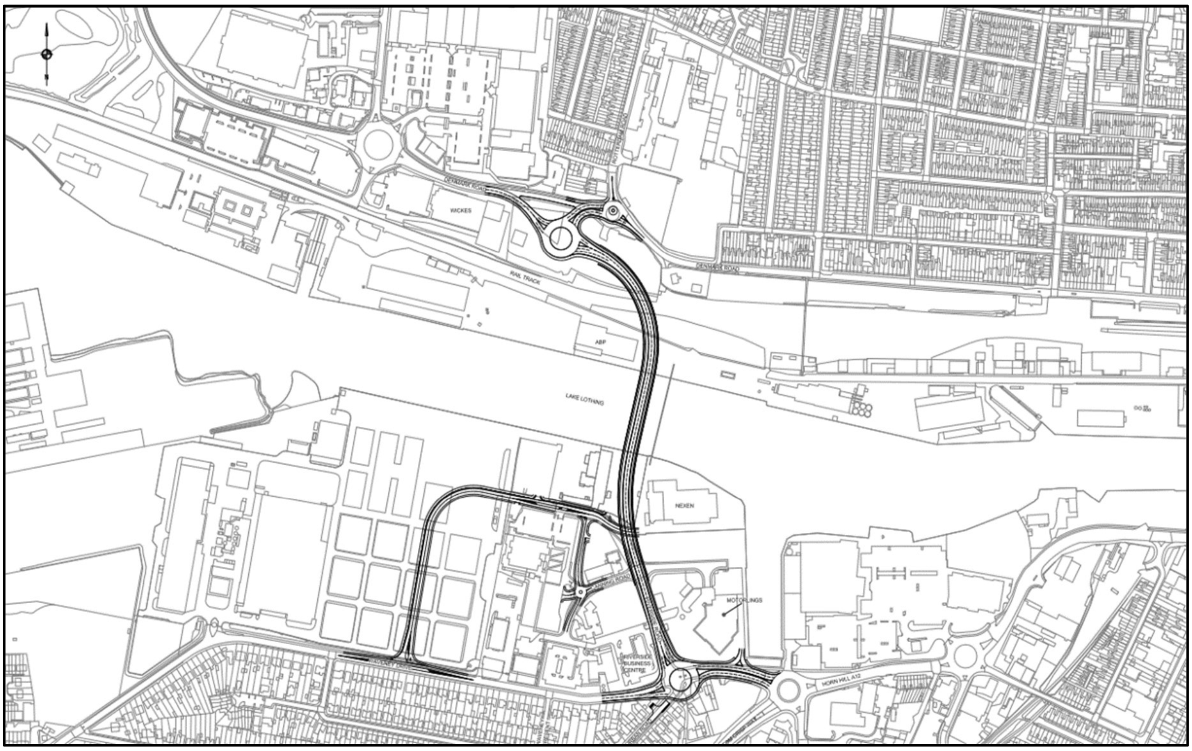


Figure 4.2: Scheme Drawing

4.2.3 The Scheme is well placed in the context of the SRN and connections throughout the East of England, to help alleviate the A47's lack of capacity within Lowestoft. It will provide an alternative route for some of the traffic presently using the Bascule Bridge, reducing congestion and delay.

4.3 The Route

4.3.1 The Scheme would be approximately 1 kilometre long as illustrated in Figure 4.2.

4.3.2 The Scheme will cross the Lake on a "central" corridor between the two existing bridges. This has the advantage of allowing traffic to travel easily between the LNSR (A1117 Millennium Way/Peto Way) and the SLRR (A12 Tom Crisp Way) without using either of the existing bridges, helping to reduce congestion and community severance. Tom Crisp Way was opened in 2007~~10~~ to ease congestion along the A12 and remove traffic from residential areas. The Lowestoft Northern Spine Road was completed in 2015 and allows traffic to reach the northern part of the A47 (formerly the A12) without having to go through the town centre. The Scheme will create a new, direct link between these two strategic routes.

4.3.3 On the north side of the Lake, the Scheme will start from a new roundabout on Denmark Road, west of the existing Peto Way / Denmark Road roundabout, and will span the East Suffolk Line and the Lake on a north – south alignment.

4.3.4 On the south side, the Scheme will follow the line of Riverside Road, descending from the bridge level to a new roundabout at the junction of Riverside Road and B1531 Waveney Drive. To accommodate this roundabout, Durban Road will be closed to motorised traffic at its junction with Waveney Drive. Waveney Drive itself will be improved between this new roundabout and its existing roundabout junction with the A12 Tom Crisp Way, linking the Scheme directly to the A12. Local roads which presently connect directly to Riverside Road will be accessed via a new connection to Waveney Drive.

4.3.5 A new bascule (lifting) bridge will be constructed to allow ships to access the inner harbour. When closed, it will have a clearance of at least 12m above Highest Astronomical Tide (HAT), much higher than that of the existing bridge at the harbour entrance (2.16m above HAT). This means that smaller boats will be able to pass under the new bridge without it needing to be lifted. This, and its location to the west of some of the docks, means that it will have to be opened less often than the existing A47 bascule bridge.

4.3.6 The new bridge will be a single carriageway, with separate footways and cycle tracks linked to existing pedestrian and cycle networks. A new control tower will be located adjacent to the Scheme on the southern bank.

4.3.7 Figure 4.3 and Figure 4.4 respectively show artist's impressions of the new bridge closed and opened for a large vessel.

Figure 4.3: Scheme Representation – Bridge open to traffic

Figure 4.4: Scheme Representation – Bridge Lifted for a Large Vessel

4.4 Northern Junction

4.4.1 The proposed northern access junctions are shown in Figure 4.5 (extracted from the General Arrangement Plans (document reference 2.2)), with an artist's impression shown in Figure 4.6.

4.4.2 On the northern approach, a new roundabout is proposed to be installed to the west of the current Denmark Road / Peto Way roundabout to connect the Scheme with the existing localised road network and spans both the East Suffolk Line and Lake Lothing on a north south alignment. This will also necessitate a reduction in the size of the existing Denmark Road roundabout. Heading south towards the Lake, the new road layout will link into the construction of a new embankment which connects to the elevated bascule bridge, enabling users of the crossing to span the Lake and connect into the new road layout on the southern bank.

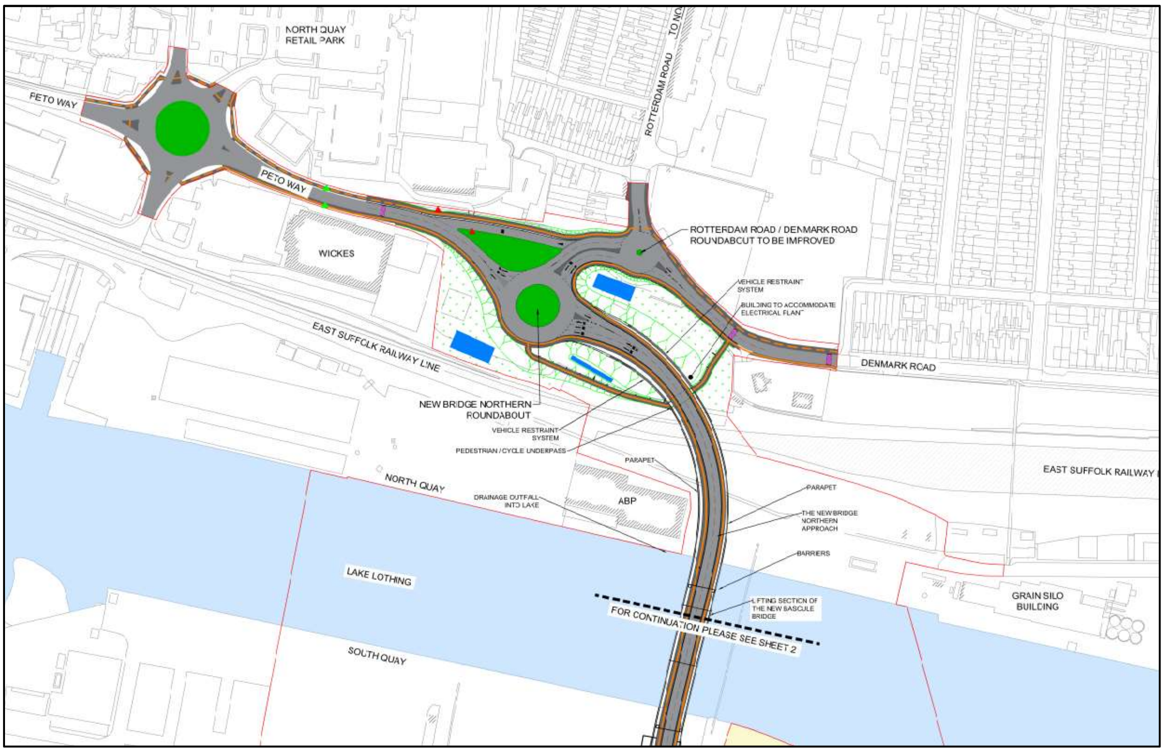


Figure 4.5: Proposed Northern Access

Figure 4.6: Proposed Northern Junction Representation

4.4.3 The northern approach area includes public space and planted drainage ponds to capture surface run-off and increase biodiversity. The area of public space features terraced steps built onto a structural embankment which provide access and allow for informal seating. A wide pedestrian and cycle path provides links with proposed crossing points. These crossing points reflect key desire lines for pedestrians and cyclists, enabling access from the proposed bridge towards the town centre, Lowestoft North Quay Retail Park, the existing play park, and nearby bus stops.

4.5 Southern Junction

4.5.1 The proposed southern access junctions are shown in Figure 4.7 (extracted from the General Arrangement Plans (document reference 2.2)), with an artist's impression shown in Figure 4.8. The full Scheme drawings are submitted separately with the DCO application.

4.5.2 On the southern side, the Scheme follows the line of Riverside Road, initially at a high level, descending to a new roundabout at the junction of Riverside Road and Waveney Drive, west of the MotorLings showroom. To accommodate the roundabout, Durban Road will be closed at its junction with Waveney Drive. Local roads which presently connect directly to Riverside Road will be served from a new connection to Waveney Drive ("new Access Road"). Durban Road will be turned into a cul-de-sac and a turning head provided at the limits of the new southern roundabout. Access will be maintained for pedestrians and cyclists.

4.5.3 Improvements between this roundabout and the existing Waveney Road / Tom Crisp Way roundabout will provide access to the A12. Local roads which presently connect directly to Riverside Road will be served in the main from a new connection to Waveney Drive through the former Jeld Wen site. This will provide access to existing property at Riverside Business Park that would otherwise become inaccessible due to changes in level on Riverside Road.

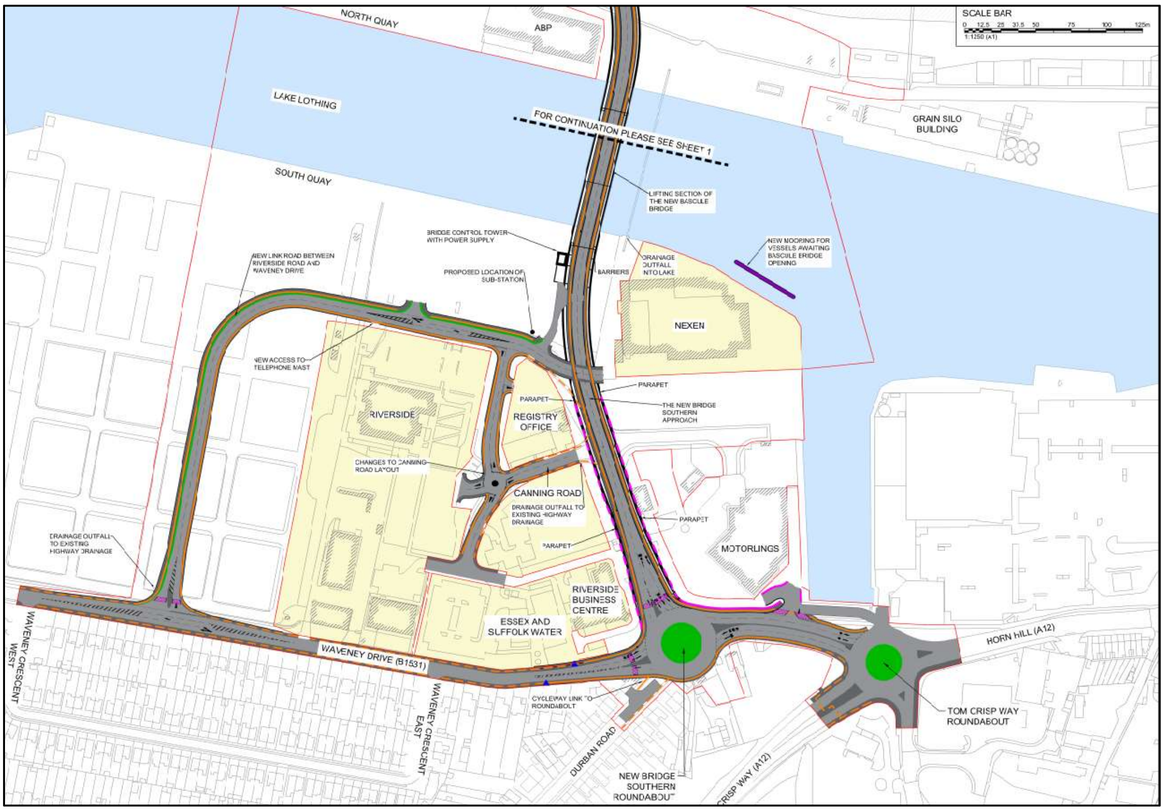


Figure 4.7: Proposed Southern Access

Figure 4.8: Proposed Southern Junction Representation

4.5.4 The closure of Durban Road has been led by the geometric requirements of the roundabout required to ensure sufficient capacity for traffic at the junction and the need to minimise the effect of the proposed southern roundabout on the existing properties to the north and south of Waveney Drive, as explained in the Design Report (Document 7.3). To ensure sufficient capacity is provided, there is a need for two entry lanes on each approach to the roundabout. In order to accommodate the angle of entry of those approach lanes to provide sufficient deflection, the roundabout requires an inscribed circle diameter as has been designed.

4.5.5 As designed, the southern roundabout is forecast to operate at practical capacity in 2037, as demonstrated in the operational assessment for Junction 18 in Section 8 of this TA.

4.5.6 There will no longer be access for vehicles between Durban Road and B1531 Waveney Drive, however access for pedestrians and cyclists will be maintained at the Durban Road/B1531 Waveney Drive junction.

4.5.7 The impact of the closure of Durban Road has been modelled in the junction assessments in Section 8 under the Do Something (DS) scenarios which demonstrate that closing Durban Road does not affect the operation of the junctions in the vicinity of the Scheme.

4.5.8 In order to ensure adequate access can be maintained for larger vehicles to this area and the Waveney Gymnastics Club, some minor changes to kerbs and on-street parking are proposed to be implemented as part of the Scheme. These are detailed in Section 9.

4.5.9 Access to certain land parcels to the south of the Lake will change as a result of the Scheme, as discussed below.

Access to Durban Road

4.5.10 Access to Durban Road will be revised as a result of the closure of the northern end of the road to vehicular traffic. Residents of Durban Road will be required to gain access from the south, via either Kimberley Road or Notley Road.

4.5.11 Access into Durban Road at the northern end will be maintained for pedestrians and cyclists and emergency vehicles.

Access to Waveney Drive Properties

4.5.12 A 'T' junction will be located on Waveney Drive to provide a new Access Road into the remaining section of Riverside Road north of Riverside Road. The new connection from Riverside Road to Canning Road will involve the relocation of the current southern access into the existing SCC and WDC car park.

4.5.13 Access to the existing Nexen site will be provided from the remaining section of Riverside Road below the new crossing.

4.5.14 Access to MotorLings will be retained through provision of a new access from B1531 Waveney Drive near the Scheme southern roundabout. The new access will provide for all vehicles requiring access to the MotorLings business.

4.5.15 Access to the existing telephone mast and land adjacent to Riverside Road, as well as the sub-station within the control tower compound north of Riverside will be provided from the new Access Road connecting Riverside Road with Waveney Drive.

4.5.16 Vehicular access will be removed from 34 Waveney Drive, in association with the land take and loss of garage from that property.

4.6 Parking

4.6.1 The implementation of the Scheme will result in the loss of around 290m (48 PCUs) of existing kerbside parking space along Riverside Road and Canning Road[28]. There are no formal parking spaces along these roads, however within these areas there are no restrictions preventing parking. It is understood that the existing parked vehicles are predominantly related to the occupiers along Riverside Road/Canning Road including Waveney District Council, Suffolk County Council and Nexen.

4.6.2 Improved connectivity for pedestrians and cyclists as a result of the Scheme will encourage a shift away from private cars to more sustainable modes of transport. The existing levels of car parking demand along Riverside Road are therefore expected to reduce as a result of the Scheme.

4.6.3 Displacement of parking as a result of the Scheme is expected to be limited, however, given the residential nature of the area immediately to the south of the Scheme it is expected any overspill parking from car parks would occur on-street. It is expected that there will be limited detrimental impacts caused by displacement parking as a result of the Scheme. Monitoring of the occurrence of displaced parking is undertaken by SCC through employee surveys related to the Travel Plans of the businesses (where applicable) located in the employment areas, and through parking surveys.

[28] Excluding areas where vehicles park illegally e.g. on the bend of junctions, on double yellow lines, across land access points etc.

4.7 Design Standards

4.7.1 The bridge has been designed using the DMRB and the reference design[29] broadly encompasses the following:

- Design speed of 30mph (48kph)
- Gradients compliant with DMRB;
- Carriageway width of 7.3m (2 x 3.65m wide traffic lanes);
- Safety strip of 0.5m between the proposed carriageway and the shared footway/carriageway to the east of the Scheme and the segregated footway / cycleway to the west of the Scheme;
- Shared footway/cycleway of 4.0m (on the east side of the new carriageway);
- Segregated 2.0m footway and cycleway of 3.5m (on the west side of the new carriageway).

4.7.2 Details of relaxations and departures from the standards set out in DMRB are provided within an Appendix to the Design Report (DR) (Document 7.3).

4.7.3 The Scheme is designed to accommodate strategic traffic, rerouting away from the town centre with a primary function to relieve congestion. As such, strategic design standards from DMRB are applied. Furthermore, the guidance for local highway schemes found in Manual for Streets does not include any reference to designing major infrastructure such as a new bridge. For both of these reasons, DMRB standards are applied to the design of the Scheme. However, for local highway connections and junction improvements proposed in Section 8 outside the Order limits, designs will accord to the guidance within Manual for Streets standards and not to DMRB, given their location.

4.8 Road Safety Audit

4.8.1 A RSA has been completed and is submitted ~~with the DCO~~ as an appendix to the ~~Dr~~~~DCO~~Design Report~~.~~.

4.8.2 The Stage 1 RSA was undertaken in accordance with DMRB Design Standard HD19. The Scheme brief and the general layout drawings was made available to the audit team prior the date of the inspection.

4.8.3 This audit comprised an examination of design drawings which took place on Wednesday 18th October 2017 and a site visit during daylight hours the following day. The documents viewed for this audit are collated within the RSA.

4.8.4 The RSA study area included the Scheme and connections to Waveney Drive and Peto Way. Many recommendations were made for improvements to the designs, including measures to ensure appropriate vehicle speeds for the geometry, and reducing conflicts between vehicles and non-motorised users. The suggested improvements are either incorporated into the submitted Scheme design where appropriate or marked for amendment within the detailed design stage where elements remain to be determined. The details of the amendments are provided in a Designer's Response Report attached to the RSA.

[29] Please refer to Design ~~& Access Statement~~Report for explanation (Document 7.3)

4.9 Pedestrian and Cycle Network

Severance

4.9.1 Community severance is a major problem in Lowestoft. It occurs when the separation of residents from the rest of their community occurs as a result of a road or transport link. In the case of Lowestoft, this is caused by the Lake and the East Suffolk Line. Community severance has several undesirable impacts for Lowestoft:

- It increases the length of journeys to work, increasing fuel consumption and emissions for car trips;
- It makes non-car modes of travel, such as walking and cycling, less attractive for work and other trips;
- It reduces people's access to local services; and
- it creates a physical separation between the businesses within the AAP area, despite their apparent proximity, making it harder for the area to function as a coherent whole.

Scheme

4.9.2 The Scheme will provide a direct, safe and secure route to cross the Lake by foot and by bicycle at a central location between the north and the south of Lowestoft. This will reduce community severance in Lowestoft. It will provide an additional link between the north and south of the town, completing a significant gap in the pedestrian and cycle network. This will integrate a greater proportion of the community with employment areas and commercial services within the town, as well as improving accessibility to potential regeneration sites around the Lake.

4.10 Port Operations

4.10.1 The Scheme will cross at a central location of the Lake, which is, as detailed above, a navigable waterway and operational Port. The location of the Scheme has operational berths both east and west of the bridge on the north bank, whilst the south bank is not currently utilised for Port operations.

4.10.2 The new bridge is expected to have an average opening cycle of 8:35 minutes, ranging from 5:50 to 11:20 minutes. The opening time of the new bridge will vary depending on the type of vessel that is passing underneath and the speed at which it is travelling. On occasion, there may be two or more vessels passing under the bridge in one opening which will require a longer opening time than a single vessel.

4.10.3 However, the new bridge will have a clearance of approximately 12m above the highest astronomical tide level, allowing a greater range of vessels to pass under it without opening.

4.10.4 The existing control room on the current A47 Bascule Bridge will remain the Port control tower and will be updated to link with a new control room installed at the Scheme. The full opening and closing sequence times, bridge clearances and opening frequency for all three crossings are shown in Table 4.1.

Bridge	Time of Full Opening and Closing Sequence	Bridge Clearance above HAT	Average Times Opened per Day
A47 Bascule	5 – 10 minutes	2.16m	14
Mutford Bridge	2 – 4 minutes	2m	2 – 4
Scheme	6-12 minutes	12m	5

Table 4.1: Bridge Operations (Predicted for Scheme)

4.10.5 The Applicant recognises that the introduction of a bridge across a navigable waterway has implications for the transit of vessels through that area, and those impacts should be mitigated through bridge design and operating provisions for the bridge. A draft Scheme of Operation for the new bridge has been submitted to the Examination (Document Reference SCC/LLTC/EX/41)~~In accordance with the provisions of the draft DCO, the Scheme of Operation will be determined in consultation with the Statutory Harbour Authority and a preliminary Scheme of Operation has been submitted to the Examining Authority~~. ~~The Applicant does not believe it necessary to specify the exact operating regime for the bridge at this time.~~

4.10.6 ~~However, t~~The opening time of the Scheme will be between 6 and 12 minutes, depending on how many and what type of vessels are passing through. The assessments including Scheme openings within this TA assume openings of either 6 minutes or 10 minutes, to provide a range of assessments within the most expected opening durations. From the data available from existing vessel surveys, a 12 minute lift duration will be an unusual situation and would occur infrequently.

4.11 Summary of the Scheme

4.11.1 The Scheme comprises a new road crossing of Lake Lothing, with provision for vehicles, pedestrians and cyclists, together with approach roads and junctions, and alterations to local roads where necessary. It will cross the Lake at a central point between the existing bridges. By building the Scheme in this central location it will improve connectivity between the two halves of the town and provide the crucial ‘missing link’ in a high standard route for north – south traffic, improving travel times and reducing congestion on the existing routes, and providing significant traffic relief to both of the existing crossings. The Scheme meets relevant design standards and has been subject to a Stage 1 Road Safety Audit.

5 Assessment Methodology

5.1 Introduction

5.1.1 This Section outlines the methodology adopted for the traffic impact assessment of the Scheme on the highway network in Lowestoft. This methodology was discussed with SCC during a scoping meeting held on 26th January 2017. Highways England has also confirmed to the Applicant that the content (and therefore methodology) within the TA is acceptable.

5.2 Model Process

5.2.1 The Scheme is categorised as an NSIP, meaning that it is nationally significant. As such, modelling has been completed at three different levels to ensure that the strategic and local impacts of the Scheme are fully understood:

- Strategic traffic modelling (wide area)
- Microsimulation modelling (local network)
- Operational modelling (junctions)

5.2.2 The Suffolk County Traffic Model (SCTM) was developed by SCC, which was then cordoned to the Lowestoft area to create the Lowestoft SATURN Traffic Model (LSTM). The LSTM model provides the strategic assessment over a wide area, the results of which are reported within the Economic Report submitted with the DCO. Traffic flow demand turning matrices developed within the strategic modelling were extracted and used for microsimulation and operational modelling.

5.2.3 The microsimulation modelling was completed in VISSIM, and assesses the impact of the Scheme in the future scenario on journey times for a number of key routes and movements across the town (north-south, and east-west). The VISSIM model assesses the local network as a whole, including the interactions between junctions. The VISSIM model also assesses the impact of the A47 Bascule Bridge and Scheme bridges lifting and railway level crossings closing on traffic queues and journey time delays.

5.2.4 The operational modelling assesses specific junctions in isolation, i.e. assessing the geometric characteristics of the junction alongside the theoretical capacity and traffic demand. The operational assessments cannot assess the impact of bridge lifts on the capacity of the junction, however the assessments are presented to demonstrate that if congestion on a network wide basis were reduced (by implementing the Scheme and associated pinch point mitigation) the junctions have the theoretical capacity to accommodate the traffic demand.

5.2.5 Whilst Baseline 2016 and DM 2022 results for the junctions are presented, that information is subject to the limitations of the operational assessments and so cannot be taken directly as a reflection of current conditions on the network. Those conditions are described in Chapter 3, with the implications assessed in the microsimulation modelling.

5.2.6 Figure 5.1 provides a process map to show how the operational model, micro-simulations and latest version of the SATURN model (October 2017) combine within this TA.

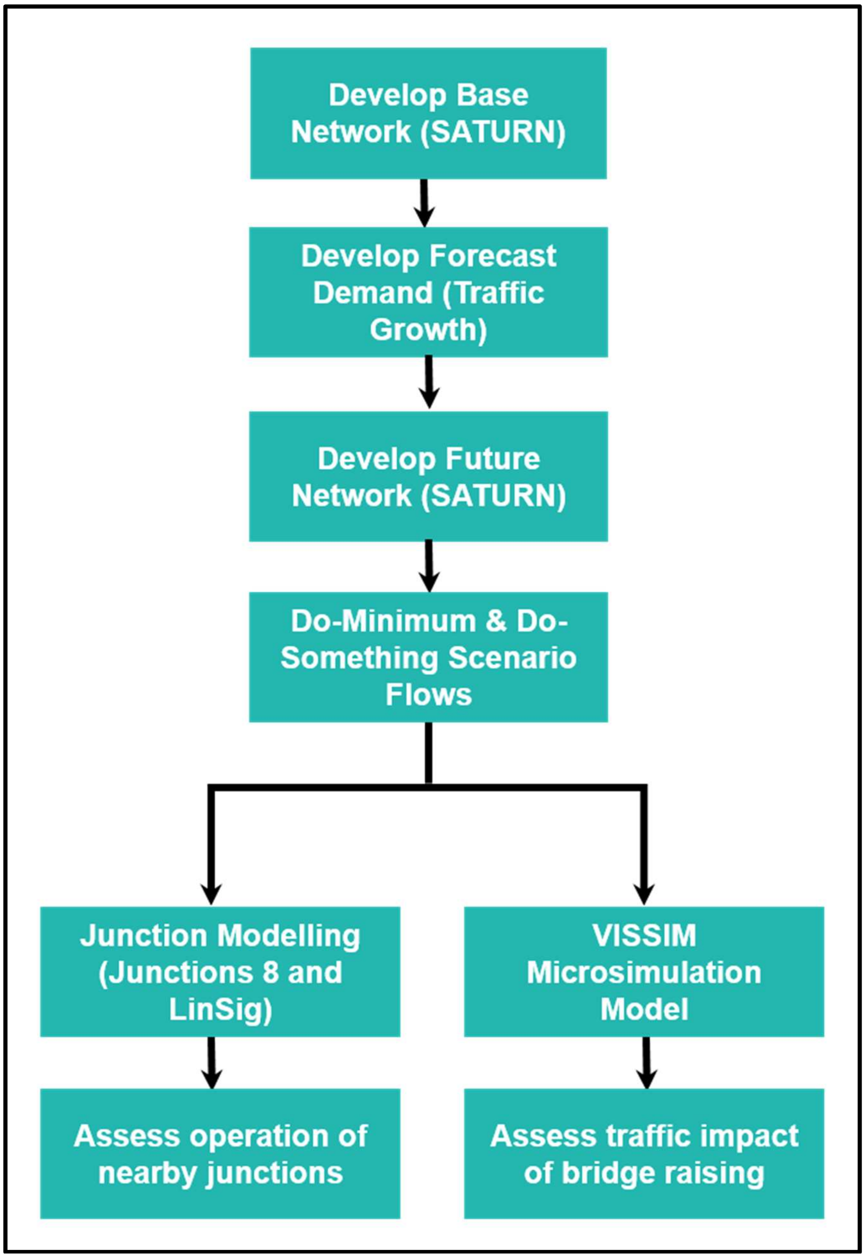


Figure 5.1: Modelling Process Diagram[30]

5.3 Strategic Traffic Model - SATURN

5.3.1 The SCTM was built in 2016 using Saturn software version 11.3.12, and covers the entire county of Suffolk. For the purposes of the assessment of the Scheme, the Lowestoft area was ‘cordoned’ to provide a smaller network for analysis.

5.3.2 SATURN (Simulation and Assignment of Traffic to Urban Road Networks) is a suite of flexible network analysis programs. As a ‘conventional’ traffic assignment model, SATURN can deal with large conurbation, regional or even national model networks. The model redirects traffic to the fastest routes when congestion builds, thereby spreading traffic to quieter routes and away from heavily congested areas. This is a realistic traffic assignment methodology given that many drivers will reroute rather than stay within a queue.

[30] ‘Bridge raising’ refers to A47 Bascule Bridge, the Scheme, and also the closure of the railway level crossings.

Mobile Network Data

5.3.3 The mobile network operator Telefonica (O2 in the UK) were requested by the Applicant to prepare origin-destination (OD) matrices for the whole of Suffolk and a buffer area surrounding it using Mobile Network Data (MND). A report detailing the methodology employed by Telefonica to derive the OD matrices from MND was produced[31].

5.3.4 Until recently the majority of transport data was collected intrusively on-site, e.g. through observations, roadside interviews or travel diary surveys. Today however, the widespread use of mobile phones means that data can be collected in a passive way through analysing people's daily activities, such as making phone calls, messaging friends, shopping online or simply by reading the submissive signals of a switched on mobile device. The continuous recording of such data is generating datasets of vast volumes, which is a step change from traditional data gathering methodologies and analysis techniques.

5.3.5 The main source of demand data in the SATURN model is mobile phone data, for a period covering April and May 2015, from Telefonica for the whole of the county of Suffolk, and most of the neighbouring authorities of Cambridgeshire, Essex and Norfolk. The data provides the start and end points (known as origins and destinations) of a sample of trips (i.e. mobile phone users on this mobile provider's network) for people travelling in and through the model area. Telefonica factor up the mobile phone data movements using population estimates from the Census in order to estimate the total number of trip movements between origins and destinations.

5.3.6 Telefonica are able to deduce from a wider dataset of several months where a phone is commonly located overnight that this is its "home" location. Similarly, where it is usually found during the day is considered to be its "work" location. More complicated patterns of movement are also handled by the data. In essence, Telefonica are able to sub divide the trips into different journey purposes. This data was used as the starting point for building up the travel patterns that are contained within the SATURN model. The use of MND is fast becoming the industry standard way of obtaining data for traffic modelling, as discussed within the Catapult report[32] produced for DfT which aims to fill a gap in WebTAG by providing recommendations as a basis for producing industry guidance in this area.

5.3.7 A number of high level checks by Telefonica have been made against the Suffolk MND, including:

- Baseline data comparison
- Trip Rates
- Trip Ends
- Trip Purpose
- Trip Distribution
- Trip Length Distribution
- Daily Profile

[31] Suffolk OD from Mobile Phone Data Project Report

[32] Catapult Transport Systems, April 2016 *Utilising Mobile Network Data for Transport Modelling – Recommendations Paper*

5.3.8 It is considered the checks presented by Telefonica have been carried out at a general, high level and more detailed verification of the data was required prior to its use in the SCTM. Additional checks were completed and are summarised within Appendix F-2 of the Highway (Local Model Validation Report) in Appendix E of this TA.

Validation and Calibration

5.3.9 The SATURN model was calibrated and validated to a base year of 2016 as per the Highway LMVR (Appendix E). The SATURN model was constructed in line with WebTAG and has been calibrated and validated to WebTAG criteria. Use of the model within this TA is therefore considered valid and appropriate.

Scenarios

5.3.10 An assessment of the Scheme, and its associated highway infrastructure (i.e. new junctions), was undertaken in 2016. The scenarios that were interrogated within the SATURN model, and from which turning flows for all operational junction models were obtained, include Base Year, DM and DS:

- Base Year 2016 (no third crossing);
- DM 2022 (opening year);
- DM 2037 (design year);
- DS 2022 (opening year); and
- DS 2037 (design year).

Base Year 2016

5.3.11 The SATURN model base year is 2016. The origin / destination matrix, which is the starting point of the calculation of model demand, uses mobile phone data to identify the origins and destinations of trips. Because it is not possible with the use of mobile phone data to capture intra-cellular trips[33], mobile phone data underestimates the volume of short-distance trips, which needs to be addressed.

5.3.12 The existing short-distance trips therefore were replaced (the matrix is essentially "infilled") with other sources of data (observed / synthetic) so that the trip length profiles match those based on independent data. This process of synthetic adjustment used Census Journey to Work data to distribute the trips combined with National Travel Survey data to extract journey purpose. This initial matrix development process is shown in Figure 5.2.

33 Intra-cellular trips – short distance trips where the mobile phone stays within one 'cell' area, and doesn't transfer between 'cell' areas.

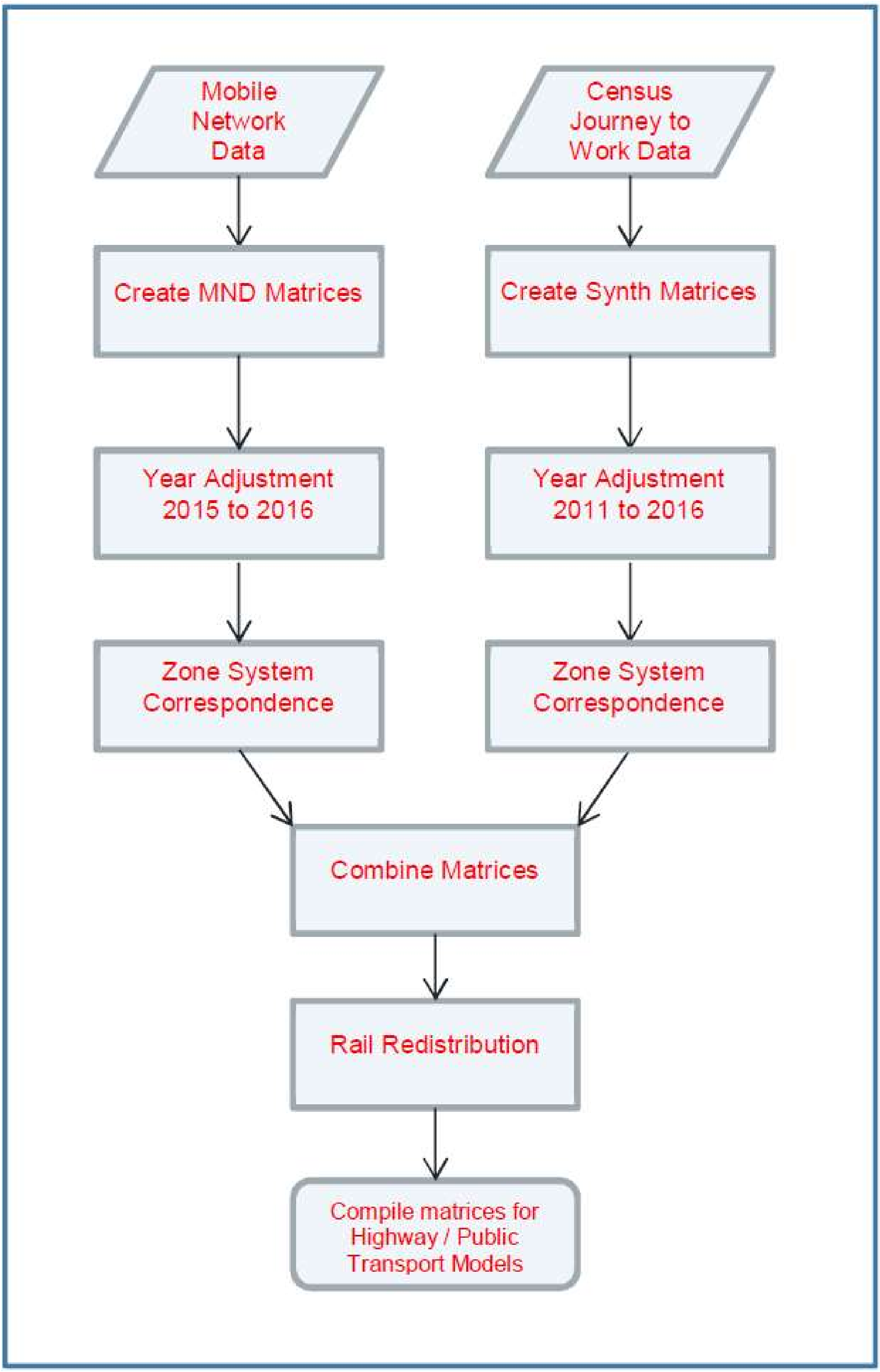


Figure 5.2: Matrix Development Process

5.3.13 The mobile phone data was then further processed as illustrated in Figure 5.3.

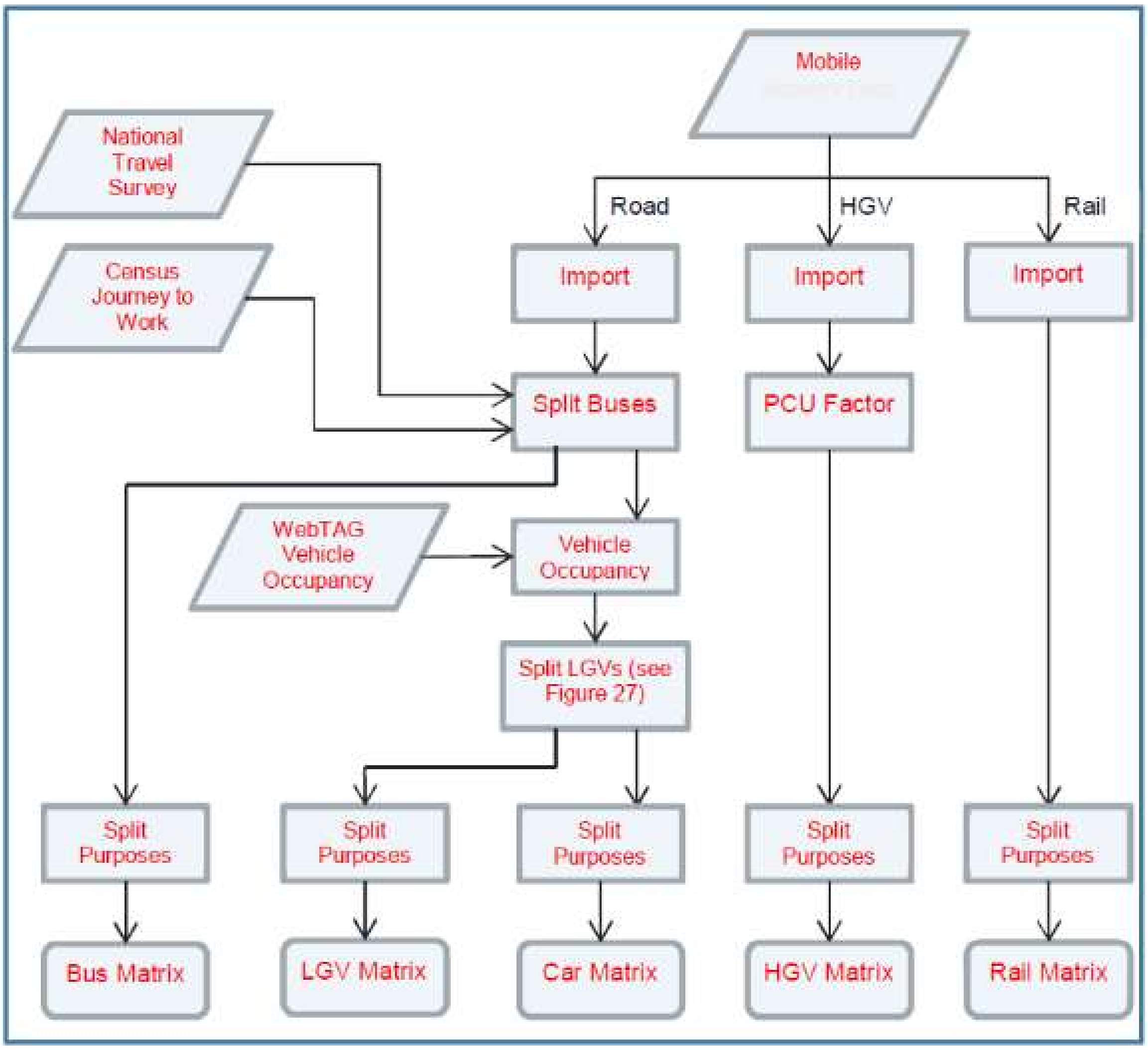


Figure 5.3: Mobile Phone Data Matrix Processing[34]

5.3.14 Additional processing was required to obtain LGV information. This process is further set out in Figure 5.4.

[34] Figure taken from Highways LMVR in Appendix E. All figures referenced within the image are from the LMVR.

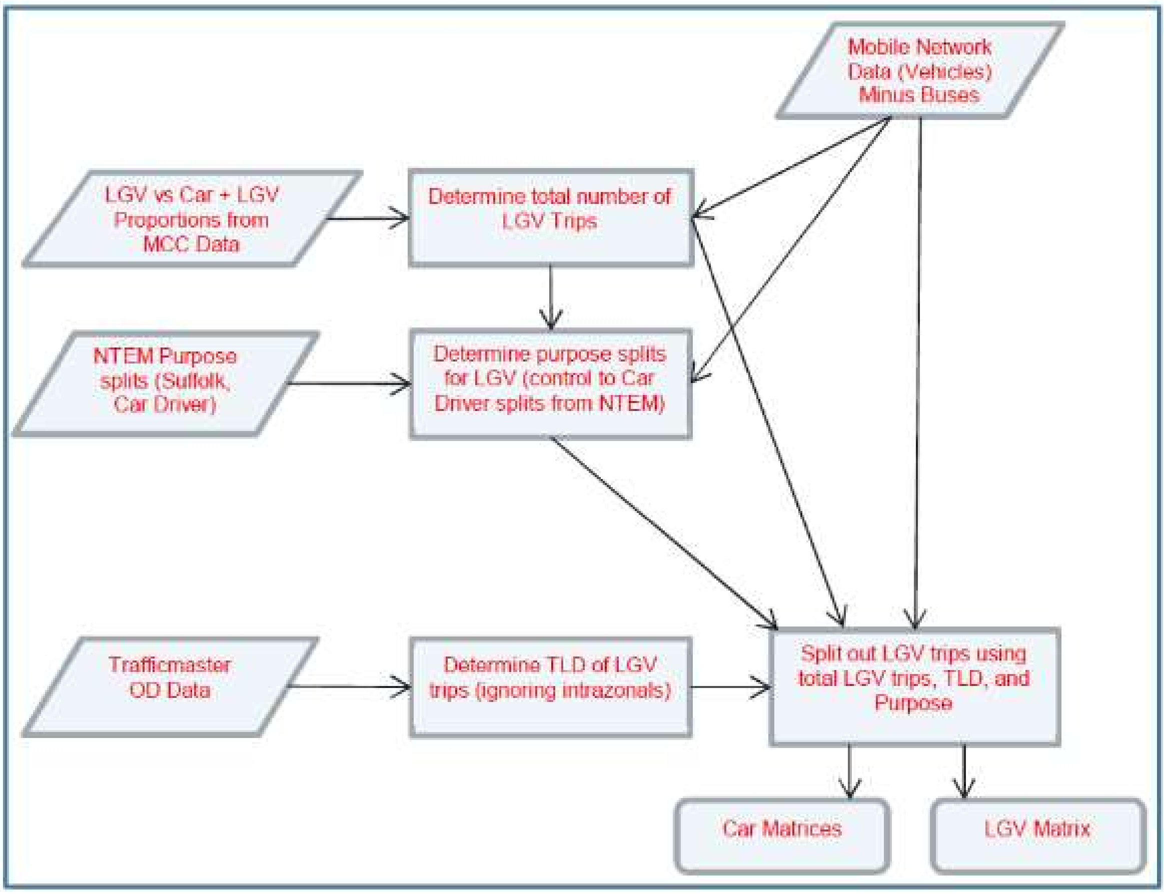


Figure 5.4: LGV Matrix Process

5.3.15 The synthetic part of the model was developed as shown in Figure 5.5, where:

- Home-based work (inbound) = HBW IB
- Home-based work (outbound) = HBW OB
- Home-based other (inbound) = HBO IB
- Home-based other (outbound) = HBO IB
- Non-home-based other (both directions) = NHBO

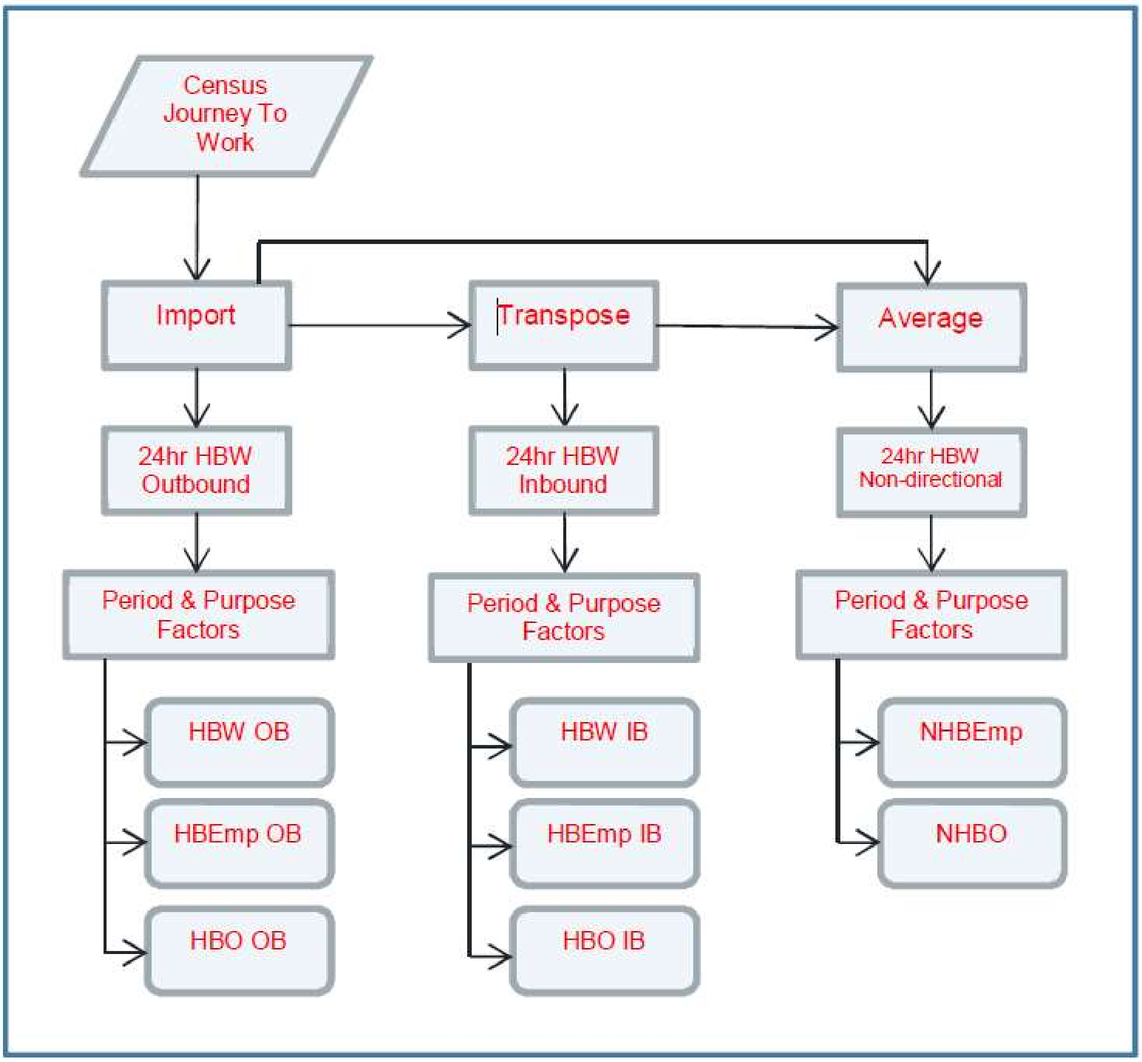


Figure 5.5: Synthetic Model Process

5.3.16 The mobile phone data matrix and synthetic matrix were combined using the following simple process:

- All trip pairs with a distance of less than two kilometres from the mobile network data matrices were removed.
- All trip pairs with a distance of equal to or more than two kilometres from the synthetic matrices were removed.
- The two sets of matrices which had no zone pairs that overlap were combined.

