Great Yarmouth Third River Crossing

Application for Development Consent Order

Document 7.2: Transport Assessment

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended) ("APFP")

APFP regulation Number: 5(2)(q)

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Foreword

This Transport Assessment accompanies an application ('the Application') submitted by Norfolk County Council ('the Applicant') to the Secretary of State 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 construction, operation and maintenance of a new bascule bridge highway crossing of the River Yare in Great Yarmouth, and which is referred to in the Application as the Great Yarmouth Third River Crossing (“the Scheme”).

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended) require that an application for a DCO be accompanied by the documents specified at Regulation 5(2)(a) to (r). This is one of those documents and is specified at Regulation 5(2)(q).

CONTENTS PAGE No.

Tables

Plates

Appendices

Appendix A – Traffic Data Collection Report
Appendix B – Paramics Local Model Validation Report
Appendix C – Paramics Forecast Report
Appendix D – Junction Assessment

Glossary of Abbreviations and Defined Terms

Term	Definition
The Applicant	Norfolk County Council (in its capacity as Highway Authority and promoter of the Scheme).
Application Site	The land bounded by the Order Limits, as shown by a red line on the Land Plans (document reference 2.5) and the Works Plans (document reference 2.6) and being land within which the authorised development may be carried out.
The APFP Regulations	The Infrastructure Planning (Applications - Prescribed Forms and Procedure) Regulations 2009 (SI 2009/2264).
Beacon Park Enterprise Zone Site	15.7 hectare site within the Great Yarmouth and Lowestoft Enterprise Zone which falls under the broader 'Space to Innovate' Enterprise Zone.
Bridge Lowered	Position of the bascule bridge where it is closed to vessels, and open to vehicular traffic, cyclists and pedestrians.
Bridge Raised	Position of the bascule bridge where it is closed to vehicular traffic, cyclists and pedestrians, and open to vessels.
Crossing	The combined double leaf bascule bridge and the Southtown Road bridge structure (i.e. from its junction with the new roundabout on William Adams Way to the new junction on South Denes Road).
Double Leaf Bascule Bridge	Opening span and mechanism needed to operate the bridge.
Eastern Power Networks plc	The licenced distribution operator for the distribution electricity network in Great Yarmouth.
The EIA Regulations	The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017.
Great Yarmouth Enterprise Zone Sites	Collective term for the South Denes and Beacon Park Enterprise Zone Sites, which form part of the broader Great Yarmouth and Lowestoft Enterprise Zone.
The Highways and Railways NSIP Order	The Highway and Railway (Nationally Significant Infrastructure Project) Order 2013 (SI 2013/1883).

Term	Definition
Kingsgate Community Centre	Kingsgate Community Centre is occupied by the Kingsgate Community Church, providing regular community events/activities, and a café.
Knuckles	The areas of the River Yare into which the proposed development extends (from the existing quay walls). These areas consist of the following: - Physical protection systems (which are protective structures provided adjacent to the bascule abutments) to fully or partial absorb the design ship collision loads from an aberrant ship or vessel. These protection systems are located on both the south and north of each bascule abutment. They consist of sheet piles driven to dense sands infilled with stone or granular material and capped with a reinforced concrete slab. - A bascule abutment which accommodates and allows the movement of the counterweight and houses the mechanical, electrical, instrumentation, control and automation systems. The bascule abutment consists of driven piles and reinforced concrete slabs and walls. - Plant and control rooms on the western side and plant rooms on the eastern side. - Vessel Impact Protection Systems located at the interface between the physical protection systems, the bascule abutments and the River Yare. There are knuckles on both the east and west sides of the River Yare.
MIND Centre and Grounds	Land located to the south of Queen Anne's Road, comprised within Plot Nos. 1-27, 2-03, 2-05, 2-06 and 2-07 on the Land Plans (document reference 2.5), which is currently leased to Great Yarmouth and Waveney Mind for the purposes of its charitable aims and objectives.
NCC	Norfolk County Council (other than in its Highway Authority role as promoter of the Scheme).
New Dual Carriageway Road	Description of road type on the Crossing.
NPS	National Policy Statement.

Term	Definition
NPS for Ports	National Policy Statement for Ports.
NPS NN	National Policy Statement for National Networks.
Order Land	Land that is proposed to be acquired and land over which new rights are proposed to be created and acquired, as shown on the Land Plans (document reference 2.5).
Opening Span	Length of bridge structure that opens.
Order Limits	Limits of land within which the authorised development may be carried out, as shown on the Land Plans (document reference 2.5) and the Works Plans (document reference 2.6).
The Outer Harbour	Part of the Port of Great Yarmouth, the deep water Outer Harbour (completed in 2010) is situated at the southern end of the South Denes peninsula and offers direct access to the North Sea.
The Planning Act	The Planning Act 2008.
The Port	The Port of Great Yarmouth, comprising both commercial quays on both sides of the River Yare and Outer Harbour and within the jurisdiction of the Great Yarmouth Port Authority.
Principal Application Site	The land comprised in the Application Site but excluding the Satellite Application Sites.
Proposed Scheme	Great Yarmouth Third River Crossing project at the time of statutory pre-application consultation.
Proposed Scheme Boundary	The boundary of the land within which the Proposed Scheme was proposed to be carried out, at the time of statutory pre-application consultation, as delineated by a red line on Figure 2.3 of the PEIR.
Reinforced Earth Embankment	A reinforced earth or reinforced soil embankment is a general term which refers to the use of placed or in situ soil or other material in which tensile reinforcements act through interface friction, bearing or other means to improve stability. The reinforced earth embankment is supported by driven piles and pilecaps.
Satellite Application Sites	The parts of the Application Site within which Work Number 13 may be carried out, as shown on the Works Plans (document reference 2.6) and

Term	Definition
	described in Schedule 1 to the draft DCO (document reference 3.1).
Scheme	The Great Yarmouth Third River Crossing project for which the Applicant seeks development consent.
Southtown Road Bridge	Bridge structure over Southtown Road.
South Denes Enterprise Zone Site	58.8 hectare site within the Great Yarmouth and Lowestoft Enterprise Zone which falls under the broader 'Space to Innovate' Enterprise Zone.
Statutory Designated Sites	Sites which have been designated under UK and in some cases European or international legislation which protects areas identified as being of special nature conservation importance.
Study Area	The boundary/extents of a specific assessment.
Underpass	The underpass beneath the Crossing, located on the east side of the River Yare, to be constructed to provide a new private means of access for the benefit of owners and occupiers of adjoining land.
Vessel Impact Protection Systems	These are specific protection systems located at the interface between the physical protection system, the bascule abutments and the River Yare. These systems will take the form of fenders or equivalent (formed of different materials) which are used to deflect or redirect an aberrant vessel away from the knuckles. The fenders are designed to provide required levels of protection to both vessels, the "knuckles" and the fenders themselves in accordance with national and international recommendations for the protection of bridge structures on navigable waterways.
Vessel Waiting Facilities	Provision of vessel waiting facilities to the north and south of the Crossing, either as floating pontoons or additional fendering to the existing berths, including any dredging and quay strengthening works that may be required.

Abbreviation	Definition
AADT	Average Annual Daily Traffic
AAP	Area Action Plan
AAWT	Annual Average Weekday Traffic
AAWT	Annual Average Weekday Traffic
ADMS	Atmospheric Dispersion Model System
AEP	Annual Exceedance Probability
AIA	Arboricultural Impact Assessment
AM	Ancient Monuments
AMCB	Analysis of Monetised Costs and Benefits
ANPR	Automatic Number Plate Recognition
AOD	Above Ordnance Datum
AONB	Area of Outstanding Natural Beauty
APIA	UK Air Pollution Information System
AQMA	Air Quality Management Areas
AST	Appraisal Summary Table
ATC	Automatic Traffic Counts
BCR	Benefit to Cost Ratio
BGL	Below Ground Level
BGS	British Geological Survey
BNL	Basic Noise Levels
BOD	Biological Oxygen Demand
BoR	Book of Reference
BPM	Best Practical Means
BS	British Standard
CA	Compulsory Acquisition (a power to acquire land, or to create and acquire new rights over land, compulsorily, for the purposes of constructing, operating and maintaining the Scheme)
CAS	Clean Air Strategy
CCME	Canadian Sediment Quality Guidelines for the Protection of Aquatic Life
CDE	Construction, Demolition and Excavation
CEA	Cumulative Effects Assessment

Abbreviation	Definition
CeFAS	Centre for Environment Fisheries and Aquaculture Science
CFMP	Catchment Flood Management Plan
CftS	Case for the Scheme
CIEEM	Chartered Institute for Ecological and Environmental Management
CIRIA	Construction Industry Research and Information Association
CJEU	Court of Justice of the European Union
COBA-LT	Cost and Benefits to Accidents – Light Touch
CoPA	Control of Pollution Act 1974
CoCP	Code of Construction Practice
CO2	Carbon dioxide
CoC	Contaminants of Concern
CPI	Consumer Price Index
CPO	Compulsory Purchase Order
CRTN	Calculation of Road Traffic Noise
CSM	Conceptual Site Model
CWS	County Wildlife Site
dB	Decibel
DCLG	Department for Communities and Local Government (as was)
DCO	Development Consent Order
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DM	Do Minimum
DML	Deemed Marine Licence
DMRB	Design Manual for Roads and Bridges
DO	Dissolved Oxygen
DoS	Degree of Saturation
DR	Design Report
DS	Do Something
EA	Environment Agency
EAR	Economic Appraisal Report
EAST	Early Assessment Sifting Tool

Abbreviation	Definition
EC	European Commission
EFT	Defra's Emission Factor Toolkit
EHOs	Environmental Health Officers
EIA	Environmental Impact Assessment
EM	Explanatory Memorandum
EQIA	Equalities Impact Assessment
EQS	Environmental Quality Standards
ES	Environmental Statement
EU	European Union
FBC	Full Business Case
FCTMP	Framework Construction Traffic Management Plan
FCWTP	Framework Construction Worker Travel Plan
FRA	Flood Risk Assessment
FTE	Full Time Equivalent
GA	General Arrangement
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIS	Geographic Information System
GLVIA	Guidelines for Landscape and Visual Impact Assessment
GP	General Practitioners
GQA	General Quality Assessment
GQRA	Generic Quantitative Risk Assessment
GVA	Gross Value Added
GWDTE	Groundwater Dependent Terrestrial Ecosystem
GYBC	Great Yarmouth Borough Council
GYPA	Great Yarmouth Port Authority
GYPC	Great Yarmouth Port Company
GYTRC	Great Yarmouth Third River Crossing
HAWRAT	Highways Agency Water Risk Assessment Tool
HAT	Highest Astronomical Tide
HDV	Heavy Duty Vehicle

Abbreviation	Definition
HE	Highways England
HE	Historic
HEHRE	Highways England Historic Railways Estate
HGV	Heavy Goods Vehicles
HLC	Historic Landscape Characterisation
HPI	Habitats of Principal Importance
HRA	Habitat Regulations Assessment
HSE	Health and Safety Executive
HUDU	Healthy Urban Development Unit
IAN	Interim Advice Note
IAQM	Institute of Air Quality Management
ICD	Inscribed Circle Diameter
IDB	Inland Drainage Board
IEMA	Institute of Environmental Management and Assessment
IMD	Indices of Multiple Deprivation
ISO	International Standards Organisation
IROPI	Imperative reasons of over-riding public interest
JNCC	Joint Nature Conservation Committee
kgCO2e	Kilograms of carbon dioxide equivalents
ktCO2e	Thousand tonnes of carbon dioxide equivalents
LAQM	Local Air Quality Management
LAT	Lowest Astronomical Tide
LDO	Local Development Order
LFRMS	Local Flood Risk Management Strategy
LGV	Light Goods Vehicle
LIQs	Land Interest Questionnaires
LLFA	Lead Local Flood Authority
LMVR	Local Model Validation Report
LNR	Local Nature Reserve
LOAEL	Lowest-observed-adverse-effect level
LoDs	Limits of Deviation

Abbreviation	Definition
LSE	Likely Significant Effects
LSOAs	Lower Layer Super Output Areas
MAD	Major Accidents and/or Disasters
MAGIC	Multi-Agency Geographic Information for the Countryside
MCC	Manual Classified Count
ME	Matrix Estimation
MHCLG	Ministry of Housing Communities and Local Government
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
MHWST	Mean High Water Spring Tide
MLWN	Mean Low Water Neap
MLWS	Mean Low Water Spring
MLWST	Mean Low Water Spring Tide
MMO	Marine Management Organisation
MMP	Materials Management Plan
MMQ	Mean Maximum Queue
MPS	Marine Policy Statement
MtCO2e	Million tonnes of carbon dioxide equivalents
NAEI	National Atmospheric Emissions Inventory
NBIS	Norfolk Biodiversity Information Service
NCC	Norfolk County Council (in all capacities other than Highway Authority acting as promoter of the Proposed Scheme)
NERC	Natural Environment and Rural Communities
NHER	Norfolk Historic Environment Record
NIA	Noise Important Areas
NIR	Noise Insulation Regulations (1975) (as amended) (SI 1975/1763)
NMU	Non-motorised user
NNR	National Nature Reserve
NPPF	National Planning Policy Framework (2019)
NOEL	No Observed Effect Level
NO2	Nitrogen Dioxide

Abbreviation	Definition
NOx	Nitrogen Oxides
NPSE	Noise Policy Statement for England
NPV	Net Present Value
NRA	Navigational Risk Assessment
NSIP	Nationally Significant Infrastructure Project
NSR	Noise Sensitive Receptor
O3	Ozone
OAR	Option Assessment Report
OBC	Outline Business Case
OCoCP	Outline Code of Construction Practice
OGV	Other Goods Vehicle
ONS	Office of National Statistics
OS	Ordnance Survey
PA	Public Accounts
PAH	Polyaromatic Hydrocarbons
PCM	Pollution Climate Mapping
PEA	Preliminary Ecological Appraisal
PEIR	Preliminary Environmental Information Report
PEL	Probable Effect Levels
PFRA	Preliminary Flood Risk Assessment
PHE	Public Health England
PIA	Personal Injury Accidents
PINS	Planning Inspectorate
PM	Particulate Matter
PM10	Particulate Matter to 10 microns
PM2.5	Particulate Matter to 2.5 microns
PMA	Private Means of Access
PPK	pence per kilometre
PPG	National Planning Practice Guidance
PPK	pence per minute
PPV	Peak Particle Velocity

Abbreviation	Definition
PRA	Preliminary Risk Assessment
PRC	Practical Reserve Capacity
ProPG	Professional Planning Guidance
PRoW	Public Rights of Way
PSD	Particle Size Distribution
PVB	Present Value of Benefits
PVC	Present Value of Costs
QRA	Quantified Risk Assessment
RBMP	River Basin Management Plan
RCP	Representative Concentration Pathways
RFC	Ratio of Flow to Capacity
RIGS	Regionally Important Geological and Geomorphological Study Area
RPA	Root Protection Area
RSI	Road Side Interview
RSPB	Royal Society for the protection of Birds
SAC	Special Areas of Conservation
SATURN	Simulation and Assignment of Traffic to Urban Road Networks
SDI	Social and Distributional Impact
SFRA	Strategic Flood Risk Assessment
SMP2	Shoreline Management Plan 2
SNCI	Sites of Nature Conservation Importance
SOAEL	Significant Observed Adverse Effect Level
SoR	Statement of Reasons
SoS	Secretary of State
SPA	Special Protection Area
SPI	Species of Principal Importance
SPZ	Source Protection Zones
SRN	Strategic Road Network
SSSI	Site of Special Scientific Interest
SWMP	Site Waste Management Plan
SuDS	Sustainable Drainage Systems

Abbreviation	Definition
tCO2e	Tonnes of Carbon Dioxide Equivalents
TA	Transport Assessment
TAG	Transport Appraisal Guidance
TCA	Townscape Character Area
tCO2	Tonnes of carbon dioxide equivalents
TDCR	Traffic Data Collection Report
TEE	Transport Economic Efficiency
TEL	Threshold Effect Levels
THI	Townscape Heritage Initiative
TOC	Total Organic Carbon
TP	Temporary Possession (a power to use and possess land temporarily for the purposes of constructing and maintaining the Scheme)
TPO	Tree Preservation Order
TUBA	Transport Users Benefits Appraisal
T&T	Turner and Townsend
UAE	Unacceptable Adverse Effect
UK	United Kingdom
UKCP09	UK Climate Projections 2009
UKCP18	UK Climate Projections 2018
UN/ECE	United Nations Economic Commission for Europe
UNFCCC	United Nations Framework Convention on Climate Change
UTC	Urban Traffic Control
UXO	Unexploded Ordnance
VA	Vehicle Actuated
VDV	Vibration Dose Value
VfM	Value for Money
VMS	Variable Message Sign
VOC	Vehicle Operating Costs
WAC	Waste Acceptance Criteria
WebTAG	Web Transport Analysis Guidance
WFD	Water Framework Directive

Abbreviation	Definition
WITA	Wider Impacts in Transport Appraisal
WLMP	Water Level Management Plan
Wm-2	Watts per square metre
WQS	Water Quality Standards
ZTV	Zone of Theoretical Visibility

Executive Summary

Introduction

This Transport Assessment (the 'TA') assesses the expected transport impacts of the proposed Great Yarmouth Third River Crossing ('the Scheme'). In doing so, it also sets out the transport case for the Scheme.

It should be read in conjunction with the Case for the Scheme and other documents accompanying the DCO.

Scope of the Transport Assessment

The TA describes the existing, or baseline, conditions, based on recent transport surveys, highlighting the existing problems of congestion, delay and poor accessibility. It explains how transport models were used to forecast future traffic conditions, showing that, without intervention, the problems would get worse. It then describes the Scheme and assesses its transport impacts, showing how it will tackle many of the problems by improving journey times and reducing congestion and delay. It systematically assesses the positive and negative transport impacts of the Scheme and considers how any negative impacts can be managed or mitigated.

Existing Problems

The existing transport problems which the Scheme is designed to address arise mainly from the physical layout of the town and the inadequacies of its transport network.

Situated on the east coast of England, Great Yarmouth lies on the A47 (formerly the A12) trunk road which connect the town with Norwich in the east and Lowestoft to the south. The western part of the town is therefore well connected to the national strategic road network (the 'SRN'). The town is, however, divided in two by the River Yare, which means that the eastern part of the town lies on a long peninsula. The Port, the Outer Harbour, the South Denes industrial estate and Enterprise Zone, and the sea front are all located on the peninsula, and do not have direct access to the SRN.

There are no bridges leading directly to southern part of the peninsula. The only available river crossings are the A47 Breydon Bridge and the A1243 Haven Bridge. All traffic, including heavy vehicles, needing to access the southern part of the peninsula has no choice but to pass through the town centre, which is located at the northern end. This results in long journey times, especially for trips from the south, traffic congestion, especially in the area around Haven Bridge, and delays. The problem of inaccessibility to the southern part of the peninsula also affects pedestrians and cyclists, whilst traffic congestion affects bus services. Taken together, these problems make the eastern part of Great Yarmouth relatively inaccessible for local people, visitors and businesses, detracting from the town centre and making it more difficult to encourage development in the Enterprise Zone.

Better accessibility is needed to support growth in the town, especially in its key role as a supply port for the growing offshore energy industry.

Public consultation on the Great Yarmouth and Gorleston Area Transportation Strategy in 2009 revealed that 68% of local residents considered traffic congestion the most serious transport problem in the town. In a subsequent statutory consultation on the Scheme in 2018, 68.3% of respondents agreed that the Scheme is needed and 56.5% said that they agreed that it would achieve the objectives of reducing congestion and improving journey times to/from the South Denes peninsula.

The Proposed New Bridge

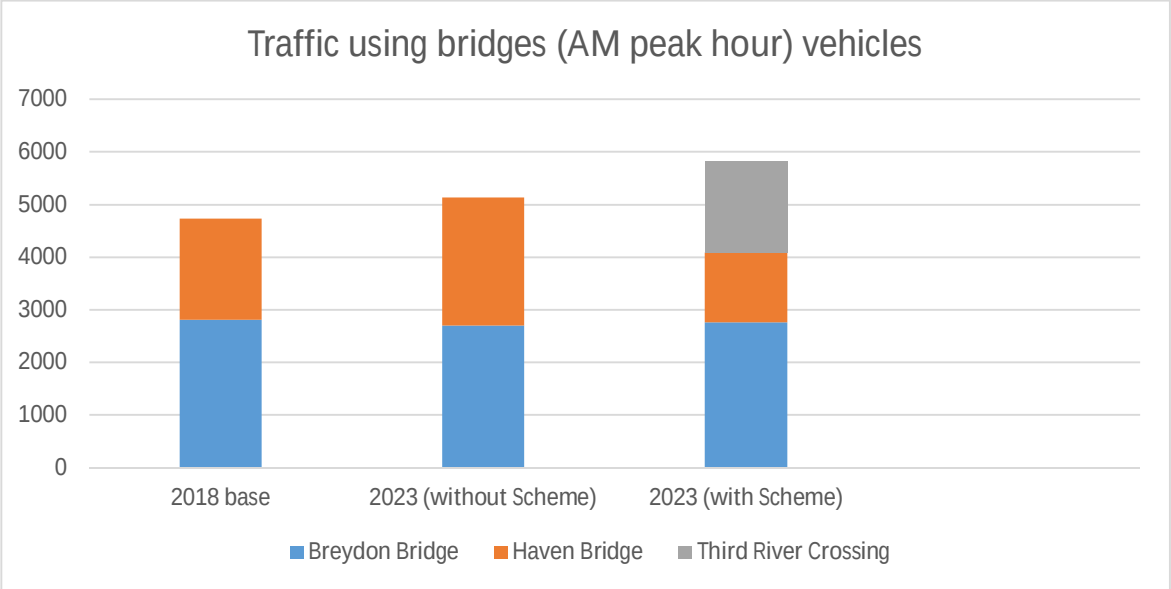
A new Double Leaf Bascule Bridge will be provided to carry a dual carriageway road across the River Yare, opening when required to allow vessels to pass through. It will link the A47 at Harfrey's Roundabout on the western side to the A1243South Denes Road on the eastern side, creating a new, direct link between the two sides of the town for vehicles, pedestrians and cyclists.

Transport impacts of the Scheme

Chapter 7 of the TA describes in detail how transport conditions are expected to change in future, both with and without the Scheme. It shows that the Scheme will significantly reduce key journey times, reduce congestion and delay, especially in the town centre, and improve accessibility to the Outer Harbour and key sites on the eastern side of the town. Some key findings are summarised below.

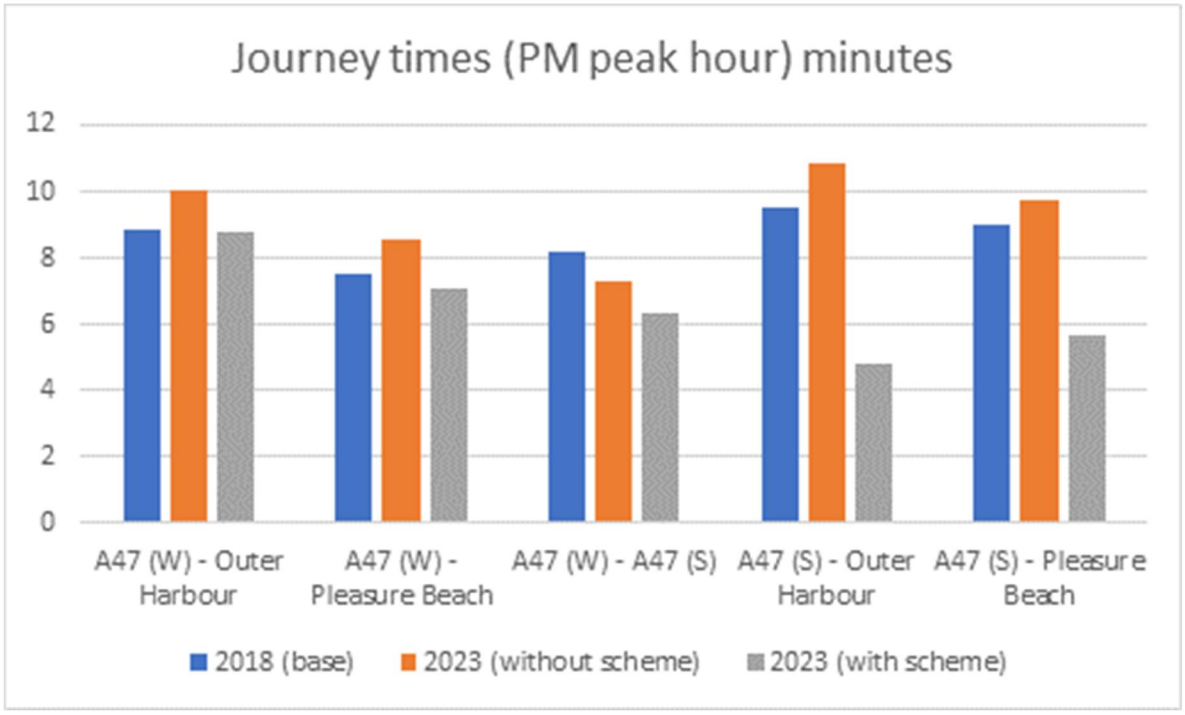
Use of the existing bridges

Traffic on the A1243 Haven Bridge will be reduced by about 41% - 45% as traffic transfers to the new crossing. This is a very significant reduction, and more than compensates for the expected growth in traffic between 2018 and 2023 when the Scheme is due to open. It shows that the new bridge will provide an attractive alternative for trips into the peninsula, and that traffic will be removed from less suitable routes through the town centre.



Journey time savings

Journey times to destinations on the peninsula will be significantly reduced as a result of the Scheme. The greatest benefit will be experienced by traffic between the A47 (south) and the Outer Harbour, where average journey times are forecast to reduce by 4.7 minutes in the morning peak hour and 6.1 minutes in the evening peak. Other trips will experience time savings as well. Taken together, these represent very large time savings for local people, visitors and businesses, and make a big contribution to the calculated transport economic benefits of the Scheme.



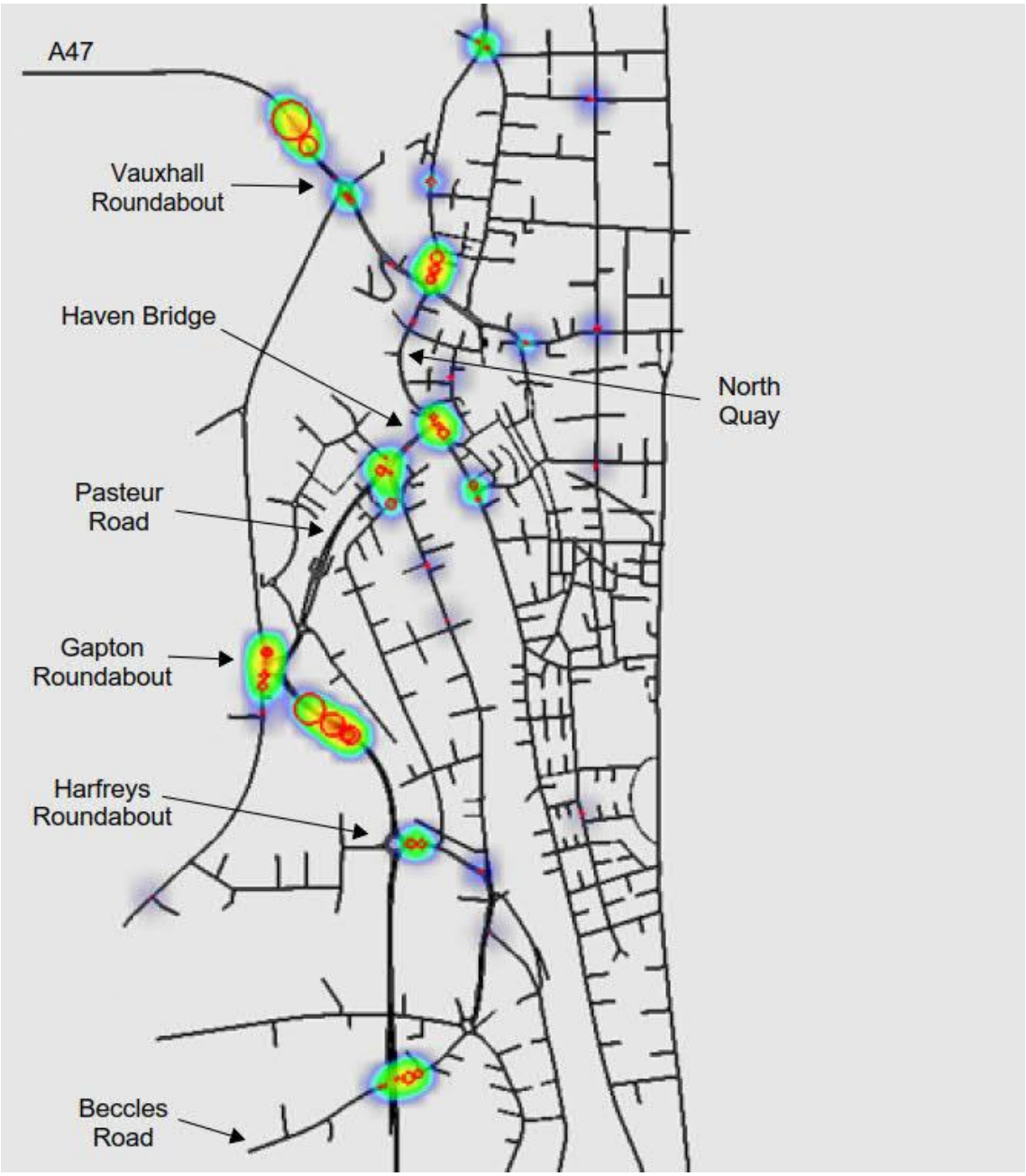
The average journey time saving for vehicles across the whole study network (including many vehicles that do not use the Scheme itself) is 30 seconds in the morning peak and 66 seconds in the evening peak. This is a significant net benefit in terms of journey time savings which translates into a considerable net transport economic benefit.

Reduced congestion, queuing and delay

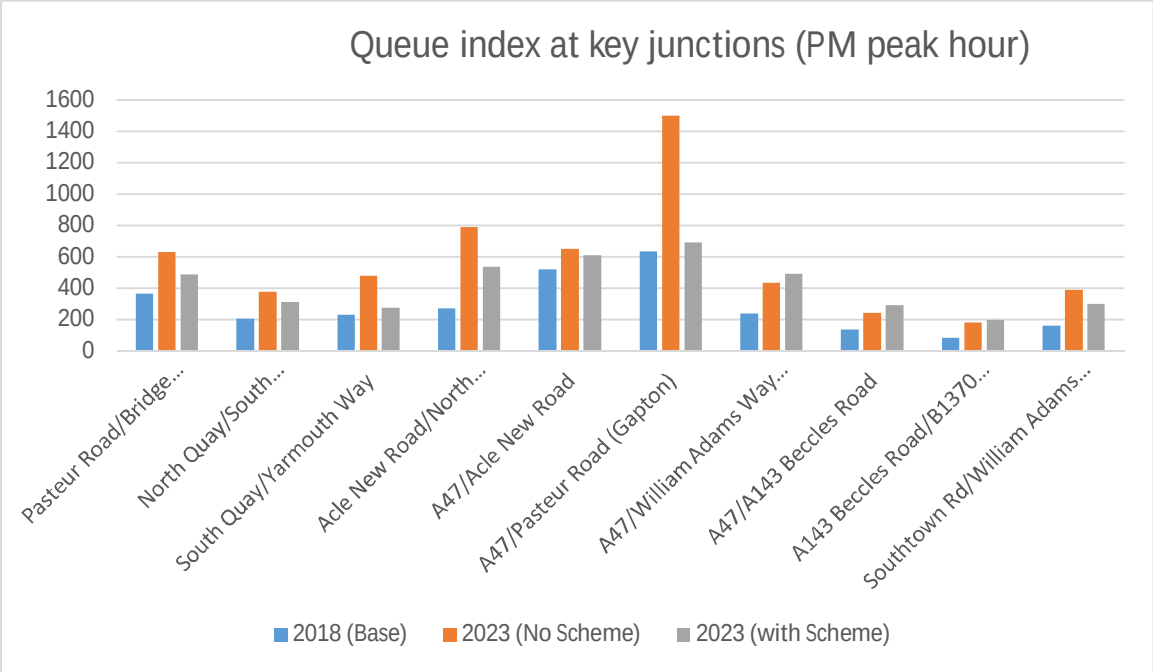
The TA assesses the scale of the existing congestion problem and the expected impact of the Scheme in a number of ways.

A “heat map” produced using the traffic simulation model shows a snapshot of areas where queuing is forecast within the network at a particular moment in time. It uses a colour scale from blue to red, with red indicating areas with the greatest congestion. This simulation bears out the anecdotal information that congestion is a problem around Haven Bridge and the town centre, at Gapton roundabout on the A47, and at other busy junctions on the A47.

Highways England (‘HE’) is planning improvements to the A47 junctions at Great Yarmouth, and these have been taken into account in the assessment by including them in the “do minimum” and “do something” traffic models. Improvements to the trunk road, though important for Great Yarmouth, will not however solve the problem of poor access between the A47 and the eastern part of the town which the Scheme is designed to address.


A47
Vauxhall Roundabout
Haven Bridge
North Quay
Pasteur Road
Gapton Roundabout
Harfreys Roundabout
Beccles Road

The TA quantifies the problem of congestion and delay by examining key junctions in detail, both in the 2018 base situation and in 2023 with, and without the Scheme. The results are set out in detail in Section 7.6 and illustrated[1] very simply below:



The graph illustrates a critical aspect of the transport case for the Scheme. Without the Scheme, congestion (as indicated by queuing) at these junctions is forecast to increase between 2018 and 2023, even with the A47 improvements, mainly because of forecast traffic growth. The effect of the Scheme, in seven out of the ten cases, would be to reduce the amount of congestion (as indicated by queuing). This reduction is relative to the more serious queuing that would occur if the Scheme was not built. For example, at Gapton roundabout the forecast aggregate queue increases from 633m in 2018 to 1496m in 2023. With the Scheme in place this reduced to 689m in 2023. At the junctions closest to the Scheme, congestion would increase. This is a particular issue at A47/William Adams Way (Harfrey's Roundabout) and the junctions on A143 Beccles Road, as the Scheme will tend to draw traffic through this area, instead of the area around Haven Bridge.

Detailed examination of the forecasts shows that the net impact of the Scheme is beneficial (the reduction in congestion at Gapton more than compensates for the increase at Harfreys). A detailed assessment of queuing on each junction approach

[1] The queuing index is based on the total of the mean maximum queue lengths (in metres) on all approaches. It is a simple way of indicating changes in the amount of queuing at a junction. Detailed definitions and forecasts of queue lengths on each junction approach, and changes in these due to the Scheme, are set out in Chapter 7.

demonstrates that in every case the mean maximum and absolute maximum queues forecast for 2023 can be accommodated within the local network without blocking other key junctions.

Congestion at 2038 levels of demand

The performance of the local road network has also been assessed at 2038 levels of demand. The results of this high-level analysis are very striking. It predicts that, without the Scheme, there would be insufficient capacity in the network to accommodate the higher level of demand. Congestion would increase to a point where a significant proportion of journeys would not be able to take place or – having started – could not be completed within the peak hour. Such congestion could deter investment and constrain the economic growth of the Port and employment areas.

By contrast, with the Scheme these adverse traffic conditions would be substantially averted. This indicates that the Scheme is needed to provide additional capacity and create the conditions in which growth can take place.

An explanation and assessment of the 2038 forecasts is set out in Section 7.7 and especially 7.8. This demonstrates that, even at 2038 levels of growth, the forecast demand could be accommodated with tolerable levels of queuing in most locations. By contrast, the DM assessment at 2038 indicates that, without a new crossing, the network would be incapable of accommodating forecast demand. Congestion would be widespread and trip making and growth would be inhibited.

Impacts on buses, and on walking and cycling

Whilst the main impacts of the Scheme will result from changes to vehicular routes, journey times and congestion, it will also have benefits for other modes of transport.

It is forecast that the Scheme will lead to a general reduction in bus journey times, benefiting passengers throughout the network. Some individual routes could experience savings of up to 2 minutes in the evening peak. Potentially, the biggest benefits are that the Scheme will also allow operators to consider amending some bus routes to make use of the new bridge, and this could lead to even bigger time savings and accessibility benefits for users of those routes.

The Scheme will create a new route into the peninsula for pedestrians and cyclists, making it much easier and quicker for users of these active modes of transport to travel between the eastern and western parts of the town. An assessment of journey times between Peggotty Road Community Centre on the eastern side of the River Yare and Southtown Common on the western side shows that savings of 35 minutes for pedestrians and 10 minutes for cyclists are forecast with the Scheme in place. The economic value of these benefits has been calculated at over £10 million over the appraisal period.

Other benefits – safety, resilience and heavy loads

The Scheme is expected to save over 50 road accident casualties over a 60-year appraisal period.

By providing additional highway capacity, the Scheme will increase the resilience of the local highway network. This would be particularly valuable when the Haven Bridge is closed for maintenance.

The Scheme would also provide a more appropriate, and in many cases shorter, route for large and heavy loads to and from the Outer Harbour and South Denes, enabling these to avoid the Haven Bridge.

Conclusions

Great Yarmouth is one of the most easterly towns in England. Its relative isolation, in transport terms, is made worse by it also being divided by the River Yare. Areas designated for employment and regeneration, including the Outer Harbour, are separated from the rest of the town and the SRN by the river, forcing traffic through town centre. Congestion is already a problem and is forecast to get worse by 2023, becoming as traffic increases in the longer term. The Scheme will effectively resolve these problems by providing a new, much shorter link between the Strategic Road Network and the eastern part of the town, avoiding unsuitable roads in the town centre. Overall it will reduce journey times, queuing and congestion, generating significant transport economic benefits.

1 Introduction

1.1 This Document

1.1.1 This document is the TA for the proposed Great Yarmouth Third River Crossing ("the Scheme"). It supports an application ("the Application") by Norfolk County Council ("the Applicant") for a Development Consent Order (DCO) for the Scheme.

1.2 Structure of the Transport Assessment

1.2.1 This TA comprises:

- Chapter 1 Introduction
- Chapter 2 Policy Context
- Chapter 3 Existing Site Information
- Chapter 4 Baseline Transport Data
- Chapter 5 The Scheme
- Chapter 6 Assessment Methodology
- Chapter 7 Transport Impacts
- Chapter 8 Mitigation of Transport Impacts

1.3 Overview of the Scheme

1.3.1 The location of the Scheme is shown in Plate 1-1.

1.3.2 The Scheme involves the construction, operation and maintenance of a new crossing of the River Yare in Great Yarmouth. It consists of a new dual carriageway road across the river, linking the A47 at Harfrey's Roundabout on the western side to the A1243 South Denes Road on the eastern side. It features an opening span Double Leaf Bascule Bridge across the river, which will involve the construction of two "knuckles" that extend the quay wall into the river. The new dual carriageway will also have a clear span over Southtown Road on the western side of the river, as it rises to the centre of the new crossing.

1.3.3 The Scheme will create a new, direct link between the western and eastern parts of the town. It will substantially improve connectivity between the A47 (part of the SRN) and significant destinations on the South Denes peninsula, including the South Denes Business Park, Great Yarmouth Energy Park, the

Port and Outer Harbour, including part of the Great Yarmouth and Lowestoft (New Anglia) Enterprise Zone.

1.3.4 The Scheme is described in more detail in Section 5.

Plate 1-1: Location of the Scheme

1.4 The Need for a Third River Crossing

1.4.1 The Scheme will provide a third crossing of the River Yare, creating a direct link into the southern part of the peninsula. It will greatly improve access to the Port, Outer Harbour, employment areas, seafront and residential areas. It will connect the peninsula and Port to the SRN, improve resilience for Port activities and support the role of the Port as an international gateway.

1.4.2 The need for a third river crossing is discussed below and evidenced in more detail in this TA.

1.4.3 Great Yarmouth is located at the mouth of the River Yare, one of the main waterways providing access to the Norfolk Broads. As illustrated in Plate 1-1, the river divides Great Yarmouth in two, with the town centre, seafront, industrial areas and Outer Harbour located on the narrow, 4 km long, South Denes peninsula between the river and the sea, isolated from the rest of the town. To the west of the River Yare, Gorleston-on-Sea is just a few hundred metres away as the crow flies but over 7km by road.

1.4.4 Great Yarmouth is considered to be England's premier offshore support port[2]. The deep water Outer Harbour at the southern end of the peninsula is strategically located to serve the oil and gas fields of the southern North Sea, as well as existing and planned NSIP offshore wind developments along the east coast of England. The Outer Harbour provides state-of-the-art facilities for larger offshore vessels, complementing the long-established facilities for offshore operations and maintenance in the river port. Great Yarmouth is also an established general and cargo port, offering the shortest North Sea crossing between Great Britain and continental Europe. It handles a wide range of cargoes including aggregates, cement, grain, fertilisers, forest products and dry and liquid bulks.

1.4.5 The Great Yarmouth and Lowestoft (New Anglia) Enterprise Zone includes two sites in Great Yarmouth: South Denes and Beacon Park. The South Denes Enterprise Zone, Business Park and Great Yarmouth Energy Park are located on the southern part of the peninsula (see Plate 3-4). The regeneration of this area is a key element of the Norfolk and Suffolk Economic Strategy and the Great Yarmouth Local Plan Core Strategy.

1.4.6 The Beacon Park Enterprise Zone is located in the south of Great Yarmouth, as shown in Plate 1-1. The two Enterprise Zone sites are separated by the

[2] East of England Energy Group, East of England Fabrication Directory, 2014

River Yare, and all traffic between them currently has to pass through the town centre. This hampers the regeneration aspirations of the town centre and stifles the links and synergies between the Enterprise Zone sites.

1.4.7 Through traffic on the A47 crosses the River Yare on the Breydon Bridge, to the north of the town centre. Access to the peninsula from the south, and from the western part of the town, is provided by the Haven Bridge at the northern end of the peninsula, which leads directly into the town centre. Both are lifting bridges. There are no crossings further south giving more direct access to the peninsula. The main industrial areas and deep water Outer Harbour are therefore up to 4 km from the nearest bridge. Access to the sea-front is similarly constrained, with all vehicles, cyclists and pedestrians from the south, and from the western parts of the town, having to use the bridges at the northern end of the peninsula.

1.4.8 The existing river crossings do not provide adequate access to the Port and employment areas in the southern part of the South Denes peninsula. The lack of a bridge further south means that traffic is forced onto unsuitable routes within the town centre, including the historic South Quay.

