Great Yarmouth Third River Crossing

OUTLINE BUSINESS CASE

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Norfolk County Council

Great Yarmouth Borough Council

New Anglia Local Enterprise Partnership for Norfolk and Suffolk

Great Yarmouth Third River Crossing

Final Options Report

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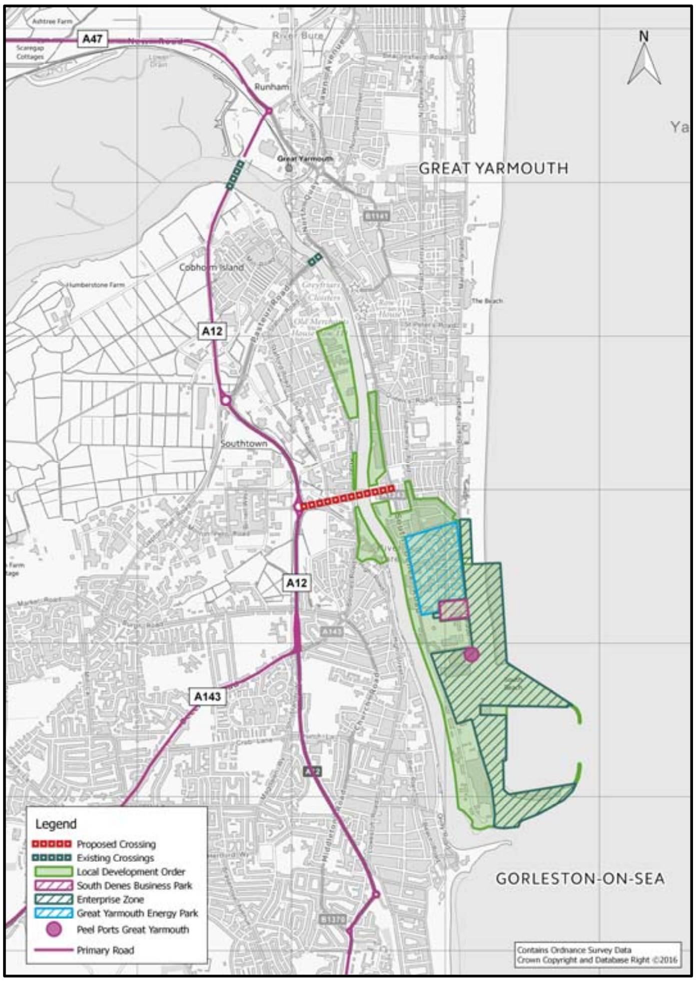
1 Introduction

1.1 Geography

Great Yarmouth is part of a larger economic sub-region with a strong economic heritage including manufacturing, food and drink processing, tourism and leisure industries.

The town itself is geographically constrained, bounded by the North Sea to the east and both the River Yare and the River Bure to the west, the latter two of which can be crossed by The Haven Bridge and Breydon Bridge respectively. The Haven Bridge crosses the River Yare along the A1243, linking in with the Strategic Road Network (SRN) to the south. The A12 Breydon Bridge crosses the River Bure from the north of the town along the A149 which becomes the A47 New Road, providing a direct route to and from Norwich as shown in Figure 1-1.

Figure 1-1 - Great Yarmouth Location



Great Yarmouth is highlighted as a key growth location within the New Anglia LEP's Strategic Economic Plan. The area has been designated one of six UK Centres for Offshore Renewable Engineering and has two Enterprise Zones designated for energy businesses, offshore engineering, ports and logistics. One is at the Port and the other at Beacon Park. In addition to the port Enterprise Zone area, a Local Development Order has been agreed for the whole of the South Denes wider area. This designation provides for greater freedoms and flexibilities in terms of planning to encourage employment growth.

1.2 Need for a River Crossing

The Great Yarmouth Area Transportation Strategy describes a Third River Crossing across the River Yare in order to relieve congestion on the existing bridges.

The Great Yarmouth Third River Crossing (GYTRC) is recognised by the Council, Norfolk and Suffolk Local Transport Body, New Anglia LEP and the A47 Alliance as a strategic priority for unlocking future economic growth in the area. It will also ease existing congestion problems and improve accessibility in Great Yarmouth, including access to the seafront, South Denes and the outer harbour areas.