5.3.17 Further traffic data sets were used to calibrate and validate the model. These included:

- ATC
- MCC
- Classified Turning Count using Automatic Number Plate Recognition

5.3.18 Further details are set out within the TDCR provided in Appendix D, the Highways LMVR in Appendix E, and a Technical Note in Appendix F.

DM and DS Scenarios

5.3.19 The DM scenario assumes background growth on the existing network, in addition to committed development and future highway measures which are not dependant on the Scheme.

5.3.20 The DS scenario assumes that the construction of the Scheme is added to the DM scenario and assumes a Scheme Bridge lift of six minutes in each peak hour.

Assessment Periods

5.3.21 The impact of the Scheme for each scenario was assessed in the following peak periods of traffic demand which correspond to local highway network peaks. The following peak periods have been assessed:

- AM Peak (08:00-09:00); and
- PM Peak (17:00-18:00).

Traffic Growth

5.3.22 In order to establish a robust vehicle trip generation, within the SATURN model, forecasts were controlled to growth contained in the DfT forecasting databases in TEMPRO (Trip End Model Presentation Program) v7.2. Use has been made of planning data assumptions within TEMPRO v7.2 to establish local growth factors, between the base year 2016, the Scheme opening year of 2022 and design year of 2037 for the geographical area of the 'Waveney' district Further detail on the application of traffic growth to the SATURN model is contained within the LMVR and Demand Model Validation Report contained in Appendix E of this TA.

5.3.23 The TEMPRO zones and SATURN zones are shown in Figure 5.6.

Figure 5.6: TEMPRO and SATURN Zones
(Contains OS data © Crown copyright and database right: 2017)

Uncertainty Log

5.3.24 An Uncertainty Log was developed by the Applicant to contain details of committed developments and infrastructure improvements within the district of Waveney. Background growth forecast by TEMPRO is complemented by growth associated with committed developments. The Uncertainty Log is included within the SATURN model to ensure appropriate growth forecasts are applied, and is presented in Appendix E of the LSTM LMVR which is provided in Appendix E of this TA

Suffolk County Traffic Model Updates February 2018

5.3.25 The version of the SCTM which underpins the traffic modelling for the Lake Lothing Third Crossing DCO Scheme was also used to support the OBC for the A12 Suffolk Energy Gateway scheme appraisal. The forecast development assumptions for Waveney District were included in the traffic forecast modelling related to both schemes. The OBC for the A12 Suffolk Energy Gateway scheme appraisal was submitted to the DfT in December 2017. Feedback on the A12 Suffolk Energy Gateway scheme was provided by the DfT in February 2018, the trip rates within the SATURN model were queried. The DfT specifically asked about how the trip rates had been derived due to the directionality of the trip rates for residential developments. For example in the AM peak, the trip rates generated more inbound trips compared to outbound trips at residential sites. In order to determine the significance of this issue, WSP derived alternative trip rates using the Alternative Planning Assumptions tool within TEMPRO which resulted in alternative trip rates which were lower and resulted in the directionality of trips changing. In the AM peak, these alternative trip rates resulted in more outbound trips compared to inbound trips at residential sites in the AM peak, and more inbound trips compared to outbound trips at residential sites in the PM peak. These updated trip rates were applied to the Waveney developments within the Uncertainty Log for A12 Suffolk Energy Gateway to derive alternative forecast traffic matrices. Sensitivity tests using the alternative matrices were submitted to DfT in response to this for the A12 Suffolk Energy Gateway with revised development trip rates. These sensitivity tests demonstrated the update to the trip rate methodology had a minor impact on the user benefits and benefit cost ratio for the A12 Suffolk Energy Gateway scheme. This issue was not significant, in part because all forecast car traffic growth within the SCTM traffic matrices is constrained to TEMPRO.

5.3.26 This revised development trip rate methodology has been applied to the forecast developments within the Uncertainty Log for the Scheme as part of an update of the SCTM. This has led to revised highway model assignments with updates to the directionality and reduced quantum of development trips across Waveney in the Uncertainty Log. Changes to the trip generation for Kirkley Waterfront highlight a reduction in traffic along Waveney Drive between Kirkley Run and A12 Tom Crisp Way. The other most significant change in development trips are reductions in flow in the vicinity of the Woods Meadow development in Oulton.

5.3.27 Following these changes in traffic flows in the SCTM, within this TA operational modelling for the junctions listed is based on the updated methodology outlined above. These junctions are closest to the Kirkley Waterfront and Woods Meadow developments and consequently show the highest changes in traffic flow as a result of the revised trip rate methodology, with reductions in flow along Waveney Drive and the Woods Meadow link road being between 75 and 100 PCUs in 203~~8~~7.

- Waveney Drive / Kirkley Run
- New Access Road
- A12 Tom Crisp Way / Waveney Drive
- Scheme southern roundabout
- A1117 Millennium Way / B1074 Somerleyton Road

5.3.28 It was not required to apply the revised trip rates to all other junctions as the flow changes outside of the areas which the above junctions are located within showed very minor differences in flow, with differences typically less than 10 PCUs. Given the magnitude of flow differences for these other junctions is not significant, it was not deemed proportionate to carry out operational modelling for all junctions with the revised trip rates. Repeating the operational modelling for all junctions would lead to a series of junction models which provide the same conclusions as those within the main submission. It is considered that the changes to the trip rates would not significantly alter the benefits in journey times which result from the Scheme and the SCTM is a suitable robust basis from which to make a judgement about flow changes and their likely impact on junctions for which operational modelling has been undertaken. The SCTM 2016 base year model underpinning the traffic forecasts which test the Scheme has a detailed series of observed journey time routes which have been used for calibration and validation of the model. This ensures the model will provide appropriate responses to the forecast traffic demand which is assigned within it.

5.3.29 Operational modelling of the above named junctions with the revised trip rates shows the conclusions for highway improvements are unaltered by the revised strategic model assignments, therefore the issues raised by the DfT regarding the Waveney forecast development trip generation have been tested and shown to not be significant.

5.4 Journey Time Assessments

Introduction

5.4.1 A microsimulation model using VISSIM has been developed to represent the existing traffic conditions and to assess the potential impacts of the Scheme on the Lowestoft highway network in the locality of the Scheme.

5.4.2 A VISSIM model is able to more accurately model on-street behaviour and network capacity issues such as lane usage and exit blocking compared to conventional models analysis such as LinSig 3, JUNCTIONS 8 and SATURN.

5.4.3 VISSIM (version 8.0.10) has been used to develop the operational model. VISSIM requires the following inputs:

- Traffic Flow Data;
- Speed limits;
- Speed reduction areas;
- Public transport information; and
- Geometric data including road features and junction features.

5.4.4 VISSIM provides classified information for each mode modelled such as traffic flows, delay information, journey times etc.

Model Extent

5.4.5 The model boundary, as shown in Figure 5.7, encompasses the A12/A47 corridor to the east, a section of the A146 corridor to the west and the A1144 to the north of Lowestoft Town Centre.

Figure 5.7: VISSIM Model Extent

5.4.6 Figure 5.8 shows that the VISSIM network includes good coverage of the SRN together with sections of the local highway network. The East Suffolk Line and the Lake are also shown on the plan.

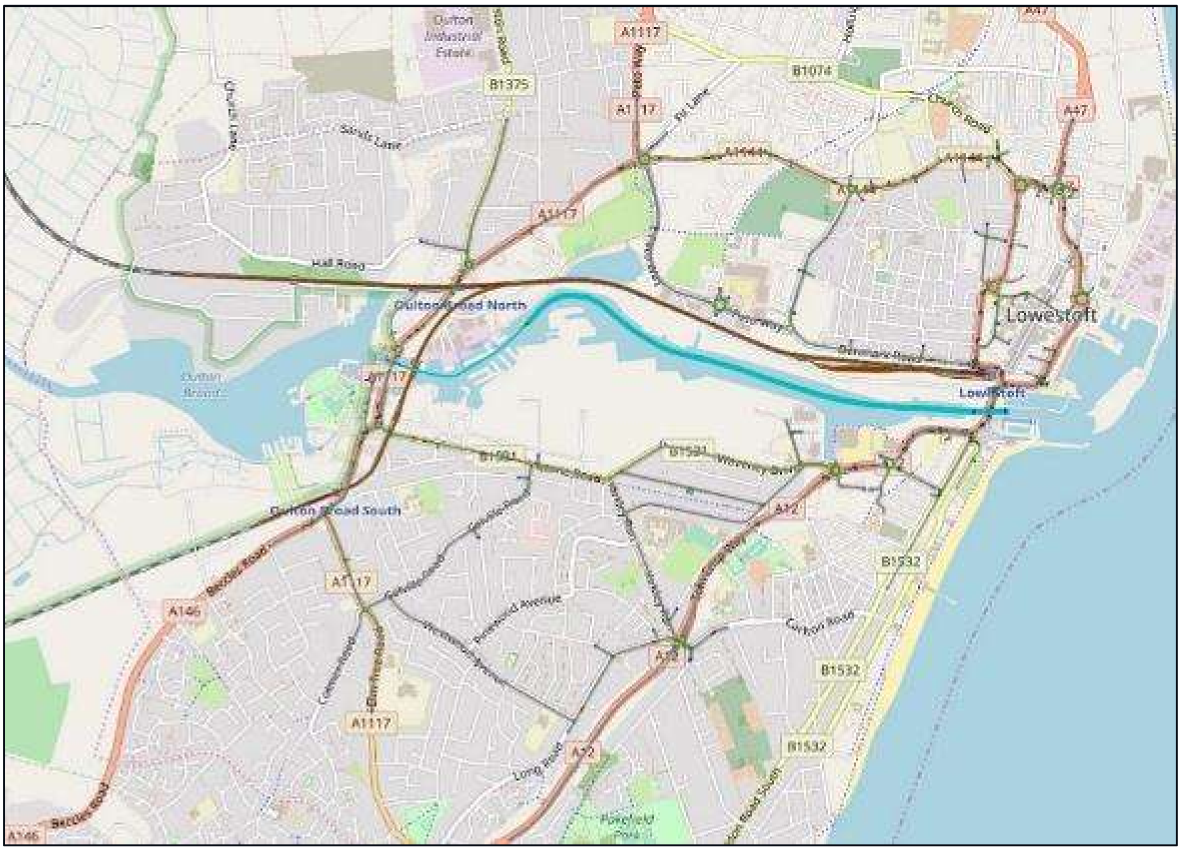


Figure 5.8: VISSIM Model Network

Model Data

5.4.7 The Base year model has been developed from a VISSIM model originally produced by AECOM[35] which used surveys from April 2015. The model has been updated using demand matrices (including traffic growth assumptions) from the 2016 Base SATURN model.

5.4.8 The VISSIM Base model was calibrated using MCC surveys on 17 key junctions collected in April 2015.

5.4.9 For the purpose of the model validation, a comprehensive set of ATC data, recorded in 2015 across nine key corridors, has been used. In addition, journey time data obtained from Traffic Master between September 2015 to June 2016 covering both time periods (AM and PM) was used.

5.4.10 The details of the model validation are provided in the report titled 'VISSIM Operational Model' of November 2017 contained within Appendix G of this TA.

Modelling Time Periods

5.4.11 The peak hour time periods for the model are consistent with the SATURN Model as follows:

- AM Peak (08:00 – 09:00)
- PM Peak (17:00 – 18:00)

[35] Lowestoft Report - draft 11-11-15 AECOM VISSIM report

5.4.12 The VISSIM model Base 2016 scenario includes no Bascule Bridge lifts in the AM peak and a Bascule Bridge lift in the PM peak to ensure validation of the model with the actual bridge openings on the day of traffic surveys.

5.5 Operational Assessments

5.5.1 During the scoping exercise with SCC, it was agreed that 22 junctions were to be assessed in detail as part of the Scheme. A further junction was added following the results of initial modelling. The junctions are presented in Table 5.1, and following the numbering set out in Section 3. These are all existing junctions in current highway network, with the exception of Junctions 17, 18 and 22, which are only present in the DS scenario.

Junction	Base Scenario	DM Scenarios	DS Scenarios
1: A47 Yarmouth Road / A1117 Millennium Way;	✓	✓	✓
2a: A47 Katwijk Way / A1144 St Peter's Street	✓	✓	✓
2b: A47 Artillery Way / A47 Jubilee Way / A12 St Peter's Street;	✓	✓	✓
3: A47 Waveney Road / Station Square / Commercial Road;	✓	✓	✓
4: A12 Pier Terrace / B1532 London Road South;	✓	✓	✓
5: A12 Belvedere Road / Mill Road / Kirkley Rise;	✓	✓	✓
6: A12 Tom Crisp Way / A12 Horn Hill / B1531 Waveney Drive;	✓	✓	✓
7: B1531 Victoria Road / B1531 Waveney Drive / Kirkley Run;	✓	✓	✓
8a: A12 Tom Crisp Way / Blackheath Road	✓	✓	✓
8b: Kirkley Run / Blackheath Road / Long Road;	✓	✓	✓
8c: Blackheath Road / Carlton Road;	✓	✓	✓
9a: A12 Tom Crisp Way / Bloodmoor Road / A1145 / Castleton Avenue;	✓	✓	✓
9b: A1117 Elm Tree Road / Long Road / A117 Bloodmoor Road;	✓	✓	✓
10: A1117 Bridge Road / A1117 Saltwater Way / B1531 Victoria Road;	✓	✓	✓
11: A1117 Normanston Drive / B1375 Gorleston Road;	✓	✓	✓
12: Peto Way / Denmark Road / Barnards Way;	✓	✓	✓
13: Denmark Road / Rotterdam Road;	✓	✓	✓
14: A1117 Normanston Drive / A1117 Peto Way;	✓	✓	✓
15: A1144 Normanston Drive / Rotterdam Road;	✓	✓	✓
16: B1531 Waveney Drive / Riverside Road / Durban Road.		✓	
17: New junction north of the Lake			✓
18: New junction south of the Lake			✓
19: Denmark Road / A47 Katwijk Way	✓	✓	✓
20: B1531 Waveney Drive / Kimberley Road	✓	✓	✓
21: A1117 Millennium Way / B1074 Somerleyton Road	✓	✓	✓
22: B1531 Waveney Drive / new Access Road			✓
23: Kirkley Run / Notley Road	✓	✓	✓

Table 5.1: Junctions to be assessed as part of the Scheme in the Base, DM and DS scenarios

5.5.2 Additional modelling of the future DS scenario was completed at the request of SCC as a result of a higher peak traffic flow on a Saturday than on a weekday. The Saturday Peak (1200-1300) modelling was completed for the following junctions:

- Site 13: Denmark Road / Rotterdam Road;
- Site 14: A1117 Normanston Drive / A1117 Peto Way; and
- Site 19: Denmark Road / A47 Katwijk Way.

5.5.3 The junctions presented in Table 5.1 have been assessed in the Base Year, DM and DS scenarios where applicable. The traffic flows for the operational assessments are derived from the SATURN model (including growth) for the Base, DM and DS scenario.

Roundabouts and Priority Junctions

5.5.4 In order to assess the impacts of the Scheme on the surrounding highway network, the traffic engineering software package 'JUNCTIONS8' has been used to model each of the existing and proposed roundabouts and priority junction layouts. The roundabout module has been used to calculate junction capacity and delays. The results show the values for the Ratio of Flow to Capacity (RFC), queues and delays for each arm of each roundabout.

5.5.5 The RFC demonstrates the operational capacity of a roundabout arm. An RFC of below 0.85 indicates that a junction will operate within operational capacity. An RFC of 0.85 to 1.0 suggests a junction is over its desired capacity but below theoretical capacity. An RFC in excess of 1.0 suggests that a junction will be in excess of theoretical capacity.

5.5.6 Those junctions assessed by JUNCTIONS8 are shown below. Their junction numbers correspond with those described in Section 3 and include:

- Junction 1: A47 Yarmouth Road / A1117 Millennium Way;
- Junction 2a: A47 Katwijk Way / A1144 St Peter's Street
- Junction 2b: A47 Artillery Way / A47 Jubilee Way / A47 St Peter's Street;
- Junction 5: A12 Belvedere Road / Mill Road / Kirkley Rise;
- Junction 6: A12 Tom Crisp Way / A12 Horn Hill / B1531 Waveney Drive / Maconochie Way;
- Junction 7: B1531 Victoria Road / B1531 Waveney Drive / Kirkley Run;
- Junction 8b: Kirkley Run / Blackheath Road / Long Road;
- Junction 8c: Blackheath Road / Carlton Road;
- Junction 9a: A12 Tom Crisp Way / Bloodmoor Road / A1145 / Castleton Avenue;
- Junction 9b: A1117 Elm Tree Road / Long Road / A117 Bloodmoor Road;
- Junction 10: A1117 Bridge Road / A1117 Saltwater Way / B1531 Victoria Road;
- Junction 11: A1117 Normanston Drive / B1375 Gorleston Road;
- Junction 12: Peto Way / Denmark Road / Barnards Way;
- Junction 13: Denmark Road / Rotterdam Road;
- Junction 14: A1117 Normanston Drive / A1117 Peto Way;
- Junction 15: A1144 Normanston Drive / Rotterdam Road;
- Junction 17: New roundabout north of the Lake;
- Junction 18: New roundabout south of the Lake;
- Junction 19: Denmark Road / A47 Katwijk Way;
- Junction 20: B1531 Waveney Drive / Kimberly Road; and

- Junction 22: B1351 Waveney Drive / Riverside Road.
- Junction 23: Kirkley Run / Notley Road

Signalised Junctions

5.5.7 LinSig 3 has been used to model the existing signal controlled junctions. Output from LinSig refers to Degree of Saturation percentage (DoS %). A DoS of below 90% suggests a junction will operate within operational capacity. A DoS of between 90% and 100% suggests a junction is over desired capacity but within its theoretical capacity. A DoS in excess of 100% suggests a junction will be in excess of its theoretical capacity.

5.5.8 The junctions assessed by LinSig are shown below and include:

- Junction 3: A47 Waveney Road / Station Square / Commercial Road;
- Junction 4: A12 Pier Terrace / B1532 London Road South;
- Junction 8a: A12 Tom Crisp Way / Blackheath Road;
- Junction 16: B1531 Waveney Drive / Riverside Road / Durban Road; and
- Junction 21: A1117 Millennium Way / B1074 Somerleyton Road.

Validation and Calibration

5.5.9 The junction models have been validated against Google Maps 'Traffic' feature which graphically displays the typical level of congestion on the network during the peak hours derived from anonymised aggregated mobile phone data. The data is considered to be suitably accurate for the purposes of validation of the operational models, which themselves are based on fully calibrated and validated Saturn model traffic flows.

5.5.10 The queuing generated by the operational models is considered sufficiently comparable to the Google traffic trend and it is therefore considered that the models are reflective of the existing operation of the junction.

Significance of Results

5.5.11 The results of the operational junction assessments are considered against the reserve capacity of the junction and the change in operational capacity when compared to the relevant DM scenario.

5.5.12 For roundabouts and priority junctions, it is desirable for the RFC to be under 0.85. However, for the future forecast models in 2037, within a congested network, an RFC under the theoretical capacity at the junction of 1.00 is considered acceptable, because of the inclusion of a long forecast horizon of around 20 years of traffic growth.

5.5.13 For traffic signals, a Practical Reserve Capacity of 90% is desirable, but again, given the congestion on the existing network and an additional 20 years of growth, a junction operating with a 100% capacity in 2037 is considered to acceptable.

5.5.14 The Scheme is an 'improvement scheme' that provides additional highway network capacity and therefore a 'mitigation' solution for existing congestion issues around Lowestoft. The Applicant has taken a 'nil detriment' approach to considering what additional improvement works should be delivered as part of the Scheme.

5.5.15 A nil detriment approach to any mitigation required ensures that for the small number of junctions where traffic is expected to cause an adverse effect, a mitigation package is proposed to keep the RFC at a point that is no worse in the DS than in the Base/DM scenario.

6 Scheme Impacts – Strategic

6.1 Introduction

6.1.1 This Section describes the strategic impact of the Scheme on the highway network including the local network and the SRN). It considers the AADT flows on the strategic routes in Lowestoft, the A12 / A47 and the A1117, and assesses the reduction in journey times on these routes resulting from the Scheme.

6.1.2 As discussed in Section 3, the A47 in Lowestoft is the worst performing part of the East of England SRN. Highways England has identified a third crossing of the Lake as an opportunity to improve journey times on the A47, and the following paragraphs detail how these benefits arise. The A1117 and A12 are of strategic importance, though they do not form part of the SRN.

6.2 AADT Analysis

6.2.1 Figure 6.1 shows the two strategic routes in Lowestoft, the A12 / A47 (blue line) and the A1117 (orange line). At key points on each route, modelled AADT flows are shown representing the base (2016), DM and DS scenarios for both the opening year (2022) and design year (2037). These provide an overview of the expected impacts of the Scheme, taking account of background traffic growth in both the DM and DS scenarios.

6.2.2 An absolute reduction in AADT flows – i.e. DS flows are less than the 2016 base flow – is forecast at the following locations:

- A1117 Site 4 Normanston Drive (2022)
- A1117 Site 5 Mutford Lock (2022 and 2037)
- A1117 Site 6 Elm Tree Road (2022 and 2037)
- A47 Site 2 Jubilee Way (2022)
- A47 Site 3 Battery Green Road (2022)
- A47 Site 4 Bascule Bridge (2022 and 2037)

6.2.3 A *relative* reduction in AADT flows – i.e. DS flows less than the equivalent DM flows in 2022 and 2037 respectively – is also forecast at the following locations:

- A1117 Site 4 Normanston Drive (2037)
- A47 Site 1 Fox burrow Hill (2022 and 2037)
- A47 Site 2 Jubilee Way (2037)
- A47 Site 3 Battery Green Road (2037)

6.2.4 These reductions on routes in the general vicinity of the Scheme are forecast because the Scheme will attract traffic that would otherwise use the existing crossings on these two main routes. At 2022 levels there is a forecast reduction of nearly 10,000 vehicles AADT at A1117 Mutford Bridge and about 13,000 vehicles AADT at the A47 Bascule Bridge.

6.2.5 An increase in traffic – i.e. DS flows greater than the equivalent DM flows – is forecast at the following locations:

- A1117 Site 1 Millennium Way (2022 and 2037)

- A1117 Site 2 Millennium Way (2022 and 2037)
- A1117 Site 3 Peto Way (2022 and 2037)
- A12 Site 5 East of the Scheme (2022 and 2037)
- A12 Site 6 Tom Crisp Way (2022 and 2037)

6.2.6 The forecast increases on the A1117 Millennium Way and Peto Way, north of the Scheme, reflect the expected increased use of the purpose built northern spine road by traffic accessing the Scheme from the north.

6.2.7 The forecast increase in traffic on the A12 reflects the expected increased use of the route as the main approach to the Scheme from the south.

6.2.8 Overall, the analysis of AADT flows on the two main existing strategiccorridors through the town shows a clear decrease in use of the existing bridges and an increase on the most direct approaches to the Scheme from both north and south.

6.2.9 There will be a substantial benefit to the SRN, with the significant reductions in traffic on the existing A47 Bascule Bridge, which has been identified as a bottleneck by Highways England who control the route. The Scheme will also help to reduce traffic levels on the A47 as it passes through the town centre and the northern part of the town.

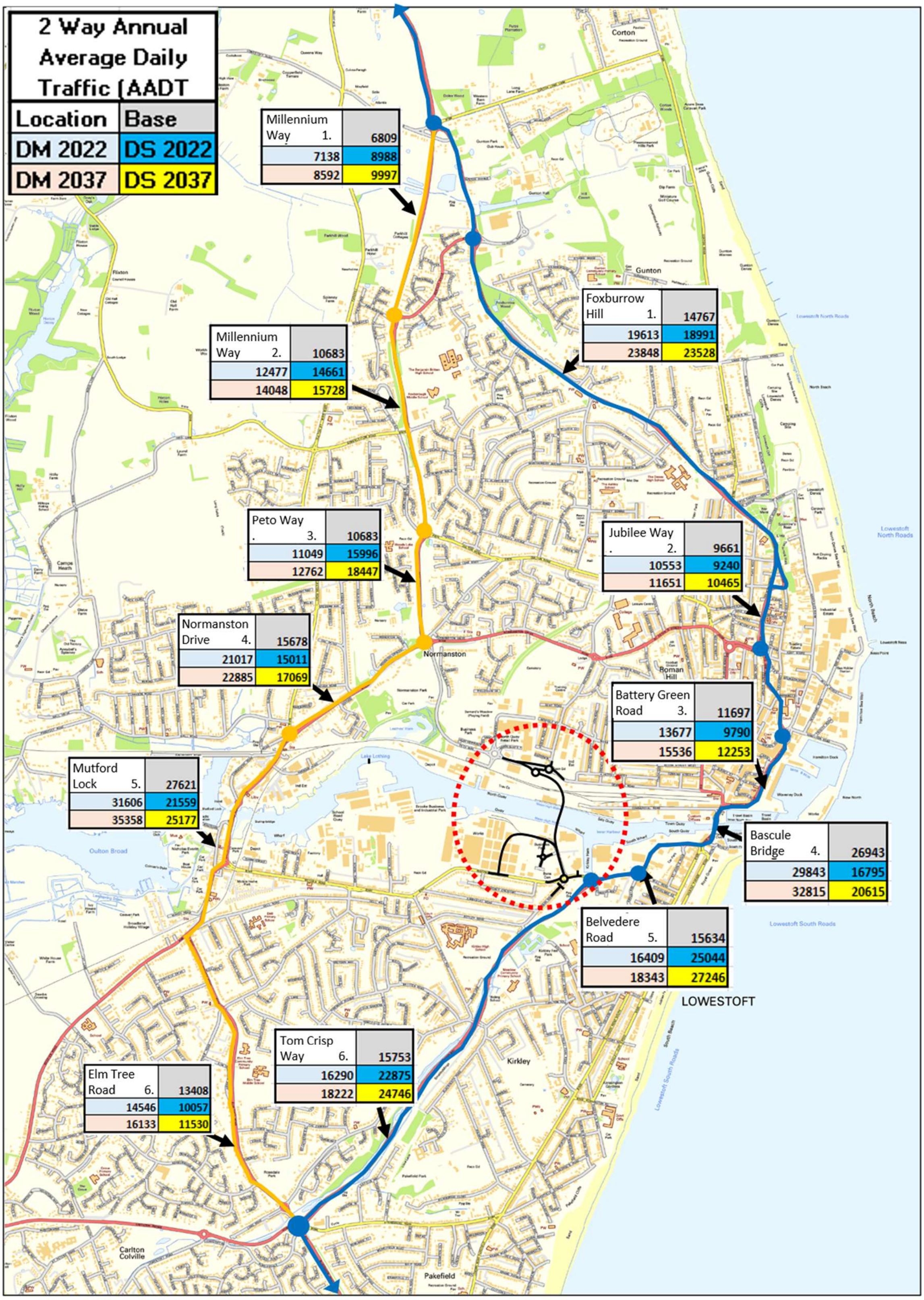

2 Way Annual Average Daily Traffic (AADT
Location
Base
DM 2022
DS 2022
DM 2037
DS 2037
Millennium Way 1. 6809
7138 8988
8592 9997
Millennium Way 2. 10683
12477 14661
14048 15728
Peto Way . 3. 10683
11049 15996
12762 18447
Normanston Drive 4. 15678
21017 15011
22885 17069
Mutford Lock 5. 27621
31606 21559
35358 25177
Elm Tree Road 6. 13408
14546 10057
16133 11530
Tom Crisp Way 6. 15753
16290 22875
18222 24746
Foxburrow Hill 1. 14767
19613 18991
23848 23528
Jubilee Way . 2. 9661
10553 9240
11651 10465
Battery Green Road 3. 11697
13677 9790
15536 12253
Bascule Bridge 4. 26943
29843 16795
32815 20615
Belvedere Road 5. 15634
16409 25044
18343 27246
Normanston
LOWESTOFT
Kirkley
Carlton Colville
Pakefield
Gunton
Corton
Oulton Broad
Lake Lothing

Figure 6.1: AADT Flows for Strategic Routes A12 / A47 (blue) and A1117 (orange)[36]

[36] The figure shows the Scheme outline for illustrative purposes only. A detailed overview of the Scheme design is included in the ES and other submitted as part of the DCO application.

6.3 Strategic Route Journey Times

6.3.1 Another measure of the strategic impact of the Scheme is the reduction in journey times along the strategic routes through Lowestoft. The strategic journey time benefits, which are also discussed in the CftS DCO document, were provided by using the 'Joy Ride' feature within SATURN. This feature allows journey times to be calculated on routes between any two points on the modelled network.

6.3.2 The journey time analysis presented within this section of the TA differs from the journey time information provided later in Section 7 calculated from VISSIM. The SATURN and VISSIM models differ in their purpose. The SATURN model provides a strategic overview of the impact of a scheme, with large zone areas and little detail in places. SATURN provides an excellent tool for determining the impacts of a scheme on strategic routes and longer distance routes. VISSIM model zones are generally smaller than in SATURN, over a much smaller network area, and including a considerable amount of detail about the links and junctions. The journey time results from the two model types will therefore ~~cannot be compared.will~~ vary.

6.3.3 The start and end points for both routes are the Millennium Way roundabout at A47/A1117 to the north of the town and Bloodmoor roundabout on A12/A1117 to the south of the town, as shown in Figure 6.2.


Millennium Roundabout
A47/A12 Route
A1117 Route
Bloodmoor Roundabout
LOWESTOFT

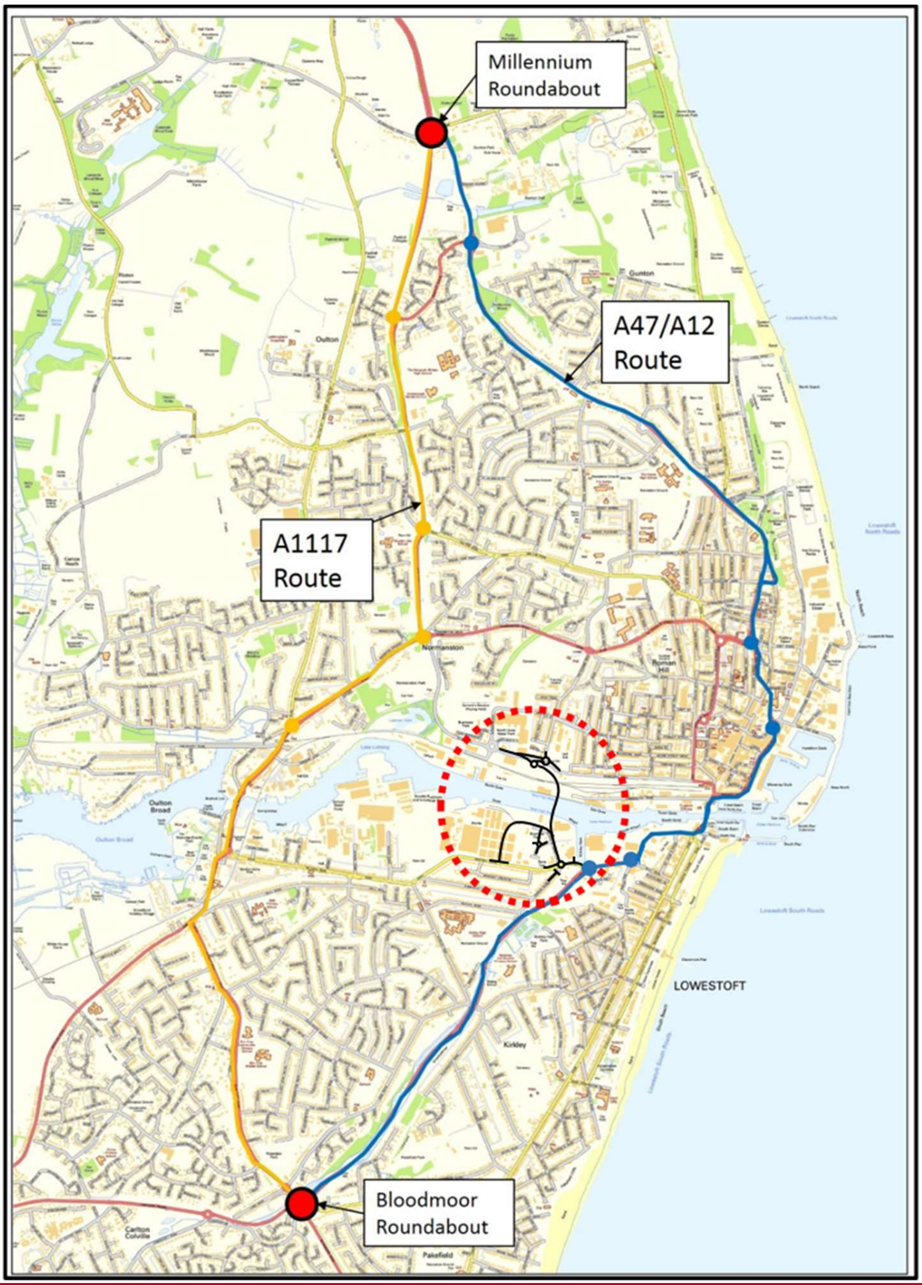


Figure 6.2: Strategic Routes A47/A12 (blue) and A1117 (orange)[37]

6.3.4 Table 6.1 shows the strategic journey time savings for the A47/A12 route, comparing the DM and DS scenarios with no bridge lifts. The highest reduction is 12% for the PM northbound journey, a time saving of 2 minutes 11 seconds.

[37] The figure shows the Scheme outline for illustrative purposes only. A detailed overview of the Scheme design is included in the ES and other submitted as part of the DCO application.

Journey Times - AM	Northbound	Southbound
DM (m:s)	14:54	14:12
DS (m:s)	14:19	13:04
Time savings (m:s)	0:35	1:08
% Change	-4%	-8%
Journey Times - PM	**Northbound**	**Southbound**
DM (m:s)	15:03	15:29
DS (m:s)	13:19	14:52
Time savings (m:s)	1:44	0:77
% Change	-12%	-4%

Table 6.1: Strategic Route Journey Time Savings for the A47/A12 (DM_2022)

6.3.5 Table 6.2 shows the strategic highway time savings for the A1117, comparing the DM and DS scenarios. The highest reduction is a time saving of 14% for AM southbound journey.

Journey Times - AM	Northbound	Southbound
DM (m:s)	13:03	13:05
DS (m:s)	12:09	11:14
Time savings (m:s)	0:54	1:51
% Change	-7%	-14%
Journey Times - PM	**Northbound**	**Southbound**
DM (m:s)	14:34	15:46
DS (m:s)	13:26	14:08
Time savings (m:s)	1:08	1:38
% Change	-8%	-10%

Table 6.2: Strategic Route Journey Time Savings for the A1117 (DS_2022_Sc8)

6.3.6 The strategic route journey times as a result of the introduction of the Scheme are significant, with an average saving of 8% northbound and 9% southbound. Given the relatively short journey lengths assessed, this is a considerable improvement for drivers using these strategic routes.

7 Scheme Impacts – Journey Times

7.1 Introduction

7.1.1 This Section examines the impact of the Scheme on journey times on key routes and movements in the vicinity of the Scheme in more detail than the strategic assessments in Section 6, using evaluations undertaken with the VISSIM microsimulation model. This also enables the impact of opening and closing the various lifting bridges to be considered in detail. A range of possible scenarios representing different bridge opening times has been tested.

7.2 Journey Time Evaluations

7.2.1 Journey times have been calculated for the key routes and movements shown in Figure 7.1. These have been evaluated as follows:

- A comparison of the key journey times for north -south movements and vice versa in the DM and DS scenarios. (This demonstrates the overall impact of the Scheme on journey times between key origins and destinations (also shown in Figure 7~~8~~.1), both on existing routes and on routes including the Scheme.)
- A comparison of the journey times on key routes in the DM and DS scenarios. (This demonstrates the impact of the Scheme on a particular route.)

7.2.2 Other evaluations include:

- Impact of the Scheme on Base and forecast year delays on the four key routes.
- Impact of the Scheme on the flow of traffic on key routes, and on queuing at key junctions.
- Impact of the Scheme on average speed and travel time at a network level.

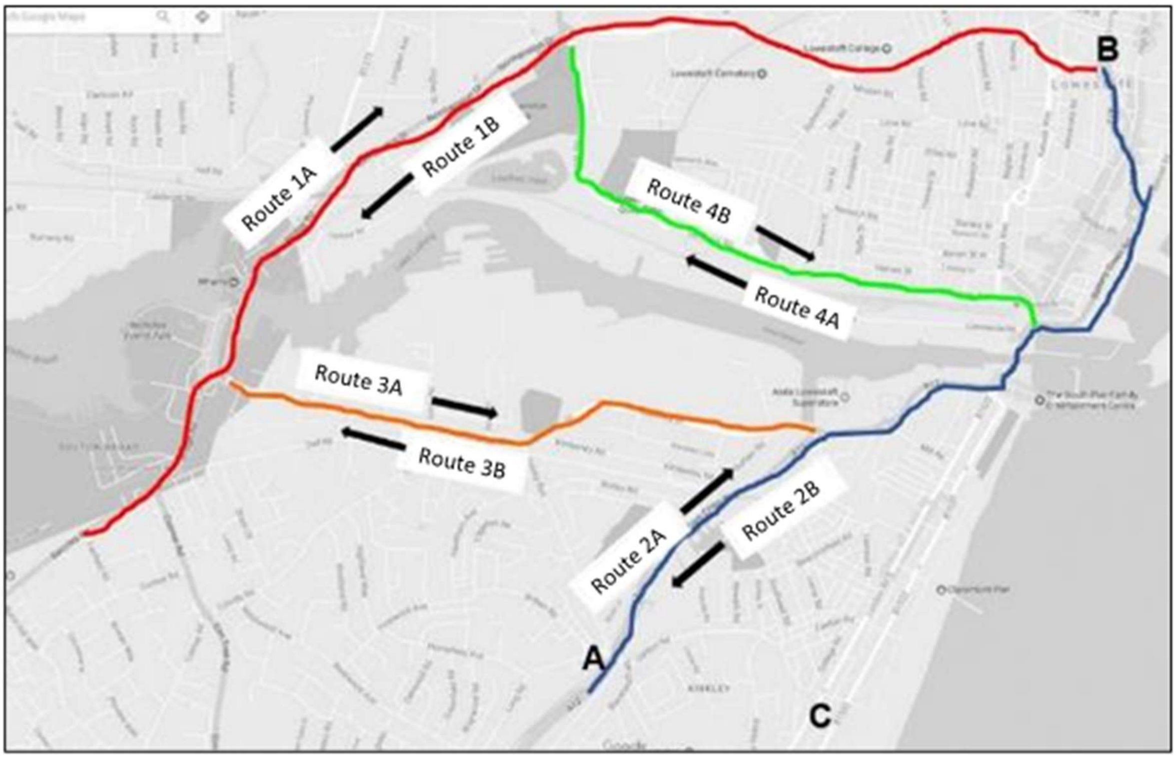


Figure 7.1: Key Routes used in Journey Time Assessments and Key Movements (A, B, C)

7.2.3 The analysis of key movements provides journey times between points A and C to the south and point B to the north. The route chosen by vehicles within the model is not fixed, and multiple options are available. To the south of Lowestoft, there is a one-way system in operation on B1532 with London Road South providing the northbound route and Marine Parade providing the southbound route. For this reason, the routing of traffic between points B to C and C to B will be different.

7.3 Assessment Scenarios

7.3.1 The existing bridge crossings of the Lake have a number of scheduled lifts and ad hoc lifts, and a similar situation will prevail for the Scheme. While there could be occasions where all three bridges are required to lift, there may be other instances where only the existing A47 Bascule Bridge and/or the Scheme bridge are required to be lifted. Therefore, a number of scenarios are possible, with different lifting times and combinations depending on the size and the number of vessels crossing.

7.3.2 To assess the impact of the opening of each of the three bridges and the subsequent closure to the traffic movement along the key routes during the lifting operation of each bridge in the AM Peak and PM Peak periods, seven scenarios have been modelled and compared with the DM scenarios. The scenarios are set out in Table 7.1. During the Vessel ~~traffic~~ S~~s~~urvey~~s~~, bridge lifting times averaged around five~~seven~~ minutes. The modelled scenarios include a range of times to test the effects of the upper and lower ends of the potential lifting times. Mutford Bridge is always open to traffic in the peak hours, and this is reflected in the scenarios.

DM_2022	**DM** – Mutford Bridge Open; A47 Bascule Bridge Open
DM_2022_5MIN	**DM** –Mutford Bridge Open; A47 Bascule Bridge Lifted (5 mins)
DM_2022_10MIN	**DM** –Mutford Bridge Open; A47 Bascule Bridge Lifted (10 mins)
DS_2022_SC-5	**Scenario 5** - Mutford Bridge Open; Scheme Lifted (6 mins); A47 Bascule Bridge Lifted (5 mins) (bridge lift offset of 1.5 minutes westbound)
DS_2022_SC-5a	**Scenario 5a** - Mutford Bridge Open; Scheme Lifted (6 mins); A47 Bascule Bridge Lifted (5 mins) (as Scenario 5 with bridges lifted simultaneously)
DS_2022_SC-6	**Scenario 6** - Mutford Bridge Open; Scheme Lifted (6 mins); A47 Bascule Bridge Lifted (10 mins)
DS_2022_SC-7	**Scenario 7** - Mutford Bridge Open; Scheme Lifted (10 mins); A47 Bascule Bridge Lifted (10 mins)
DS_2022_SC-8	**Scenario 8** - Mutford Bridge Open; Scheme Open; A47 Bascule Bridge Open
DS_2022_SC-9	**Scenario 9** - Mutford Bridge Open; Scheme Open; A47 Bascule Bridge Lifted (5 mins)
DS_2022_SC-10	**Scenario 10** - Mutford Bridge Open; Scheme Open; A47 Bascule Bridge Lifted (10 mins)

Table 7.1: VISSIM Model Assessment Scenarios (NB 'Open' means open to traffic)

7.3.3 The operating regime for the Scheme remains to be determined, however the scenarios listed in Table 7.1 are considered to provide a robust range of assessments from which the impact of the Scheme can be determined. A 6 minute Scheme lift would accommodate the one-way transit of a single or two vessels, and a 10 minutes Scheme lift would accommodate the transit of a larger commercial vessel in bad weather.

7.3.4 If both the Scheme Bridge and the Bascule Bridge are required to lift, it is likely that there will be an offset in the timing of the lift of each bridge. Within the VISSIM model, Scenario 5 includes a bridge lift offset of 1.5 minutes, i.e. the Scheme begins to lift 1.5 minutes after the A47 Bascule Bridge reopens to traffic. This is the average offset taken from the Vessel Simulation Report. For further testing, scenarios 5a, 6 and 7 assume that the A47 Bascule Bridge and the Scheme lift at the same time, with vehicular traffic stopped at both bridges together.

7.3.5 Further information on the operating regime for the Scheme is provided in Section 4 of this TA and in the ES (Document 6.1). In all scenarios, the railway level crossings are closed to traffic as per the timetabled train arrival/departures (as shown in Section 3).

7.3.6 The results of these scenario tests, all of which assume 2022 levels of traffic, are set out in detail in the following paragraphs. An assessment for 2037 has not been completed using VISSIM due to the limitations of the software in managing the levels of traffic predicted in the DM 2037 and DS 2037 scenarios.

7.4 Forecast Year 2022 DM

7.4.1 In the modelled average 2022 AM peak scenario, the locations where the delays occur are consistent with the 2016 Base year.

DM 2022 AM

7.4.2 The 2022 AM scenario, with A47 Bascule Bridge open to traffic, the delays are considered proportionate to those of the 2016 Base year. The A47 Bascule Bridge operates a narrow three lane tidal system, with northbound benefits of two lanes traffic movement in the AM peak and with southbound benefits of two lanes traffic movement in the PM peak.

7.4.3 The A12 NB offside lane is heavily congested and this leads to queues that extend to the A12 \ Mill Road junction (approx. 400 metres from the A47 Bascule Bridge), as shown in Figure 7.2.

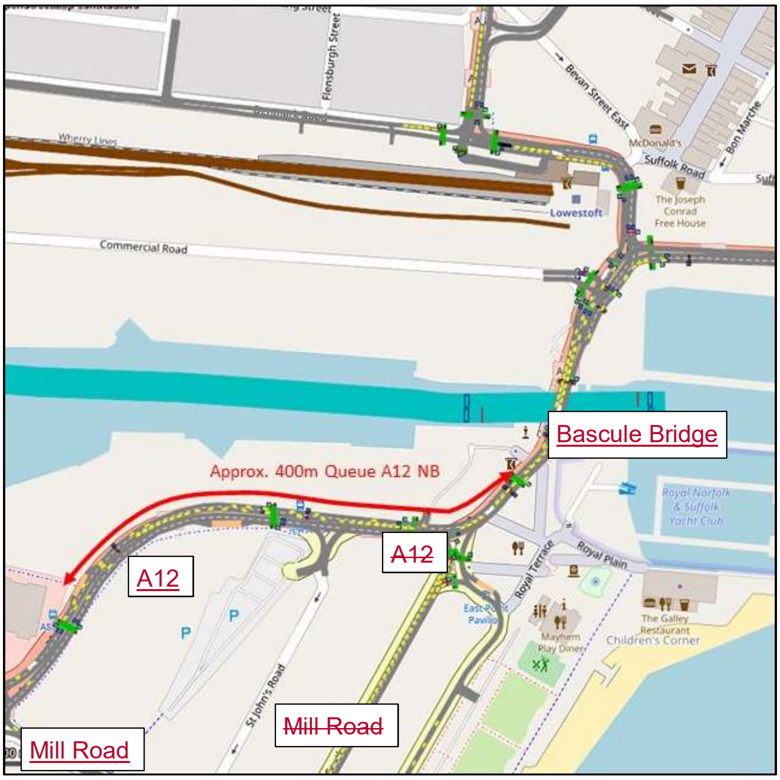


Figure 7.2: Congestion in the DM "without Scheme" scenario (DM_2022) in 2022 AM

7.4.4 In 2022 AM scenario, with A47 Bascule Bridge lifted for 5 mins, queues extend back beyond the ASDA roundabout (approx. 650m) as shown in Figure 7.3.

Figure 7.3: Congestion in the DM "without Scheme" scenario (DM-2022_5min) in 2022 AM

7.4.5 With A47 Bascule Bridge lifted for 10 mins, northbound traffic held up at the Bascule Bridge creates a queue that extends back onto Waveney Drive (approximately 1.2km). Southbound traffic queues back to the roundabout on A47 at Battery Green Road, a distance of around 750m, and along Denmark Road/Katwijk Way for around 600m as shown in Figure 7.4.

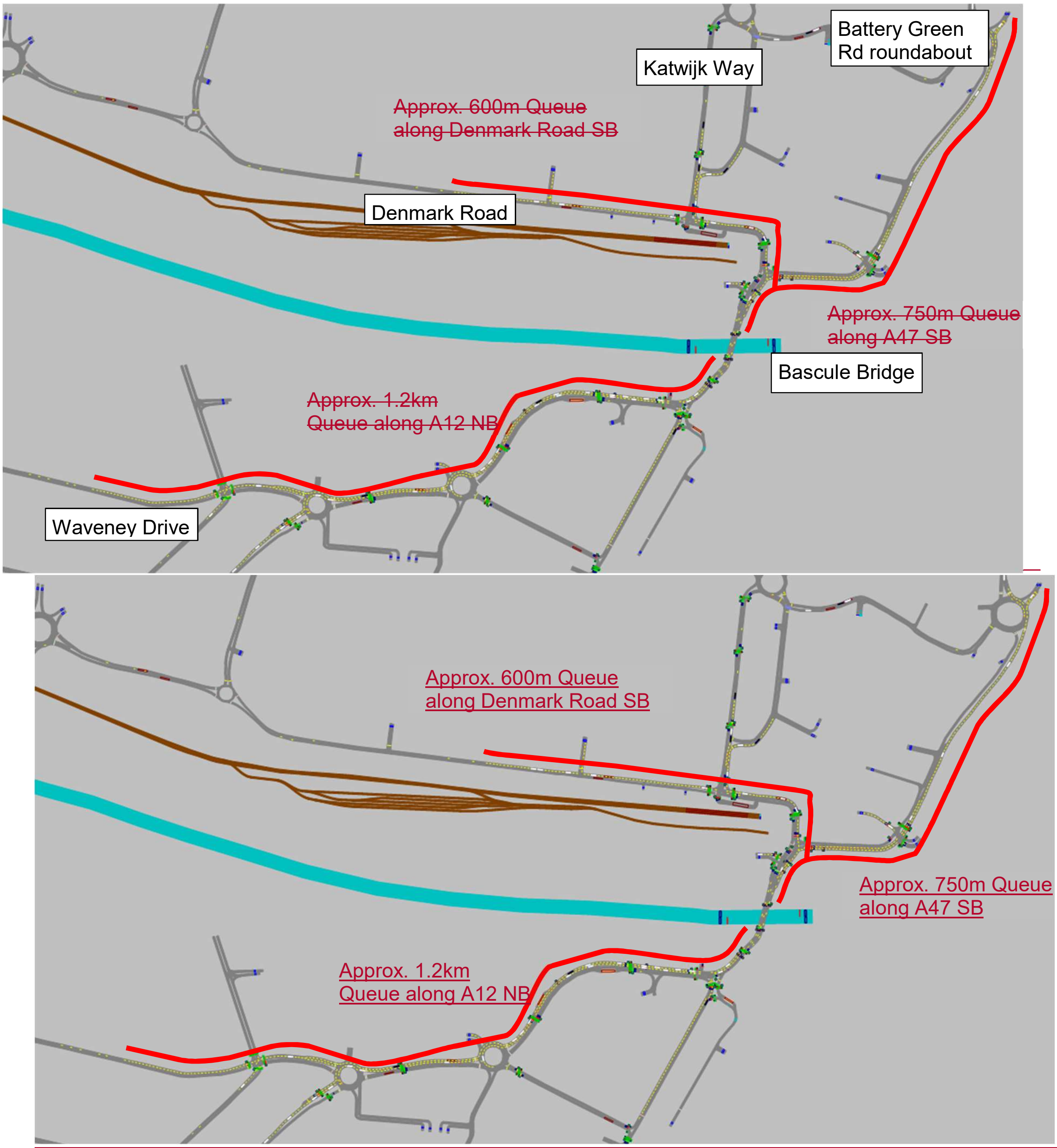


Figure 7.4: Congestion in the DM "without Scheme" scenario (DM-2022_10min) in 2022 AM

7.4.6 In the area around Mutford Bridge, the observed effects of the Bascule Bridge lift are broadly similar in the five minute lift scenario as in the ten minute lift scenario. The five minute lift scenario in Figure 7.5 shows Mutford Bridge at around 08:10, with traffic appearing heavier than in the base year. Although traffic still flows generally well, the heavier flows can occasionally lead to some flow breakdown across Mutford Bridge and further south along this link in both directions.