1.4.9 Congestion, especially on the Haven Bridge, causes delays and makes journey times unreliable. The mixture of port-related and local traffic makes it more difficult for people to access the town centre, seafront, and leisure facilities. The lack of a direct river crossing makes Great Yarmouth seem remote, and discourages inward investment. Bus users, cyclists and pedestrians have long, indirect journeys into the peninsula, which discourages commuting to work by more sustainable modes.

1.4.10 Traffic levels are forecast to increase. With the present inadequate road network, this means congestion will continue to get worse in the future. A new river crossing is needed to improve connectivity from the strategic road network ("the SRN") to the Port and the Enterprise Zone, and to accommodate traffic growth without making existing problems worse. Without a new crossing, the full potential for growth in the Enterprise Zone and the area around the Port and Outer Harbour may not be realised because of congestion and delay on the existing routes into the peninsula.

1.4.11 The Scheme has been developed to address these issues and meet the present and future needs of the town.

1.5 Objectives of the Scheme

1.5.1 The objectives of the Scheme are:

- To support Great Yarmouth as a centre for both offshore renewable energy and the offshore oil and gas industry, enabling the delivery of

renewable energy Nationally Significant Infrastructure Projects and enhancing the Port's role as an international gateway;

- To improve access and strategic connectivity between Great Yarmouth port and the national road network thereby supporting and promoting economic and employment growth (particularly in the Enterprise Zone);
- To support the regeneration of Great Yarmouth, including the town centre and seafront, helping the visitor and retail economy;
- To improve regional and local access by enhancing the resilience of the local road network, reducing congestion and improving journey time reliability;
- To improve safety and to reduce road casualties and accidents, in part by reducing heavy traffic from unsuitable routes within the town centre;
- To improve access to and from the Great Yarmouth peninsula for pedestrians, cyclists and buses, encouraging more sustainable modes of transport and reducing community severance and;
- To protect and enhance the environment by reducing emissions of greenhouse gases and minimising the environmental impact of the Scheme.

1.6 Need for a Transport Assessment

1.6.1 Paragraph 111 of the National Planning Policy Framework (NPPF), states that all developments that generate significant amounts of movement should be required to produce a Travel Plan, and the application should be supported by a Transport Statement or TA. It further defines a transport statement as a simplified version of a TA where it is agreed the transport issues arising from development proposals are limited and a full TA is not required.

1.6.2 The Scheme has the potential to cause significant changes to the pattern of movement in Great Yarmouth. Although this will mainly involve the reassignment of trips to different routes, rather than the generation of new trips as a result of the Scheme itself, it is considered that the Scheme will require a TA, and this approach was agreed with the NCC development planning officer. A Framework Construction Travel Plan has also been produced (document 6.16B)

1.6.3 Following a direction from the Secretary of State (SoS) under Section 35 of the Planning Act 2008, the Scheme has been categorised as a Nationally Significant Infrastructure project (NSIP). NSIPs require an application for Development Consent Order (DCO) to be made to the Planning Inspectorate (PINS). This TA supports the application for a DCO for the Scheme.

1.7 Scope of the Assessment

1.7.1 This TA has been undertaken in line with the National Policy Statement for National Networks (NPS NN), National Policy Statement for Ports and National Planning Policy Framework (NPPF), National Planning Practice Guidance (NPPG) and national and regional standards and guidelines, as well as the Department for Transport's web-based Transport Appraisal Guidance (WebTAG).

1.7.2 The TA considers:

- the existing (baseline) situation
- the impacts of the Scheme on roads and traffic
- the impacts of the Scheme on walking and cycling
- the impacts of the Scheme on public transport by bus and rail
- the mitigation of transport impacts

1.7.3 By assessing these impacts under existing conditions (the baseline) and then with and without the Scheme in the future (the "do something" and "do minimum" scenarios) the assessment demonstrates:

- that there is a strong transport case for the Scheme
- that the net transport impacts are overwhelmingly beneficial

1.7.4 The TA does not consider:

- the impacts of the Scheme on shipping and marine operations
- traffic-related construction impacts

1.7.5 The impacts on shipping have been assessed in Chapter 14 (People and Communities) of the Environmental Statement (ES).

1.7.6 The traffic-related construction impacts have been assessed in Chapter 17 of the ES

2 Policy Context

2.1 Overview

2.1.1 The alignment of the Scheme with relevant national, sub-national and local policies and strategies is described in detail in the Case for the Scheme ("CftS") including the Planning Statement.

2.1.2 The CftS shows that the Scheme is generally compliant with national policies and strategies for transport, industry and ports, as well as local policies including the Great Yarmouth Local Plan Core Strategy (2013 – 2030), the Norfolk Local Transport Plan, and the Great Yarmouth Economic Growth Strategy 2017 – 2021.

2.1.3 Common themes in the local policies and strategies are:

- The importance of good transport connectivity to Ports
- The need and opportunity for economic regeneration in Great Yarmouth
- The potential for growth associated with the offshore energy industry, especially in the Enterprise Zone and Outer Harbour
- The need to address a lack of adequate links between potential development areas on the peninsula and the SRN, especially to the A47 (south)
- The need to address heavy traffic on the existing bridges, and congestion in adjacent parts of the town centre
- The need for a third crossing of the River Yare to provide traffic relief, and better access to strategic routes, supporting regeneration and growth on the peninsula and the town centre

2.1.4 The vision for Great Yarmouth conveyed by these policies is for a once prosperous town to take advantage of the new opportunities for growth and regeneration afforded by offshore energy, commercial and port-related development and tourism, by dramatically improving accessibility and by providing traffic relief to the historic centre: a more prosperous town, and a better place in which to live.

2.1.5 The Scheme will support this vision by providing better transport links between existing and planned development and the SRN, reducing congestion and the impact of traffic on the town, and creating new opportunities for journeys by sustainable modes of transport.

3 Existing Site Information

3.1 Overview

3.1.1 This chapter describes:

- The location of the Proposed Scheme
- Existing land uses
- Planned or potential future land uses
- Air Quality Management Areas
- Abnormal load routes

3.2 Location of the Scheme

Surrounding Area

3.2.1 The Scheme is located in Great Yarmouth, on Norfolk's North Sea coast, about 30 km east of the County town, Norwich. It is further east than any other town in Britain except Lowestoft, as shown in Plate 3-1. The Borough of Great Yarmouth a population of about 99,400[3].

3.2.2 Great Yarmouth is connected to Norwich by rail, and by the A47 road which is part of the SRN. It is linked to Lowestoft by the A47 road (formerly the A12), also part of the SRN.

3.2.3 Great Yarmouth is located at the mouth of the River Yare, one of the main waterways providing access to the Norfolk Broads. By virtue of its location, the town is relatively isolated. Despite this, Great Yarmouth is an important employment centre and tourist destination. The town caters for over 5 million day visits and over 4 million visitor nights each year.

Location within Great Yarmouth

3.2.4 Plate 3-2 shows the location of the Scheme within the built-up area of Great Yarmouth. The River Yare divides the town in two, with the town centre,

3 3 Office of National Statistics (unknown) NOMIS [online] Available at https://www.nomisweb.co.uk/https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/uklabourmarket/previousReleases [Accessed 19th November 2018]

seafront, leisure facilities, industrial areas and Outer Harbour located on the narrow, 4 km long, South Denes peninsula between the river and the sea, isolated from the rest of the town. To the west of the River Yare, Gorleston-on-Sea is just a few hundred metres away as the crow flies, but over 7km distant by road.

3.2.5 The Scheme will provide a new crossing of the River Yare, about 1.6km further south than the existing Haven Bridge, creating a more direct link between the southern part of the peninsula and the A47 trunk road. It will greatly improve access to the port, Outer Harbour, employment areas, the seafront, leisure facilities and residential areas.

Site of the Scheme

3.2.6 Plate 3-3 shows the location of the Scheme in relation to its more immediate surroundings. It will run between the A47 at Harfrey's roundabout on the west side of the river and the A1243 South Denes Road on the east side.

3.3 Permitted and Existing Use of the Site

3.3.1 Land within the Application Site and surrounding areas is in a mixture of private and public ownership. Private landholdings are owned by various parties. The public-sector landholdings, including residential properties, are owned by Highways England, Norfolk County Council (NCC) and GYBC.

3.3.2 The Application Site also includes a section of the River Yare used for berthing and as a navigation channel for commercial and leisure vessels. In addition, six sections of road that would be improved via variable message signage VMS (to advise of the status of the bridge) are also included within the Application Site. The six sections of road are located along (from south to north): A47 (south of western junction improvement); Gapton Hall Road; Yarmouth Way; Fullers Hill; North Quay and Acle New Road. The Application Site for all these six sites lies within the existing highway boundary.

3.3.3 There are a number of local businesses located within the Application Site and surrounding area. Local businesses, including the Kings Centre and Simpsons New and Used Motorhomes, are located off Queen Anne's Road and Suffolk Road. Businesses are also located off Suffolk Road, including, but not limited to, Space 4 U Storage Ltd and Great Yarmouth Day Services.

3.3.4 Harfrey's Industrial Estate is situated immediately west of the A47 / Williams Adam Way roundabout and comprises a variety of mixed industrial premises. To the east of the River Yare, an industrial area including UK Power Networks (UKPN), Asco, and Perenco is located adjacent to the river.

Plate 3-1: Location of Great Yarmouth

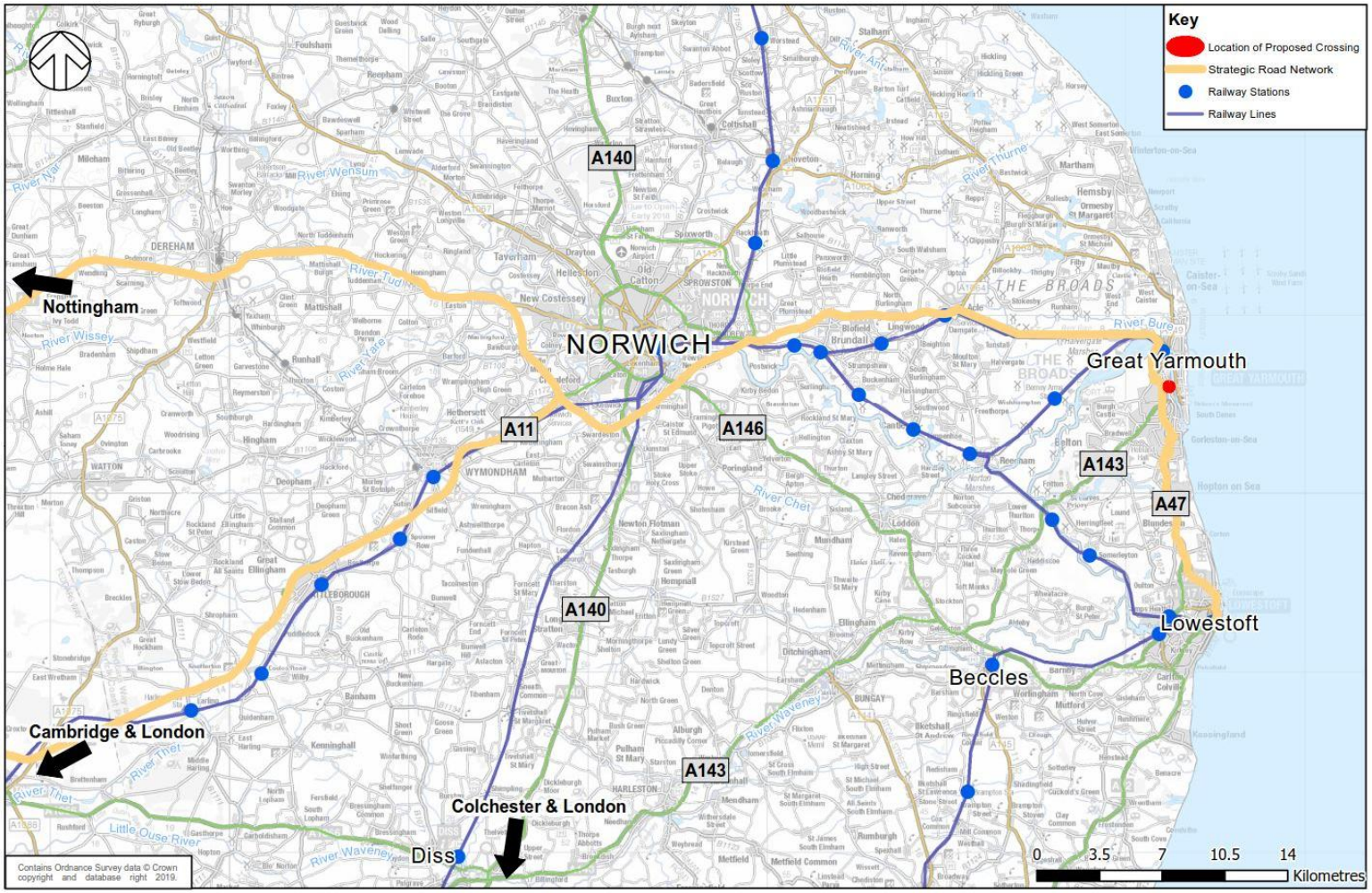


Plate 3-2: Location of the Scheme in Great Yarmouth

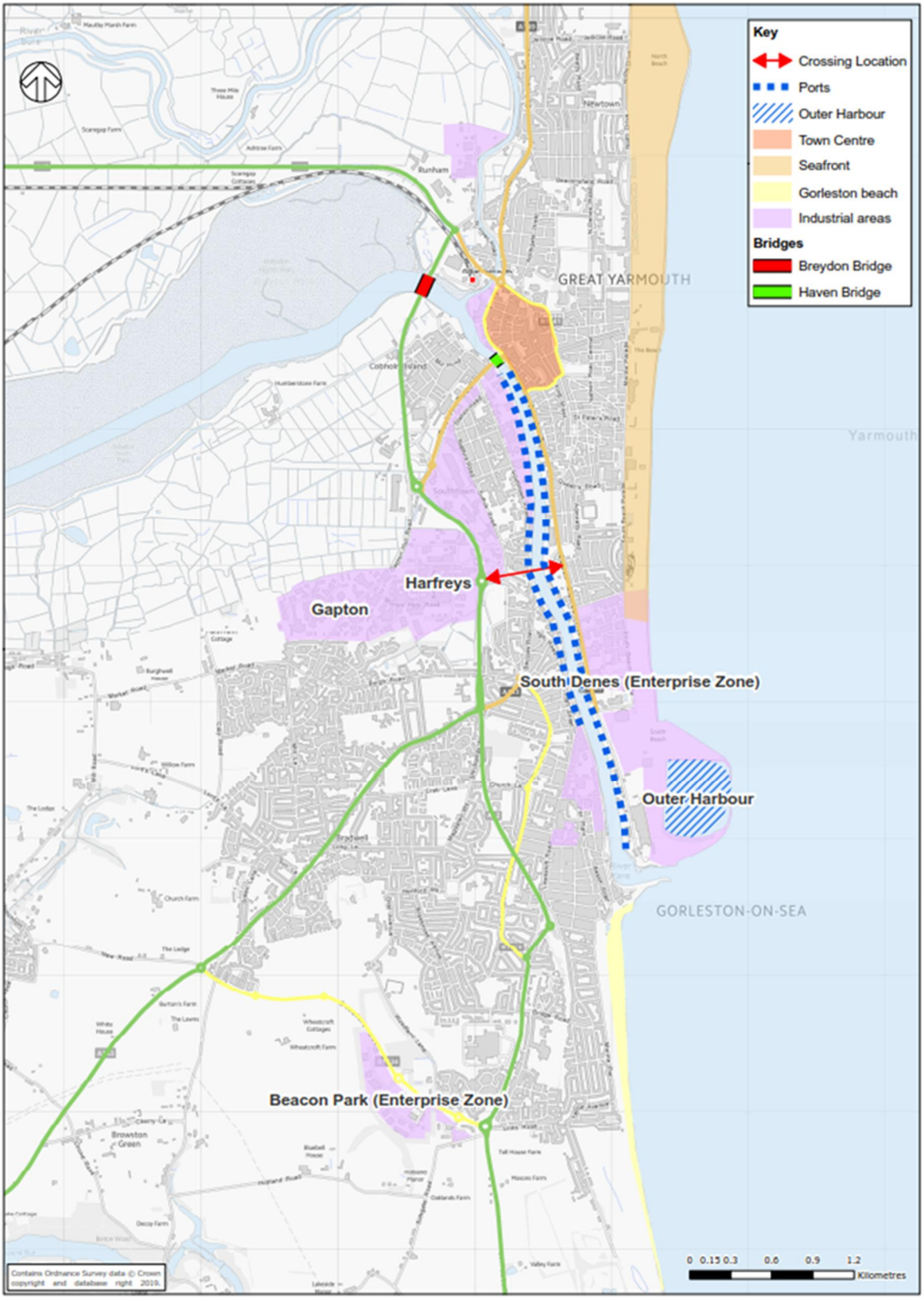
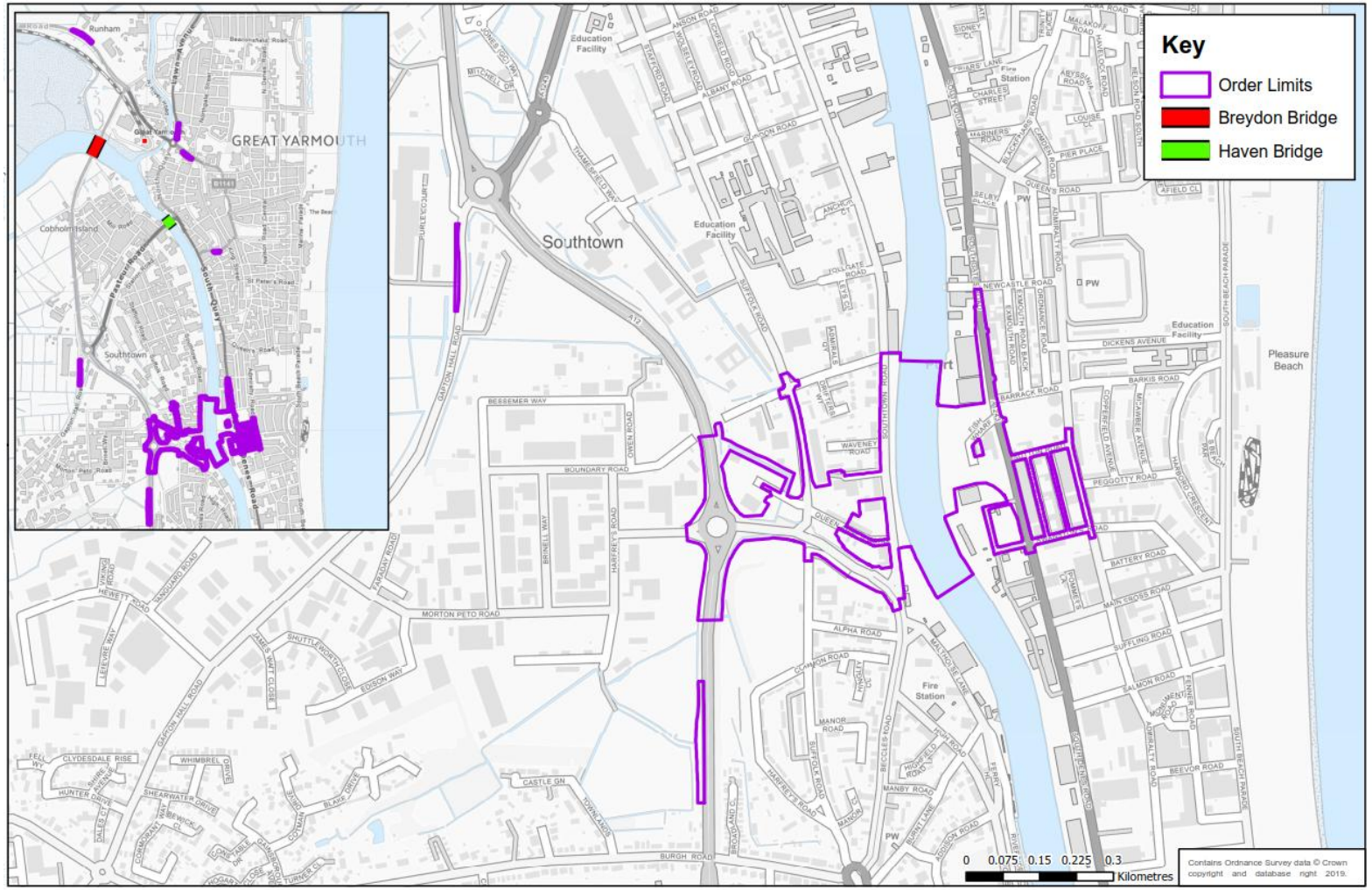


Plate 3-3: Location of the Scheme



3.4 Existing and Proposed Land Use in the Vicinity of the Scheme

Overview of Existing Land Use

3.4.1 The existing and permitted land uses on the site of the Scheme have been described in Paragraph 3.3 above. The land uses in the wider area around the Scheme are summarised below.

3.4.2 The existing land uses in the immediate area surrounding the River Yare consist mainly of employment (business and retail), extending from the Norfolk Broads in the west to the Outer Harbour in the east. The eastern and western edge of the River Yare are flanked by the prominent port and marine industries, including major offshore energy companies and maritime operations.

3.4.3 The port of Great Yarmouth comprises both a river port and a deep water outer harbour. The long-established river port has commercial berths along both banks of the River Yare for two miles from the river entrance. The outer harbour is at the southern tip of the peninsula. It was completed in 2009 and further improved in 2016. The Port has a pivotal role in the offshore and renewable energy sectors, as well as handling very significant volumes of grain, fertiliser, aggregates, timber and other cargoes.

3.4.4 The seafront lies on the eastern side of the peninsula with its wide sandy beaches, stunning views and extensive leisure facilities. The seaside promenade, which extends from the Britannia Pier to the Pleasure Beach, is known locally as the Golden Mile.

3.4.5 At the northern end of the peninsula, the Waterfront Area - brownfield land on both sides of the River Yare in the vicinity of the Haven Bridge and Breydon Bridge - has been identified for regeneration and development.

3.4.6 Specific areas are described in more detail below.

Enterprise Zone, Local Development Order, Energy Park and South Denes Business Park

Enterprise Zone

3.4.7 The Great Yarmouth and Lowestoft (New Anglia) Enterprise Zone (EZ) is one of 24 such zones created in England since 2011. It aims to stimulate growth by providing a portfolio of strategic sites, with concessions/incentives offered to businesses locating there. Business rates growth within the Zone is retained by the LEP to support economic priorities for at least 25 years.

3.4.8 The EZ includes two sites in Great Yarmouth which are designated for energy businesses, offshore engineering, ports and logistics:

- Beacon Park (16.7 hectares)
- South Denes (58.8 hectares)

3.4.9 Both sites have been allocated for B1 (light industrial / business), B2 (general industrial) and B8 (storage and distribution uses). The Zone as a whole is expected to create up to 9,000 direct jobs and 4,500 indirect jobs by 2025.

3.4.10 The Beacon Park EZ (shown in Plate 3-2 above) is located in the commercial area of Gorleston on the southern side of Great Yarmouth, with direct access to the A47 corridor. It includes mixed office, industrial and leisure development.

3.4.11 The South Denes EZ (shown in Plate 3-4) is centred on the deep water Outer Harbour on the South Denes peninsula, to the south of Great Yarmouth town centre and northeast of Gorleston-on-Sea on Norfolk's east coast. The area is characterised by the activities of the Port and related industries. There is significant land for development within the site, most of which is in the ownership of Peel Ports. GYBC has recently sought to expand the EZ at South Denes with the inclusion of three additional sites.

3.4.12 The Scheme will improve connectivity between the Beacon Park EZ and the Port, Outer Harbour, and the South Denes EZ.

Local Development Order

3.4.13 The southern part of the South Denes peninsula, together with small areas to the west of the river, is covered by a Local Development Order (LDO) which facilitates energy related development without the need for planning permission, subject to compliance with the LDO design guide. The LDO areas are illustrated in Plate 3-4. The LDO also covers the Beacon Park area at Gorleston-on Sea, to the south of Great Yarmouth. Incentives offered

within the LDO include business rates relief worth up to £275,000 over five years; simplified planning regulations; and Government support for the provision of super-fast broadband.

Plate 3-4: South Denes: Enterprise Zone, LDO, Energy Park and Business Park

Great Yarmouth Energy Park and South Denes Business Park

3.4.14 The LDO for South Denes also covers the Great Yarmouth Energy Park and South Denes Business Park. The South Denes area is especially relevant to the Scheme as it is very close to the proposed crossing location and will benefit from the improved accessibility to the A47 (part of the SRN) which the Scheme will provide.

The Seafront

3.4.15 Great Yarmouth is a very popular seaside resort, focused on the long sandy beach which stretches along the east side of the peninsula. Marine Parade is a mile-long strip of traditional seaside attractions – the "Golden Mile" – with amusement arcades, the Sealife Centre, model village, golf, restaurants and bars. At one end is the Britannia Pier, and at the other is the Pleasure Beach, a nine-acre seafront funfair.

3.4.16 The Scheme will provide an alternative route into the southern part of the seafront, enabling traffic to avoid the town centre and Haven Bridge.

The Waterfront Area

3.4.17 The Waterfront Area comprises about 50 hectares of mainly brownfield waterfront land, as shown in Plate 3-5:. Policy CS17 (Regenerating Great Yarmouth's Waterfront) of the Local Plan Core Strategy highlights the importance of this area, and seeks to create an attractive location for housing, shopping and offices that is attractive to visitors, investors and existing residents.

3.4.18 The ambitious growth expectations for the area (although it is acknowledged that not all are intended to be within the current plan period) includes the identification of sites for:

- 1,000 new dwellings of a mix of types (at least 300, or 350 according to Policy CS3, to be delivered in the plan period);
- 16,500m^2 of employment space (7,700m2 anticipated to be delivered in the plan period);
- 14,200m^2 of retail and leisure floorspace (5,050m2 of which is anticipated to be delivered in the Plan period).

3.4.19 The Scheme will reduce demand and associated congestion on the local highway network on critical links surrounding the Waterfront area, particularly on the western side of the river, creating better conditions for both new development and the redevelopment of existing assets within the strategic site.

Plate 3-5: Waterfront Area

3.5 Abnormal Load Uses

3.5.1 There are no formally designated abnormal load routes within Great Yarmouth. However, abnormal loads do on occasions need to pass through the area. The Scheme has been designed to provide an alternative route for these abnormal loads, removing them from the town centre. This is described in more detail in Chapter 7.

3.6 Air Quality Management Areas

3.6.1 No Air Quality Management Areas ("AQMA") have been designated in Great Yarmouth.

4 Baseline Transport Data

4.1 Introduction

4.1.1 This chapter describes the data which have been used to determine the existing conditions on Great Yarmouth's transport network. This includes data used to develop traffic models for the more detailed assessment of current and future conditions and the impacts of the Scheme, described in Chapters 6 and 7 below.

4.1.2 It describes:

- The local road network 4.2
- Traffic flows 4.3
- Congestion and queuing 4.4
- Key links and junctions for assessment 4.5
- Journey times 4.6
- Accidents 4.7
- Public transport facilities 4.8
- Pedestrian and cycle facilities 4.9
- Pedestrian and cycle movement 4.10
- Parking facilities 4.11
- Other planned transport improvements 4.12

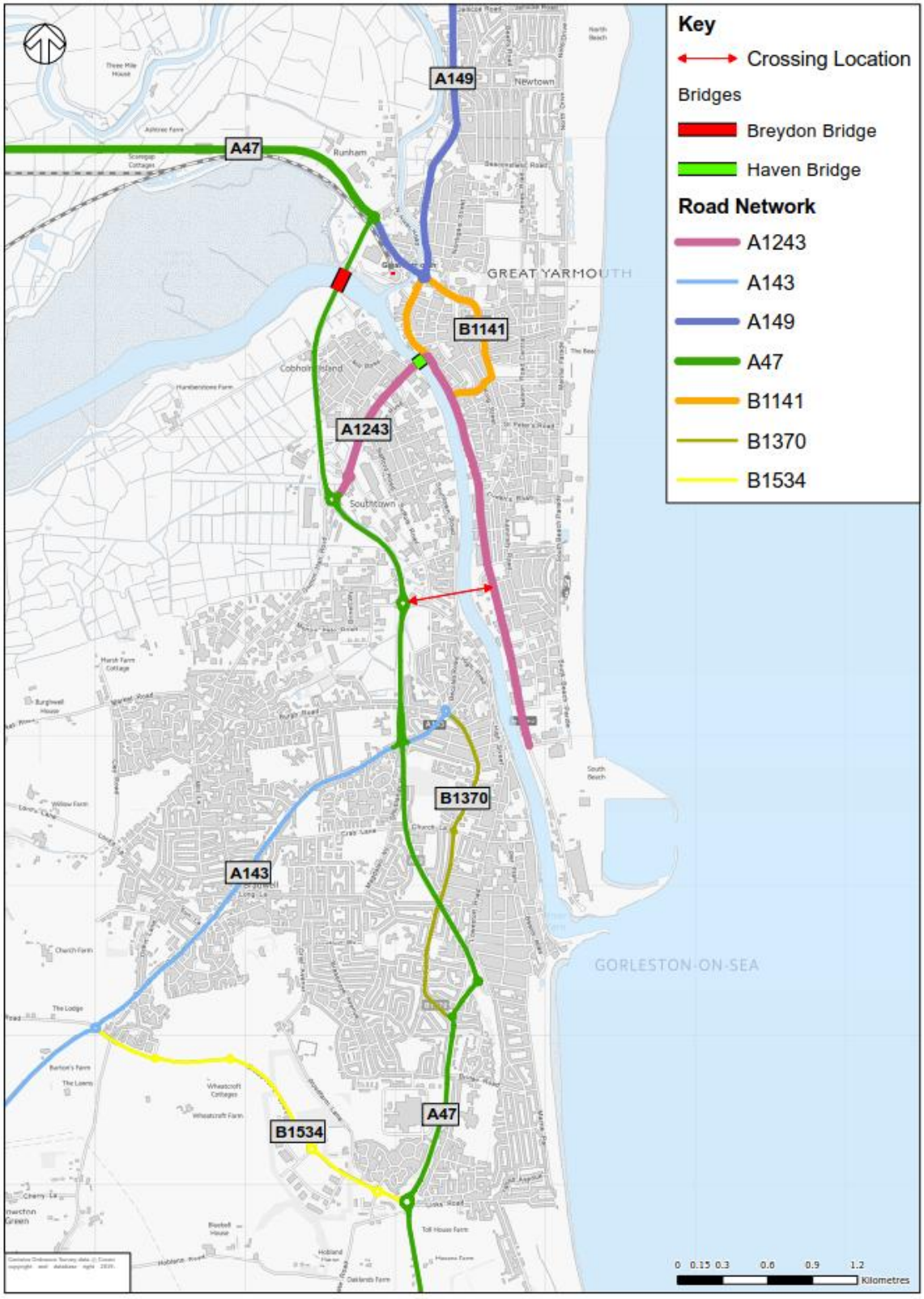
4.2 The Local Road Network

4.2.1 This section provides a description and functional classification of the local road network.

Main Roads

4.2.2 The main roads into and through Great Yarmouth are shown in Plate 4-1 and described below.

Plate 4-1: Main Roads, Great Yarmouth



A47 (formerly A47/A12) Trunk Road

4.2.3 The A12 trunk road between Lowestoft and Great Yarmouth was re-numbered A47 in March 2017. This means that the A47 is now a continuous trunk road from Peterborough to Lowestoft via Great Yarmouth, part of the SRN.

4.2.4 The A47 runs due east from Norwich to Great Yarmouth. It does not enter the town centre, but crosses the River Yare on a north-south alignment on the Breydon Bridge. Breydon Bridge is a single carriageway lifting bridge with one lane in each direction. It is opened frequently but irregularly to allow the passage of river traffic.

4.2.5 South of Breydon Bridge, the A47 skirts the western side of Great Yarmouth. It is a modern, single carriageway road with 1m margins and is subject to a 50 mph speed limit. There are no frontage accesses. It intersects at a large at-grade roundabout (Gapton Roundabout) with A1243 Pasteur Road, which leads via Haven Bridge into the town centre, sea front and Port areas.

4.2.6 The A47 continues as a two-lane dual carriageway and intersects with William Adams Way at another large at-grade roundabout known as Harfrey's Roundabout. It continues southwards as a two-lane dual carriageway with a north-facing grade-separated intersection with A143 Beccles Road, and bridges over local roads through Gorleston-on-sea, before connecting to local roads Victoria Road and Middleton Road at a pair of large at-grade roundabout junctions.

4.2.7 South of Middleton Road the A47 is a four-lane single carriageway with frontage access, an at-grade signal controlled junction with B1141 Brazenose Avenue and Bridge Road (the bridge in this case being a former railway bridge). It continues southwards as A47 Lowestoft Road, and eventually narrows to a single carriageway before intersecting with B1534 Beaufort Way and Links Road at the southern edge of the built-up area.

A1243

4.2.8 The A1243 Pasteur Road starts at the A47 Gapton roundabout in Southtown. It becomes Bridge Road before crossing the Haven Bridge, with two lanes in each direction, into Great Yarmouth town centre, where it joins the B1141 North Quay to the north. To the south, the A1243 runs alongside the River Yare on Hall Quay and South Quay, and continues as Southgates Road and South Denes Road before terminating at the Hartmann Road junction.

A143

4.2.9 The A143 from Bury St Edmunds is the primary route from Great Yarmouth to Haverhill in Suffolk. It ties in with the A47 just south of the Scheme location before terminating at the Beccles Road roundabout. The A143 is the main route to the area south west of Great Yarmouth, joining up with the A146 at Gillingham and the A140 at Scole.

A149

4.2.10 The A149 runs along the North Norfolk coast from Great Yarmouth to King's Lynn. It is a single carriageway road and provides direct access to Great Yarmouth railway station and Breydon Bridge via the Fuller's Hill roundabout. The A149 runs north towards Caister-on-Sea and on towards Cromer to the north of Great Yarmouth.

B1141

4.2.11 The B1141 forms a loop, starting at the eastern end of the Haven Bridge. The road runs north along North Quay and meets the A149 at the Fuller's Hill roundabout. It skirts the eastern edge of the town centre before terminating at Yarmouth Way.

B1370

4.2.12 The B1370 starts at the A47 / Middleton Road roundabout in Gorleston and runs generally northwards along the residential Middleton Road before terminating at the A47 / Beccles Road roundabout.

B1534

4.2.13 The B1534, opened in 2015, runs between the A143 and A47, to the south-west of Great Yarmouth. It is a single carriageway road with at-grade roundabout junctions.

Existing River Crossings and Town Centre Roads

4.2.14 Plate 4-2 shows the existing river crossings and the roads in and around the town centre.

4.2.15 Great Yarmouth lies at the mouth of the River Yare, which separates the town from the other parts of the Borough. The River Yare is navigable to small coastal vessels between Norwich and the North Sea. The historic town centre and sea front lie on a narrow peninsula, sandwiched between the river and the sea. It is linked to Gorleston-on Sea and other parts of the Borough by two bridges over the river:

- The A1243 Haven Bridge (two lanes in each direction, single carriageway)
- The A47 Breydon Bridge (one lane in each direction, single carriageway)

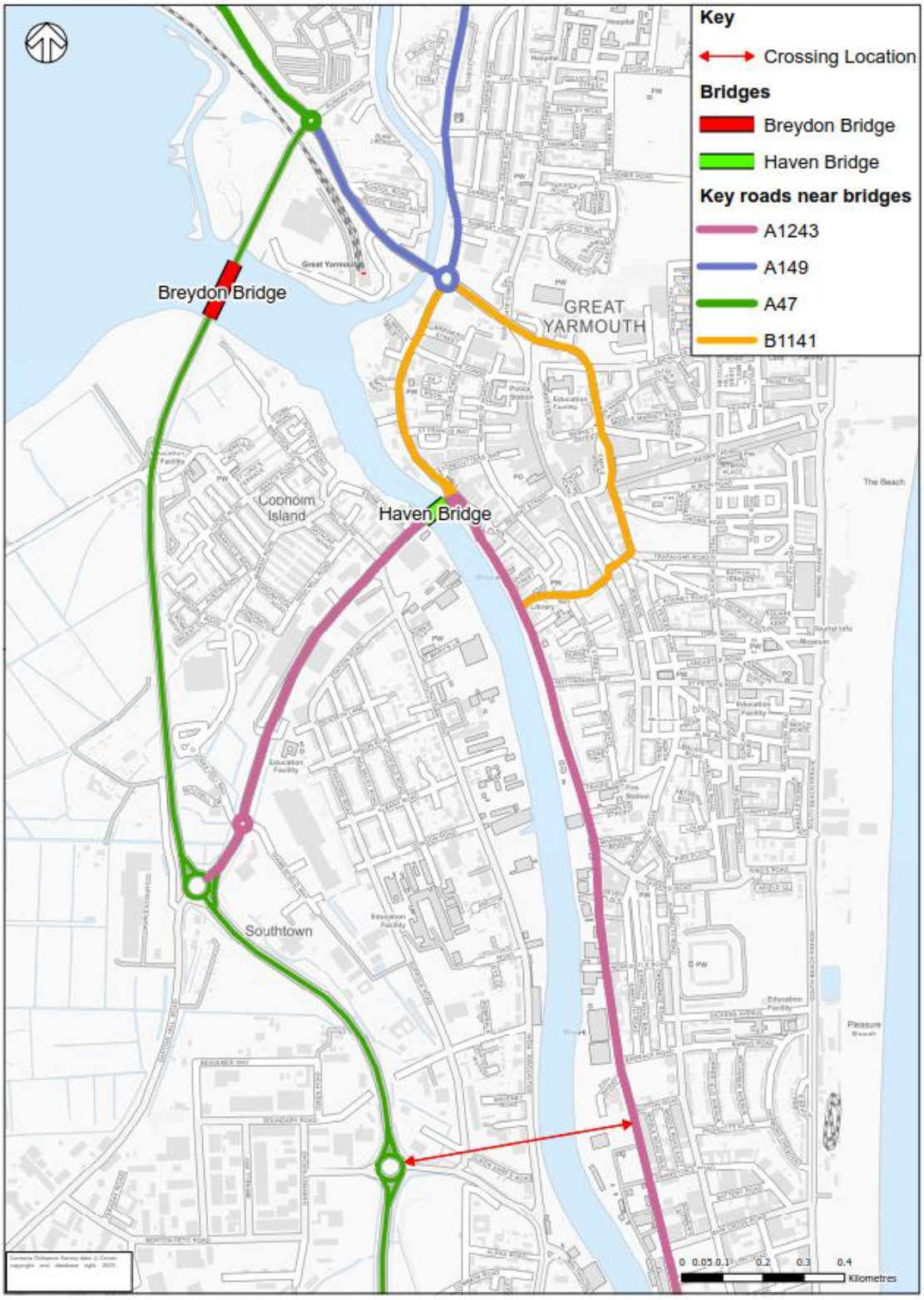
4.2.16 The A1243 Haven Bridge is the key route into and out of the town centre and peninsula from the SRN south of Great Yarmouth, with an alternative route along Acle New Road for heavy loads and trips from the SRN west of Great Yarmouth.

4.2.17 Both Haven and Breydon bridges are lifting bridges, to enable boats and ships to pass through. To the west of Breydon Bridge lies Breydon Water, a large, sheltered estuary which forms the gateway to the Norfolk Broads.

4.2.18 The Breydon Bridge, constructed in 1985, enables A47 traffic to bypass the centre. The Haven Bridge provides access into the northern part of the town centre. There are, however, no bridges further south than this. As a result, the southern part of Great Yarmouth, which is built on the peninsula, is effectively isolated from the rest of the Borough.

4.2.19 Breydon Bridge and Haven Bridge are subject to high traffic flows and become severely congested during peak hours. Great Yarmouth and Gorleston also experience a dramatic increase in traffic flows during the holiday season. This extra traffic conflicts with town centre, port and commercial traffic, creating congestion problems on the town centre road network, particularly on the A47, South Quay, North Quay, Fullers Hill and Lawn Avenue.

Plate 4-2: Existing River Crossings and Town Centre Road Network



4.3 Traffic Flows

4.3.1 Extensive traffic surveys on links and at junctions have been undertaken in order to develop the 'base year' (2018) traffic model for the assessment of the Scheme. They include surveys taken in 2018, supplementing other surveys taken in 2016 and earlier. Details of all these surveys are given in the Traffic Data Collection Report (Appendix A).

4.3.2 These surveys have been used to determine the traffic flows on key links and junctions, as summarised in the following sections.