The Breydon and Haven bridges currently cater for daily traffic of around 70,000 vehicles with about 5,000 vehicles using the bridges in the peak hours. There has been a steady but modest growth in traffic since 2003 when the possibility of a third river crossing was first explored. Currently, with additional development pressures, river crossing traffic is anticipated to rise to between 80,000 (Large Local Major Transport Scheme Bid Document, 2016) and 100,000 (Mott Macdonald, 2009) vehicles per day by 2030.

2 CURRENT SITUATION

2.1 Transport Policy

This chapter sets out the wider strategic and policy context against which the Great Yarmouth Third River Crossing could be developed. The strategic aims and responsibilities of the Local Enterprise Partnership for New Anglia and other policies impacting on the future situation are identified in later sections of this chapter.

National Policy

2.1.1 Investing in Britain's Future (2013, HM Treasury)

This document presents a dynamic vision for the future of British infrastructure. It includes proposals for the biggest investment in the road network since the 1970s, a plan to build and repair 200,000 affordable homes, and the long term certainty that the energy sectors need.

The paper draws upon how the road network is fundamental to the UK economy and while traffic and congestion have risen, investment over the past few decades has fallen.

Roads underpin a free-flowing and successful economy but have suffered from massive historic underinvestment. This trend, when combined with a model of delivery, has served to hold back the country’s transport infrastructure for the worse.

Over the last fifty years the volume of traffic in this country has risen dramatically – from 70 billion vehicle miles travelled per year in 1960-61 to 304 billion in 2011-12. The level of public investment in the road network on the other hand has not met this increase in demand, and has fluctuated wildly over the same period as the result of short sighted decisions of successive governments.

2.1.2 Action for Roads (2013, DfT)

This command paper highlights the significant challenges faced on the road network and reiterates the need for investment. The paper underlines how the road network is vital to the UK and is a crucial part of the wider transport network.

Without investment, conditions are expected to worsen by 2040, particularly on the most important routes. By then, around 15% of the entire strategic road network may experience regular peak-time congestion and become susceptible to poor conditions at other times of the day. Workers will likely find their job opportunities are constrained by travel times and people travelling between towns and cities will face significant delays. Congestion will work against current efforts to help the economy grow with Enterprise Zones, potential housing sites and other areas of high growth being held back by bottleneck conditions. The paper also draws upon how major national arteries will start to experience stress, British businesses will find it more difficult to access export markets and the environment will suffer due to increased congestion.

2.1.3 *National Infrastructure Delivery Plan (NIDP) 2016–2021*
The NIDP sets out key projects and programmes, and major policy milestones, in each infrastructure sector and includes details of the government's ongoing work to improve the prioritisation, performance and delivery of infrastructure, including building a skilled workforce, reducing costs and encouraging private sector investment.

The paper identifies roads as being fundamental to modern society. They keep people connected, making it possible to travel for work and leisure. The road network brings communities closer together, providing users with freedom and flexibility that is unrivalled by any other mode of transport and are used for 90% of passenger journeys and almost 70% of freight.

The paper emphasises how local roads are a crucial element of the transport system. A reliable and high-performing road network helps improve productivity, but over decades, the quality of the network has declined and congestion, noise and poor air quality have become problems at certain hotspots. Poor or missing links mean cities which are close together do less business with one another.

Local Policy

2.1.4 *Great Yarmouth Core Strategy (LDF)*
The Core Strategy establishes the spatial vision and objectives for how the borough of Great Yarmouth will develop and grow. It sets out a series of strategic policies and site allocations, which provide the strategic context for future Local Plan documents, Supplementary Planning Documents and Neighbourhood Development Plans.

The core strategy's plan period is for 2013-2030. It is the planning framework for implementing the Council's aims and objectives that affect the use of land and buildings. The vision of the Core Strategy is that by 2030, the Borough of Great Yarmouth will be a more attractive and aspirational place to live, work, and play, with strong links to Lowestoft, the Broads, Norwich, rural Norfolk and the wider New Anglia (Norfolk and Suffolk) Local Enterprise Partnership area.

It is expected that 7,140 new homes will be provided by 2030. This housing will be located to take advantage of public transport accessibility and to help maintain and 9 enhance the vitality and viability of existing settlements. The majority of this new housing will be located in the main towns of Great Yarmouth and Gorleston-on-Sea, and at key service centres (Bradwell and Caister-on-Sea).

There is commitment to protect and enhance the Borough's natural and historic areas and buildings that help to create the identity of the borough. New green infrastructure will enhance the network of green corridors linking settlements to the Broads and the open countryside providing greater opportunities for healthy lifestyles.