Figure 7.5: Traffic flow across Mutford Bridge (DM-2022_5min) in 2022 AM, approx. 08:10

7.4.7 Figure 7.6 shows the bridge around 08:35 after the Bascule Bridge has lifted. It suggests that traffic flow is heavier as traffic queues back from the Victoria Road roundabout in the southbound direction. Although traffic is moving, the back of the queue has reached the bridge.

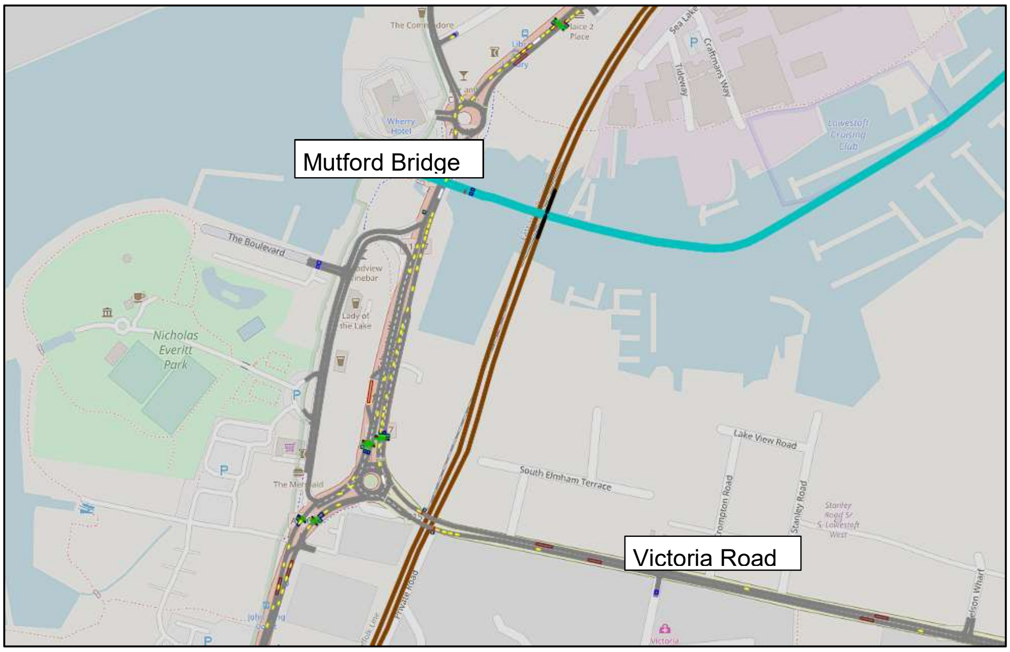


Figure 7.6: Traffic flow across Mutford Bridge (DM-2022_5min) in 2022 AM, approx. 08:35

DM 2022 PM

7.4.8 With the A47 Bascule Bridge open to traffic, in the PM peak there are considerable queues in the A12 NB direction and to the junction of Katwijk Way in the SB direction, as shown in Figure 7.7.

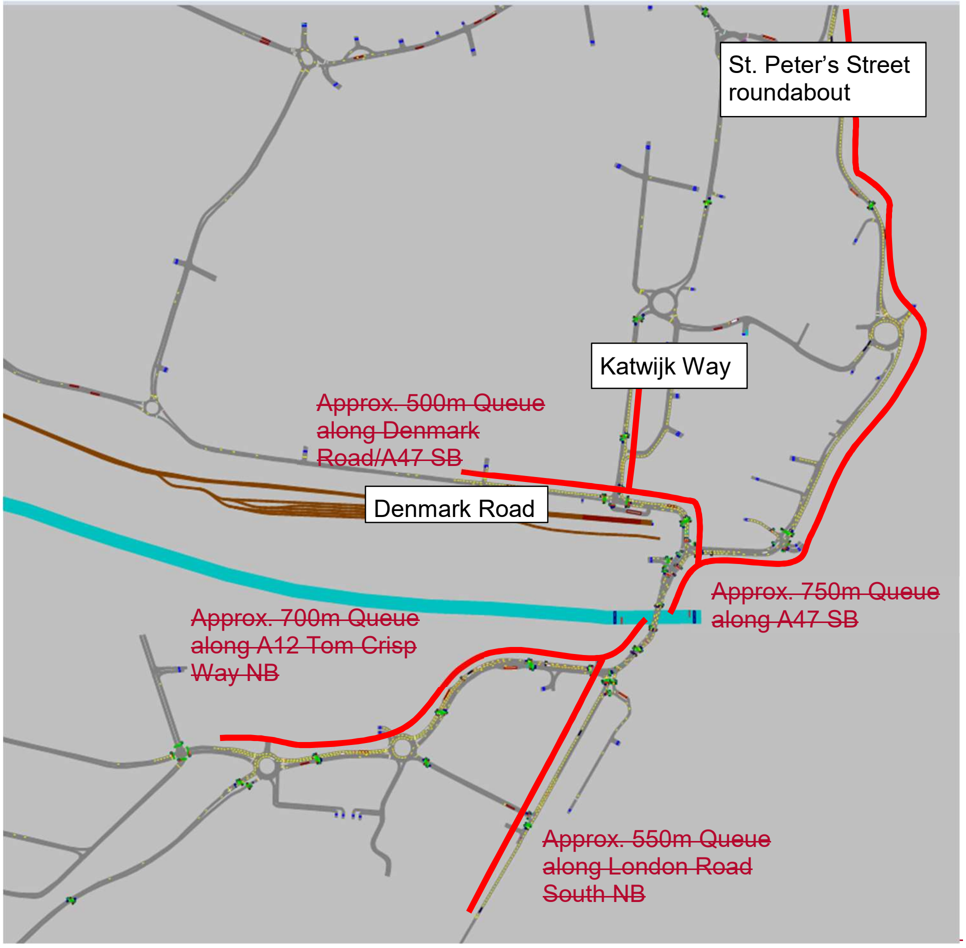
Figure 7.7: Congestion in the DM "without Scheme" scenario (DM_2022) in 2022 PM

7.4.9 In the PM peak, queues along Denmark Road westbound extend back to Clemence Street (approx. 800m) with the A47 Bascule Bridge lifted for 5 minutes as shown in Figure 7.8. This also leads to exit blocking along Katwijk Way southbound with queuing extending back to the next roundabout.

Figure 7.8: Congestion in the DM "without Scheme" scenario (DM_2022_5min) in 2022 PM

7.4.10 With A47 Bascule Bridge lifted for 10 mins, northbound traffic held up at the Bascule Bridge creates a queue that extends back onto A12 Tom Crisp Way~~Waveney Drive~~

~~(approx. 1.2km)~~. Southbound traffic queues back to the roundabout on A47 at St. Peter's Street, a distance of around 1.2km and along Denmark Road/Katwijk Way for around 5~~6~~00m as shown in Figure 7.9.


St. Peter's Street roundabout
Katwijk Way
~~Approx. 500m Queue along Denmark Road/A47 SB~~
Denmark Road
~~Approx. 750m Queue along A47 SB~~
~~Approx. 700m Queue along A12 Tom Crisp Way NB~~
~~Approx. 550m Queue along London Road South NB~~

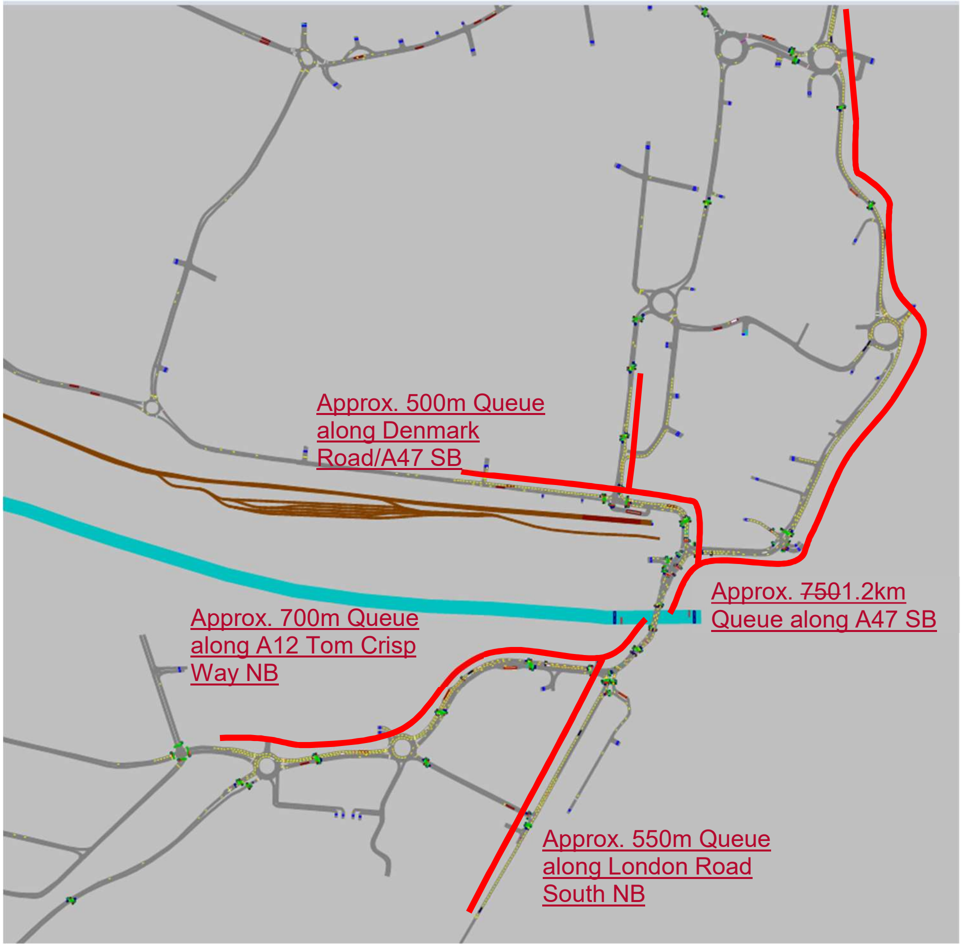


Figure 7.9: Congestion in the DM "without Scheme" scenario (DM_2022_10min) in 2022 PM

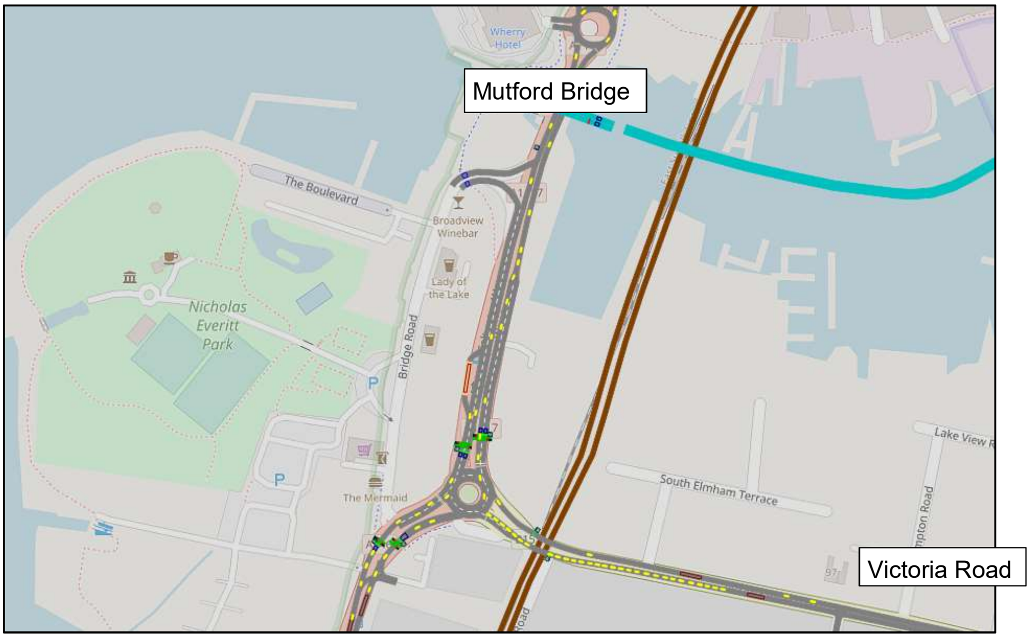


Figure 7.10: Traffic flow across Mutford Bridge (DM-2022_5min), in 2022 PM approx. 17:10

7.4.11 Figure 7.10 shows Mutford Bridge at around 17:10 in the PM peak. More traffic is observed over the bridge compared to the base year. While this tends not to have any impact on the bridge itself, the greater southbound flow has an impact on the Victoria Road roundabout, causing queuing on Victoria Road beyond the railway level crossing.

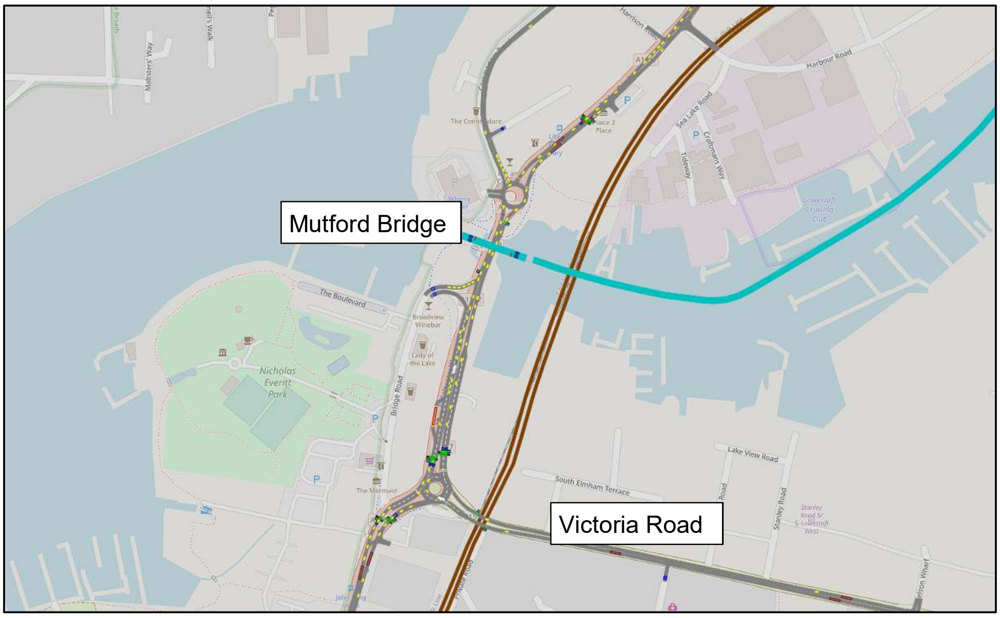


Figure 7.11: Traffic flow across Mutford Bridge (DM-2022_5min), in 2022 PM approx. 17:40

7.4.12 Figure 7.11 shows Mutford Bridge around 17:40, five minutes after the Bascule Bridge has reopened. The level crossing to the north has also reopened. While the original queue dissipates along the entire northbound link, residual stop-start queuing occurs across the bridge for a few minutes more, while new vehicles join the rear of the queue. This behaviour is seen until approximately 17:45.

7.4.13 Table 7.2 and Table 7.3 show a comparison of average delays on key routes (as shown in Figure 7.1) in the Base 2016 scenario and the DM 2022 scenarios. ~~In the DM AM and PM peak scenarios.~~ The delay is calculated by comparing the actual peak hour modelled journey time to the modelled freeflow time. In the DM AM and PM peak scenarios ~~. T~~there are considerable delays to vehicles, particularly those travelling along the A12 corridor. The delay is exacerbated by the A47 Bascule Bridge lifting.

Route	Description	Base AM	DM_2022	DM_2022_ 5min	DM_2022_ 10min
Route 1 A	A146-Fairfield Rd/Nor'ton Dr (NB)	23	98	101	101
Route 1 B	A146-Fairfield Rd/Nor'ton Dr (SB)	0	76	53	58
Route 2 A	A12/A47 (NB)	158	176	228	372
Route 2 B	A12 (SB)	74	91	151	261
Route 3 A	Waveney Drive (EB)	42	52	50	86
Route 3 B	Waveney Drive (WB)	28	28	34	35
Route 4 A	Denmark Road (WB)	51	55	45	35
Route 4 B	Denmark Road (EB)	67	100	259	403

Table 7.2: Delay (sec) on key routes in Base and 2022 DM (without Scheme) AM

Route	Description	Base PM	DM_2022	DM_2022_ 5min	DM_2022_ 10min
Route 1 A	A146-Fairfield Rd/Nor'ton Dr (NB)	66	70	61	111
Route 1 B	A146-Fairfield Rd/Nor'ton Dr (SB)	67	107	96	103
Route 2 A	A12/A47 (NB)	97	113	265	403
Route 2 B	A47/A12 (SB)	129	172	294	414
Route 3 A	Waveney Drive (EB)	24	34	34	45
Route 3 B	Waveney Drive (WB)	46	66	67	67
Route 4 A	Denmark Road (WB)	49	43	40	42
Route 4 B	Denmark Road (EB)	59	87	184	259

Table 7.3: Delay (sec) on key routes in Base and 2022 DM (without Scheme) PM

7.4.14 The results show that the average delay between A12 Tom Crisp Way/Blackheath Rd and 47 St Peters St / Jubilee Way in the 2016 Base scenario is around 120 seconds in both time periods. The delay increases to around 420 seconds in the 2022 DM scenario.

7.4.15 In the 2016 Base and DM (without A47 Bascule Bridge lift), there is some delay at the junction of Denmark Road and A47/A12 under normal operating conditions. The queues worsen in the 2022 DM scenarios when the Bascule Bridge is lifted for 5 and 10 minutes and the road is closed to general traffic.

7.4.16 The average delay on Denmark Road is around 60 seconds in the 2016 Base year and DM scenario (without A47 Bascule Bridge lift) and increases to 180 and 240 seconds in the 2022 DM scenario with 5 and 10 minute bridge lift times respectively.

7.5 Forecast Year 2022 DS

Scenario 5 - Mutford Bridge Open; Scheme Lifted (6 mins); A47 Bascule Bridge Lifted (5 mins) (bridge lift offset 1.5 minutes westbound)

7.5.1 Table 7.4~~Table 7.4~~ ~~shows~~compares the ~~comparison of~~ AM peak journey ~~time~~times for the Do Minimum (assuming a 5 minute ~~closure~~lift of A47 Bascule Bridge) with Scenario 5 for key north-south movements~~ with and without the Scheme.~~. This~~e above table~~ shows that there is an overall decrease in journey time across all key movements with significant savings between B1532 London Road South and A47 Jubilee Way (43%).

Route	Description	DM_2022_~~10 min~~5min	DS_2022_SC-5	% Diff
A to B	A12 Tom Crisp Way to A47 Jubilee Way	580	515	-11%
B to A	A47 Jubilee Way Jn to A12 Tom Crisp Way	497	457	-8%
C to B	London Rd South to A47 Jubilee Way	576	328	-43%
B to C	A47 Jubilee Way to B1532 Marine Parade	307	274	-11%

Table 7.4: Comparison of Journey time (sec) between key N-S movements - Scenario 5 AM[38]

7.5.2 Table 7.5~~Table 7.5~~ shows the change in AM peak journey time on key routes with and without Scheme. The table shows that there are journey time savings on the majority of the key routes in the AM peak, particularly Denmark Road eastbound which experiences a substantial reduction in journey time. Only Waveney Drive eastbound would see an increase in journey time, on the approach to the Scheme.

Route	Description	DM_2022_~~10 min~~5min	DS_2022_SC-5	% Diff
Route 1 A	A146-Fairfield Rd/Normanston Dr (NB)	570	542	-5%
Route 1 B	A146-Fairfield Rd/Normanston Dr (SB)	544	528	-3%
Route 2 A	A12/A47 (NB)	540	492	-9%
Route 2 B	A47/A12 (SB)	476	452	-5%
Route 3 A	Waveney Drive (EB)	217	235	8%
Route 3 B	Waveney Drive (WB)	218	207	-5%
Route 4 A	Denmark Road (WB)	235	218	-7%
Route 4 B	Denmark Road (EB)	486	314	-35%

Table 7.5: Comparison of Journey time (sec) on key routes in DM and DS – Scenario 5 AM[39]

7.5.3 Table 7.6~~Table 7.6~~ ~~shows~~compares the ~~comparison of~~ PM peak journey times for ~~north-south movements~~the Do Minimum (assuming a 5 minute closure of Bascule Bridge) with ~~and without the Scheme.~~Scenario 5. The table shows that there are savings in journey time on northbound movements with a significant decrease in journey time for northbound

[38] Column 3 of Table 7.4 has been amended to show that DM scenario assumes a 5 minute lift of Bascule Bridge lift (the original version of the TA was incorrectly labelled as a 10 minute lift for Bascule Bridge)
[39] Column 3 of Table 7.5 has been amended to show that DM scenario assumes a 5 minute lift of Bascule Bridge lift (the original version of the TA was incorrectly labelled as a 10 minute lift for Bascule Bridge

traffic to A47 Jubilee Way from A12 Tom Crisp Way (-20%) and London Road South (-46%).

Route	Description	DM_2022_5min	DS_2022_SC5	% Diff
A to B	A12 Tom Crisp Way to A47 Jubilee Way	630	504	-20%
B to A	A47 Jubilee Way Jn to A12 Tom Crisp Way	629	670	7%
C to B	London Rd South to A47 Jubilee Way	672	361	-46%
B to C	A47 Jubilee Way to B1532 Marine Parade	365	367	1%

Table 7.6: Comparison of Journey time (sec) between key N-S movements - Scenario 5 PM[40]

7.5.4 Table 7.7~~Table 7.7~~ presents the PM peak journey time for Scenario 5 for the key routes. The table shows that in the PM peak, there is an overall reduction in travel time on most routes with considerable savings on A12/A47 northbound (-22%) and on Denmark Road eastbound (-28%). There are some increases in travel time on A47/A12 southbound ~~and on Waveney Drive eastbound~~ which could be attributed to the volume of additional southbound traffic in the PM peak and on Waveney Drive eastbound which would be due to traffic approaching the Scheme. ~~.~~

Route	Description	DM_2022_~~10min~~	DS_2022_SC-5	% Diff
Route 1 A	A146-Fairfield Rd/Normanston Dr (NB)	551	557	1%
Route 1 B	A146-Fairfield Rd/Normanston Dr (SB)	589	595	1%
Route 2 A	A12/A47 (NB)	585	457	-22%
Route 2 B	A47/A12 (SB)	605	622	3%
Route 3 A	Waveney Drive (EB)	205	230	12%
Route 3 B	Waveney Drive (WB)	252	232	-8%
Route 4 A	Denmark Road (WB)	233	235	1%
Route 4 B	Denmark Road (EB)	400	288	-28%

Table 7.7: Comparison of Journey time (sec) on key existing routes in DM and DS - Scenario 5 PM[41]

7.5.5 In the AM Peak for Scenario 5, queuing due to the Bascule Bridge lift is much reduced compared to the equivalent DM scenario (Figure 7.3), both to the north and south of the bridge. When the Scheme Bridge lifts, queuing traffic is generally confined to the Scheme bridge itself, the adjoining junctions and Waveney Drive. The queueing due to the Bascule Bridge lift has largely dissipated.

7.5.6 The conditions after a 5 minute lift of the Bascule Bridge in the AM peak for Scenario 5 are illustrated from a plot taken from the VISSIM model and presented in Figure 7.12

[40] Column 3 of Table 7.6 has been amended to show that DM scenario assumes a 5 minute lift of Bascule Bridge lift (the original version of the TA was incorrectly labelled as a 10 minute lift for Bascule Bridge)

[41] Column 3 of Table 7.7 has been amended to show that DM scenario assumes a 5 minute lift of Bascule Bridge lift (the original version of the TA was incorrectly labelled as a 10 minute lift for Bascule Bridge)

Figure 7.12: Scenario 5 AM: 08:36 after the Bascule Bridge reopens to traffic

7.5.7 In the PM Peak, the Bascule Bridge lift causes the majority of queueing on the north side of the river. Queues on the A47 southbound stretch back almost to the Battery Green Road roundabout. The level is similar to the comparable DM scenario (Figure 7.8). The traffic has a chance to dissipate before the start of queueing caused by the Scheme Bridge. This queueing is confined to the Scheme bridge approaches ~~entrances~~ and a short section of Waveney Drive.

7.5.8 The conditions after a 5 minute lift of the Bascule Bridge in the PM peak for Scenario 5 are presented in Figure 7.13.

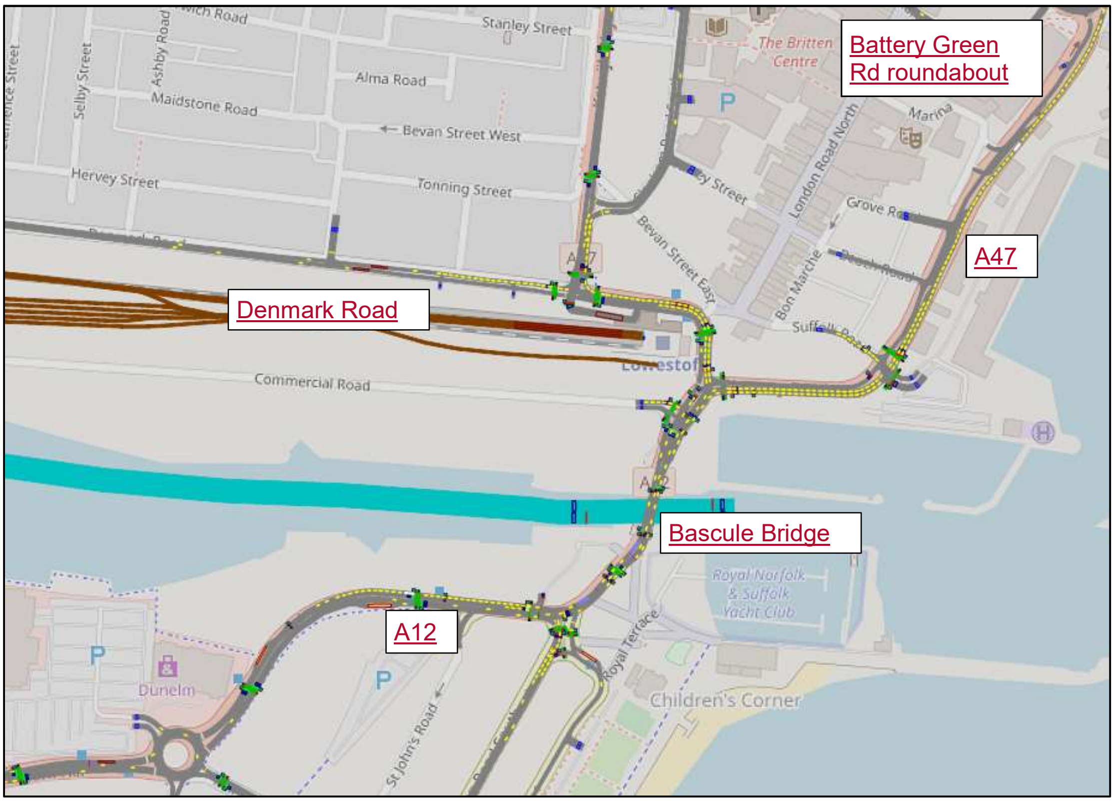


Figure 7.13: Scenario 5 PM: 17:36 after Bascule Bridge reopens to traffic

~~7.5.5~~7.5.9 Scenario 5 includes a staggered bridge lifting sequence that is likely to be the most probable scenario. Overall, the results show that in this scenario, there will be significant benefits to journey times on key north south movements and key routes because of the Scheme.

Scenario 5a – Mutford Bridge Open; Scheme Lifted (6 mins); A47 Bascule Bridge Lifted (5 mins) (Simultaneous Bridge Lifts)

~~7.5.6~~7.5.10 Table 7.8 ~~shows~~compares the ~~comparison of~~ AM peak journey ~~time~~times for the Do Minimum (assuming a 5 minute closure of Bascule Bridge) against Scenario 5a for key north-south movements ~~with and without the Scheme~~. The specific routes taken between the end points is defined by the model using a dynamic assignment, i.e. taking the benefit of rerouting traffic where congestion occurs. The table shows that there is an overall decrease in journey time on all movements with the Scheme in place compared to the DM Scenario, with a significant decrease in journey time (resulting from redistributed traffic using the Scheme) for traffic between London Rd South and A47 Jubilee Way (44%) which is one of the key routes in Lowestoft.

Route	Description	DM_2022_5min	DS_2022_SC-5a	% Diff
A to B	A12 Tom Crisp Way to A47 Jubilee Way	580	545	-6%
B to A	A47 Jubilee Way Jn to A12 Tom Crisp Way	497	460	-8%
C to B	London Rd South to A47 Jubilee Way	576	324	-44%
B to C	A47 Jubilee Way to B1532 Marine Parade	307	274	-11%

Table 7.8: Comparison of Journey time (sec) between key N-S movements - Scenario 5a AM

~~7.5.7~~7.5.11 Table 7.9 shows a change in AM peak journey time on key routes with and without the Scheme. The table shows that there is an overall reduction in journey time on almost all routes. The slight increase in journey time on Waveney Drive eastbound is likely to be caused by the increased volume of traffic accessing the Scheme giving way to traffic on the new roundabout.

Route	Description	DM_2022_5min	DS_2022_SC-5a	% Diff
Route 1 - A	A146-Fairfield Rd/Normanston Dr (NB)	570	542	-5%
Route 1 - B	A146-Fairfield Rd/Normanston Dr (SB)	544	533	-2%
Route 2 - A	A12/A47 (NB)	540	502	-7%
Route 2 - B	A47/A12 (SB)	476	453	-5%
Route 3 - A	Waveney Drive (EB)	217	250	15%
Route 3 - B	Waveney Drive (WB)	218	212	-3%
Route 4 - A	Denmark Road (WB)	235	222	-6%
Route 4 - B	Denmark Road (EB)	486	316	-35%

Table 7.9: Comparison of Journey time (sec) on key routes in DM and DS - Scenario 5a AM

~~7.5.8~~7.5.12 Table 7.10 shows the comparison of PM peak journey times for key north-south movements with and without the Scheme. The table shows there is an overall decrease in journey time on most movements with a significant decrease in journey time for traffic between London Road South and A47 Jubilee Way (45%). There is an increase in journey time on A47 ~~sou~~northbound as a result of the closure of both bridges together.

Route	Description	DM_2022_5min	DS_2022_SC-5a	% Diff
A to B	A12 Tom Crisp Way to A47 Jubilee Way	630	519	-18%
B to A	A47 Jubilee Way Jn to A12 Tom Crisp Way	629	688	9%
C to B	London Rd South to A47 Jubilee Way	672	369	-45%
B to C	A47 Jubilee Way to B1532 Marine Parade	365	370	1%

Table 7.10: Comparison of Journey time (sec) between key N-S movements - Scenario 5a PM

~~7.5.9~~7.5.13 Table 7.11 shows a change in PM peak journey time on key routes with and without Scheme. The table shows a considerable decrease in the northbound journey time on A12/A47 (21%) and a decrease in journey time on Denmark Road EB (27%). There is an increase in journey time on Waveney Drive eastbound (17%) and this is consistent with the AM peak scenario, and the reassignment of traffic to the Scheme.

Route	Description	DM_2022_5min	DS_2022_SC-5a	% Diff
Route 1 A	A146-Fairfield Rd/Normanston Dr (NB)	551	565	3%
Route 1 B	A146-Fairfield Rd/Normanston Dr (SB)	589	593	1%
Route 2 A	A12/A47 (NB)	585	464	-21%
Route 2 B	A47/A12 (SB)	605	653	8%
Route 3 A	Waveney Drive (EB)	205	239	17%
Route 3 B	Waveney Drive (WB)	252	235	-7%
Route 4 A	Denmark Road (WB)	233	234	1%
Route 4 B	Denmark Road (EB)	400	291	-27%

Table 7.11: Comparison of Journey time (sec) on key routes in DM and DS - Scenario 5a PM

~~7.5.10~~7.5.14 Overall, the results show that in Scenario 5a, there is likely to be substantial benefit because of implementation of the Scheme on key north-south movements and also on key routes even when the effect of a 6 minute Scheme bridge lift is accounted for, alongside a simultaneous 5 minute lift of the A47 Bascule Bridge. The benefits to journey times are however slightly less than with a sequential bridge lift (Scenario 5).

Scenario 6 - Mutford Bridge Open; Scheme Lifted (6 mins); A47 Bascule Bridge Lifted (10 mins) (Simultaneous bridge lifts)

~~7.5.11~~7.5.15 Table 7.12 ~~shows the comparison of~~ compares AM peak Do Minimum journey ~~time for~~ times (assuming a 10 minute closure of Bascule Bridge) with Scenario 6 for key north-south movements ~~with and without the Scheme. The table~~. Table 7.12 shows that there is an overall decrease in journey time across all key movements with significant savings between London Road South and A47 Jubilee Way (25%) and A12 Tom Crisp Way to A47 Jubilee Way (15%).

Route	Description	DM_2022_10min	DS_2022_SC-6	% Diff
A to B	A12 Tom Crisp Way to A47 Jubilee Way	728	622	-15%
B to A	A47 Jubilee Way Jn to A12 Tom Crisp Way	607	545	-10%
C to B	London Rd South to A47 Jubilee Way	680	511	-25%
B to C	A47 Jubilee Way to B1532 Marine Parade	417	358	-14%

Table 7.12: Comparison of Journey time (sec) between key N-S movements - Scenario 6 AM

~~7.5.12~~7.5.16 Table 7.13 shows the change in AM peak journey time on key routes with and without Scheme. The table shows that there is an overall decrease in journey time on most routes compared to the DM scenario. In particular, traffic along Denmark Road eastbound (-33%) ~~which~~ experiences a substantial reduction in journey time.

Route	Description	DM_2022_10min	DS_2022_SC-6	% Diff
Route 1 A	A146-Fairfield Rd/Normanston Dr (NB)	569	539	-5%
Route 1 B	A146-Fairfield Rd/Normanston Dr (SB)	549	535	-3%
Route 2 A	A12/A47 (NB)	684	614	-10%
Route 2 B	A47/A12 (SB)	585	538	-8%
Route 3 A	Waveney Drive (EB)	253	256	1%
Route 3 B	Waveney Drive (WB)	219	216	-2%
Route 4 A	Denmark Road (WB)	246	225	-8%
Route 4 B	Denmark Road (EB)	630	419	-33%

Table 7.13: Comparison of Journey time (sec) on key routes in DM and DS – Scenario 6 AM

~~7.5.13~~7.5.17 Table 7.14 presents the PM peak journey times for key north-south movements with and without the Scheme. The table shows that there is an overall reduction in journey time across all the key movements with a significant decrease in journey time for northbound movements to A47 Jubilee Way which is consistent with in the AM peak scenario.

Route	Description	DM_2022_10min	DS_2022_SC-6	% Diff
A to B	A12 Tom Crisp Way to A47 Jubilee Way	812	571	-30%
B to A	A47 Jubilee Way Jn to A12 Tom Crisp Way	753	728	-3%
C to B	London Rd South to A47 Jubilee Way	749	468	-38%
B to C	A47 Jubilee Way to B1532 Marine Parade	490	450	-8%

Table 7.14: Comparison of Journey time (sec) between key N-S movements - Scenario 6 PM

~~7.5.14~~7.5.18 Table 7.15 shows the change in PM peak journey time on key routes with and without Scheme. The table shows there is an overall reduction in travel time on most routes with considerable savings on A12 northbound (-29%) and on Denmark Road eastbound (-31%). There are some increases in travel time on A12 southbound and Waveney Drive eastbound owing to the high volume of southbound traffic in the PM.

Route	Description	DM_2022_10min	DS_2022_SC-6	% Diff
Route 1 A	A146-Fairfield Rd/Normanston Dr (NB)	601	540	-10%
Route 1 B	A146-Fairfield Rd/Normanston Dr (SB)	597	589	-1%
Route 2 A	A12/A~~a~~47 (NB)	724	515	-29%
Route 2 B	A47/A12 (SB)	724	770	6%
Route 3 A	Waveney Drive (EB)	216	255	18%
Route 3 B	Waveney Drive (WB)	251	230	-8%
Route 4 A	Denmark Road (WB)	234	244	4%
Route 4 B	Denmark Road (EB)	475	326	-31%

Table 7.15: Comparison of Journey time (sec) on key existing routes in DM and DS - Scenario 6 PM

7.5.19 In the AM Peak, Scenario 6 exhibits greater levels of queueing following a Bascule Bridge lift of 10 minutes when compared against Scenario 5 (Figure 7.~~21~~12), with the A12/A47 northbound queues passing the Asda roundabout. The queueing is not however quite as extensive as in the DM scenario (Figure 7.4). Queueing due to the Scheme Bridge lift is not dissimilar to that in Scenario 5. There is a longer queue on Waveney Drive.

7.5.20 The conditions after a 10 minute lift of the A47 Bascule Bridge in the AM peak for Scenario 6 are presented in Figure 7.14.

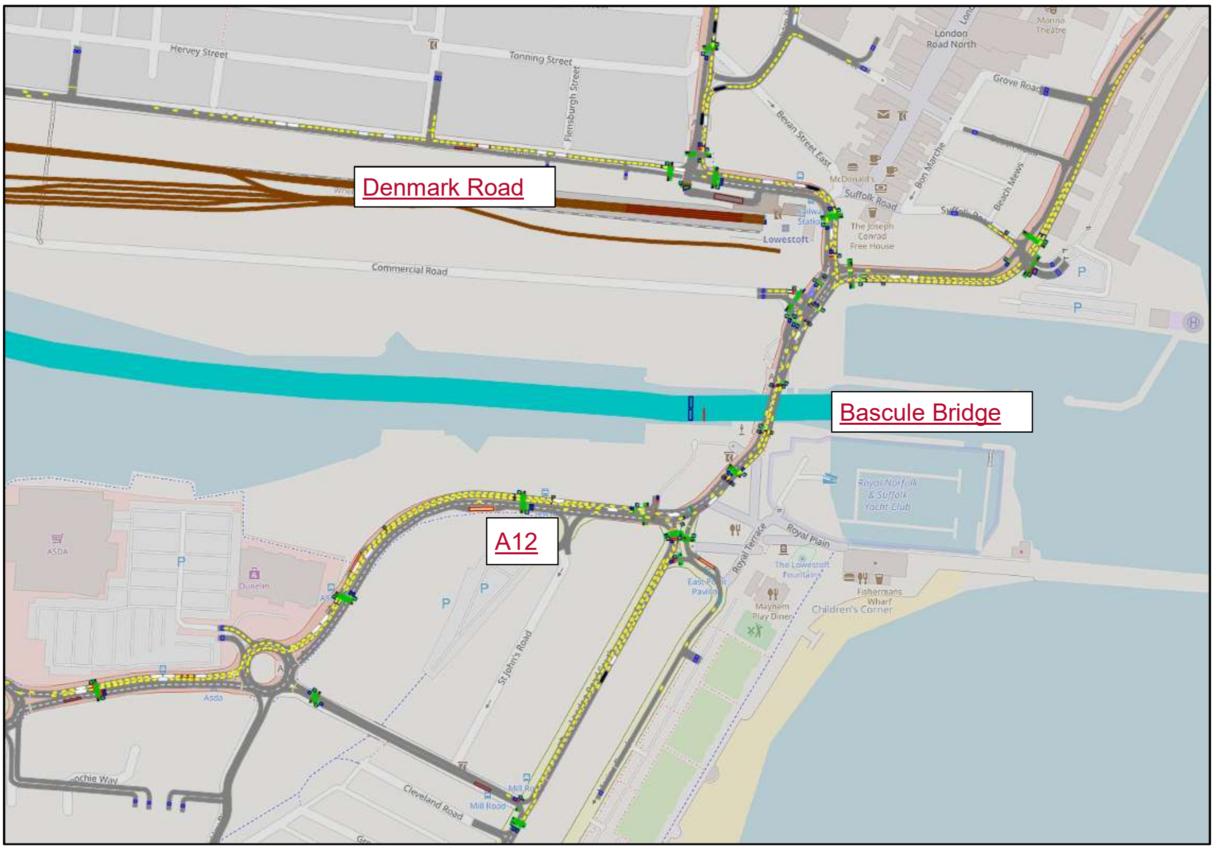


Figure 7.14: Scenario 6 AM: 08:42 after Bascule Bridge reopens to traffic

7.5.21 In the PM Peak, there is a greater queue length after the A47 Bascule Bridge lift when compared with Scenario 5 (Figure 7.13), as would be expected, and more queueing on the south side of the lake~~river~~ for northbound traffic stretching past the Asda roundabout. Queueing in Scenario 6 caused by the Scheme Bridge lift is of a similar level to Scenario 5, however the queuing due to the Bascule Bridge lift is still apparent.

7.5.22 The conditions after a 10 minute lift of the A47 Bascule Bridge in the PM peak for Scenario~~n~~ 6 are presented in Figure 7.15.

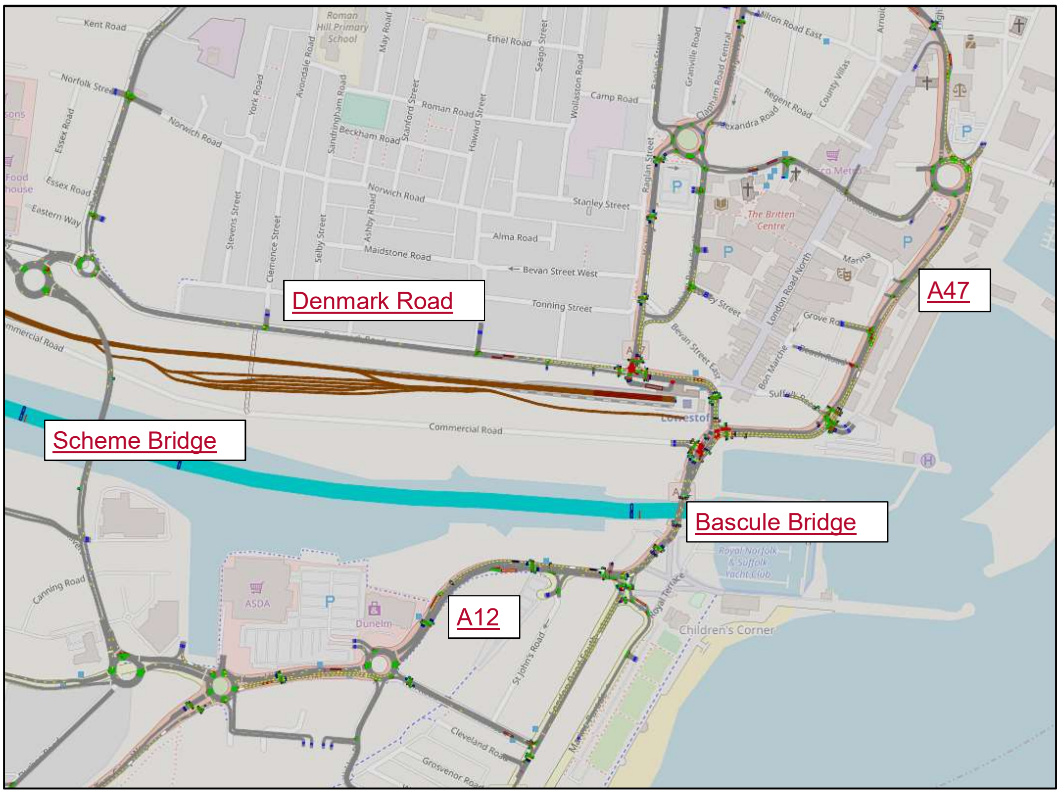


Figure 7.15: Scenario 6 PM: 17:42 just after Bascule Bridge reopens to traffic

~~7.5.15~~7.5.23 Overall, the results show that in Scenario 6, there is likely to be substantial benefit on key north-south movement and also on key routes, even~~ing~~ accounting for a 6 minute Scheme bridge lift and a 10 minute lift of the A47 Bascule Bridge.

Scenario 7 - Mutford Bridge Open; Scheme Lifted (10 mins); A47 Bascule Bridge Lifted (10 mins) (Simultaneous bridge lifts)

~~7.5.16~~7.5.24 Table 7.16 ~~shows the comparison of~~ compares AM peak Do Minimum journey ~~time for~~ times (assuming a 10 minute closure of Bascule Bridge) with Scenario 7 for key north-south movements~~ with and without the Scheme.~~ The table shows that there is an overall decrease in journey time across all key movements with significant savings between London Road South and A47 Jubilee Way (-31%).

Route	Description	DM_2022_10min	DS_2022_SC-7	% Diff
A to B	A12 Tom Crisp Way to A47 Jubilee Way	728	661	-9%
B to A	A47 Jubilee Way Jn to A12 Tom Crisp Way	607	581	-4%
C to B	London Rd South to A47 Jubilee Way	680	468	-31%
B to C	A47 Jubilee Way to B1532 Marine Parade	417	367	-12%

Table 7.16: Comparison of Journey time (sec) between key N-S movements - Scenario 7 AM

~~7.5.17~~7.5.25 Table 7.17 shows the change in AM peak journey time on key routes with and without Scheme. The table shows that impact on the key routes in the AM are consistent with Scenario 6, particularly along A12/A47 northbound, Denmark Road eastbound and A146 Fairfield Rd/Normanston Drive southbound which experiences a substantial reduction in journey time. Waveney Drive eastbound sees an increase in journey time as a result of additional traffic accessing the Scheme.

Route	Description	DM_2022_10min	DS_2022_SC-7	% Diff
Route 1 A	A146-Fairfield Rd/Normanston Dr (NB)	569	543	-5%
Route 1 B	A146-Fairfield Rd/Normanston Dr (SB)	549	529	-4%
Route 2 A	A12/A47 (NB)	684	623	-9%
Route 2 B	A47/A12 (SB)	585	553	-6%
Route 3 A	Waveney Drive (EB)	253	336	33%
Route 3 B	Waveney Drive (WB)	219	247	13%
Route 4 A	Denmark Road (WB)	246	228	-7%
Route 4 B	Denmark Road (EB)	630	402	-36%

Table 7.17: Comparison of Journey time (sec) on key routes in DM and DS - Scenario 7 AM

~~7.5.18~~7.5.26 ~~Table 7.18~~Table 7.18 shows the comparison of PM journey times for north-south movements with and without the Scheme. The table shows that the savings in journey time on key routes are consistent with Scenario 6 and there continues to be a significant decrease in journey time for northbound traffic to A47 Jubilee Way from A12 Tom Crisp Way (-27%) and London Road South (-34%).

Route	Description	DM_2022_10min	DS_2022_SC-7	% Diff
A to B	A12 Tom Crisp Way to A47 Jubilee Way	812	592	-27%
B to A	A47 Jubilee Way Jn to A12 Tom Crisp Way	753	801	6%
C to B	London Rd South to A47 Jubilee Way	749	492	-34%
B to C	A47 Jubilee Way to B1532 Marine Parade	490	472	-4%

Table 7.18: Comparison of Journey time (sec) between key N-S movements - Scenario 7 PM

~~7.5.19~~7.5.27 Table 7.19 presents the PM peak journey time for Scenario 7 for the key routes. The table shows that in the PM peak, there is an overall reduction in travel time on most routes with considerable savings on A12/A47 northbound (-26%) and on Denmark Road eastbound (-31%). There are some increases in travel time on A47/A12 southbound, Waveney Drive eastbound (17%) and Denmark Road westbound (8%) which could be attributed to the volume of additional southbound traffic in the PM peak adding to the congestion caused by the increased lift time of the Scheme bridge.