Peak Hours

4.3.3 Peak hours for traffic have been determined from a review of all survey data and have been determined to be as follows:

- Morning peak 08:00 – 09:00;
- Inter-peak 13:00 – 14:00;
- Evening peak 16:30 – 17:30

Traffic Flows on Links

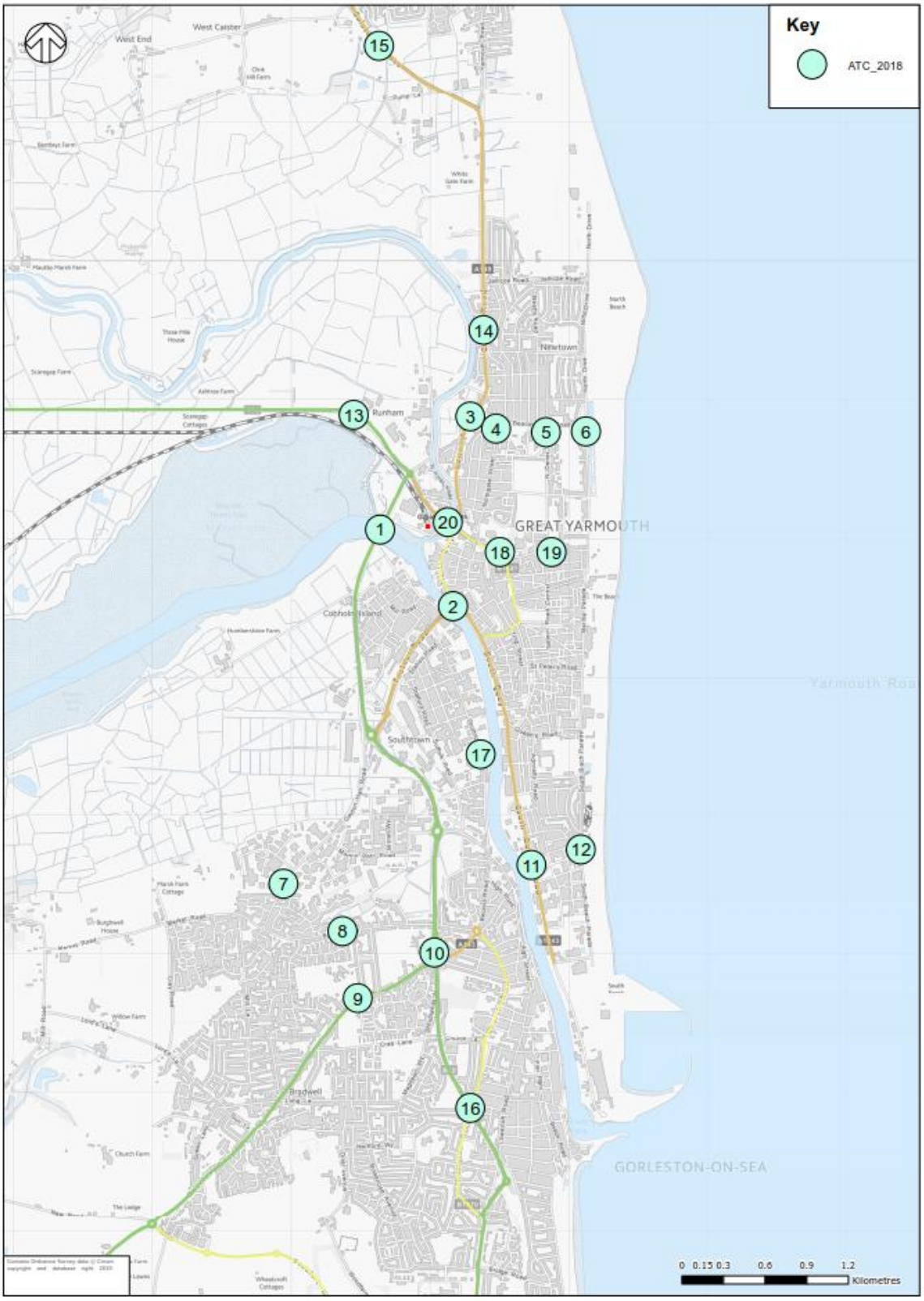
4.3.4 Automatic traffic count (ATC) data was collected at 20 key locations for a two-week period between Monday 5th March and Sunday 18th March 2018. This data was processed in order to derive representative peak and off-peak flows for an average weekday and normalised to account for monthly and yearly variation using factors from long term Highways England counts, as described in the Traffic Data Collection Report (Appendix A).

4.3.5 The flows on key links in the morning peak, inter-peak and evening peak periods are shown in Table 4-1. The locations of the ATC surveys are shown in Plate 4-3.

Table 4-1: Traffic Flows on Links (derived from ATC surveys 2018)

ID	Link	A.M. peak flow 2-way (veh)	Inter-peak flow 2-way (veh)	P.M. peak flow 2-way (veh)
1	**A47 - Breydon Bridge**	2,468	2,040	2,645
2	**Haven Bridge**	1,807	1,654	1,968
3	**Lawn Avenue**	1,333	1,268	1,444
4	**Northgate Street**	753	538	640
5	**North Denes Road**	485	317	668
6	**North Drive**	625	435	575
7	**Gapton Hall Rd**	1,176	920	1,330
8	**Burgh Rd**	482	335	522
9	**Beccles Rd**	959	710	985
10	**A47/Beccles Rd**	2,979	2,292	3,015
11	**S Denes Rd**	288	318	330
12	**S Beach Parade**	112	120	162
13	**A47 New Rd**	1,438	1,212	1,620
14	**Caister Rd**	1,619	1,448	1,666
15	**A149 Caister By-Pass**	1,430	1,169	1,342
16	**B1370 Middleton Rd**	814	640	836
17	**Southtown Rd**	767	691	801
18	**B1141 Priory Plain**	792	812	721
19	**Euston Rd**	217	304	284
20	**Acle New Rd**	1,974	1,932	1,967

Plate 4-3: Locations of ATC Surveys (2018)



Traffic Flows at Junctions

Manual classified counts (2018)

4.3.6 Manual classified traffic counts (MCC) were undertaken at 15 junctions within Great Yarmouth town centre on Thursday 8 March 2018. Each covered twelve hours (07:00 – 19:00). Data was classified according to six vehicle types:

- Pedal cycle / motorcycle
- Cars
- Light Goods Vehicles (LGV)
- Other Goods Vehicles (OGV1)
- Other Goods Vehicles (OGV2)
- Public Service Vehicles (PSV)

4.3.7 The 2018 MCC survey locations are listed in Table 4-2 and shown in Plate 4-4.

Table 4-2: Manual Classified Counts (2018)

Ref No.	Junction
1	Fuller's Hill roundabout
2	Vauxhall roundabout
3	Gapton Hall roundabout
4	Harfreys roundabout
5	Hall Quay
6	A149 Acle New Rd / Great Yarmouth Station access
7	Beccles Rd / Burgh Rd roundabout
8	Beccles Rd / William Adams Way / Southtown Rd
9	Southtown Rd / Pasteur Rd / Bridge Rd / Mill Rd
10	Fuller's Hill / Priory Plain / Northgate St / Market Place
11	Nicholas Rd / Nelson Rd / Euston Rd
12	North Dr / Car Park Access / Euston Rd / Marine Parade
13	South Quay / Yarmouth Way
14	Alexandra Rd / Dene Side / King St / Yarmouth Way
15	Alexandra Rd / Trafalgar Rd

Manual classified counts (2016)

4.3.8 Manual classified traffic counts (MCC) were undertaken at 41 junctions within Great Yarmouth town centre, Gorleston, Bradwell and Caister on Tuesday 4 October 2016 and Wednesday 5 October 2016. Each count covered twelve hours (07:00 – 19:00). Data was classified according to six vehicle types:

- Pedal cycle / motorcycle
- Car
- LGV
- OGV1
- OGV2
- PSV.

4.3.9 The 2016 MCC survey locations are listed in Table 4-3 and shown in Plate 4-4.

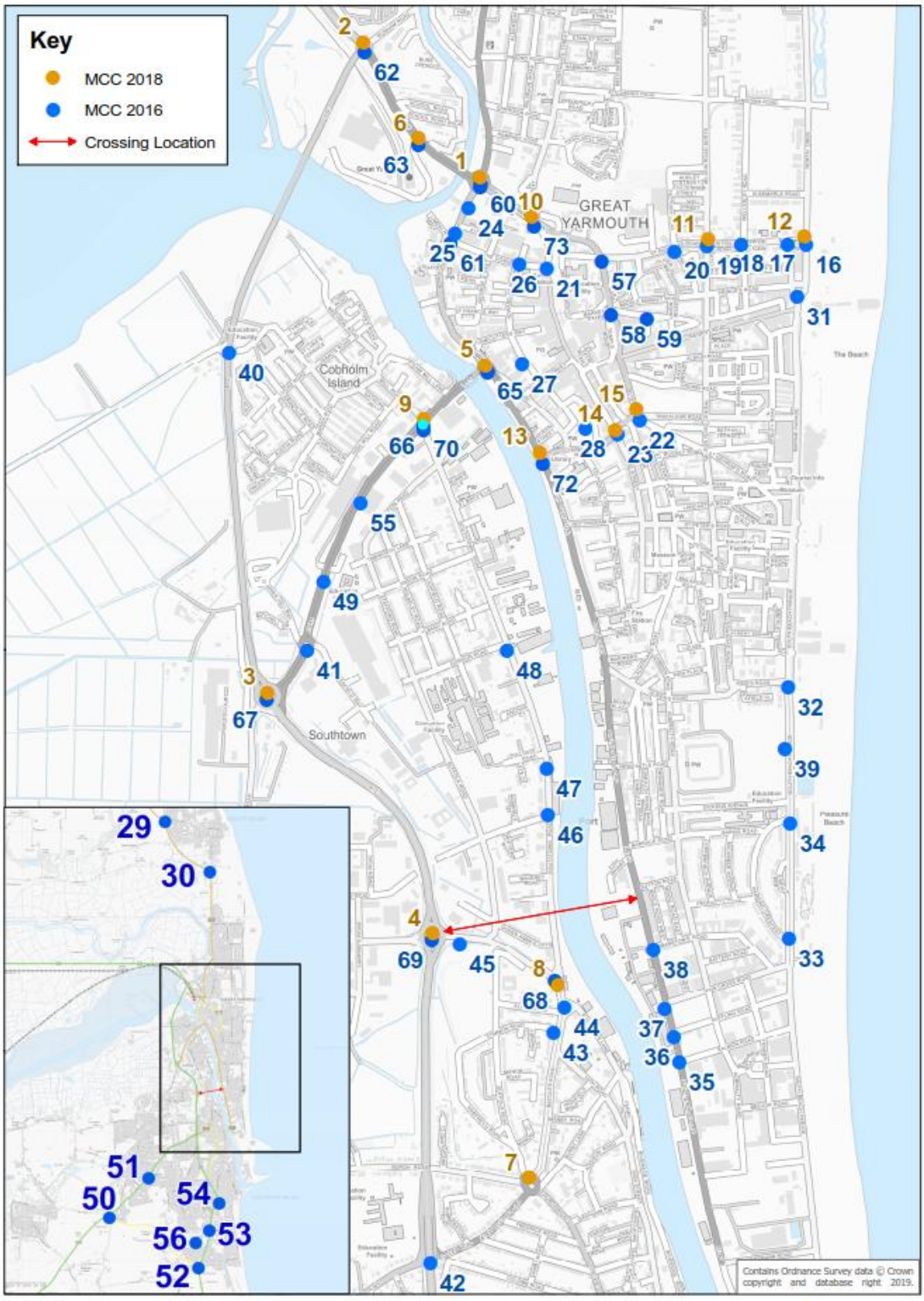
4.3.10 The selection of count sites is discussed in Appendix A, the Traffic Data Collection Report, and the full results are included in Appendix B, the Local Model Validation Report.

Table 4-3: Manual Classified Count Locations (2016)

Ref No.	Location	Ref No.	Location	Ref No.	Location
16	Euston Rd / North Dr Roundabout	**37**	S Denes Rd / Main Cross Rd	**58**	South Market Road / Temple Road / Regent Boulevard
17	Euston Rd / Marine Parade	**38**	S Denes Rd / Swanston's Rd	**59**	South Market Road / Car Park
18	Euston Rd / Wellesley Rd	**39**	South Beach Parade Car Park	**60**	Acle New Road / N Quay / Fuller's Hill Roundabout
19	St Nicholas Rd / Nelson Rd	**40**	A12 (Rugby Club)	**61**	N Quay / Limekiln Walk / The Conge
20	St Nicholas Rd (Sainsbury's)	**41**	Pasteur Rd / Jones Way Roundabout	**62**	A47 Acle New Road / A12 / A149 / Runham Road
21	The Conge / Fuller's Hill / King St / Car Park	**42**	A47 / Beccles Rd	**63**	A149 Acle New Road / Great Yarmouth Station
22	Alexandra Rd / Trafalgar Rd	**43**	Beccles Rd / High Rd	**64**	A149 N Quay / A149 Acle New Road / Fuller's Hill / B1141
23	Yarmouth Way / King St	**44**	Beccles Rd / Malthouse Ln / Alpha Rd	**65**	A1243 Bridge Road / A1423 S Quay / B1141 N Quay
24	N. Quay/Aldi	**45**	William Adams Way / Suffolk Rd	**66**	A1243 Bridge Road / A1243 Pasteur Road / Mill Road / Southtown Road
25	Brewery Street /Aldi	**46**	Southtown Rd / Boundary Rd	**67**	A12 / A1243 Pasteur Road / Gapton Hall Road
26	The Conge / Howards St N/Northern road	**47**	Southtown Rd / Tollgate Rd	**68**	Southtown Road / Beccles Road / William

Ref No.	Location	Ref No.	Location	Ref No.	Location
					Adams Way
27	Howard Street South Car Park	**48**	Southtown Rd / Gordon Rd	**69**	A12 / William Adams Way
28	King Street Car Park	**49**	Pasteur Road/GC Way road	**70**	Southtown Road / Pasteur Road / Bridge Road / Mill Road
29	Norwich Rd / Caister By-Pass Roundabout	**50**	Beccles Rd / New Rd Roundabout	**71**	A1243 Haven Bridge / B1141 North Quay / A1243 Hall Quay
30	Yarmouth Rd / Caister By-Pass Roundabout	**51**	Beccles Rd / Church Ln / Long Ln	**72**	Yarmouth Way / South Quay
31	Marine Parade / North Dr	**52**	A12 / Links Rd / Beaufort Way Roundabout	**73**	Northgate St / Fuller's Hill / Priory Plain
32	S Beach Parade / Kings Rd Roundabout	**53**	A47 / Brasenose Ave / Bridge Rd		
33	S Beach Parade / Harbord Cres (north junction)	**54**	A47 / Victoria Rd Roundabout		
34	S Beach Parade / Harbord Cres (south junction)	**55**	Lidl Car Park		
35	S Denes Rd / Salmon Rd	**56**	James Paget University Hospital		
36	S Denes Rd / Suffling Rd	**57**	Priory Plain / St Nicholas Rd		

Plate 4-4: Manual Classified Count Locations (2016 and 2018)



Other Traffic Surveys

4.3.11 In addition, traffic data was obtained from:

- Roadside interview surveys in 2016
- Automatic traffic counts at 30 locations in 2016
- Journey time surveys on 8 routes in 2016

Use of Traffic Flow Information

4.3.12 The collection and processing of this data is detailed in Appendix A, the Traffic Data Collection Report.

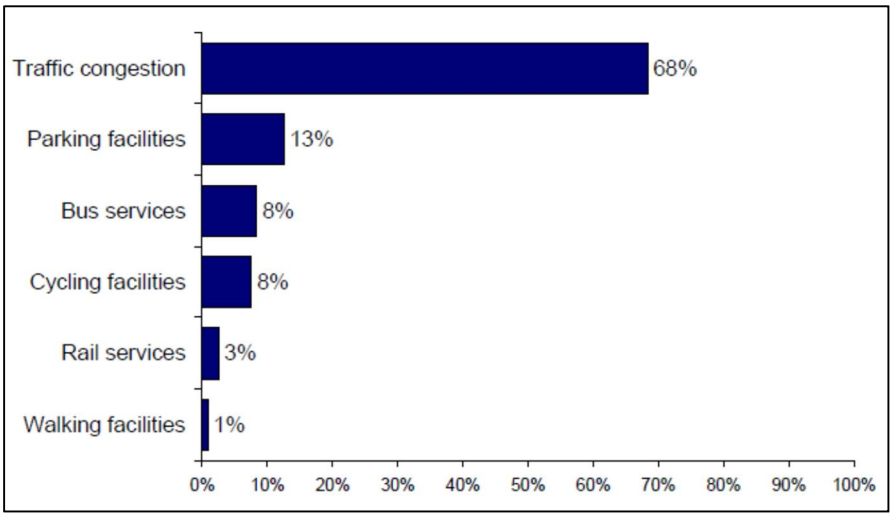
4.3.13 Taken together, the various traffic counts and surveys provide a detailed picture of the existing traffic in Great Yarmouth. This data was used in the development, calibration and validation of the traffic models used to assess the impacts of the Scheme. The assessment methodology is described in Section 6.

4.4 Congestion and Queuing

4.4.1 A survey of local residents in 2009[4] identified traffic congestion as the most serious transport problem to be tackled, by a considerable margin, as illustrated in Plate 4-5.

[4] Survey for the Great Yarmouth and Gorleston Area Transport Strategy, 2009

Plate 4-5: Residents' Survey on Aspects of Transport Most Important to Improve



4.4.2 In a subsequent pre-application consultation[5] about the Third River Crossing in 2018:

- 68.3% of respondents agreed that the Scheme is needed
- 56.5% said that they agreed that it would achieve the objectives of reducing congestion and improving journey times to/from the South Denes peninsula.

Congestion

The microsimulation model of Great Yarmouth provides an insight into the location of congestion hotspots in and around the town centre. Plate 4-6. Plate 4-6: Congestion "Heat Map" AM Peak 2018 (from microsimulation model)

4.4.3 Plate 4-6 is a congestion "heat map" for the calibrated base year (2018) model at that time, providing a snapshot of the levels of congestion across the local road network in the morning peak period.

4.4.4 The heat map shows a snapshot of areas of queuing that have occurred within the network at a particular moment in time using a colour scale from blue to red, with red indicating areas with the greatest congestion. This plot indicates that important junctions along the A47 including Vauxhall, Gapton and Harfreys roundabouts and the junctions either side of Haven Bridge experience congestion in the AM peak.

[5] Environmental Statement (DCO Document 6.1) Chapter 5

Plate 4-6: Congestion "Heat Map" AM Peak 2018 (from microsimulation model)

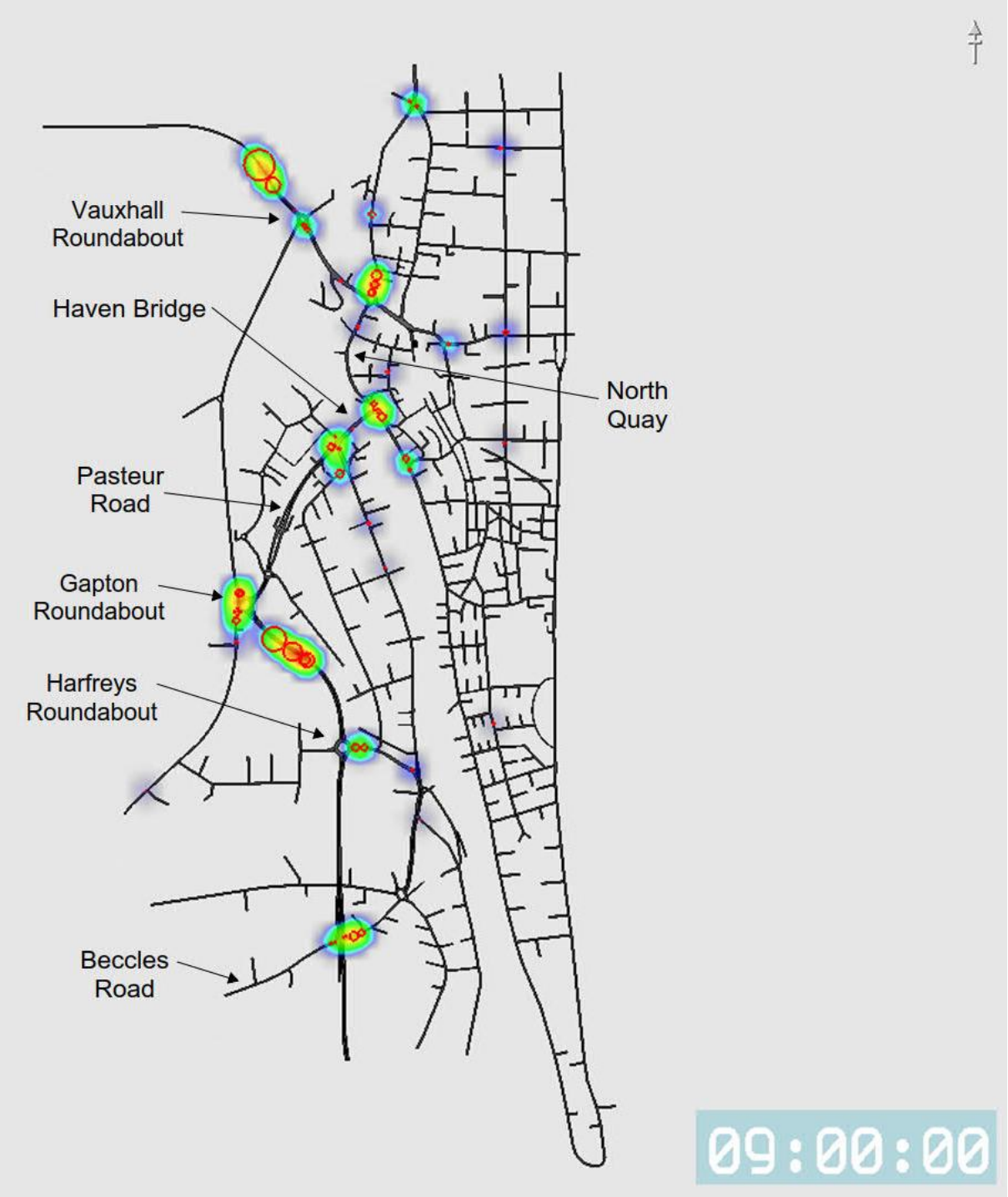


Plate 4-7: Congestion on Approach to Haven Bridge

4.4.5 Congestion is a problem in peak periods throughout the year, but also occurs during the summer when many tourists visit the town centre, pleasure beach and seafront attractions. The town caters for over 5 million day visits and over 4 million visitor nights each year - a collective industry worth nearly £600 million a year. Seasonal events, such as festivals, fireworks displays and horse races are all associated with increased congestion and traffic delay.

4.4.6 On days with especially fine weather, increased numbers of day trippers add to traffic and congestion. The raising of the bridges to allow shipping to pass through creates further significant delays and long queues which can take a very long time to clear. The proposed third crossing, whilst also a lifting bridge, will provide additional network capacity, reducing overall traffic on Haven Bridge and the build-up of queues – in effect increasing resilience.

4.4.7 Critically, congestion at the bridges makes it difficult to provide adequate access to the important employment areas in the South Denes Enterprise Zone, including the new deep water Outer Harbour.

4.4.8 Congestion affects bus users and cyclists, as well as car users. Pedestrians are also affected by the long traffic signal cycle times needed to handle demand at junctions.

Queuing

4.4.9 As it can be quite difficult to measure congestion in absolute terms, a range of survey results, open source data, and model investigations were used to illustrate the severity of queuing and delay on town centre roads. Taken together, these provide evidence that congestion is a very real problem for people in Great Yarmouth, not just a perception.

4.4.10 Detailed classified traffic counts and queue length surveys were undertaken at key locations near the Haven Bridge and town centre between 7 a.m. and 7 p.m. on Thursday 8th March 2018. The survey locations are shown in Plate 4-8 and the observed maximum queue lengths are set out in Table 4-4. This queuing is associated with the high volumes of traffic using the Haven Bridge and nearby roads.

Plate 4-8: Traffic Counts and Queue Survey Locations, March 2018

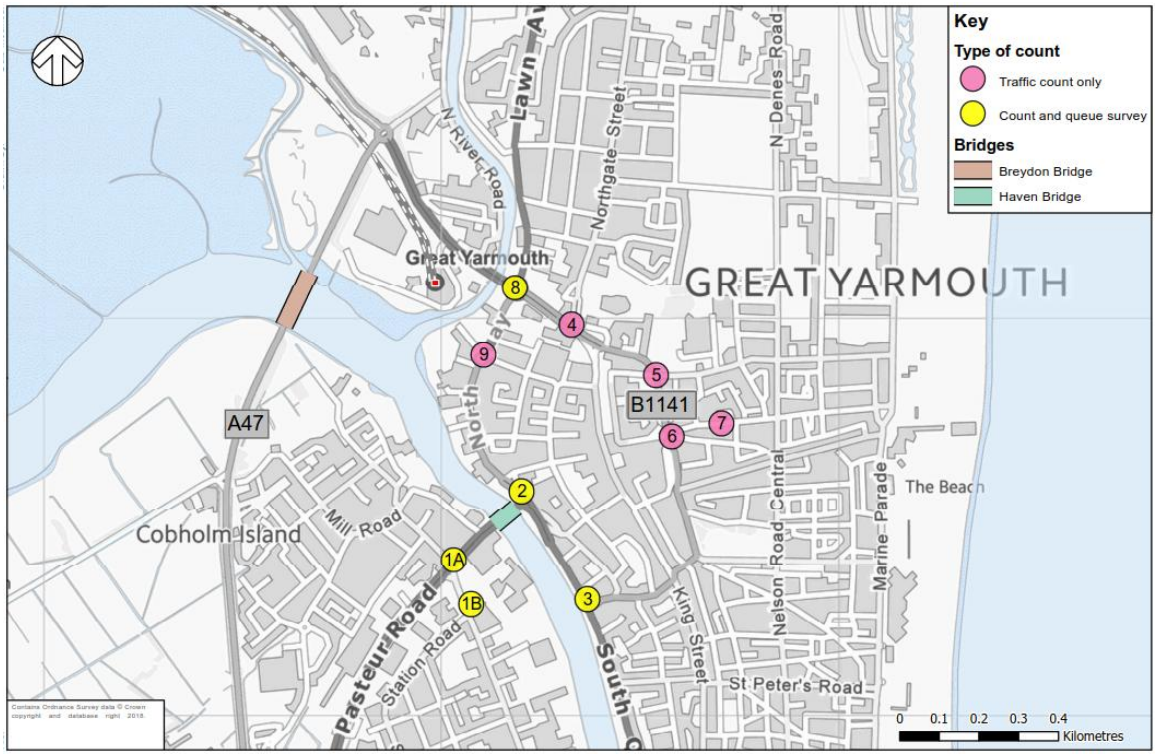


Table 4-4: Maximum Queue Lengths Observed (metres)

Location	Direction	March 2018
1A	From Pasteur Road	>150
1A	From Bridge Road	124
1A	From Southtown Road	110
2	From North Quay	73
2	From South Quay	74
2	From Bridge Road	>150
3	From the north	>150
3	From the south	68
8	From Acle New Road	88
8	From North Quay (north)	>150
8	From Fullers Hill	39
8	From North Quay (south)	72

Table 4-5: Two-way Traffic Volumes over 12 hrs (7am – 7pm)

Location	March 2018
A1243 Haven Bridge (across River Yare)	22,354
South Quay, south of Haven Bridge	23,308
North Quay, north of Haven Bridge	13,436
Acle New Road (across River Bure)	24,746
Fullers Hill	9,392
Temple Road	No data

4.5 Key Links and Junctions for Assessment

4.5.1 In order to assess the transport impacts of the Scheme, and its effectiveness in delivering its objectives, the following key links and junctions have been identified, on the basis that they experience congestion, or that they are close to the Scheme and/or could experience significant changes in traffic because of it.

Key Links for Assessment

- Breydon Bridge

- Haven Bridge
- North Quay
- South Quay
- Southgates Road
- South Denes Road
- Marine Parade
- South Beach Parade
- Admiralty Road
- Sutton Road
- Swanston's Road
- Main Cross Road
- Salmon Road
- William Adams Way
- Beccles Road
- Southtown Road
- A47 north of Harfrey's RB
- A47 south of Harfrey's RB
- Fuller's Hill
- Yarmouth Street
- Suffolk Road
- Pasteur Road
- Lawn Avenue

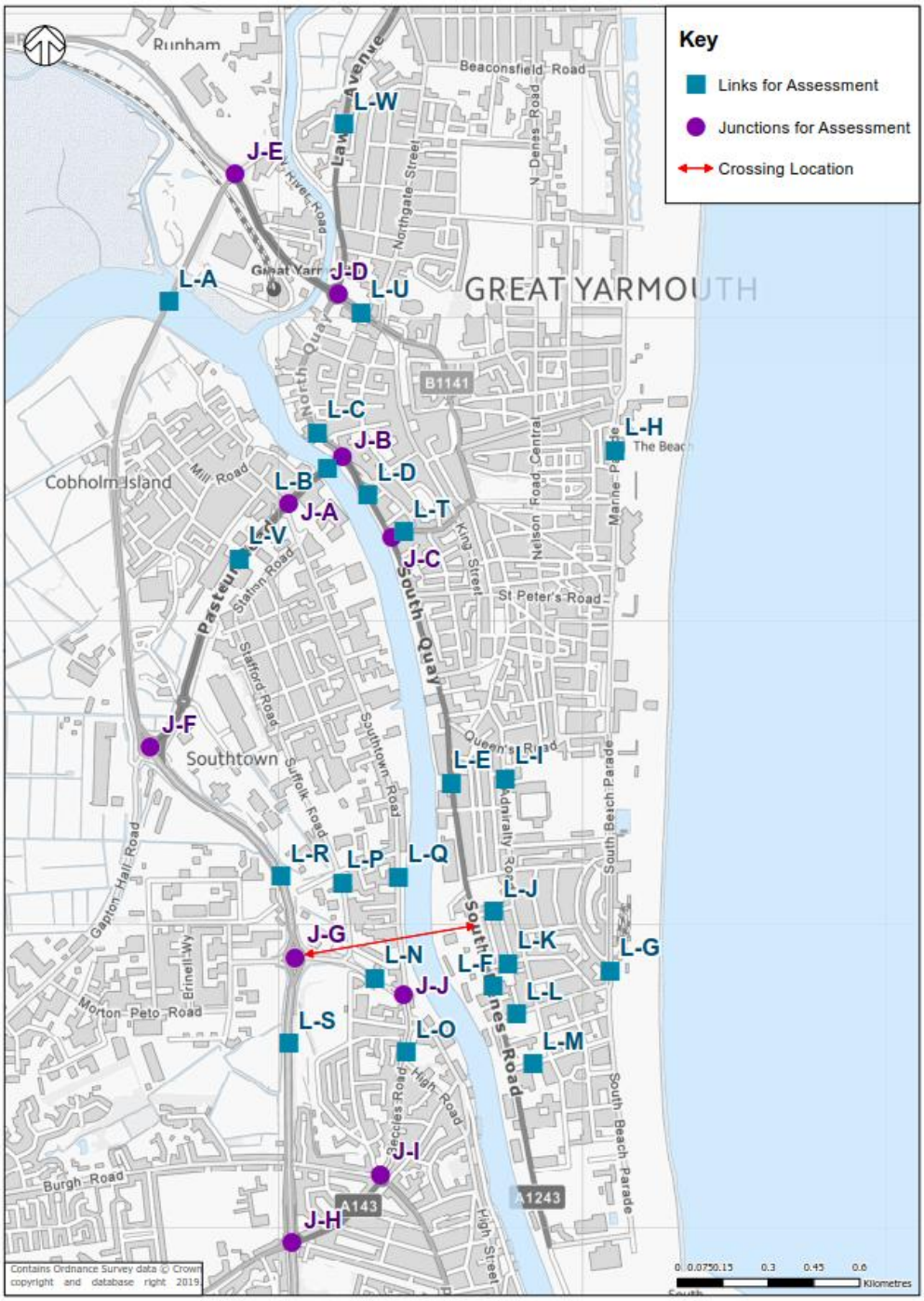
Key Junctions for Further Assessment

- Pasteur Road/Bridge Road/Southtown Road
- North Quay/South Quay/Bridge Road
- South Quay/Yarmouth Way
- Acle New Road/North Quay/Fullers Hill
- A47/Acle New Road
- A47/Pasteur Road (Gapton)
- A47/William Adams Way (Harfrey's RB)

- A47/A143 Beccles Road
- A143 Beccles Road/B1370 Burgh Road
- William Adams Way/ Southtown Road

4.5.2 These links and junctions are shown in Plate 4-9.

Plate 4-9: Key Links and Junctions for Assessment



4.5.3 The forecast traffic flows on these key links, together with the performance of the key junctions, is assessed in Chapter 7 both with and without the Scheme to determine its impact on traffic in Great Yarmouth.

4.6 Journey Times

4.6.1 The Scheme is expected to reduce journey times for trips within Great Yarmouth in two ways:

- By providing new, shorter routes via the new bridge
- By reducing congestion and delay on existing routes as a result of reduced traffic on these routes

4.6.2 A set of six journeys has been defined to enable these impacts to be assessed, and to determine whether there are any journeys where journey times increase as a result of the Scheme. The defined journeys are indicative of trips to and from key areas. For example, by examining trips to the "Pleasure Beach", we can illustrate changes in the accessibility of the sea front from the SRN. Similarly, the "Outer Harbour" is indicative of the southern part of the South Denes peninsula and EZ. Using the same journeys in all scenarios ensures that any changes in time are correctly determined[6].

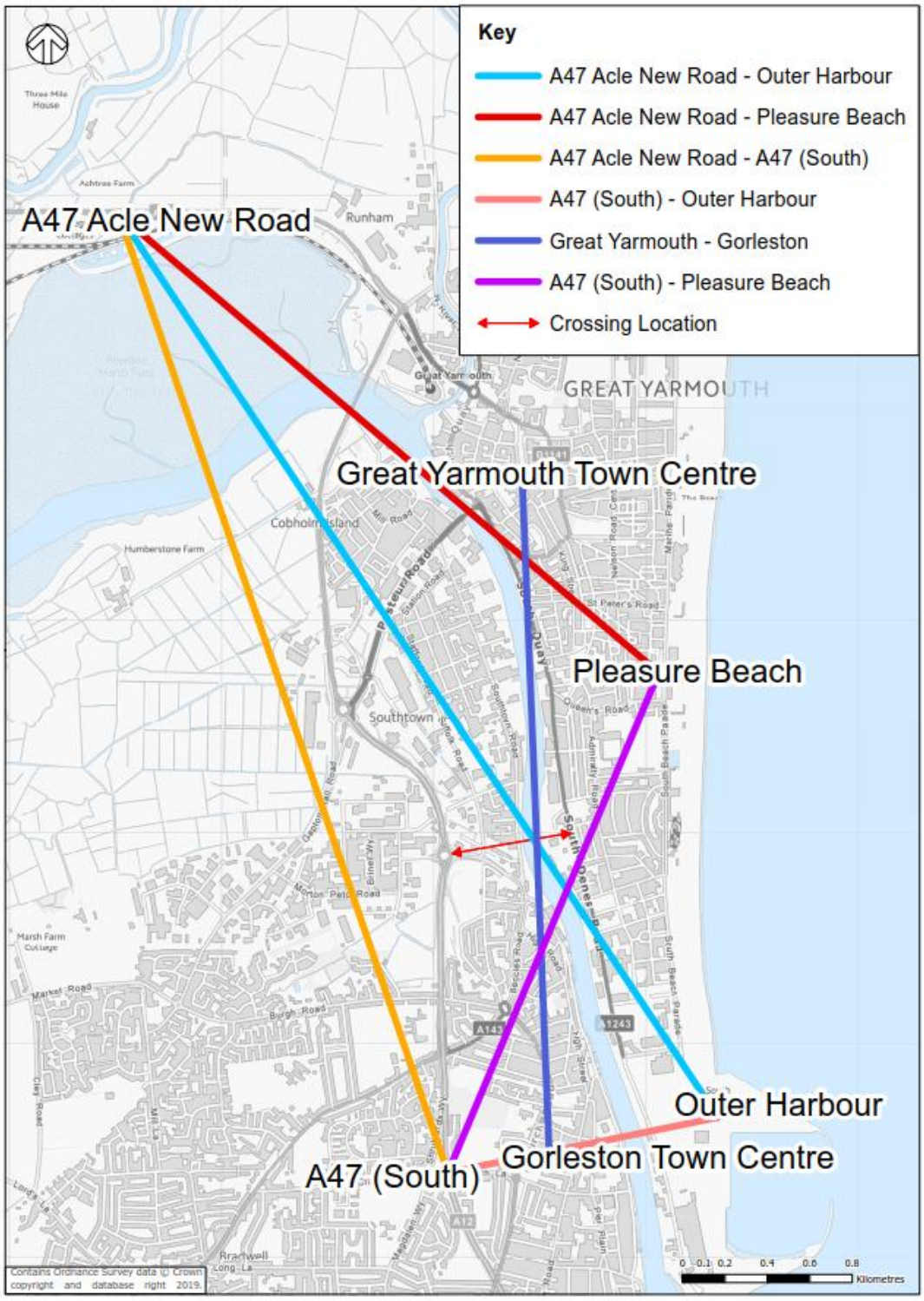
4.6.3 These journeys are described below and shown in Plate 4-10.

- Between A47 Acle New Road and the Outer Harbour
- Between A47 Acle New Road and the Pleasure Beach (St Nicholas' Car Park)
- Between A47 Acle New Road and A47 (south)
- Between A47 (south) and the Outer Harbour
- Between A47 (south) and the Pleasure Beach (St Nicholas' Car Park)
- Between Great Yarmouth Town Centre and Gorleston (Library)

[6] The traffic simulation models assess changes in journey time between many thousands of individual origin-destination pairs to determine route choice and the overall impact of the Scheme. The six journeys were selected to illustrate the main changes.

4.6.4 The forecast times for these indicative journeys are set out in Section 7.5 both with and without the Scheme, to assess the impact of the Scheme on journey times in Great Yarmouth.

Plate 4-10: Origins and Destinations for Journey Time Calculations



4.7 Accidents

Personal Injury Accidents

4.7.1 Plate 4-11 shows the locations of all personal injury accidents (PIA) in the five years from July 2013 to June 2018. There were 637 recorded collisions in the study area shown, involving 807 casualties.

4.7.2 Table 4-6 shows the number of PIAs recorded in each year.

Table 4-6: Personal Injury Accidents - July 2013 to June 2018 (5 years)

	2013 Jul – Dec	2014	2015	2016	2017	2018 Jan-June	Annual average
PIA	***62**	**120**	**119**	**136**	**143**	***57**	**127.4**

**Totals in 2013 and 2018 are for 6 months only*

4.7.3 Of the 637 PIAs recorded:

- 192 involved non-motorised users
- 527 caused slight injuries, 106 caused serious injuries and four were fatal
- Three of the four fatal accidents occurred along the Beccles Road (A143) corridor. Of these, two were single vehicle accidents and one involved a collision with a pedestrian at the junction with Crab Lane
- The other fatal accident, on Burgh Road, also involved a collision with a pedestrian

4.7.4 Most of the accidents occurred in the town centre, where several clusters can be identified:

- Hall Quay: 18 accidents
- St Peter's Road between King's Street and Nelson Road Central: 16 accidents
- North Quay: 13 accidents (5 of them serious)
- Southtown Road between Station Road and Bridge Road: 10 accidents
- North Quay / Fuller's Hill / Acle New Road Roundabout: 8 accidents
- Runham Road / Acle New Road Roundabout: 8 accidents

4.7.5 Outside of the central area, the most prominent accident clusters are:

- A47 / A143: 11 accidents (1 fatal and 4 serious)

- Lowestoft Road / High Street between Clarkes Road and Cross Road: 15 accidents
- A47 / Gapton Hall Road / Pasteur Road: 15 accidents
- A47 / William Adams Way (Harfrey's Roundabout): 14 accidents
- Magdalen Way / Trinity Way area: 12 accidents

Accidents Involving Non-Motorised Users

4.7.6 Plate 4-12 shows the locations of the 192 accidents involving non-motorised users over the same time period. 89 of these occurred close to the town centre. Concentrations of NMU accidents were observed at Bridge Road/Hall Quay, Alexandra Road/Deneside, North Quay and in the commercial area around the High Street, Gorleston-on-Sea.