Policy CS16 on improving accessibility and transport, refers to the Council and its partners working together to make the best use of, and improve, existing transport infrastructure within and connecting to the Borough, having first considered solutions to transport problems that are based on better management and the provision and promotion of sustainable forms of travel. It details that this will be achieved by:

a) Supporting improvements that reduce congestion, improve accessibility and improve road safety without an unacceptable impact on the local environment, in accordance with Policy CS11; and communities, in accordance with Policy CS9. High priority schemes that will assist in achieving this include:

- Working with our partners to mitigate congestion at pinch points and actively manage the road network
- Working with our partners to reduce car dependency by improving both the quantity and quality of the public transport service on offer in the borough and the wider area, including the promotion of a quality bus corridor from Great Yarmouth to Lowestoft
- Upgrading Great Yarmouth Railway and Bus Stations to provide higher quality facilities that encourage greater use of public transport
- Improving accessibility to employment, education, health, recreation, leisure and shopping facilities by enhancing linkages between existing 'green travel' routes to create a coherent network of footpaths, cycleways and bridleways
- Supporting the port and its future development as a passenger and freight intermodal interchange, with facilities to achieve efficient staging, loading and unloading and to realise the potential of the port to function as a sustainable transport corridor

b) Directing new development towards the most sustainable locations in accordance with Policy CS2, thereby reducing the need to travel and maximising the use of sustainable transport modes

c) Ensuring that new development does not have an adverse impact on the safety and efficiency of the local road network for all users

d) Seeking developer contributions towards transport infrastructure improvements, including those made to sustainable transport modes, in accordance with Policy CS14 10

e) Minimising the impact of new development on the existing transport infrastructure by encouraging applicants to:

- Produce and implement Transport Assessments and Travel Plans, as appropriate
- Improve accessibility to sustainable transport modes

The Core Strategy states that a Third River Crossing will encourage efficient patterns of movement and emphasises its importance in meeting the borough's needs.

It recognises that the two existing river crossings are subject to high traffic flows and become severely congested during peak hours. To help ease congestion and making the Borough more attractive to investors, the Core Strategy expresses support for the development of a Third River Crossing within the heritage area of North Quay and South Quay, reducing pressure on Haven Bridge and generally improving access across the River Yare and to help the Outer Harbour realise its long-term potential.

2.1.5 *Great Yarmouth Waterfront Area Action Plan (LDF)*

The Great Yarmouth Waterfront Area Action Plan is a statutory planning document which forms part of Great Yarmouth's Local Development Framework (LDF). It seeks to facilitate the comprehensive regeneration of Great Yarmouth's historic quaysides and provide improved linkages between the town centre and its riverfront which for many years has been subject to industrial decline and underutilisation. The Area Action Plan included a Third River Crossing as one of several preferred options to address regeneration within the town.

2.1.6 *The Norfolk Local Transport Plan for 2026*

Norfolk's 3rd Local Transport Plan, Connecting Norfolk, sets out the strategy and policy framework for transport up to 2026. Norfolk's Transport Vision is for a transport system that allows residents and visitors a range of low carbon options to meet their transport needs and attracts and retains business investment in the county. The six aims that support this vision will:

- Manage and maintain the transport network to an appropriate standard
- Deliver sustainable growth
- Enhance strategic connections
- Reduce emissions
- Improve road safety
- Improve accessibility

Sustainable growth - There will be significant growth in Norfolk during the period up to 2026. The Local Plan provides a framework for this to be delivered in, setting the Transport Authority's requirements. These include:

- Adequate regard is given to reducing the traffic impacts of growth to negate a detrimental effect on the road network or existing communities
- The delivery of transport infrastructure that supports growth, with focus on sustainable travel options

Strategic connections - Norfolk's key strategic connections are identified and they include the following that impact on the Great Yarmouth area;

- Connections to Norwich Airport and the Ports at King's Lynn and Great Yarmouth, including a future Third River Crossing for the River Yare

- The A47, part of the European TEN-T network, providing the main east-west road connection and route to the Midlands and north of England

Transport emissions – Importance is placed on taking measures to reduce emissions that include;

- Promoting active and healthier travel options for short journeys to schools, services and places of employment
- Enhancing integration between different travel modes, particularly at key bus and rail stations and Norwich Airport

Road safety – There is an understanding that road safety continues to be a major public concern and measures will be prioritised to reduce the number of people killed or seriously injured on Norfolk's roads

Improving Accessibility – Importance is placed on achieving efficient movement into town and urban centres, favouring short term parking for car drivers, which benefits the local economy and supports alternative travel options.