Route	Description	DM_2022_10min	DS_2022_SC-7	% Diff
Route 1 A	A146-Fairfield Rd/Normanston Dr (NB)	601	548	-9%
Route 1 B	A146-Fairfield Rd/Normanston Dr (SB)	597	584	-2%
Route 2 A	A12/A47 (NB)	724	534	-26%
Route 2 B	A47/A12 (SB)	724	846	17%
Route 3 A	Waveney Drive (EB)	216	290	34%
Route 3 B	Waveney Drive (WB)	251	253	1%
Route 4 A	Denmark Road (WB)	234	253	8%
Route 4 B	Denmark Road (EB)	475	329	-31%

Table 7.19: Comparison of Journey time (sec) on key existing routes in DM and DS - Scenario 7 PM

7.5.28 In the AM Peak, Scenario 7 exhibits similar levels of queueing following a Bascule Bridge lift as Scenario 6 (Figure 7.14), with the A12 northbound queues passing the Asda roundabout. The queueing is not however quite as extensive as in the DM scenario (Figure 7.4). This scenario has a 10-minute Scheme Bridge and this leads to substantial queuing along Waveney Drive. Queueing to the north of the Scheme Bridge is not significant.

7.5.29 The conditions after a 10 minute lift of the A47 Bascule Bridge in the AM peak for Scenario 7 are presented in Figure 7.16.

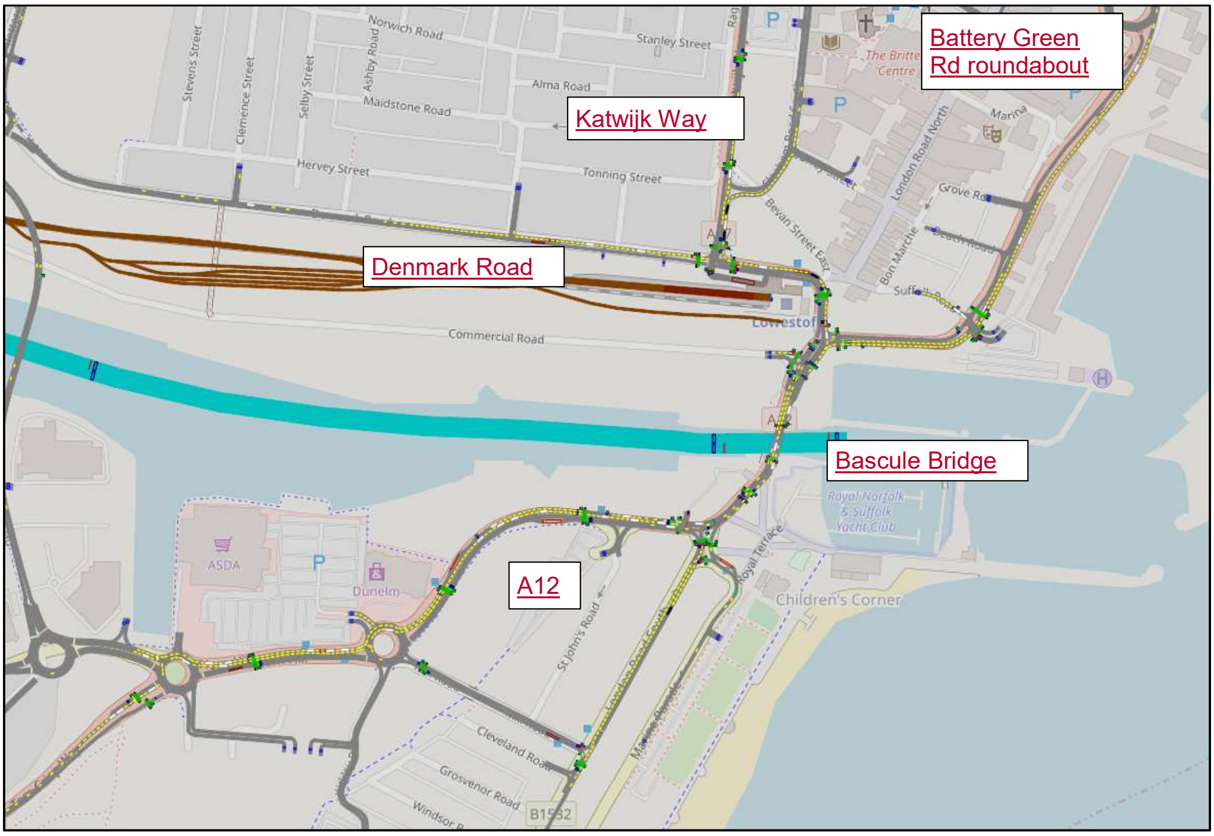


Figure 7.16: Scenario 7 AM: 08:42 after Bascule Bridge reopens to traffic

7.5.30 In the PM Peak, queuing due to the A47 Bascule Bridge lift is lower than in the comparable DM scenario (Figure 7.9). The A47 southbound queue in the DS extends past Battery Green Road roundabout, whereas in the DM it is much further, extending past the St Peter's Street roundabout. Queuing on the south side of the river is reduced too, most likely due to the Scheme Bridge being open and providing an extra route. Queueing due to the Scheme Bridge lift extends further down Waveney Drive and also north of the river along Rotterdam Road. The A47 Bascule Bridge queuing has not had a chance to dissipate and is still in evidence along the A47 and A12.

7.5.31 The conditions after a 10 minute lift of the A47 Bascule Bridge in the PM peak for Scenario 7 are presented in Figure 7.17.

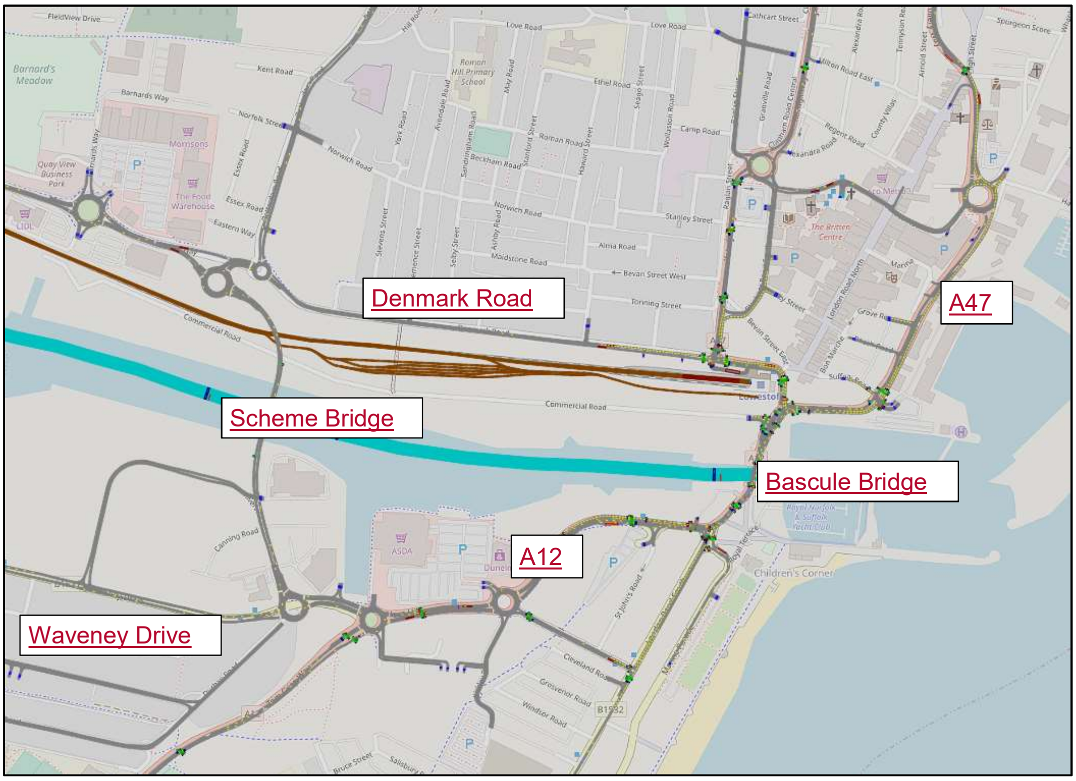


Figure 7.17: Scenario 7 PM: 17:42 after Bascule Bridge reopens to traffic

~~7.5.20~~7.5.32 Overall, the results show that in Scenario 7, there would be benefits ~~because~~as a result of the Scheme on key north-south routes and movements. However, there will be increased journey times on some routes closest to the ~~crossings~~bridges, particularly in the PM peak, as a result of the increased lift time of the Scheme (10 minutes) and A47 Bascule Bridge (10 minutes).

Scenario 8 - Mutford Bridge Open; Scheme Open; A47 Bascule Bridge Open

~~7.5.21~~7.5.33 Table 7.20~~Table 7.20 shows the comparison of~~compares AM peak Do Minimum journey ~~time~~times (assuming Bascule Bridge is not lifted with journey times for Scenario 8 for key north-south movements~~ with and without the Scheme.~~. The table shows that there is an overall decrease in journey time across all key movements with significant savings between London Road South and A47 Jubilee Way (-35.2%).

Route	Description	DM_2022	DS_2022_SC-8	% Diff
A to B	A12 Tom Crisp Way to A47 Jubilee Way	504	497	-1.4%
B to A	A47 Jubilee Way Jn to A12 Tom Crisp Way	424	409	-3.6%
C to B	London Rd South to A47 Jubilee Way	427	277	-35.2%
B to C	A47 Jubilee Way to B1532 Marine Parade	240	226	-5.8%

Table 7.20: Comparison of Journey time (sec) between key N-S movements - Scenario 8 AM

~~7.5.22~~7.5.34 Table 7.21~~Table 7.21~~ shows the change in AM peak journey time on key routes with and without Scheme. The table shows that in the AM, there is an overall reduction in journey time and in particular for Denmark Road EB traffic, which experiences a substantial reduction in journey time (-22.3%).

Route	Description	DM_2022	DS_2022_SC-8	% Diff
Route 1 A	A146-Fairfield Rd/Normanston Dr (NB)	567	492	-6.3%
Route 1 B	A146-Fairfield Rd/Normanston Dr (SB)	567	474	-5.8%
Route 2 A	A12/A47 (NB)	489	468	-4.3%
Route 2 B	A47/A12 (SB)	416	405	-2.6%
Route 3 A	Waveney Drive (EB)	219	233	6.4%
Route 3 B	Waveney Drive (WB)	212	203	-4.2%
Route 4 A	Denmark Road (WB)	245	221	-9.8%
Route 4 B	Denmark Road (EB)	327	176	-22.3%

Table 7.21: Comparison of Journey time (sec) on key routes in DM and DS - Scenario 8 AM

~~7.5.23~~7.5.35 Table 7.22~~Table 7.22~~ shows the comparison of PM journey times for north-south movements with and without the Scheme. The table shows that there is an increase in journey time for southbound traffic between A47 Jubilee Way and A12 Tom Crisp Way and Marine Parade and there is a substantial decrease in journey time from London Rd South to A47 Jubilee Way.

Route	Description	DM_2022	DS_2022_SC-8	% Diff
A to B	A12 Tom Crisp Way to A47 Jubilee Way	472	468	-0.8%
B to A	A47 Jubilee Way Jn to A12 Tom Crisp Way	503	579	15.0%
C to B	London Rd South to A47 Jubilee Way	416	313	-24.7%
B to C	A47 Jubilee Way to B1532 Marine Parade	249	286	15.2%

Table 7.22: Comparison of Journey time (sec) between key N-S movements - Scenario 8 PM

~~7.5.24~~7.5.36 Table 7.23~~Table 7.23~~ presents the PM peak journey time for Scenario 8 for the key routes. The table shows that in the PM peak, there is some increase in travel time on A12 southbound. However, there is some decrease in journey time on Waveney Drive westbound and Denmark Road eastbound.

Route	Description	DM_2022	DS_2022_SC-8	% Diff
Route 1 A	A146-Fairfield Rd/Normanston Dr (NB)	560	567	1.3%
Route 1 B	A146-Fairfield Rd/Normanston Dr (SB)	600	604	0.7%
Route 2 A	A12/A47 (NB)	434	430	-0.9%
Route 2 B	A47/A12 (SB)	483	651	34.8%
Route 3 A	Waveney Drive (EB)	204	217	6.4%
Route 3 B	Waveney Drive (WB)	251	220	-12.4%
Route 4 A	Denmark Road (WB)	236	232	-1.7%
Route 4 B	Denmark Road (EB)	304	270	-11.2%

Table 7.23: Comparison of Journey time (sec) on key routes in DM and DS - Scenario 8 PM

~~7.5.25~~7.5.37 As is the case in Scenarios 5, 5A, 6 and 7, t~~T~~he additional delay in the PM peak DS scenario is attributed to queuing which occurs at the A12 Tom Crisp Way/ Blackheath Road junction. Both the Scheme route and the A47 Bascule Bridge route assign traffic heading south onto A12 Tom Crisp Way and the signalised junction at Blackheath Road suffers greater congestion when compared to the DM scenario when less traffic uses the route.

~~7.5.26~~7.5.38 The traffic signal timings within the VISSIM model remain as per the existing timings in the Base model. A sensitivity test to amend the traffic signal timings at the Blackheath Road junction only has been completed to demonstrate the effect of optimising the signal timings to better accommodate the future traffic flows. The results of the sensitivity test are shown in Table 7.24~~Table 7.24~~ and Table 7.25~~Table 7.25~~.

Route	Description	DM_2022	DS_2022_SC-8	% Diff
A to B	A12 Tom Crisp Way to A47 Jubilee Way	472	455	-4%
B to A	A47 Jubilee Way Jn to A12 Tom Crisp Way	503	524	4%
C to B	London Rd South to A47 Jubilee Way	416	289	-31%
B to C	A47 Jubilee Way to B1532 Marine Parade	249	305	23%

Table 7.24: Comparison of Journey time (sec) between key N-S movements - Scenario 8 PM (optimised at Blackheath Road)

Route	Description	DM_2022	DS_2022_SC-8	% Diff
Route 1 A	A146-Fairfield Rd/Normanston Dr (NB)	560	544	-3%
Route 1 B	A146-Fairfield Rd/Normanston Dr (SB)	600	584	-3%
Route 2 A	A12/A47 (NB)	434	409	-6%
Route 2 B	A47/A12 (SB)	483	539	12%
Route 3 A	Waveney Drive (EB)	204	218	7%
Route 3 B	Waveney Drive (WB)	251	219	-13%
Route 4 A	Denmark Road (WB)	236	223	-6%
Route 4 B	Denmark Road (EB)	304	238	-22%

Table 7.25: Comparison of Journey time (sec) on key routes in DM and DS - Scenario 8 PM (optimised at Blackheath Road)

~~7.5.27~~7.5.39 Signal timings at the A12 Tom Crisp Way/Blackheath ~~road~~Road were amended to give more green time to the mainline ahead and right turn movements, to allow the queue to clear. The tables show that this has a positive impact on the route in question and other routes with the journey time on R~~r~~oute 2B increasing by 12%. Although the journey time still increases compared to the DM scenario due to the extra traffic, the impact is much less severe than without signal optimisation (34.8%). ~~Such~~Optimisation of signal ~~optimisation can~~timings at this junction could be implemented manually or through the introduction of adaptive signal control strategies such as MOVA.

~~7.5.28~~7.5.40 ~~Other signalised junctions on the highway network are also under pressure due to the extra traffic, and are modelled with existing Base traffic signal timings. With~~. In the future when traffic flow is reassigned or demand changes in a certain location as a result of the Third Crossing, SCC will undertake further optimisation at key signal junctions across the whole of Lowestoft which will further reduce journey times and increase the benefits from what has currently been assessed. ~~In the future when demand changes in a certain location as a result of the Third Crossing, further optimisation of all signalised will be undertaken at signal junctions, which could result in further reductions in journey times will reduce further on the key routes across Lake Lothing.~~

~~7.5.29~~7.5.41 The individual junction modelling is the most robust indication of the actual junction performance. The A12 Tom Crisp Way / Blackheath Road junction has been modelled in further detail using the specific traffic signal model software LinSig. The results of that assessment are presented in Section 8 of this TA and indicate that MOVA would need to be installed at this junction post 2037.

~~7.5.30~~7.5.42 Taking the results of these two assessments together, an improvement to the junction of A12 Tom Crisp Way/Blackheath Road in the form of the introduction of adaptive signal control strategies such as MOVA at the opening of the Scheme is proposed and is detailed further in Section 9 of this TA.

7.5.43 In Scenario 8, neither the Bascule nor the Scheme Bridge is lifted. In the AM Peak there is significantly less congestion in this scenario than the DM, with the option of an additional route across the river.

7.5.44 The conditions in the AM peak for Scenario 8 are presented in Figure 7.18.

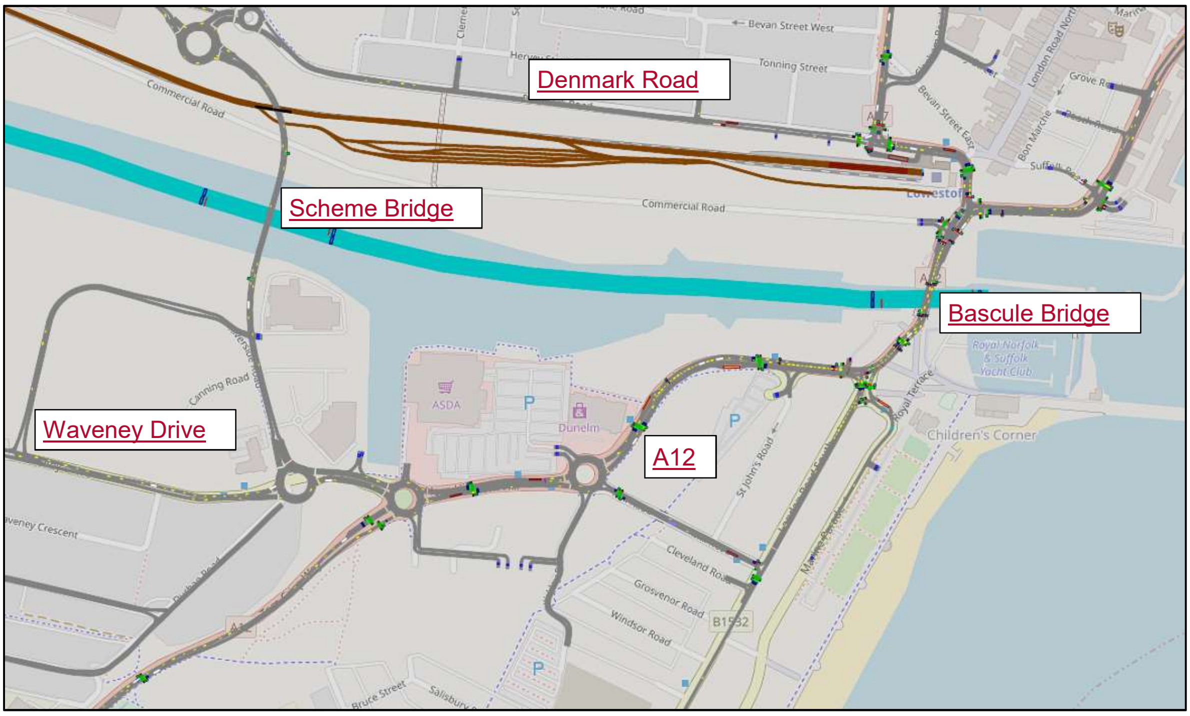


Figure 7.18: Scenario 8 AM: around 08:30

7.5.45 In the PM Peak, queueing and congestion is similarly much reduced, with no significant queuing anywhere. This is illustrated in Figure 7.19.

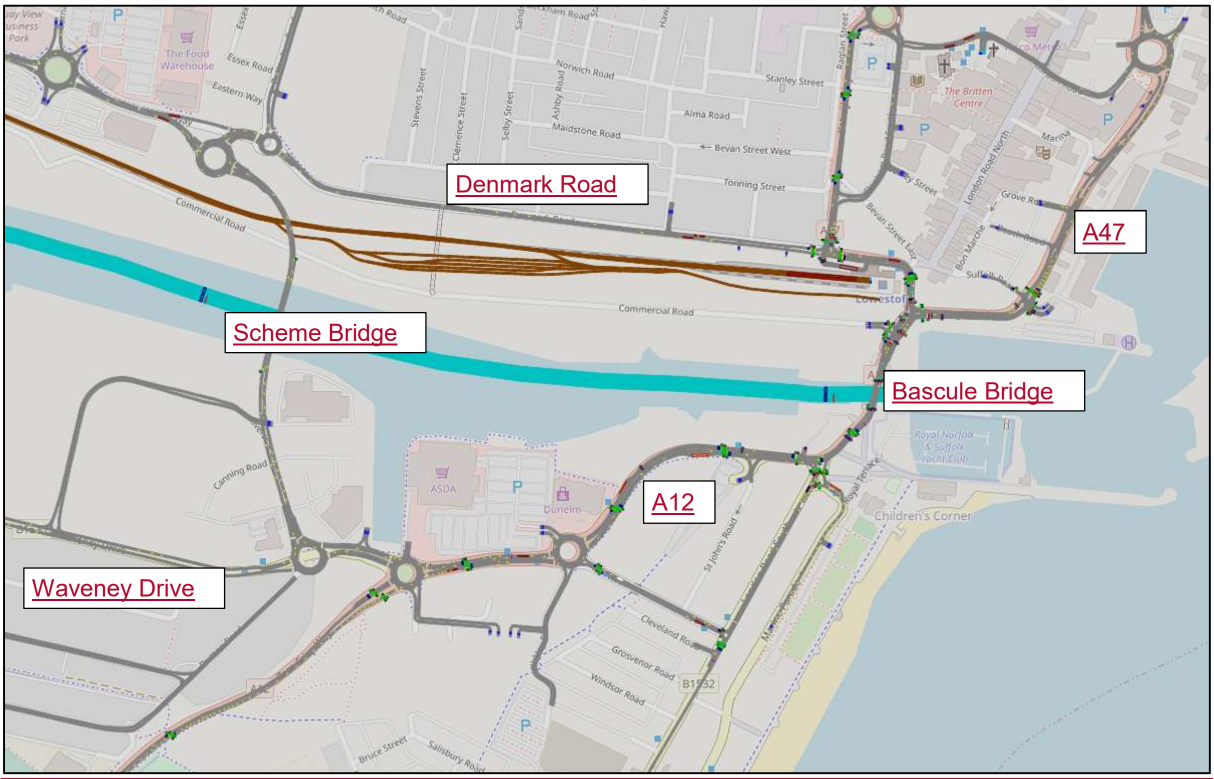


Figure 7.19: Scenario 8 PM: approximately 17:30

~~7.5.31~~7.5.46 Overall, the results show that, in Scenario 8, the Scheme provides journey time benefits, with significant benefit experienced particularly in the AM peak. Many routes have much reduced times, including Denmark Road (eastbound) where the journey time is almost halved. With optimisation of the traffic signals across the whole Lowestoft highway network, the benefits will be further increased.

Scenario 9 - Mutford Bridge Open; Scheme Open; A47 Bascule Bridge Lifted (5 mins)

~~7.5.32~~7.5.47 Table 7.26~~Table 7.26 shows the comparison of~~ compares AM peak Do Minimum journey times (assuming a 5 minute closure of Bascule Bridge) with journey time for Scenario 9 for key north-south movements~~ with and without the Scheme~~. The above table shows that there is an overall decrease in journey time across all key movements with significant savings between London Road South and A47 Jubilee Way (-43.8 %).

Route	Description	DM_2022_5min	DS_2022_SC-9	% Diff
A to B	A12 Tom Crisp Way to A47 Jubilee Way	580	506	-12.8%
B to A	A47 Jubilee Way Jn to A12 Tom Crisp Way	497	457	-8.1%
C to B	London Rd South to A47 Jubilee Way	576	324	-43.8%
B to C	A47 Jubilee Way to B1532 Marine Parade	307	271	-11.7%

Table 7.26: Comparison of Journey time (sec) between key N-S movements - Scenario 9 AM

~~7.5.33~~7.5.48 Table 7.27~~Table 7.27~~ shows the change in AM peak journey time on key routes with and without Scheme. The table shows that there is a positive impact on journey time, particularly along Denmark Road eastbound which experiences a substantial reduction in journey time.

Route	Description	DM_2022_5min	DS_2022_SC-9	% Diff
Route 1 A	A146-Fairfield Rd/Normanston Dr (NB)	570	501	-4.9%
Route 1 B	A146-Fairfield Rd/Normanston Dr (SB)	544	474	-1.8%
Route 2 A	A12/A47 (NB)	540	487	-9.8%
Route 2 B	A47/A12 (SB)	476	449	-5.7%
Route 3 A	Waveney Drive (EB)	217	233	7.4%
Route 3 B	Waveney Drive (WB)	218	203	-6.9%
Route 4 A	Denmark Road (WB)	235	218	-7.2%
Route 4 B	Denmark Road (EB)	486	212	-40.5%

Table 7.27: Comparison of Journey time (sec) on key existing routes in DM and DS - Scenario 9 AM

~~7.5.34~~7.5.49 Table 7.28~~Table 7.28~~ shows the comparison of PM journey times for north-south movements with and without the Scheme. The above table shows that the savings in journey time on these routes are consistent with the AM peak with the exception of an increase from A47 Jubilee Way Jn to A12 Tom Crisp Way) - and there continues to be a significant decrease in journey time for northbound traffic between A47 Jubilee Way from A12 Tom Crisp Way and London Road South.

Route	Description	DM_2022_5min	DS_2022_SC-9	% Diff
A to B	A12 Tom Crisp Way to A47 Jubilee Way	630	485	-23.0%

B to A	A47 Jubilee Way Jn to A12 Tom Crisp Way	629	737	17.1%
C to B	London Rd South to A47 Jubilee Way	672	377	-43.9%
B to C	A47 Jubilee Way to B1532 Marine Parade	365	388	6.3%

Table 7.28: Comparison of Journey time (sec) between key N-S movements - Scenario 9 PM

~~7.5.35~~7.5.50 Table 7.29~~Table 7.29~~ presents the PM peak journey time for Scenario 9 for the key routes. The table shows that in the PM peak, there is some increase in journey time on A12 southbound and on Waveney Drive Road eastbound which could be attributed to the congestion caused by the high volume of traffic ~~arriving via the existing route and~~ approaching the new bridge and causing delays at the Tom Crisp Way Blackheath Rd junction.

Route	Description	DM_2022_5min	DS_2022_SC-9	% Diff
Route 1 A	A146-Fairfield Rd/Normanston Dr (NB)	551	567	2.9%
Route 1 B	A146-Fairfield Rd/Normanston Dr (SB)	589	582	-1.2%
Route 2 A	A12/A47 (NB)	585	484	-17.3%
Route 2 B	A47/A12 (SB)	605	883	46.0%
Route 3 A	Waveney Drive (EB)	205	249	21.5%
Route 3 B	Waveney Drive (WB)	252	214	-15.1%
Route 4 A	Denmark Road (WB)	233	230	-1.3%
Route 4 B	Denmark Road (EB)	400	346	-13.5%

Table 7.29: Comparison of Journey time (sec) on key existing routes in DM and DS - Scenario 9 PM

~~7.5.36~~7.5.51 ~~Similarly,~~Similar to Scenario 8, additional delay occurs on the southbound key movements and routes from north to south in the PM peak. Again, the additional delay is because of additional queuing at the A12 Tom Crisp Way/Blackheath Road signalised junction. ~~–~~A sensitivity test to optimise the traffic signal timings at this junction was completed and the revised results are provided in Table 7.30~~Table 7.30~~ and Table 7.31~~Table 7.31~~.

Route	Description	DM_2022_5min	DS_2022_SC-9	% Diff
A to B	A12 Tom Crisp Way to A47 Jubilee Way	630	485	-23%
B to A	A47 Jubilee Way Jn to A12 Tom Crisp Way	629	653	4%
C to B	London Rd South to A47 Jubilee Way	672	351	-48%
B to C	A47 Jubilee Way to B1532 Marine Parade	365	377	3%

Table 7.30: Comparison of Journey time (sec) between key N-S movements - Scenario 9 PM (optimised at Blackheath Road)

Route	Description	DM_2022_5min	DS_2022_SC-9	% Diff
Route 1 A	A146-Fairfield Rd/Normanston Dr (NB)	551	542	-2%
Route 1 B	A146-Fairfield Rd/Normanston Dr (SB)	589	568	-4%
Route 2 A	A12/A47 (NB)	585	462	-21%
Route 2 B	A47/A12 (SB)	605	688	14%
Route 3 A	Waveney Drive (EB)	205	238	16%

Route 3 B	Waveney Drive (WB)	252	212	-16%
Route 4 A	Denmark Road (WB)	233	226	-3%
Route 4 B	Denmark Road (EB)	400	304	-24%

Table 7.31: Comparison of Journey time (sec) on key routes in DM and DS - Scenario 9 PM (optimised at Blackheath Road)

~~7.5.37~~7.5.52 The tables show that this has a positive impact on the route in question and other routes with the journey time on R~~r~~oute 2B now increasing by 14%. Although the journey time still increases compared to the DM scenario due to the extra traffic, the impact is much less severe than without signal optimisation (46%).

7.5.53 Scenario 9 has a five-minute Bascule Bridge lift and no Scheme Bridge lift. In the AM Peak, congestion is not significant following a five-minute Bascule lift, and much less than in the DM scenario (Figure 7.3).

7.5.54 The conditions after a 5 minute lift of the A47 Bascule Bridge in the AM peak for Scenario 9 are illustrated in a plot taken from the VISSIM model and are presented in Figure 7.20.

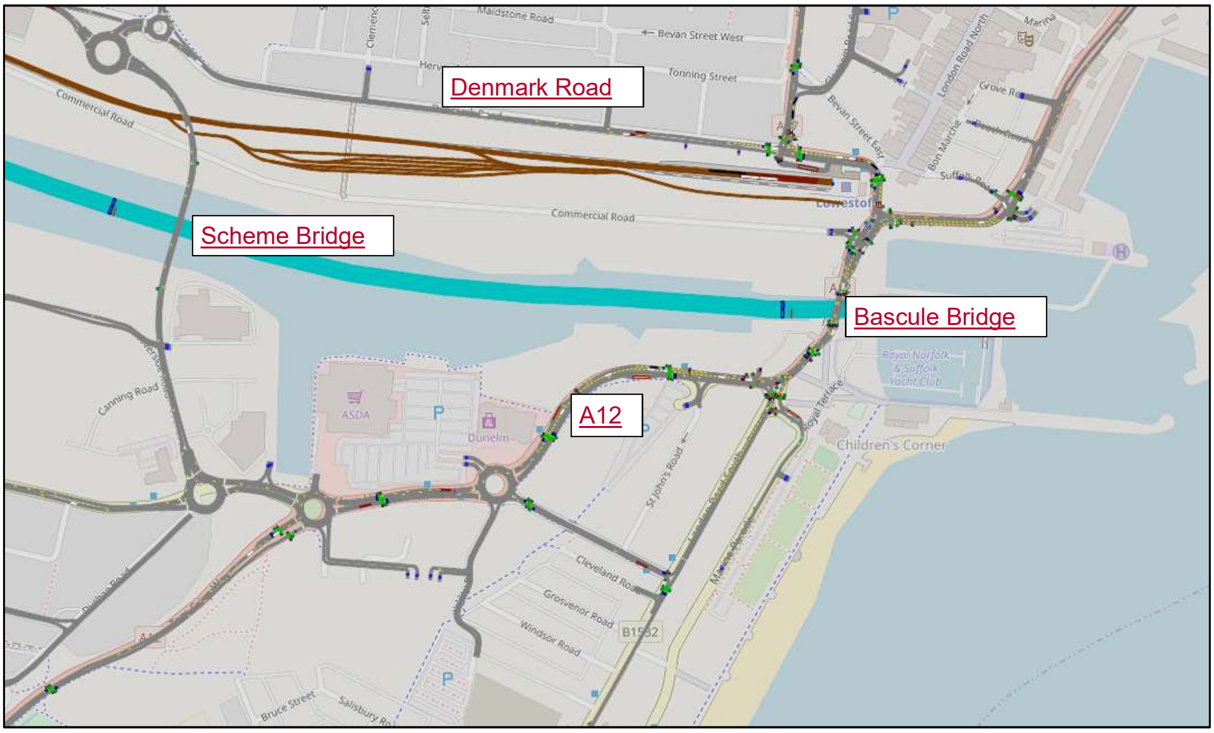


Figure 7.20: Scenario 9 AM: 08:37 after Bascule Bridge reopens to traffic

7.5.55 In the PM Peak, queues extend along the A47 for only a relatively short section, when compared with the DM (Figure 7.4). On the south side of the river, northbound queue lengths are shorter than the DM. There is queuing in the southbound direction that occurs at the A12 Tom Crisp Way/Blackheath Road junction, likely due to rerouted traffic using the Scheme Bridge and onto the A12. This is illustrated in Figure 7.21.

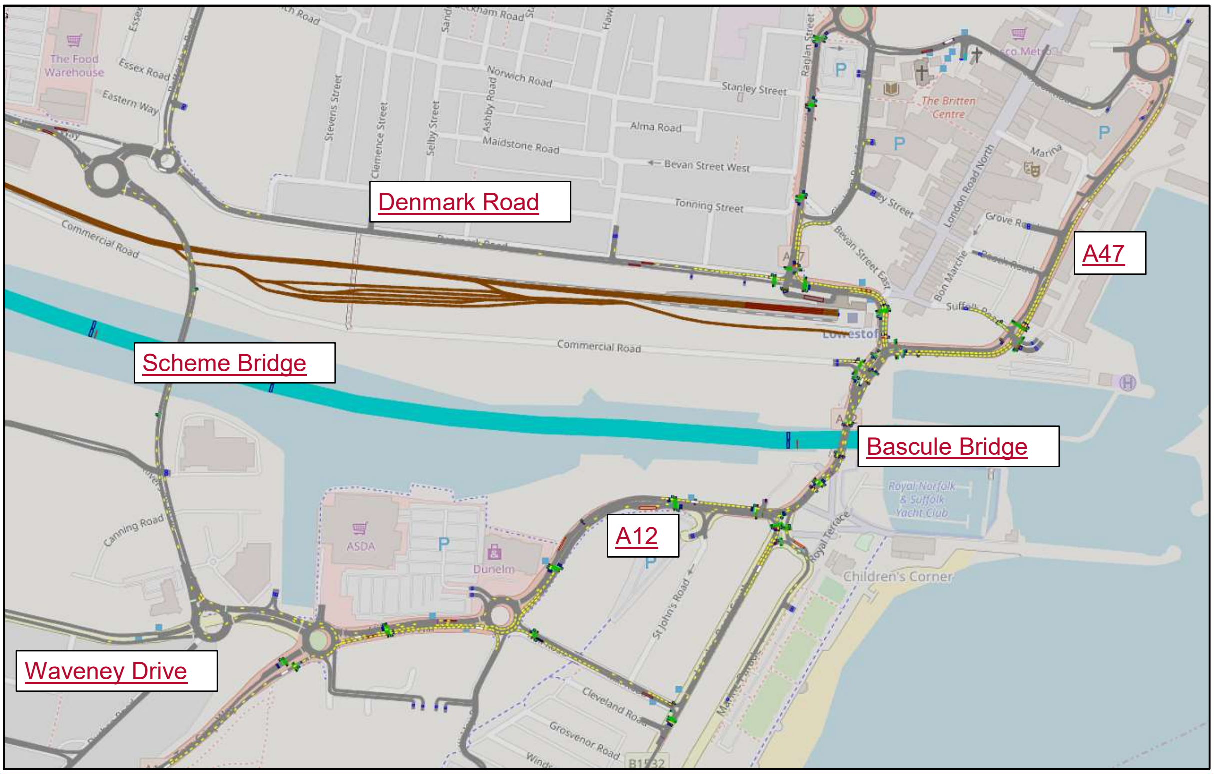


Figure 7.21: Scenario 9 PM: 17:37 after Bascule Bridge reopens to traffic

~~7.5.38~~7.5.56 Overall, the results show that in Scenario 9, there will be benefits on key north-south movements and key routes. However, there will be increased delays on some routes, particularly in the PM peak, which ~~would~~could be reduced following optimisation of the traffic signal timings at signalised junctions.

Scenario 10 - Mutford Bridge Open; Scheme Open; A47 Bascule Bridge Lifted (10 mins)

~~7.5.39~~7.5.57 Table 7.32~~Table 7.32 shows the comparison of~~ compares AM peak Do Minimum journey ~~time~~times (assuming a 10 minute closure of Bascule Bridge) with journey times for Scenario 10 for key north-south movements~~ with and without the Scheme.~~. The above table shows that there is an overall decrease in journey time across all key movements with significant savings between London Road South and A47 Jubilee Way (-34.8 %) and A12 Tom Crisp Way to A47 Jubilee Way (-25.6%).

Route	Description	DM_2022_10min	DS_2022_SC-10	% Diff
A to B	A12 Tom Crisp Way to A47 Jubilee Way	728	542	-25.6%
B to A	A47 Jubilee Way Jn to A12 Tom Crisp Way	607	541	-10.8%
C to B	London Rd South to A47 Jubilee Way	680	444	-34.8%
B to C	A47 Jubilee Way to B1532 Marine Parade	417	362	-13.4%

Table 7.32: Comparison of Journey time (sec) between key N-S movements - Scenario 10 AM

~~7.5.40~~7.5.58 Table 7.33~~Table 7.33~~ shows the change in AM peak journey time on key routes with and without Scheme. The table shows that there are journey time savings on the key routes in the AM peak particularly Denmark Road eastbound which experiences a substantial reduction in journey time.

Route	Description	DM_2022_10min	DS_2022_SC-10	% Diff
Route 1 A	A146-Fairfield Rd/Normanston Dr (NB)	569	510	-3.0%
Route 1 B	A146-Fairfield Rd/Normanston Dr (SB)	549	485	-0.9%
Route 2 A	A12/A47 (NB)	684	562	-17.8%
Route 2 B	A47/A12 (SB)	585	536	-8.4%
Route 3 A	Waveney Drive (EB)	253	220	-13.0%
Route 3 B	Waveney Drive (WB)	219	198	-9.6%
Route 4 A	Denmark Road (WB)	246	218	-11.4%
Route 4 B	Denmark Road (EB)	630	309	-38.1%

Table 7.33: Comparison of Journey time (sec) on key routes in DM and DS – Scenario 10 AM

~~7.5.41~~7.5.59 Table 7.34~~Table 7.34~~ shows the comparison of PM peak journey times for north-south movements with and without the Scheme. The table shows that the savings in journey time on existing routes are consistent with the AM peak where there is a significant decrease in journey time for northbound traffic between A47 Jubilee Way from A12 Tom Crisp Way and London Road South.

Route	Description	DM_2022_10min	DS_2022_SC10	% Diff
A to B	A12 Tom Crisp Way to A47 Jubilee Way	812	511	-37.0%
B to A	A47 Jubilee Way Jn to A12 Tom Crisp Way	753	715	-5.1%
C to B	London Rd South to A47 Jubilee Way	749	430	-42.7%
B to C	A47 Jubilee Way to B1532 Marine Parade	490	477	-2.7%

Table 7.34: Comparison of Journey time (sec) between key N-S movements - Scenario 10 PM

~~7.5.42~~7.5.60 Table 7.35~~Table 7.35~~ presents the PM peak journey time for Scenario 10 for the other routes. The table shows that in the PM peak, there is an overall reduction in travel time on most routes with considerable savings on A12 northbound and on Denmark Road eastbound. There are some increases in travel time on A12 southbound which could be attributed to the volume of additional southbound traffic in the PM peak.

Route	Description	DM_2022_10min	DS_2022_SC-10	% Diff
Route 1 A	A146-Fairfield Rd/Normanston Dr (NB)	601	534	-11.1%
Route 1 B	A146-Fairfield Rd/Normanston Dr (SB)	597	576	-3.5%
Route 2 A	A12/A47 (NB)	724	520	-28.2%
Route 2 B	A47/A12 (SB)	724	884	22.1%
Route 3 A	Waveney Drive (EB)	216	220	1.9%
Route 3 B	Waveney Drive (WB)	251	213	-15.1%
Route 4 A	Denmark Road (WB)	234	235	0.4%
Route 4 B	Denmark Road (EB)	475	401	-15.6%

Table 7.35: Comparison of Journey time (sec) on key existing routes in DM and DS - Scenario 10 PM

~~7.5.43~~7.5.61 ~~Similarly,~~Similar to Scenario 8 and 9, additional delay occurs on the southbound key movements and routes from north to south. Again, the additional delay is because of additional queuing at the A12 Tom Crisp Way/Blackheath Road signalised junction. A sensitivity test to optimise the traffic signal timings at this junction was completed and the revised results are provided in Table 7.36~~Table 7.36~~ and Table 7.37~~Table 7.37~~.

Route	Description	DM_2022_10min	DS_2022_SC10	% Diff
A to B	A12 Tom Crisp Way to A47 Jubilee Way	812	516	-36%
B to A	A47 Jubilee Way Jn to A12 Tom Crisp Way	753	681	-10%
C to B	London Rd South to A47 Jubilee Way	749	435	-42%
B to C	A47 Jubilee Way to B1532 Marine Parade	490	491	0%

Table 7.36: Comparison of Journey time (sec) between key N-S movements - Scenario 10 PM (optimised at Blackheath Road)

Route	Description	DM_2022_10min	DS_2022_SC-10	% Diff
Route 1 A	A146-Fairfield Rd/Normanston Dr (NB)	601	542	-10%
Route 1 B	A146-Fairfield Rd/Normanston Dr (SB)	597	596	0%
Route 2 A	A12/A47 (NB)	724	508	-30%
Route 2 B	A47/A12 (SB)	724	747	3%
Route 3 A	Waveney Drive (EB)	216	215	-1%
Route 3 B	Waveney Drive (WB)	251	213	-15%
Route 4 A	Denmark Road (WB)	234	241	3%
Route 4 B	Denmark Road (EB)	475	385	-19%

Table 7.37: Comparison of Journey time (sec) on key routes in DM and DS - Scenario 10 PM (optimised at Blackheath Road)

~~7.5.44~~7.5.62 The tables show that this has a positive impact on the route in question and other routes with the journey time on R~~r~~oute 2B increasing by just 3%. Although the journey time still increases compared to the DM scenario due to the extra traffic, the impact is much less severe than without signal optimisation (22.1%).

7.5.63 Scenario 10 has a ten-minute Bascule Bridge lift and no Scheme Bridge lift. In the AM Peak there is a similar comparison with the respective DM scenario as Scenario 9 (Figure 7.20), in that queuing is much reduced. While queues extend south of the Bascule Bridge past the Asda roundabout, this is more comparable with a five-minute Bascule lift DM scenario (Figure 7.3).

7.5.64 Queueing north of the bridge is closer to the DM 10-minute lift scenario level (Figure 7.4) although still lower, with queues reaching almost to the Battery Green Road roundabout. The conditions in the AM peak for Scenario 10 are presented in Figure 7.22.

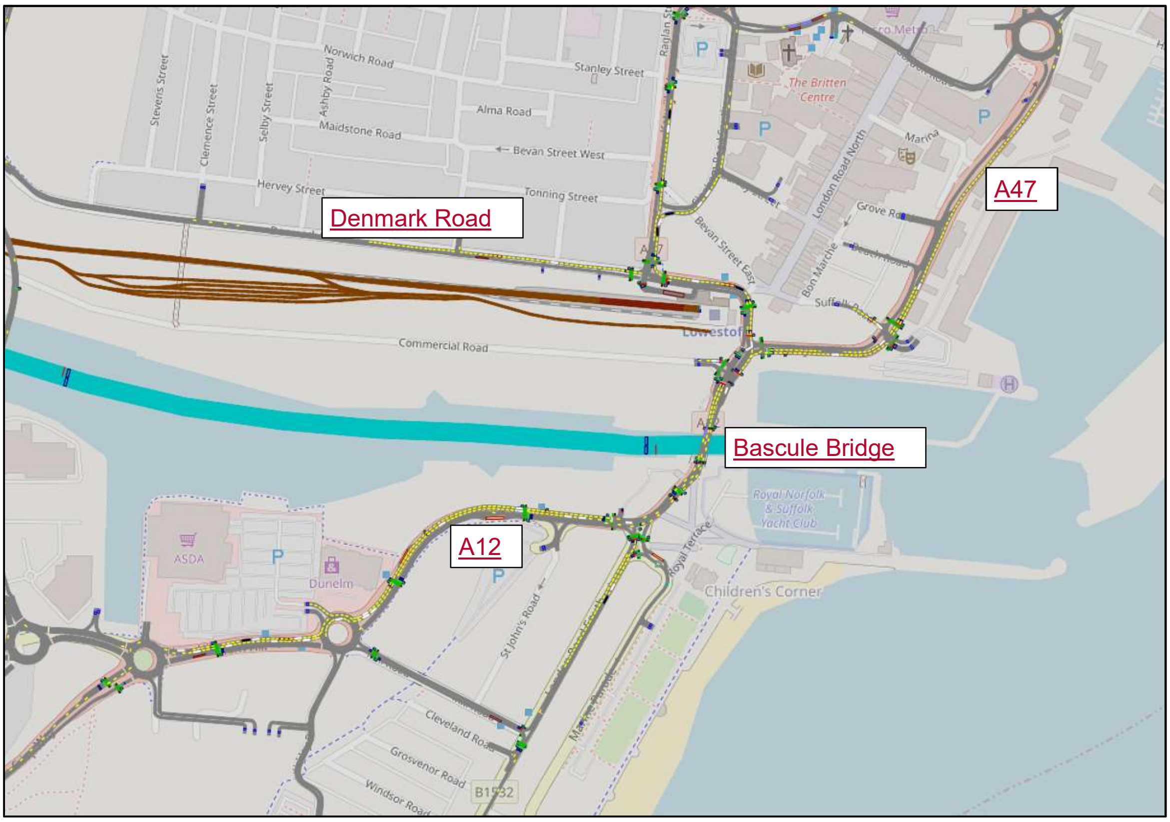


Figure 7.22: Scenario 10 AM: 08:42 after Bascule Bridge reopens to traffic

7.5.65 In the PM Peak, there are shorter queue lengths than in the DM 10-minute lift scenario, particularly on the A47 southbound. Queues in the DS extend past Battery Green Road roundabout, but not past St. Peter's Street roundabout, which happens in the DM. The A12 northbound also has reduced queues. Queues along Denmark Road and Katwijk Way appear similar which may indicate that traffic using these roads does not travel on a route where the Scheme Bridge would provide a suitable alternative.

7.5.66 The conditions in the PM peak for Scenario 10 are presented in Figure 7.23.

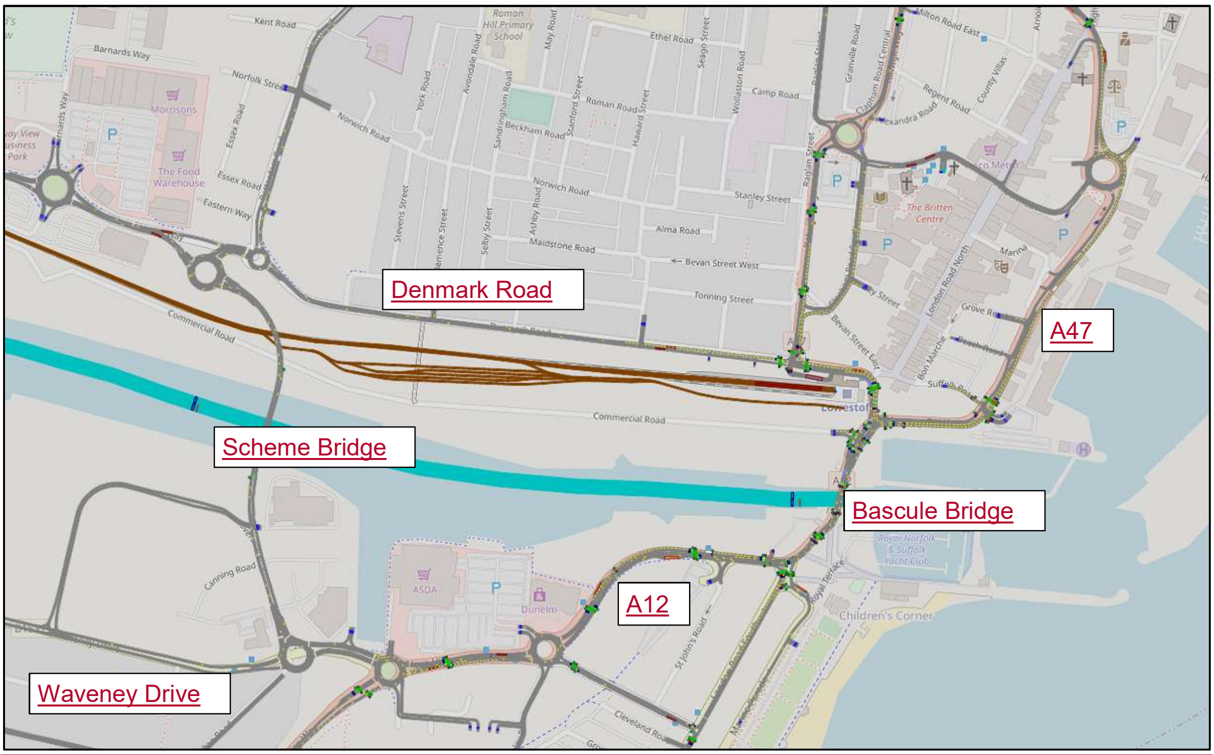


Figure 7.23: Scenario 10 PM: 17:42 after Bascule Bridge reopens to traffic

7.5.67 Overall, the results show that in Scenario 10, there will be benefits to journey times on key north south movements and key routes because of the Scheme~~.~~. However, there will be increased delays on some routes, particularly in the PM peak, which could be reduced following optimisation of the traffic signal timings at signalised junctions.