4.7.7 NMU accidents involving serious injuries included:

- Two cycle accidents and one pedestrian accident on North Quay
- Two cycle accidents on the Haven Bridge
- Two pedestrian accidents on Beccles Road, south of the William Adams Way/Southtown Road roundabout

4.7.8 Fatal accidents involving NMUs occurred at Burgh Road and Beccles Road, but not as part of a cluster.

Plate 4-11: Personal Injury Accidents 2013-2018 (5 years)

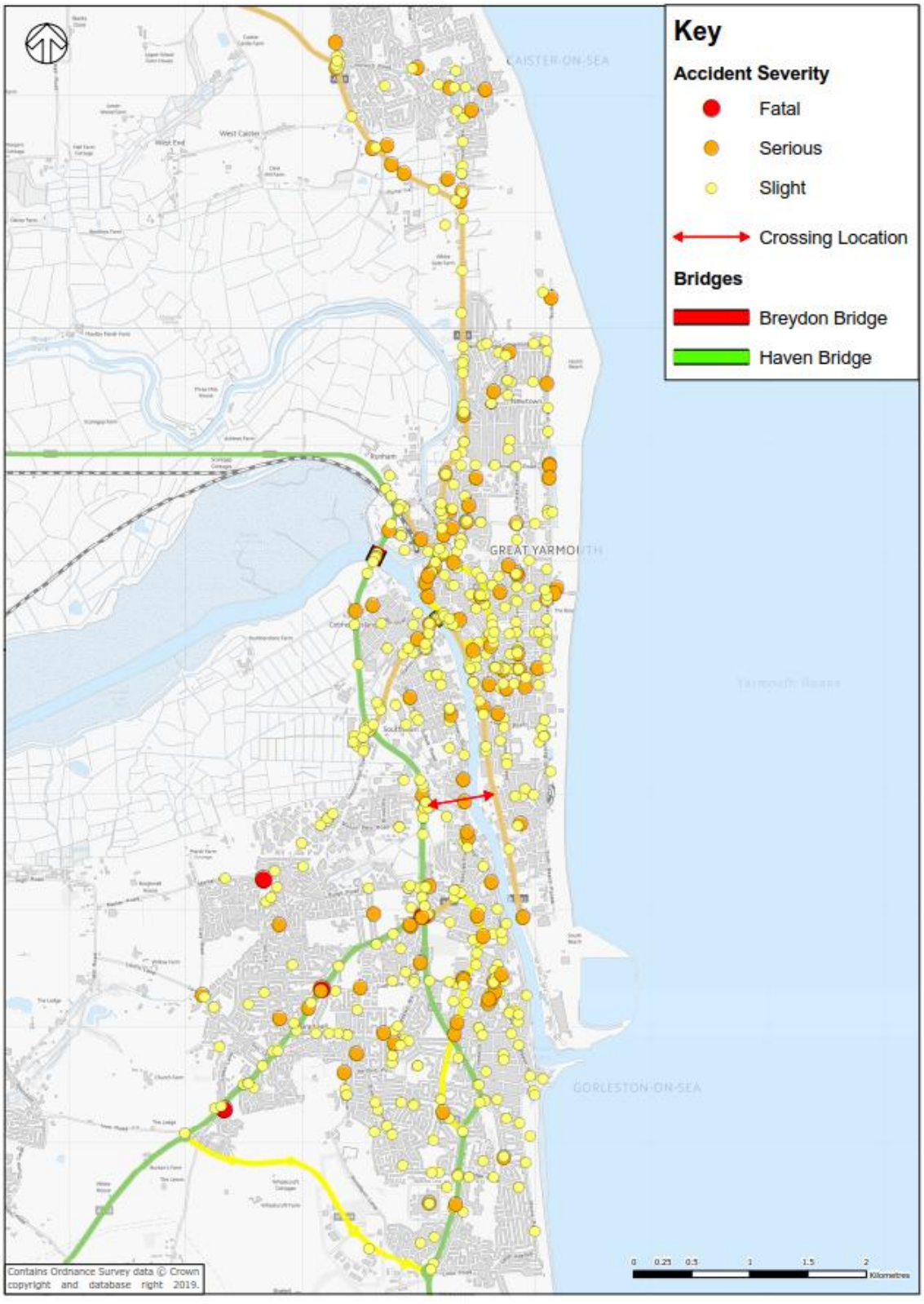
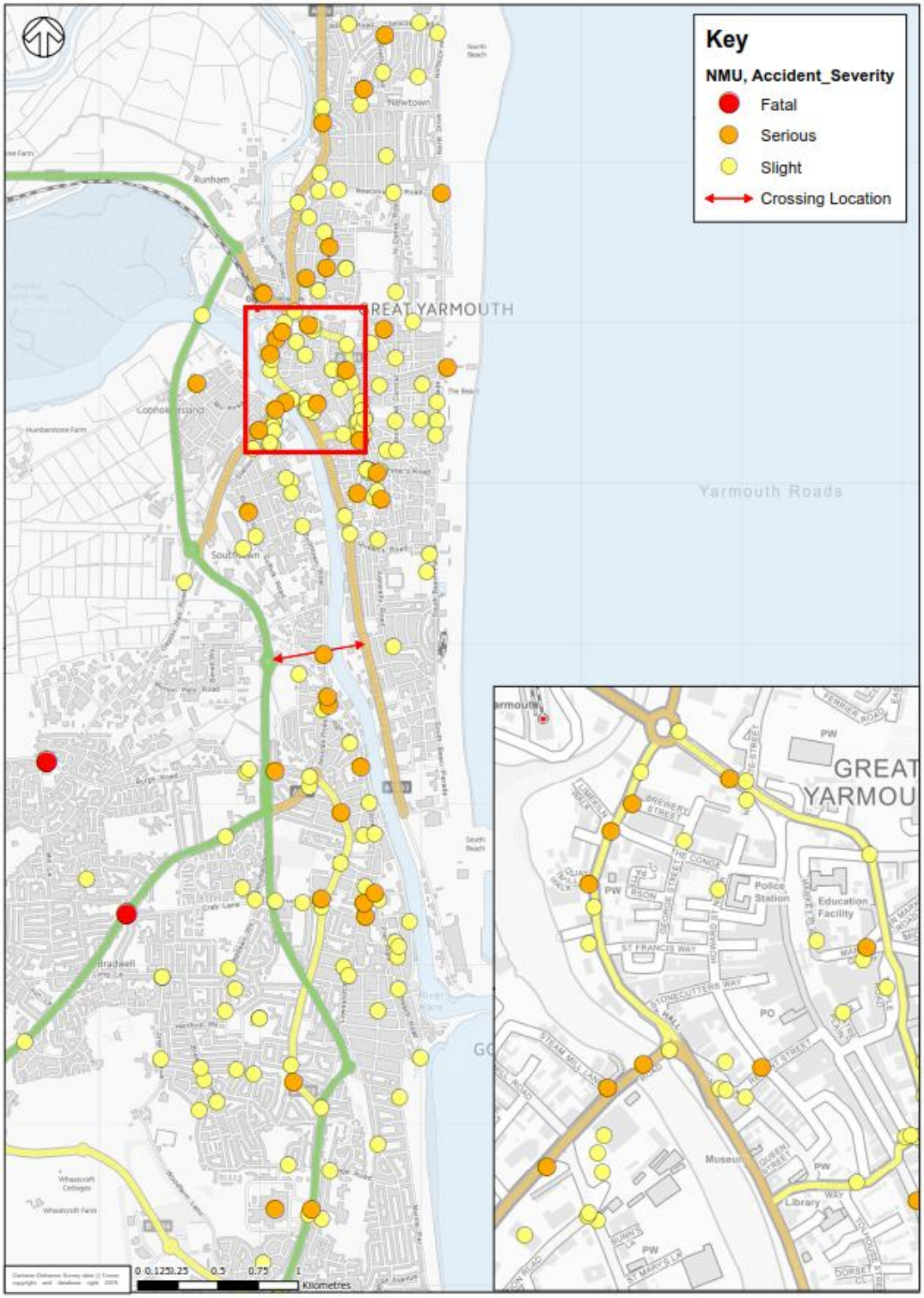


Plate 4-12: Personal Injury Accidents involving NMUs 2013-2018 (5 years)



4.8 Public Transport Facilities

Bus Services

4.8.1 Bus services cover the main corridors through the town, with all routes from outlying areas serving the town centre and Market Gates bus station. The majority of bus services in Great Yarmouth are operated by First in Norfolk and Suffolk, with a small number operated by other local bus operators.

4.8.2 Most bus services run in a north - south direction connecting Great Yarmouth with the Caister-on-Sea to the north or Gorleston-on-Sea to the south. Exceptions to this are bus service 2, a circular route serving the town centre and the peninsula only, and bus service 74 which runs between Great Yarmouth Town Centre and Little Plumstead to the west.

4.8.3 The bus services which operate in the vicinity of the scheme are illustrated in Plate 4-13 and described below. Apart from service 2, all these services run along Southtown Road and Beccles Road. Information is correct at the time of writing, but subject to change.

4.8.4 Consideration of existing bus journey times and the forecast changes to bus journey times in the future scenarios are described in Chapter 7.

Coastal Clipper 1

4.8.5 The Coastal Clipper 1, operated by First in Norfolk and Suffolk, is a coastal route between Martham and Lowestoft. The service operates at hourly intervals during the morning and afternoon before running at 30 minute intervals during the evening, Monday to Friday. Saturday services are no different and run at hourly intervals throughout the morning and afternoon and then at 30 minute intervals in the evening. Services are reduced on Sundays, running at 2 hour intervals in the morning and afternoon and hourly in the evening.

Coastal Clipper 1A

4.8.6 The Coastal Clipper 1A is also operated by First in Norfolk and Suffolk and operates a similar route to that of Coastal Clipper 1, with an hourly service during the morning and afternoon. Together the Coast Clipper 1 and 1A services offer passengers a half hourly service, Monday to Friday between Martham and Lowestoft. The Coastal Clipper 1 A operates no weekday evening service and is replaced instead by the Coastal Clipper 1 service. The Saturday is the same as the weekday service, with an hourly frequency during the morning and afternoon, running concurrently with Coastal Clipper 1. Buses run at 2 hour intervals on Sundays, running concurrently with Coastal Clipper 1, offering passengers an hourly service during the morning

and afternoon. The Coastal Clipper 1A service operates no evening services at weekends.

Bus route X1

4.8.7 The X1 service, operated by First in Norfolk and Suffolk, is an express bus service that runs between Norwich and Lowestoft via Great Yarmouth. Services run twice per hour, Monday to Saturday, reduced to once per hour on Sundays.

Bus route X11

4.8.8 The X11, operated by First in Norfolk and Suffolk, is an express bus service that runs between Norwich and Belton via Great Yarmouth. Between Norwich and Great Yarmouth, it follows the same route as the X1 service. It operates a half hourly service, Monday to Saturday, and hourly service on Sundays.

Bus route 2

4.8.9 This is a circular route, operated by First in Norfolk and Suffolk, between Market Gates bus station and the Pleasure Beach. This is the only route that serves the south of the peninsula. Buses run approximately every 10 minutes Monday to Saturday, with a reduced service in the early morning and late evening. On Sundays buses run approximately every 20 minutes, with no early morning service and reduced late evening service.

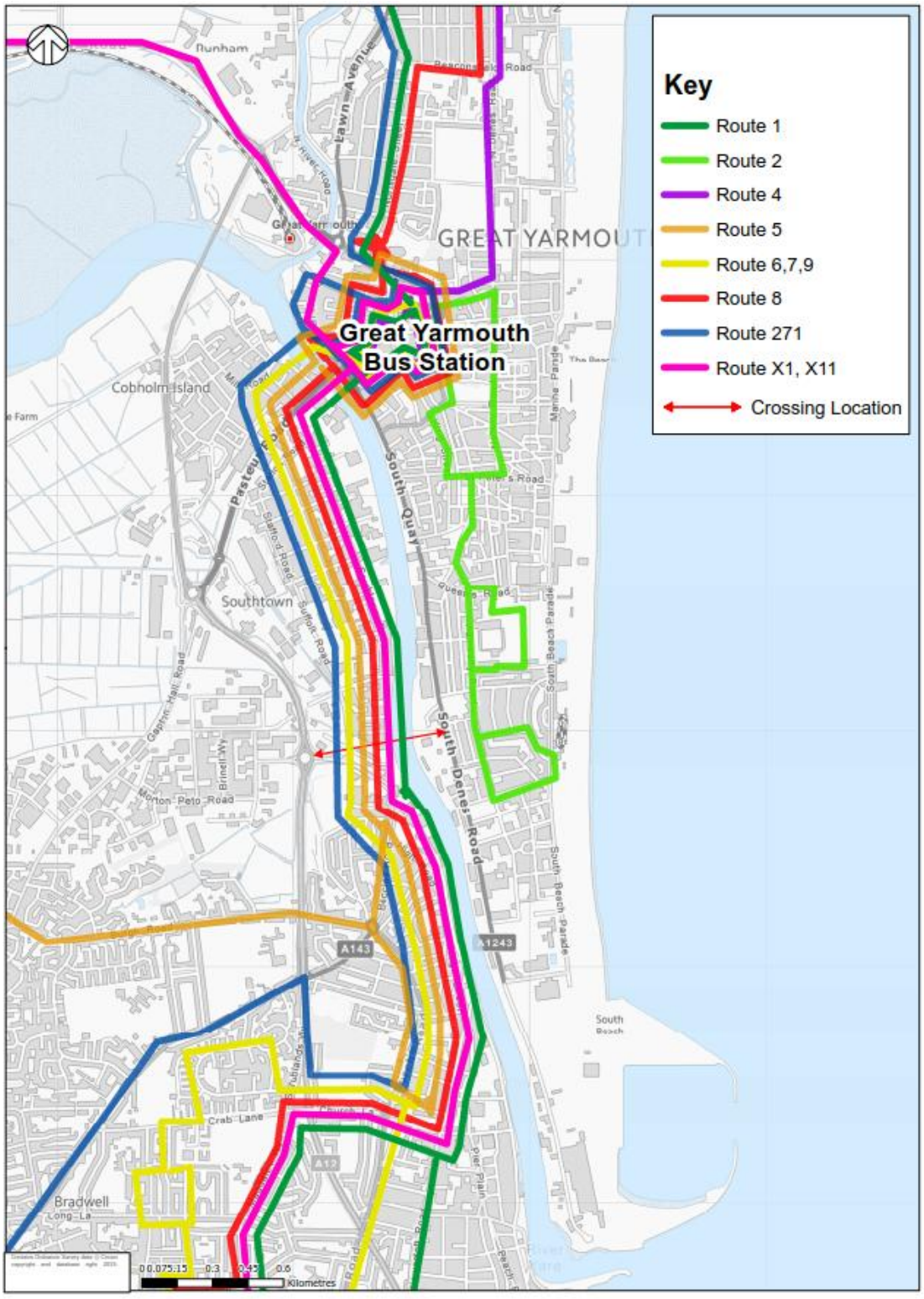
Bus route 5

4.8.10 Bus Route 5, operated by First in Norfolk and Suffolk, is a circular service running between Great Yarmouth and Burgh Castle via Gorleston and Burgh Castle. There are 10 hourly services Monday to Saturday, with no early morning or late evening services. The service runs on Sundays but is very limited with 4 buses per day

Bus route 6

4.8.11 Bus Route 6, operated by Sanders Coaches, is a local stopping service that runs between Bradwell and Great Yarmouth via Gorleston. Buses run every 30 minutes during the morning and afternoon Monday to Saturday. There are also 3 hourly services running afterwards in to the evening. Sunday services are reduced to hourly intervals but still provide evening buses up until after 9pm.

Plate 4-13: Bus Routes in the Vicinity of the Scheme



Bus route 7

4.8.12 Bus Route 7, operated by First in Norfolk and Suffolk, runs between Belton and Great Yarmouth. The service follows a route similar to the X11, but with an additional stop in Bradwell and no stop at James Paget Hospital. This service operates is a morning and evening only. Monday to Friday there are 3 buses per day towards Belton and 4buses per day towards Great Yarmouth. On Saturdays there are 2 buses a day towards Belton and 4 buses per day towards Great Yarmouth. On Sundays evenings there are two buses in each direction.

Bus route 8

4.8.13 Bus Route 8, operated by First in Norfolk and Suffolk, provides over 50 services per day Monday to Saturday between James Paget Hospital in Gorleston and Caister-on-Sea. These run approximately every 15 minutes and offer early morning and late evening services. Sunday services are reduced to 30 minute intervals but still run from early morning to late evening, offering over 30 services throughout the day.

Bus route 9

4.8.14 Bus Route 9, operated by First in Norfolk and Suffolk, runs between Great Yarmouth and James Paget Hospital. Services are generally provided every 30 minutes Monday to Saturday. There are no evening or Sunday services.

Bus route 271

4.8.15 Bus Route 271, operated by Our Bus, runs between Hemsby and Great Yarmouth. The service runs 2 buses per day Monday to Friday in both directions (mid-morning and early afternoon) with first bus of the day continuing towards / originating from Bradwell. There are no weekend services.

Bus route 580

4.8.16 Bus Route 580, operated by Boarder Bus, runs between Bungay and Great Yarmouth. The service operates 1 bus per hour Monday to Saturday and no service on Sundays. The earliest service from Bungay is just after 8am and the latest service to depart Great Yarmouth towards Bungay is just before 4pm. The last service to Beccles departs Great Yarmouth just after 5pm.

Bus route 922

4.8.17 Bus Route 922, operated by First in Norfolk and Suffolk, is a school service that runs between Great Yarmouth and Cliff Park Ormiston Academy This

operates 1 service per day Monday to Friday in each direction and no service at the weekends.

Bus Station

4.8.18 Great Yarmouth Market Gates bus station is located in the town centre, 2 km north of the Scheme, and is approximately 550m from the sea front, or a 5 to 7 minute walk. Public realm improvements are currently being undertaken at Market Hill Bus Station, this includes new Real Time Passenger Information (RTPI) displays along, new lighting and new railings.

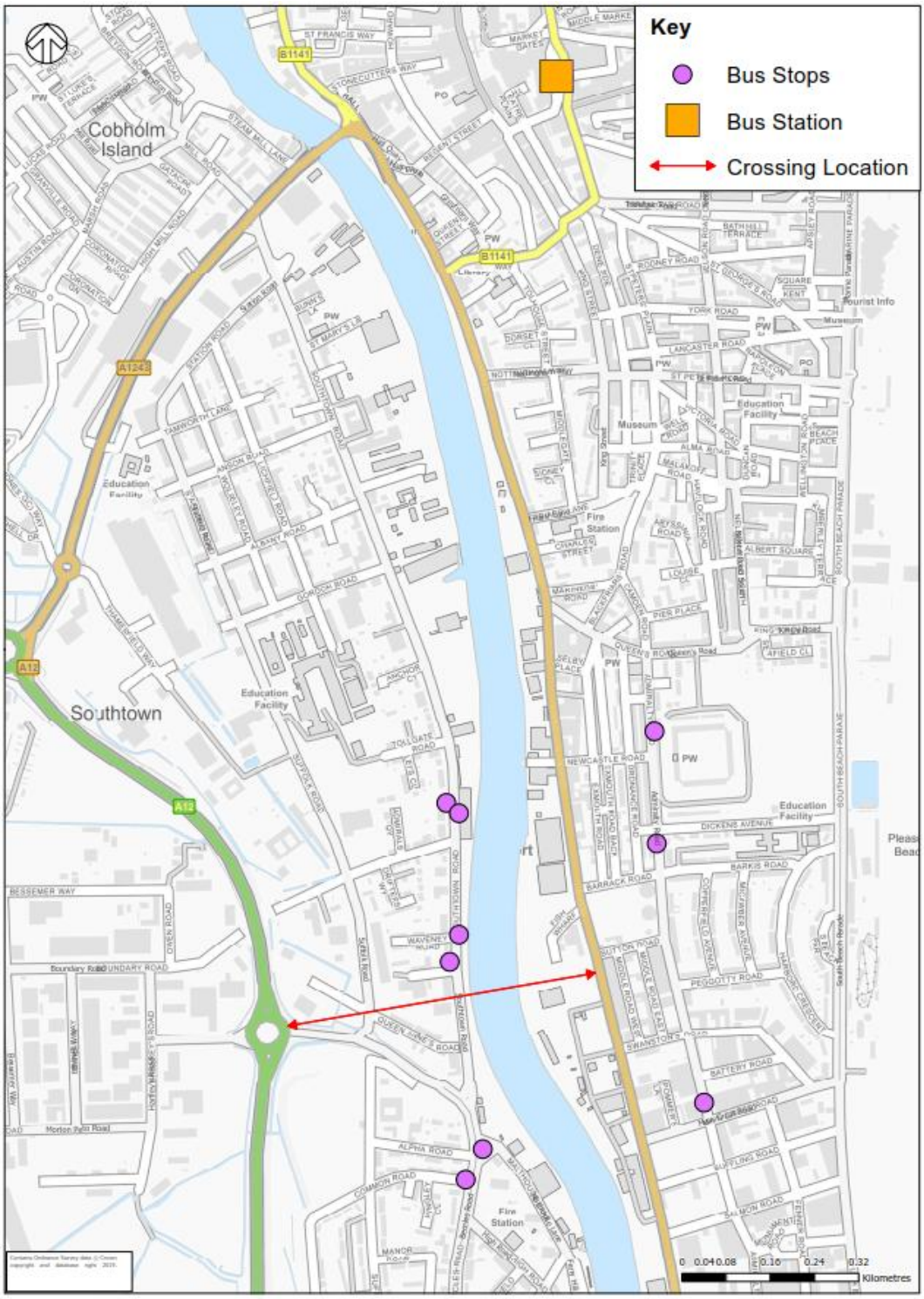
Bus Stops

4.8.19 The bus stops in the vicinity of the Scheme and are illustrated in Plate 4-14. The nearest to the scheme is the Waveney Road bus stop on Southtown Road. There are two other stops nearby on the west side of the river, on Southtown Road and Beccles Road.

4.8.20 All the bus stops in the immediate vicinity of the Scheme are on Southtown Road and Beccles Road to the west of the River Yare. The most central of these are Waveney Road bus stops and comprise a flag and pole only.

4.8.21 There are no bus stops to the east of the River Yare within the immediate vicinity of the Scheme. The closest bus stop on the east side is the Battery Road bus stop on Admiralty Road, approximately 300m east of the river This is the southernmost bus stop on the peninsula and is served by bus route 2 only. This is a circular route that connects the peninsula with Great Yarmouth town Centre. There are no bus stops along the A1243 South Denes Road.

Plate 4-14: Bus Stops Close to the Proposed Scheme



Railway Station

4.8.22 Great Yarmouth Station is one of two termini on the Wherry Line from Norwich, the other being Lowestoft to the south. The station is located

approximately 1.5 miles, or a 30-minute walk, from the Scheme. No bus services regularly serve the station forecourt. The station is approximately 1km from the town centre, or a 10 to 15 minute walk via Vauxhall Bridge where a number of bus services can be accessed.

Train Services

4.8.23 All train services from Great Yarmouth Station are operated by Abellio Greater Anglia. According to the Office of Rail Regulation usage figures for 2016-2017, Great Yarmouth was the fifth-busiest railway station in Norfolk, after Norwich, King's Lynn, Diss and Downham Market.

4.8.24 The majority of services from Great Yarmouth run direct to Norwich via Acle, however two trains per day run direct to Norwich via Berny Arms. On both routes, the majority of services call at all intermittent stations. The approximate journey time between Great Yarmouth and Norwich is 35 minutes.

4.8.25 During the AM peak period (07:00-10:00), four services depart from Great Yarmouth to Norwich. In the PM peak period (16:00-19:00), there are five services to Norwich.

4.9 Pedestrian and Cycle Facilities

4.9.1 The River Yare divides the western side of Great Yarmouth from the town centre, sea front, harbour and other destinations on the South Denes peninsula. To access these facilities, all pedestrian and cycle journeys between east and west have to cross the existing bridges. For pedestrians this means using Haven Bridge, as the Breydon Bridge has no footways. As a result, for many trips the time and distance involved is significant when compared with the equivalent "crow fly" distance.

Pedestrian Network

4.9.2 The pedestrian network along the eastern bank of the River Yare is adequate, with footways generally provided on both sides of the A1243. Along South Quays Road the footways are generally between 1.5m and 2.0m in width, however as you travel further south these become very narrow, with footways of between 1.0 and 1.5m in width on both sides of Southgates Road and South Denes Road. South of Hartman Road there is also large stretches South Denes with no footway provision.

4.9.3 On the western side of the river, the pedestrian network is less comprehensive with no public realm space or footway directly alongside the river due to the existing industrial units that occupy this space.

4.9.4 On Southtown Road, which runs parallel to the River Yare, there are footways of between 1.2 to 1.5m on both sides the carriageway and at the signalised junction of William Adams Way / Beccles Road / Southtown Road there are pedestrian crossing facilities. To the south of Southtown Road there is limited footway provision along Malthouse Lane and Riverside Road.

4.9.5 Footways of about 2m in width are provided along the south side of William Adams Way, however at the A47 / William Adams Way roundabout, only informal pedestrian crossing facilities are provided. There is a ramped pedestrian and cycle bridge on William Adams Way which provides access to Suffolk Road and Queen Anne's Road.

4.9.6 Haven Bridge is the main crossing for pedestrians travelling between Gorleston and Great Yarmouth. Footways of approximately 2m in width are provided on Bridge Road on approach and across the River Yare on both sides of the carriageway. Breydon Bridge to the north has no footways and is not considered suitable for use by non-motorised users due to the 50mph speed limit.

Cycle Network

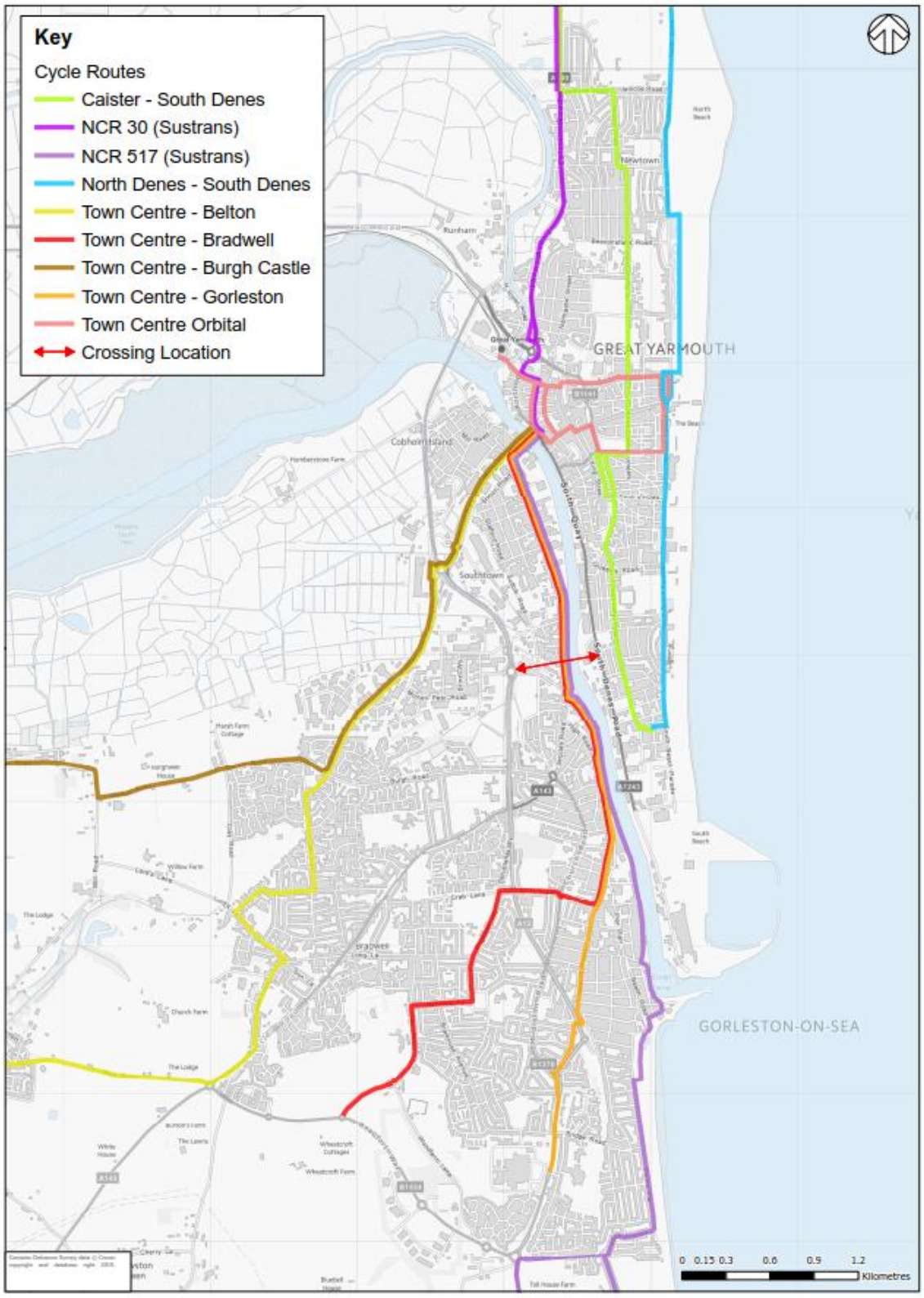
4.9.7 Great Yarmouth's cycle network, as shown in Plate 4-15 comprises sections of National Cycle Network (Routes 30 and 517) and the Regional Cycle Network, as well as other signposted on-road cycle routes (referred to as pedalways), advisory cycling routes and some traffic free cycle routes.

4.9.8 Existing opportunities for cyclists to cross the River Yare is limited. The Breydon Bridge has designated cycle lanes on either side of the carriageway, however, these are unsegregated and pose a risk to cycle users due to the nature of the road (50mph speed limit). The Haven Bridge has a shared use path leading up to it on either side of the river as part of the National Cycle Network Route 517, however, there is no provision on the crossing itself and cycle users have to dismount along the east bank of the River Yare. There is a wide segregated footway/cycleway along the western side of A1243 South Quay between Haven Bridge and Nottingham Way. South of Nottingham Way and towards the location of the Scheme there is no designed cycle route or infrastructure along the A1243. Pedalway Route 1 runs parallel to the A1243 along Blackfriars Road, Camden Road and Admiralty Road and connects with Pedalway Route 2 which runs along the beach front. This route is principally on-street along quieter residential roads with limited provision for cyclists.

4.9.9 Opposite the Haven Bridge, there is a dedicated cycle lane on Regent Street (Pedalway Route 7) which provides cycle access to the town centre. To the north of Haven Bridge, an on-road cycle route starts at Stonecutters Way and runs through to George Street, and The Conge, before linking in with National Cycle Route 30 at the North Quay junction.

4.9.10 On the western side of the River Yare, Southtown Road is designated as National Cycle Network Route 517, it is non-segregated apart from a section close to the Pasteur Road junction. The route continues on to Malthouse Lane and Riverside Road before reaching Gorleston. Pedalway Routes 5 and 6 follow the same route before turning on to Ferry Hill at the Riverside Road junction towards Bradwell and Gorleston respectively. Pedalways Routes 3 and 4 follow Pasteur Road on an off-carriageway footway/cycleway from Haven Bridge before continuing on to Gapton Hall Road towards Burgh Castle and Belton.

Plate 4-15: Cycle Network



4.10 Pedestrian and Cycle Movement

4.10.1 The most southerly point at which pedestrians and cyclists are currently able to cross the River Yare between the western and eastern parts of Great Yarmouth is the Haven Bridge. Some of these trips are expected to transfer to the Scheme. Surveys were undertaken in 2016 to determine the present use of the bridge by pedestrians and cyclists.

Pedestrian Flows

4.10.2 To understand existing pedestrian use of Haven Bridge a Non-Motorised User Audit Survey was undertaken in 2016, this found that there are typically 4,700 pedestrian crossing movements across Haven Bridge each day. The typical weekday pedestrian flow across Haven Bridge is summarised in Table 4-7 below.

Table 4-7: Pedestrian Trips over Haven Bridge (typical weekday from 7am to 7pm)

Haven Bridge	
Pedestrian Trips	
Eastbound	2,443
Westbound	2,299
Total	4,742

4.10.3 Surveys undertaken as part of the same NMU Audit Survey found that a significant proportion of home to work journeys within the town are short trips undertaken at morning peak times with return journeys at evening peak times. The busiest time for pedestrian activity at Haven Bridge is during the evening peak period, reflecting its use for journeys to and from work.

Table 4-8: Pedestrian Trips at Peak Periods, Haven Bridge

Haven Bridge		
Period	**Pedestrian trips**	**Percentage of daily pedestrian trips**
07:00-09:00	581	9%
16:00-18:00	848	16%

Cycle flows

4.10.4 A NMU survey of Haven Bridge found that on a typical weekday, there are 1,056 cycle crossing movements across Haven Bridge each day. The typical flow of cyclists across Haven Bridge on weekday is summarised in Table 4-9.

Table 4-9: Cycle Trips over Haven Bridge (typical weekday from 7am to 7pm)

Haven Bridge	
Cycle Trips	
Eastbound	533
Westbound	523
Total	1,056

4.10.5 The busiest time for cycle activity at Haven Bridge is during the evening peak period, reflecting its use for journeys to and from work.

Table 4-10: Cycle Trips at Peak Periods, Haven Bridge

Haven Bridge		
Period	**Cycle trips**	**Percentage of daily cycle trips**
07:00-09:00	206	17%
16:00-18:00	261	21%

4.11 Parking Facilities

Car Parks

4.11.1 Great Yarmouth Borough Council operates 36 car parks, of which 22 are pay and display. Long-term parking is discouraged in the town centre car parks in order to maximise availability of spaces.

4.11.2 There are 955 free and 2,549 charged off-street parking spaces within the borough.

4.11.3 An audit of car parking spaces of Great Yarmouth Controlled Parking Enforcement ("CPE" Area was undertaken by Great Yarmouth Borough Council Car Parking Strategy Steering Group in 2013. This identified a total of 3,098 spaces in car parks and 3,051 spaces on street. A breakdown of the total number of car parking spaces in the CPE area is provided in Table 4-11.

Table 4-11: Car Parking Audit

Car Parking Audit Results (Core CPE area)	
Pay and Display	
Town centre	881
Sea front	945
Free parking	
Town centre	57
Private parking	**3,098**
On-street parking	
Town centre	1,265
Sea front	1,786

4.11.4 A residents parking scheme is in place by Great Yarmouth Borough Council to help residents in Great Yarmouth park within close proximity to their homes. It only applies to residents of certain streets and designated areas in the town centre and permits are provided for an annual fee with only one permit per household allowed. Non-residents can buy vouchers that allow them to park in shared use parking bays between 9am and 4pm.

4.11.5 Car parking is prohibited along the majority of Southtown Road, enforced by double yellow lines, with the exception of a small stretch (approximately 100m) of space for on street residential parking between the Waveney Road and Queen Anne's Road junctions.

4.11.6 On South Denes Road, there are designated bays for residential parking to the north of the Friar's Lane junction. There is also a stretch of approximately 150m south of the Newcastle Road junction which allows free on-street parking on the eastern side of South Denes Road without a resident's permit, however, for the most part, on-street parking is prohibited along South Denes Road and is enforced by double yellow lines.

4.12 Other Planned Transport Improvements

4.12.1 Highways England has proposals to improve junctions on the A47 Trunk Road in Great Yarmouth (formerly the A12 south of Vauxhall roundabout) as part of the government's Road Investment Strategy for 2015-2020 (RIS 1). In August 2017, based on work which did not consider the Scheme to be a committed improvement, Highways England made a preferred route announcement for an improvement scheme. This comprised two locations in Great Yarmouth (Illustrated in Plate 4 16) and described below:

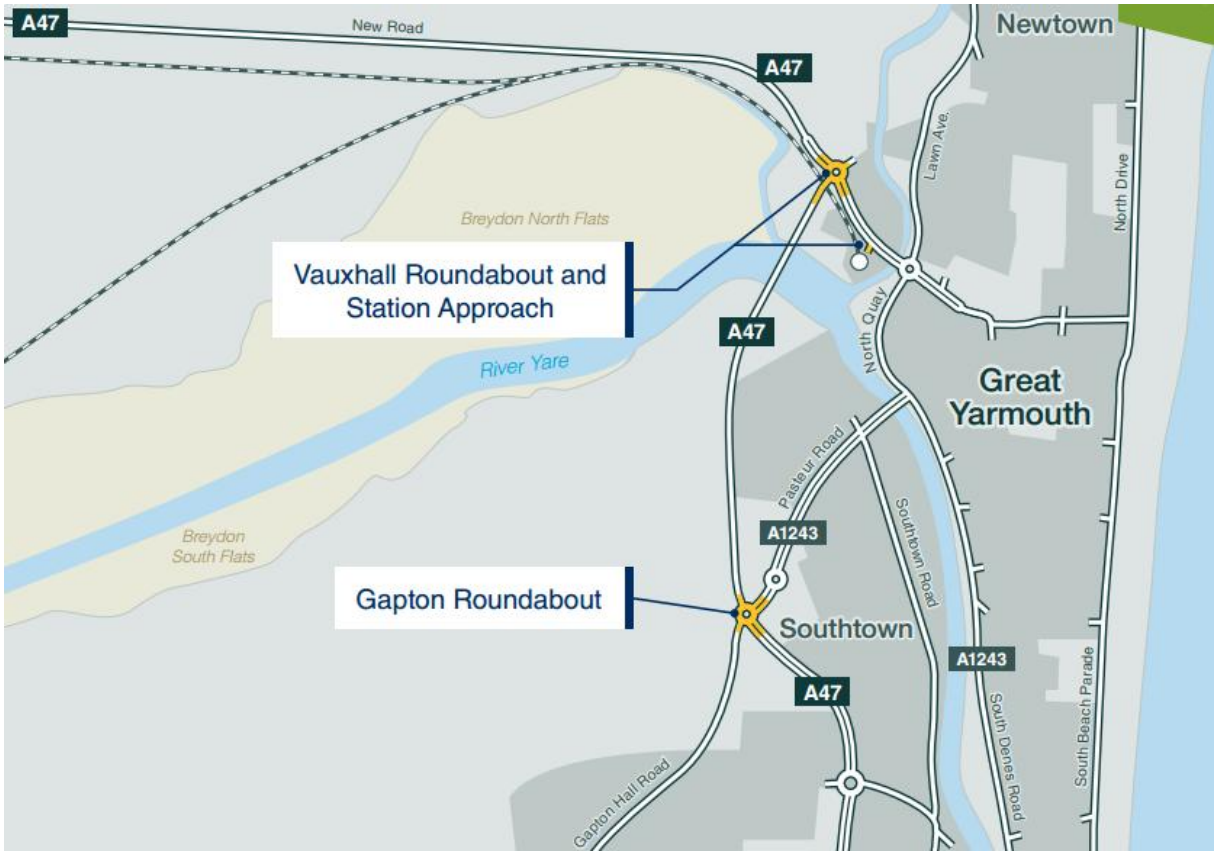
A47 Vauxhall Roundabout and Station Approach

- Enlarged roundabout
- Widening and realignment of approaches
- Possible improvements for non-motorised users
- Minor improvements to existing layout and signals, and reinstated right turn at Station Approach (now complete)

A47 Gapton Roundabout

- Signalisation of roundabout
- Possible improvements for non-motorised users

Plate 4-16: Planned RIS-1 Junction Improvements (Source: Highways England)



4.12.2 Highways England has advised that, with the Scheme in place, the improvement scheme detailed in their preferred route announcement may not be the best option. In view of this they have commissioned NCC and WSP to evaluate proposals comprising different combinations of junction improvements including economic appraisal. This work has included the consideration of alterations at Harfrey's Roundabout.

A47 Harfrey's Roundabout

4.12.3 The key findings of this work are that:

- an improvement at Gapton Hall Roundabout would only be beneficial if there is no Scheme
- an improvement at Vauxhall Roundabout (preferred route announcement) would also be more suited to the non-Scheme scenario.

4.12.4 Highways England have advised that they are considering doing further work to design junction improvements which would work better with the Scheme, to deliver positive economic benefits in Great Yarmouth.

Other Schemes

4.12.5 The New Anglia Local Enterprise Partnership Growth Deal allocation for 2016 to 2021 includes £9m funding for Great Yarmouth to help tackle congestion and create attractive alternatives to the car by improving facilities for public transport users, walking and cycling.

4.12.6 NCC, working with partners, is leading the development of these enhancement projects. Improvement schemes for Fuller's Hill roundabout, The Conge and access to the railway station are finished, and an evaluation of improvement packages for sustainable transport schemes is currently underway.

4.12.7 The development of all schemes has involved widespread consultation and engagement with local stakeholders and wherever possible this has been combined with the consultation and engagement activities undertaken on the third river crossing.

4.12.8 These schemes will, however, be delivered independently of the Great Yarmouth Third River Crossing, and have been included where appropriate in the "Do Minimum" scenarios[7]. They include:

- Station access improvements
- Southtown Road improvement

Summary

4.12.9 In summary, this section has demonstrated that:

- Great Yarmouth is served by the A47 trunk road as well as the A149 and A143 principal roads, but connections into the peninsula, which contains the South Denes Enterprise Zone, Outer Harbour and Seafront are poor, with no direct link to the SRN. There is no crossing of the River Yare below the Haven Bridge so traffic has to use longer, less suitable routes through the town centre.
- Detailed traffic surveys were undertaken, and used to develop, calibrate and validate the traffic models employed to assess the Scheme.
- Congestion is the most serious transport concern amongst local people, and this view is borne out by the results of queuing surveys and simulations of the performance of the network.

[7] Schemes included and the reasons for inclusion are described in the Paramics Forecasting Report, Uncertainty Log

- Congestion, together with a lack of direct routes, make it difficult for all modes of transport (cars, HGVs, buses, cycles and people on foot) to access the Enterprise Zone, and this makes it harder to attract development and achieve economic growth.
- Planned improvements to the A47, though beneficial to users of the SRN, will not deal with these problems, because they do not connect directly to the peninsula.

5 The Scheme

5.1 Overview

5.1.1 This section describes the Scheme which has been designed to address the identified problems and provide the capacity needed to support economic growth and development by providing a third crossing of the River Yare.

5.1.2 The Scheme will provide a third crossing over the River Yare, creating a new, more direct link between the western and eastern parts of Great Yarmouth. Specifically, it will provide a connection between the SRN (A47) and the South Denes Business Park, Enterprise Zone, Great Yarmouth Energy Park and the Outer Harbour, all of which are located on the South Denes peninsula.

5.2 Location

5.2.1 The River Yare is one of the main waterways providing access to the Norfolk Broads. At Great Yarmouth, it separates the town into two parts, west and east, with the town centre, seafront, industrial areas and Outer Harbour located on the narrow, 4km long, South Denes peninsula. The River Yare itself forms a river port with commercial quays on either side. The eastern and western banks are flanked by a mixture of commercial and residential properties. Commercial vessels and leisure boats enter the Port from the North Sea at a southern access point via the Outer Harbour.

5.2.2 The Scheme consists of a new dual carriageway road across the river, linking the A47 at Harfrey's Roundabout on the west side with the A1243 Southtown Road on the east side. It will have a clear span over Southtown Road on the west side of the river.

5.2.3 The location of the scheme within Great Yarmouth is shown in Plate 3-2 above. The Order Limits are illustrated in Plate 3-3. The Scheme Masterplan is shown in Plate 5-1 below.

Plate 5-1: Scheme Masterplan

5.3 Scheme Description

5.3.1 Chapter 2 of Volume I of the Environmental Statement (ES) (DCO Document 6.1) provides a full description of the Scheme, and is accompanied by the General Arrangement Plan (DCO Document 2.2). Both documents should be read alongside the Transport Assessment, as a detailed project description is not provided in this document to prevent unnecessary duplication.

5.3.2 The Scheme involves the construction, operation and maintenance of a new crossing of the River Yare in Great Yarmouth. The Scheme consists of a new dual carriageway road, including a road bridge across the river, linking the A47 at Harfrey's Roundabout on the western side of the river to the A1243 South Denes Road on the eastern side. The Scheme would feature an opening span double leaf bascule (lifting) bridge across the river, involving the construction of two new 'knuckles' extending the quay wall into the river to support the bridge. The Scheme would include a bridge span over the existing Southtown Road on the western side of the river, and a bridge span on the eastern side of the river to provide an underpass for existing businesses, enabling the new dual carriageway road to rise westwards towards the crest of the new crossing.