2.1.7 Great Yarmouth and Gorleston Area Transportation Strategy (2009)

The Great Yarmouth and Gorleston Area Transportation Strategy examined a wide range of strategic solutions to the areas transport problems and opportunities.

The fundamental direction of the strategy is to support the investment in public infrastructure and public services necessary to accommodate Great Yarmouth's growing population and economic activity. The strategy states that this must be done in a way that supports the LTP (Local Transport Plan) in promoting sustainable patterns of development and regeneration, and in particular underpins the renewal of Great Yarmouth's key development opportunity areas. Two of the key critical issues listed are:

- Meeting the challenge of economic and demographic growth by investing to deliver the necessary additional public transport capacity and reliability and;
- Meeting the challenge of promoting social inclusion and regeneration by providing the transport links and accessibility to underpin economic development.

The strategy mentions the Third River Crossing on several occasions citing it as a major scheme designed to overcome the problem of limited road access to the peninsula of Great Yarmouth and the congestion which this causes. It does this by offering a more direct route into the town from the south and providing relief to the two existing road bridges. As such the scheme would provide the missing link between the A12 trunk road and the expanding port facilities. In addition, it will provide accessibility benefits to the town by providing more direct routes between housing and employment areas.

2.1.8 *New Anglia Strategic Economic Plan (SEP)*

The central focus of the New Anglia SEP is to drive growth in high impact sectors in order to create new high value jobs and to work with existing businesses to improve their productivity and competitiveness. The energy sector offers an opportunity for rapid growth. The SEP also highlights four sectors that should be supported because they underpin the economy and form the largest employers in the region. These include Ports and Logistics, and Tourism and Culture. The SEP has identified key areas and corridors for growth in jobs, productivity and housing.

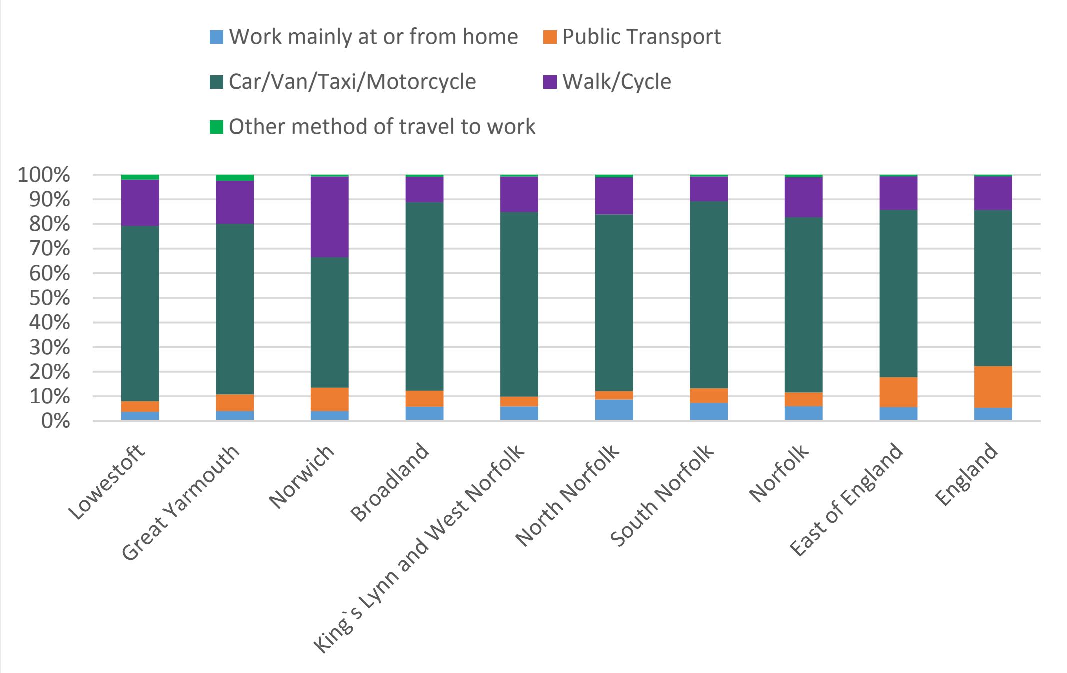
Great Yarmouth is one of the areas that is identified as needing investment in schemes that directly unlock employment and housing sites; that provide access to the trunk networks; and packages of investment in sustainable urban transport. The SEP acknowledges that connectivity and travel times are major obstacles to productivity, and that faster connections, through better strategic road and rail links, are vital to improve productivity and access to markets. In addition, the national rail and road networks need more capacity. The SEP recognises that there is a need to connect areas of growth with each other, and the rest of the country, by the rail and strategic road networks. There is a clear plan for these networks which are managed by Network Rail, the rail franchises or Highways England. There is a commitment to work more closely with them to ensure their priorities dovetail with local plans. These networks are so important to local growth, that there are a number of junctions and bottlenecks where scheme development has been funded to help support the case for their inclusion in Highways England or Network Rail capital programmes.