7.6 Network Performance

7.6.1 A comparison of average network wide travel time savings between the DM and the DS Scenarios for the forecast year 2022 is shown in Table 7.38. The travel time savings are the average per vehicle taken across the whole network, i.e. across all journey time routes. The results show that with the Scheme there is a travel time saving across the network of between 36 seconds and 162 seconds.

	AM	PM
DS_2022_SC-5	*154*	*100*
DS_2022_SC-5a	*128*	*36*
DS_2022_SC-6	*117*	*59*
DS_2022_SC-7	*117*	*111*
DS_2022_SC-8	*143*	*108*
DS_2022_SC-9	*162*	*37*

	AM	PM
DS_2022_SC-10	*145*	*114*

Table 7.38: Average Travel Time Savings per Vehicle (s) - Network wide

7.6.2 The average travel time savings across the network show that in Scenario 9 (with the Bascule Bridge lifted for 5 minutes) there would be a considerable saving of 162 seconds (2 minutes 41 seconds) per vehicle in the AM peak compared to the same scenario without the Scheme.

7.6.3 In the PM peak the highest average network travel time saving is in Scenario 10 (with the Bascule Bridge lifted for 10 minutes), where a saving of 114 seconds (1 minute 53 seconds) per vehicle would occur.

7.6.4 A comparison of average network wide speed increases between the DM and the DS scenarios for forecast year 2022 is shown in Table 7.39, i.e. the average increase in speed per vehicle across the network. The results show that with the Scheme, there is an increase in average vehicular speed in all scenarios of between 1.23 mph and ~~4.88mph~~5.46 mph.

	AM	PM
DS_2022_SC-5	*5.46*	*3.84*
DS_2022_SC-5a	*4.23*	*1.87*
DS_2022_SC-6	*3.60*	*2.12*
DS_2022_SC-7	*3.26*	*3.37*
DS_2022_SC-8	*3.41*	*2.46*
DS_2022_SC-9	*3.72*	*1.23*
DS_2022_SC-10	*3.11*	*2.42*

Table 7.39: Average Speed increase (mph) - Network wide

7.6.5 The network performance results show a clear overall benefit in all scenarios, both AM and PM peak, compared to the DM. This is shown in both the likely scenario 5 with a sequential bridge lift, and the scenarios where both bridges open at the same time. Scenario 5 has a network average journey time saving that is comparable with the scenarios where there is no bridge lift, and a greater saving than scenario 8. This is however because Scenario 8 is compared with the DM with no bridge lift, so the overall delay is much less.

7.6.6 Scenario 9 shows the greatest saving in the AM peak of 162 seconds, while in the PM peak the saving is much less. This is likely to be due to issues around the A12 Blackheath Road junction identified in section 7.5.51~~7.5.3551~~. When the traffic signals are optimised, the scenario 9 PM saving increases to 119 seconds. Therefore it is most beneficial if the Scheme Bridge does not lift during the peak hours.

7.7 Impact on Traffic Flows and Queuing

7.7.1 In both AM and PM peaks there is a decrease in traffic volume on the key strategic route of A47 Battery Green Road and the Bascule Bridge in both directions. In the AM and PM peak the queues extending from the junction of Denmark Road and A47, as a result of the lifting of the Bascule Bridge, are comparatively less in the DS scenario than in the DM scenario.

7.7.2 In the AM and PM peak scenarios there is an expected increase in traffic on Waveney Drive (between Kimberley Road and Waveney Crescent) in both directions in the DS scenarios and an increase on Peto Way particularly in the AM peak. These increases arise as a result of traffic reassigning to gain access to the Scheme. Delays resulting from the additional traffic will be minimal and are expected only in the immediate vicinity of the Scheme. Some minor increases in delay on these particular routes is considered acceptable in order to benefit the strategic routes and local and highway network as a whole.

7.7.3 Queuing on A12 Tom Crisp Way at the junction with Blackheath Road increases southbound in the PM peak as a result of the convergence of traffic using both the Scheme and the Bascule Bridge. Traffic flows are higher than in the DM as a result of rerouting from Mutford Bridge to the Scheme, and therefore onto A12 Tom Crisp Way. Improvements to the junction are proposed, as detailed in Section 9.

7.7.4 Traffic on Mutford Bridge reduces overall as a result of the Scheme, with reduced queuing on both northbound and southbound approaches when the railway level crossing is not closed to traffic.

7.8 Journey Time Reliability

7.8.1 Journey time reliability increases throughout Lowestoft as a result of reduced congestion and reduced journey times. Detailed analysis and monetised benefits of enhanced journey time reliability has been completed and further detail on the reliability savings is provided within the Economics Report submitted with the DCO application.

7.9 Summary & Conclusions

7.9.1 The VISSIM 2016 Base model shows that are already significant delays on the A12/A47 corridor with an average delay of approximately two minutes in both directions. There are also significant delays at the junction of Denmark Road and A47 under normal operating conditions. Queuing and delays increase in the 2022 DM, particularly when the A47 Bascule Bridge is lifted and the road is closed to general traffic, indicating that, with no intervention, these problems will be exacerbated in the future.

7.9.2 A comparison of journey times between the DM 2022 and DS 2022 shows that there will be a significant decrease in journey time for traffic between London Road South and A47 Jubilee Way across all scenarios in the AM and PM peaks. This shows that following completion of the Scheme, a large proportion of trips between these two key zones will be using the new alternate route. Vehicles using the northbound route via the Scheme will experience significant saving on their journey time compared to the existing northbound A12/A47 route in the AM peak. The Scheme will also reduce congestion on the A47 Battery Green Road in the AM and PM peak hours.

7.9.3 Also in the AM peak, there will be an increase in journey time for traffic on the eastbound approach of Waveney Drive in almost all scenarios. This is because more traffic is expected to be re-assigned along B1531 Waveney Drive to approach the Scheme from Victoria Road.

7.9.4 There will also be a significant decrease in journey time along the eastbound approach of Denmark Road in both the AM and PM peaks as a result of traffic which previously travelled along Denmark Road to access the A47 Bascule Bridge finding the route via the Scheme more favourable. This will reduce congestion on Denmark Road eastbound and surrounding roads.

7.9.5 There is currently no planned operating regime for the Scheme Bridge, but a range of possible scenarios has been assessed, including bridges lifting sequentially and simultaneously. It is noted that the Vessel Simulation Report indicates that lifting sequentially may be better from a navigational point of view. The results show that lifting both bridges simultaneously provides benefits in all scenarios when compared with the DM. With a sequential bridge lift, the benefits are even greater.

7.9.6 Looking at the overall scenario comparison, this shows that, in the AM peak, keeping the Scheme Bridge open to traffic throughout the entire peak provides the most benefit. In the PM this is not the case, unless the traffic signals along the A12 Tom Crisp Way are optimised, which as detailed in section 9 of the TA, is proposed to be undertaken by the

Applicant. This would then mean that not lifting the Scheme Bridge would provide the most benefit in the PM peak.

7.9.7 Overall, the Scheme provides significant benefits by improving journey time and link speeds, and reducing congestion on the key route corridors through the town. The reduced journey times will in turn have a beneficial effect on businesses and local residents, boosting the local economy and achieving the aims and objectives of the Scheme. Further detail on the economic benefits of reduced journey times is included within the Economics Report submitted separately with the DCO application.

8 Scheme Impacts - Junction Operation

8.1 Introduction

8.1.1 This Section examines in greater detail the impact of the Scheme on key junctions on the local highway network as listed below. The assessments are based on detailed modelling of individual junctions, using traffic demand forecast for the various scenarios.

1: A47 Yarmouth Road / A1117 Millennium Way;

2a: A47 Katwijk Way / A1144 St Peter's Street;

2b: A47 Artillery Way / A47 Jubilee Way / A47 St Peter's Street;

3: A47 Waveney Road / Station Square / Commercial Road;

4: A12 Pier Terrace / B1532 London Road South;

5: A12 Belvedere Road / Mill Road / Kirkley Rise;

6: A12 Tom Crisp Way / A12 Horn Hill / B1531 Waveney Drive;

7: B1531 Victoria Road / B1531 Waveney Drive / Kirkley Run;

8a: A12 Tom Crisp Way / Blackheath Road;

8b: Kirkley Run / Blackheath Road / Long Road;

8c: Blackheath Road / Carlton Road;

9a: A12 Tom Crisp Way / Bloodmoor Road / A1145 / Castleton Avenue;

9b: A1117 Elm Tree Road / Long Road / A117 Bloodmoor Road;

10: A1117 Bridge Road / A1117 Saltwater Way / B1531 Victoria Road;

11: A1117 Normanston Drive / B1375 Gorleston Road;

12: Peto Way / Denmark Road / Barnards Way;

13: Denmark Road / Rotterdam Road;

14: A1117 Normanston Drive / A1117 Peto Way;

15: A1144 Normanston Drive / Rotterdam Road;

16: B1531 Waveney Drive / Riverside Road / Durban Road;

17: New junction north of the Lake;

18: New junction south of the Lake;

19: Denmark Road / A47 Katwijk Way;

20: B1531 Waveney Drive / Kimberley Road;

21: A1117 Millennium Way / B1074 Somerleyton Road;

22: B1531 Waveney Drive / Riverside Road; and

23: Kirkley Run / Notley Road.

8.1.2 In each case, the situation with the Scheme is compared with the baseline conditions, to show the impact of the Scheme on Lowestoft's local highway network. The impact of the lifting of the A47 Bascule Bridge and Mutford Bridge is not included within the operational assessments of individual junctions within this Section of the TA.

8.1.3 Full details of the results of junction modelling are set out in Appendix ~~H~~I. A summary per junction is provided below.

8.2 Junction 1 – A47 Yarmouth Road / A1117 Millennium Way roundabout

8.2.1 The junction of the A47 Yarmouth Road and A1117 Millennium Way is a five arm roundabout, recently constructed as the northern terminus to the Northern Spine Road. The northern arm of the A47 Yarmouth Road provides a direct link, approximately 6km in length, to Great Yarmouth, whilst the south-eastern arm directs traffic towards Lowestoft town centre. The A1117 Millennium Way, the Northern Spine Road, forms the south-western arm of the roundabout.

8.2.2 The B1385 Corton Long Lane is the minor arm to the east and the minor arm to the west is Blundeston Road. The northern arm of A47 Yarmouth Road comprises of a dual lane approach, which is fed by the dual carriageway preceding the junction. The south-eastern arm of the A47 Yarmouth Road flares locally from a single lane to also provide a dual lane approach. In comparison, the A1117 Millennium Way and eastern and western arms of the roundabout provide a single lane approach.

Figure 8.1: A47 Yarmouth Road / A1117 Millennium Way roundabout (Source: Google Maps Streetview)

Arm	AM			PM		
	Queue (PCU)	Delay (s)	RFC	Queue (PCU)	Delay (s)	RFC
	Base 2016					
A47 Yarmouth Road North	0.~~67~~54	2.~~62~~41	0.~~40~~35	~~1.01~~0.93	~~3.13~~2.97	0.~~50~~48
B1385 Corton Long Lane	0.~~45~~33	~~7.21~~6.31	0.~~31~~25	0.~~27~~25	6.78~~7.10~~	0.~~21~~20
A47 Yarmouth Road South	0.~~80~~68	3.~~97~~61	0.~~45~~41	0.~~89~~76	~~4.20~~3.88	0.~~47~~43
A1117 Millennium Way	0.~~50~~49	4.~~52~~35	0.~~34~~33	0.27	3.~~85~~70	0.21
Blundeston Road	0.~~15~~14	4.~~41~~21	0.~~13~~12	0.09	3.~~89~~77	0.08
	2022 DM					
A47 Yarmouth Road North	0.70	2.71	0.41	1.10	3.25	0.53
B1385 Corton Long Lane	0.31	6.70	0.24	0.31	7.56	0.24
A47 Yarmouth Road South	0.80	3.93	0.45	1.03	4.55	0.51
A1117 Millennium Way	0.56	4.69	0.36	0.32	4.09	0.24
Blundeston Road	0.20	4.63	0.17	0.10	4.05	0.09
	2022 DS					
A47 Yarmouth Road North	0.88	3.03	0.47	1.17	3.35	0.54
B1385 Corton Long Lane	0.47	8.01	0.32	0.30	7.67	0.23
A47 Yarmouth Road South	0.88	4.32	0.47	0.96	4.45	0.49
A1117 Millennium Way	0.70	5.11	0.41	0.45	4.42	0.31
Blundeston Road	0.21	4.82	0.17	0.13	4.25	0.12
	2037 DM					
A47 Yarmouth Road North	1.10	3.41	0.52	1.49	3.87	0.60
B1385 Corton Long Lane	0.45	8.63	0.31	0.44	9.27	0.31
A47 Yarmouth Road South	1.14	4.81	0.53	1.84	6.52	0.65
A1117 Millennium Way	0.81	5.74	0.45	0.~~5~~50	5.12	0.33
Blundeston Road	0.28	5.42	0.22	0.13	4.67	0.12
	2037 DS					
A47 Yarmouth Road North	1.44	3.96	0.59	1.54	3.94	0.61
B1385 Corton Long Lane	0.68	10.87	0.41	0.45	9.49	0.31
A47 Yarmouth Road South	1.21	5.21	0.55	2.06	7.12	0.68
A1117 Millennium Way	0.96	6.20	0.49	0.61	5.~~6~~60	0.38
Blundeston Road	0.23	5.36	0.19	0.17	5.02	0.15

Table 8.1: A47 Yarmouth Road / A1117 Millennium Way Roundabout Results Summary

8.2.3 It can be seen that this junction operates below operational capacity in the Base scenario, with a maximum RFC of 0.~~50~~48 on A47 Yarmouth Road North in the PM Peak. With background growth this increases to 0.60 in the 2037 DM scenario, however the junction continues to operate well below capacity.

8.2.4 The Scheme will have a marginal impact on the operation of the roundabout, increasing to just 0.61 in 2037; again, this junction continues to operate below capacity.

8.3 Junctions 2a and 2b – A47 Katwijk Way / A1144 St Peter's Street roundabouts

8.3.1 The junctions of A47 Katwijk Way/A1144 St. Peter's Street and A47 Artillery Way/A47 St Peter's Street are located in close proximity to one another, with less than 100m between the two junctions. As such, the two junctions have been modelled together within JUNCTIONS8.

Junction 2a: A47 Katwijk Way / A1144 St Peter's Street

8.3.2 The junction at the A47 Katwijk Way and A1144 St Peter's Street is a three arm roundabout, located close to the town centre. The A1144 St Peter's Street arm provides access to an east-west link across Lowestoft, to the north of the Lake, whilst the A47 St Peter's Street arm provides access to the town centre to the east.

8.3.3 The A47 Katwijk Way arms directs movements towards Lowestoft railway station. It also consists of a pedestrian crossing, including a pedestrian refuge island. The A47 St Peter's Street arm provides a dual lane approach into the roundabout. The A1144 St Peter's Street flares out on approach to the roundabout to provide a narrow nearside lane for ahead-only movements, with the outside lane allowing for right-turn movements onto the A47 Katwijk Way arm. The approach from the A47 Katwijk Way arm is single lane.

Figure 8.2: A12 Katwijk Way / A1144 St Peter's Street roundabout (Source: Google Maps Streetview)

Junction 2b: A47 Artillery Way / A47 Jubilee Way / A47 St Peter's Street

8.3.4 The junction at the A47 Artillery Way, A47 Jubilee Way and A47 St Peter's Street is a five arm roundabout. The A47 Jubilee Way is the northern arm which provides a dual lane approach, with connections to the A47 Yarmouth Road and north of Lowestoft. Dukes Head Street forms a minor eastern arm with access to the High Street and provides a dual lane approach.

8.3.5 The A47 Artillery Way forms one of the two southern arms, with access provided towards the Port. The approach flares out into two lanes, with line markings allowing for a left-only movement on the nearside lane and an ahead-only movement for the outside lane. Tennyson Road forms the second southern arm and is exit-only, providing access to Tennyson Road car park and a residential area enforced by a 20mph speed limit.

8.3.6 The A47 St Peter's Street arm also provides a dual lane approach and in the opposite direction, leads directly into the junction described above. Pedestrian crossings exist on the Dukes Head Street and A47 Artillery Way arms with refuge islands.

8.3.7 Toucan crossings exist on the A47 St Peter's Street and A47 Jubilee Way arms, approximately 20m and 15m back from the stop line on the roundabout, respectively.

Figure 8.3: A47 Artillery Way / A47 Jubilee Way / A47 St Peter's Street roundabout (Source: Google Maps Streetview)

Arm	AM			PM		
	Queue (PCU)	Delay (s)	RFC	Queue (PCU)	Delay (s)	RFC
	Base 2016					
J1: A47 St Peter's Street East	0.~~26~~21	2.~~35~~16	0.~~21~~17	0.~~36~~21	2.~~39~~09	0.~~26~~18
J1: A47 Katwijk Way	0.~~44~~17	3.~~87~~14	0.~~30~~15	0.~~56~~13	~~4.47~~3.	0.~~36~~11
J1: A1144 St Peter's Street West	1.~~01~~82	~~5.36~~8.	0.~~50~~65	0.~~63~~75	~~4.28~~5.	0.~~39~~43
J2: A47 Jubilee Way	0.~~57~~61	~~2.94~~4.	0.~~36~~38	0.~~49~~52	~~2.76~~4.	0.~~33~~35
J2: Dukes Head Street	0.~~35~~32	4.~~48~~14	0.~~26~~24	0.~~69~~47	~~5.57~~4.	0.~~41~~32
J2: A47 Artillery Way	0.~~19~~32	~~2.82~~3.	0.~~16~~24	~~1.14~~0.	~~5~~4.10	0.~~54~~43
J2: A47 St Peter's Street	0.~~5~~90	~~2.54~~4.	0.~~34~~48	0.~~61~~53	~~3.13~~4.	0.~~38~~35
	2022 DM					
J1: A47 St Peter's Street East	0.17	2.08	0.15	0.25	2.14	0.20
J1: A47 Katwijk Way	0.~~19~~18	3.~~14~~13	0.16	0.14	3.~~18~~17	0.12
J1: A1144 St Peter's Street West	1.~~02~~81	~~4.92~~8.	0.~~51~~65	~~0.63~~1.	~~3.90~~6.	0.~~39~~53
J2: A47 Jubilee Way	0.~~34~~60	~~2.76~~4.	0.~~26~~38	0.~~32~~55	~~2.55~~4.	0.~~24~~36
J2: Dukes Head Street	0.40	4.26	0.29	0.65	5.21	0.40
J2: A47 Artillery Way	0.39	3.35	0.28	0.92	4.69	0.48
J2: A47 St Peter's Street	~~0.56~~1.	~~2.85~~5.	0.~~36~~51	0.~~48~~86	~~2.91~~5.	0.~~32~~46
	2022 DS					
J1: A47 St Peter's Street East	0.16	2.04	0.14	0.25	2.17	0.20
J1: A47 Katwijk Way	0.17	3.06	0.15	0.17	3.~~25~~24	0.14
J1: A1144 St Peter's Street West	~~0.91~~1.	~~4.68~~8.	0.~~48~~62	0.~~44~~76	~~3.50~~6.	0.~~31~~44
J2: A47 Jubilee Way	0.~~31~~54	~~2.67~~4.	0.~~24~~35	0.~~28~~49	~~2.38~~4.	0.~~22~~33
J2: Dukes Head Street	0.39	4.16	0.28	0.60	4.73	0.38
J2: A47 Artillery Way	0.26	3.02	0.20	0.56	3.84	0.36
J2: A47 St Peter's Street	0.~~52~~97	~~2.69~~5.02	0.~~34~~50	0.~~33~~57	~~2.46~~4.34	0.~~25~~37
	2037 DM					
J1: A47 St Peter's Street East	0.20	2.14	0.17	0.27	2.19	0.21
J1: A47 Katwijk Way	0.21	3.~~26~~25	0.17	0.16	3.~~28~~27	0.14
J1: A1144 St Peter's Street West	~~1.17~~2.	~~5.31~~9.	0.~~54~~68	~~0.71~~1.	~~4.12~~7.	0.~~42~~56
J2: A47 Jubilee Way	0.~~35~~61	~~2.81~~4.	0.~~26~~38	0.~~32~~55	~~2.6~~4.5	0.~~24~~36
J2: Dukes Head Street	0.46	4.36	0.32	0.75	5.48	0.43
J2: A47 Artillery Way	0.43	3.52	0.30	1.66	6.65	0.63
J2: A47 St Peter's Street	~~0.62~~1.	~~2.99~~5.	0.~~38~~54	~~0.60~~1.	~~3.41~~6.	0.~~38~~53
	2037 DS					
J1: A47 St Peter's Street East	0.17	2.07	0.15	0.28	2.23	0.22
J1: A47 Katwijk Way	0.19	3.~~15~~13	0.16	0.18	3.~~35~~34	0.16
J1: A1144 St Peter's Street West	1.~~06~~86	~~5.06~~8.	0.~~52~~66	0.~~50~~89	~~3.69~~6.	0.~~34~~47
J2: A47 Jubilee Way	0.~~33~~58	4.84~~2.~~	0.~~25~~37	0.~~29~~50	~~2.44~~4.	0.~~23~~34
J2: Dukes Head Street	0.46	4.32	0.32	0.70	5.03	0.41
J2: A47 Artillery Way	0.31	3.23	0.24	0.91	4.77	0.48
J2: A47 St Peter's Street	~~0.58~~1.	~~2.84~~5.	0.~~37~~53	0.~~40~~70	~~2.75~~4.	0.~~28~~42

Table 8.2: Junctions 2a and 2b – A47 Katwijk Way / A1144 St Peter's Street Results Summary

Junction 2a (J1) – A47 Katwijk Way / A1144 St Peter's Street roundabout

8.3.8 This junction operates below operational capacity in the base scenario, with a maximum RFC of ~~just~~ 0.~~48~~65 on A1144 St Peter's Way Street West in the AM Peak. With background growth this increases to 0.~~54~~68 in the 2037 DM scenario, however the junction continues to operate well below capacity.

8.3.9 The Scheme can be seen to have a marginal impact on the operation of the roundabout, with ~~a small~~an improvement demonstrated on A47 Katwijk Way and A1144 St Peter's Street West in both peak periods.

Junction 2b (J2) – A47 Artillery Way / A47 Jubilee Way / A47 St Peter's Street roundabout

8.3.10 It can be seen that this junction operates below operational capacity in the base scenario, with a maximum RFC of just 0.~~36~~48 on A47 ~~Artillery Way~~St Peter's Street in the ~~PM~~AM Peak. With background growth this increases to 0.~~63~~54 in the 2037 DM scenario, however the junction continues to operate well below capacity.

8.3.11 The Scheme can be seen to have a marginal impact on the operation of the junction, with an improvement demonstrated on ~~all arms in both peak periods. In particular an improvement can be seen on A47 Jubilee Way in the AM Peak and~~ A47 Artillery Way in the PM Peak.

8.3.12 Overall the impact at these junctions as a result of the Scheme is negligible, and they operate well below capacity in all scenarios.

8.4 Junction 3 – A47 Waveney Road / Station Square / Commercial Road signalised junction

8.4.1 The junction at the A47 Waveney Road, Station Square and Commercial Road is a major traffic signal-controlled junction in the centre of Lowestoft, in close proximity to the A47 Bascule Bridge. The junction is complex in its nature, with two junctions operating in unison and close proximity, to form a large, staggered crossroad. Within the LinSig model, the junction is split into three smaller junctions in order to replicate the signals accurately.

8.4.2 Station Square forms the northern arm of the large junction and consists of a dual lane approach. The nearside lane allows for ahead- and left-only movements, whilst the outside lane allows ahead-only movements, towards the A47 Bascule Bridge. A puffin crossing exists approximately 35m from the stop line on Station Square, whilst an advanced stop line to accommodate cyclists at the junction also exists on the northern arm.

8.4.3 The A47 Waveney Road provides the eastern arm of the junction. It is a dual lane approach and each lane allows for left-only movements. All other movements are prohibited. An advanced stop line to accommodate cyclists at the junction also exists on this approach.

8.4.4 The A47 Waveney Road leads vehicles directly onto the Station Square northern arm. This approach is flared out to three lanes to accommodate the convergence of vehicles from Station Square and Waveney Road. The two nearside lanes allow for ahead-only movements onto the A47 Bascule Bridge (A47 Pier Terrace), whilst the outside lane allows for left-only movements onto Commercial Road.

8.4.5 Station Square also forms the southern arm of the junction, leading directly from the A47 Bascule Bridge (A47 Pier Terrace) and consists of a three lane approach. The nearside lane provides for left-only movements onto Commercial Road and is segregated from the two outside lanes at the stop line by a refuge island. The two outside lanes allow for ahead-only movements continuing on Station Square. Advanced stop lines exist on this arm across all lanes. This southern arm also extends past Commercial Road to connect with the northern arm of Station Square and the A47 Waveney Road. On this approach, there are two lanes; the nearside lane allows for left-only movements continuing onto Station Square, whilst the outside lane allows for right-only movements onto the A47 Waveney Road.

8.4.6 Commercial Road forms the western arm of the junction. This is a relatively narrow no-through road, providing access to waterfront industry on the northern flank of the Lake. Its approach to the junction is characterised by a single lane, and also consists of an advanced stop line for cyclists. The approach allows both left- and right-turn movements onto Station Square and the A47 Bascule Bridge, respectively.

Figure 8.4: A47 Waveney Road / Station Square / Commercial Road – Station Square northbound approach from southern arm (Source: Google Maps Streetview)

Figure 8.5: A47 Waveney Road / Station Square / Commercial Road – Station Square southbound approach from northern arm (Source: Google Maps Streetview)

Junction and Link	Base 2016		2022 DM		2022 DS		2037 DM		2037 DS	
	DoS	MMQ[42]	DoS	MMQ	DoS	MMQ	DoS	MMQ	DoS	MMQ
J1: Station Square SB Ahead	7.2%	0.5	6.0%	0.4	3.7%	0.3	7.1%	0.5	0.4%	0.0
J1: Station Square SB Ahead	17.2%	1.4	19.6%	1.6	13.4%	1.0	20.4%	1.8	11.7%	0.9
J2: Station Square SB Left/Right	31.6%	3.7	23.5%	2.9	21.6%	1.9	27.1%	3.5	2.3%	0.2
J2: Station Square SB Right	76.4%	10.8	78.1%	12.3	77.2%	8.9	78.7%	12.8	64.3%	7.1
J2: A47 Waveney Road Left	39.3%	5.3	40.2%	5.5	15.4%	1.6	43.3%	6.1	24.8%	2.8
J2: A47 Waveney Road Left	4.3%	0.5	8.4%	0.9	2.7%	0.3	10.5%	1.2	6.4%	0.6
J2: A47 Station Square NB Left	37.8%	0.3	39.9%	0.3	11.8%	0.1	41.7%	0.4	15.5%	0.1
J2: A47 Station Square NB Right	67.4%	7.9	71.3%	7.7	46.0%	4.2	72.8%	7.8	58.8%	6.1
J2: Station Square NB Ahead	39.2%	0.7	41.3%	0.7	12.2%	0.9	43.2%	0.7	16.1%	1.1
J3: A47 Pier Terrace Left Ahead	61.3%	15.0	65.6%	16.8	20.9%	2.7	70.2%	19.0	29.9%	3.7
J3: A47 Pier Terrace Ahead	60.0%	14.9	61.4%	15.7	44.5%	9.6	60.9%	15.4	56.2%	13.6
J3: Commercial Road Right Left	31.3%	2.0	33.0%	2.1	30.0%	2.0	36.2%	2.4	37.1%	2.5
J3: A47 Station Square SB Ahead	39.5%	4.8	37.3%	4.4	15.7%	1.4	40.6%	4.8	20.4%	2.3
J3: A47 Station Square SB Ahead/Right	63.8%	3.4	61.9%	3.5	36.5	1.7	65.5	3.5	49.7%	2.4

Table 8.3: Junction 3 – A47 Waveney Road / Station Square / Commercial Road signalised junction Results Summary (AM Peak)

[42] The Mean Maximum Queue (MMQ) is the estimated mean number of vehicles (or PCUs) which have added onto the back of the queue up to the time when the queue finally clears

Junction and Link	Base 2016		2022 DM		2022 DS		2037 DM		2037 DS	
	DoS	MMQ	DoS	MMQ	DoS	MMQ	DoS	MMQ	DoS	MMQ
J1: Station Square SB Ahead	15.8%	1.3	16.3%	1.4	1.9%	0.1	20.0%	1.7	11.4%	0.9
J1: Station Square SB Ahead	27.9%	2.6	29.4%	2.7	22.8%	2.0	29.2%	2.7	26.9%	2.5
J2: Station Square SB Left/Right	49.0%	7.8	48.0%	7.9	5.8%	0.7	60.2%	10.4	35.3%	5.2
J2: Station Square SB Right	86.9%	18.2	86.9%	18.8	67.5%	12.3	88.7%	19.5	84.0%	17.0
J2: A47 Waveney Road Left	60.2%	9.7	65.6%	11.0	60.8%	9.8	71.2%	12.6	52.0%	7.9
J2: A47 Waveney Road Left	55.4%	8.7	61.5%	10.0	47.5%	7.1	67.7%	11.7	31.6%	4.3
J2: A47 Station Square NB Left	27.6%	0.2	29.2%	0.2	8.2%	0.0	31.5%	0.2	8.9%	0.0
J2: A47 Station Square NB Right	57.6%	8.0	61.3%	7.8	41.5%	2.6	61.7%	8.2	41.4%	3.1
J2: Station Square NB Ahead	28.6%	0.7	30.3%	0.7	8.5%	0.4	32.6%	0.9	9.3%	0.5
J3: A47 Pier Terrace Left Ahead	83.3%	28.1	87.5%	31.8	51.7%	11.0	91.4%	36.3	52.3%	11.4
J3: A47 Pier Terrace Ahead	48.9%	3.4	52.1%	3.7	51.8%	3.1	57.7%	4.1	62.6%	3.9
J3: Commercial Road Right Left	57.6%	5.1	60.3%	6.8	37.5%	3.6	70.1%	10.8	47.4%	6.4
J3: A47 Station Square SB Ahead	72.6%	4.7	77.1%	5.6	59.6%	9.3	81.5%	7.7	56.0%	10.0
J3: A47 Station Square SB Ahead/Right	15.8%	1.3	16.3%	1.4	1.9%	0.1	20.0%	1.7	11.4%	0.9

Table 8.4: Junction 3 – A47 Waveney Road / Station Square / Commercial Road signalised junction Results Summary (PM Peak)

8.4.7 It can be seen that in the Base 2016 scenario all arms of the junction operate well below operational capacity (90.0%) in the AM Peak, with a maximum DoS of just 76.4% on J1: Station Square SB Right. With background growth this increases to 78.7% in 2037, with an associated queue of approximately 7 PCUs (Passenger Car Units).

8.4.8 In the PM Peak the most congested lane is J3: A47 Pier Terrace Left Ahead, with a DoS of 83.3% for both lanes and a MMQ of approximately 28 PCUs. With background growth in 2037 both lanes are modelled as exceeding operational capacity, with a DoS of 91.4% and a MMQ of approximately 36 PCUs.

8.4.9 The Scheme can be seen to provide a significant betterment to the operation of the junction, with a particular improvement seen on J3: Pier Terrace Left Ahead in the AM Peak, with a reduction in DoS of 57% and a reduction in MMQ of approximately 15 PCUs in the 2037 scenarios.

8.4.10 An improvement can also be seen at the junction in PM Peak, with a particular improvement shown on J2: Station Square SB Left/Right with a reduction in DoS of 48% and a reduction in MMQ of 5 PCUs. In relation to J3: A47 Pier Terrace Left Ahead which is modelled as over operational capacity in the 2037 DM scenario, it can be seen that the Scheme greatly improve this link, with a DoS of just 52.3% and a MMQ of 12 PCUs.

8.4.11 Overall the Scheme can be seen to significantly improve the operation of this junction.

8.5 Junction 4 – A12 Pier Terrace / A12 Belvedere Road / B1532 London Road South signalised junction

8.5.1 The junction at the A12 Pier Terrace, B1532 London Road South and B1532 Parade Road North is a traffic signal-controlled junction. The A12 Pier Terrace northern approach operates with a ‘one-addition’ central lane, which is only opened in the direction of flow deemed in greatest demand by traffic at a particular time in the day. This approach leads directly from the A47 Bascule Bridge and provides two ahead-only lanes, with an exit-only access to Parade Road North provided immediately prior to the signals. A toucan signal-controlled crossing exists on this exit road and forms part of the overall segregated island crossing on this arm of the junction. In order for the LinSig software to accurately represent the junction, it is split into two smaller junctions within a single model.

8.5.2 The B1532 London Road South arm leads directly from a one-way system and provides one left-only lane and one right-only lane onto the A12 Pier Terrace. Approximately 20m prior to the stop line of the primary junction on this arm, vehicles are able to make a ‘U-turn’ movement onto Parade Road North. This is also a toucan signal-controlled movement.

8.5.3 The A12 Belvedere Road forms the western approach and is characterised by two lanes, however right-turn movements onto Parade Road North are prohibited. There is also a toucan crossing present on this arm. An uncontrolled no-through road exists to the immediate north of the junction, providing access to lakefront industry.

Figure 8.6: A12 Pier Terrace / B1532 London Road South / B1532 Parade Road North junction (Source: Google Maps Streetview)

Junction and Link	Base 2016		2022 DM		2022 DS		2037 DM		2037 DS	
	DoS	MMQ	DoS	MMQ	DoS	MMQ	DoS	MMQ	DoS	MMQ
J1: A12 Pier Terrace SB Ahead	46.~~1~~10%	5.6	48.~~6~~60%	6.2	26.~~2~~20%	2.5	54.~~0~~00%	7.5	33.~~0~~00%	3.3
J1: A12 Pier Terrace ~~SB~~NB Ahead	32.~~5~~60%	1.~~3~~2	33.~~4~~50%	1.~~2~~5	21.~~0~~10%	0.~~1~~3	35.~~4~~50%	1.~~0~~4	~~20.9~~21.10%	0.~~1~~6
J1: A12 Pier Terrace NB Ahead	~~49.0~~48.90%	1.~~5~~4	50.~~8~~70%	1.~~5~~7	33.~~8~~70%	~~1.4~~2.0	55.~~2~~10%	1.~~9~~8	~~28.1~~27.90%	0.~~8~~9
~~J1~~J2: A12 Pier Terrace ~~NB~~SB Left Ahead	~~73.5~~68.2 : 68.2%	~~17~~16.1	~~77.7~~72.1 : 72.1%	~~19~~17.1	~~48.5~~43.1 : 43.1%	~~8.5~~7.3	~~86.3~~81.2 : 81.2%	~~25.4~~21.6	~~59.1~~43.8 : 43.8%	~~13.0~~8.2
J2: ~~A12 Pier Terrace SB~~B1532 London Road South Ahead Left~~/Ahead~~	~~2~~68.7 : 68.7%	~~0.4~~10.6	~~2.7~~72.3 : 72.3%	~~0~~11.4	~~2.2~~42.5 : 42.5%	~~0.3~~6.7	~~3~~80.0 : 80.0%	~~0.4~~13.7	~~6.4~~42.8 : 42.8%	~~1.0~~4.3
~~J2: B1532 London Road South Left~~	~~71.9%~~	~~13.0~~	~~75.9%~~	~~14.2~~	~~47.8%~~	~~8.7~~	~~86.0%~~	~~17.9~~	~~27.9%~~	~~4.2~~
J2: B1532 London Road South ~~Ahead/~~Right	~~60.9~~13.10%	~~14.6~~2.3	~~62.5~~13.90%	~~15.~~2.5	~~47.3~~12.80%	~~9.5~~2.4	~~66.2~~14.90%	~~16.5~~2.7	~~46.2~~10.90%	~~9.2~~1.8
J2: A12 Belvedere Road Ahead	~~59.1~~56.30%	13.~~8~~4	~~60.6~~57.90%	~~14.4~~13.8	~~46.0~~41.60%	~~9.1~~8.5	~~63.9~~62.20%	15.~~6~~4	~~45.7~~33.30%	~~9.1~~6.7
J2: A12 Belvedere Road Ahead	~~46.1~~54.20%	~~5~~12.6	~~48.6~~55.60%	~~6.2~~13.1	~~26.2~~40.10%	~~2.5~~8.1	~~54.0~~59.70%	~~7.5~~14.6	~~33.0~~32.40%	~~3.3~~6.4
J2: The Beach Right	4.~~9~~90%	0.0	5.~~2~~20%	0.0	5.~~7~~70%	0.0	5.~~7~~70%	0.0	3.~~5~~50%	0.0

Table 8.5: Junction 4 - A12 Pier Terrace / B1532 London Road South signalised junction Results Summary (AM Peak)[43]

[43] The model initially developed for the capacity assessment of Junction 4 as presented in the original TA was based upon an old satellite image of this junction layout. This resulted in the lane configuration on B1532 London Road being modelled incorrectly. The junction model was subsequently revised in line with the current layout and results of the updated capacity assessment are presented in Table 8.5.

	Base 2016		2022 DM		2022 DS		2037 DM		2037 DS	
	DoS	MMQ	DoS	MMQ	DoS	MMQ	DoS	MMQ	DoS	MMQ
J1: A12 Pier Terrace SB Ahead	52.~~3~~50%	7.2	54.~~5~~60%	7.~~5~~8	40.~~2~~50%	4.5	59.~~3~~40%	9.~~1~~2	43.~~8~~60%	5.1
J1: A12 Pier Terrace SB Ahead	42.~~7~~40%	~~5.0~~4.9	45.~~3~~20%	5.5	31.~~3~~10%	3.1	51.~~4~~40%	6.8	34.~~5~~60%	3.~~6~~7
J1: A12 Pier Terrace NB Ahead	56.~~5~~50%	~~10.7~~9.5	58.~~7~~70%	~~12.4~~10.8	27.~~9~~90%	2.~~1~~2	62.~~3~~30%	~~14.7~~13.1	28.~~3~~30%	1.~~9~~7
~~J1~~J2: A12 Pier Terrace ~~NB~~SB Left Ahead	~~62.0~~60.1 : 60.1%	~~11~~10.1	~~64.7~~62.6 : 62.6%	~~12.4~~10.8	~~49~~47.1 : 47.1%	8.~~8~~2	~~69.8~~67.5 : 67.5%	~~15.0~~12.8	~~53.9~~0.0 : 55.2%	~~13~~11.9
J2: A12 Pier Terrace SB ~~Left/~~Ahead	~~55.2~~52.90%	~~11.3~~10.7	~~58.5~~56.30%	~~12.5~~11.9	~~41.5~~39.20%	7.~~8~~2	~~65.7~~63.30%	~~15.4~~13.8	~~45.7~~47.00%	~~10.4~~8.9
J2: B1532 London Road South Ahead Left	~~3.0~~59.2 : 59.2%	~~0.2~~4.5	~~3.4~~59.0 : 59.0%	~~0.3~~4.5	~~3.0~~44.5 : 44.5%	~~0.2~~3.4	65.4~~.1~~ : 65.4%	~~0.3~~4.8	~~8.3~~54.4 : 54.4%	~~0~~5.7
J2: B1532 London Road South ~~Ahead/~~Right	~~62.2~~10.50%	~~5.6~~1.3	~~62.4~~10.90%	~~5.6~~1.4	~~49.5~~12.40%	~~4.5~~1.6	~~70.3~~13.40%	~~6.3~~1.7	~~74.4~~11.00%	~~8.~~1.6
J2: A12 Belvedere Road Ahead	~~34.3~~33.10%	6.~~5~~0	~~35.9~~34.60%	6.~~9~~4	~~16.0~~15.20%	2.~~6~~4	~~37.8~~36.50%	~~7.4~~6.8	~~17.9~~13.90%	2.3~~.2~~
J2: A12 Belvedere Road Ahead	~~34.3~~33.10%	6.~~5~~0	~~35.9~~34.60%	6.~~9~~4	15.~~9~~10%	2.~~6~~4	~~37.8~~36.50%	~~7.4~~6.8	~~17.9~~13.90%	2.3~~.2~~
J2: The Beach Right	2.~~3~~30%	0.0	2.~~4~~40%	0.0	2.~~8~~80%	0.0	2.~~8~~80%	0.0	3.~~0~~00%	0.0

Table 8.6: Junction 4 - A12 Pier Terrace / B1532 London Road South signalised junction Results Summary (PM Peak)

8.5.4 It can be seen that in the Base 2016 scenario all arms of the junction operate well below capacity in the AM Peak, with a maximum DoS of just ~~73.5~~68.7% for both lanes on J2: ~~A12 Pier Terrace SB.~~B1532 London Road South Ahead Left. With background growth this is shown to increase to ~~86.3~~80.0% in 2037. In the PM Peak the most congested link is J2: A12 Pier Terrace SB Left Ahead, with ~~an associated queue~~a DoS of ~~approximately 25 PCUs.~~just 60.1% for both lanes. With background growth in 2037 this increases to 67.5%.

~~8.5.5 In the PM Peak the most congested link is J2: B1532 London Road South, with a DoS of just 62.2% for both lanes, and a MMQ of just under 6 PCUs. With background growth in 2037 this increases to 70.3% and a queue of just over 6 PCUs.~~

~~8.5.6~~ The Scheme can be seen to provide a significant betterment to the operation of all approaches to the junction~~, with~~. In the AM Peak, a particular improvement can be seen on J2: A12 Pier Terrace ~~S~~SB, with a reduction in DoS of ~~33~~37% across both lanes and a reduction in MMQ of approximately ~~15~~14 PCUs in the 2037 DS scenario.

~~8.5.7~~8.5.5 ~~An improvement can also be seen at the junction in~~ In the PM Peak,~~ with~~ a particular improvement ~~shown~~can be seen on J1: A12 Pier Terrace NB Ahead with a reduction in DoS of approximately ~~31~~34% and a reduction in MMQ of just under ~~14~~11 PCUs.

~~8.5.8~~8.5.6 Overall the Scheme can be seen to significantly improve the operation of this junction.

8.6 Junction 5 – A12 Belvedere Road / A12 Horn Hill roundabout

8.6.1 The junction at the A12 Belvedere Road and the A12 Horn Hill is a five arm roundabout. The A12 Belvedere Road provides the eastern arm and a dual lane approach. Mill Road is a minor south-eastern arm and links to the B1532 London Road South and the South Beach Tourist Route. Kirkley Rise is a minor southern arm and provides direct access to Clifton Road car park (. Mill Road and Kirkley Rise are characterised by single lane approaches.

8.6.2 The A12 Horn Hill provides the western arm to the roundabout and a dual lane approach. The north-western arm provides direct access into the Superstore car park and is characterised by a single lane approach on exit. Pedestrian crossings are present on the Kirkley Rise and Superstore car park access arms, both of which include pedestrian refuge islands.

Figure 8.7: A12 Belvedere Road / A12 Horn Hill roundabout (Source: Google Maps Streetview)

Arm	AM			PM		
	Queue (PCU)	Delay (s)	RFC	Queue (PCU)	Delay (s)	RFC
	Base 2016					
A12 Belvedere Road	0.~~30~~42	~~1.99~~2.77	0.~~23~~29	~~1.15~~2.19	~~3.39~~6.52	0.~~54~~69
Mill Road	0.08	4.~~54~~65	0.07	0.~~15~~20	~~7.59~~10.19	0.~~13~~17
Kirkley Rise	0.~~00~~01	~~2.43~~3.96	0.~~00~~01	0.00	0.00	0.00
A12 Horn Hill	~~7.58~~3.68	~~21.09~~9.92	0.~~89~~79	~~1.15~~0.90	~~5.17~~4.06	0.~~54~~48
Asda Access	0.~~25~~22	~~5.03~~4.51	0.~~20~~18	0.~~45~~37	3.73~~4.46~~	0.~~31~~27
	2022 DM					
A12 Belvedere Road	0.~~35~~50	2.~~10~~98	0.~~26~~33	~~1.34~~2.80	~~3.73~~7.90	0.~~57~~74
Mill Road	0.09	4.~~70~~87	0.08	0.~~28~~42	~~8.89~~13.08	0.~~22~~30
Kirkley Rise	0.00	0.00	0.00	0.00	0.00	0.00
A12 Horn Hill	~~15.46~~5.36	~~40.22~~13.63	0.~~96~~85	1.~~35~~04	~~5.73~~4.41	0.~~58~~51
Asda Access	0.~~32~~29	~~5.44~~4.90	0.~~24~~22	0.~~54~~45	4.~~83~~01	0.~~35~~31
	2022 DS					
A12 Belvedere Road	0.~~12~~15	~~1.76~~2.34	0.~~10~~13	0.~~44~~66	~~2.36~~3.56	0.~~30~~40
Mill Road	0.~~20~~19	4.~~55~~48	0.~~17~~16	0.~~40~~46	~~7.11~~8.19	0.~~29~~32
Kirkley Rise	0.00	0.00	0.00	0.00	0.00	0.00
A12 Horn Hill	1.45~~2.03~~	~~7.05~~5.04	0.~~67~~59	0.~~70~~57	3.~~99~~27	0.~~41~~37
Asda Access	0.~~25~~22	~~4.10~~3.54	0.~~20~~18	0.~~46~~38	~~4.01~~3.29	0.~~32~~27
	2037 DM					
A12 Belvedere Road	0.~~40~~58	~~2~~3.20	0.~~29~~37	4.10~~1.63~~	~~4.30~~11.01	0.~~62~~81
Mill Road	0.11	~~4.97~~5.23	0.10	0.~~41~~71	~~10.75~~18.99	0.~~29~~42
Kirkley Rise	0.01	~~2.57~~4.35	0.01	0.00	0.00	0.00
A12 Horn Hill	~~49.06~~10.28	~~103.01~~24.78	~~1.04~~0.92	1.~~77~~31	5.02~~6.78~~	0.~~64~~57
Asda Access	0.~~39~~37	5.~~88~~55	0.~~28~~27	0.~~69~~57	4.46~~5.45~~	0.~~41~~36
	2037 DS					
A12 Belvedere Road	0.~~14~~18	~~1.81~~2.44	0.~~12~~16	0.~~54~~85	~~2.57~~4.06	0.~~35~~46
Mill Road	0.24	4.~~85~~83	0.~~20~~19	0.~~49~~60	~~8.17~~10.12	0.~~33~~38
Kirkley Rise	0.00	0.00	0.00	0.00	0.00	0.00
A12 Horn Hill	2.03~~3.10~~	~~9.63~~6.24	0.~~76~~67	0.~~95~~76	~~4.58~~3.66	0.~~49~~43
Asda Access	0.~~32~~27	~~4.51~~3.88	0.~~24~~22	0.~~59~~47	~~4.47~~3.62	0.~~37~~32

Table 8.7: Junction 5 - A12 Belvedere Road / Mill Road / Kirkley Rise Roundabout Results Summary

8.6.3 It can be seen that ~~in~~ the junction operates below capacity in the Base 2016 scenario, with a maximum RFC of 0.79 on A12 Horn Hill ~~is approaching capacity~~ in the AM Peak ~~with an RFC of 0.89, with all other arms of the junction operating below capacity in both peak periods.~~. With background growth, A12 Horn Hill ~~exceeds~~is approaching capacity in the 2037 DM scenario with a RFC of ~~1.04~~0.92.

8.6.4 The Scheme can be seen to provide a significant betterment to the operation of the roundabout, with a particular improvement seen on A12 Belvedere Road. ~~In relation to the arms of the junction which are shown to be exceeding capacity in the 2037 DM scenario, the~~The Scheme can be seen to reduce the RFC on A12 Horn Hill by ~~27~~25% in the AM Peak, bringing it well below capacity with the Scheme in place.

8.7 Junction 6 – A12 Tom Crisp Way / A12 Horn Hill / B1531 Waveney Drive / Maconochie Way roundabout

8.7.1 The junction at the A12 Tom Crisp Way, A12 Horn Hill and B1531 Waveney Drive is a four arm roundabout, located in close proximity to the Scheme. The A12 Horn Hill provides the eastern arm with the approach characterised by two lanes, a nearside lane for movements continuing onto the A12 Tom Crisp Way and an outside lane for movements turning onto the B1531 Waveney Drive east-west corridor.