5.3.3 If constructed, the Scheme would comprise the following principal elements:a new dual carriageway road, crossing the River Yare in an east-west orientation, comprising of:

- A new double-leaf bascule bridge providing an opening span to facilitate vessel movement within the river. This would include structures to support and accommodate the operational requirements of the bridge-opening mechanism, including counterweights below the level of the bridge deck. The bridge would be supported on driven piles;
- New substructures, supported by driven piles, to support the double leaf bascule bridge within the existing quays either side of the river and within the river itself, requiring new permanent "knuckle" walls, creating cofferdams in the waterway to accommodate their construction;
- A new five-arm roundabout connecting the new dual carriageway road with Suffolk Road, William Adams Way and the western end of Queen Anne's Road. Sections of the new five arm roundabout would be supported on driven piles where deep soft ground is encountered;
- A single-span bridge over Southtown Road, with reinforced earth embankments joining that bridge to the new roundabout at William Adams Way. Southtown Road bridge and the reinforced earth embankments would be supported on driven piles;

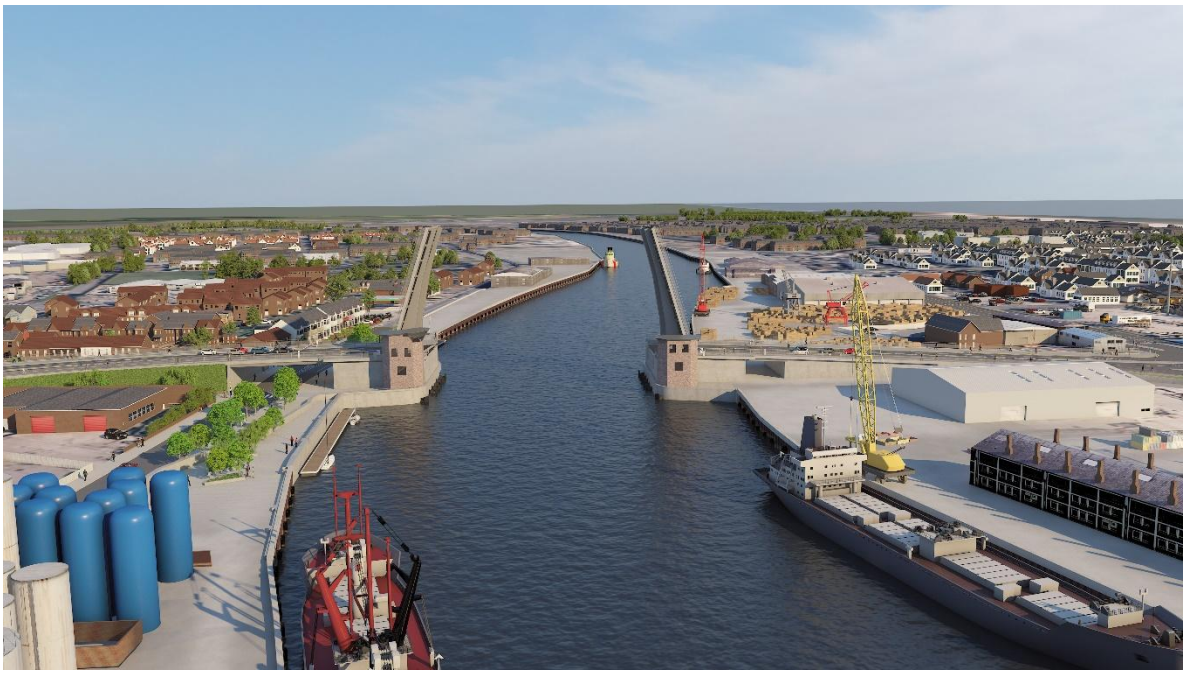
- A single-span bridge to provide an underpass on the eastern side of the river, with reinforced earth embankments joining that single span bridge to South Denes Road. The underpass and reinforced earth embankments would be supported on driven piles; and
- A new signalised junction connecting the new road with A1243 South Denes Road. The closure of Queen Anne's Road, at its junction with Suffolk Road, and the opening of a new junction onto Southtown Road providing vehicular and pedestrian access to residential properties and the MIND Centre and Grounds at the eastern end of Queen Anne's Road;
- Revised access arrangements for existing businesses onto the local highway network;
- Dedicated provision for cyclists and pedestrians which ties into existing networks;
- Implementation of part of a flood defence scheme along Bollard Quay that is proposed to be promoted by the Environment Agency, and works to integrate with the remainder of the flood defence scheme;
- A control tower structure located immediately south of the crossing on the western side of the river. The control tower would facilitate the 24/7 operation of the opening span of the new double-leaf bascule bridge;
- A plant room located on the eastern side of the river for the operation of the opening span of the new double-leaf bascule bridge;
- The demolition of an existing footbridge on William Adams Way;
- Associated changes, modifications and/or improvements to the existing local highway network;
- Additional signage, including Variable Message Signs (VMS) at discrete locations, to assist the movement of traffic in response to network conditions and the openings / closings of the double-leaf bascule bridge;
- The relocation of existing allotments to compensate for an area to be lost as a result of the Scheme and other works, including those at the MIND Centre and Grounds; and
- New public realm, landscape, ecology and sustainable drainage measures.

5.3.4 The Scheme also includes works to facilitate the construction, operation and maintenance of the above elements including:

- Creation of temporary construction sites and accesses from the public highway;
- Provision of new utilities and services and the diversion of existing utilities;

- Provision of drainage infrastructure, lighting and landscaping;
- Demolition of a number of existing residential and commercial / business properties; and
- Provision of vessel waiting facilities to the north and south of the new crossing, either as floating pontoons or additional fendering to the existing berths, including any dredging and quay strengthening works that may be required.

Plate 5-2: Bascule Bridge 3D Visualisation



6 Assessment Methodology

6.1 Introduction

6.1.1 Detailed traffic models have been developed to assess existing and future conditions and to determine the impacts of the Scheme. These have been developed over time to support each stage in the development of the Scheme.

6.1.2 A tiered approach has been followed comprising:

- Developing a SATURN model (used for strategic analysis and to feed into the economic appraisal)
- Building a Paramics Discovery microsimulation model (used in the option selection process and to forecast operational performance in more detail).

Origins of the Traffic Models

6.1.3 The strategic SATURN model - the Great Yarmouth Traffic Model ("GYTM") - was based on a SATURN model originally built in 2008. This was recalibrated to create a new 2016 base model. The more detailed Paramics Discovery microsimulation model ("the Paramics model") was based on the SATURN model.

Updating the Traffic Models to 2018

6.1.4 The two models have been updated and re-run with refinements including:

- Updating the base year to 2018 (the OBC modelling used a 2016 base year)
- Updating assumptions on committed developments and infrastructure
- Updating the bridge opening schedule for the Scheme in both models to ensure consistency
- Using the updated SATURN model to update the economic appraisal and calculate an updated BCR
- Using trips from the updated SATURN model in an updated Paramics model
- Refining the Paramics model further to ensure good validation against additional traffic flow data collected in March 2018

6.1.5 The methodology takes account of feedback from DfT on the modelling and appraisal work submitted with the OBC.

6.1.6 The development of the SATURN model is described in the following reports, which form appendices to Document 7.6 Economic Appraisal Report:

- Document 7.6 Appendix A: Local Model Validation Report (LMVR) Addendum (SATURN)
- Document 7.6 Appendix B: Forecasting Report (SATURN)
- Document 7.6 Appendix H: Correspondence with DfT

6.1.7 The development of the Paramics model is described in detail in the following reports which form appendices to this TA:

- Appendix A: Traffic Data Collection Report
- Appendix B: Local Model Validation Report (Paramics)
- Appendix C: Forecasting Report (Paramics)

6.2 Use of Traffic Modelling to Support the Transport Assessment

6.2.1 The purpose of this TA is to assess in detail the impacts of the Scheme on the local transport networks, focusing on the areas where these impacts are likely to be greatest, and where mitigation may be needed. The modelling needs to be detailed, transparent and able to provide detailed predictions of how roads and junctions will perform with and without the Scheme.

6.2.2 Microsimulation modelling is the most appropriate way to do this. Therefore, the assessment of impacts in this is based on the Paramics model, updated and validated using the 2018 traffic data (described in Chapter 4).

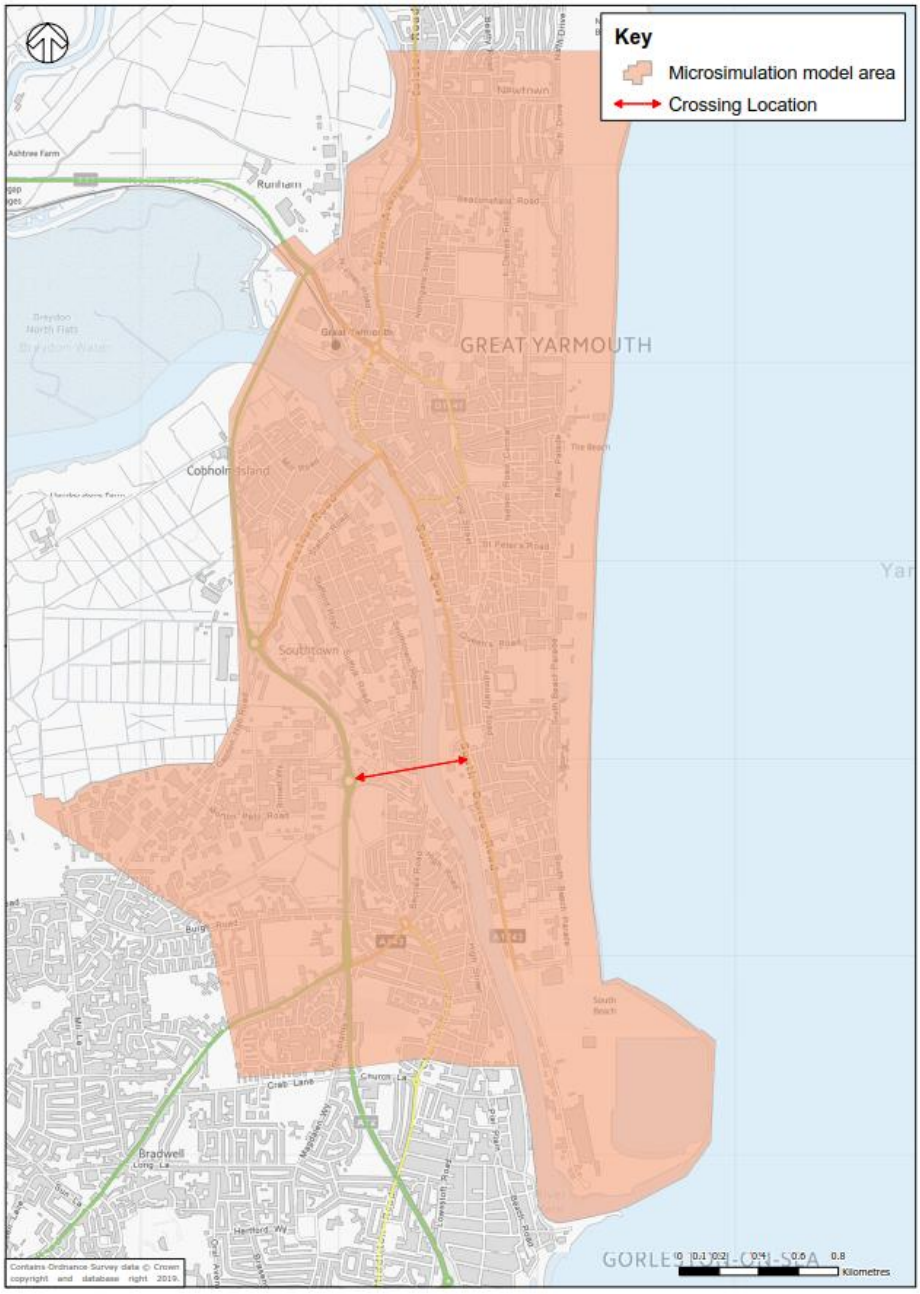
6.2.3 The 2018 Paramics model is briefly described below.

6.3 The 2018 Paramics Model

Model Area

6.3.1 The model area is shown in Plate 6-1.

Plate 6-1: Microsimulation Model Area



Peak Periods

6.3.2 Peak hours for the Paramics model were determined from a review of all survey data:

- AM (morning peak hour) 08:00 – 09:00
- IP (inter peak) 13:00 – 14:00
- PM (evening peak hour) 16:30 – 17:30

Traffic Release Profiles

6.3.3 Paramics allows variations in demand within peak periods to be modelled, in order to reproduce the demand variation during the simulation - the 'peak within the peak' - as well as the build-up and dissipation of queues. For added realism, different "release profiles" are used in different areas of the model. These are based on survey data, when available, or by selecting a profile based on land use or proximity to a zone where profiles are available.

Normalisation of Traffic Count Data

6.3.4 Because the surveys were carried out in different months and years, it was necessary to adjust the traffic data in order to represent an average weekday in a neutral month in 2018. Normalisation factors have been calculated using trustworthy, long-term traffic data within, or as near as possible to the study area. Highway England WebTRIS provided the necessary information to carry out the calculation of these factors by means of three permanent traffic counts locations.

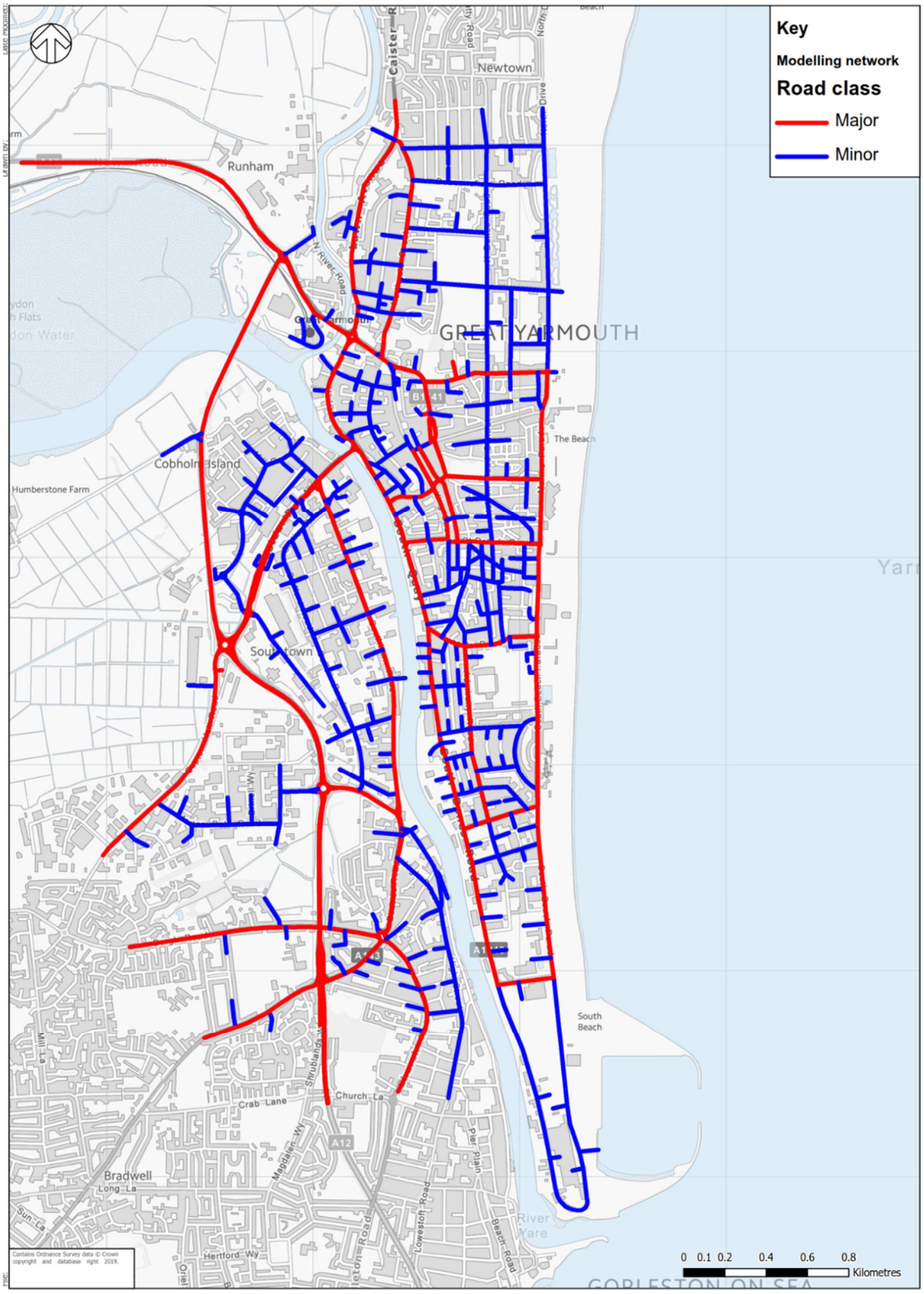
Modelling the Road Network

6.3.5 The model network was created with reference to Ordnance Survey AutoCAD mapping and as-built drawings provided by NCC. Both sources provide information regarding the physical features of Great Yarmouth highways, and the junction layouts allow accurate replication of stop line positions, signal staging phasing and timing.

6.3.6 Additional information such as speed limits, give-way priorities, banned movements, lane configuration, bus stop locations and vehicle behaviour were gathered from the CAD drawings, satellite and street images.

6.3.7 Paramics allows different road categories to be modelled which improves the accuracy of route choice. The main link categories are 'Major' and 'Minor' roads. These link types determine the road importance and likely utilisation depending on whether the drivers are familiar or not with the network. The road hierarchy of the Paramics model is shown in Plate 6-2. It should be noted that there is not public access to the area of road at the southern end of the Peninsula, but this has been included in the model network to enable traffic from the Port to be loaded onto the network correctly.

Plate 6-2: Paramics Microsimulation Model Road Hierarchy



6.3.8 NCC provided traffic signal controller specifications and as-built drawings where the data was available, for twenty-five signal controlled junctions and pedestrian crossings within the study area network. Signal timings for junctions and pedestrian crossings during the modelled periods were calculated using the controller specifications provided. NCC confirmed that most of the junctions run under SCOOT control and timing logs were provided for most junctions.

Modelling the Haven Bridge

6.3.9 NCC provided historical data from 2014/15/16 for the number of Haven Bridge lifts per month. A more detailed log from June 16 provides the precise times when the bridge was lifted and closed to traffic. It was closed to traffic for durations of between 5 to 10 minutes. The timings in the log file indicate that bridge lifts appear to be concentrated outside the peak hour period, and are likely to be dominated by tidal times.

6.3.10 During summer 2015 the Haven Bridge was lifted over 40 times per month, with a peak of 61 lifts in May. During the winter it was fewer than 20 times per month. Due to the limited number of bridge openings, and the fact that the port authority generally avoids bridge openings during peak times, Haven Bridge has been modelled as a fixed road link (i.e. the opening of the bridge was not modelled).

Breydon Bridge

6.3.11 The Breydon Bridge lifts are very infrequent and therefore this has also been modelled as a fixed road link.

Modelling the Do Minimum Network

6.3.12 The Do Minimum (DM) network represents the network as it is expected to be in the future, but without the Scheme. It therefore includes schemes proposed for the study area which are not in the Base network, but are likely to be delivered. Working closely with the Applicant's highways officers, and in line with DfT guidance on Transport Appraisal, an uncertainty log was agreed, detailing potential schemes and their status. Inclusion in the DM network was then determined from the expected timing and level of certainty of each scheme. Some schemes, such as the improvements to the rail station forecourt and Trafalgar Road, were not included in the DM as they would not significantly alter the operational highway layout or impact on its performance.

6.3.13 The network improvements included in the 2023 and 2038 models are:

- Great Yarmouth Station Access. (This scheme is now complete but was not included in the 2018 base model as, it was under construction when the 2018 traffic surveys were carried out.)
- Vauxhall Junction
- Gapton Hall Junction
- Southtown Road improvements (removal of signals from Station Road).

6.3.14 The modelled traffic signal timings were adjusted at junctions where the model forecast a significant redistribution of turning movements in the DM network in 2023 and 2038. These included the locations of the above highway improvements and the Hall Plain and Station access junctions.

Modelling the Scheme: the "Do Something" (DS) Network

6.3.15 The Scheme was modelled according to the general arrangement plans, which describe the physical features of the highway and junctions, with faithful replication of kerb lines and stop/give way line positions. This ensures, for example, the vehicle paths through the Scheme are appropriate and correctly reflect the conflicts between different traffic streams at junctions.

6.3.16 The modelling of the Scheme within the DS network is consistent in all respects with the modelling of the rest of the network.

6.3.17 The modelled traffic signal timings were adjusted at junctions where the model forecast a significant redistribution of turning movements in the DS network. These included the new signalised junction at South Denes Road, the A47 signalised junctions and the junctions on either side of Haven Bridge (Southtown Road/Pasteur Road and Hall Plain).

6.3.18 The main part of the Scheme is modelled as a new dual carriageway road, crossing the river Yare by means a Double Leaf Bascule Bridge. The new bridge will open on demand for any commercial vessel when required. When the bridge is raised the route for road traffic will be closed. The opening and closing of the bridge is represented in the model. Section 5.3 of Appendix C, the Forecasting Report, describes the statistical analysis done to calculate the schedule of opening times.

6.3.19 A VMS system will inform drivers about the status of the bridge, so drivers can decide whether to take another alternative route or wait for the bridge to be lowered again. This is also represented in the model, as described in Section 5.4 of Appendix C.

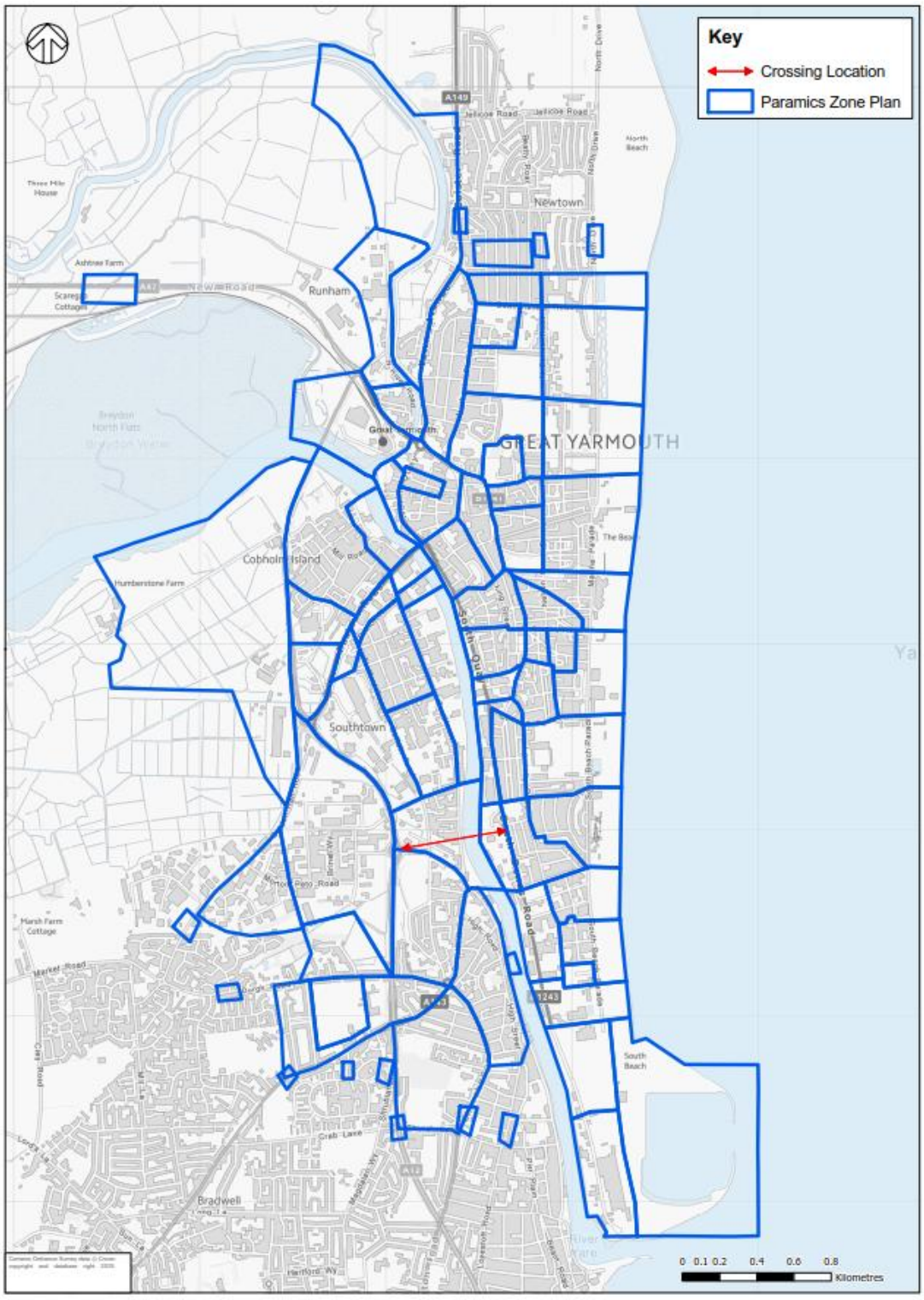
Zoning

6.3.20 The zone system represents specific areas within the model from which trips start and end. Each individual zone has access and egress points where vehicles are 'released' into the network or leave the model. Vehicles make their trip choice through the network based on the driver's perception of cost and then leave the network at their destination zone.

6.3.21 The zoning plan for the Paramics model was based on that developed for the strategic SATURN model, with several of the SATURN zones being subdivided to achieve a greater level of detail.

6.3.22 The resulting zone plan is shown in Plate 6-3:

Plate 6-3: Paramics Model: Zone Plan



Modelling Public Transport

6.3.24 The main bus routes in Great Yarmouth have been included in the model. Information on the timetables and routes was obtained from the official sites of public transport operators. The location of bus stops was determined by visual inspection of Google street view and maps.

6.3.25 After careful examination of the available information, public transport services were modelled along with their complete timetables and bus stops within the study area.

Matrix Development

6.3.26 The demand matrices for the Paramics model were developed from the SATURN matrices by 'cordoning off' the area covered by the Paramics model network. Zones within the cordoned area were expanded where necessary, with trips allocated to parts of a split zone by reference to land use and trip generation rates from TRICS.

6.3.27 There is one-to-one mapping between the SATURN cordon model cut points and zones in the Paramics model, except for one zone (29) which was split into zones 291, 292 and 293 in Paramics.

6.3.28 Demand matrices were developed for morning and evening peak periods, and for the inter-peak period. Hourly matrices were expanded to include warm-up and cool-down periods, based on survey data. The five user classes in the SATURN model were simplified into three, which were modelled separately: Car, LGV and HGV. Buses in the Paramics model are allocated to fixed routes.

6.3.29 The validation of the Paramics trip matrices is described in detail in the Appendix B: Paramics LMVR.

Future Years Modelled

6.3.30 The strategic SATURN model has been used to inform the distribution and traffic growth through the model area. For the GYTM, a number of growth scenarios and forecast years had been considered, of which the following were used in the Paramics microsimulation model:

- 2023 CORE scenario with Variable Demand Modelling ("VDM")
- 2038 CORE scenario with VDM.

6.3.31 Cordon matrices were extracted from the SATURN matrices for each of the above scenarios. Changes were made to the SATURN zone system and

user classes to make them suitable for use in the Paramics model, as described above.

6.3.32 The Paramics forecast matrices for 2023 and 2038 were developed from the cordon matrices extracted from SATURN as follows:

- A set of sectors were defined to avoid outliers caused by lack of data for small zones
- Growth factors from the SATURN base and forecast matrices were calculated using the sectors already defined
- The growth factors were applied to the 2018 validation matrices produced after Matrix Estimation
- Trips generated by new development were added to the forecast matrices.

6.3.33 More information on the development of the Paramics model can be found in Appendices B and C.

7 Transport Impacts

7.1 Introduction

7.1.1 The Paramics microsimulation model described in Chapter 6 above has been used to assess existing and future traffic conditions and the transport impacts of the Scheme. The results are set out and explained in this chapter.

7.1.2 Traffic flows have been determined for the following scenarios:

- The existing network (Base) in 2018
- The "Do Minimum" (DM) network in 2023
- The "Do Something" (DS) network in 2023

7.1.3 The Base scenario represents the existing situation, with no interventions.

7.1.4 The DM scenario includes forecast traffic growth to 2023, as well as the other transport schemes expected to be in place by 2023, but excludes the Scheme.

7.1.5 The DS scenario includes traffic growth to 2023 and other transport schemes, exactly as in the DM, except that it also includes the Scheme, which is expected to open in 2023.

7.1.6 The transport impacts directly attributable to the Scheme are then determined by comparing the DS with the DM.

7.1.7 The impact of traffic growth and other schemes delivered between 2018 and 2023 can be seen by comparing the DM and DS with the Base scenario.

7.1.8 The following time periods are considered:

- AM (morning peak hour) 08:00 – 09:00
- IP (inter peak) 13:00 – 14:00
- PM (evening peak hour) 16:30 – 17:30

7.1.9 Except where stated otherwise, all traffic figures in the assessment represent hourly flows of total motor vehicles.

7.1.10 Detailed analysis has been undertaken for 2023, the planned opening year for the Scheme. The impact of forecast traffic growth beyond 2023 to 2038, both with and without the Scheme, has also been considered (Section 7.8 below).

7.1.11 The following sections consider:

- Existing (2018) traffic conditions and the impact of growth to 2023
- The impact of the Scheme on the existing bridges and route choice
- The overall impact of the Scheme on traffic flows on the network
- The impact of the Scheme on journey times and congestion
- The impact of the Scheme on link flows
- The impact of the Scheme on junctions, queuing and delay.
- The impact of the Scheme at 2038 levels of demand
- The impact of the Scheme on walking and cycling
- The impact of the Scheme on public transport
- The impact of the Scheme on abnormal loads routes
- The impact of the Scheme on road safety
- The impact of the Scheme on network resilience
- The impact of the Scheme on car parking
- The overall benefits of the Scheme

7.1.12 Simple tables and, wherever possible, diagrams are used to identify clearly the location, nature (beneficial or adverse) and scale of these impacts.

7.1.13 The approach taken is firstly to describe existing traffic conditions and problems and also comment on how traffic growth would affect conditions and potentially worsen the severity of current problems.

7.1.14 The impacts of the Scheme are then described, and it is determined whether they are beneficial or potentially adverse (e.g. if a link flow is forecast to increase). Any potentially adverse impacts are then examined in more detail to determine whether they are acceptable (e.g. if the increase is small and manageable) or whether mitigation is required. In these cases, potential mitigation measures are discussed.

7.1.15 As well as assessing transport impacts and their mitigation, it is also appropriate to summarise the overall benefits of the Scheme in terms of delivering its agreed objectives. A summary is provided at the end of this chapter.

7.2 Existing Traffic Conditions and the Impact of Traffic Growth to 2023

7.2.1 The traffic model, developed using the observed data previously described, has been used to examine in detail the overall performance of the local road network in 2018, and to project this forward to the planned opening year, taking account of traffic growth and planned developments to 2023. The impact of growth beyond 2023 is considered in Section 7.8.

Overall Increase in Traffic 2018 to 2023

7.2.2 Total traffic in the study area is forecast to increase as a result of background growth and planned development, and this is reflected in the model. The forecast increase in total trips between the 2018 (Base) and 2023 (DM) scenarios is:

- 5.3% in the AM peak
- 4.4% in the PM peak
- 7.6% in the Inter Peak

Increase in Traffic using Haven Bridge (2018 to 2023)

7.2.3 Overall, traffic using the Haven Bridge is forecast to increase between 2018 and 2023:

Table 7-1: Forecast Traffic Changes on Haven Bridge

Traffic Flow AM (2 Way veh.)	2018 Base	2023 DM No Scheme	Difference % Base à DM
AM peak hour	1,937	2,436	+26%
PM peak hour	2,300	2,174	-5%
Inter-peak hour	1,777	2,174	+22%

7.2.4 Traffic in the PM peak is not forecast to rise on Haven Bridge. Examination of the forecasts in detail shows instead that traffic would transfer to Breydon Bridge, possibly suggesting that junctions near Haven Bridge would be close to their capacity in the PM peak in 2023.

Increase in Journey Times (2018 to 2023)

7.2.5 As traffic increases, journey times will also increase as a result of congestion and delay. The forecast changes in journey times between key locations (see Plate 4-10) are detailed below.

Table 7-2: Forecast Journey Time Changes 2018 - 2023 AM Peak

Between	And	Base 2018 (minutes)	DM 2023 No Scheme (minutes)	Time increase DM – Base (minutes)
A47 Acle New Road	Outer Harbour	7.9	8.8	+0.9
A47 Acle New Road	Pleasure Beach	6.6	7.4	+0.8
A47 Acle New Road	A47 (south)	6.7	6.4	-0.3
A47 (south)	Outer Harbour	8.6	9.8	+1.2
A47 (south)	Pleasure Beach	7.9	8.6	+0.7
Gorleston (Town Centre)	Gr. Yarmouth (Town Centre)	8.5	9.0	+0.5

Table 7-3: Forecast journey time changes 2018 - 2023 Inter Peak

Between	And	Base 2018 (minutes)	DM 2023 No Scheme (minutes)	Time increase DM – Base (minutes)
A47 Acle New Road	Outer Harbour	7.1	8.2	+1.1
A47 Acle New Road	Pleasure Beach	6.1	7.1	+1.0
A47 Acle New Road	A47 (south)	5.3	5.6	+0.3
A47 (south)	Outer Harbour	8.0	9.0	+1.0
A47 (south)	Pleasure Beach	7.2	7.7	+0.5
Gorleston (Town Centre)	Gr. Yarmouth (Town Centre)	7.9	8.3	+0.4

Table 7-4: Forecast Journey Time Changes 2018 - 2023 PM Peak

Between	And	Base 2018 (minutes)	DM 2023 No Scheme (minutes)	Time increase DM – Base (minutes)
A47 Acle New Road	Outer Harbour	8.9	10.1	+1.2
A47 Acle New Road	Pleasure Beach	7.6	8.6	+1.2
A47 Acle New Road	A47 (south)	8.2	7.3	+1.1
A47 (south)	Outer Harbour	9.5	10.8	+1.3
A47 (south)	Pleasure Beach	9.0	9.7	+0.7
Gorleston (Town Centre)	Great Yarmouth (Town Centre)	9.8	9.3	-0.5

Increased Queuing 2018 – 2023

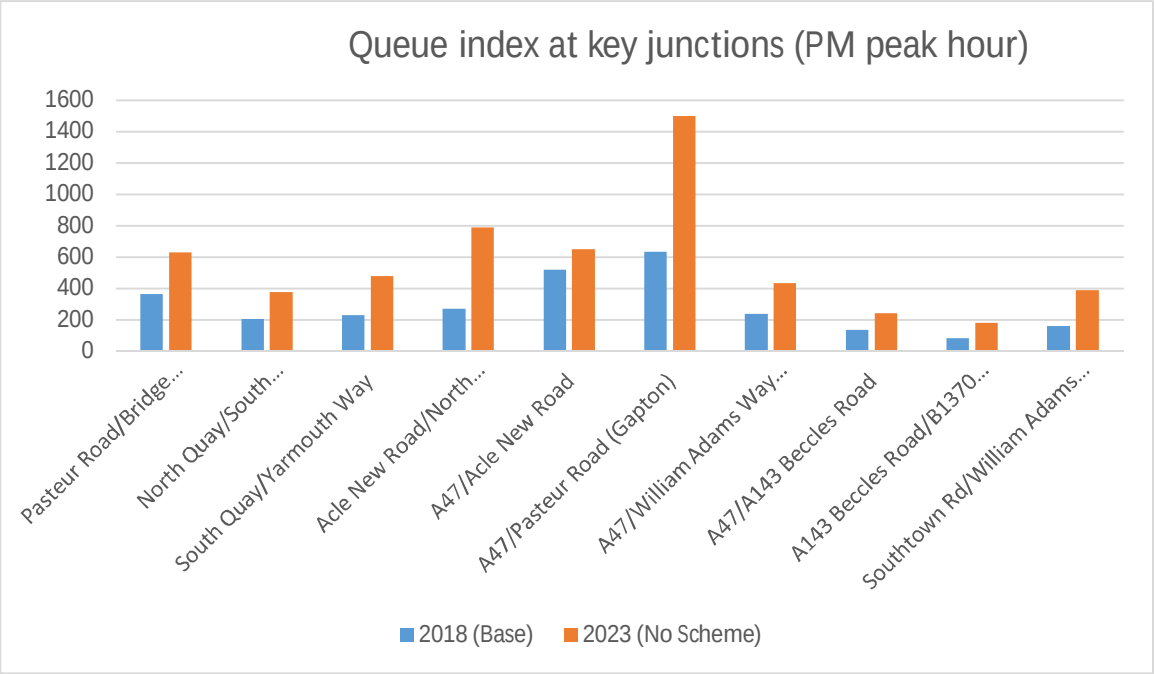
7.2.6 Further insight into the existing, and growing, problems of congestion and delay can be gained by examining queuing at key junctions, both in the 2018 base situation and in 2023. The results are set out below for the PM peak hour, and – to illustrate the general increases in queuing - show the modelled mean maximum queue[8] lengths, summed across all approaches to each junction:

[8] Mean Maximum Queue (MMQ) is calculated as follows: The maximum queue length is determined for each 5 min segment within the simulation period, and the mean of these maximum values is calculated. This means, for example, that the MMQ reflects queues which build up during a red phase at traffic signals.

Table 7-5: Forecast Increase in Queue Lengths 2018 - 2023 (PM peak)

Aggregate Queues (PM peak) (total MMQ summed for all approaches) - metres			
Junction	**2018 (base)**	**2023 (no Scheme)**	**Increase 2018 - 2023**
Pasteur Road/Bridge Road/Southtown Road	363	629	+73%
North Quay/South Quay/Bridge Road	203	374	+84%
South Quay/Yarmouth Way	227	477	+110%
Acle New Road/North Quay/Fullers Hill	270	786	+191%
A47/Acle New Road	519	649	+25%
A47/Pasteur Road (Gapton)	633	1,496	+136%
A47/William Adams Way (Harfrey's RB)	236	433	+83%
A47/A143 Beccles Road	136	240	+76%
A143 Beccles Road/B1370 Burgh Road	80	178	+123%
Southtown Rd/William Adams Way/Beccles Rd	160	389	+143%

Plate 7-1: Forecast Increase in Aggregate Queues 2018 - 2023 (PM peak)



7.2.7 This illustrates an important aspect of the transport case for the Scheme. Without the Scheme, congestion (as indicated by queuing) at these junctions is forecast to increase significantly between 2018 and 2023, even with the A47 improvements, mainly because of forecast traffic growth.

7.2.8 Overall, as traffic increases between 2018 and 2023 (the projected scheme opening year, traffic conditions will progressively worsen. Sections 7.3 to 7.7 demonstrate, in more detail, how the Scheme, opening to traffic in 2023, will transform this situation, reducing congestion and delay and improving journey times.

7.2.9 If, however, the Scheme was not provided, the traffic modelling shows that conditions would substantially deteriorate in the period after 2023.

Impact of Traffic Growth 2023 – 2038 (without Scheme)

7.2.10 The impacts of forecast traffic growth to 2038 levels of demand have also been considered. This has been undertaken at a high level of detail, for the reasons explained below.

7.2.11 Traffic demand has been forecast for 2038, taking account of the expected levels of development and growth over the 15 years from opening of the Scheme. This demand was then assigned to the DM microsimulation networks in the same way as the forecast 2023 demand.

7.2.12 The outcome of this high-level analysis is very striking. In the DM situation – that is, without the Scheme – there is insufficient capacity within the overall network to cope with the higher level of demand. Congestion is forecast to increase to a level at which a significant proportion of journeys would not be able to take place, or – having started - could not be completed within the peak period.

7.2.13 The model represents this by being unable to release trips onto the network. Examination of the results shows that between 25% and 36% of trips are not able to be assigned because of lack of network capacity in the DM – that is, without the scheme.

7.2.14 Beyond this, it is not possible to rely on the 2038 microsimulation model to assess performance of the DM network in detail, as it is not designed to be used in a situation where free flow has broken down in significant parts of the network to the extent that trips have been suppressed.

7.2.15 It is, however, reasonable to conclude that the modelling supports the assertions that:

- without the Scheme, congestion in parts of Great Yarmouth could increase to unacceptable levels
- without the Scheme, the growth and development which fuels increased demand could be inhibited by lack of capacity on parts of the road network
- there is a strong case for intervention to prevent the above problems occurring

7.2.16 Section 7.8 therefore considers the 2038 DS forecasts – that is, with the Scheme - and demonstrates that the situation in 2038 will be significantly better with the Scheme in place.

Summary of the Do Minimum Situation

7.2.17 Using the traffic simulation model, it has been shown above that without the Scheme traffic conditions in Great Yarmouth will continue to get worse, as evidenced by forecasts (at 2023 levels) of:

- Increased traffic demand
- Increased demand on Haven Bridge, limited by the capacity of adjacent junctions
- Increased journey times, especially for trips from the A47 to the Outer Harbour
- Increased queueing at key junctions

7.2.18 Further traffic simulations have provided evidence that, with projected growth to 2038, congestion could increase to the point where traffic flow breaks down during peak periods, inhibiting trip making. This could deter new development and constrain the town's economic growth.

7.2.19 To avoid these problems, and to enable Great Yarmouth to cope with forecast growth, it is concluded that there is a strong transport case for a scheme to provide the necessary extra capacity.

7.2.20 The following sections therefore consider the effects of the Scheme, firstly at 2023 levels of demand, and then at 2038 levels.

7.3 Impact of the Scheme on the Existing Bridges and Route Choice

7.3.1 The purpose of the Scheme is to provide a new crossing of the River Yare, augmenting and relieving the existing bridges by offering a more attractive route for some journeys. A measure of the effectiveness of the Scheme is therefore the amount of traffic which is forecast to transfer from the existing bridges to the third river crossing.

7.3.2 Table 7-6, Table 7-7 and Table 7-8 show the forecast hourly traffic volumes on the existing bridges and the third river crossing in each scenario.

Table 7-6: Forecast Traffic Changes on all Bridges (AM peak hour)

Traffic Flow AM (2 Way veh.)	2018 Base	2023 DM No Scheme	2023 DS With Scheme	Difference % DM à DS
A47 Breydon Bridge	2,803	2,730	2,728	-0.1%
A1243 Haven Bridge	1,937	2,436	1,359	-44.2%
Third River Crossing	-	-	1,731	-

Table 7-7: Forecast Traffic Changes on all Bridges (PM peak hour)

Traffic Flow PM (2 Way veh.)	2018 Base	2023 DM No Scheme	2023 DS With Scheme	Difference % DM à DS
A47 Breydon Bridge	2,711	2,890	2,908	+0.6%
A1243 Haven Bridge	2,300	2,174	1,286	-40.9%
Third River Crossing	-	-	1,577	-

Table 7-8: Forecast Traffic Changes on all Bridges (Inter-peak hour)

Traffic Flow IP (2 Way veh.)	2018 Base	2023 DM No Scheme	2023 DS With Scheme	Difference % DM à DS
A47 Breydon Bridge	2,352	2,491	2,393	-3.9%
A1243 Haven Bridge	1,777	2,174	1,191	-45.2%
Third River Crossing	-	-	1,392	-

Impact on Haven Bridge

7.3.3 The effect of the Scheme on Haven Bridge is very clear. In both the morning and evening peak hours, and in the inter-peak, it is forecast to reduce the amount of traffic using the Haven Bridge by about 41% - 45% compared to the 2023 DM - a very significant reduction which should lead to a marked improvement in traffic conditions as fewer vehicles enter the town centre by this route. Traffic on Haven Bridge in 2023 is also forecast to be significantly lower than in the 2018 Base for all time periods.

Impact on Breydon Bridge

7.3.4 The Scheme is forecast to have a much smaller effect on the traffic using Breydon Bridge. Traffic will reduce slightly from the 2023 DM levels in the inter-peak and AM peak, but increase slightly, in the PM peak where a 0.6% increase is forecast. This may be due to traffic from the peninsula using the new Bridge and continuing along the A47 over the Breydon Bridge, rather than passing though the town centre. As such, it would represent a benefit to the town centre, and an appropriate use of the SRN. Overall, though, it is considered that the Scheme will make only a limited difference to traffic on the Breydon Bridge, which forms part of the SRN and is intended to carry longer distance through traffic.

7.3.5 The total volume of traffic crossing the River Yare is forecast to increase with the Scheme. The main reason for this is the re-routing effects caused by the Scheme – predominantly that traffic travelling to and from the west will be able to use the new crossing to access the peninsula from the SRN and will therefore cross the river twice (on the new crossing and Breydon Bridge). Currently much of this traffic uses Acle New Road and North Quay, avoiding any river crossings. As noted above, it is more appropriate for this traffic to use the SRN.