The SEP identifies that Great Yarmouth suffers from congestion arising from bottlenecks, at key locations, including North Quay and Haven Bridge and also how limited river crossings in the town are forcing traffic onto congested routes. The design of a third crossing in Great Yarmouth is listed as a transport priority within the report and states that it should be included in the Highways Agency national programme as soon as possible.

2.2 Travel Demand

Using the 2011 national census ‘method of travel to work’ data, a comparison can be made between the mode share at a local, regional and a national level (Figure 2-1). Driving to work is by far the most common mode of commuting in Great Yarmouth with over 69% of the working population using a private car, van, taxi or motorcycle. This is significantly higher than the national average (63%). Over 17% of the working population commute by non-motorised modes (walking and cycling) whereas only 7% travel to work using public transport.

Figure 2-1 - Mode Share Comparison



2.2.1 *Average Speed Data*

A review has been carried out of available traffic flow and average speed data based on Highways England's WebTris Phase 1. Data has been extracted from WebTris based on the average of four neutral weekdays, Monday to Thursday (26/09/2016 to 29/09/2016) at two sites (A12 and A47) (Table 2-1). Average speed and total flow data has also been extracted for the AM peak (08:00-09:00) and PM peak (17:00-18:00) hours.

Daily average speed for each link has been calculated to allow for comparison of peak and off-peak average speeds.

The average AM and PM peak speeds along the A47 eastbound indicate significant congestion.

Table 2-1 - A12 & A47 Average Speed

TMU Site	Average AM Peak Hour Speed (km/h)	Average PM Peak Hour Speed (km/h)	Daily Average Speed (km/h)	Total Recorded Flow (veh)
A12 northbound between A1243 and A47	35.9	32.3	39.6	17,117
A12 southbound between A1243 and A47	34.8	35.3	37.91	19,299
A47 eastbound between A12 and A1064	26.1	15.5	41.1	10,707
A47 westbound between A12 and A1064	45.7	45.5	46.7	11,189

2.3 Highway Safety

In the five years from 2011 to 2015, there were 394 recorded collisions in the Great Yarmouth area, involving 489 casualties (Table 2-2).

Of the 489 casualties, 99 (20%) were pedestrians and 50 (10%) were cyclists with 72 casualties (15%) involving motorcycle accidents. There are clusters of accidents on the approaches to the existing bridges, including at North Quay.

Table 2-2 – Great Yarmouth collisions and casualties 2011-2015

	Collisions	Casualties
Fatal	2	2
Serious	46	47
Slight	346	440
Total	**394**	**489**

A third crossing is expected to reduce overall vehicle kilometres travelled in and around the Town , and thereby also reduce an exposure to accident risk, and produce a net reduction in casualties.

An assessment of the accident benefits (using COBALT) has not been undertaken at this time but will be included in the Outline Business case when the latest traffic forecasts are known. Accident benefits will be calculated during the next stage of detailed appraisal, following completion of the 2016 Traffic Model and it is expected benefits will be of a similar order to previous assessments.

2.4 Opportunities

The range of ongoing and planned improvements in Great Yarmouth present a number of opportunities and constraints to support growth and the need for enhancements to the transport network.