8.7.2 Maconochie Way forms the southern arm which provides access to small industries. The south-western arm is provided by the A12 Tom Crisp Way, which leads into south of Lowestoft. The approach to the junction is dual lane and a toucan crossing exists approximately 30m prior to the stop line at the roundabout. The B1531 Waveney Drive forms the western arm and is within 125m of the proposed southern junction to the Scheme. Its approach to the roundabout is also dual lane. There is an access-only road for vehicles delivering goods to the Superstore, to the north of the roundabout.

Figure 8.8: A12 Tom Crisp Way / A12 Horn Hill / B1531 Waveney Drive / Maconochie Way roundabout (Source: Google Maps Streetview)

Arm	AM			PM		
	Queue (PCU)	Delay (s)	RFC	Queue (PCU)	Delay (s)	RFC
	Base 2016					
A12 Horn Hill	0.51	2.86	0.34	2.61	6.77	0.73
Maconochie Way	0.04	3.07	0.03	0.10	5.45	0.09
A12 Tom Crisp Way EB	1.52	4.94	0.60	0.47	3.21	0.32
B1531 Waveney Drive	0.53	3.88	0.35	0.29	2.56	0.22
	2022 DM					
A12 Horn Hill	0.52	2.86	0.34	2.90	7.40	0.75
Maconochie Way	0.02	3.14	0.02	0.05	5.55	0.04
A12 Tom Crisp Way EB	1.60	5.13	0.62	0.45	3.05	0.31
B1531 Waveney Drive	0.63	4.00	0.39	0.33	2.54	0.25
	2022 DS					
A12 Horn Hill	0.57	3.98	0.36	3.63	11.64	0.79
Maconochie Way	0.04	4.62	0.04	0.07	8.72	0.07
A12 Tom Crisp Way EB	2.93	7.93	0.75	1.49	5.51	0.60
B1531 Waveney Drive	2.64	7.56	0.73	1.27	4.08	0.56
	2037 DM					
A12 Horn Hill	0.64	3.18	0.39	4.55	10.72	0.82
Maconochie Way	0.02	3.31	0.02	0.06	6.53	0.06
A12 Tom Crisp Way EB	1.71	5.35	0.63	0.54	3.33	0.35
B1531 Waveney Drive	0.89	4.84	0.47	0.37	2.67	0.27
	2037 DS					
A12 Horn Hill	0.73	4.54	0.42	7.10	20.64	0.89
Maconochie Way	0.05	5.18	0.05	0.10	10.95	0.09
A12 Tom Crisp Way EB	4.01	10.38	0.80	2.03	6.96	0.67
B1531 Waveney Drive	5.09	13.09	0.84	1.41	4.41	0.59

Table 8.8: Junction 6 – A12 Tom Crisp Way / A12 Horn Hill / B1531 Waveney Drive / Maconochie Way roundabout Results Summary

8.7.3 The results in Table 8.8 show that this junction is forecast to operate within capacity in the DM scenarios.

8.7.4 The junction is forecast to exceed the 0.85 threshold for operational capacity on the A12 Horn Hill arm in the PM peak of 2037 with the Scheme in place, but will otherwise operate within capacity at other times. The junction will operate within theoretical 100% capacity in all scenarios.

8.8 Junction 7 – B1531 Victoria Road / B1531 Waveney Drive / Kirkley Run mini roundabout

8.8.1 The junction at the B1531 Waveney Drive, B1531 Victoria Road and Kirkley Run is a three arm mini-roundabout. The B1531 Waveney Drive forms the north-eastern arm and leads directly from the location of the Scheme. Kirkley Run provides the south-eastern arm and leads movements towards the A12 Tom Crisp Way. The B1531 Victoria Road forms the western arm of the junction and, combined with Waveney Drive, forms the east-west corridor along the south side of the Lake.

8.8.2 All arms provide a single lane approach to the junction, whilst the area surrounding the junction is mostly residential. Pedestrian crossings, include refuge islands, are present on the B1531 Victoria Road and Kirkley Run arms.

Figure 8.9: B1531 Waveney Drive / B1531 Victoria Road / Kirkley Run mini-roundabout (Source: Google Maps Streetview)

Arm	AM			PM		
	Queue (PCU)	Delay (s)	RFC	Queue (PCU)	Delay (s)	RFC
	Base 2016					
B1531 Waveney Drive	0.31	6.49	0.24	2.28	16.49	0.70
Kirkley Run	1.05	12.22	0.51	0.92	13.4	0.48
B1531 Victoria Road	0.95	7.29	0.49	0.50	5.22	0.34
	2022 DM					
B1531 Waveney Drive	0.45	7.02	0.31	3.51	23.09	0.79
Kirkley Run	1.37	14.38	0.58	1.56	18.86	0.62
B1531 Victoria Road	1.29	8.96	0.57	0.62	5.86	0.38
	2022 DS					
B1531 Waveney Drive	0.91	8.81	0.48	83.54	380.50	1.19
Kirkley Run	3.91	32.10	0.81	1.89	23.40	0.66
B1531 Victoria Road	1.99	13.88	0.67	0.63	6.32	0.39
	2037 DM					
B1531 Waveney Drive	0.64	8.05	0.39	8.85	52.26	0.92
Kirkley Run	2.10	19.50	0.68	3.13	32.80	0.77
B1531 Victoria Road	2.56	14.41	0.73	0.83	6.83	0.46
	2037 DS					
B1531 Waveney Drive	1.37	11.12	0.58	251.41	1171.83	1.46
Kirkley Run	11.77	84.78	0.96	3.78	40.75	0.81
B1531 Victoria Road	6.67	38.29	0.89	0.89	7.56	0.47

Table 8.9: Junction 7 – B1531 Victoria Road / B1531 Waveney Drive / Kirkley Run mini roundabout Results Summary

8.8.3 This junction operates below capacity in the base scenario, with a maximum RFC of 0.70 on B1531 Waveney Drive in the PM peak. With background growth, it can be seen that this arm exceeds capacity in 2037 DM with an RFC of ~~1.19~~0.92, whilst all other arms continue to operate well below capacity.

8.8.4 The Scheme has a negative impact on the operation of the junction in both peak hours, with an RFC on the worst approach of 0.96 in the AM Peak and 1.46 in the PM Peak in DS 2037.

8.8.5 Due to this junction being forecast to operate in exceedance of capacity, mitigation improvements are proposed as set out in Section 9.

8.9 Junction 8a, 8b and 8c – A12 Tom Crisp Way / Blackheath Road signalised junction; Kirkley Run / Blackheath Road / Long Road priority junction; and Blackheath Road / Carlton Road priority junction

8.9.1 The junctions of A12 Tom Crisp Way / Blackheath Road, Kirkley Run / Blackheath Road / Long Road, and Blackheath Road / Carlton Road priority junction are located adjacent to one another and operate as one larger junction. As such, the three junctions have been modelled together in one LinSig model to ensure the interactions between the junctions are accurately represented within the assessment.

Junction 8a: A12 Tom Crisp Way / Blackheath Road

8.9.2 The junction of the A12 Tom Crisp Way and Blackheath Road is a significant, four arm traffic signal-controlled junction on Lowestoft's highway network. The northern arm of the A12 Tom Crisp Way is a three arm approach, subjected to a 40mph speed limit. The nearside lane provides for left-turn movements onto the Blackheath Road eastern arm, as well as ahead movements, together with the middle lane. The outside lane is dedicated for right-only movements onto the Blackheath Road western arm and is approximately 50m in length to allow for queuing. The left- and ahead-movements are separated from the right-only movements by a pedestrian refuge island.

8.9.3 Blackheath Road forms the eastern arm of the junction and is characterised by a dual lane approach. The outside lane allows for right-only movements towards the town centre via the A12 Tom Crisp Way. The approach on Blackheath Road is subjected to a 30mph speed limit.

8.9.4 The A12 Tom Crisp Way also forms the south-western arm of the junction and is a three arm approach, subjected to a 40mph speed limit. The nearside lane provides for left-turn movements onto the western Blackheath Road arm, as well as ahead movements, together with the middle lane. The outside lane is dedicated for right-only movements onto the Blackheath Road eastern arm and is approximately 40m in length to allow for queuing. The left- and ahead-movements are separated from the right-only movements by a pedestrian refuge island.

8.9.5 Blackheath Road also forms the western arm of the junction and is characterised by a dual lane approach. The outside lane allows for right-only movements onto the A12 Tom Crisp Way, signposted for Ipswich. The approach is subjected to a 30mph limit and links directly to the priority junction of Blackheath Road / Kirkley Run.

8.9.6 Toucan crossings are present on the northern, eastern and southern arms of the junction and are staggered in order to provide a refuge island for pedestrians and cyclists.

Figure 8.10: A12 Tom Crisp Way / Blackheath Road junction – heading southbound (Source: Google Maps Streetview)

Figure 8.11: A12 Tom Crisp Way / Blackheath Road junction – heading eastbound (Source: Google Maps Streetview)

Junction 8b: Kirkley Run / Blackheath Road / Long Road

8.9.7 The junction at Kirkley Run, Blackheath Road and Long Road is a three arm priority junction. Kirkley Run forms the northern arm of the junction and vehicles are entitled to turn eastbound onto Blackheath Road or westbound onto Long Road. However, vehicles egressing from Kirkley Run must ‘give-way’ to all other movements at the junction.

8.9.8 The eastern arm is provided by Blackheath Road and links directly to the A12 Tom Crisp Way. The approach is dual lane, with a dedicated outside lane for right-turn movements onto Kirkley Run, and a nearside lane for ahead-only movements onto Long Road. The speed limit is 30mph on this approach, reducing from the 40mph limit on the A12 Tom Crisp Way. Long Road forms the southwestern arm of the junction and consists of a single lane approach, providing access to residential areas of southern Lowestoft.

Figure 8.12: Kirkley Run / Blackheath Road / Long Road priority junction (Source: Google Maps Streetview)

Junction 8c: Blackheath Road / Carlton Road

8.9.9 The junction at Blackheath Road and Carlton Road is a three arm priority junction. Blackheath Road forms the north-western and southern arms of the junction. The north-western arms links directly to the A12 Tom Crisp Way and is a dual lane approach. A dedicated outside lane allows for right-turn movements only for vehicles continuing onto the southern arm of Blackheath Road. The nearside lane provides for ahead-only movements onto Carlton Road. The speed limit is 30mph on this approach, reducing from the 40mph limit on the A12 Tom Crisp Way.

8.9.10 The southern arm is formed by Blackheath Road. Its approach widens from a single carriageway to provide two lanes; the outside lane for right-only movements onto Carlton Road and the nearside lane for left-only movements onto the A12 Tom Crisp Way, via Blackheath Road. There are no line markings delineating these lanes, however, navigational markings exist to suggest the turning movements that are available to vehicles. Vehicles egressing from this arm must also ‘give-way’ to all other movements at the junction. A pedestrian crossing, including a pedestrian refuge island, is present on the southern arm of the Blackheath Road.

Figure 8.13: Blackheath Road / Carlton Road priority junction (Source: Google Maps Streetview)

	Base 2016		2022 DM		2022 DS		2037 DM		2037 DS	
	DoS	MMQ	DoS	MMQ	DoS	MMQ	DoS	MMQ	DoS	MMQ
J1: A12 Tom Crisp Way SB Left/Ahead	43.40%	7.0	36.50%	5.7	60.50%	11.5	42.80%	6.8	74.00%	14.7
J1: A12 Tom Crisp Way SB Ahead/Right	47.0 : 47.0%	3.4	42.5 : 42.5%	5.9	63.7 : 63.7%	12.1	51.1 : 48.2%	7.0	76.2 : 76.2%	15.5
J1: Blackheath Road WB Right Left/Ahead	79.2 : 79.2%	10.9	76.3 : 76.3%	10.2	79.6 : 79.6%	10.4	86.7 : 86.7%	13.2	83.8 : 83.8%	12.4
J1: A12 Tom Crisp Way NB Ahead/Left	76.10%	14.8	81.70%	16.7	78.20%	17.2	82.60%	16.6	83.30%	18.7
J1: A12 Tom Crisp Way NB Ahead/Right	78.2 : 78.2%	15.5	83.3 : 83.3%	17.6	79.6 : 79.6%	17.8	84.4 : 84.4%	17.6	84.6 : 84.6%	19.3
J1: Blackheath Road EB Left Ahead/Right	78.2 : 78.2%	8.3	69.7 : 69.7%	6.8	79.0 : 79.0%	6.9	83.4 : 83.4%	9.9	85.2 : 85.2%	8.2
J2: Long Road Left Ahead	5.90%	0.0	4.70%	0.0	8.80%	0.0	7.60%	0.0	10.60%	0.1
J2: Kirkley Run Right Left	10.40%	0.1	10.20%	0.1	7.80%	0.0	11.50%	0.1	8.90%	0.0
J2: Blackheath Road WB Ahead/Right	14.4 : 14.4%	0.1	14.6 : 14.6%	0.1	8.7 : 8.7%	0.0	14.9 : 15.2%	0.1	9.1 : 9.1%	0.1
J3: Carlton Road Left Ahead	13.20%	0.1	12.50%	0.1	13.10%	0.1	14.70%	0.1	14.80%	0.1
J3: Blackheath Road NB Right/Left	9.6 : 9.6%	0.1	8.2 : 8.2%	0.0	11.1 : 11.1%	0.1	11.3 : 11.3%	0.1	12.7 : 12.7%	0.1
J3: Blackheath Road EB Ahead/Right	11.3 : 11.3%	0.1	12.1 : 12.1%	0.1	14.8 : 14.8%	0.1	13.8 : 13.8%	0.1	16.9 : 16.9%	0.1

Table 8.10: Junction 8a, 8b and 8c – A12 Tom Crisp Way / Blackheath Road signalised junction, Kirkley Run / Blackheath Road / Long Road priority junction and Blackheath Road / Carlton Road priority junction Results Summary (AM Peak)

	Base 2016		2022 DM		2022 DS		2037 DM		2037 DS	
	DoS	MMQ	DoS	MMQ	DoS	MMQ	DoS	MMQ	DoS	MMQ
J1: A12 Tom Crisp Way SB Left/Ahead	81.90%	15.4	85.40%	16.7	92.90%	23.5	95.10%	22.2	100.00%	31.8
J1: A12 Tom Crisp Way SB Ahead/Right	84.3 : 84.3%	16.2	87.3 : 87.3%	17.6	93.6 : 93.6%	24.8	95.8 : 95.8%	23.1	100.1 : 100.1%	33.4
J1: Blackheath Road WB Right Left/Ahead	86.5 : 86.5%	13.7	89.0 : 89.0%	14.7	93.8 : 93.8%	17.3	95.2 : 95.2%	20.4	101.8 : 101.8%	27.5
J1: A12 Tom Crisp Way NB Ahead/Left	52.50%	8.2	57.20%	9.2	54.00%	9.7	67.90%	11.3	59.50%	10.9
J1: A12 Tom Crisp Way NB Ahead/Right	59.1 : 59.1%	5.3	62.7 : 62.7%	5.3	61.2 : 60.3%	10.6	68.7 : 68.7%	4.8	66.6 : 63.9%	11.9
J1: Blackheath Road EB Left Ahead/Right	84.2 : 84.2%	10.5	88.4 : 88.4%	11.9	89.4 : 89.4%	9.5	96.7 : 96.7%	14.4	98.2 : 98.2%	13.3
J2: Long Road Left Ahead	5.20%	0.0	5.50%	0.0	5.80%	0.0	5.20%	0.0	6.30%	0.0
J2: Kirkley Run Right Left	18.90%	0.1	19.90%	0.1	17.00%	0.1	23.00%	0.1	19.80%	0.1
J2: Blackheath Road WB Ahead/Right	22.3 : 22.3%	0.1	22.6 : 22.6%	0.1	18.0 : 18.0%	0.1	24.1 : 24.1%	0.2	19.1 : 19.0%	0.1
J3: Carlton Road Left Ahead	15.70%	0.1	16.10%	0.1	17.80%	0.1	19.00%	0.1	19.80%	0.1
J3: Blackheath Road NB Right/Left	6.3 : 6.3%	0.0	6.8 : 6.8%	0.0	8.9 : 8.9%	0.0	11.6 : 11.6%	0.1	10.9 : 10.9%	0.1
J3: Blackheath Road EB Ahead/Right	20.5 : 20.5%	0.1	21.1 : 21.1%	0.1	23.1 : 23.1%	0.2	30.0 : 30.0%	0.2	25.1 : 25.1%	0.2

Table 8.11: Junction 8a, 8b and 8c – A12 Tom Crisp Way / Blackheath Road signalised junction, Kirkley Run / Blackheath Road / Long Road priority junction and Blackheath Road / Carlton Road priority junction Results Summary (PM Peak)

8.9.11 It can be seen that the junction currently operates within operational capacity in the AM Peak, with a maximum DoS of just 79.2% across both lanes on J1: Blackheath Road WB. With background growth this increases to 86.7% in 2037 DM, with all arms operating below absolute capacity.

8.9.12 In the PM Peak it can be seen that the junction continues to operate below operational capacity with a maximum DoS of 86.5% again across both lanes on J1: Blackheath Road WB. With background growth it can be seen that at Junction 1 A12 Tom Crisp Way SB and Blackheath Road in both directions exceed operational capacity, with a maximum DoS of 96.7% across both lanes on Blackheath Road EB.

8.9.13 With the proposals in place, the junction continues to operate below operational capacity in the AM Peak, however, three of the arms (A12 Tom Crisp Way SB Left / Ahead, A12 Tom Crisp Way SB Ahead / Right and Blackheath Road WB Right Left / Ahead) are shown to exceed absolute capacity (100%) in the PM Peak. Improvements are proposed at this junction as detailed further in Section 9 of this TA.

8.10 Junction 9a and 9b – A12 Tom Crisp Way / Bloodmoor Road roundabouts

8.10.1 The roundabouts at A12 Tom Crisp Way (Bloodmoor) and Elm Tree Road/Long Road are in close proximity to one another and therefore interact if queuing occurs. As such, the junctions have been modelled together within JUNCTIONS8 to ensure they are accurately represented within the assessments.

Junction 9a: A12 Tom Crisp Way / A12 Bloodmoor Road / A1145 Castleton Avenue

8.10.2 Bloodmoor Roundabout, the junction of the A12 Tom Crisp Way, A12 Bloodmoor Road and the A1145 Castleton Avenue, is a five arm roundabout, located towards the southern boundary of Lowestoft. The A12 Tom Crisp Way forms the north-eastern arm. The carriageway widens from a single lane to dual lane on the approach to the junction, and the speed limit is reduced from 40mph to 30mph. The nearside lane allows for left-only movements for vehicles continuing on the A12 Bloodmoor Road. The outside lane provides for all other movements at the junction. A toucan crossing is present approximately 30m prior to the stop line at the roundabout.

8.10.3 The B1384 Stradbroke Road is the eastern arm and is characterised by a single lane approach. A toucan crossing is present approximately 30m prior to the stop line at the roundabout. The A12 Bloodmoor Road forms the south-eastern arm of the roundabout and leads vehicles towards Ipswich from Lowestoft. Its approach to the roundabout is dual lane, with the outside lane allowing for vehicles to continue on the A12 towards Lowestoft town centre. The nearside lane provides for vehicle movements onto the A1117 towards Oulton Broad and the A1145 towards Beccles.

8.10.4 Ribblesdale forms the minor southern arm of the roundabout and provides access into a residential area. A single lane flares out to widen the approach to the junction. A toucan crossing is present approximately 20m prior to the stop line at the roundabout.

8.10.5 The A1145 Castleton Avenue forms the western arm of the roundabout. Its approach to the junction is reduced in speed limit from 40mph to 30mph and also widens from a single lane to dual lane. A toucan crossing is present approximately 20m prior to the stop line at the roundabout, connecting pedestrians and cyclists directly to the north-western arm toucan crossing.

8.10.6 The A1117 Bloodmoor Road forms the north-western arm and consists of a dual lane approach. The toucan crossing is present approximately 25m prior to the stop line at the roundabout.

Figure 8.14: A12 Tom Crisp Way / A12 Bloodmoor Road / A1145 Castleton Avenue roundabout (Source: Google Maps Streetview)

Junction 9b: A1117 Elm Tree Road / A1117 Bloodmoor Road / Long Road

8.10.7 The junction at the A1117 Bloodmoor Road, A1117 Elm Tree Road and Long Road is a four arm roundabout. The A1117 Elm Tree Road forms the north-western arm of the roundabout, whilst Long Road provides the north-eastern and western arms. The A1117 Bloodmoor Road forms the southern arm and connects directly with Junction 9a, described above. All arms are single lane approaches and all contain refuge islands, albeit with no provision for pedestrian crossings.

Figure 8.15: A1117 Elm Tree Road / A1117 Bloodmoor Road / Long Road roundabout (Source: Google Maps Streetview)

Arm	AM			PM		
	Queue (PCU)	Delay (s)	RFC	Queue (PCU)	Delay (s)	RFC
	Base 2016					
J1: A12 Tom Crisp Way	0.40	2.88	0.29	1.15	4.55	0.54
J1: B1384 Stradbroke Road	0.~~52~~65	~~5.60~~7.0	0.~~34~~40	~~0.88~~1.21	~~9.41~~13.	0.~~47~~55
J1: A12 Bloodmoor Road	0.92	4.14	0.48	2.18	8.34	0.69
J1: Ribblesdale	0.98	7.92	0.50	0.61	8.02	0.38
J1: A1145 Castleton Avenue	1.63~~2.0~~	~~11.45~~8.	0.~~68~~62	1.~~54~~27	~~9.12~~7.4	0.~~61~~56
J1: A1177 Bloodmoor Road	2.14	9.67	0.69	1.40	6.59	0.59
J2: A1117 Elm Tree Road	1.86	9.59	0.65	1.68	9.19	0.63
J2: Long Road East	0.20	6.52	0.17	0.20	6.30	0.16
J2: A1117 Bloodmoor Road	0.56	2.75	0.36	0.78	3.13	0.44
	2022 DM					
J1: A12 Tom Crisp Way	0.41	3.00	0.29	1.41	5.34	0.59
J1: B1384 Stradbroke Road	0.~~60~~77	~~6.01~~7.7	0.~~38~~44	1.~~21~~80	~~12.39~~1	0.~~55~~65
J1: A12 Bloodmoor Road	1.37	5.12	0.58	2.~~89~~88	10.40	0.75
J1: Ribblesdale	1.35	10.23	0.58	0.67	8.~~80~~79	0.41
J1: A1145 Castleton Avenue	~~3.03~~2.2	~~16.30~~11	0.~~76~~69	1.~~82~~46	~~10.29~~8.	0.~~65~~60
J1: A1177 Bloodmoor Road	2.~~94~~95	12.~~81~~82	0.75	2.01	8.42	0.67
J2: A1117 Elm Tree Road	2.85	13.11	0.75	2.62	12.~~45~~4	0.73
J2: Long Road East	0.14	6.61	0.12	0.24	7.11	0.20
J2: A1117 Bloodmoor Road	0.64	2.90	0.39	0.82	3.22	0.45
	2022 DS					
J1: A12 Tom Crisp Way	0.95	3.86	0.49	2.30	7.17	0.70
J1: B1384 Stradbroke Road	0.~~66~~87	~~6.87~~8.9	0.~~40~~47	1.~~10~~61	~~13.07~~1	0.~~53~~63
J1: A12 Bloodmoor Road	1.54	5.57	0.61	3.46	11.~~91~~9	0.78
J1: Ribblesdale	1.53	11.53	0.61	0.72	9.19	0.42
J1: A1145 Castleton Avenue	~~2.31~~1.7	~~13.53~~10	0.~~70~~64	~~2.15~~1.69	~~11.63~~9.	0.~~69~~63
J1: A1177 Bloodmoor Road	1.41	8.~~37~~38	0.59	2.41	10.87	0.71
J2: A1117 Elm Tree Road	1.08	7.21	0.52	1.91	9.85	0.66
J2: Long Road East	0.14	5.41	0.13	0.29	6.92	0.23
J2: A1117 Bloodmoor Road	0.41	2.49	0.29	0.48	2.62	0.32
	2037 DM					
J1: A12 Tom Crisp Way	0.56	3.42	0.36	2.23	7.79	0.69
J1: B1384 Stradbroke Road	~~0.89~~1.2	~~7.72~~10.	0.~~47~~55	1.~~11~~65	~~14.80~~2	0.~~53~~63
J1: A12 Bloodmoor Road	2.18	7.07	0.69	4.19	14.~~58~~5	0.81
J1: Ribblesdale	2.55	17.~~91~~90	0.73	0.92	10.83	0.48
J1: A1145 Castleton Avenue	~~4.27~~2.7	~~24.37~~15	0.~~82~~74	~~3.03~~2.24	~~15.15~~1	0.~~76~~70
J1: A1177 Bloodmoor Road	4.~~23~~24	17.~~86~~90	0.82	4.~~46~~47	16.~~14~~1	0.83
J2: A1117 Elm Tree Road	3.79	16.46	0.80	4.88	20.75	0.84
J2: Long Road East	0.16	7.01	0.14	0.47	9.27	0.32
J2: A1117 Bloodmoor Road	0.79	3.17	0.44	0.89	3.36	0.47
	2037 DS					
J1: A12 Tom Crisp Way	1.~~22~~23	4.53	0.55	3.~~26~~27	9.~~78~~79	0.77

Arm	AM			PM		
	Queue (PCU)	Delay (s)	RFC	Queue (PCU)	Delay (s)	RFC
J1: B1384 Stradbroke Road	~~0.98~~1.3	~~8.89~~12.	0.~~50~~58	1.~~04~~53	~~14.69~~2	0.~~51~~61
J1: A12 Bloodmoor Road	2.38	7.~~59~~58	0.71	4.~~55~~54	15.~~21~~2	0.83
J1: Ribblesdale	2.87	20.~~08~~07	0.75	0.92	10.58	0.48
J1: A1145 Castleton Avenue	~~4.21~~2.7	~~24.27~~15	0.~~82~~74	~~3.55~~2.54	~~17.38~~1	0.~~79~~72
J1: A1177 Bloodmoor Road	1.89	10.~~78~~80	0.66	4.~~00~~01	16.~~85~~8	0.81
J2: A1117 Elm Tree Road	1.41	8.48	0.59	2.62	12.~~44~~4	0.73
J2: Long Road East	0.18	5.84	0.16	0.42	7.94	0.30
J2: A1117 Bloodmoor Road	0.51	2.71	0.34	0.52	2.72	0.34

Table 8.12: Junction 9a and 9b - A12 Tom Crisp Way / Bloodmoor Road Roundabouts Results Summary

Junction 9a (J1) - A12 Tom Crisp Way / Bloodmoor Road / A1145 / Castleton Avenue roundabout

8.10.8 It can be seen that this junction generally operates well in the base scenario, ~~except on A12 Bloodmoor Road~~ with a maximum RFC of ~~just~~ 0.69 on A1117 Bloodmoor Road in the ~~PM~~AM Peak~~. With background growth this increases~~, increasing to 0.~~81~~82 in 2037 DM. All arms continue to operate within capacity.

8.10.9 Overall, the Scheme provides a slight detrimental impact to the junction overall in 2037 compared to the 2037 DM scenario, though does not result in the junction operating over capacity.

Junction 9b (J2) - A1117 Elm Tree Road / Long Road / A117 Bloodmoor Road roundabout

8.10.10 It can be seen that this junction operates well below capacity in the base scenario, with a maximum RFC of 0.~~69~~65 on ~~A1177 Bloodmoor~~A1117 Elm Tree Road in the AM Peak. With background growth this increases to 0.~~82~~80 in 2037 DM~~, however all~~. All arms continue to operate ~~well below~~within capacity.

8.10.11 The Scheme generally can be seen to ~~provide an improvement to the~~improve operation of the junction, in particular on A1117 Elm Tree Road in ~~the AM Peak and A1117 Bloodmoor Road in the PM Peak.~~both peak periods. All arms of the junction operate below capacity in all scenarios.

8.10.12 It is noted that Long Road SW has not been included within the model, as it is a residential cul-de-sac which is likely not to have a significant number of trips associated with it. No flows were available for this approach and so it has been excluded from the model. As can be seen from Table 8.12, the junction is well within capacity and inclusion of the small number of trips likely associated with Long Road SW would not alter the conclusions drawn above.

8.11 Junction 10 – A1117 Bridge Road / A1117 Saltwater Way / B1531 Victoria Road roundabout

8.11.1 The junction at the A1117 Bridge Road, A1117 Saltwater Way and the B1531 Victoria Road is a three arm roundabout. The roundabout is the western terminus for the B1531 east-west corridor on the southern boundary of the Lake. The A1117 Saltwater Way forms the northern arm of the roundabout and leads directly onto Mutford Bridge, the western crossing over the Lake. Its approach to the roundabout is dual lane and a toucan crossing exists on this approach, approximately 25m prior to the stop line.

8.11.2 The B1531 Victoria Road forms the eastern arm of the roundabout. The approach widens from a single lane at the level crossing of the East Suffolk Line, approximately 45m back from the stop line at the roundabout, to dual lane. The south-western arm is formed by the A1117 Bridge Road and provides a dual lane approach. This is widened from the single lane at the toucan crossing which is located approximately 55m back from the stop line at the roundabout.

Figure 8.16: A1117 Saltwater Way / A1117 Bridge Road / B1531 Victoria Road roundabout (Source: Google Maps Streetview)

Arm	AM			PM		
	Queue (PCU)	Delay (s)	RFC	Queue (PCU)	Delay (s)	RFC
	Base 2016					
A1117 Saltwater Way	0.82	2.~~6~~60	0.45	1.07	2.94	0.52
B1531 Victoria Road	4.11	29.32	0.82	7.~~5~~50	56.87	0.91
A1117 Bridge Road	4.07	17.87	0.81	5.97	24.03	0.87
	2022 DM					
A1117 Saltwater Way	1.06	2.92	0.51	1.46	3.48	0.59
B1531 Victoria Road	14.42	90.34	0.98	121.04	646.72	1.48
A1117 Bridge Road	8.00	33.21	0.91	5.08	20.~~9~~90	0.84
	2022 DS					
A1117 Saltwater Way	0.52	2.17	0.34	0.87	2.67	0.47
B1531 Victoria Road	0.46	6.74	0.31	1.25	14.08	0.56
A1117 Bridge Road	1.94	8.~~2~~20	0.66	2.440	10.19	0.71
	2037 DM					
A1117 Saltwater Way	1.32	3.31	0.57	1.89	4.09	0.66
B1531 Victoria Road	71.52	347.66	1.23	249.89	1544.85	1.95
A1117 Bridge Road	30.88	105.58	1.03	4.49	17.97	0.83
	2037 DS					
A1117 Saltwater Way	0.63	2.33	0.39	1.03	2.89	0.51

B1531 Victoria Road	0.64	8.06	0.39	3.81	33.25	0.81
A1117 Bridge Road	3.64	13.39	0.79	3.71	15.53	0.8

Table 8.13: Junction 10 – A1117 Bridge Road / A1117 Saltwater Way / B1531 Victoria Road Roundabout Results Summary

8.11.3 It can be seen that A1177 Bridge Road and B1531 Victoria Road currently operate over operational capacity, with RFCs of 0.87 and 0.91 respectively. With background growth Victoria Road exceeds capacity in both 2022 and 2037.

8.11.4 The Scheme can be seen to provide a significant improvement to the operation of all arms of the roundabout, with all arms being under theoretical capacity by approximately 72%.

8.12 Junction 11 – B1375 Gorleston Road / A1117 Normanston Drive / A1117 Bridge Road roundabout

8.12.1 The junction at the B1375 Gorleston Road, A1117 Normanston Drive and the A1117 Bridge Road is a three arm roundabout, located immediately north-east of Oulton Broad North level crossing. The B1375 Gorleston Road forms the northern arm of the roundabout and consists of a dual lane approach. The nearside lane allows for left-only movements onto A1117 Normanston Drive, whilst the outside lane allows for all other movements. Approximately 40m prior to the stop line on this northern arm of the junction there is a mini-roundabout connecting Hall Road to Gorleston Road.

8.12.2 The north-eastern arm is provided by the A1117 Normanston Drive, which has a dual lane approach, flaring out from a single carriageway. The A1117 Bridge Road forms the south-western arm of the roundabout and also provides a dual lane approach for vehicles. A petrol station exists on the eastern border of this arm. Vehicles can only enter the station forecourt from the roundabout but are only permitted to exit onto the A1117 Bridge Road. Therefore, a priority junction allows vehicles to exit the petrol station and make a right-turn onto the A1117 Bridge Road, re-entering the roundabout, as shown in Figure 8.17~~Figure 8.17~~. Further to this, Holly Road connects to the A1117 Bridge Road on the northbound approach, approximately 15m prior to the stop line at the roundabout.

Figure 8.17: Priority junction for vehicles exiting the petrol station onto the northbound approach of the A1117 Bridge Road (Source: Google Maps Streetview)

Figure 8.18: B1375 Gorleston Road / A1117 Normanston Drive / A1117 Bridge Road roundabout (Source: Google Maps Streetview)

Arm	AM			PM		
	Queue (PCU)	Delay (s)	RFC	Queue (PCU)	Delay (s)	RFC
	Base 2016					
A1117 Normanston Drive	8.79	61.~~5~~50	0.93	32.44	226.14	1.12
A1117 Bridge Road	1.64	4.86	0.62	1.75	4.97	0.64
B1375 Gorleston Road	1.15	5.93	0.54	1.69	6.49	0.63
	2022 DM					
A1117 Normanston Drive	23.65	165.31	1.06	58.95	450.55	1.33
A1117 Bridge Road	1.92	5.31	0.66	2.63	6.56	0.73
B1375 Gorleston Road	2.46	10.18	0.72	3.00	10.65	0.75
	2022 DS					
A1117 Normanston Drive	1.48	12.68	0.~~6~~60	18.39	132.26	1.02
A1117 Bridge Road	0.82	3.32	0.45	1.09	3.89	0.52
B1375 Gorleston Road	0.58	3.~~7~~70	0.37	1.05	4.~~5~~50	0.51
	2037 DM					
A1117 Normanston Drive	31.33	218.32	1.12	79.79	684.29	1.56
A1117 Bridge Road	2.51	6.35	0.72	3.23	7.~~7~~70	0.77
B1375 Gorleston Road	5.53	22.17	0.86	5.83	19.42	0.86
	2037 DS					
A1117 Normanston Drive	2.39	18.~~8~~80	0.71	32.22	228.99	1.12
A1117 Bridge Road	1.13	3.~~9~~90	0.53	1.43	4.~~5~~50	0.59
B1375 Gorleston Road	0.86	4.62	0.46	1.43	5.~~5~~50	0.59

Table 8.14: Junction 11 – A1117 Normanston Drive / B1375 Gorleston Road Roundabout Results Summary

8.12.3 It can be seen that A1117 Bridge Road and B1375 Gorleston Road both currently operate well below capacity in both peak periods. A1117 Normanston Drive is shown to exceed capacity in the AM and PM peaks, which only worsens as background growth is added.

8.12.4 The Scheme ~~can be seen to~~would provide a significant improvement to the operation of all arms of the roundabout, with the RFC on A1117 Normanston Drive ~~returning to operate within capacity with a RFC of 0.71~~ reducing from 1.12 in the 2037 AM peak ~~as a result of~~ to 0.71 with the Scheme. A1117 Normanston Drive remains over capacity in the 2037 DS PM peak, however the RFC, queues and delay are considerably lower ~~than in~~compared against the 2037 DM~~, therefore the~~. As a result of the Scheme ~~provides a significant improvement at this junction. An improvement can~~ there would also be reductions in ~~seen on improvements to~~ traffic flows on A1117 Bridge Road and B1375 Gorleston Road, with significant reductions in delay and congestion.

8.13 Junction 12 – Barnards Way / Denmark Road / Peto Way roundabout

8.13.1 The junction at Barnards Way, Denmark Road and Peto Way is a five arm roundabout. Barnards Way forms the northern arm of the roundabout and provides direct access into the North Quay Industrial Estate. It consists of a single lane approach on entry to the junction. The north-eastern arm is provided by the access road for the North Quay Retail Park. This is the only entry and egress point for vehicles utilising the car parking spaces within the retail park. A single lane approach to the junction exists.

8.13.2 Denmark Road forms the eastern arm and has a short dual lane approach. The nearside lane allows for left-turn movements into the access road for the retail store, supermarket and Health Club car parks or ahead movements onto Peto Way. The outside lane provides for a right-only movement into Barnards Way or the North Quay Retail Park.

8.13.3 The southern arm is an access road for the retail store, supermarket and Health Club car parks, and consists of a wide approach without any line markings. Peto Way forms the western arm of the roundabout and has a dual lane approach, widening from a single carriageway approximately 50m prior to the stop line. The nearside lane is for left-only movements onto Barnards Way, whilst the outside lane allows for all other movements at the roundabout. Pedestrian crossings, including refuge islands, are present on all arms of the junction.

Figure 8.19: Barnards Way / Denmark Road / Peto Way roundabout (Source: Google Maps Streetview)

8.13.4 The results for this junction are shown in Table 8.15.

Arm	AM			PM			Saturday		
	Queue (Veh)	Delay (s)	RFC	Queue (Veh)	Delay (s)	RFC	Queue (Veh)	Delay (s)	RFC
	Base 2016								
Peto Way	0.32	2.53	0.24	0.34	2.55	0.25	0.2	3.36	0.17
Barnards Way	0.08	3.33	0.08	0.15	3.68	0.13	1.82	9.28	0.65
North Quay Retail	0.10	3.28	0.09	0.42	4.26	0.30	1.75	9.56	0.64
Denmark Rd	0.36	3.29	0.26	0.53	4.07	0.35	0.56	5.7	0.36
Lidl	0.03	1.94	0.03	0.04	2.16	0.04	0.64	3.17	0.39
	2022 DM								
Peto Way	0.38	2.73	0.28	0.35	2.64	0.26	0.20	3.29	0.17
Barnards Way	0.11	3.55	0.10	0.16	3.93	0.14	1.72	8.77	0.63
North Quay Retail	0.11	3.45	0.10	0.48	4.55	0.33	1.91	10.31	0.66
Denmark Rd	0.53	3.68	0.35	0.78	4.61	0.44	0.57	5.87	0.37
Lidl	0.04	2.01	0.04	0.04	2.26	0.04	0.64	3.11	0.39
	2022 DS								
Peto Way	1.42	5.02	0.59	0.96	3.94	0.49	0.21	3.57	0.18
Barnards Way	0.16	5.15	0.14	0.22	5.2	0.18	2.06	10.56	0.68
North Quay Retail	0.19	5.07	0.16	0.75	6.7	0.43	9.49	38.61	0.92
Denmark Rd	1.78	6.66	0.64	3.17	10.53	0.76	0.75	7.72	0.43
Lidl	0.05	2.39	0.04	0.06	2.70	0.05	0.86	3.54	0.46
	2037 DM								
Peto Way	0.49	2.98	0.33	0.41	2.78	0.29	0.20	3.32	0.17
Barnards Way	0.15	3.85	0.13	0.19	4.16	0.16	1.75	8.96	0.64
North Quay Retail	0.14	3.67	0.12	0.59	4.99	0.37	2.15	11.19	0.69
Denmark Rd	0.69	4.14	0.41	1.09	5.53	0.52	0.59	6.02	0.37
Lidl	0.05	2.11	0.04	0.05	2.41	0.05	0.66	3.16	0.40
	2037 DS								
Peto Way	2.18	6.71	0.69	1.28	4.6	0.56	0.22	3.64	0.18
Barnards Way	0.24	6.21	0.19	0.27	5.88	0.22	2.17	11.13	0.69
North Quay Retail	0.25	5.97	0.20	1.05	8.29	0.51	17.79	65.61	0.98
Denmark Rd	2.99	9.74	0.75	6.03	18.53	0.87	0.79	8.18	0.45
Lidl	0.06	2.60	0.06	0.07	2.97	0.07	0.92	3.65	0.48

Table 8.15: Junction 12 – Barnards Way / Denmark Road / Peto Way roundabout

8.13.5 The DS scenario increases the flows through the junction as expected, given that Denmark Road and Peto Way provide the main route onto the Scheme from the west.

8.13.6 The table shows that the junction operates within the limit of theoretical capacity (an RFC of 1.00) in both AM and PM peaks in all scenarios. The results for the Saturday models show that the junction does come under some pressure as a result of high traffic demand for the North Quay Retail Park compared to on a weekday. The queuing would be limited to the North Quay Retail Park arm of the junction, and would therefore be contained within the retail park and off the local highway network. Given that the impact is related to a short shopping peak on a Saturday, and queues would be contained off-highway, the impact at this junction is considered acceptable.

8.14 Junction 13 – Denmark Road / Rotterdam Road roundabout

8.14.1 The junction at Denmark Road and Rotterdam Road is a three arm roundabout. Rotterdam Road forms the northern arm of the roundabout, providing a single lane approach. It connects to the A1144 to the north. Denmark Road is an east-corridor on the northern boundary of the Lake and therefore provides the eastern and western arms of the roundabout. The eastern arm flares out into a dual lane approach from a single carriageway, whilst the western arm provides only a single lane approach.

8.14.2 A pedestrian crossing, including a refuge island, exists on the Rotterdam Road arm. Refuge islands are also present on the Denmark Road eastern and western arms, but do not provide crossings.

8.14.3 To the south of the roundabout is vacant industrial land, however, this will provide the location for the northern junction of the Scheme.

Figure 8.20: Rotterdam Road / Denmark Road roundabout (Source: Google Maps Streetview)

8.14.4 The 2022 and 2037 DM flows have been tested on the existing roundabout layout, however the proposed connecting link through to the Scheme will necessitate minor amendments to the geometry of the existing roundabout at Demark Rd / Rotterdam Rd junction, and the 2022 and 2037 DS flows have therefore been tested using the amended roundabout geometries. The results for this junction are shown in Table 8.16.

Arm	AM			PM			Saturday		
	Queue (PCU)	Delay (s)	RFC	Queue (PCU)	Delay (s)	RFC	Queue (PCU)	Delay (s)	RFC
	Base 2016								
Denmark Road WB	0.08	2.45	0.08	0.11	2.53	0.10	0.16	2.71	0.14
Denmark Road EB	0.23	2.47	0.19	0.29	2.56	0.22	0.44	2.99	0.30
Rotterdam Road	0.25	3.02	0.20	0.27	3.04	0.21	0.62	3.93	0.38
	2022 DM								
Denmark Road WB	0.12	2.55	0.~~1~~10	0.16	2.71	0.14	0.18	2.82	0.15
Denmark Road EB	0.~~3~~30	2.65	0.23	0.~~4~~40	2.93	0.28	0.49	3.2	0.33
Rotterdam Road	0.38	3.32	0.27	0.~~4~~40	3.36	0.28	0.67	4.06	0.~~4~~40
	2022 DS								
Denmark Road WB	0.~~4~~30	~~4.58~~3.	0.~~29~~23	0.~~47~~51	~~4.63~~3.9	0.~~32~~3	~~1.75~~0.81	~~10.54~~5.	0.~~64~~4
Denmark Road EB	0.~~26~~58	~~3.18~~2.	0.~~21~~37	0.~~43~~42	~~3.68~~2.4	0.30	~~0.66~~1.51	4.~~65~~47	0.~~4~~60
Rotterdam Road	0.~~5~~47	~~2.61~~4.	0.~~33~~32	0.~~37~~56	~~2.39~~4.9	0.~~27~~3	~~1.~~2.64	~~3.91~~14.	0.~~55~~7
	2037 DM								
Denmark Road WB	0.~~2~~20	2.89	0.16	0.14	2.68	0.12	0.21	2.91	0.17
Denmark Road EB	0.~~5~~50	3.23	0.33	0.39	2.95	0.28	0.~~6~~60	3.49	0.38
Rotterdam Road	0.45	3.53	0.31	0.47	3.54	0.32	0.81	4.43	0.45
	2037 DS								
Denmark Road WB	0.~~44~~36	3.51~~4.~~	0.~~31~~27	0.~~5~~61	4.~~78~~24	0.~~33~~3	~~2.07~~0.99	~~11.92~~5.	0.~~68~~5
Denmark Road EB	0.~~31~~65	~~3.33~~2.	0.~~24~~40	0.~~51~~45	~~3.91~~2.5	0.~~34~~3	~~0.78~~1.64	~~5.07~~4.7	0.~~44~~6
Rotterdam Road	0.~~56~~53	~~2.72~~5.	0.~~36~~35	0.~~39~~59	~~2.42~~5.1	0.~~28~~3	~~1.29~~3.33	~~4.08~~17.	0.~~56~~7

Table 8.16: Junction 13 – Denmark Road / Rotterdam Road Roundabout Results Summary

8.14.5 It can be seen that the junction operates within operational capacity in all scenarios.

8.14.6 Within the traffic modelling assessments in SATURN, traffic on Rotterdam Road is forecast to increase as a result of the Scheme. The Applicant believes that this effect will not occur in reality as Rotterdam Road is a narrow residential road, for which there are significantly more attractive alternative routes for drivers. As such, the Applicant will monitor the traffic flows on Rotterdam Road following the implementation of the Scheme. Further information is provided in Section 9.

8.15 Junction 14 – A1117 Normanston Drive / A1117 Peto Way roundabout

8.15.1 The junction at the A1117 Normanston Drive and the A1117 Peto Way is a five arm roundabout. The A1117 Peto Way forms the northern arm of the roundabout and is subject to a 40mph speed limit, which is reduced to 30mph on approach to the junction. The approach is dual lane, which flares out from a single carriageway approximately 40m prior to the stop line at the roundabout. The nearside lane supports left- and ahead-only movements, whilst the outside lane allows for right- and ahead-only movements.

8.15.2 Fir Lane provides the north-eastern arm of the junction and consists of a single lane approach. The eastern arm of the roundabout is the western terminus for the A1144 Normanston Drive east-west corridor to the north of the Lake. Its approach widens from single to dual lane, with the outside lane allowing for right-only movements onto the A1117 Peto Way and Fir Lane. The nearside lane allows for all other movements at the roundabout.

8.15.3 The C970 Peto Way provides the southern arm of the roundabout. On approach, the single carriageway flares out to provide two lanes – the nearside lane allows for left-only movements onto the A1117 Normanston Drive, whilst the outside lane provides for all other movements.

8.15.4 The A1117 Normanston Drive forms the south-western arm of the roundabout, providing a dual lane approach, which expands out from a single lane carriageway. The arm leads towards Mutford Bridge, the western crossing over the Lake. Pedestrian crossings exist on all arms of the roundabout and include pedestrian refuge islands.

Figure 8.21: A1117 Peto Way / A1117 Normanston Drive roundabout (Source: Google Maps Streetview)

Arm	AM			PM			Sat		
	Queue (PCU)	Delay (s)	RFC	Queue (PCU)	Delay (s)	RFC	Queue (PCU)	Delay (s)	RFC
	Base 2016								
Fir Lane	0.33	5.82	0.25	0.28	5.08	0.22	0.44	6.81	0.31
A1144 Normanston Drive	0.18	3.26	0.15	0.38	3.~~8~~80	0.28	0.44	4.38	0.31
Peto Way	0.31	2.77	0.24	0.72	3.85	0.42	1.44	5.33	0.59
A1117 Normanston Drive	2.~~07~~55	~~6.71~~8.2	0.~~68~~7	~~0.94~~1.0	~~4.56~~5.1	0.~~49~~5	~~2.34~~3.0	~~9.23~~11.	0.~~70~~7
A1117 Peto Way	0.49	4.24	0.33	0.47	3.71	0.32	0.59	4.81	0.37
	2022 DM								
Fir Lane	0.45	7.00	0.31	0.25	5.25	0.~~2~~20	0.51	7.45	0.34
A1144 Normanston Drive	0.~~2~~20	3.28	0.17	0.55	4.~~3~~30	0.35	0.49	4.66	0.33
Peto Way	0.33	2.77	0.25	0.84	4.33	0.46	1.69	5.96	0.63
A1117 Normanston Drive	~~2.74~~3.53	~~8.34~~10.	0.~~74~~7	1.~~3~~52	~~5.48~~6.4	0.~~57~~6	~~3.01~~4.1	~~11.35~~15	0.~~76~~8
A1117 Peto Way	0.57	4.75	0.36	0.55	4.01	0.36	0.67	5.18	0.~~4~~40
	2022 DS								
Fir Lane	1.03	14.15	0.51	0.95	8.~~4~~40	0.49	1.62	16.28	0.63
A1144 Normanston Drive	0.28	4.49	0.22	0.~~8~~80	5.83	0.45	0.75	6.82	0.43
Peto Way	0.~~8~~80	3.68	0.44	2.00	6.89	0.67	115.~~9~~90	216.19	1.14
A1117 Normanston Drive	1.~~5~~80	~~6.48~~7.7	0.~~60~~6	0.~~72~~81	~~4.9~~5.56	0.~~42~~4	1.~~46~~78	~~8.1~~9.94	0.~~66~~4
A1117 Peto Way	2.54	10.57	0.72	0.72	4.~~3~~30	0.42	2.45	10.31	0.71
	2037 DM								
Fir Lane	0.~~65~~64	9.~~58~~53	0.~~4~~39	0.29	5.63	0.23	0.72	9.~~54~~48	0.42
A1144 Normanston Drive	0.25	3.57	0.20	0.65	4.64	0.40	0.65	5.~~48~~47	0.~~4~~40
Peto Way	0.44	3.04	0.31	1.~~2~~20	5.21	0.55	2.61	8.29	0.73
A1117 Normanston Drive	~~7.39~~13.5	~~19.81~~36	0.~~89~~9	~~1.89~~2.3	~~7.3~~9.01	0.~~66~~7	~~6.94~~13.	~~24.21~~46	0.~~89~~9
A1117 Peto Way	0.~~88~~87	6.~~14~~11	0.47	0.58	4.23	0.37	0.~~92~~91	6.~~34~~30	0.48
	2037 DS								
Fir Lane	3.~~36~~34	41.~~99~~82	0.79	1.11	9.89	0.53	4.~~5~~49	40.~~09~~03	0.84
A1144 Normanston Drive	0.~~4~~40	5.45	0.28	1.16	7.~~3~~30	0.54	1.12	9.34	0.53
Peto Way	1.16	4.53	0.54	3.55	10.68	0.78	238.65	548.23	1.~~3~~30
A1117 Normanston Drive	~~3.33~~4.65	~~12.03~~17	0.~~77~~8	1.~~24~~48	~~6.9~~8.24	0.~~56~~6	2.~~14~~78	~~10.34~~13	0.~~69~~7
A1117 Peto Way	7.~~24~~21	27.~~5~~40	0.89	0.91	5.01	0.48	4.02	15.~~62~~61	0.81

Table 8.17: Junction 14 – A1117 Normanston Drive / A1117 Peto Way Roundabout Results Summary

8.15.5 It can be seen that the junction operates well below capacity in the base scenario, with a maximum RFC of ~~just~~ 0.~~68~~76 on A1117 Normanston Drive in the ~~AM~~Saturday Peak. With background growth this increases to 0.~~89~~95 in 2037 DM, ~~however all arms continue to operate below capacity~~with a similar RFC seem on this approach in the AM Peak also.