7.4 Overall Impact of the Scheme on Traffic Flows on the Network

7.4.1 The strategic impact of the Scheme in providing an alternative to the existing river crossings is illustrated in Plate 7-2:(AM peak) and Plate 7-4 (PM peak).

In these “bandwidth” diagrams, the width of the road indicates the volume of traffic.

7.4.2 The diagrams illustrate how the Scheme will provide the main road link from the A47 trunk road into the southern part of the peninsula, drawing traffic away from the Haven Bridge.

7.4.3 The Breydon Bridge, as part of the strategic A47 route, will remain the busiest of the three bridges. Pressure on the Haven Bridge will be greatly reduced, though it will continue to carry local traffic to and from the town centre. The new bridge (the Scheme) will assume the role of carrying traffic bound for the South Denes industrial area, South Denes Enterprise Zone, Port and Outer Harbour. In this way, the Scheme will clearly fulfil its objective of providing improved access to the Enterprise Zone and the Port, whilst also removing traffic from the town centre.

7.4.4 The forecast differences resulting from the Scheme are highlighted even more clearly in Plate 7-3 and Plate 7-5. These “bandwidth” diagrams show just the forecast changes in traffic flow due to the Scheme in the opening year, 2023. Links which will experience an increase in traffic are coloured red, and links which will experience a reduction are coloured green. The amount of increase or decrease is represented by the width and shade of the coloured band.

Plate 7-2: Forecast Traffic Flows 2023 AM Peak (0800-0900), With and Without Scheme

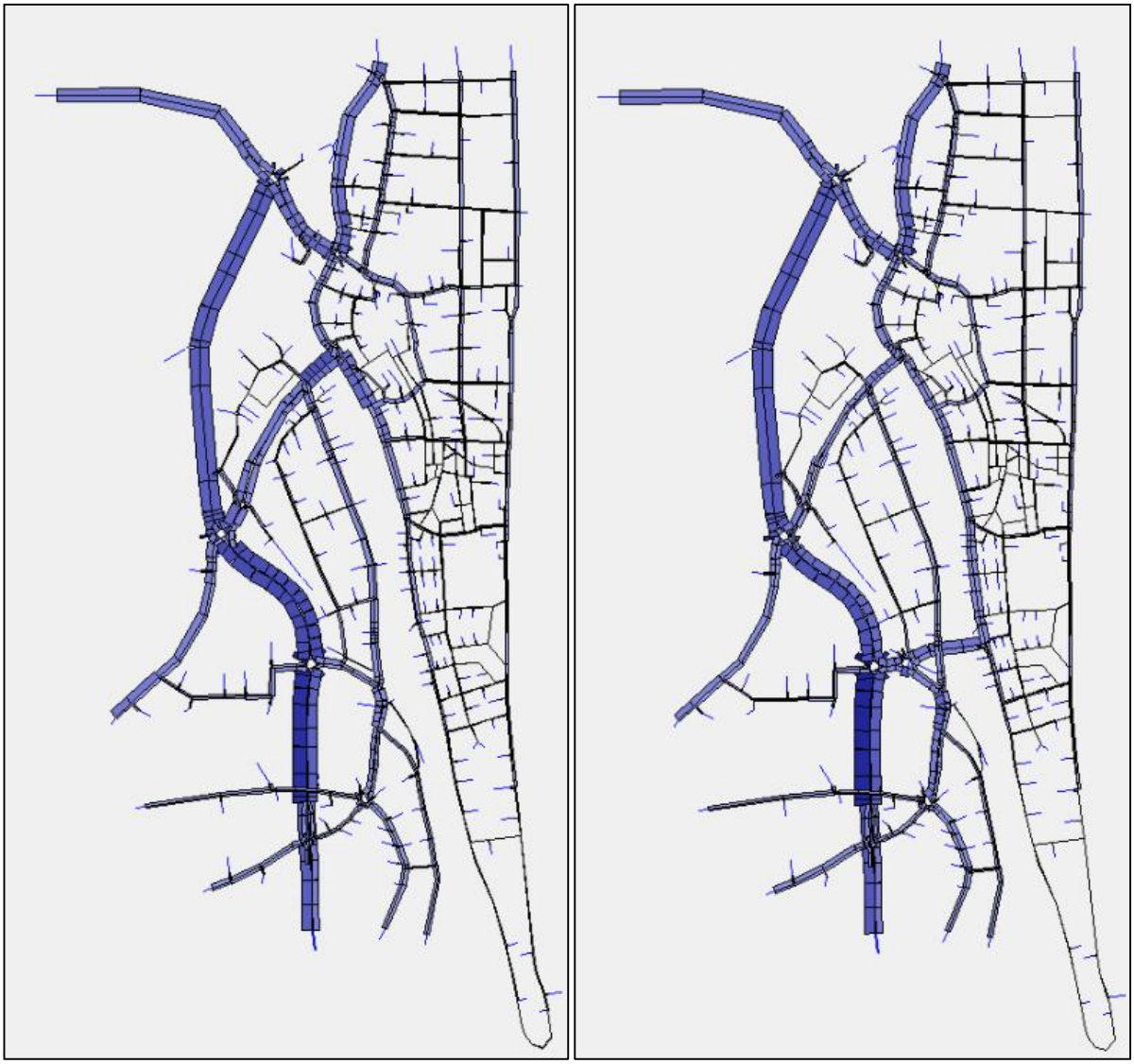


Plate 7-3: Changes in Traffic Flow due to the Scheme (2023 AM peak 0800-0900)

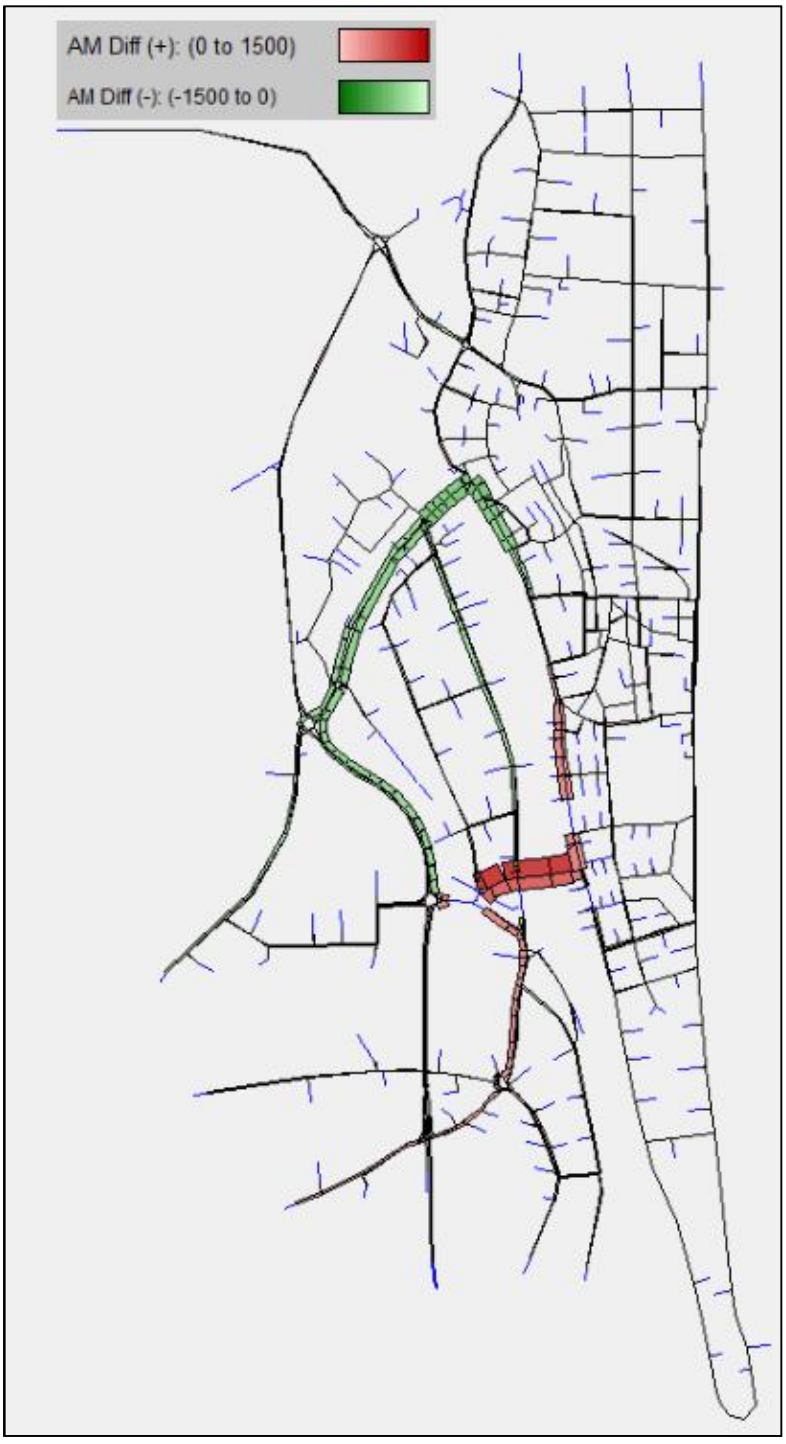


Plate 7-4: Forecast Traffic Flows 2023 AM Peak (1630-1730), With and Without Scheme

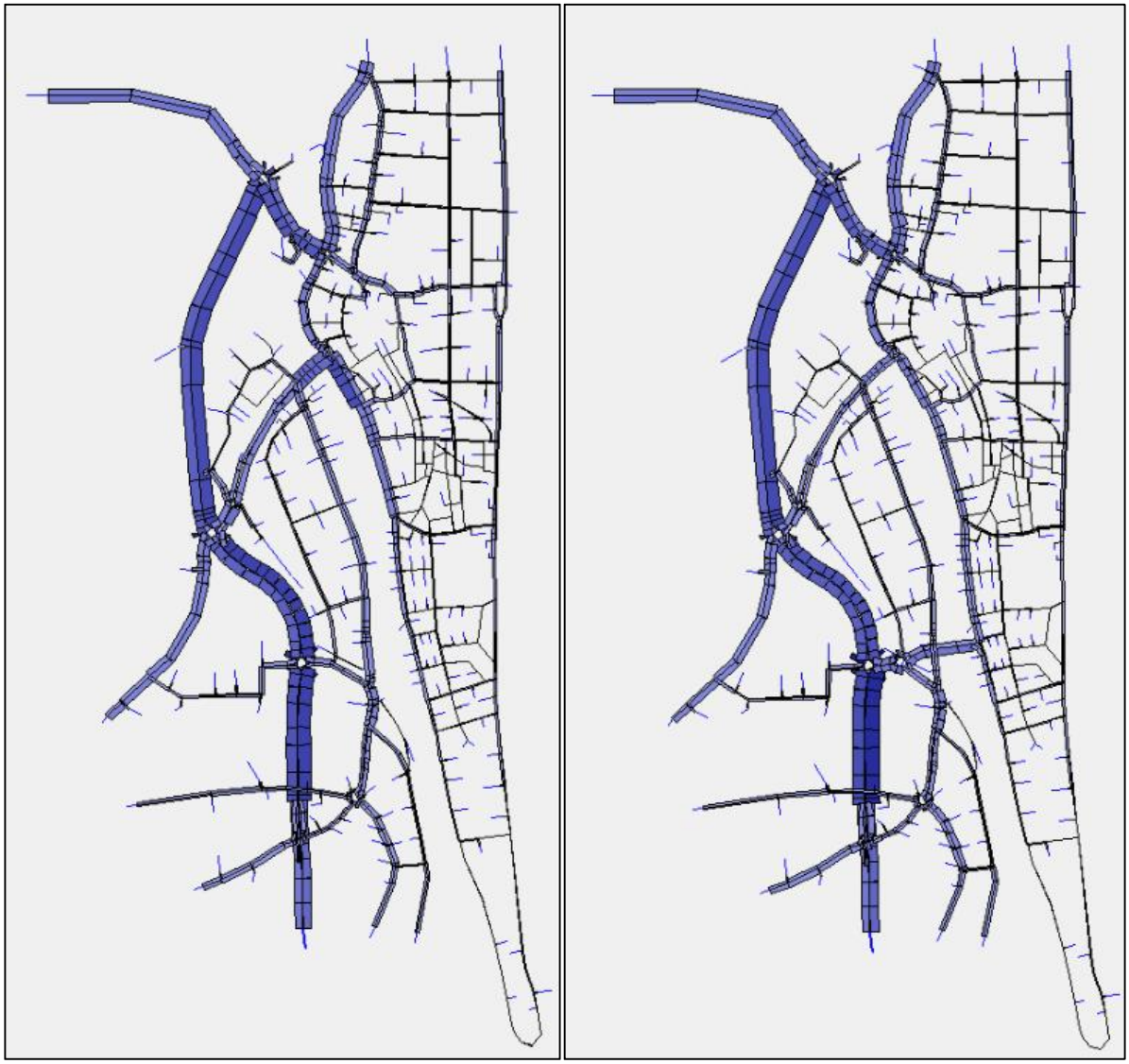
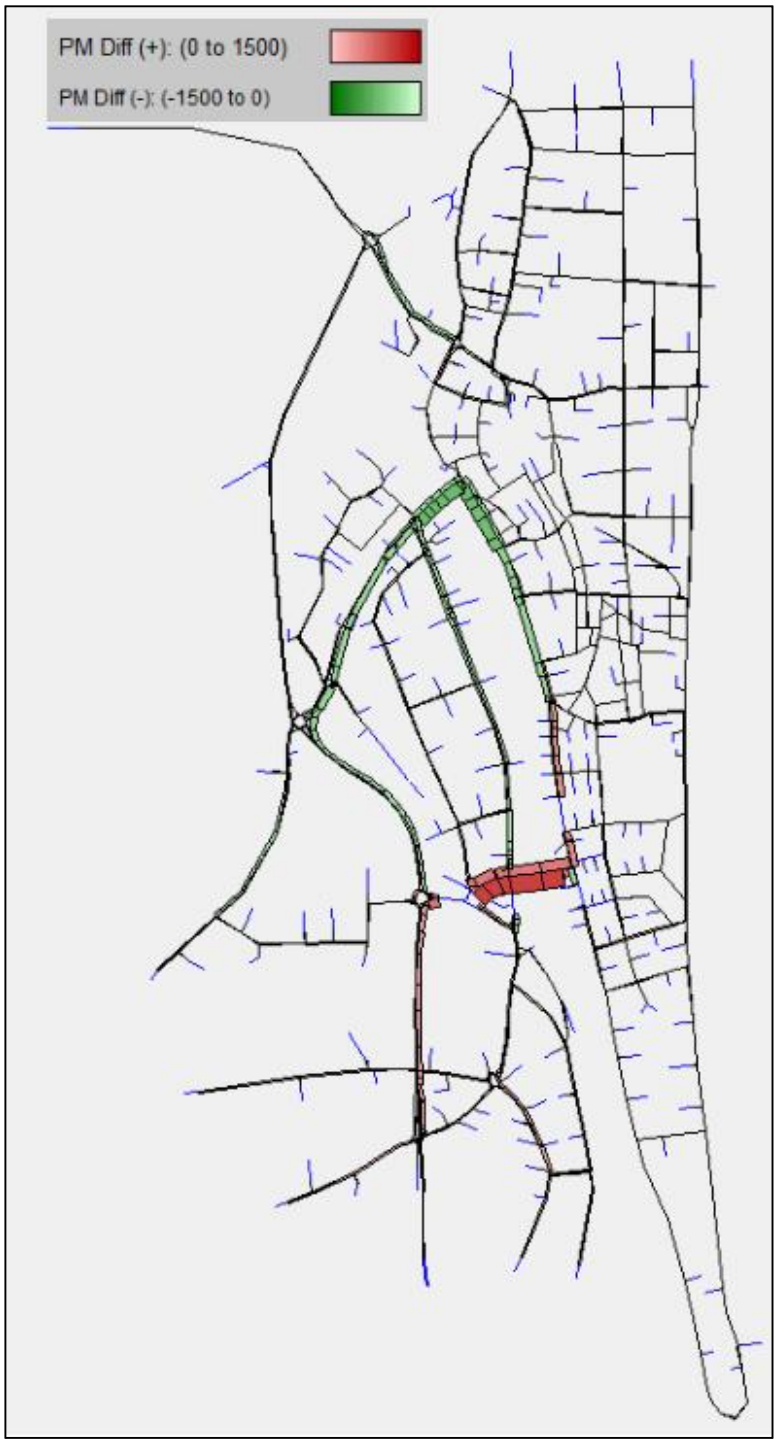


Plate 7-5: Changes in Traffic Flow due to the Scheme (2023 PM peak 1630-1730)



7.5 Impact of the Scheme on Journey Times and Congestion

Impact on Journey Times

7.5.1 The Scheme will reduce multiple journey times throughout in Great Yarmouth, leading to the time and fuel savings which underpin its economic benefits. This impact can be seen in Table 7-9, Table 7-10 and Table 7-11 which examine the changes in journey times between a set of representative points. The journey times in both directions are averaged to produce a single figure.

7.5.2 The locations of the journey start and end points are shown in Plate 4-10.

Table 7-9: Forecast Journey Time Savings 2023 AM Peak

Between	And	Base 2018 (minutes)	DM 2023 No Scheme (minutes)	DS 2023 with Scheme (minutes)	Time saving DM – DS (minutes)
A47 Acle New Road	Outer Harbour	7.9	8.8	8.1	0.7
A47 Acle New Road	Pleasure Beach	6.6	7.4	6.9	0.5
A47 Acle New Road	A47 (south)	6.7	6.4	6.3	0.1
A47 (south)	Outer Harbour	8.6	9.8	5.1	4.7
A47 (south)	Pleasure Beach	7.9	8.6	6.4	2.2
Gorleston (Town Centre)	Great Yarmouth (Town Centre)	8.5	9.0	7.9	1.1

Table 7-10: Forecast Journey Time Savings 2023 Inter Peak

Between	and	Base 2018 (minutes)	DM 2023 No Scheme (minutes)	DS 2023 with Scheme (minutes)	Time saving DM – DS (minutes)
A47 Acle New Road	Outer Harbour	7.1	8.2	7.2	1.0
A47 Acle New Road	Pleasure Beach	6.1	7.1	6.7	0.4
A47 Acle New Road	A47 (south)	5.3	5.6	5.6	0.0
A47 (south)	Outer Harbour	8.0	9.0	4.6	4.4
A47 (south)	Pleasure Beach	7.2	7.7	5.9	1.8
Gorleston (Town Centre)	Great Yarmouth (Town Centre)	7.9	8.3	7.5	0.8

Table 7-11: Forecast Journey Time Savings 2023 PM Peak

Between	And	Base 2018 (minutes)	DM 2023 No Scheme (minutes)	DS 2023 with Scheme (minutes)	Time saving DM – DS (minutes)
A47 Acle New Road	Outer Harbour	8.9	10.1	8.8	1.3
A47 Acle New Road	Pleasure Beach	7.6	8.6	7.1	1.5
A47 Acle New Road	A47 (south)	8.2	7.3	6.3	1.0
A47 (south)	Outer Harbour	9.5	10.8	4.8	6.1
A47 (south)	Pleasure Beach	9.0	9.7	5.7	4.0
Gorleston (Town Centre)	Great Yarmouth (Town	9.8	9.3	7.8	1.5

Between	And	Base 2018 (minutes)	DM 2023 No Scheme (minutes)	DS 2023 with Scheme (minutes)	Time saving DM – DS (minutes)
	Centre)				

7.5.3 Average journey times on all these routes, in all the periods studied, are forecast to reduce in 2023 because of the Scheme. The most significant time savings are forecast on journeys between the A47 (south) and locations on the peninsula such as the Outer Harbour or Pleasure Beach where savings of up to 6.1 minutes are forecast. Journey times between the town centres of Gorleston and Great Yarmouth will also be reduced

7.5.4 These very large time savings will be achieved because the Scheme will provide a new, more direct route for these and similar bus journeys.

7.5.5 Journey time savings are also forecast for journeys that may not necessarily use the Scheme to cross the River Yare – for example journeys between A47 Acle New Road and the Pleasure Beach. These smaller time savings are a result of reduced delay on roads which will have less traffic on them because of the Scheme.

7.5.6 These examples show how the Scheme will contribute to reductions in journey times on a range of potential journeys within Great Yarmouth.

7.5.7 Journey time savings will be achieved across the study area, as indicated by the average peak period travel time per vehicle for all trips (around 33,000 trips in the AM peak and 36,000 trips in the PM peak) in the DM and DS networks, shown in Table 7-12.

Table 7-12: Network Average Journey Time Savings

	Average journey time 2023 DM (no Scheme)	Average journey time 2023 DS (with Scheme)	Average journey time saving per vehicle DM - DS
AM peak	325 sec.	295 sec.	30 sec.
PM peak	362 sec.	296 sec.	66 sec.

Impact on Congestion

7.5.8 Congestion occurs when the volume of traffic trying to use a section of road is close to, or greater than, its capacity. Traffic slows down, or stops, and

queues form. In urban areas such as Great Yarmouth, the junctions at the end of a link can limit the amount of traffic that can exit the link. Queues of stationary or slow-moving traffic build up. In either case, traffic is delayed and average speeds fall.

7.5.9 The congestion heat map (Plate 4-6 in Section 4) gives an overview of the parts of the network which suffer congestion and delay. This supports anecdotal reports but only represents an instant in a continually changing situation.

7.5.10 Plate 7-6 and Plate 7-7 highlight the links in the modelled network where average journey times are forecast to change because of the Scheme in the AM and PM peak hours in 2023.

7.5.11 Links where journey times are forecast to reduce (because there will be less congestion) are shown in green, with the size of the reduction indicated by the shade and width of the coloured bands.

7.5.12 Links where journey times are forecast to increase (because there will be more congestion) are shown in red, again with the size of the increase indicated by the shade and width of the coloured bands.

7.5.13 These diagrams show that congestion will be reduced on links to the north of the Scheme, especially on Pasteur Road and Southtown Road, and on the A47 and Gapton Hall Road, around Gapton Roundabout. The improvement is greatest in the PM peak, where forecast improvements in journey time are seen on Fuller's Hill, Acle New Road and North Quay.

7.5.14 The only locations where link journey times are forecast to increase, indicating an increase in congestion, are on the roads leading to the Scheme itself. This is because, as already noted, some traffic will divert onto these roads to use the new bridge. It is worth noting that overall journey times will still be reduced for diverting traffic, because of the reduced distances travelled, even though some of the links in the journey may be slower. The links affected are A47 south of Harfreys Roundabout, William Adams Way and part of South Denes Road, close to the Scheme. These impacts (which are mainly attributable to queueing at junctions rather than lack of capacity on the links) are most noticeable in the AM peak.

7.5.15 Overall, the Scheme will reduce congestion. The impacts of the Scheme on Harfrey's Roundabout, William Adams Way and South Denes Road are considered in more detail in Section 7.7.

Plate 7-6: Changes in Average Link Time (seconds) due to the Scheme (AM peak)

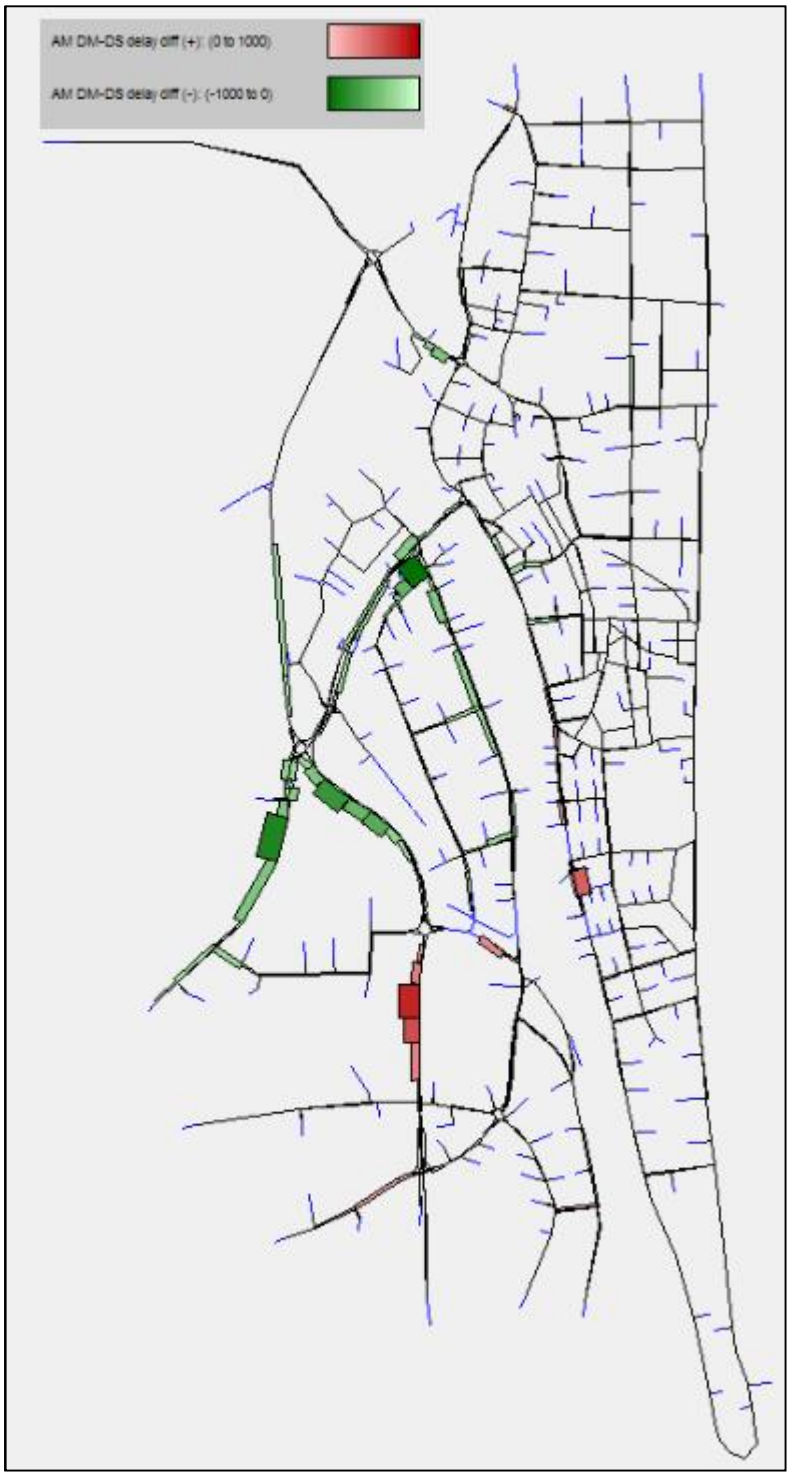
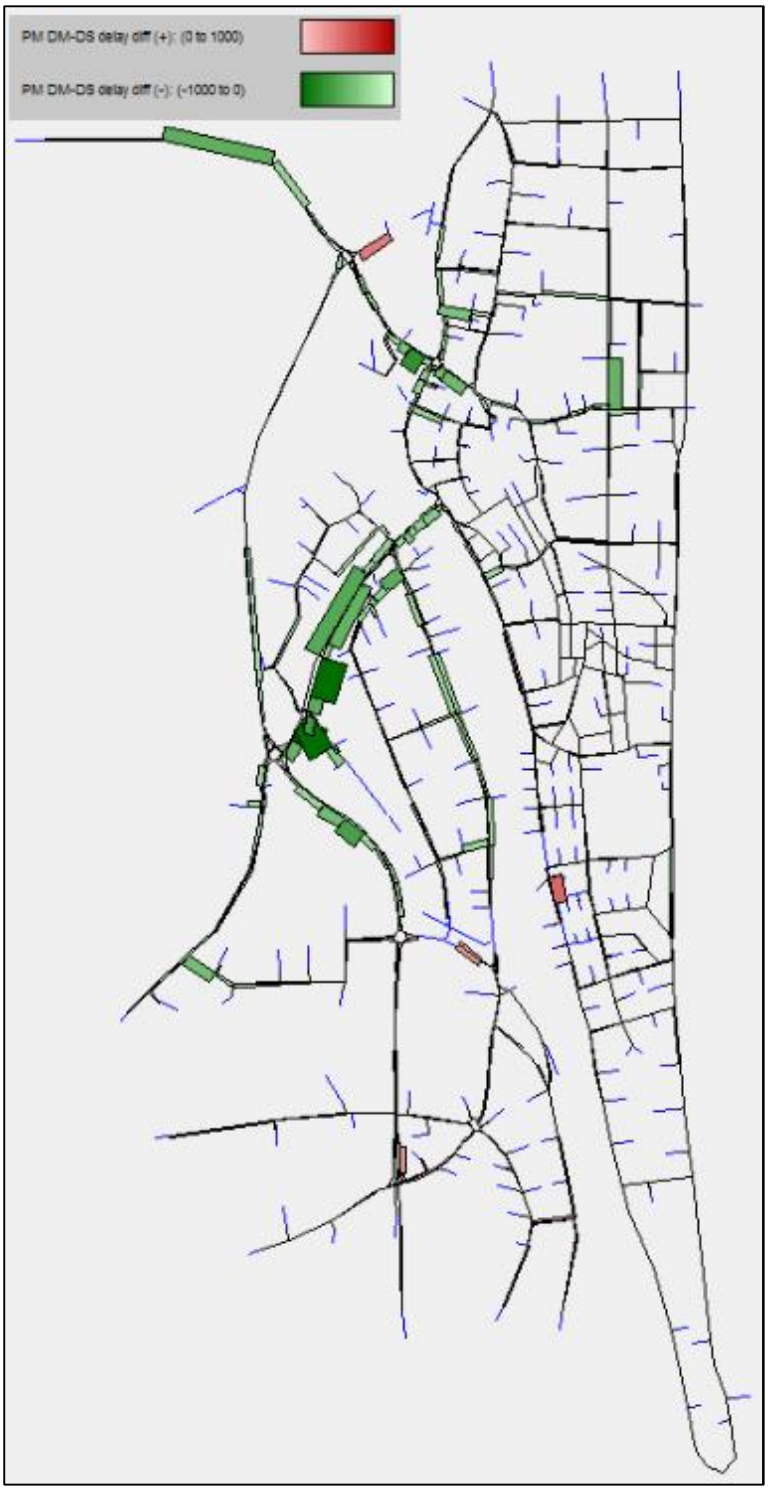


Plate 7-7: Changes in Average Link Time (seconds) due to the Scheme (PM peak)



7.6 Impact of the Scheme on Link Flows

7.6.1 This section considers in more detail the impact of the Scheme on link flows to determine where (and by how much) these will change because of the Scheme.

Overview

7.6.2 Inspection of the diagrams in the previous section shows that the biggest impact of the Scheme will be to reduce traffic on the Haven Bridge and the routes which lead to and from it, including:

- Bridge Road
- Pasteur Road
- A47 between Gapton Roundabout and Harfrey's Roundabout
- Southtown Road
- Hall Quay
- South Quay

7.6.3 Traffic will increase on the routes leading to the Scheme, notably

- Beccles Road
- William Adams Way
- Southgate Road

7.6.4 In general terms, except on this limited set of routes, the impacts of the Scheme on link flows will be minor, with only limited changes in traffic compared with the DM scenario.

Assessment of Impact on Link Flows

The forecast impact of the Scheme on link flows is examined in greater detail in Table 7-13. These show the forecast change in peak hour traffic flow on each of the key links which were identified for further assessment in Section 4.5 above. These links are illustrated in Plate 4-9, and comprise links which are already congested, or are close to the Scheme, or were considered likely to experience significant changes in traffic because of it.

7.6.5 For each link, Table 7-13 and Table 7-14 show, for the AM and PM peak hours respectively:

- The modelled 2-way vehicular flow in 2018
- The forecast 2-way vehicular flow in 2023 (DM) i.e. with no Scheme
- The forecast 2-way vehicular flow in 2023 (DS) i.e. with the Scheme
- The forecast increase (+) or decrease (-) in traffic in 2023
- The forecast increase expressed as a percentage

7.6.6 A “RAG” score is then derived as follows:

- Traffic reduces for DS compared to DM
- Traffic increases by fewer than 100 vehicles per hour
- Traffic increases by more than 100 veh/hr, but less than 10%
- Traffic increases by more than 100 veh/hr and more than 10%

Table 7-13: Impact of the Scheme on Link Flows (AM peak hour)

Link	2018 Base	2023 DM (veh)	2023 DS (veh)	Change DS-DM	Change %	Impact (RAG)
Breydon Bridge	2,803	2,730	2,728	-2	0%	
Haven Bridge	1,937	2,436	1,359	-1,078	-44%	
North Quay	915	1,101	1,229	128	12%	
South Quay	1,863	2,276	1,224	-1,052	-46%	
Southgates Road	573	625	1,159	534	86%	
South Denes Road	231	268	283	15	6%	
Marine Parade	309	482	409	-73	-15%	
South Beach Parade	148	345	326	-19	-6%	
Admiralty Road	143	136	201	65	48%	
Sutton Road	27	35	105	70	198%	
Swanston's Road	31	37	54	17	46%	
Main Cross Road	97	120	265	145	120%	
Salmon Road	58	99	125	27	27%	
William Adams Way	750	767	1,227	460	60%	
Beccles Road	1,336	1,387	1,803	416	30%	
Southtown Road	686	880	638	-243	-28%	
A47 N of Harfrey's RB	3,125	3,247	2,701	-545	-17%	
A47 S of Harfrey's RB	3,183	3,350	3,465	115	3%	
Fuller's Hill	882	842	712	-131	-16%	
Yarmouth Way	630	733	638	-95	-13%	

Link	2018 Base	2023 DM (veh)	2023 DS (veh)	Change DS-DM	Change %	Impact (RAG)
Suffolk Road	301	306	220	-86	-28%	
Pasteur Road	1,326	1,645	895	-750	-46%	
Lawn Avenue	1,489	1,693	1,738	45	3%	

Table 7-14: Impact of the Scheme on Link Flows (PM peak hour)

Link	2018 Base	2023 DM (veh)	2023 DS (veh)	Change DS-DM	Change %	Impact (RAG)
Breydon Bridge	2,711	2,890	2,908	18	1%	
Haven Bridge	2,300	2,174	1,286	-889	-41%	
North Quay	1,158	1,060	1,135	75	7%	
South Quay	2,409	2,286	1,458	-828	-36%	
Southgates Road	817	817	994	178	22%	
South Denes Road	349	357	416	59	16%	
Marine Parade	442	585	447	-138	-24%	
South Beach Parade	258	434	387	-48	-11%	
Admiralty Road	182	188	182	-7	-4%	
Sutton Road	49	57	135	78	136%	
Swanston's Road	49	56	94	38	68%	
Main Cross Road	141	163	256	93	57%	
Salmon Road	70	101	143	42	41%	
William Adams Way	728	757	1,000	244	32%	
Beccles Road	1,292	1,342	1,446	104	8%	
Southtown Road	753	895	515	-379	-42%	
A47 N of Harfrey's RB	2,900	2,853	2,876	23	1%	
A47 S of Harfrey's RB	3,221	3,186	3,620	434	14%	
Fuller's Hill	866	932	842	-90	-10%	
Yarmouth Way	758	672	608	-64	-10%	

Link	2018 Base	2023 DM (veh)	2023 DS (veh)	Change DS-DM	Change %	Impact (RAG)
Suffolk Road	388	315	252	-63	-20%	
Pasteur Road	1,644	1,171	885	-286	-24%	
Lawn Avenue	1,668	1,593	1,739	146	9%	

7.6.7 The RAG analysis of changes in link flow highlights the following links as having potentially adverse impacts in one or both peak periods:

- Southgates Road
- William Adams Way
- Beccles Road
- Main Cross Road
- A47 south of Harfrey's Roundabout
- North Quay
- Lawn Avenue

7.6.8 The forecast traffic changes on these links are summarised below.

Table 7-15: Forecast Traffic Impacts on Southgates Road

Southgates Road	2018 Base	2023 DM (veh)	2023 DS (veh)	Change DS-DM	Change %	Impact (RAG)
AM peak traffic	573	625	1,159	534	86%	
PM peak traffic	817	817	994	178	22%	

Table 7-16: Forecast Traffic Impacts on William Adams Way

William Adams Way	2018 Base	2023 DM (veh)	2023 DS (veh)	Change DS-DM	Change %	Impact (RAG)
AM peak traffic	750	767	1,227	460	60%	
PM peak traffic	728	757	1,000	244	32%	

Table 7-17: Forecast Traffic Impacts on Beccles Road

Beccles Road	2018 Base	2023 DM (veh)	2023 DS (veh)	Change DS-DM	Change %	Impact (RAG)
AM peak traffic	1,336	1,387	1,803	416	30%	
PM peak traffic	1,292	1,342	1,446	104	8%	

Table 7-18: Forecast Traffic Impacts on Main Cross Road

Main Cross Road	2018 Base	2023 DM (veh)	2023 DS (veh)	Change DS-DM	Change %	Impact (RAG)
AM peak traffic	97	120	265	145	120%	
PM peak traffic	141	163	256	93	57%	

Table 7-19: Forecast Traffic Impacts on A47 south of Harfrey's Roundabout

A47 south of Harfrey's Roundabout	2018 Base	2023 DM (veh)	2023 DS (veh)	Change DS-DM	Change %	Impact (RAG)
AM peak traffic	3,183	3,350	3,465	131	3%	
PM peak traffic	3,221	3,186	3,620	434	14%	

Table 7-20: Forecast Traffic Impacts on North Quay

North Quay	2018 Base	2023 DM (veh)	2023 DS (veh)	Change DS-DM	Change %	Impact (RAG)
AM peak traffic	915	1,101	1,229	128	12%	
PM peak traffic	1,158	1,060	1,135	75	7%	

Table 7-21: Forecast Traffic Impacts on Lawn Avenue

Lawn Avenue	2018 Base	2023 DM (veh)	2023 DS (veh)	Change DS-DM	Change %	Impact (RAG)
AM peak traffic	1,489	1,693	1,738	45	3%	
PM peak traffic	1,668	1,593	1,739	146	9%	

Link Capacity

7.6.9 Having identified those links where an increase in traffic could lead to a potentially adverse impact, consideration has been given to whether forecast traffic would exceed the capacity of these links.

7.6.10 Link capacities have been determined with reference to DfT advice in TA 79/99, the Design Manual for Roads and Bridges ("DMRB")[9]. Paragraphs 1.4 and 1.5 state:

> *"This Advice Note gives the maximum hourly vehicle capacity for various types of Urban Trunk Road. All capacities quoted are for traffic compositions including up to 15% heavy vehicles; corrections are provided for higher proportions. The capacities may be used as starting points in the design and assessment of new urban trunk road links. They may also be used as a guide to the capacity of existing urban roads…."*

7.6.11 Tables 1 and 2 of TA79/99 define the types of urban road and the features that distinguish them, and give the maximum one-way hourly flow that can be accommodated on each type of road, depending on its particular characteristics.

7.6.12 Table 7-22 shows the category of each of the identified links and compares the link capacity with the forecast flow in the busiest direction flow in 2023 (with the Scheme). In every case, the forecast busiest direction flow is within the capacity of that link.

[9] Design Manual for Roads and Bridges Volume 6 Section 1 TA 79/99 Traffic Capacity of Urban Roads

Table 7-22: Capacity and forecast Link Flow in Busiest Direction

Link	Road Type	Lanes Single/dual	Road width	Capacity	Flow	Within capacity?
Haven Bridge	UAP2	4 (single)	14m	2100	945	Yes
Southgates Road	UAP3	2 (single)	9m	1530	527	Yes
William Adams Way	UAP2	2 (single)	7.3m	1470	570	Yes
Beccles Road	UAP2	2 each way (dual)	7.3m	3200	857	Yes
Main Cross Road	UAP3	2 (single)	7.3m	1300	168	Yes
A47 South of Harfrey's roundabout	UAP1	2 each way (dual)	7.3m	3600	2053	Yes
North Quay	UAP3	2-3 (single)	10m	1620	879	Yes
Lawn Avenue	UAP3	2 (single)	8.5m	1530	1042	Yes
Main Cross	UAP3	2 (single)	6m	900	265	Yes

7.6.13 Although it is important to note that, even where traffic flows increase with the scheme, they remain well within the calculated link capacity, the performance of the network depends on more than just link capacity. Paragraph 2.3 of TA 79/99 also states that:

> *"The potential capacity of a link will not be reached if either the capacity of junctions along the link or the capacity of the adjoining network is lower than the link in question. The flow on an urban road may also be affected by turning movements restricting the mainline capacity. Such constraints should be identified at an early stage."*

7.6.14 Further assessment of junction operation, including forecast changes in flow, delays and queues at critical junctions is described in Section 7.7, with more detailed information given in Appendix D.

7.7 Impact on Junctions, Queuing and Delay

Junctions assessed

7.7.1 The following junctions were identified (in paragraph 4.5 above) as potentially critical, on the basis that they are congested, or that they are close to the Scheme and/or could experience significant changes in traffic because of it.

- Pasteur Road/Bridge Road/Southtown Road
- North Quay/South Quay/Bridge Road
- South Quay/Yarmouth Way
- Acle New Road/North Quay/Fullers Hill
- A47/Acle New Road (Vauxhall RB)
- A47/Pasteur Road (Gapton)
- A47/William Adams Way (Harfrey's RB)
- A47/A143 Beccles Road
- A143 Beccles Road/B1370 Burgh Road
- William Adams Way/Southtown Road junction

7.7.2 The analysis of journey times, changes in link flow and congestion described in the preceding sections suggests that, because of the Scheme, conditions should improve at junctions in the area north of the Scheme, especially around Haven Bridge. The same analysis indicates that there could be additional pressure on the junctions closer to the Scheme, especially at Harfrey's Roundabout and around A143 Beccles Road.

7.7.3 To examine these issues in more detail, an analysis has been undertaken of all the above junctions, using the traffic model to forecast changes in flows, delays and queuing on each junction approach. A two-stage approach has been followed:

- Review performance at all junctions to identify those where traffic conditions will clearly improve as a result of the Scheme.
- Identify junctions where conditions could get worse in some way on one or more approaches and assess these in more detail to determine whether this is acceptable or whether mitigation needs to be considered.

7.7.4 The tables below (Table 7-23 to

7.7.5 Table 7-43) set out, for each junction and each peak period:

- The forecast change in traffic flow on each approach
- The forecast change in mean delay on each approach
- The forecast change in mean maximum queue length on each approach

7.7.6 The Mean Maximum Queue (MMQ) is calculated as follows: The maximum queue length is determined for each 5 min segment within the simulation period, and the mean of these maximum values is calculated. This means, for example, that the MMQ reflects queues which build up during a red phase at traffic signals.