2.4.1 Investment in the Strategic Road Network

Options to improve a number of A47/A12 junctions in Great Yarmouth (including the Harfrey's Roundabout) are being explored by Highways England to significantly improve connectivity between the LDO / Enterprise Zone including the Port of Great Yarmouth, and the strategic road network. However, there remains uncertainty over the timing and delivery of these improvements, which have therefore been categorised as "reasonably foreseeable" or "hypothetical" in the latest traffic forecasts and will not be included in future do minimum scenarios in the Outline Business Case. The early estimates of traffic likely to transfer to the new bridge would amount to 1,200 vehicles in the peak periods with around the same number of trips generated by development traffic on the peninsula. These estimates give an indication of likely future demand for travel across the new bridge and will be updated as part of the current assessment

2.4.2 Investment via Local Growth Funding

Norfolk County Council has secured £11m via the New Anglia LEP Growth Deal to deliver a range of measures between 2016/17 and 2020/21. The aim of these improvements is to reduce congestion by implementing a series of sustainable transport measures in addition to improving transport linkages to assist town centre regeneration.

2.4.3 Growth in offshore energy

The renewables energy sector has established or committed investments in excess of £4bn, from Scottish Power Renewables, RWE (Galloper), and Statoil (Dudgeon).

2.4.4 Growth in the LDO area and the Enterprise Zone

Planned growth in the LDO area and both Enterprise Zones including the Energy Park and South Denes Business Park.

2.4.5 Sustainable Transport Funding

Norfolk County Council has been awarded funding from the DfT from the Sustainable Transport Transition Year fund for the 'Pushing Ahead : A to Better' programme. The programme aims to assist in Reducing single occupancy car trips; increasing active travel to reduce congestion and improve air quality; improving health; supporting access to work and learning; and improving safety.

2.4.6 Tourism

Great Yarmouth's biggest single business sector is tourism, and directly and indirectly it represents an economic impact of £532 million per annum (2011) and 29.3% of the district's employment.

3 FUTURE SITUATION

This chapter sets out the future growth aspirations, planned development and predictions of the resultant increase in levels of traffic and its subsequent impact on the strategic highway network. A review of recent and current planning applications for development sites located in the vicinity of the proposed third river crossing has been undertaken with the aim of identifying developments which could potentially have an influence on the future performance of the crossing.

3.1 Land Uses and Policies

The New Anglia Strategic Economic Plan states that 9,000 new jobs will be created in the Enterprise Zones by 2025 and a further 4,500 indirect jobs which will help reduce the unemployment rate. The aim is to support inward investment and expansion of businesses requiring access or proximity to the port and riverside.

3.1.1 South Denes Enterprise Zone and Energy Park

The 58.8 hectare South Denes Enterprise Zone site features land suitable for development, storage and laydown. The area is enveloped by a 136.3 hectare Local Development Order that includes the Outer Harbour and a long section of the river quayside and brownfield development land. The potential for creating additional employment land (up to 22 hectares) by land reclamation to the north of the Outer Harbour is currently being explored as part of the Local Plan.

Energy related development is also being promoted on the Energy Park at South Denes and Power Park in Lowestoft.

3.1.2 Beacon Park Enterprise Zone

The existing Beacon Park Enterprise Zone is a mixed-use area of both residential and commercial uses. Approximately 10-15 hectares of new employment land to the south of the new A12/A143 link road and west of the existing Beacon Business Park has been identified where approximately 1,000 new homes are planned south of Bradwell. Persimmon Homes have outline planning permission for 850 homes, a primary school, shops, open space and business space, plus detailed permission for the first phase of 150 homes, with construction already underway.

3.2 Changes to Infrastructure

There are a variety of transport schemes being implemented or considered over the period up to 2020/21. This section covers schemes that are likely to impact on sustainable transport.

3.2.1 A47 Acle Straight Dualling

A proposal by Highways England is designed to address safety concerns by making short-term and long-term improvements, potentially including installation of safety barriers and junction and road widening improvements. These will be subject to appropriate environmental mitigation, working with Natural England and the Broads Authority at all stages. Norfolk County Council continues to campaign for dualling of the A47 Acle Straight.

3.2.2 A47/A12 Vauxhall Roundabout and Great Yarmouth junction improvements

Highways England have recently completed the feasibility stage of improvements to the A47 corridor and this junction is listed within their Major Improvements Investment Plan 2015-20. This junction is one of the schemes that is at the options development phase which will include further and detailed technical assessment and appraisal of options. This will include traffic modelling to inform the initial design and operational requirements. This phase is currently predicted to last until December 2016.