8.15.6 The Scheme can be seen to have a negative impact on the operation of Peto Way, with capacity over 1.00 on a Saturday. ~~The~~A significant impact can also be seen on A1117 Peto Way in the ~~junction on a weekday peak is negligible.~~AM and Saturday Peak periods. Mitigation is proposed for implementation at this junction, as detailed in Section 9 of this TA.

8.16 Junction 15 – Rotterdam Road / A1144 St Peter's Street / A1144 Normanton Drive roundabout

8.16.1 The junction at Rotterdam Road, A1144 St Peter's Street and the A1144 Normanston Drive is a five arm roundabout. Rotterdam Road forms the northern and south-western arms and is a minor north-south corridor between the northern border of the Lake and northern Lowestoft. Each arm provides a single lane approach and provide pedestrian crossings, include refuge islands.

8.16.2 The A1144 St Peter's Street forms the eastern arm of the roundabout. It has a single lane approach, however approximately 10m prior to the stop line at the roundabout, connects with Minden Road, from which vehicles are permitted to make left-only movements and enter the roundabout. A pedestrian crossing, including a refuge crossing is present on the arm.

8.16.3 On the south-west corner of the roundabout, there is an access road to Lowestoft Cemetery. The north-western arm is provided by the A1144 Normanston Drive and is characterised by a single lane approach. A pedestrian crossing, including a refuge island, exists on the arm.

Figure 8.22: Rotterdam Road / A1144 St Peter's Street / A1144 Normanston Drive roundabout (Source: Google Maps Streetview)

Arm	AM			PM		
	Queue (PCU)	Delay (s)	RFC	Queue (PCU)	Delay (s)	RFC
	Base 2016					
A1144 St Peter's Street	0.24	3.09	0.19	0.37	3.47	0.27
Rotterdam Road South	0.11	3.47	0.10	0.11	3.71	0.10
A1144 Normanston Drive	0.67	5.28	0.40	0.28	4.02	0.22
Rotterdam Road North	0.08	4.37	0.07	0.12	4.00	0.11
	2022 DM					
A1144 St Peter's Street	0.27	3.19	0.21	0.45	3.76	0.31
Rotterdam Road South	0.14	3.61	0.12	0.16	3.95	0.13
A1144 Normanston Drive	0.86	5.99	0.46	0.35	4.34	0.26
Rotterdam Road North	0.11	4.73	0.10	0.23	4.57	0.19
	2022 DS					
A1144 St Peter's Street	0.32	3.58	0.24	0.68	4.62	0.41
Rotterdam Road South	0.34	4.23	0.25	0.42	4.89	0.29
A1144 Normanston Drive	0.83	6.39	0.46	0.32	4.64	0.24
Rotterdam Road North	0.45	6.17	0.31	0.48	5.42	0.32
	2037 DM					
A1144 St Peter's Street	0.33	3.37	0.25	0.55	4.07	0.36
Rotterdam Road South	0.16	3.77	0.14	0.18	4.15	0.15
A1144 Normanston Drive	1.33	7.58	0.57	0.43	4.67	0.30
Rotterdam Road North	0.15	5.23	0.13	0.3	4.96	0.23
	2037 DS					
A1144 St Peter's Street	0.38	3.76	0.28	0.82	5.04	0.45
Rotterdam Road South	0.35	4.37	0.26	0.45	5.20	0.31
A1144 Normanston Drive	1.13	7.45	0.53	0.38	4.89	0.28
Rotterdam Road North	0.56	7.03	0.36	0.55	5.86	0.36

Table 8.18: Junction 15 – A1144 Normanston Drive / Rotterdam Road Roundabout Results Summary

8.16.4 It can be seen that this junction operates well below capacity in the base scenario, with a maximum RFC of just 0.27 on A1144 St Peter's Street in the PM Peak. With background growth this increases to 0.36 in 2037 DM, however all arms continue to operate below capacity.

8.16.5 Generally the Scheme can be seen to have a slightly negative impact on the operation of the junction with RFCs increasing on the majority of the arms; however, it can be seen that A1144 Normanston Drive sees a reduction in RFC and queue with the Scheme in place. The junction remains operating within capacity.

8.16.6 The cemetery access has not been included within the junction model, as it is unlikely to generate a significant number of vehicle trips. As can be seen from Table 8.18, the junction is well within capacity and inclusion of the small number of trips likely associated with the cemetery access would not alter the conclusions drawn above.

8.17 Junction 16 – Riverside Road / B1531 Waveney Drive / Durban Road signalised junction

8.17.1 The junction at Riverside Road, the B1531 Waveney Drive and Durban Road is currently a four arm, traffic signal controlled junction. Riverside Road forms the northern arm and is currently a no-through road, providing access to lakefront businesses and shared Council offices.

8.17.2 The B1531 Waveney Drive provides the eastern and western arms of the junction, forming an east-west corridor on the south side of the Lake between the junction with the A12 in the east and the A1117 in the west.

8.17.3 Durban Road forms the south-western arm, providing access to residential areas in southern Lowestoft. All arms are characterised by a single lane approach. The junction is also marshalled by a puffin crossing on all four arms, providing a safe crossing movement for pedestrians.

Figure 8.23: Riverside Road / B1531 Waveney Drive / Durban Road junction (Source: Google Maps Streetview)

8.17.4 Analysis of the performance of the existing signal junction has been undertaken with LinSig 3 using the 2022 and 2037 DM flows.

8.17.5 The junction currently operates with a 96 second cycle time using a three stage sequence. This junction operates with an all red stage which is called on pedestrian demand.

8.17.6 In the absence of any live signal timing data, the existing operation of this junction has been tested under two scenarios:

- Pedestrian stage is called every cycle; and
- No pedestrian stage is called.

8.17.7 The 2022 and 2037 DM results for these two scenarios are therefore shown in Table 8.19~~Table 8.19~~ and Table 8.20~~Table 8.20~~ for the AM and PM Peaks respectively.

	Pedestrian stage called every cycle				No pedestrian stage called			
	2022 DM		2037 DM		2022 DM		2037 DM	
	DoS	MMQ	DoS	MMQ	DoS	MMQ	DoS	MMQ
Riverside Road	27.0%	1.3	35.6%	1.6	23.1%	1.0	24.0%	1.2
Waveney Drive WB	46.6%	7.1	50.0%	5.3	27.3%	2.4	28.4%	2.4
Durban Road	46.7%	2.0	61.6%	2.5	33.4%	1.4	40.6%	1.6
Waveney Drive EB	48.8%	8.8	60.7%	12.4	35.1%	3.6	45.3%	5.5

Table 8.19: Junction 16 – B1531 Waveney Drive / Riverside Road / Durban Road signalised junction Results Summary (AM Peak)

	Pedestrian stage called every cycle				No pedestrian stage called			
	2022 DM		2037 DM		2022 DM		2037 DM	
	DoS	MMQ	DoS	MMQ	DoS	MMQ	DoS	MMQ
Riverside Road	56.7%	5.1	63.9%	6.0	43.1%	3.6	48.6%	4.1
Waveney Drive WB	57.4%	10.6	64.6%	12.7	43.7%	5.9	49.1%	7.0
Durban Road	37.1%	1.9	40.3%	2.0	23.7%	1.3	25.2%	1.3
Waveney Drive EB	26.1%	4.1	30.0%	4.7	19.0%	2.1	21.4%	2.4

Table 8.20: Junction 16 - B1531 Waveney Drive / Riverside Road / Durban Road signalised junction Results Summary (PM Peak)

8.17.8 It can be seen that this well within the operational capacity in all time periods if the all red pedestrian stage is called, and with no pedestrian stages running. The actual performance of this junction would therefore depend on how often there is pedestrian demand to cross the junction.

8.17.9 It is proposed that this junction is turned into a roundabout which will incorporate the southern access to the Scheme, and therefore the future DS results are discussed subsequently under Junction 18.

8.18 Junction 17 – New roundabout north of the Lake

8.18.1 A new roundabout will be constructed north of the Lake which will connect the Scheme to the current local highway network on Denmark Road.

Arm	AM			PM		
	Queue (PCU)	Delay (s)	RFC	Queue (PCU)	Delay (s)	RFC
	2022 DS					
Denmark Road WB	0.~~52~~63	0.~~05~~06	0.~~34~~39	~~0.79~~1.00	0.~~06~~07	0.~~44~~50
Scheme	~~0.98~~1.21	0.~~05~~06	0.~~49~~55	1.~~06~~32	0.~~05~~06	0.~~51~~57
Denmark Road EB	1.~~05~~35	0.~~09~~10	0.~~51~~58	~~0.99~~1.25	0.~~08~~09	0.~~50~~56
	2037 DS					
Denmark Road WB	0.~~64~~80	0.~~06~~07	0.~~39~~45	~~0.95~~1.24	0.~~07~~08	0.~~49~~56
Scheme	1.~~26~~61	0.~~06~~07	0.~~56~~62	1.~~28~~65	0.~~06~~07	0.~~56~~62
Denmark Road EB	~~1.48~~2.03	0.~~1~~13	0.~~60~~67	1.~~18~~54	0.~~09~~11	0.~~54~~61

Table 8.21: Junction 17 – New roundabout north of the Lake Results Summary

8.18.2 It can be seen that this roundabout is forecast to operate well within its operational capacity during both peaks, with a maximum RFC of 0.56 on the Scheme arm in the AM and PM peak.

8.19 Junction 18 – New roundabout south of the Lake

8.19.1 A new roundabout will be constructed south of the Lake which will connect the Scheme to the current local highway network on the B1531 Waveney Drive. The junction will replace the existing B1531 Waveney Drive / Riverside Road / Durban Road signal controlled junction (see Section 8.17 above), and will necessitate the closure of Durban Road as described in Section 4 of this TA.

Arm	AM			PM		
	Queue (PCU)	Delay (s)	RFC	Queue (PCU)	Delay (s)	RFC
	2022 DS					
Riverside Road	0.80~~0.64~~	3.90~~3.43~~	0.45~~0.39~~	0.56~~0.46~~	3.46~~3.11~~	0.36~~0.31~~
Waveney Drive WB	1.67~~1.28~~	4.93~~4.15~~	0.63~~0.56~~	2.24~~1.66~~	5.71~~4.63~~	0.69~~0.62~~
Waveney Drive EB	1.65~~1.27~~	5.59~~4.72~~	0.62~~0.56~~	5.29~~3.03~~	15.01~~9.18~~	0.85~~0.75~~
	2037 DS					
Riverside Road	1.35~~1.01~~	5.23~~4.30~~	0.58~~0.50~~	0.75~~0.60~~	3.95~~3.50~~	0.43~~0.38~~
Waveney Drive WB	2.56~~1.81~~	6.85~~5.28~~	0.72~~0.64~~	3.44~~2.32~~	8.01~~5.88~~	0.78~~0.70~~
Waveney Drive EB	2.19~~1.61~~	6.91~~5.54~~	0.69~~0.62~~	23.21~~6.61~~	59.11~~18.80~~	0.99~~0.87~~

Table 8.22: Junction 18 - New roundabout south of the Lake Results Summary

8.19.2 It can be seen from the table that all arms operate within capacity in 2022. Waveney Drive eastbound ~~marginally~~ exceeds operational capacity in the 2037 PM peak, however the arm is still within absolute capacity. The junction has been designed to provide ~~generate~~ the best capacity available given the land availability constraints within this area.

8.19.3 The queueing that would occur on Waveney Drive eastbound in the 2037 DS PM Peak would equate to 23~~seven~~ vehicles. ~~, which is just two additional vehicles compared to the worst case 2037 DS test (pedestrian stage called every cycle).~~ Whilst the junction would operate with an RFC of 0.~~87~~99, the ~~additional~~ queuing ~~would be minimal and~~ would not impede access to any driveways or access points on the eastbound carriageway. ~~This is discussed further in Paragraph 9.19.5 and 9.19.6.~~

8.19.4 There will be no implications for pedestrians and cyclists as a result of the closure of Durban Road. A scheme to prevent routine vehicular access to Durban Road, but maintaining access for pedestrians and cyclists, will be implemented.

~~*Sensitivity Test*~~

~~8.19.5 To demonstrate the significance of Waveney Drive eastbound being marginally in excess of operational capacity in the 2037 PM Peak, a sensitivity test has been undertaken. The junction model geometric parameters for Waveney Drive were amended to make Waveney Drive eastbound operate at operational capacity (0.85) by amending the approach width from 3.0m to 3.3m.~~

~~8.19.6 This assessment showed that an RFC of 0.85 on this approach resulted in a queue of 5.49, just 1 PCU less than when operating with an RFC of 0.87. This clearly demonstrates that there is no significant detrimental impact of one approach at the junction being slightly over operational capacity in 2037 PM Peak.~~

8.20 Junction 19 – (A47) Denmark Road / A47 Katwijk Way signalised junction

8.20.1 The junction at (A47) Denmark Road and the A47 Katwijk Way is a traffic signal-controlled junction, in close proximity to Lowestoft railway station. Denmark Road is an east-west corridor which runs in parallel with the northern border of the Lake until its terminus to the west at the North Quay Retail Park. The eastern approach on

Denmark Road forms part of the A47, and a right-only lane is provided at the junction, approximately 50m in length, to allow vehicles to continue onto the A47 Katwijk Way. A nearside, ahead-only lane allows movements to continue onto a narrow section of Denmark Road.

8.20.2 The western approach of Denmark Road is single lane and also narrow. The A47 Katwijk Way approach is dual lane, with a lane provided for left-turn movements onto the A47 Denmark Road, towards the A47 Bascule Bridge, and a lane provided for right-turn movements onto Denmark Road, heading towards North Quay Retail Park. An entry-only access to the junction from the forecourt of Lowestoft railway station exists on the southern arm, used only by buses and taxis exiting the station. The junction is marshalled by a toucan crossing on all arms.

Figure 8.24: (A47) Denmark Road / A47 Katwijk Way signalised junction (Source: Google Maps Streetview)

	Base 2016		2022 DM		2022 DS		2037 DM		2037 DS	
	DoS	MMQ	DoS	MMQ	DoS	MMQ	DoS	MMQ	DoS	MMQ
~~Network~~	~~78.8%~~	~~-~~	~~57.7%~~	~~-~~	~~20.8%~~	~~-~~	~~61.2%~~	~~-~~	~~23.8%~~	~~-~~
Denmark Road West Left Ahead	77.9%	9.5	57.7%	7.8	~~20.8~~28.6%	2.~~1~~3	~~60~~58.0%	8.~~4~~3	~~23.8~~33.0%	~~2.7~~3.0
A47 Katwijk Way Right Left	32.8 : 32.8%	2.1	0.0 : 17.6%	3.0	0.0 : 5.~~7~~3%	0.~~9~~8	0.0 : 20.~~4~~7%	3.~~5~~6	0.0 : ~~9.1~~8.3%	1.~~4~~2
Denmark Road East Ahead Right U-Turn	78.8 : 78.8%	19.1	57.5 : 57.5%	7.5	~~20.6 : 20.6~~18.9 :	~~3.~~2.9	61.~~2~~9 : 61.~~2~~9%	7.~~8~~9	~~23.8 : 23.8~~21.4 :	3.~~9~~4

Table 8.23: Junction 19 – Denmark Road / A47 Katwijk Way signalised junction Results Summary (AM Peak)

	Base 2016		2022 DM		2022 DS		2037 DM		2037 DS	
	DoS	MMQ	DoS	MMQ	DoS	MMQ	DoS	MMQ	DoS	MMQ
~~Network~~	~~68.2%~~	~~-~~	~~46.0%~~	~~-~~	~~16.4%~~	~~-~~	~~47.7%~~	~~-~~	~~19.7%~~	~~-~~
Denmark Road West Left Ahead	~~68.0~~70.1%	11.~~3~~5	~~45.6~~55.8%	~~8~~9.3	~~16.1~~26.8%	2.~~0~~4	~~46.6~~58.3%	9.8~~.6~~	~~19.6~~32.2%	2.~~4~~7
A47 Katwijk Way Right Left	~~64.9 : 64.9~~57.7 : 57.7%	~~6.3~~5.9	0.0 : ~~41.3~~35.7%	~~7~~6.7	0.0 : ~~16.4~~13.9%	2.~~8~~2	0.0 : ~~46.8~~39.6%	~~8.9~~7.7	0.0 : ~~19.7~~16.9%	~~3.4~~2.7
Denmark Road East Ahead Right U-Turn	~~68.2 : 68.2~~67.1 : 67.1%	10.~~7~~6	~~46.0 : 46.0~~41.7 : 41.7%	4.~~9~~7	~~13~~11.4 : ~~13~~11.4%	1.~~7~~4	~~47.7 : 47.7~~42.9 : 42.9%	5.~~5~~4	~~15.7 : 15.7~~13.4 : 13.4%	~~2.~~1.7

Table 8.24: Junction 19 – Denmark Road / A47 Katwijk Way signalised junction Results Summary (PM Peak)

	Base 2016		2022 DM		2022 DS		2037 DM		2037 DS	
	DoS	MMQ	DoS	MMQ	DoS	MMQ	DoS	MMQ	DoS	MMQ
~~Network~~	~~68.2%~~	~~-~~	~~65.7%~~	~~-~~	~~19.70%~~	~~-~~	~~73.20%~~	~~-~~	~~19.00%~~	~~-~~
Denmark Road West Left Ahead	~~68.0~~56.2%	~~11.3~~6.8	~~64.3~~58.9%	~~8.1~~7.2	~~18.80~~13.6%	1.~~6~~3	~~70.50~~63.3%	~~9~~8.2	17.~~80~~4%	1.~~6~~5
A47 Katwijk Way Right Left	~~64.9~~53.1 : 53.1%	~~6.3~~4.1	~~60.6~~55.9 : 55.9%	4.~~8~~4	~~19.7 : 19.7~~12.2 : 12.2%	~~1~~0.6	~~66.7 : 66.7~~62.5 : 62.5%	5.~~5~~0	~~19.0 : 19.0~~16.8 : 16.8%	~~1~~0.8

Denmark Road East Ahead Right U-Turn	~~68.2~~57.4 : 57.4%	~~10~~8.7	~~65.7~~60.3 : 60.3%	~~10.5~~9.2	~~13.1 : 13.1~~11.7 :	1.43	~~73.2 : 73.2~~68.7 :	~~12.3~~11.1	13.~~1~~4 : 13.~~1~~4%	1.5

Table 8.25: Junction 19 – Denmark Road / A47 Katwijk Way signalised junction Results Summary (Saturday)

8.20.3 It can be seen that in the Base 2016 scenario all arms of the junction operate well below capacity in ~~both~~ the AM and PM ~~Peaks, with~~Peak. Denmark Road East ~~being~~is the most congested link in the AM Peak with a DoS ~~readings~~ of 78.8~~%~~%, and ~~68.2%~~Denmark Road West is the most congested in the ~~AM and~~ PM Peak ~~respectively.~~ with a DoS of 70.1%.

8.20.4 The Scheme can be seen to provide a significant betterment to the operation of the junction, in particular in the AM Peak with the DoS on Denmark Road East reducing by ~~55%.~~41% in 2037. Queueing can also be seen to be more than halved on all arms of the junction.

8.20.5 A significant improvement can also be seen in the PM Peak, with DoS decreasing on all arms of the junction and queueing being over halved on all arms. The junction also operates well within capacity on a Saturday, with significant improvements in the DoS and queueing as a result of the Scheme.

8.20.6 Overall the Scheme can be seen to significantly improve the operation of this junction.

8.21 Junction 20 – Waveney Drive / Kimberley Road Priority Junction

8.21.1 The junction at Waveney Drive and Kimberley Road is a three-arm priority junction, with the other end of Kimberley Road being connected to Durban Road which is to be closed off upon introduction of the Scheme. Amendments to the junction are proposed (as discussed in Section 9) to accommodate large vehicles (e.g. coaches) turning into Kimberley Road as a result of the closure of Durban Road. The proposed geometric changes to the kerb radii do not affect the modelling inputs for the junction.

Figure 8.25: Waveney Drive / Kimberley Road priority junction (Source: Google Maps Streetview)

Arm	AM			PM		
	Queue (PCU)	Delay (s)	RFC	Queue (PCU)	Delay (s)	RFC
	Base 2016					
Kimberley Drive	0.04	6.~~47~~86	0.~~06~~03	0.06	~~7.59~~8.10	0.05
Waveney Drive Right Turn	0.05	6.~~41~~21	0.~~08~~04	0.08	7.~~56~~36	0.07
	2022 DM					
Kimberley Drive	0.07	~~6.98~~7.43	0.06	0.08	8.~~28~~87	0.07
Waveney Drive Right Turn	0.05	6.~~57~~38	0.04	0.11	~~8.17~~7.96	0.09
	2022 DS					
Kimberley Drive	0.~~17~~18	~~10.99~~11.92	0.~~13~~14	0.~~34~~39	~~18.06~~20.35	0.~~24~~26
Waveney Drive Right Turn	0.04	6.~~98~~79	0.~~04~~03	0.11	~~10.1~~9.94	0.09
	2037 DM					
Kimberley Drive	0.08	7.~~38~~87	0.07	0.~~1~~10	~~8.84~~9.50	0.~~08~~09
Waveney Drive Right Turn	0.~~06~~05	6.~~77~~57	0.05	0.~~11~~10	8.~~56~~37	0.09
	2037 DS					
Kimberley Drive	0.~~21~~23	~~12.64~~13.86	0.~~16~~17	0.~~19~~63	~~15.37~~30.06	0.~~15~~37
Waveney Drive Right Turn	0.05	7.~~3~~11	0.04	0.14	11.~~4~~30	0.11

Table 8.26 Junction 20 – Waveney Drive / Kimberley Road priority junction Results Summary

8.21.2 It can be seen that all arms currently operate within operational capacity, and with background growth will continue to operate within capacity in 2037.

8.21.3 The Scheme can be seen to have a slightly negative impact to the operation of the junction but it still operates within capacity on all arms.

8.22 Junction 21 - A1117 Millennium Way / B1074 Somerleyton Road signalised junction

8.22.1 The junction at A1117 Millennium Way / B1704 Somerleyton Road is a traffic signal-controlled junction. A1117 Millennium Way forms part of the Northern Spine Road, and on both its northbound and southbound approaches to the junction two lanes are provided separating the left and ahead movements from the right turn movements. A toucan crossing is also provided on the southbound approach to the junction.

8.22.2 B1704 Somerleyton Road runs east-west, and on its approach to the junction one wide lane is provided for all movements with a signalised crossing.

8.22.3 Grasmere Drive serves primarily as an access to the Aldi Superstore, however it also gives access to Foxborough Road and the surrounding residential area. A single lane approach is provided at the junction with no crossing facilities.

Figure 8.26: A1117 Millennium Way / B1074 Somerleyton Road signalised junction (Source: Google Maps Streetview)

	Base 2016		2022 DM		2022 DS		2037 DM		2037 DS	
	DoS	MMQ	DoS	MMQ	DoS	MMQ	DoS	MMQ	DoS	MMQ
A1117 Millennium Way N Left Ahead Right	42.7 : 42.7%	5.4	62.1 : 62.1%	8.0	95.1 : 95.1%	24.~~9~~7	71.1 : 71.1%	10.0	105.1 : 105.1%	~~50.0~~49.9
Grasmere Drive Right Left Ahead	7.70%	0.4	14.2%	0.7	18.5%	0.9	16.3%	0.8	21.2%	1.0
A1117 Millennium Way S Ahead Right Left	64.6 : 64.6%	9.7	82.4 : 82.4%	11.9	84.8 : 0.0%	14.0	98.3 : 0.0%	22.9	103.1 : 0.0%	32.7
B1074 Somerleyton Road Left Ahead Right	134.40%	41.2	79.9%	9.5	97.1%	14.9	95.2%	14.3	100.6%	18.2

Table 8.27: Junction 21 – A1117 Millennium Way / B1074 Somerleyton Road signalised junction Results Summary (AM Peak)

	Base 2016		2022 DM		2022 DS		2037 DM		2037 DS	
	DoS	MMQ	DoS	MMQ	DoS	MMQ	DoS	MMQ	DoS	MMQ
A1117 Millennium Way N Left Ahead Right	49.6 : 49.6%	7.8	68.7 : 68.7%	10.5	72.1 : 72.1%	11.7	76.4 : 76.4%	12.3	75.9 : 75.9%	12.6
Grasmere Drive Right Left Ahead	57.80%	3.2	88.0%	9.0	93.3%	10.3	96.0%	13.7	95.4%	12.0
A1117 Millennium Way S Ahead Right Left	69.7 : 0.0%	10.9	88.1 : 0.0%	14.3	92.5 : 0.0%	16.9	98.9 : 0.0%	21.5	98.0 : 0.0%	21.2
B1074 Somerleyton Road Left Ahead Right	92.90%	8.1	85.8%	8.7	89.9%	10.4	95.4%	12.4	102.3%	19.0

Table 8.28: Junction 21 – A1117 Millennium Way / B1074 Somerleyton Road signalised junction Results Summary (PM Peak)

8.22.4 It can be seen that in the Base 2016 scenario the Somerleyton Road arm of the junction is indicated to exceed capacity considerably in the AM Peak with a DoS of 134.4%, and be in exceedance of operational capacity in the PM Peak with a DoS of 92.9%. All other arms are indicated to operate well below capacity in both peak periods.

8.22.5 Whilst traffic flows at the junction increase in 2022 DM and 2037 DM, Table 8.27 and 8.28 show that optimisation of the existing traffic signals ~~will~~would improve the operation of the junction ~~somewhat~~ to provide a more balanced operation compared to the Base 2016.

8.22.6 The Scheme can be seen to have a negative impact on the operation of the junction; in 2022 junction performance is predicted to decrease and further worsen in 2037 with a DoS on the worst approach of 105%.

8.22.7 Due to this junction being forecast to operate in exceedance of capacity, improvements are proposed as are set out in Section 9.

8.23 Junction 22 - B1531 Waveney Drive / new Access Road 'Ghosted Right Turn' Junction

8.23.1 A new 'Ghosted Right Turn' junction will be constructed south of the Lake connecting into Waveney Drive from a new Access Road that will connect to businesses on Riverside Road/Canning Road. The connection will run through the former Jeld Wen site and provide access businesses that would otherwise become inaccessible due to changes in level on Riverside Road.

8.23.2 The modelling results for this junction are shown in Table 8.29.

Arm	AM			PM		
	Queue (PCU)	Delay (s)	RFC	Queue (PCU)	Delay (s)	RFC
	2022 DS					
New Access Road Right Turn	0.06	6.80	0.05	0.20	7.28	0.17
New Access Road Left Turn	0.04	12.24	0.04	0.29	13.86	0.22
Waveney Drive WB	0.20	7.90	0.17	0.03	5.60	0.03
	2037 DS					
New Access Road Right Turn	0.08	7.75	0.07	0.27	8.10	0.22
New Access Road Left Turn	0.06	15.97	0.06	0.39	18.19	0.28
Waveney Drive WB	0.27	9.41	0.21	0.03	5.82	0.03

Table 8.29: Junction 22 – B1531 Waveney Drive / Riverside Road 'Ghosted Right Turn' Junction Results Summary

8.23.3 It can be seen that this junction is forecast to operate well within its operational capacity during both peaks, with a maximum RFC of 0.38 for left turners on the new Access Road in the PM Peak in 2037.

8.24 Junction 23 – Kirkley Run / Notley Road Priority Junction

8.24.1 The junction of Kirkley Run with Notley Road is a simple priority junction. With the closure of Durban Road as part of the Scheme, it is expected that there will be additional traffic at the junction, hence an assessment of the future capacity of the junction has been completed.

Figure 8.27: Kirkley Run / Notley Road Priority Junction (Source: Google Maps Streetview)

8.24.2 The modelling results for this junction are shown in Table 8.30.

Arm	AM			PM		
	Queue (PCU)	Delay (s)	RFC	Queue (PCU)	Delay (s)	RFC
	Base 2016					
Notley Road	0.04	7.71	0.04	0.08	7.95	0.08
Kirkley Run Right Turn	0.03	4.69	0.03	0.06	5.15	0.04
	2022 DM					
Notley Road	0.03	7.77	0.03	0.03	7.77	0.03
Kirkley Run Right Turn	0.04	4.71	0.03	0.04	4.71	0.03
	2022 DS					
Notley Road	0.16	8.81	0.14	0.25	10.98	0.20
Kirkley Run Right Turn	0.05	4.58	0.04	0.09	5.39	0.06
	2037 DM					
Notley Road	0.04	8.10	0.04	0.09	8.27	0.09
Kirkley Run Right Turn	0.05	4.65	0.04	0.06	5.05	0.04
	2037 DS					
Notley Road	0.19	9.40	0.16	0.31	11.87	0.24
Kirkley Run Right Turn	0.06	4.50	0.04	0.10	5.29	0.06

Table 8.30: Junction 23 – Kirkley Run / Notley RoadPriority Junction Results Summary

8.24.3 It can be seen that this junction is forecast to operate well within operational capacity during both peaks in all scenarios, with a maximum RFC of 0.24 for right turners on the Notley Road in the PM Peak in 2037.

8.25 Summary of Junction Operation Impacts

8.25.1 The majority of the junctions assessed using operational models operate well within capacity in the 2022 and 2037 DS scenario including the Scheme. A small number of junctions require some improvements to mitigate the impact of the Scheme, generally on the main approaches to the Scheme where additional traffic is to be expected.

8.25.2 An overall summary of the junction operation is included in Table 8.31 and Table 8.32 for 2022 and 2037 respectively, with the following colour classifications:

- Green – operating under 0.85/85%
- Orange – operating between 0.85/85% and 1.00/100%
- Red – operating over 1.00/100%

Junction	AM Peak DM	AM Peak DS	PM Peak DM	PM Peak DS	Saturday DM	Saturday DS	Mitigation Required
1					-	-	No
2					-	-	No
3					-	-	No
4					-	-	No
5					-	-	No
6					-	-	No
7					-	-	**Yes**
8					-	-	No
9					-	-	No
10					-	-	No
11					-	-	No
12							No
13							No
14							**Yes**
15					-	-	No
16		-		-	-	-	No
17	-		-		-	-	Scheme North Rbt
18	-		-		-	-	Scheme South Rbt
19							No
20					-	-	No
21					-	-	No
22	-		-		-	-	Scheme Junction
23					-	-	No

Table 8.31: Summary of Junction Operation Assessments in 2022

Junction	AM Peak DM	AM Peak DS	PM Peak DM	PM Peak DS	Saturday DM	Saturday DS	Mitigation Required
1					-	-	No
2					-	-	No
3					-	-	No
4					-	-	No
5					-	-	No
6					-	-	No
7					-	-	**Yes**
8					-	-	**Yes**
9					-	-	No
10					-	-	No
11					-	-	No
12							No
13							No
14							**Yes**
15					-	-	No
16		-		-	-	-	No
17	-		-		-	-	Scheme North Rbt
18	-		-		-	-	Scheme South Rbt
19							No
20					-	-	No
21					-	-	**Yes**
22	-		-		-	-	Scheme Junction
23					-	-	No

Table 8.32: Summary of Junction Operation Assessments in 2037

8.25.3 It can be seen that only Junction 7 and Junction 14 require mitigation with the implementation of the Scheme in 2022, whilst Junction 8 and 21 do not require any mitigation until 2037.

8.25.4 It should be noted that whilst Junction 11 is shown to be operating over 1.00 in both 2022 and 2037~~, and Junction 12 in 2037,~~ the Scheme shows an improvement to the DM scenarios and consequently no mitigation is required.

9 Scheme Impacts – Mitigation

9.1 Introduction

9.1.1 This TA has assessed the impact of the Scheme on the local highway network, and proposes a package of mitigation measures, where necessary, to ensure that the residual and cumulative impacts of the Scheme are not severe.

9.1.2 Junction improvements are required for a small number of junctions to ensure that there is sufficient capacity to accommodate the planned growth and reassignment of traffic for the Scheme.

9.1.3 As well as junction capacity, there is a need to make some alterations to improve access to Durban Road and the Waveney Gymnastics Club as a consequence of the proposed closure at its junction with Waveney Drive, and monitor the impacts of the Scheme on Rotterdam Road. Details of the proposed mitigation are detailed in Section 9.7 and 9.8, and Appendix J~~I~~ contains a scale drawing for each mitigation scheme.

9.1.4 It should be noted that determination of whether or not mitigation is required and when it is required has been based upon the causation of the impact, i.e. as a result of background growth which would occur regardless, or as a direct impact of the Scheme. This will be ascertained through the monitoring of the junctions set out in this section of the report, as secured through the DCO.

9.1.5 The proposed mitigation measures will be secured by the DCO, and all measures fall within highway land so can be provided by SCC as Local Highway Authority.

9.2 The Scheme

9.2.1 The Scheme can be considered as mitigation for existing traffic problems within Lowestoft. The Scheme will open up a third crossing of the Lake, offering a wider variety of route choice and thereby reducing traffic on existing routes. The implementation of the Scheme will therefore reduce congestion in the town, provide greater journey time reliability for public transport, and increase connectivity for pedestrians and cyclists.

9.3 Junction 7 - B1531 Victoria Road / B1531 Waveney Drive / Kirkley Run Mini Roundabout

9.3.1 The Scheme will have a negative impact on the operation of the B1531 Victoria Road / B1531 Waveney Drive / Kirkley Run mini roundabout junction. The junction is predicted to exceed capacity in both the 2022 and 2037 DS scenarios in the PM peak. Consequently, a highway improvement scheme is proposed to improve the future operation of the junction, and will need to be provided alongside the implementation of the Scheme in 2022.

9.3.2 A number of alternative junction arrangements have been considered and assessed, including a larger roundabout, a 'ghosted right turn' junction and traffic signals.

9.3.3 The assessment of a 'ghosted right turn' junction showed excessive queues on Kirkley Run, with around 100 vehicles in the morning peak and 50 vehicles in the evening peak, and associated RFC's of 1.4 and 1.3 respectively in 2037.

9.3.4 It is proposed that an improvement to this junction is implemented in two phases, with an advanced signal operation installed with the Scheme in 2022 and upgrade to a full signalisation scheme for 2037, if required following monitoring of traffic flows and the operation of the junction.

9.3.5 The initial improvement implemented with the Scheme in 2022 (Phase 1) would comprise implementation of a signalled stopline on the Victoria Road approach to the roundabout, about 30m in advance of the roundabout entry. The roundabout would continue to operate on an uncontrolled basis, with give-way entries on all three arms. The aim of the traffic signal would be to periodically hold traffic at the advanced stopline, during periods when queues were excessive on the Waveney Drive approach (i.e. when it was operating at levels above practical capacity). This would cause a temporary drop in the controlling flow from Victoria Road. With less controlling traffic opposing it, the capacity of the Waveney Drive entry would increase, thus enabling a higher entry flow and allowing any excessive queue to discharge.

9.3.6 It is anticipated that the traffic signal on Victoria Road would operate on a part-time basis, as needed, during the pm peak periods. When not required (i.e. when queues on Waveney Drive were not excessive), the signal could be switched off. One or more presence or queue loops located on Waveney Drive could operate so as to detect a queue sitting over the detector loop, thus triggering the signal to be switched on when required. Whilst operating, the signals would operate in a similar fashion to normal traffic signals, periodically showing red and green aspects to the Victoria Road traffic for suitable predetermined times, in order to adequately constrain the traffic flow.

9.3.7 The optimum positions of the queue loop and the Victoria Road stopline would be subject to detailed design. A concept scheme layout is provided in Figure 9.1

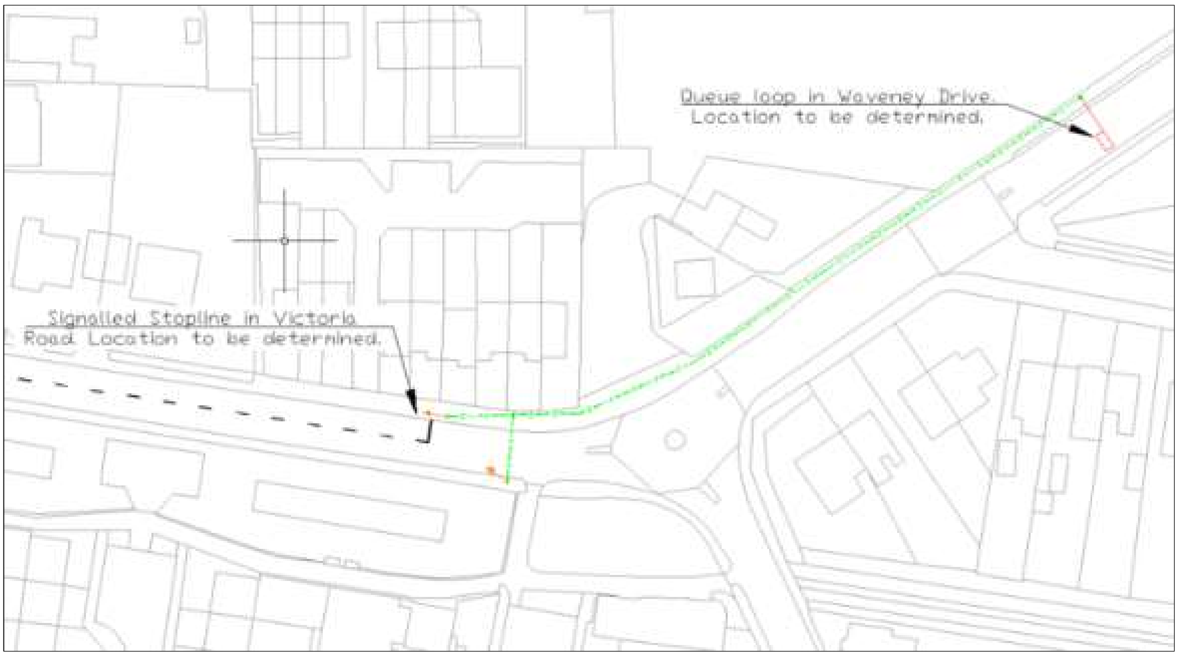


Figure 9.1 Junction 7 Mitigation Improvements – Advanced Signal

9.3.8 The Victoria Road advanced signals option was assessed using LinSig software. An initial model was first constructed using the give-way intercept flows and give-way coefficients derived from the existing roundabout ARCADY model. This was in order to replicate, as closely as possible, the retained roundabout give-way entry operation. The advance signals in Victoria Road were then added to the model and different cycle times and green times experimented with, in order achieve a reasonable balance between the performances of the Waveney Drive and Victoria Road arms.

Junction Arm	2022 DS PM Peak			2037 DS PM Peak		
	DoS	MMQ	Delay (s)	DoS	MMQ	Delay (s)
Waveney Drive	78%	9	12	95%	18	35
Kirkley Run	92%	6	59	122%	42	371
Victoria Road	74%	4	21	92%	9	50

Table 9.1: B1531 Victoria Road / B1531 Waveney Drive / Kirkley Run Phase 1 Mitigated Results

9.3.9 The results indicate that the Waveney Drive would have spare capacity in 2022 but would operate above practical capacity in 2037. When compared to the existing mini-roundabout results, this arm operates significantly better in both years, and, though still over capacity in 2037, the queues and delays are considered to be reasonably short.

9.3.10 The Kirkley Run arm performs less well in both years, and is significantly over-saturated by 2037. The reason for this is that the increased capacity given to the ~~Victoria~~Waveney Drive arm by the signal control, allows more controlling traffic into the roundabout, to which Kirkley Road has to give way.

9.3.11 The Victoria Road arm similarly performs worse than in the case of the uncontrolled roundabout, due to the constraining influence of the advanced signals. It would operate above practical capacity by 2037.

9.3.12 The full solution, if required for 2037 following monitoring and review of traffic flows and junction operation, is to convert the junction into a signal controlled T-junction with the major arms being B1531 Victoria Road / B1531 Waveney Drive, and to widen the carriageway on the B1531 Waveney Drive approach to provide two lanes, separating the ahead and left turn movements, as shown in Figure 9.2

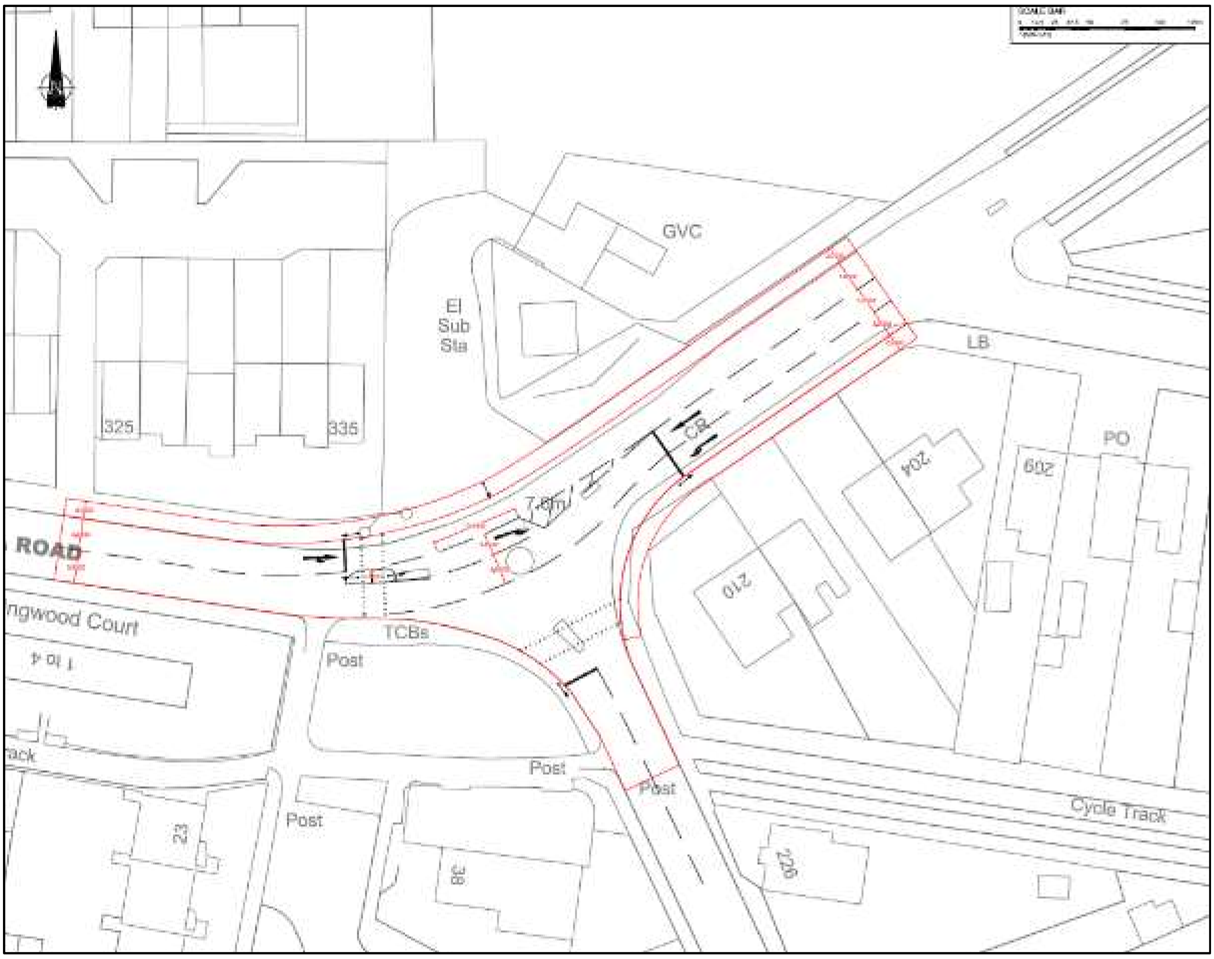


Figure 9.2: Junction 7 Mitigation Improvements – Potential Full Signalisation

9.3.13 To do this, it is proposed to remove the existing 'ghosted right turn' (GRT) at the Kimberley Drive junction to the east. A PICADY junction model has been created for the Kimberley Drive junction and the results have shown that the GRT is not needed for the junction to operate satisfactorily (maximum RFC of 0.16 in 2037 DS without the GRT).

9.3.14 The proposed amendments have been entered into a LinSig model and the DoS results are summarised in Table 9.2

9.3.15 For the purpose of this assessment it has been assumed that the pedestrian phase is called every other cycle.

	2022 DS Mitigated (DoS)		2037 DS Mitigated (DoS)	
	AM	PM	AM	PM
B1531 Waveney Drive	34.8 : 34.8%	70.1 : 70.1%	40.1 : 40.1%	87.1 : 87.1%
Kirkley Run	79.60%	70.00%	97.10%	86.60%
B1531 Victoria Road	79.20%	44.60%	94.50%	62.40%

Table 9.2: B1531 Victoria Road / B1531 Waveney Drive / Kirkley Run Mitigated Results

9.3.16 With the proposed mitigation implemented, the junction is indicated to operate within practical reserve capacity in the 2022 DS scenario, with a DoS on the worst approach of 80% in the morning peak.

9.3.17 In the 2037 DS scenarios, the junction is indicated to operate within theoretical capacity in both peak periods, with a DoS on the worst approach of 97% in the morning peak and 87% in the evening peak.

9.3.18 It is important to note that considerable private development is proposed in the vicinity of this junction, and the layout of the local highway network will change as a result of that development, including the site at Brooke Peninsula (former Jeld Wen site). The detailed design of improvements to the junction will therefore need to be considered in light of other development/improvements coming forward, and the results of monitoring the junction.

9.4 Junction 8a, 8b and 8c – A12 Tom Crisp Way / Blackheath Road signalised junction

9.4.1 The results of the VISSIM analysis show that significant queuing could occur on the A12 Tom Crisp Way (southbound) arm of the junction with Blackheath Road during the PM peak in 2022. The operational modelling shows that the junction is forecast to operate at just over 100% capacity in the 2037 DS scenario. The junction will operate with an RFC of 96% in the 2037 DM scenario. The impact of the Scheme at this junction is therefore not severe, however it is as a direct result of the Scheme that the junction will operate over 100% capacity.

9.4.2 It is therefore proposed to introduce MOVA into the traffic signals for 2022. MOVA is a form of urban traffic control which can adapt the traffic signal timings to accommodate peak hour demand as required to operate the junction most efficiently. MOVA can typically create benefits of c.10% additional capacity from a junction.

9.4.3 Introducing MOVA at the A12 Tom Crisp / Blackheath Road junction would release additional capacity within the junction to accommodate growth to 2022 and beyond as a result of the reassignment of trips associated with the Scheme. The Applicant, in in its capacity as the highway authority, will monitor the operation of the traffic signals following implementation of the Scheme and MOVA to determine whether further improvement measures are required to increase capacity prior to 2037.

9.5 Junction 14 – A1117 Normanston Drive / A1117 Peto Way roundabout

9.5.1 The junction of A1117 Normanston Drive/Peto Way is forecast to operate over capacity during the Saturday peak in the 2022 and 2037 DS scenarios. The junction is forecast to operate within capacity on weekdays. It is anticipated that the increase in demand on a Saturday is as a result of the North Quay Retail Park located on Peto Way.