7.7.7 In each case the comparison is made at 2023 levels, and is the difference between DS and DM, representing the impact of the Scheme. Results representing a worsening of the situation are shown in red. More detailed information can be found on Appendix D.

7.7.8 A RAG score is given for each approach, for each peak hour as follows:

- Queues and delay reduce
- Negligible increase in queues and/or delay
- Delay increases by more than 60 sec or queue increases by more than 30m (approximately 5 vehicles)
- Delay increases by more than 120 sec or queue increases by more than 60m (approximately 10 vehicles)

7.7.9 An overall RAG score for each junction, based on the “worst” approach in either peak hour according to the above criteria, is then given in Table 7-44.

7.7.10 Junctions where queuing and delays are forecast to increase significantly are then examined in more detail.

Pasteur Road/Bridge Road/Southtown Road

Table 7-23: Pasteur Road/Bridge Road/Southtown Road (2023 AM)

AM peak	Pasteur Road/Bridge Road/Southtown Road				
Approach	**Flow change (veh)**	**Flow change (%)**	**Mean Delay change (sec)**	**Mean Max Queue change (m)**	**RAG assessment**
Mill Road	+13	+14	-1	+5	
Bridge Road	-573	-58	-1	-30	
Southtown Road	-169	-23	-3	-13	
Pasteur Road	-312	-35	-10	-63	
TOTAL	-1,041	-38	-3	-	

Table 7-24: Pasteur Road/Bridge Road/Southtown Road (2023 PM)

PM peak	Pasteur Road/Bridge Road/Southtown Road				
Approach	**Flow change (veh)**	**Flow change (%)**	**Delay change (sec)**	**Mean Max Queue change (m)**	**RAG assessment**
Mill Road	+4	+2	-12	-8	
Bridge Road	-628	-58	-43	-121	
Southtown Road	-185	-25	-5	-10	
Pasteur Road	-40	-8	-14	-6	
TOTAL	-850	-34	-20	-	

7.7.11 Overall, traffic flows into this junction will reduce by 38% (AM) and 34% (PM) leading to a net reduction in queuing and delay. A negligible increase in the mean maximum queue is forecast on Mill Road in the AM peak.

North Quay/South Quay/Bridge Road

Table 7-25: North Quay/South Quay/Bridge Road (2023 AM)

AM peak	North Quay/South Quay/Bridge Road				
Approach	**Flow change (veh)**	**Flow change (%)**	**Delay change (sec)**	**Mean Max Queue change (m)**	**RAG assessment**
North Quay	+5	+1	-3	-4	
South Quay	-497	-42	-1	-1	
Bridge Road	-498	-34	-1	-26	
TOTAL	-990	-33	0	-	

Table 7-26: North Quay/South Quay/Bridge Road (2023 PM)

PM peak	North Quay/South Quay/Bridge Road				
Approach	**Flow change (veh)**	**Flow change (%)**	**Delay change (sec)**	**Mean Max Queue change (m)**	**RAG assessment**
North Quay	-3	-1	-8	-70	
South Quay	-576	-40	+2	-32	
Bridge Road	-251	-23	-1	+40	
TOTAL	-831	-29	+1	-	

7.7.12 Overall, traffic flow through this junction will be reduced by one third. Queuing generally will be less but, in this assessment, the length of the mean maximum queue on Bridge Road is forecast to increase by 40m, although average delay does not increase.

7.7.13 The forecast queue length on Bridge Road in the PM peak is 134m in the DM and 173m in the DS, and there is sufficient space for this queue to form without blocking back to the preceding junction.

7.7.14 In practice, with the substantial reduction in total traffic, it would be possible to adjust traffic signal timings to optimise the queue lengths between approaches.

7.7.15 A sensitivity test has been undertaken using industry standard software LINSIG. The forecast PM peak 2023 DS flows from the Paramics model were input to LINSIG and the signal timings were optimised. The table below demonstrates that a better balance of operation can be achieved, resulting in reduced queues on all approaches compared with forecast do minimum queues from Paramics:

Table 7-27: North Quay/South Quay/Bridge Road (2023 PM) Sensitivity test with Revised Signal Timings from Linsig

PM peak	North Quay/South Quay/Bridge Road				
Approach	**Flow change (veh)**	**Flow change (%)**	**Mean Max Queue (m) Linsig**	**Mean Max Queue change (m)**	**RAG assessment**
North Quay	-3	-1	52	-86	
South Quay	-576	-40	63	-39	
Bridge Road	-251	-23	75	-59	
TOTAL	-831	-29		-	

South Quay/Yarmouth Way

Table 7-28: South Quay/Yarmouth Way (2023 AM)

AM peak	South Quay/Yarmouth Way				
Approach	**Flow change (veh)**	**Flow change (%)**	**Delay change (sec)**	**Mean Max Queue change (m)**	**RAG assessment**
South Quay (N)	-429	-49	-9	-64	
Yarmouth Way	-95	-13	-26	-34	
South Quay (S)	-131	-25	+1	-4	
TOTAL	-655	-31	-11	-	

Table 7-29: South Quay/Yarmouth Way (2023 PM)

PM peak	South Quay/Yarmouth Way				
Approach	**Flow change (veh)**	**Flow change (%)**	**Delay change (sec)**	**Mean Max Queue change (m)**	**RAG assessment**
South Quay (N)	-171	-25	-2	-28	
Yarmouth Way	-64	-10	-26	-94	
South Quay (S)	-357	-43	-11	-82	
TOTAL	-593	-27	-12	-	

7.7.16 The performance of the South Quay/Yarmouth way junction improves as a result of the Scheme.

Acle New Road/North Quay/Fullers Hill

Table 7-30: Acle New Road/North Quay/Fullers Hill (2023 AM)

AM peak	Acle New Road/North Quay/Fullers Hill				
Approach	**Flow change (veh)**	**Flow change (%)**	**Delay change (sec)**	**Mean Max Queue change (m)**	**RAG assessment**
North Quay (N)	+41	4	-9	-47	
Fullers Hill	-60	-21	-3	-10	
North Quay (S)	+47	8	-2	-13	
Acle New Road	-167	-18	+6	+23	
TOTAL	-138	-5	-2	-	

Table 7-31: Acle New Road/North Quay/Fullers Hill (2023 PM)

PM peak	Acle New Road/North Quay/Fullers Hill				
Approach	**Flow change (veh)**	**Flow change (%)**	**Delay change (sec)**	**Mean Max Queue change (m)**	**RAG assessment**
North Quay (N)	+66	+7	-35	-90	
Fullers Hill	-85	-21	-68	-90	
North Quay (S)	+218	+28	-42	-75	
Acle New Road	-215	-21	+9	+5	
TOTAL	-16	-1	-27	-	

7.7.17 The performance of the Acle New Road/North Quay/Fullers Hill junction generally improves as a result of the Scheme.

A47/Acle New Road (Vauxhall RB)

Table 7-32: A47/Acle New Road (Vauxhall RB) (2023 AM)

AM peak	A47/Acle New Road (Vauxhall RB)				
Approach	**Flow change (veh)**	**Flow change (%)**	**Delay change (sec)**	**MMQ change (m)**	**RAG assessment**
A47 Acle New Road	-1	0	+1	+30	
Runham Road	+3	+7	+7	+42	
Acle New Road	-54	-5	-3	-5	
A47	+5	0	-5	-39	
TOTAL	-65	-2	-3	-	

Table 7-33: A47/Acle New Road (Vauxhall RB) (2023 PM)

PM peak	A47/Acle New Road (Vauxhall RB)				
Approach	**Flow change (veh)**	**Flow change (%)**	**Delay change (sec)**	**MMQ change (m)**	**RAG assessment**
A47 Acle New Road	+10	+1	+5	+12	
Runham Road	-7	-7	+68	+15	
Acle New Road	-102	-7	-7	-49	
A47	-23	-2	-7	-17	
TOTAL	-122	-3	-2	-	

7.7.18 Vauxhall Roundabout generally performs well with the Scheme in place but, as currently modelled, the queue length on Runham Road, which is lightly trafficked, is forecast to increase by 15m in the morning peak, and the delay on Runham Rd increase by 68 sec. in the PM peak.

7.7.19 The forecast mean maximum queue length on Runham Road in the DS is 42m, and there is ample room for this queue to be accommodated without

blocking back to the next junction. There is also scope for further optimisation of the signals which could improve performance of the Runham Road approach, which carries a relatively low volume of traffic (90 veh/hr in the PM peak).

A47/Pasteur Road (Gapton RB)

Table 7-34: A47/Pasteur Road (Gapton RB) (2023 AM)

AM peak	A47/Pasteur Road (Gapton RB)				
Approach	**Flow change (veh)**	**Flow change (%)**	**Delay change (sec)**	**Mean Max Queue change (m)**	**RAG assessment**
A47 (N)	+32	+2	-2	-44	
Pasteur Road	-439	-49	+1	-4	
A47 (S)	-140	-9	-34	-276	
Gapton Hall Road	-131	-16	-17	-32	
TOTAL	-679	-14	-12	-	

Table 7-35: A47/Pasteur Road (Gapton RB) (2023 PM)

PM peak	A47/Pasteur Road (Gapton RB)				
Approach	**Flow change (veh)**	**Flow change (%)**	**Delay change (sec)**	**Mean Max Queue change (m)**	**RAG assessment**
A47 (N)	+99	+6	-36	-320	
Pasteur Road	-226	-24	-120	-57	
A47 (S)	+153	+13	-96	-364	
Gapton Hall Road	-131	-16	-22	-67	
TOTAL	-105	-2	-67	-	

7.7.20 The performance of the A47/Pasteur Road (Gapton Roundabout) junction improves as a result of the Scheme.

A47/William Adams Way (Harfrey's RB)

Table 7-36: A47/William Adams Way (Harfrey's RB) (2023 AM)

AM peak	A47/William Adams Way (Harfrey's RB)				
Approach	**Flow change (veh)**	**Flow change (%)**	**Delay change (sec)**	**Mean Max Queue change (m)**	**RAG assessment**
A47 (N)	-404	-25	-	+5	
Wm Adams Way (E)	+396	+110	-31	-1	
A47 (S)	+92	+5	+34	+254	
Wm **Adams Way** (W)	-44	-14	+2	-10	
TOTAL	+40	+1	+12	-	

Table 7-37: A47/William Adams Way (Harfrey's RB) (2023 PM)

PM peak	A47/William Adams Way (Harfrey's RB)				
Approach	**Flow change (veh)**	**Flow change (%)**	**Delay change (sec)**	**Mean Max Queue change (m)**	**RAG assessment**
A47 (N)	-119	-7	-6	-55	
Wm Adams Way (E)	+602	+166	-21	+54	
A47 (S)	+79	+5	-	+20	
Wm Adams Way (W)	-29	-5	+4	+35	
TOTAL	+534	+13	-5	-	

7.7.21 Harfrey's Roundabout will be the main point at which the Scheme connects, via William Adams Way, to the A47 trunk road. Because of this, the pattern of turning flows at the roundabout will change, with more traffic turning to use William Adams Way and the new bridge and less using the A47(N). This is expected to lead to increased queuing, on the A47(S) in the AM.

7.7.22 It should however be noted that the forecast extra delay for traffic approaching Harfreys from the A47 (south) in the AM peak (34 seconds) is expected to be balanced by a commensurate reduction in delay for traffic approaching Gapton from the A47 south (also 34 seconds) indicating that these impacts would in effect cancel each other out for SRN traffic. The same is true of the forecasts mean maximum queue, where an increase at Harfreys for northbound traffic in the AM peak is expected to be more than compensated for by the reduction at Gapton

7.7.23 The performance of Harfrey's Roundabout will be reviewed as part of a post-Scheme Monitoring and Evaluation Plan.

A47/A143 Beccles Road

Table 7-38: A47/A143 Beccles Road (2023 AM)

AM peak	A47/A143 Beccles Road				
Approach	**Flow change (veh)**	**Flow change (%)**	**Delay change (sec)**	**MMQ change (m)**	**RAG assessment**
A47 (SB off slip)	+24	+6	-1	+5	
Beccles Road (E)	-14	-5	-13	+6	
Shrublands Way	+23	+7	+6	+17	
Beccles Road (W)	+187	+37	+1	+60	
TOTAL	+219	+15	-	-	

Table 7-39: A47/A143 Beccles Road (2023 PM)

PM peak	A47/A143 Beccles Road				
Approach	**Flow change (veh)**	**Flow change (%)**	**Delay change (sec)**	**MMQ change (m)**	**RAG assessment**
A47 (SB off slip)	+239	+43	+7	+40	
Beccles Road (E)	+68	+17	+1	+12	
Shrublands Way	+12	+8	-	-1	
Beccles Road (W)	+9	+2	-2	+1	
TOTAL	+328	+21	+2	-	

7.7.24 Total traffic through this junction increases by 15% - 21% with the Scheme, but the average increase in delay per vehicle is small (2 seconds per vehicle). However, as presently modelled, queuing is forecast to increase on the Beccles Road (W) approach in the AM peak. Here the forecast queue length increases from 45m in the DM to 105m in the DS.

7.7.25 The performance of A47/A143 Beccles Road junction will be reviewed as part of a post-Scheme Monitoring and Evaluation Plan.

A143 Beccles Road/B1370 Burgh Road

Table 7-40: A143 Beccles Road/B1370 Burgh Road (2023 AM)

AM peak	A143 Beccles Road/B1370 Burgh Road				
Approach	**Flow change (veh)**	**Flow change (%)**	**Delay change (sec)**	**MMQ change (m)**	**RAG assessment**
Beccles Road (N)	+84	+21	+1	+33	
Burnt Lane	+9	+11	-	-	
Church Road	+114	+28	+1	+15	
Beccles Road (W)	+237	+83	+4	+50	
Burgh Road	+39	+13	+4	+27	
Suffolk Road	+2	+3	+1	+0	
TOTAL	+485	+31	+3	-	

Table 7-41: A143 Beccles Road/B1370 Burgh Road (2023 PM)

PM peak	A143 Beccles Road/B1370 Burgh Road				
Approach	**Flow change (veh)**	**Flow change (%)**	**Delay change (sec)**	**MMQ change (m)**	**RAG assessment**
Beccles Road (N)	+106	+18	+1	+6	
Burnt Lane	+6	+13	-	-	
Church Road	+45	+10	-	+11	
Beccles Road (W)	+61	+25	-	-5	
Burgh Road	+22	+8	+1	+5	
Suffolk Road	+5	+10	+1	+1	
TOTAL	+221	+13	+1	-	

7.7.26 Traffic will increase by 31% (AM) and 13% (PM) leading to a modest increase in queue lengths with the Scheme in the AM peak, especially on Beccles Road. Here, the mean maximum queue length in the DS increases from 41m to 91m, and there is ample room for this queue to form without blocking any other junctions. Increases in delay are negligible.

William Adams Way/Southtown Road junction

Table 7-42: William Adams Way/Southtown Road junction (2023 AM)

AM peak	William Adams Way/Southtown Road junction				
Approach	**Flow change (veh)**	**Flow change (%)**	**Delay change (sec)**	**Mean Max Queue change (m)**	**RAG assessment**
Southtown Road	-75	-18	-1	-7	
Beccles Road	+385	+47	-8	-6	
William Adams Way	+35	+19	-11	+50	
TOTAL	+344	+21	-7	-	

Table 7-43: William Adams Way/Southtown Road junction (2023 PM)

PM peak	William Adams Way/Southtown Road junction				
Approach	**Flow change (veh)**	**Flow change (%)**	**Delay change (sec)**	**Mean Max Queue change (m)**	**RAG assessment**
Southtown Road	-241	-35	-22	-129	
Beccles Road	+52	+10	-5	-34	
William Adams Way	+176	+44	-12	+72	
TOTAL	-12	-1	-12	-	

7.7.27 This junction will generally perform well with the Scheme, but changes in the pattern of flow are forecast to increase the queue length on the William Adams Way approach by 72m in the PM peak. There is potential for the

performance of this signal-controlled junction to be fine-tuned and optimised once the Scheme is in place.

7.7.28 As this junction forms part of the network in the immediate vicinity of the Scheme, its performance is examined in more detail in the next section.

Summary of Junction Assessment (existing junctions)

7.7.29 An overall RAG score for each junction is given in Table 7-44 below. This is based on the worst performing junction approach, in either peak hour and serves to identify junctions which need to be examined in more detail.

Table 7-44: Critical Junctions: Summary of Performance

Junction	Worst case RAG score	Comments
Pasteur Road/Bridge Road/Southtown Road		Queuing and delay reduced
North Quay/South Quay/Bridge Road		Reduced queuing generally, but longer queue on Bridge Road (PM peak) No blocking back. Scope to adjust signal timings to balance queues.
South Quay/Yarmouth Way		Queuing and delay reduced
Acle New Road/North Quay/Fullers Hill		Queuing and delay reduced
A47/Acle New Road (Vauxhall RB)		Limited impacts generally, but longer queue and increased delay on lightly trafficked Runham Road (in AM and PM peak respectively). No blocking back.
A47/Pasteur Road (Gapton)		Queuing and delay significantly reduced
A47/William Adams Way (Harfrey's RB)		Significantly longer queue on A47 (south) approach (AM peak)
A47/A143 Beccles Road		Significantly longer queue on A143 (W) Beccles Road (AM peak)
A143 Beccles Road/B1370 Burgh Road		Limited increases in queueing generally. Bigger queue increase on Beccles Road (AM peak) but no blocking back.
William Adams Way/Southtown Road junction		Overall reduction in delay but longer queue on William Adams Way. No blocking back

7.7.30 In summary, of the ten existing junctions which were identified as potentially critical, there are two where a significant increase in queuing and/or delay is forecast on at least one approach, and three where a more modest increase is forecast. In general, though, there will be sufficient road space to accommodate any additional queuing without blocking back to other junctions.

7.7.31 It is important to note that, in places where average queues and delays appear to be only slightly reduced by the Scheme, the number of road users experiencing those queues and delays may be significantly less as a result of traffic diverting to use the Scheme.

7.7.32 Similarly, even at locations where traffic using the Scheme leads to higher flows, and therefore higher localised queues and delays, there will usually still be a net time saving for road users who are able to make a shorter journey via the Scheme.

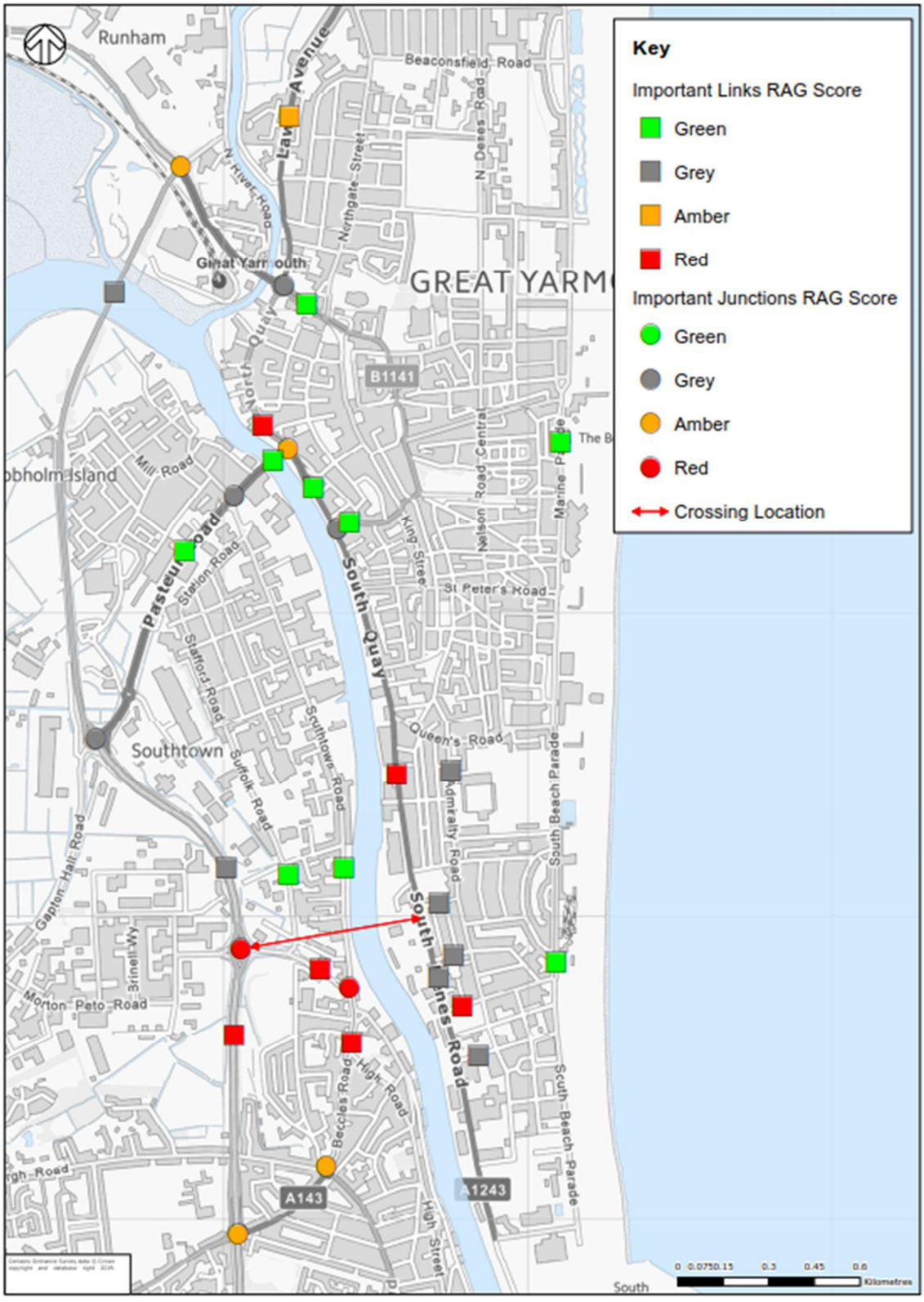
7.7.33 Overall there will be average journey time savings for all users in the network of over a minute in the PM peak, with through trips on the A47 benefitting from savings of a minute on the route from the south of Harfreys roundabout to the Acle Straight. Similarly, trips between the A47 south and the Pleasure Beach and Outer Harbour are forecast to reduce by 4 minutes and 6.1 minutes respectively.

Summary of Impacts

7.7.34 The results of the assessment of the impact of the scheme on links and junctions are summarised in Plate 7-8. This shows that there will be benefits to the key links and junctions nearest to the Haven Bridge and the town centre. In the vicinity of the Scheme, there will be some increases in traffic, due to reassignment of trips to use the new bridge.

7.7.35 The impacts of this are examined in more detail in the following sections which confirms that they are manageable. Section 7.8 provides additional evidence that the Scheme, once open, will continue to provide important benefits in terms of overall network performance.

Plate 7-8: Link and Junction Assessment Results



Further Consideration of Queuing at Key Junctions

7.7.36 Plate 7-9 and Plate 7-10 illustrate the forecast peak hour queuing at all of these junctions in the DS peak hours, in a way that shows whether queues could block back across other junctions. For each junction approach these plans show:

- Red - the mean maximum queue (MMQ)

  The maximum queue length is determined for each 5 min segment within the simulation period, and the mean of these maximum values is calculated. This means, for example, that the MMQ reflects the queues which build up during a red phase at traffic signals.

  MMQs are shown as red lines, drawn to scale on the plan

- Blue - the absolute maximum queue

  This is the absolute maximum queue observed at any time during the simulation period – the extreme limit of possible queuing. This means that, in Great Yarmouth, it will reflect the extent to which queues could build up during openings of the Scheme to allow shipping to pass through the bridge.

  Absolute maximum queues are shown as blue lines, drawn to scale on the plan.

7.7.37 It can be seen that queuing in the DS can be accommodated within the available road space in the network. There are places where queuing increases, including at Harfreys roundabout, but there are also reductions in queuing, including at Gapton roundabout which balance these for users of the A47, contributing to a net benefit.

Plate 7-9: AM Peak Queue Lengths at Critical Junctions (DS) – with Scheme

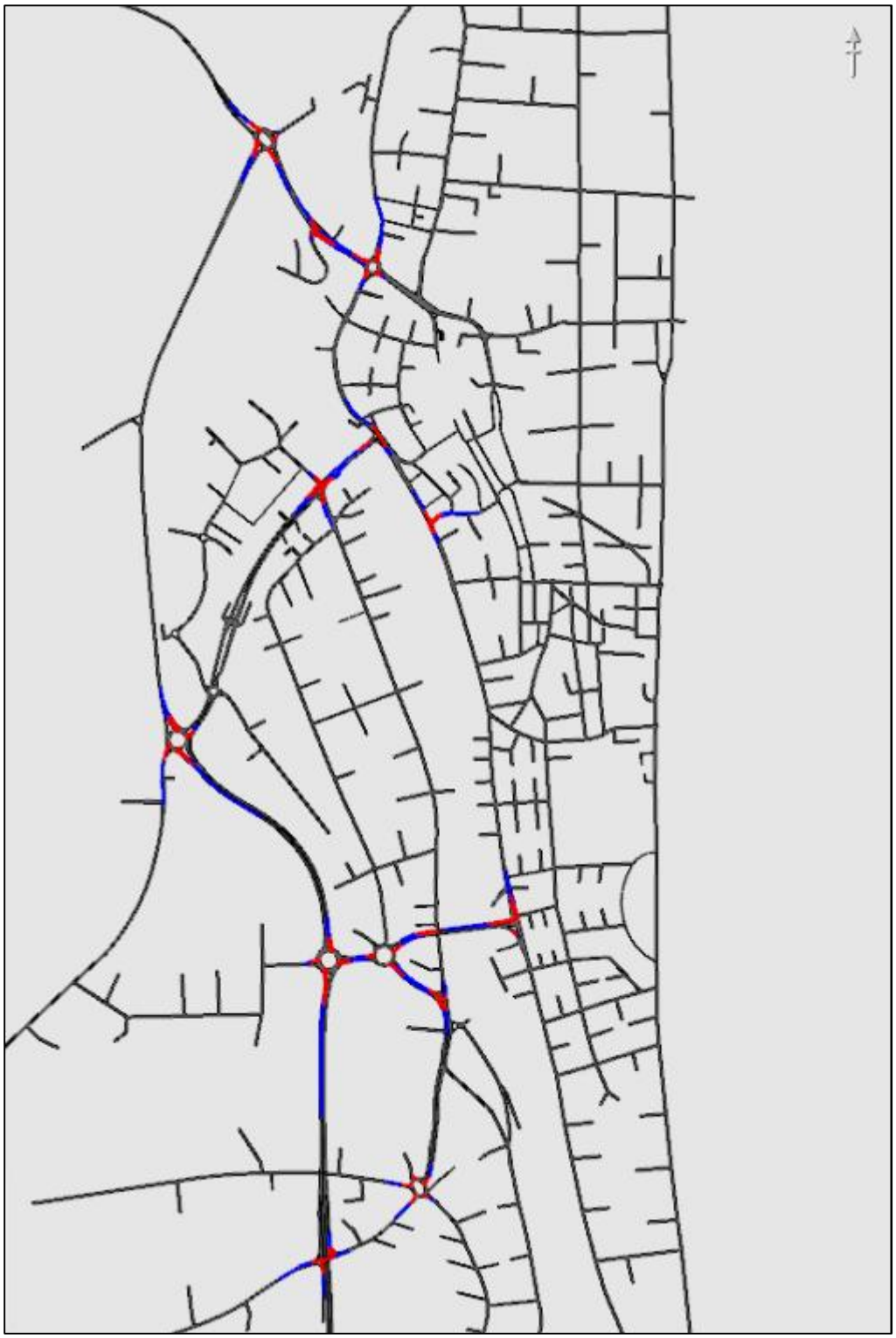
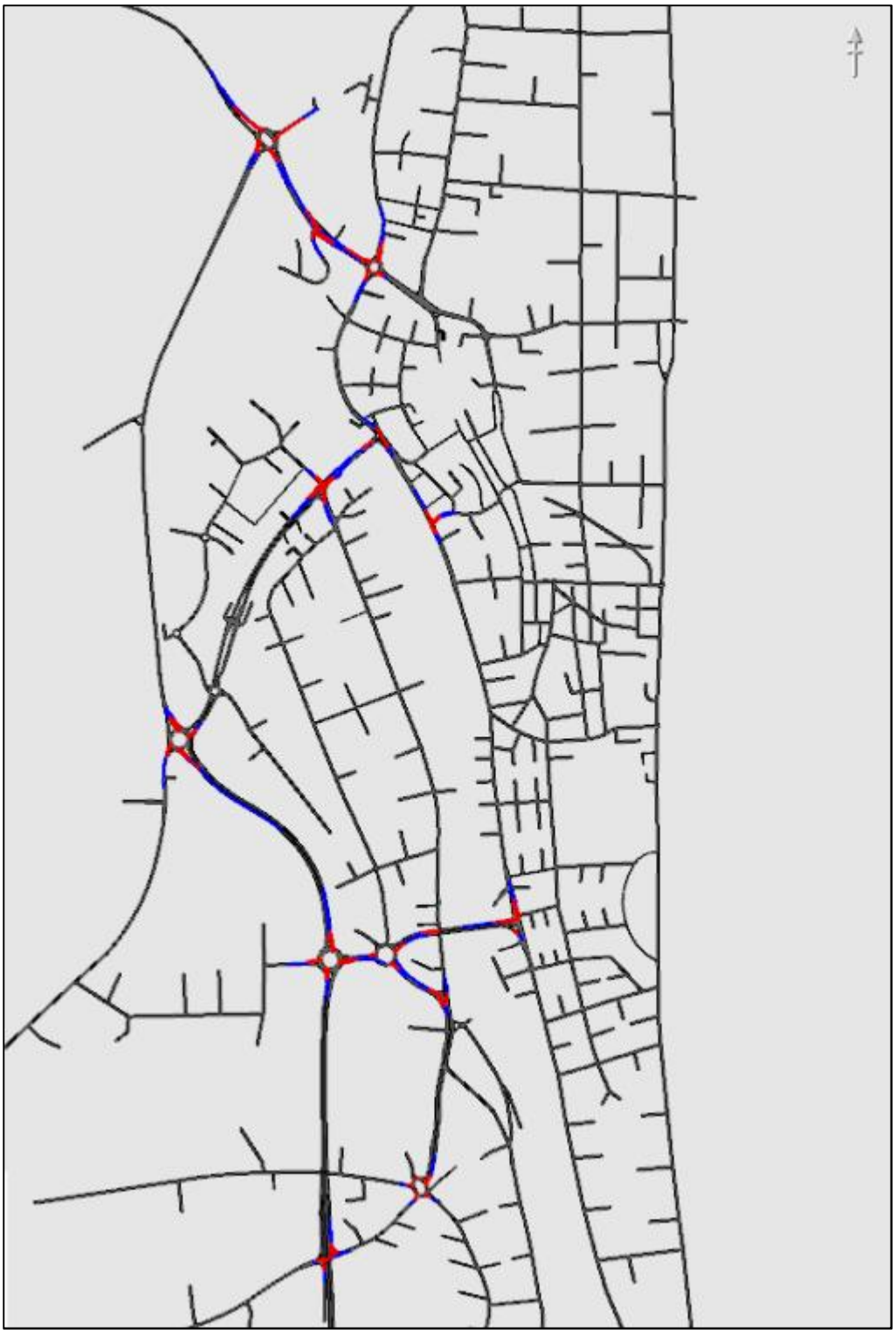


Plate 7-10: PM Peak Queue Lengths at Critical Junctions (DS) - with Scheme



Performance of Junctions Close to the Scheme, including Harfrey's

Plate 7-11 shows queuing in the area around the Scheme in the AM peak 2023 in the DS scenario.

7.7.38 Plate 7-12 shows the same area in the PM peak, again in the DS scenario.

7.7.39 The mean maximum and absolute maximum forecast queues can be accommodated within the local network without blocking other key junctions.

Plate 7-11: Queuing at Junctions near the Scheme, 2023 AM (DS) - with Scheme

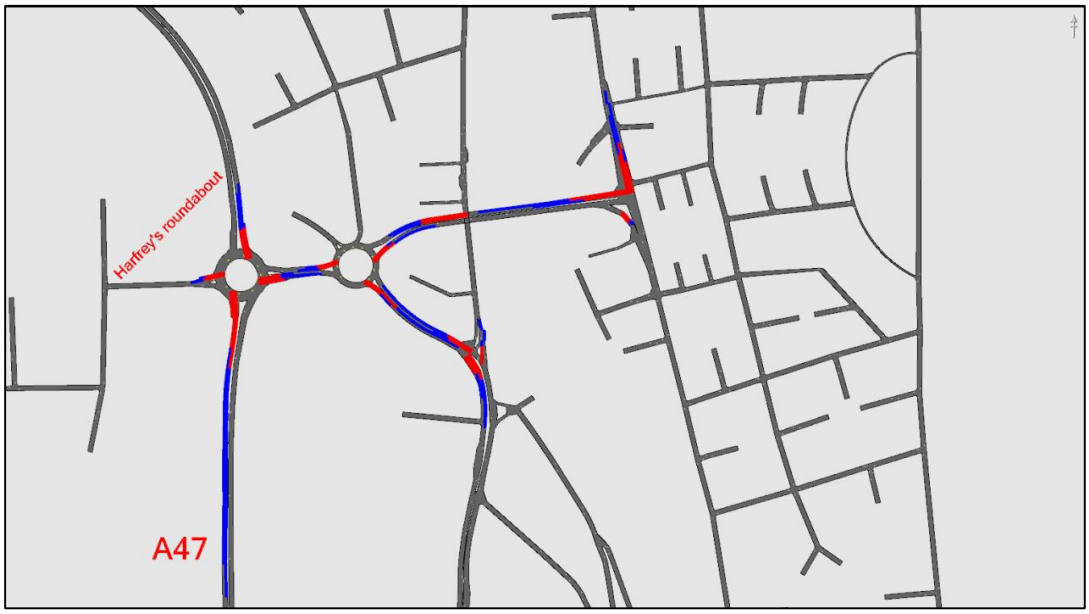
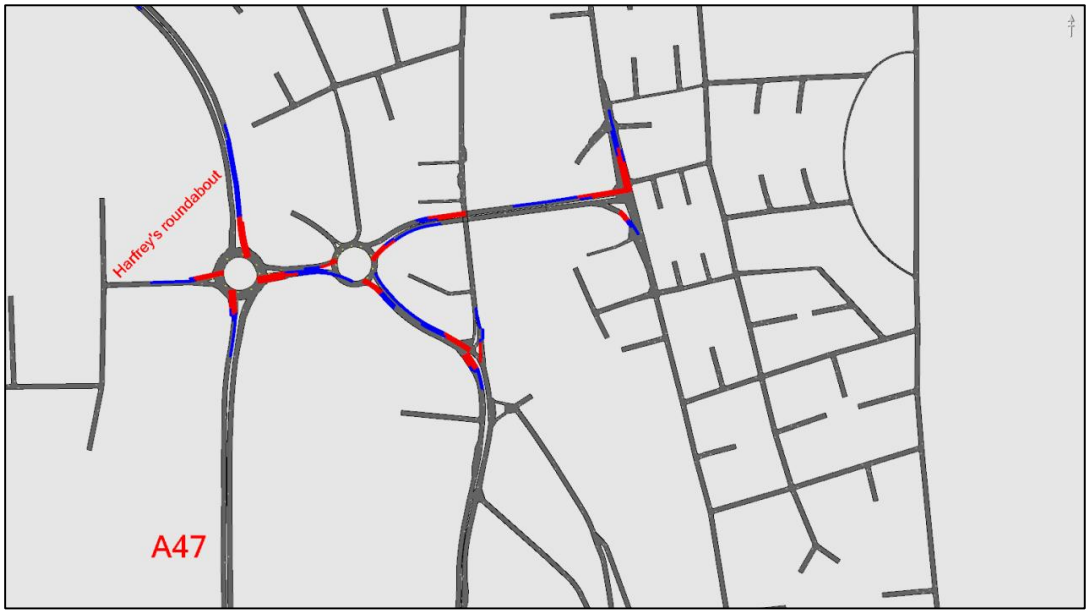


Plate 7-12: Queuing at Junctions near the Scheme, 2023 PM (DS) - with Scheme



7.7.40 The following new junctions will be created as part of the scheme.

- William Adams Way new RB
- South Denes Road New signal junction

7.7.41 The performance these junctions in 2023 is set out in Table 7-45 and Table 7-46.

Table 7-45: Performance of new junctions 2023 AM Peak (DS) – with Scheme

Junction	Arm	Traffic Flow	Delay (s)	MMQ (m)
South Denes Road Signalised Junction	South Denes Road (N)	666	53	143
	South Denes Road (S)	175	19	20
	Third River Crossing	996	55	250
	TOTAL	**1,838**	**51**	
New Roundabout	William Adams Way (E)	766	27	155
	Third River Crossing	709	44	96
	William Adams Way (W)	918	11	63
	TOTAL	**2,393**	**26**	

Table 7-46: Performance of New Junctions 2023 PM Peak (DS) – with Scheme

Junction	Arm	Traffic Flow	Delay (s)	MMQ (m)
South Denes Road Signalised Junction	South Denes Road (N)	586	51	122
	South Denes Road (S)	577	19	49
	Third River Crossing	582	52	161
	TOTAL	**1,745**	**41**	
New Roundabout	William Adams Way (E)	422	23	66
	Third River Crossing	1008	44	124
	William Adams Way (W)	882	9	36
	TOTAL	**2,312**	**27**	

7.7.42 In both cases, the new junctions and local road network are shown to be capable of handling the forecast demand.

Performance of Junctions on Beccles Road

7.7.43 Plate 7-14: Queuing at Beccles Road Junctions, 2023 PM (DS) – with Scheme Plate 7-13 shows forecast queuing at the two junctions on Beccles Road in the AM peak 2023 in the DS scenario. Plate 7-14shows the same area in the PM peak, again in the DS scenario.

7.7.44 The mean maximum and absolute maximum forecast queues can be accommodated within the local network without blocking other key junctions.

Plate 7-13: Queuing at Beccles Road Junctions, 2023 AM (DS) – with Scheme

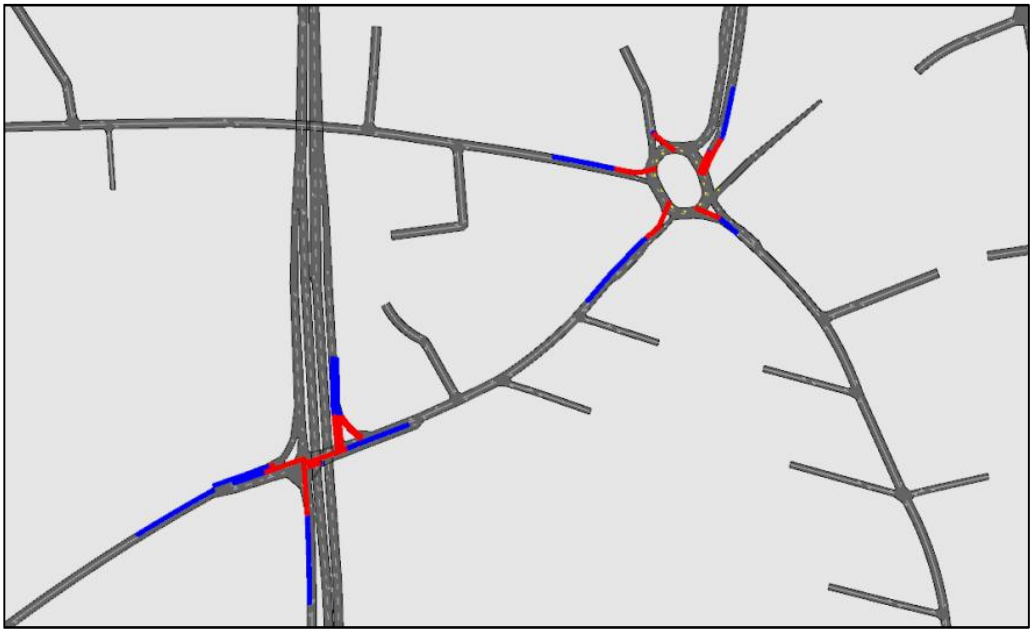
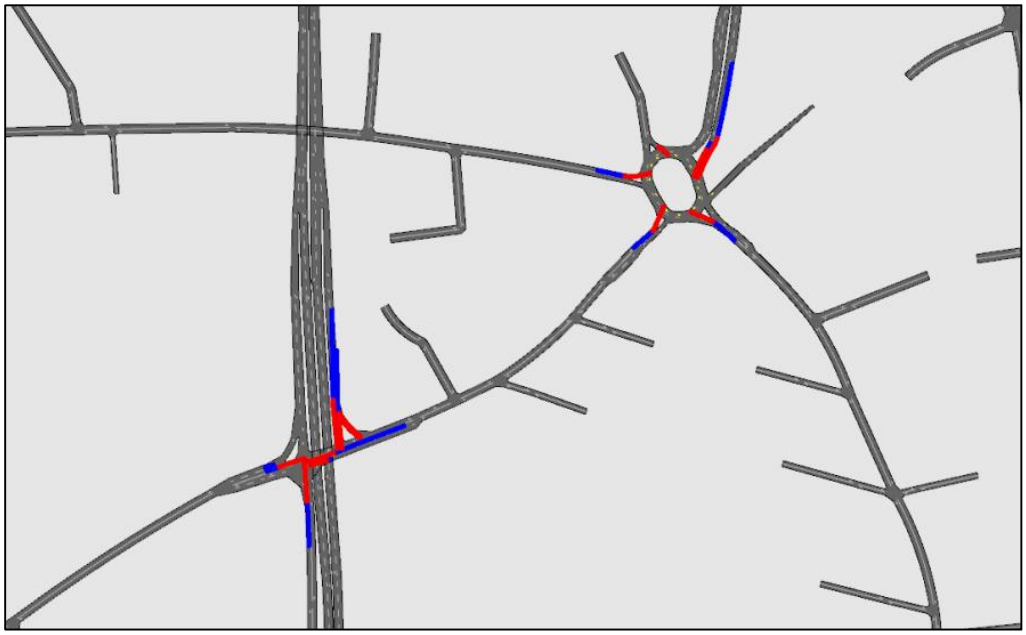


Plate 7-14: Queuing at Beccles Road Junctions, 2023 PM (DS) – with Scheme



Performance of Junctions around Haven Bridge

7.7.45 Plate 7-16 show forecast queuing in the 2023 AM and PM DS scenario (i.e. with the Scheme) at the junctions near to the Haven Bridge, including:

- Pasteur Road/Bridge Road/Southtown Road
- North Quay/South Quay/Bridge Road
- South Quay/Yarmouth Way

7.7.46 The mean maximum queues can be accommodated within the local network without blocking other key junctions.

7.7.47 The absolute maximum queues can generally be accommodated without blocking other key junctions, except for that on Yarmouth Way which could extend past the Greyfriars Way junction. However, this is also occurs in the DM and there is a “Keep Clear” box at the junction. The forecast queue in the DS is still shorter than in the DM, so the Scheme does provide an improvement.