3.2.3 Town Centre Congestion Relief

There will be measures to improve junction hot-spots in Great Yarmouth, namely those around the one-way gyratory system and at the Southtown end of Haven Bridge. These schemes are at an assessment stage and some microsimulation modelling is being conducted as part of the third crossing traffic modelling, which may assist in developing solutions. Any possible improvements will aim to reduce congestion and delays to motorists, whilst also improving conditions for pedestrians and cyclists where appropriate. The following are currently being progressed:

Southtown Road/Pasteur Road/Bridge Road/Mill Road scheme

This scheme is yet to be determined and various options are being tested which require additional microsimulation modelling which currently being carried out with an aim to be completed over the coming 2 to 3 months. Detailed design and statutory processes could be carried out in 2017/18 with a view to construction in 2018/19. Due to the early stage of development of this scheme it is not included in the microsimulation modelling.

Fullers Hill Roundabout

An improvement to the roundabout to provide two parallel right turn lanes from North Quay to Acle New Road. This will have a significant impact on reducing queues and delays (particularly on the southbound approach to the roundabout) and not cause and strategic re-routeing. This is currently at detailed design stage for implementation in 2017/18 and is included in the microsimulation modelling. The trunk road programme will also include improvements to the train station and supermarket right turn junction.

3.2.4 Trafalgar Road linking St. George's Park west to South Quay

This scheme will improve the important link between the South Quay, town centre and seafront. A Feasibility Study Preferred Option for St Georges Park and the area around the theatre has been successful in reinvigorating the area. These improvement measures include cycle links (east/west link from St Georges Park to Marine Parade).

Cycle paths have been created from the South Quay through the library up to the theatre, through to the park and along Marine parade on the seafront. This scheme aims to complete the missing link on Trafalgar Road.

3.2.5 Market Place to Rail Station Foot and Cycle Links

Pedestrian and cycle improvements to Vauxhall Bridge have improved links from the train station to the Conge, and provides the start of a route through to the Town Centre. The proposed scheme delivers on the Great Yarmouth Town Centre Masterplan objectives and aspirations to improve the Waterfront area. Proposals include the creation of shared footways, landscape improvements and improved road markings to separate pedestrians and cyclists at the signal crossing on North Quay. The scheme is funded through the Local Growth Fund, and is planned to be implemented 2017-19.

4 NEED FOR INTERVENTION

The need for a third river crossing in Great Yarmouth, to provide direct access to the southern end of the peninsula, was first identified in the mid-1980's and has long been an ambition for the County Council and other partners including Great Yarmouth Borough Council, however, limited work has been undertaken since 2009. Circumstances are now more favourable for the scheme to become reality due to:

- The Great Yarmouth Third River Crossing (GYTRC) has a good strategic fit with the East of England Regional Assembly's Regional Spatial Strategy and Norfolk County Council's Corporate Plan.
- The GYTRC has been assigned a priority of 1b in the Regional Funding Allocation.

The Urban Regeneration Company for the waterfront areas of Great Yarmouth and Lowestoft, 1stEast, has produced a summary of main land use proposals for Great Yarmouth which is currently the subject of public consultation. It is recognised by 1st East that the GYTRC is key to facilitate access to these proposed developments.

The scheme is designed to overcome the problem of limited road access to the peninsula of Great Yarmouth and the congestion which this causes. It offers a more direct route into the town from the south and provides relief to Haven and Breydon Bridges in addition to enabling traffic travelling to the port and South Denes Enterprise Zone to avoid the town centre.

The Core Strategy recognises the challenges of Great Yarmouth's unique geography, noting that the seafront, central shopping area and outer harbour are geographically separated from a high percentage of the resident population by the River Yare. The two existing river crossings; 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 additional seasonal traffic combines with town centre, port and commercial traffic, creating congestion problems on both the local and strategic road network, particularly on the A47 and A12, South Quay, North Quay, Fullers Hill and Lawn Avenue.

There is a dependency on the tourist industry, which has an estimated worth of over £530 million per year, and 78 per cent of the jobs in the Borough are service-based. In the summer months the population of the town effectively doubles, further adding to the demands on the transport network.

For the Peninsula, the New Anglia Strategic Economic Plan estimates that 9,000 new jobs will be created in the Enterprise Zones by 2025 and a further 4,500 indirect jobs will be created in the Town thereby supporting inward investment and the expansion of businesses requiring access or proximity to the port and riverside.

The Breydon Bridge, constructed in 1985, enables A12 traffic to bypass the centre whereas 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.