9.5.2 Whilst there are two approach lanes to the junction on Peto Way currently, the lanes are narrow at 2.7m each, widening towards the entry to the roundabout. The narrow lanes restrict the capacity through the junction. A junction improvement scheme, consisting of the widening of approach lanes on Peto Way is proposed, which will provide sufficient additional capacity to accommodate the future growth for a Saturday peak. The improvement would consist of removing the existing white hatching and a minor realignment of the nearside kerbline, as shown in Figure 9.3. The detailed design of improvements to the junction will be considered in light of the results of monitoring the performance of the junction.

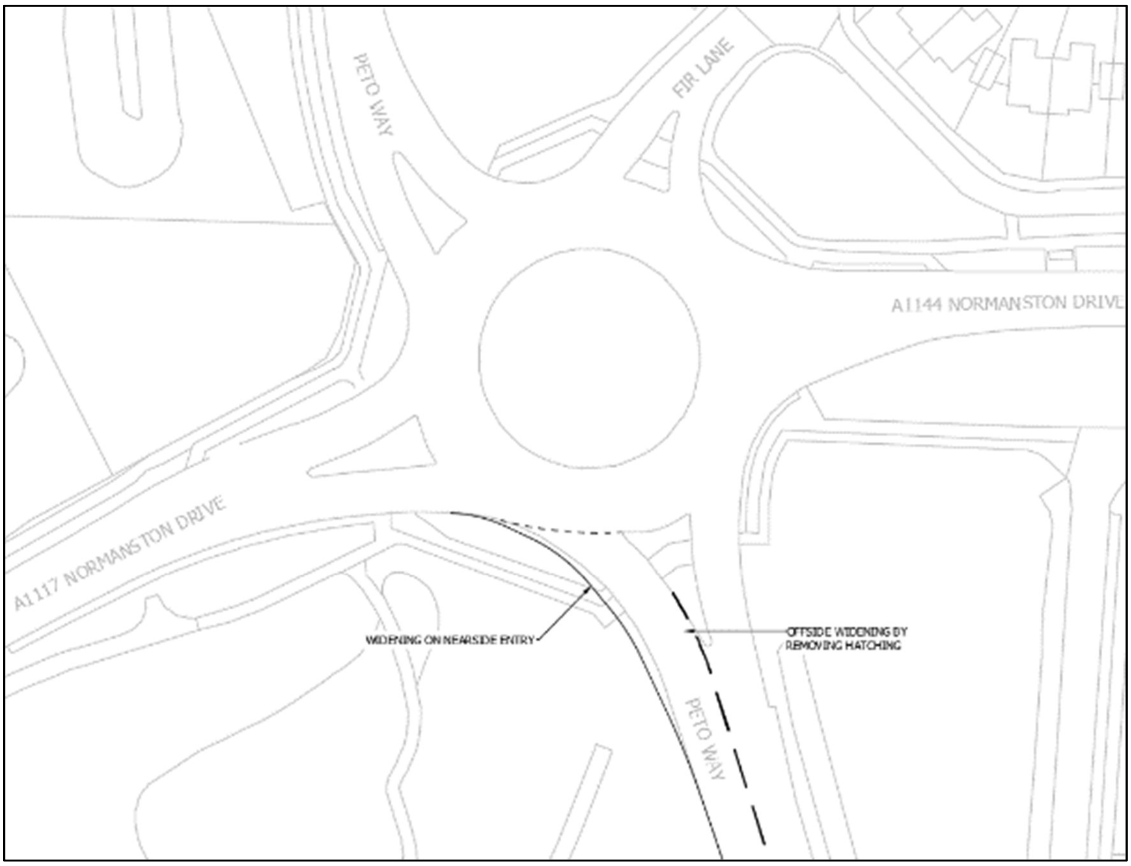


Figure 9.3: Junction 14 Mitigation Improvements

9.5.3 The proposed amendments have been entered into a JUNCTIONS8 model and the results are summarised in Table 9.3.

Arm	AM			PM			Sat		
	Queue (PCU)	Delay (s)	RFC	Queue (PCU)	Delay (s)	RFC	Queue (PCU)	Delay (s)	RFC
	2022 DS								
Fir Lane	0.98	13.48	0.50	0.93	8.25	0.48	1.66	16.68	0.63
A1144 Normanston Drive	0.27	4.43	0.22	0.79	5.75	0.44	0.73	6.67	0.42
Peto Way	0.52	2.42	0.34	1.05	3.58	0.51	6.25	13.54	0.87
A1117 Normanston Drive	1.~~49~~78	~~6.41~~7.6	0.~~60~~64	0.~~71~~80	~~4.85~~5.5	0.~~42~~45	~~1.71~~2.1	~~9.53~~12.	0.~~63~~69
A1117 Peto Way	1.73	7.12	0.64	0.59	3.55	0.37	1.81	7.55	0.65
	2037 DS								
Fir Lane	2.~~97~~96	36.~~95~~84	0.77	1.08	9.65	0.52	5.~~51~~46	~~49.38~~48	0.87
A1144 Normanston Drive	0.39	5.36	0.28	1.14	7.16	0.53	1.08	9.00	0.52
Peto Way	0.71	2.77	0.42	1.49	4.440	0.60	24.49	47.~~42~~43	0.99
A1117 Normanston Drive	~~3.26~~4.5	~~11.77~~16	0.~~77~~83	1.~~22~~45	~~6.79~~8.0	0.~~55~~60	~~3.46~~5.2	~~17.12~~6.	0.~~79~~85
A1117 Peto Way	3.~~44~~43	12.~~63~~62	0.78	0.74	4.04	0.43	2.~~92~~91	11.~~23~~21	0.75

Table 9.3: A1117 Normanston Drive / A1117 Peto Way (Saturday Peak)

9.5.4 With the proposed mitigation implemented, the junction is indicated to operate within capacity in the 2022 and 2037 DS scenarios, with an RFC on the worst approach of 0.~~78~~83 in the AM Peak and 0.60 in the PM Peak. Although the junction is forecast to operate over theoretical capacity (0.9) in the Saturday Peak, the improvements represent a reduction in the RFC of 0.31 compared to the unmitigated 2037 DS scenario, and an increase in RFC of just 0.10 compared to the 2037 DM scenario.

9.6 Junction 21 - A1117 Millennium Way / B1074 Somerleyton Road Signalised Junction

9.6.1 The Scheme can be seen to have a negative impact on the operation of the A1117 Millennium Way / B1074 Somerleyton Road signalised junction, and it is indicated to exceed capacity in the 2037 DS scenario. Consequently, an improvement scheme could be implemented to safeguard the future operation of the junction.

9.6.2 The existing carriageway width on B1074 Somerleyton Road at the approach to the junction is very wide at approximately 9.75m, but only one 5.3m wide lane is provided at the junction. It is therefore proposed to provide an additional lane on this arm to separate the right turn movements from the ahead and left movements as shown in Figure 9.4.

9.6.3 The detailed design of improvements to the junction will be considered in light of the results of monitoring the performance of the junction.

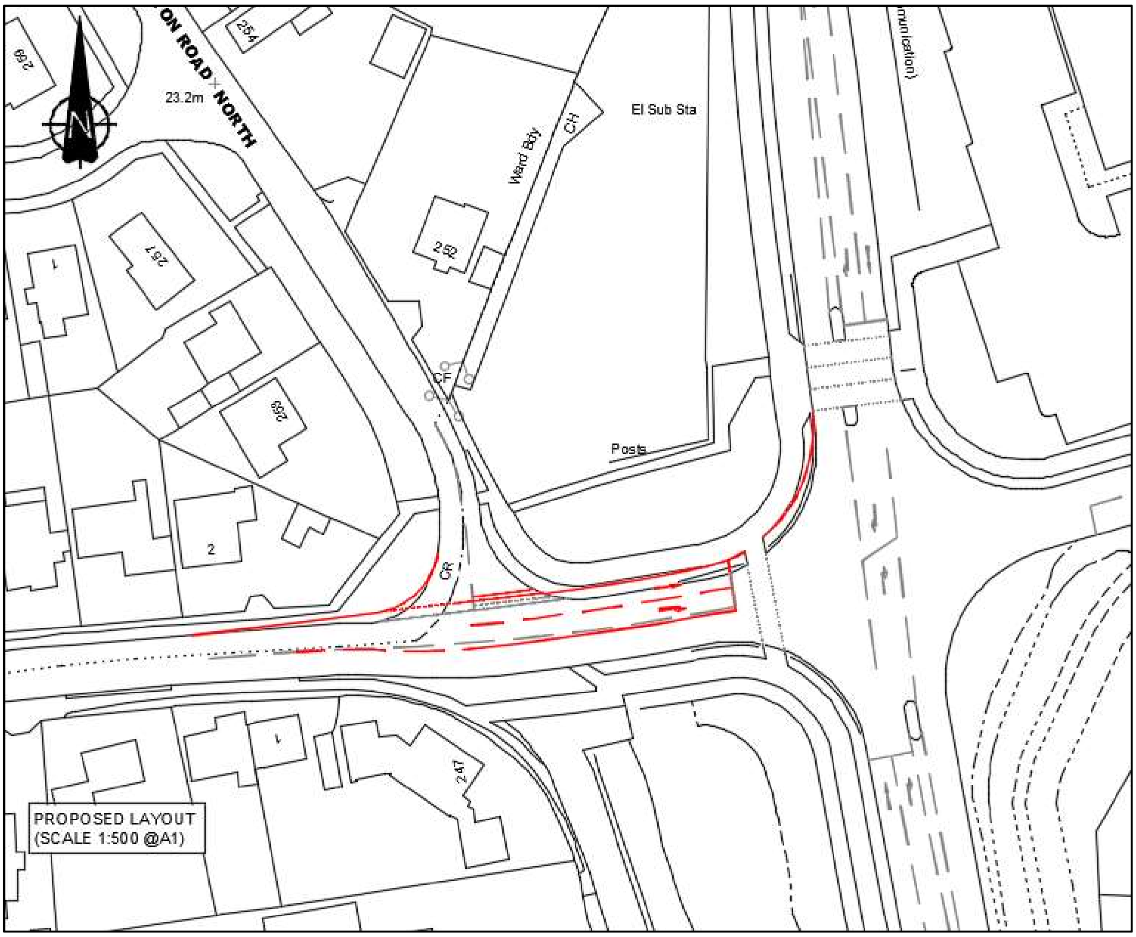


Figure 9.4: A1117 Millennium Way / B1074 Somerleyton Road Improvements

9.6.4 The provision of the additional lane increases the capacity of the arm, and enables the ‘green time’ for the arm to be decreased. That ‘spare’ green time can then be distributed across the other arms of the junction where demand has increased (primarily on A1117 Millennium Way) to improve the overall operation of the junction.

9.6.5 The proposed amendments have been entered into the LinSig model and the results are summarised in Table 9.4 and Table 9.5 for the AM and PM Peak respectively.

	2022 DS		2037 DS	
	DoS	MMQ	DoS	MMQ
A1117 Millennium Way N Left Ahead Right	87.9 : 87.9%	20.~~1~~0	97.0 : 97.0%	~~29.1~~28.9
Grasmere Drive Right Left Ahead	18.5%	0.9	21.2%	1.0
A1117 Millennium Way S Ahead Right Left	76.2 : 0.0%	12.3	92.7 : 0.0%	19.2
B1074 Somerleyton Road Left Ahead Right	90.0 : 90.0%	9.2	91.6 : 91.6%	9.8

Table 9.4: A1117 Millennium Way / B1074 Somerleyton Road (AM Peak)

	2022 DS		2037 DS	
	DoS	MMQ	DoS	MMQ
A1117 Millennium Way N Left Ahead Right	70.2 : 70.2%	11.4	73.8 : 73.8%	12.3
Grasmere Drive Right Left Ahead	85.5%	8.3	88.1%	9.5
A1117 Millennium Way S Ahead Right Left	88.9 : 0.0%	15.4	94.0 : 0.0%	18.0
B1074 Somerleyton Road Left Ahead Right	88.2 : 88.2%	8.4	93.6 : 93.6%	10.7

Table 9.5: A1117 Millennium Way / B1074 Somerleyton Road (PM Peak)

9.6.6 With the proposed mitigation implemented, the junction is indicated to operate within theoretical capacity in the 2037 DS scenarios, with a DoS on the worst approach of 97~~%%~~% in the AM Peak. The mitigated layout presents an improvement in DoS of around ~~8~~9% in the PM peak compared to the 2037 DM scenario.

9.7 Mitigation required as a consequence of Durban Road Closure

9.7.1 As a result of the closure of Durban Road, the left turn kerb radius at Kimberley Road will be widened to accommodate large vehicles, especially coaches accessing the gymnastics club. The amended kerb design is shown broadly in Figure 9.5 and with further detail provided in Appendix J~~I~~.

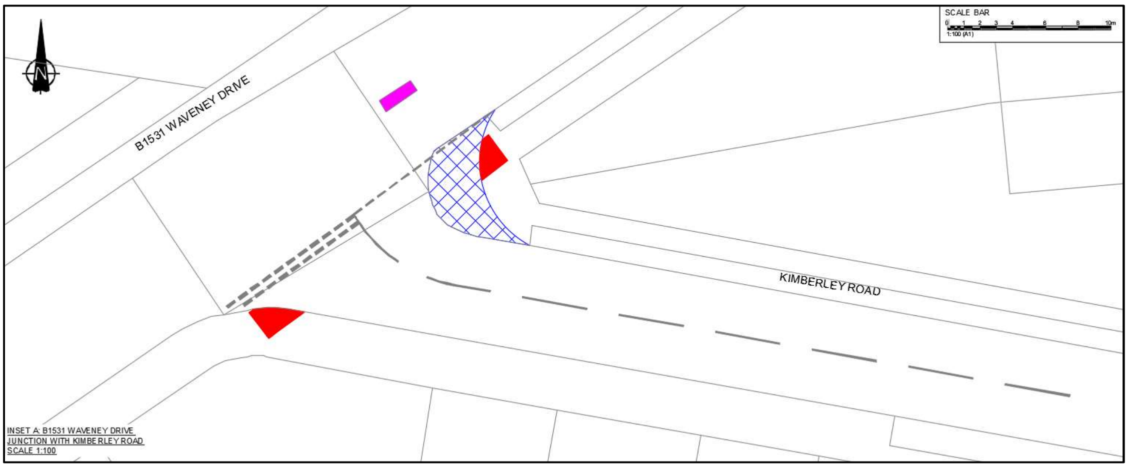


Figure 9.5: Kimberley Road Kerb Amendments

9.7.2 The Applicant has undertaken on-site testing to demonstrate that coaches can access Durban Road via Kimberly Road and Notley Road. This showed that it would be beneficial to provide some additional parking restrictions to help maintain access for coaches and large vehicles. The proposed new restrictions are shown in Figure 9.6, Appendix J~~I~~ and the Traffic Regulation Measures Plan (Document 2.6) and it is proposed that these would be implemented at the same time that Durban Road is permanently closed to vehicles at the north end.

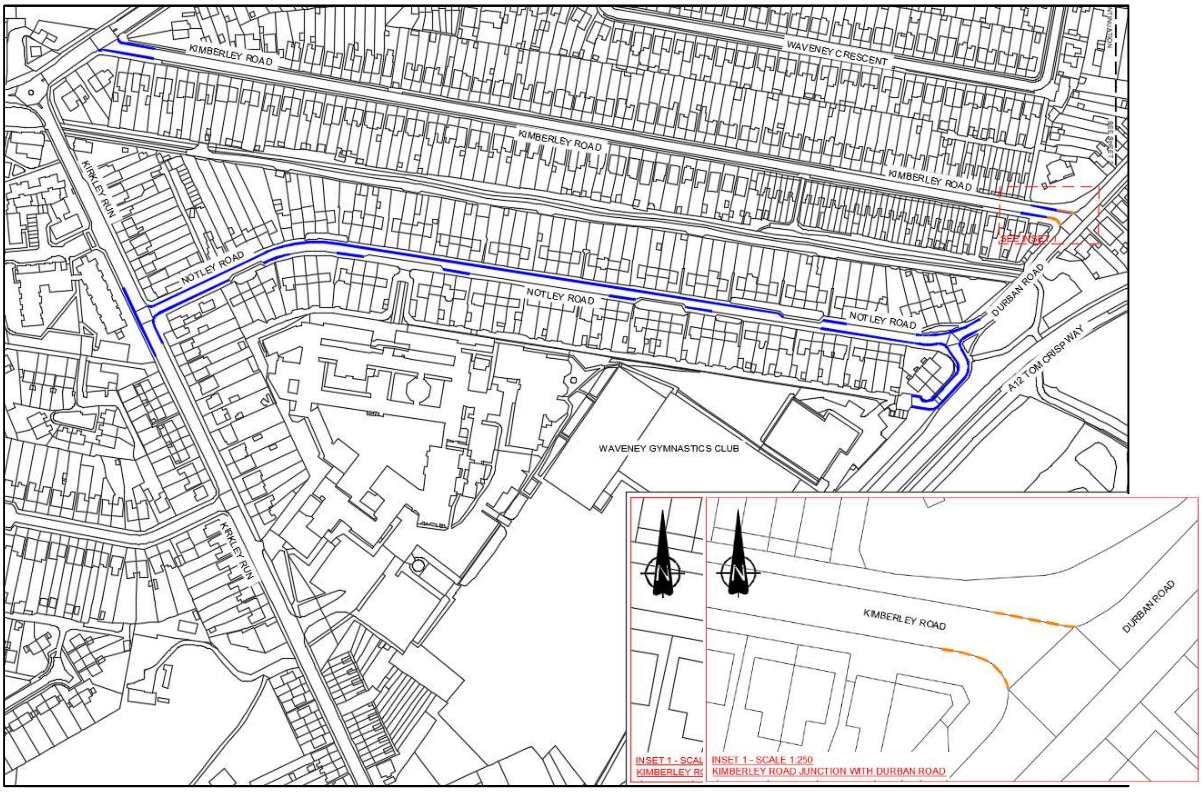


Figure 9.6: Proposed Parking Restrictions on Notley Road and Kimberley Road

9.8 Rotterdam Road

9.8.1 Within the traffic modelling assessments in SATURN, traffic on Rotterdam Road is forecast to increase as a result of the Scheme. The Applicant believes that this effect will not occur in reality as Rotterdam Road is a narrow residential road, for which there are significantly more attractive alternative routes for drivers. During the consultation events for the DCO, the potential increase in traffic on Rotterdam Road shown within the modelling was raised as an issue by local residents.

9.8.2 As such, the Applicant will monitor the traffic flows on Rotterdam Road following the implementation of the Scheme and will provide an improvement aimed at making the use of Rotterdam Road even less attractive than the alternative routes. The improvements could include traffic management features such as horizontal or vertical deflection, however an appropriate scheme would be designed following identification of the need subsequent to the monitoring of traffic flows in the future year.

9.9 Summary

9.9.1 The mitigation measures outlined within this Section clearly show that any traffic impacts associated with the proposed development will be mitigated through a series of highway improvements. This will ensure that the impact of the Scheme is not detrimental to the operation of the junctions within the local and strategic highway networks. The mitigation measures are secured via the DCO and its associated plans, where relevant.

10 Scheme Impacts – Construction

10.1 Introduction

10.1.1 This Section details the impact from the construction of the Scheme on the local road network. Further details on construction of the Scheme are provided in Chapter 5 of the ES.

10.1.2 There will be an impact on the local highway network during construction, as a result of the movement of vehicles delivering/removing goods and people. The impact will be for a duration of approximately two years.

10.1.3 The peak in staff numbers is anticipated about a third of the way through the construction and there is anticipated to be approximately 100 full time equivalents working on site each day.

10.1.4 An indicative profile of staff and material HGVs are shown in Figure 10.1 and Figure 10.2 respectively.

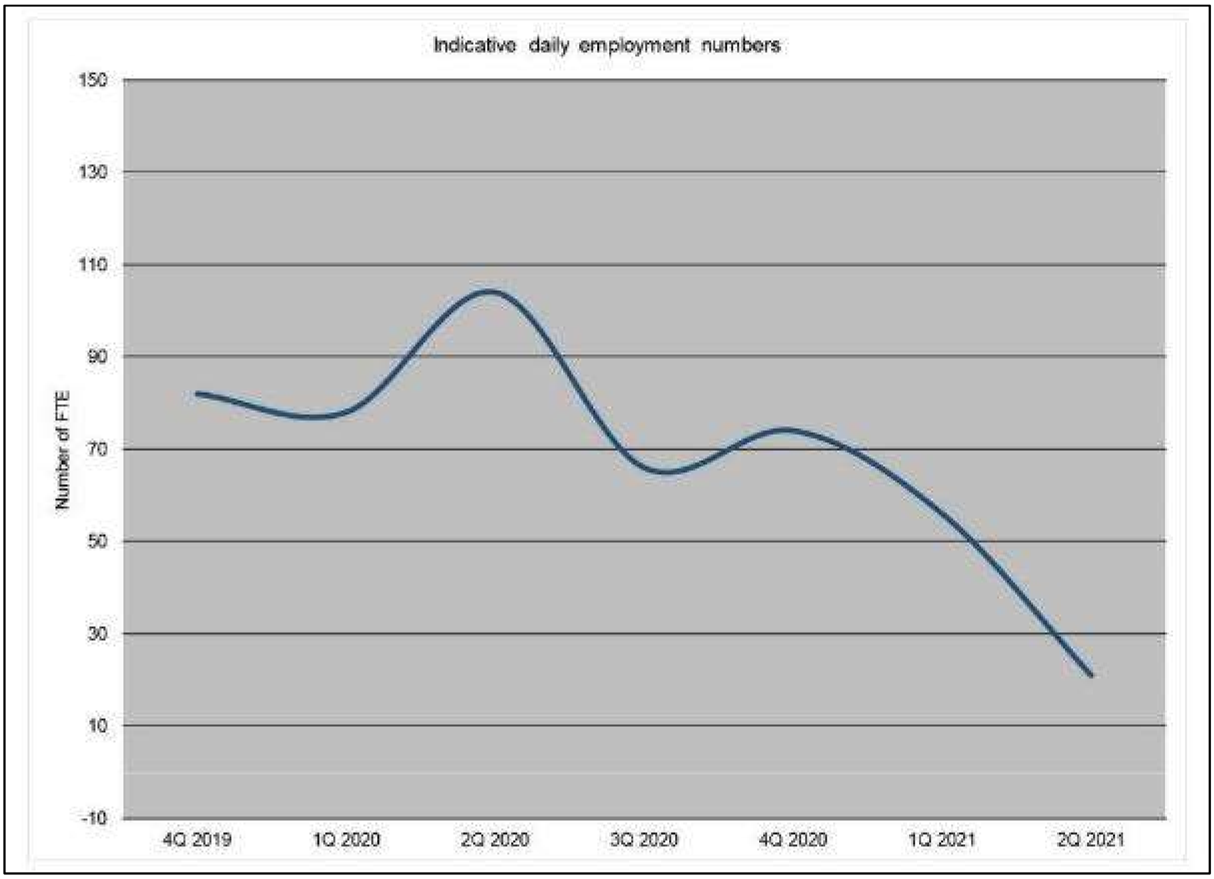


Figure 10.1: Indicative Daily Employment Numbers

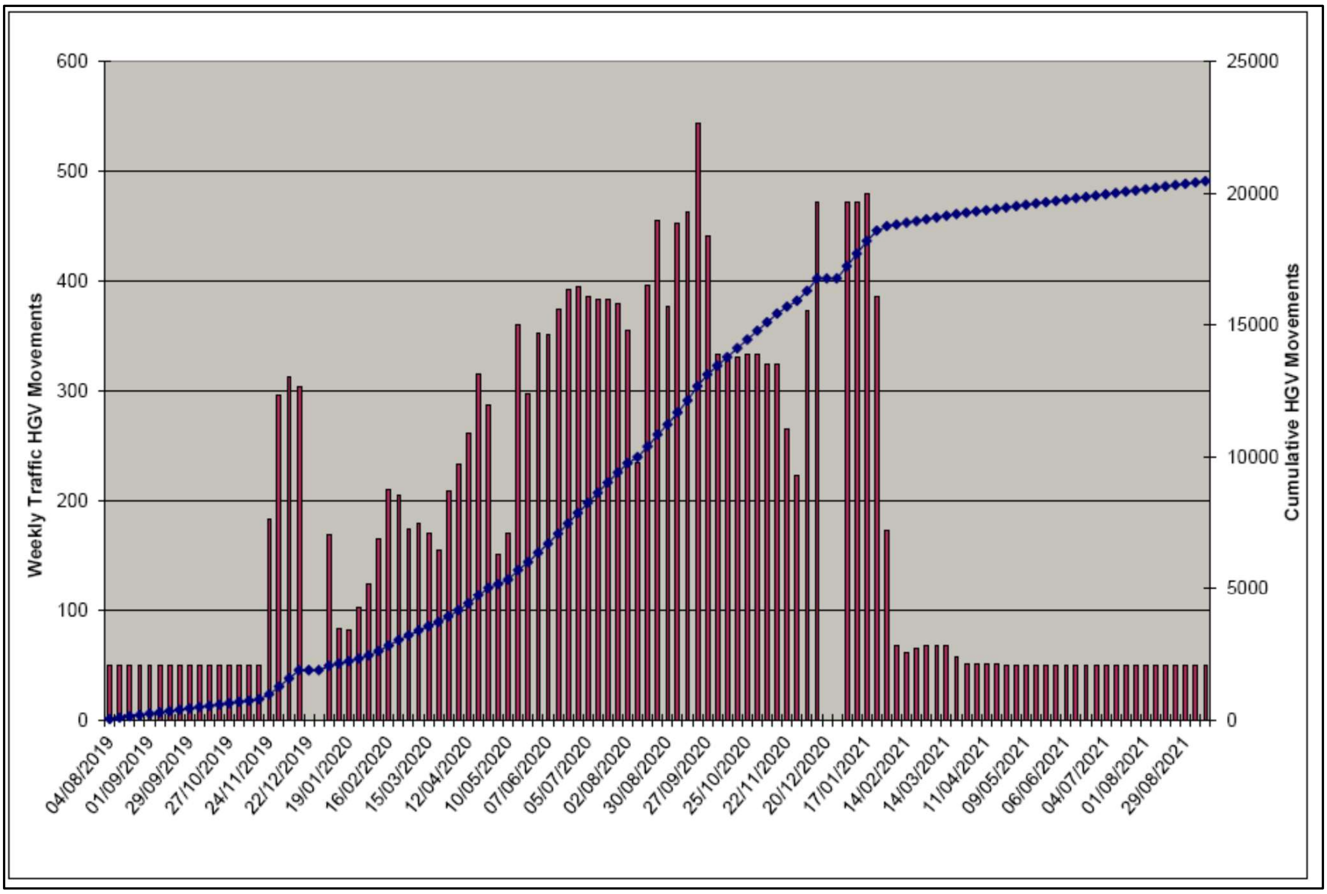


Figure 10.2: Weekly HGV Movements

10.1.5 Similarly, to the staff numbers, HGV movements show a peak approximately one third into the assumed construction programme. For the purposes of the assessment within the ES, it is assumed that 50% of movements would be to/from the southern compound and 50% to/from the north and hence movements along Waveney Drive or Peto Way would be approximately 50% of the value presented.

10.1.6 As shown in Figure 10.2, HGV movements peak at approximately 540 per week (or 108 per day assuming a five-day week). Figure 10.2 also shows the cumulative numbers of HGV movements that totals just over 20,000 over the Construction phase of the Scheme. Assuming a 50/50 split of movements there will be 54 HGV movements per week day to both the north and south of Lake Lothing at the peak of construction.

10.1.7 Assuming this 50/50 split of HGVs, 54 two way movements a day at the peak of construction is the assumed movements of HGVs through Station Square and along Waveney Drive. As the construction hours for the Scheme will be from 07:00 to 19:00, a twelve hour day, this equates to fewer than five HGV movements per hour. For the purposes of this calculation, it has been assumed that no HGV deliveries are made on a Saturday.

10.1.8 Base year traffic data, derived from the SATURN model shows that total vehicle movements along Commercial Road are approximately 2,400 of which approximately 50 are HGVs. An increase of 54 HGVs per day represents only a 2.2% increase in traffic along Commercial Road, which is not anticipated to present a severe impact for existing users/businesses.

10.1.9 Traffic data from the SATURN model also identifies a flow of approximately 8500 vehicles per day using Waveney Drive of which approximately 1.5%, or 127, are HGVs. Given that the peak number of HGVs that are likely to access the southern compound is 54, and this is for a very limited period of the construction, it is unlikely that there will be significant effects arising from construction related traffic.

10.2 Interim Code of Construction Practice

10.2.1 Construction impacts have been considered and mitigated as far as possible as part of the Interim Code of Construction Practice (ES Appendix 5A) further detail of which is provided within the ES.

11 Scheme Impacts - Other

11.1 Introduction

11.1.1 This Section details all other development impacts, which are expected to be caused by the Scheme. It covers impacts to pedestrians, cyclists, and public transport.

11.2 Active Mode Appraisal

Pedestrians

11.2.1 An AMA is a DfT-approved economic appraisal tool which details the monetary changes resulting from a transport intervention, in terms of quantitative impacts on active modes. An AMA was carried out as a component of the economic analysis within the OBC for the Scheme. This estimated the demand changes attributable to sustainable travel modes and detailed the overall economic benefit as a result of these changes.

11.2.2 The appraisal anticipated that the provision of a third crossing will encourage an increase in people opting to walk due to the improved footpath infrastructure provision as well as creating shorter journey lengths for some pedestrian trips.

11.2.3 The appraisal assumed a proportion of the existing and additional pedestrians would cross a third central bridge if it was available. The proportion of existing pedestrians diverting to a new central bridge was assumed to be the same as the vehicular proportional change on the bridges, provided by the outputs of the traffic modelling. The traffic modelling projected that, in 2037, 43% of vehicular traffic in the AM peak would use the Scheme whereas 40% would use the Scheme in the PM peak. Therefore, the average of the AM and PM peak proportions (i.e. 42%) was used as a prediction of the percentage of pedestrians that would divert from the existing crossing points to use the Scheme. The methodology used to estimate pedestrian and cycle trips is the same as in the active mode appraisal of the OBC. The OBC was approved by the Department for Transport in March 2016.

11.2.4 In order to estimate the uplift in demand that could result from the implementation of the Scheme, the appraisal conducted a desktop research exercise to find appropriate comparative studies of schemes that had been implemented in other relevant locations. The research identified a wide range in levels of increases in walking from provision of additional, new and improved footpaths. The appraisal considered an increase in pedestrian numbers in the range of 5% to 15% resulting from the Scheme.

11.2.5 In addition the appraisal assumed that the provision of the Scheme between the two existing crossing points would reduce some current car user's journey lengths and / or time for some existing trips and thereby generate further pedestrian trips as car users shift to walking. This appraisal suggested a 10% increase in walking trips would be expected as a result of the provision of the Scheme.

11.2.6 The 10% uplift value and the proportion of pedestrians using the Scheme bridge instead of the existing bridges were applied to the expected DM walking trips in 2021. The DM pedestrian trips were calculated using pedestrian survey data at the existing bridges from 2014 and TEMPRO growth factors for the study area (i.e. Lowestoft). From this estimates of existing pedestrian trips re-routing to the Scheme and new pedestrian trips using the Scheme were calculated.

11.2.7 The appraisal suggests that the number of pedestrians that could be anticipated to use the Scheme per day could be 4,726; this figure is compiled as shown in Table 11.1.

Pedestrian use	Pedestrians
Existing pedestrian trips re-routing to the Scheme	4,207
New pedestrian trips using the Scheme	519
Totals	**4,726**

Table 11.1: Future pedestrian trips on the Scheme

Cyclists

11.2.8 The AMA also assessed the impact of the Scheme on cycle users.

11.2.9 The appraisal anticipated that the provision of the Scheme will encourage an increase in people opting to cycle due to the improved cycleway infrastructure provision as well as creating shorter journey lengths for some cycle trips.

11.2.10 The appraisal assumed a proportion of the existing and additional cyclists would cross a third central bridge if it was available. The proportion of existing cycle trips diverting to a new central bridge was assumed to be the same as the vehicular proportional change on the bridges, provided by the outputs of the traffic modelling. Therefore, as for pedestrians described in in the previous section above, the average of the AM and PM peak proportions (i.e. 42%) was used as a prediction of the percentage of cyclists that would divert from the existing crossing points to use the Scheme.

11.2.11 In order to estimate the uplift in demand that could result from the implementation of the Scheme, the appraisal conducted a desktop research exercise to find appropriate comparative studies of schemes that had been implemented in other relevant locations. The research identified a wide range in levels of increases in cycling from provision of additional, new and improved cycleways and footpaths. The appraisal considered an increase in cycling numbers in the range of 7.5% to 30% resulting from the Scheme.

11.2.12 In addition, the appraisal assumed that the provision of a new bridge between the two existing crossing points would reduce some current car user's journey lengths and / or time for some existing trips and thereby create further cyclist trips as car user's shift to cycling. This appraisal suggested a 15% increase in cycling trips would be expected as a result of the provision of a new bridge.

11.2.13 The 15% uplift value and the proportion of cyclists using the Scheme bridge instead of the existing bridges were applied to the expected DM cycle trips in 2021. The DM cycle trips were calculated using cycle survey data at the existing bridges from 2014 and TEMPRO growth factors for the study area (i.e. Lowestoft). From this estimates of existing cycle trips re-routing to the Scheme and new cycle trips using the Scheme were calculated.

11.2.14 The appraisal suggests that the number of cyclists that could be anticipated to use the Scheme per day could be 1,420; this figure is made up as shown in Table 11.2.

Cycle use	Cyclists
Existing cyclists re-routing to the Scheme	1,206
New cyclists using the Scheme	214
Totals	**1,420**

Table 11.2: Future cycle trips on the Scheme

11.3 Impact on Pedestrian Journey Times

11.3.1 Lowestoft is divided by the Lake and the opportunities to cross from the north and to the south of the town are limited. The existence of only two lake crossings, Mutford Bridge and the A47 Bascule Bridge, which have a distance of 3km between them, increases the length of some walking journeys, making these sustainable modes of travel less attractive. This is especially problematic for people walking between the central part of south Lowestoft, the town centre, or residential areas in north Lowestoft.

11.3.2 An example is shown in Figure 11.1, whereby a resident of Burnham Way, to the south of the town, wanting to travel to the North Quay Retail Park, a distance of one kilometre "as the crow flies", would have to travel 3.5km to get there via the Bascule Bridge which would take approximately 9 minutes by car. For a pedestrian, the trip would take approximately 44 minutes via the same route. Routing via the Scheme would reduce the journey distance by 1.7km to 1.9km, or a 24 minute walk.

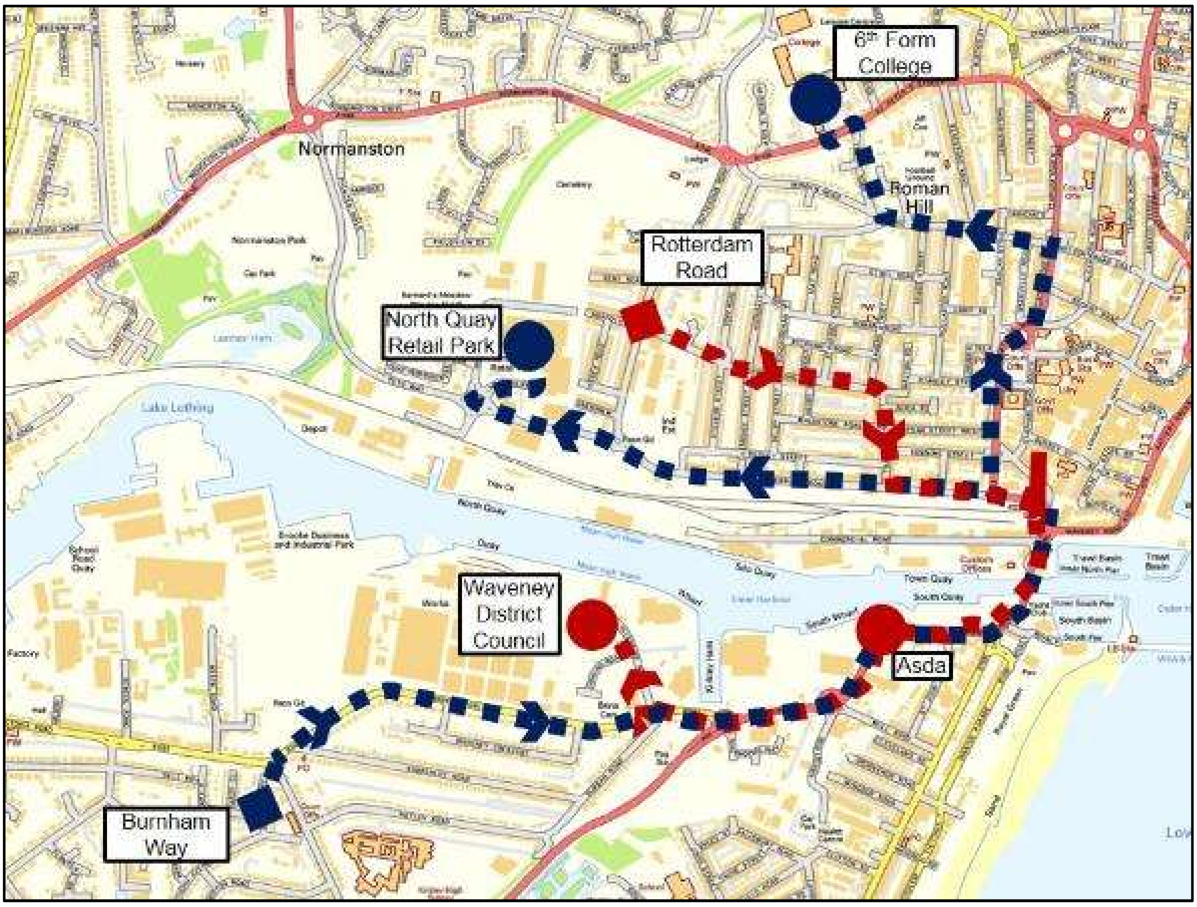


Figure 11.1: Examples of How the Lake Separates the Town and Increases Journey Length for Local Trips

11.3.3 The existing journey times for pedestrians accessing various locations both north and south of the Lake are shown in Table 11.3 along with the revised journey time crossing the Lake via the Scheme.

Origin	Destination	Existing Route		Future Route		Reduction	
		Distance	Time	Distance	Time	Distance	Time
Burnham Way (south of Lake)	North Quay Retail Park	3.5km	44mins	1.9km	24mins	1.7km	20mins
	Lowestoft 6th Form College	3.4km	43mins	2.0km	25mins	1.4km	18mins
Rotterdam Road (north of Lake)	Waveney District Council	2.5km	31mins	0.9km	11mins	1.6km	20mins
	Asda	2.0km	25mins	1.2km	15mins	0.8km	10mins

Table 11.3: Pedestrian Distances to Key Destinations

11.4 Census Data Analysis of Enhanced Population Amenity

11.4.1 2011 Census data has been analysed to further understand the impact of the Scheme on pedestrians and cyclists. To do this, three zones were identified:

- North of the bridge in the centre of the employment zone
- South of the bridge in the employment zone
- Town Centre

11.4.2 The number of people within walking distance of each zone is shown in Table 11.4, whilst those within cycling distance are shown in Table 11.5.

Distance (m)	Without Bridge			With Bridge			Difference		
	North	South	Town	North	South	Town	North	South	Town
400	266	178	556	314	179	559	48	1	3
800	1,542	1,320	3,915	1,601	1,408	3,951	60	88	36
1,200	3,308	2,566	4,279	3,621	2,838	4,378	313	271	98
2,000	4,657	5,225	3,804	6,096	6,170	3,951	1,439	945	147
Total	**6,914**	**5,234**	**5,595**	**9,798**	**7,815**	**5,463**	**2,884**	**2,580**	**-132**

Table 11.4: People within Walking Distance of the Zones (2011 Census Data)

Distance (m)	Without Bridge			With Bridge			Difference		
	North	South	Town	North	South	Town	North	South	Town
1,000	3,489	2,820	6,750	3,813	2,996	6,722	324	175	-28
2,000	12,735	11,764	11,322	16,967	15,289	11,285	4,232	3,525	-36
3,000	17,934	18,624	13,384	22,142	20,461	13,459	4,207	1,837	75
4,000	13,945	19,493	16,858	13,599	19,419	16,850	-346	-74	-8
5,000	10,577	11,651	13,664	9,101	84,00	13,654	-1,476	-3,251	-10
Total	**58,680**	**64,352**	**61,977**	**65,622**	**66,564**	**61,969**	**6,942**	**2,212**	**-8**

Table 11.5: People within Cycling Distance of the Zones (2011 Census Data)

11.4.3 It can be seen that the Scheme has little to no impact on pedestrian / cycle trips to / from the Town Centre, given that the majority of pedestrians and cyclists would continue to use the Bascule Bridge due to its proximity to the Town Centre. It is noted that the negative values shown for this zone are produced due to the way the extents of the area change within the calculation, which therefore means they intersect Census zones differently.

11.4.4 The Scheme can be seen to put an additional 2,884 people within walking distance and 6,942 people within cycling distance of the northern employment zone. For the southern employment zone, the Scheme can be seen to enable an additional 2,580 pedestrians and 2,212 cyclists to access the zone on foot / by bike. This analysis clearly highlights the improved pedestrian and cyclist connectivity and reduced severance as a result of the Scheme.

11.4.5 Isochrones which illustrate this analysis are contained in Appendix K.

11.5 Impact on Public Transport

11.5.1 The Scheme will directly benefit the commercially operated public transport services. Existing bus services would benefit from reduced congestion around the south of Lowestoft, especially around the Bascule Bridge. This will enable operators to provide an enhanced service to passengers through greater journey time reliability. The provision of the new crossing will also provide an opportunity for operators to provide additional or alternative bus routes in the future, to take advantage of the increased connectivity between north and south Lowestoft.

11.6 Impact on Collisions

11.6.1 The assessment of Scheme safety benefits was undertaken using Cost Benefit Analysis Light Touch (COBALT), the DfT's cost-benefit analysis software for accident savings. COBALT assesses the safety aspects of road schemes using detailed inputs.

11.6.2 Five-year collision data was obtained for Lowestoft between July 2012 and August 2017, and the assessment was based on a comparison of collisions by severity using 'Without-Scheme' and 'With-Scheme' forecasts from the SATURN model. The COBALT assessment was undertaken to assess the Scheme over a 60 year period (2022 to 2081) with an opening year of 2022 and design year of 2037.

11.6.3 The COBALT analysis estimates that 169 collisions will be saved over the 60-year appraisal period as a result of the Scheme, along with a saving of 294 casualties of varying levels of severity.

11.6.4 Further details of the collision analysis using COBALT are set out within the Economics Report submitted with the DCO application.

12 Residual and Cumulative Impacts

12.1.1 This Section considers the residual and cumulative impacts and benefits, which are reviewed and described in detail throughout this TA. The cumulative impacts of development are assessed within this TA through the inclusion of the development and infrastructure Uncertainty Log within the SATURN assessment and the resulting operational modelling, as described within Section 6 of this TA, i.e. it forms part of the DM and DS scenarios. As such, the residual cumulative impacts and benefits of the Scheme are considered within the context of the NNNPS and paragraph 32 of the NPPF.

12.1.2 On the basis of this assessment, it is acknowledged that the Scheme will have a considerable positive impact on the Lowestoft highway network. Journey times along key routes both north-south and east-west across Lowestoft will be improved, along with an improvement in journey times for more strategic routes through Lowestoft, including on the SRN.

12.1.3 Traffic flows on the A47 through the east of the town will also reduce, thereby relieving congestion on the SRN. The forecast flow across the Bascule Bridge following implementation of the Scheme will be circa 13,000 vehicles per day lower than in the future DM scenario.

12.1.4 The operation of the majority of junctions will remain within practical capacity and will operate well, with many junctions operating with greater residual capacity as a result of the Scheme. Only four junctions of the 21 assessed require improvements as a result of the increased traffic along the approaches to the Scheme, as discussed in Section 9, which will ensure that any negative impacts of the Scheme on junction operation are mitigated.

12.1.5 The transport benefits created through the implementation of the Scheme will act as a catalyst for regeneration and economic growth within the town, as set out within the Case for the Scheme and associated DCO documents.

12.1.6 Overall, the residual cumulative impact of the Scheme is beneficial and therefore cannot be considered to be severe in the context of paragraph 32 of the NPPF.

13 Summary and Conclusions

13.1.1 The provision of a third crossing of Lake Lothing has been an objective of SCC for many years. Following submission of an OBC in January 2016, government funding was approved, and the Scheme was categorised as a NSIP. Planning and other statutory consents for any development categorised as an NSIP are subject to an application to the Planning Inspectorate for a DCO. This TA is one of several documents that support the DCO application.

13.1.2 The TA helps to demonstrate the case for the Scheme by identifying existing traffic and transport problems in Lowestoft, and showing how the Scheme will address these. It provides a review of the expected transport impacts of the Scheme, and describes how any adverse impacts will be mitigated.

13.1.3 Lake Lothing and The East Suffolk (railway) Line divide Lowestoft into two parts, north and south, causing community severance and accessibility problems for general traffic, buses, cyclists and pedestrians. The problem is compounded by queuing and delay at the existing A47 Bascule Bridge at the harbour entrance, at the A1117 Mutford Bridge, and the level crossing, which create pinch points. Journeys for work and other purposes are long, slow and inefficient as a result, especially in the morning and evening peak periods. The problems of queuing and delay become even worse when the bridges have to be lifted, and therefore closed to traffic, in order to allow vessels to pass through.

13.1.4 Apart from the transport problems caused by the constraints of the Lake and The East Suffolk Line, other baseline transport conditions are adequate, with a reasonable provision of public transport, walking and cycling infrastructure and services.

13.1.5 The transport related objectives of the Scheme, are:

- To reduce congestion and delay on the existing bridges over the Lake;
- To reduce congestion in the town centre and improve accessibility;
- To reduce community severance between north and south Lowestoft;
- To encourage more people to walk and cycle, and reduce conflict between cycles, pedestrians and other traffic;
- To improve bus journey times and reliability; and
- To reduce collisions.

13.1.6 The Scheme comprises a new road crossing of Lake Lothing, with provision for vehicles, pedestrians and cyclists, together with approach roads and junctions. It will cross the Lake at a point about half way between the existing bridges. By building the Scheme in this central location it will improve connectivity between the two halves of the town and provide the crucial ‘missing link’ in a high standard route for north – south traffic, improving travel times and reducing congestion on the existing routes, and providing significant traffic relief to both of the existing crossings. The Scheme meets all relevant design standards and has been subject to a safety audit.

13.1.7 The Scheme aligns with national, regional and local planning policies and strategies. It will address congestion problems on the A47, part of the SRN, by reducing traffic, especially at the A47 Bascule Bridge which has been identified by Highways England as a bottleneck. It will improve access to the key regeneration areas around the Lake identified in local planning policy, and is expected to stimulate growth.

13.1.8 The TA has identified the key committed and potential development sites in the vicinity of the Scheme. These will generate traffic demand for the Scheme, whilst the Scheme will make them more attractive for regeneration by improving their accessibility.

13.1.9 Detailed and extensive traffic surveys have been undertaken to determine the baseline situation and to confirm the extent and severity of the problems identified. These include assessments of journey times, queuing and delays.

13.1.10 A strategic highway model (SATURN) has been used to test the strategic impacts of the Scheme. In particular it has been used to show that the Scheme will lead to reassignment of traffic from the more congested routes to the new crossing and its approaches. Tests have been carried out for base year (2016), opening year (2022) and design year (2037) scenarios, for morning and evening peak periods. Overall the Scheme will improve traffic flow and the operation of the network, especially around the existing bridges.

13.1.11 A more detailed microsimulation model has been developed and used to test the impact of the Scheme on the local road network in more detail, including a close examination of queuing and delay in the base, DM and DS scenarios. This demonstrates that the Scheme will be very effective in reducing queuing and delay, and improving network efficiency. The model has also been used to test the performance of the network under a range of possible bridge opening scenarios, both with and without the Scheme. Again, this shows that the Scheme will improve the operation of the local network under a range of future conditions.

13.1.12 Detailed modelling has been undertaken in order to assess the capacity and operation of a large number of junctions on the local highway network, both with and without the Scheme. In some cases, the Scheme will lead to additional traffic at junctions, requiring improvements to capacity. The TA proposes highway improvements where required, and provides further detailed assessments of junction performance to demonstrate that this will be effective in mitigating the impacts of the Scheme.

13.1.13 The assessments completed within this TA comply with the requirements of the NNNPS, as detailed within this TA and the CfTS. The Scheme is supported by WDC, the New Anglia LEP and the DfT[44].

13.1.14 The Scheme will deliver significant benefits in terms of reducing congestion and delay on the local road network and will alleviate a serious bottleneck on the SRN. Connectivity for pedestrians and cyclists will be improved with reduced severance and alternative route choices. The Scheme will support planned development and encourage regeneration, in line with national and local policy aims. Improvements to the local highway network have been proposed where required and will be secured by the DCO where relevant.

[44] Without prejudice to any decision by the SoS on the DCO application

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