Plate 7-15: Queuing at Junctions near Haven Bridge, 2023 AM (DS)

Plate 7-16: Queuing at Junctions near Haven Bridge, 2023 PM (DS)

7.8 Impact of the Scheme at Forecast 2038 Levels of Demand

7.8.1 The impacts of the Scheme at 2038 levels of demand have also been considered. This has been undertaken at a more "high level" of detail, for the reasons explained below.

7.8.2 Traffic demand has been forecast for 2038, taking account of the expected levels of development and growth over the 15 years from opening of the Scheme. This demand was then assigned to the DM and DS microsimulation networks in the same way as the forecast 2023 demand.

7.8.3 The results of this modelling were very striking. In the DM situation – that is, without the Scheme – there is insufficient capacity within the overall network to cope with the higher level of demand. Congestion is forecast to increase to a level at which a significant proportion of journeys would not be able to take place, or – having started - could not be completed within the peak period.

7.8.4 The model represents this by being unable to release trips onto the network, as illustrated in Table 7-47.

Table 7-47: Non-Assignment of Trips at 2038 demand levels

Total vehicles assigned to network			
Time Period	**DM**	**DS**	**Difference**
AM peak	24,628	38,248	-36%
PM peak	30,910	41,293	-25%

7.8.5 Between 25% and 36% of trips are not able to be assigned because of lack of network capacity in the DM scenario – that is, without the scheme. However, in the DS situation – that is, with the scheme - virtually all trips are assigned, indicating that the network is within capacity.

7.8.6 Beyond this, it is not possible to rely on the 2038 microsimulation model to assess the change in performance of the network as a result of the Scheme in detail, as it is not designed to be used in a DM situation where free flow has broken down in significant parts of the network to the extent that trips have been suppressed.

7.8.7 It is, however, reasonable to conclude that the modelling supports the assertions that:

- without the Scheme, congestion in parts of Great Yarmouth could increase to unacceptable levels,

- without the Scheme, the growth and development which fuels increased demand could be inhibited by lack of capacity on parts of the road network
- the Scheme is key to providing additional capacity and creating the conditions in which forecast growth can take place
- overall traffic conditions in 2038 would be significantly better with the Scheme in place, as the network would be better able to support the forecast demand (as indicated by virtually all modelled trips being completed within the peak periods)

Whilst it is not possible to make more detailed comparisons between performance of the 2038 DS and DM networks (because trips are suppressed in the DM) it is possible to examine the performance of the 2038 DS network (with the Scheme) in terms of queuing at junctions in the same way as was done for 2023. The results are illustrated in Plate 7-17,

7.8.8 Plate 7-18 and Plate 7-19 below.

7.8.9 For each critical junction approach these plans show:

- Red – the mean maximum queue (MMQ)
- The maximum queue length is determined for each 5 min segment within the simulation period, and the mean of these maximum values is calculated. This means, for example, that the MMQ reflects queues which build up during a red phase at traffic signals.

7.8.10 MMQs are shown as red lines, drawn to scale on the plan

- Blue - the absolute maximum queue

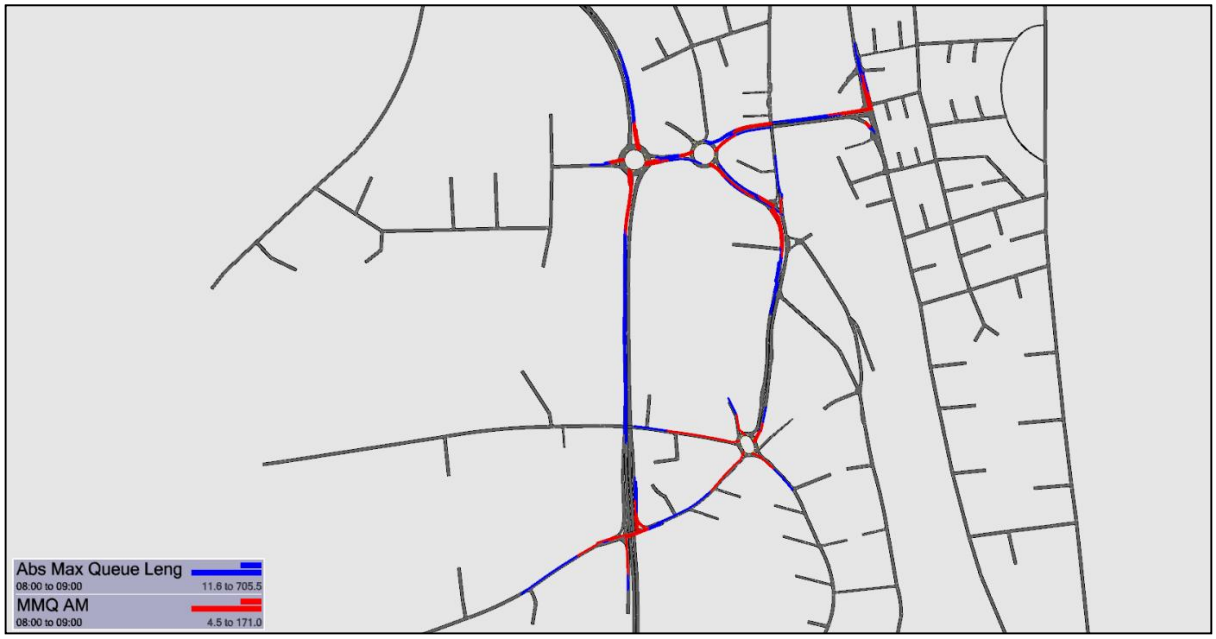
7.8.11 This is the absolute maximum queue observed at any time during the simulation period – the extreme limit of possible queuing. This means that, in Great Yarmouth, it will reflect the extent to which queues could build up during openings of the Scheme to allow shipping to pass through the bridge.

7.8.12 Absolute maximum queues are shown as blue lines, drawn to scale on the plan.

Plate 7-17: Queuing at Junctions, 2038 DS (north)

Plate 7-18: Queuing at Junctions, 2038 DS (central)

Plate 7-19: Queuing at Junctions, 2038 DS (south)



7.8.13 In general, these show that queues can be accommodated on the network, and are similar to, or less than, those occurring at present without the Scheme.

7.8.14 At A47 Harfrey's roundabout, however, there is evidence that the junction would suffer from significant queuing and blocking back on the southern A47 approach. This is to be expected, given that problems were identified at 2023 levels with this approach. This problem is addressed in Section 8 (Mitigation of Impacts).

7.9 Impact of the Scheme on Walking and Cycling

7.9.1 The impact of the Scheme on NMU facilities, as a result of the changes to facilities discussed in Section 5.6, is described in detail in the ES Chapter 14: People and Communities (Document 6.1). The key changes to NMU facilities as a result of the Scheme are as follows:

- The proposed footways and cycleway along the proposed bridge would enable pedestrian and cyclists to safely cross the River Yare, linking the communities either side of the river.
- The proposed removal of the William Adams Way footbridge would mean that NMUs travelling from the north to south of William Adams Way would have travel a slightly longer distance and use at-grade crossings rather than a segregated footbridge

- The NCN route 517, Hopton-on-Sea to Sea Palling (national trail) and proposed cycle route along Southtown Road would not be directly affected by the Scheme.

7.9.2 Chapter 17 of the ES includes an assessment of the impact that the Scheme is forecast to have on pedestrian and cyclist journey times. Figures 17.7 and 17.8 in the ES illustrate example walking and cycling routes and journey times between destinations on either side of the river. Journey times have been calculated using an average walking speed of 5kph and cycling speed of 20kph, as recommended in DMRB Volume 11.

7.9.3 Table 7-48 below summarises forecast change in journey times from Peggotty Road Community Centre on the eastern side of the River Yare to Harfreys Industrial Estate and Southtown Common on the western side, with and without the Scheme. This analysis demonstrates that substantial time savings are forecast for walking and cycling trips as a result of the Scheme.

Table 7-48: Walking and Cycling Journey Times

Walking Journey Times				
From	**To**	**Without Scheme**	**With Scheme**	**Time Saving (Minutes)**
Peggotty Road Community Centre	Harfreys Industrial Estate	47 mins	18 mins	29 mins
Peggotty Road Community Centre	Southtown Common	44 mins	9 mins	35 mins
Cycling Journey Times				
From	**To**	**Without Scheme**	**With Scheme**	**Time Saving (Minutes)**
Peggotty Road Community Centre	Harfreys Industrial Estate	12 mins	4½ mins	7½ mins
Peggotty Road Community Centre	Southtown Common	12 mins	2 mins	10 mins

7.9.4 Plate 7-20 and

7.9.5 Plate 7-21 below demonstrate the improvements to accessibility as a result of the scheme for both pedestrians and cyclists. This shows that the Scheme

is forecast to significantly increase the area that can reasonably be accessed by pedestrians and cyclists.

Plate 7-20: Accessibility for Pedestrians 2023 DM (left) and DS (right)

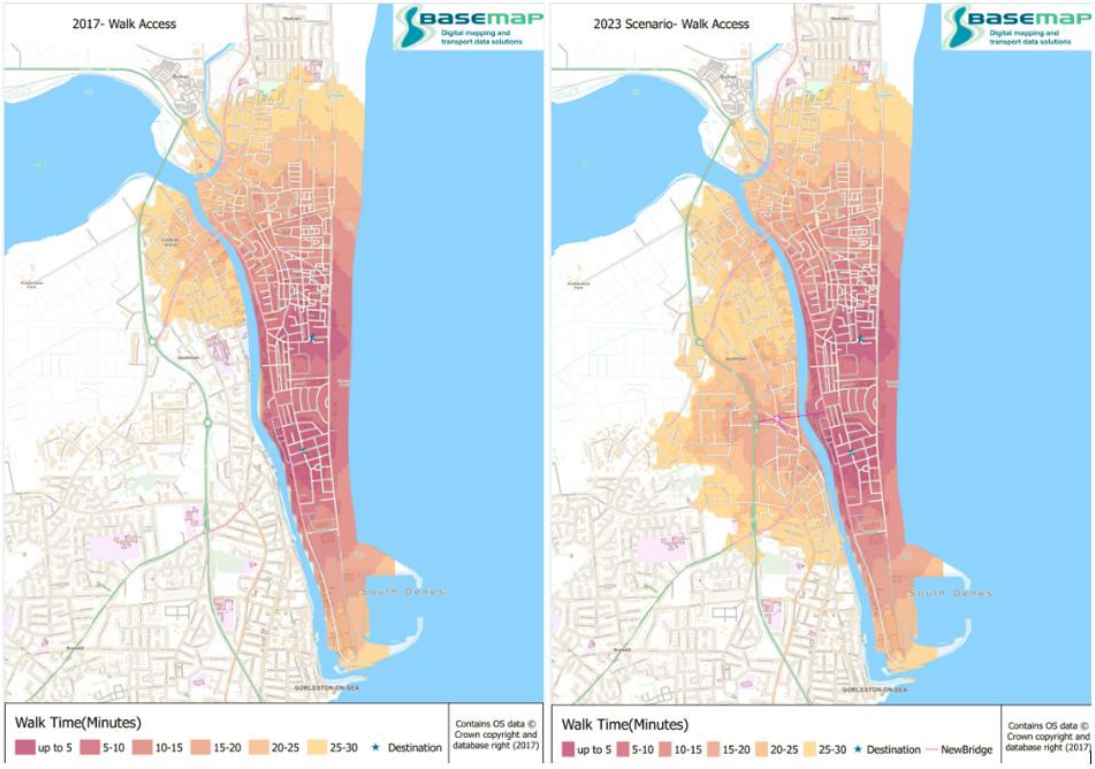
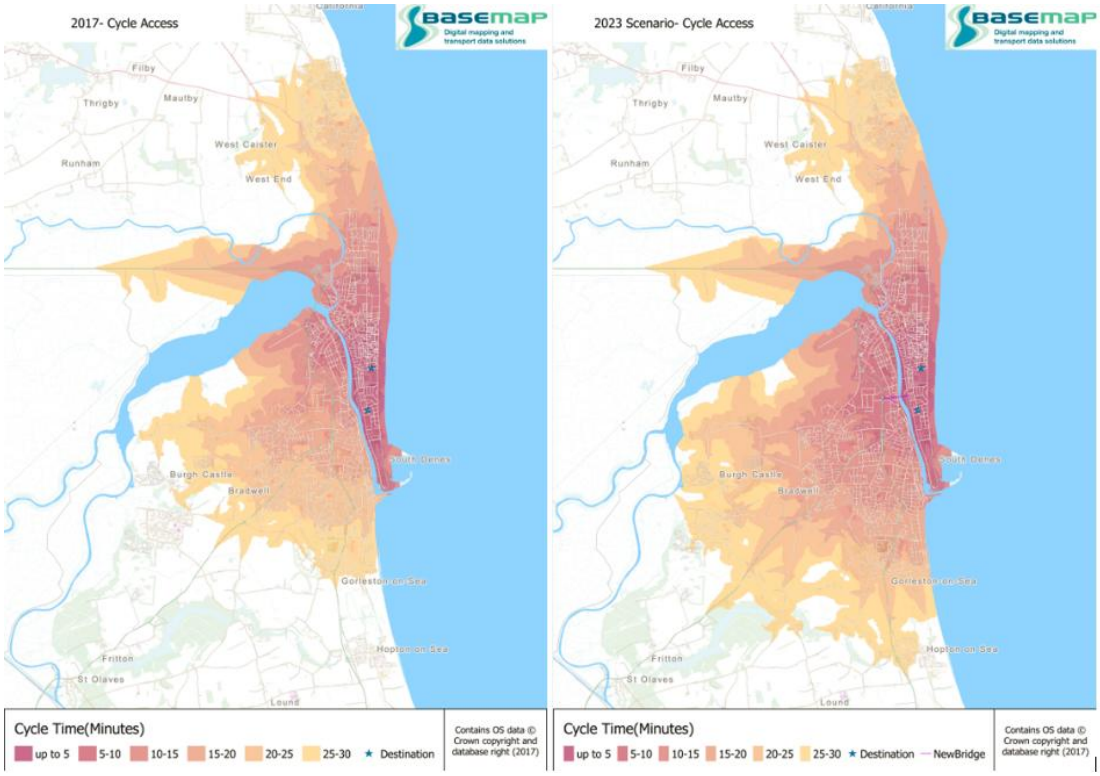


Plate 7-21: Accessibility for Cyclists 2023, DM (left), DS (Right)



7.9.6 As part of the Social and Distributional Impact Assessment (Document 7.6 Appendix E), an assessment of the impact of the Scheme on severance has been conducted. This assessment considers the changes in traffic flow as a result of the Scheme and how this will impact non-car drivers' access to community facilities and services.

7.9.7 The assessment found that although some roads will see an increase in traffic that may increase severance, the provision of a new crossing between two previously poorly connected parts of Great Yarmouth will have a significant positive impact on community severance by offering an alternative central crossing, providing access to the town centre and other key amenities and facilities. In addition to the new river crossing, the additional pedestrian facilities that are being provided on the crossing and on William Adams Way as part of the Scheme aim to reduce the impact on pedestrian movement.

7.9.8 An Active Modes Appraisal[10] (AMA) was undertaken as part of the work on the OBC. This used a DfT approved economic appraisal methodology to determine the changes in walking and cycling caused by the Scheme, together with an assessment of the associated economic benefits, including health benefits.

7.9.9 This appraisal was subsequently updated to take into account feedback received from DfT and to reference the updated modelling for the DCO. The methodology and results are set out in detail in Document 7.6 Economic Appraisal Report Appendix D.

7.9.10 The Present Value of Benefits for each active mode impact are summarised in Table 7-4950. It is calculated that the present value of the active modes benefits for the Great Yarmouth Third River Crossing, over a 30 year appraisal period, is £10.2 million (2010 prices).

Table 7-49: Present Value of Active Mode Impacts over 30 year Appraisal Period (£000) (2010 prices)

Impact	Pedestrian	Cycle user	Total
Physical Activity (Health)	£2,152	£913	£3,065
Absenteeism	£84	£47	£131
Journey Quality/Ambience	£903	£745	£1,648
Journey Time	£5,034	£326	£5,360
Total	£8,173	£2,031	£10,204

7.10 Impact of the Scheme on Public Transport

7.10.1 In order to quantify the impact on bus journeys, an extensive review of all existing bus services, timetables, routes and bus stops has been undertaken, and this information has been coded into the Paramics Model. The information used and methodology adopted is described in detail in the Paramics LMVR.

7.10.2 The Paramics model outputs in the tables below indicate a general improvement in bus journey times in the study area as a result of the

[10] DCO Document 7.6 Economic Appraisal Report - Appendix D

Scheme, with an average saving of 12 seconds (1%) in the morning peak and 42 seconds (3%) during the evening peak.

Table 7-50: Bus Journey Time Comparisons AM Peak

Service Name	2023 AM Do Min Average Journey Time (min)	2023 AM Do Something Average Journey Time (min)	Absolute Difference	% Difference
Route 1 NB	41	40	- 0.8	-2%
Route 1 SB	26	26	- 0.1	-1%
Route 1A NB	41	41	0.0	0%
Route 1A SB	27	27	-0.1	0%
Route 2	25	25	0.1	0%
Route 4 NB	16	15	-0.0	0%
Route 4 SB	8	8	-0.1	-1%
Route 5 NB	19	19	0.3	1%
Route 5 SB	11	11	0.0	0%
Route 5 SB_2	4	4	-0.0	-1%
Route 6 NB	20	21	0.9	4%
Route 6 SB	18	18	-0.5	-3%
Route 8 NB	35	35	-0.4	-1%
Route 8 SB	28	27	-0.4	-1%
Route 9 NB	21	21	-0.2	-1%
Route 9 SB	19	19	-0.5	-2%
Route X1 NB	30	29	-0.5	-2%
Route X1 SB	23	22	-0.6	-3%
Route X11 NB	30	30	-0.3	-1%
Route X11 SB	23	22	-0.7	-3%
All Services	**24.5**	**24.3**	**- 0.2**	**-1%**

Table 7-51: Bus Journey Time Comparisons PM Peak

Service Name	2023 PM Do Min Average Journey Time (min)	2023 PM Do Something Average Journey Time (min)	Absolute Difference	% Difference
Route 1 NB	42	41	-0.8	-2%
Route 1 SB	27	26	- 0.7	-3%
Route 1A NB	41	40	-0.9	-2%
Route 1A SB	28	27	-0.5	-2%
Route 2	25	25	-0.0	0%
Route 4 NB	16	15	-0.3	-2%
Route 4 SB	9	8	-0.3	-3%
Route 5 NB	21	21	- 0.2	-1%
Route 5 SB	12	11	-0.2	-2%
Route 5 SB_2	4	4	- 0.0	0%
Route 6 NB	21	21	-0.2	-1%
Route 6 SB	19	18	-0.1	-1%
Route 8 NB	35	35	-0.4	-1%
Route 8 SB	29	28	-1.0	-4%
Route 9 NB	21	20	- 0.4	-2%
Route 9 SB	19	18	-0.7	-4%
Route X1 NB	31	29	-1.7	-6%
Route X1 SB	23	22	-1.0	-4%
Route X11 NB	31	29	-1.7	-5%
Route X11 SB	24	22	-2.2	-9%
All Services	**25.2**	**24.5**	**-0.7**	**-3%**

7.10.3 The Scheme also incorporates improvements to the urban realm which will benefit local residents and visitors, non-motorised users and bus users. This includes the relocation and upgrade of the existing southbound bus stop on Southtown Road. The current facility is sub-standard and requires passengers to negotiate several steps to board or alight the bus.

7.10.4 The proposed new bus stop will be relocated to the south in order to better tie in with proposed cycle and pedestrian routes and crossings. It will incorporate a shelter/seating and lighting.

7.10.5 Initial consultation has been undertaken with representatives from First Bus. Norfolk County Council will continue to liaise with the main operators in order to obtain a formal response and to investigate opportunities to improve the existing bus network by the creation of new or extended services such as circular routes using the Third River Crossing.

7.11 Impact of the Scheme on Abnormal Loads Routes

7.11.1 Currently, there are no formally defined Abnormal Load routes in Great Yarmouth, as the choice of route for each delivery would depend upon its origin and destination and specific characteristics such as weight, dimensions and timing and would be reviewed and agreed in advance by the street works and bridges teams.

7.11.2 The routes chosen would generally avoid Haven Bridge and Barnard Avenue Bridge, which are both unsuitable for heavier vehicles and are subject to weight restrictions.

7.11.3 Trips from the A47 to the Outer Harbour and berths on the east of the river are typically routed via Vauxhall roundabout, Fullers Hill, North Quay and Hall Plain (therefore avoiding Haven Bridge) then South Quay and South Denes Road.

7.11.4 For berths on the west of the river then the typical route from the A47 would be via Gapton Hall, Pasteur Road/Southtown Road, or via Harfrey's roundabout and William Adams Way/Southtown, depending on the relevant berth number.

7.11.5 The Scheme would provide an alternative (and in many cases shorter) route for these trips and therefore the impact of the Scheme on Abnormal Load Routes is expected to be beneficial.

7.12 Impact of the Scheme on Road Safety

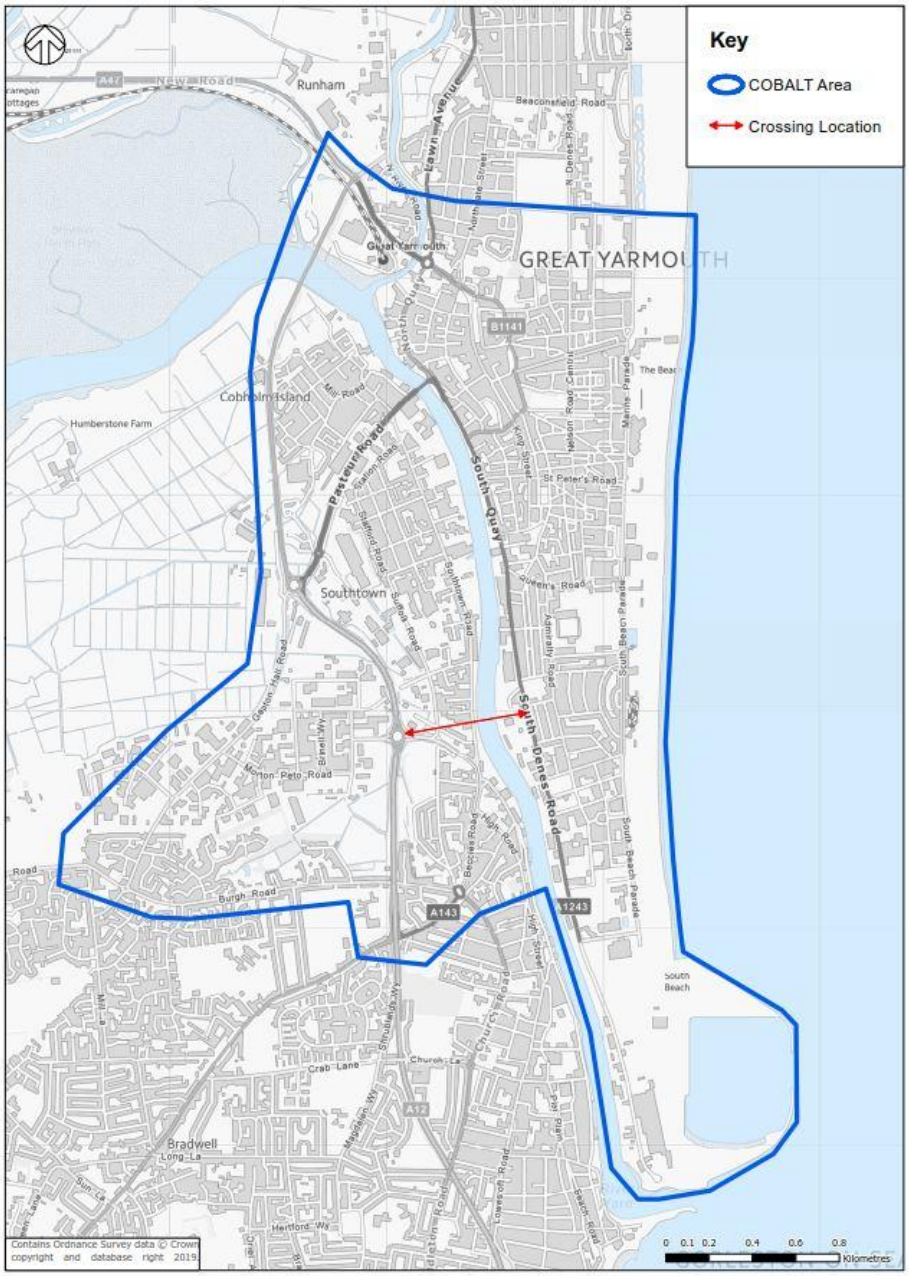
7.12.1 As part of the Economic Appraisal of the Scheme, the cost benefits associated with changes to the forecast number of accidents and casualties as a result of the Scheme have been quantified using the DfT software Cost and Benefits to Accidents - Light Touch (v2013_02 COBA-LT). The methodology, assumptions and outputs are fully documented in the Economic Appraisal Report (Document 7.8).

7.12.2 In summary, the total cost of accidents on a network is calculated by multiplying the number of accidents predicted to occur on the network by the cost per accident. The number of accidents on a given length of road is expressed by accident rates, defined as the number of Personal Injury Accidents (PIA) per million vehicle kilometres travelled. The outputs are expressed as the change in the number of accidents and casualties when a scheme is introduced, and the economic cost implications of these changes.

7.12.3 The savings in the number of accidents / casualties as a result of the scheme were calculated from the difference between accident and casualty costs in the Do-Minimum and Do-Something,

7.12.4 The extent of the study area was based on links with AADT flow differences of over 5%. The resulting study area is illustrated in Plate 7-22.

Plate 7-22: COBA-LT Study Area



7.12.5 The Scheme is forecast to result in a considerable redistribution of traffic thus impacting flows on a number of links and junctions in the Study Area. Therefore, it is considered appropriate to assess links and junctions separately within COBA-LT. Default accident rates were used across the COBA-LT network.

7.12.6 The COBA-LT study area includes a considerable number of junctions, including a number of minor junctions where safety is unlikely to be impacted

by the scheme. The junctions included in the assessment were selected using the following methodology:

- All junctions where at least one Personal Injury Accident (PIA) were recorded in the 6-year period between 2010 and 2015 were included. This assessment of observed accidents was undertaken for selection purposes only. No observed accidents were included in the COBA-LT input file;
- Any other major junctions likely to be impacted by the scheme;
- The existing priority junction at Swanston's Road/South Denes Road on the Peninsula (to be replaced by the new signalised junction) was included with flows in the Do-Minimum scenario only; and
- The proposed new roundabout and traffic signal junctions on the west and eastern side of the new bridge respectively were included with flows in the Do-Something scenario only.

7.12.7 Table 7-52 summarises the accident benefits generated by the Scheme over the 60 year appraisal period, discounted to 2010 prices. The scheme is forecast to save 20 accidents with a resultant benefit of £0.9 million.

Table 7-52: Scheme Accident Benefits

	DM	DS	Saving
Number of Accidents	5,174	5,154	20
Cost of Accidents (£000)	187,885	186,938	947

7.12.8 Table 7-53 summarises the savings in casualties. The scheme is forecast to result in a saving of 54 casualties over the 60 year appraisal period.

Table 7-53: Scheme Casualty Benefit

Severity	DM	DS	Saving
Fatal	30	30	0
Serious	437	436	1
Slight	6,770	6,717	53
Total	7,237	7,183	54

7.12.9 Accident savings are broken down by links and junctions in Table 7-54. It can be seen that the accident savings are largely associated with savings at junctions. This can be attributed to the removal of trips from a number of junctions, resulting in a reduction in collisions, due to the reassignment of trips.

Table 7-54: Accident Savings (£000) over 60 years

Location	DM
Links Only	52
Junction Only	895
Total	947

7.13 Impact on Network Resilience

7.13.1 Resilience in a transport network has been defined[11] as "the ability to absorb shocks gracefully". It may be understood in terms of the way different components of the network work complement each other:

- **Redundancy** Different components serving the same function
- **Diversity** Components are functionally different
- **Efficiency** Network performance is optimised
- **Autonomy** Components are able to function separately
- **Strength** Ability to withstand a disruptive event
- **Collaboration** Information and resources shared amongst components
- **Adaptability** Flexible, able to learn from past experiences
- **Mobility** Ability to reach a chosen destination with an acceptable level of service
- **Safety** Exposes fewer users to hazards
- **Recovery** Level of service can be restored quickly

7.13.2 Lack of resilience is a problem if a transport network is unable to cope with disruptive events, such as surges in demand, accidents, extreme weather conditions or road works. The more common the event, the more important it is for the network to be able to recover quickly in order to restore an acceptable level of service and avoid compounding the problem.

7.13.3 Lack of resilience is a serious problem in Great Yarmouth due to:

[11] Resilience Theory and System Evaluation, Verification and Validation of Complex Systems: Human Factor Issues, Vol.110, p35-60, Harold Foster (1993)

- Openings of the Haven and Breydon Bridges requiring closure to road traffic, causing localised network congestion
- A lack of alternative routes to and from the South Denes Industrial Estate and Outer Harbour
- Seasonal and weather-related variations in traffic demand from visitors
- The high risk of flooding affecting the Haven Bridge

7.13.4 When the Haven Bridge is raised to allow ships to pass through, it is difficult for traffic to divert to alternative routes. Openings can generate long tailbacks of traffic, and it can take up to 20 minutes for the queues to clear and for traffic to return to normal.

7.13.5 If Haven Bridge is closed for maintenance, traffic has to be diverted over Breydon Bridge. Haven Bridge is in an area which is susceptible to flooding and is usually the first area of the town to be closed to traffic during flooding incidents.

7.13.6 Other incidents, such as accidents, can occur on any part of the network. The issue in Great Yarmouth is not that such disruptions occur, but that the network cannot cope well with these disruptions because of a lack of capacity in the town centre, and the lack of alternative routes to the peninsula.

7.13.7 The provision of an additional river crossing would greatly increase the resilience of the local transport network. In terms of the factors identified above, it would provide:

- **Redundancy**: An alternative, more direct route into the peninsula
- **Diversity** A bridge in a different location
- **Efficiency** Shorter, more direct routes for many journeys
- **Autonomy** The bridges would open independently of one another
- **Strength** The new bridge would be less susceptible to flooding
- **Collaboration** Traffic would be directed to the new bridge if the Haven bridge has to be closed for maintenance
- **Adaptability** The new bridge would have capacity to cope with present and future traffic demand
- **Mobility** The new bridge would provide much more reliable access to the harbour and Enterprise Zone

- **Safety** Shorter journeys on a bridge and junctions designed to modern standards reduces exposure to accident risk
- **Recovery** Increased total river crossing capacity would enable a normal level of service to be restored quickly after an incident.

7.14 Impact on Car Parking

7.14.1 The scheme will not result in the removal of any off-street car parking spaces.

7.14.2 On-street parking restrictions ("No waiting at any time") will be introduced at a number of locations, as set out in Table 7-55:

Table 7-55: On-Street Parking Restrictions

Road	Location	Direction	Distance	Car spaces (5m / car)
South Denes Road	Between Sutton Road and Swanston's Road	East	145 m	29
South Denes Road	Between Barrack Road and Sutton Road	East	35 m	7
South Denes Road	Between Newcastle Road and Barrack Road	East	16 m	3
Suffolk Road	North of the new roundabout	Both	44 m	18
Queen Anne's Road	Below the new roundabout	Both	60 m	24
Queen Anne's Road	East of the new roundabout	North	20 m	4
Queen Anne's Road	East of the new roundabout	South	28 m	5-6
Queen Anne's Road	West of the new roundabout	Both	65 m	26
Sutton Road	Between South Denes Road and Middle Road West	North	38 m	7-8

7.14.3 The proposed restrictions are necessary to allow the safe and efficient operation of the highway including the new junctions. In all cases alternative free unrestricted on street parking is available nearby – for example, along Sutton Road and Swanstons Road adjacent to South Denes Road and along Southtown Road near Queen Anne's Road.

7.14.4 On-street parking restrictions ("No waiting at any time") will be revoked at a number of locations, as set out in Table 7-55:

Table 7-56: On-Street Parking Restrictions revoked

Road	Location	Direction	Distance	Car spaces (5m / car)
Sutton Road	Between Middle Road East and Admiralty Road	South	5 m	1
Sutton Road	Between Middle Road East and Admiralty Road	South	3 m	1
Sutton Road	Between Middle Road East and Middle Road West	South	4 m	1
Sutton Road	Between Middle Road East and Admiralty Road	Both	4 m	2
Middle Road West	North of Swanston's Road	East	18 m	3-4
Cromwell Road	End of the road	South	46 m	9

7.15 Overall Benefits of the Scheme

Economic Benefits

7.15.1 Whilst this TA focuses on the expected impacts of the Scheme on transport in Great Yarmouth, it also needs to be read in the light of the Economic Assessment Report ("EAR"), (Document 7.6). The EAR focuses on the monetised economic benefits which the Scheme will generate and compares these with the cost of delivering the Scheme.

7.15.2 The monetised economic benefits are a consequence of the impacts of the scheme on travel and transport, and arise from the value of:

- travel time savings
- savings in vehicle operating costs (including fuel)

- reductions in greenhouse gas emissions
- improvements in journey quality
- increased physical activity
- accident savings
- taxation revenues
- improved reliability
- wider economic impacts

7.15.3 Of these, by far the largest benefits are those arising directly from the savings in travel time as a result the availability of shorter routes using the Scheme and the overall reduction in congestion in the transport network.

7.15.4 The monetised economic benefits have been calculated in accordance with DfT guidance and compared with the cost of delivering the Scheme. This shows that the benefit-cost ratio ("BCR") for the Scheme is 2.7, and that it offers high value for money, as defined by DfT.

Achievement of Objectives

7.15.5 As well as the transport impacts detailed in this TA and the economic impacts detailed in the EAR, it is important to note that the Scheme will achieve the policy objectives which were set. These are listed below, together with a brief explanation of how the Scheme will contribute to their achievement.

- To support Great Yarmouth as a centre for both offshore renewable energy and the offshore oil and gas industry, enabling the delivery of renewable energy NSIPs and enhancing the Port's role as an international gateway.
  - *The Scheme will greatly improve the accessibility of the Energy Park and the Port, especially the Outer Harbour.*
- To improve access and strategic connectivity between Great Yarmouth port and the national road network thereby supporting and promoting economic and employment growth (particularly in the Enterprise Zone).
  - *The Scheme will provide a new direct link between the SRN and the Port and employment areas on the South Denes peninsula, including the Enterprise Zone. It will reduce journey times and operating costs for businesses and enable people to travel more easily to work in the area. It will provide the capacity needed to accommodate planned development – without it, worsening congestion is forecasted to inhibit growth.*

- To support the regeneration of Great Yarmouth, including the town centre and seafront, helping the visitor and retail economy.
  - *The Scheme will improve access to the seafront, and will reduce traffic and congestion in the town centre, especially Haven Bridge. It works well with planned regeneration in the Waterfront area.*
- To improve regional and local access by enhancing the resilience of the local road network, reducing congestion and improving journey time reliability.
  - *The Scheme will increase resilience by providing an additional route into the South Denes peninsula and adding capacity to the local road network. It will generally reduce congestion, and generate quantifiable reliability benefits.*
- To improve safety and to reduce road casualties and accidents, in part by reducing heavy traffic from unsuitable routes within the town centre.
  - *The Scheme will reduce traffic on Haven Bridge and within the town centre. It is expected to lead to a modest but nevertheless significant saving of more than 50 accidents over 60 years.*
- To improve access to and from the Great Yarmouth peninsula for pedestrians, cyclists and buses, encouraging more sustainable modes of transport and also reducing community severance.
  - *The Scheme will provide a new more direct route for pedestrians and cyclists into the peninsula, and is expected to encourage more people to use these active modes of travel, with commensurate health benefits. It will allow operators to consider amending bus routes to make use of the Scheme. The new bridge will improve the accessibility of the peninsula for all road users, and reduce its severance from the western part of the town.*
- To protect and enhance the environment by reducing emissions of greenhouse gases and minimising the environmental impact of the Scheme.
  - *The Scheme is expected to lead to a reduction in fuel consumption and emissions of greenhouse gases, and has been designed to minimise its environmental impact.*

8 Mitigation of Transport Impacts

8.1 Introduction

8.1.1 This chapter describes the mitigation measures which are proposed to address the potential adverse impacts described in Chapter 7. These comprise:

- Signage Strategy (VMS) (embedded mitigation). The Paramics microsimulation modelling effectively assumes that drivers in the modelled area will have knowledge of when the Third River Crossing is closed to highway traffic, and will take the associated delay into account when making route choices. As in real life, a proportion of drivers will choose to continue to the Third River Crossing and wait in the queue, whereas other drivers may reroute via the Haven Bridge.
- Monitoring
- Critical Signal Controlled Junctions
- Liaison with Highways England

8.2 Signage Strategy (VMS)

8.2.1 Static signage will guide drivers to choose the most appropriate route to their destination with the Third River Crossing in place and thus reinforce the road hierarchy and minimise the risk of drivers choosing inappropriate routes or “rat running” through residential areas or past sensitive locations.

8.2.2 The Scheme includes the introduction of six VMS on key approaches, to enable drivers to choose an appropriate alternative route on the occasions when the Third River Crossing is closed to enable the movement of river vessels.

8.2.3 The detailed design of the VMS will be developed in accordance with applicable design standards and guidance and approved by relevant parties including the Local Highway Authority, Highways England and the Port Authority.

8.2.4 As described in the Paramics Forecasting Report (Appendix C) it is forecast that the Third River Crossing will open for river vessels approximately 15 times per day on a typical weekday for an average of 5.5 minutes. However, the timing and duration of each opening will vary, as it is dictated by the arrival pattern and required transit time for the river vessel(s) which pass

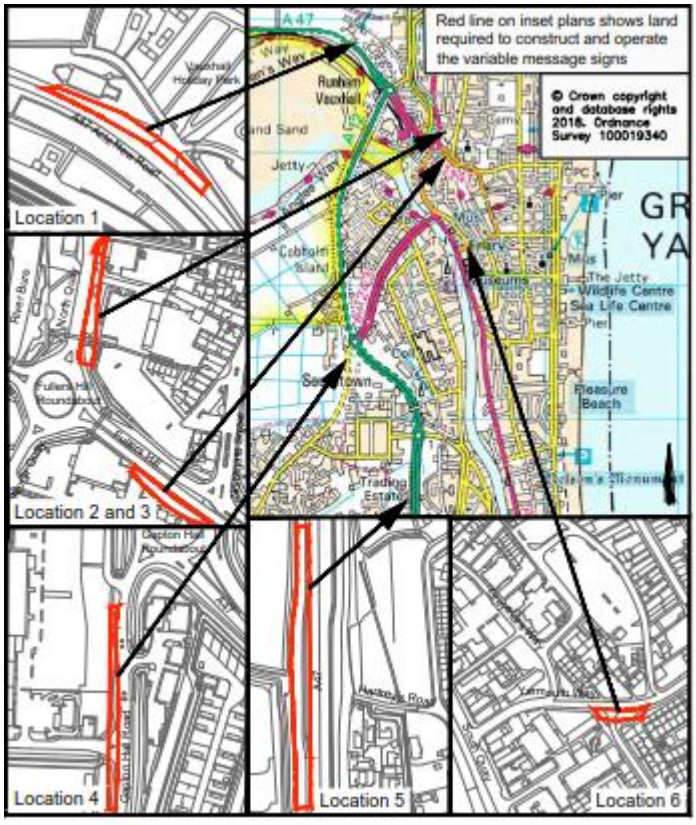
through, which in themselves are dictated by other factors such as the need for and availability of a pilot vessel and tidal and weather conditions.

8.2.5 In order to minimise delays to drivers, it is proposed to include variable message signage at key points on the local network as part of the Scheme. The signs will indicate to drivers that the Third River Crossing is closed or about to close and will suggest use of an alternative route.

8.2.6 The plate below indicates the proposed areas for the VMS within the Order Limits.

8.2.7 The precise locations, specification and operating parameters for the VMS system will be developed by the Contractor and agreed with relevant parties as part of the detailed design process.

Plate 8-1: Proposed Locations for VMS



8.3 Monitoring

8.3.1 As the Scheme progresses to full approval, the Full Business Case will set out the Applicant's plans for monitoring and evaluation. This will include monitoring changes in traffic patterns, accidents and performance of key

junctions across the network. This will enable the Applicant to make adjustments where necessary, for example to traffic signal timings.

8.4 Critical Traffic Signal Controlled Junctions

8.4.1 As discussed in Chapter 7, the analysis of journey times, changes in link flow and congestion suggest that the following traffic signal-controlled junctions are likely to experience changes in traffic volumes or turning movements as a result of the Scheme:

- Pasteur Road/Bridge Road/Southtown Road
- North Quay/South Quay/Bridge Road
- South Quay/Yarmouth Way
- A47/Acle New Road (Vauxhall RB)
- A47/Pasteur Road (Gapton)
- A47/A143 Beccles Road
- William Adams Way/Southtown Road junction

8.4.2 Whilst it is anticipated that conditions should improve at junctions in the area north of the Scheme, especially around Haven Bridge, the same analysis indicates that there could be additional pressure on the junctions closer to the Scheme.

8.4.3 It is recommended that Norfolk County Council review and if necessary update timings at the above junctions as part of their “business as usual” management of the local highway network. Signal staging and timing arrangements will be optimised accordingly using the professional judgement of the Norfolk County Council Urban Traffic Control team, in liaison with Highways England as required.

8.5 Liaison with Highways England

8.5.1 Norfolk County Council continue to liaise closely with Highways England and have recently completed a joint study to quantify the value for money and operational performance of alternative combinations of schemes at Vauxhall, Gapton Hall and Harfreys roundabouts, both with and without the proposed Third River Crossing Scheme.

8.5.2 The outcomes of this study will be used to inform ongoing discussions between Norfolk County Council and Highways England in order to promote optimum improvements in Great Yarmouth.