5 OBJECTIVES

In response to the identified transport issues, clear objectives have been identified by the Council for the scheme.

5.1 Strategic

The strategic **high level objectives** for the scheme are:

- To support the creation of new jobs especially in the South Denes Local Development Order area and the Enterprise Zone by being a catalyst for investment
- To support Great Yarmouth as a Centre for Offshore Renewable Engineering, and as a Port
- To support the regeneration of Great Yarmouth, including the town centre and the seafront, helping the visitor and retail economy
- To improve strategic connectivity and reduce community severance
- To protect and improve the environment

5.2 Specific and Operational

The **specific and intermediate objectives** of the scheme are:

- To provide traffic relief to Breydon Bridge and Haven Bridge
- To reduce congestion and delay in the town centre
- To improve journey time reliability
- To reduce traffic in historic areas, especially North Quay and Hall Quay
- To improve vehicular access to South Denes and the outer harbour, especially from the A12
- To improve access to the Great Yarmouth peninsula for buses
- To improve access to the Great Yarmouth peninsula for cyclists
- To improve access to the Great Yarmouth peninsula for pedestrians
- To reduce road accident casualties
- To reduce emissions of greenhouse gases
- To improve the resilience of the local road network

The **operational objectives** of the scheme are:

- To provide an additional crossing of the River Yare for vehicles, cyclists and pedestrians
- To reduce overall journey times and vehicle kilometres in Great Yarmouth
- To minimise environmental impact, compulsory purchase and demolition of residential and commercial property.
- To achieve a balance between the needs of road and river traffic

6 AREA OF IMPACT

This section will look at the geographic areas of impact to be addressed by the intervention.

6.1 Peninsula

The new crossing is designed to overcome the problem of limited road access to the peninsula of Great Yarmouth and the congestion which this causes. It offers a more direct route into the town from the south and provides relief to Haven and Breydon Bridges. The preliminary operational assessment work has shown significant congestion relief and other transport benefits such as improving accessibility for buses.

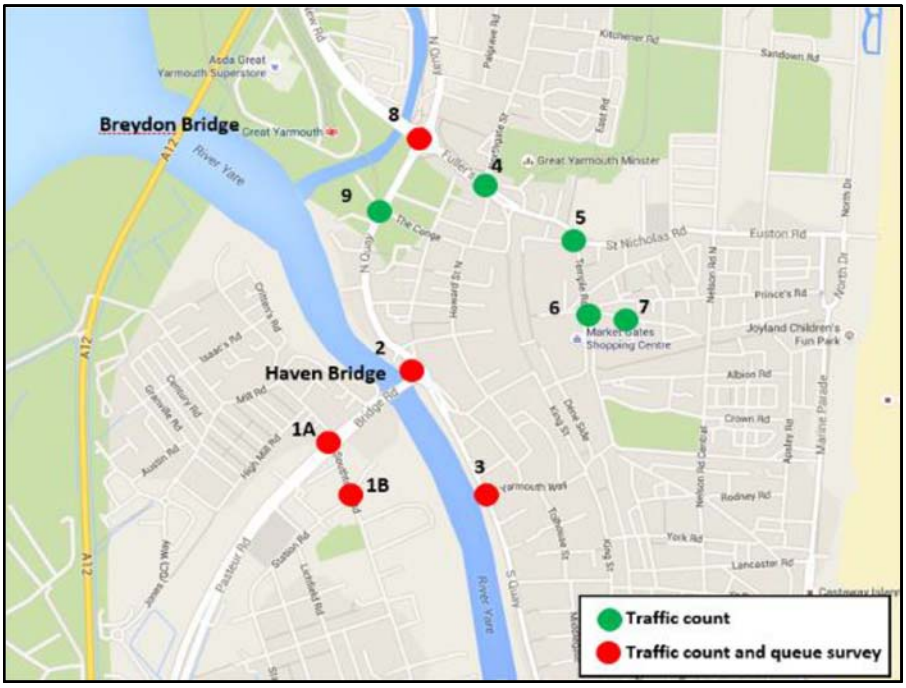
The crossing provides improved scope to better manage traffic movements and it would enable traffic at the port and South Denes regeneration area to avoid the town centre. The South Denes regeneration area is subject to a Local Development Order includes an Enterprise Zone at the port which is likely to generate more traffic movements. The impact of this traffic growth will be mitigated by the new bridge. In addition to the direct congestion and accessibility benefits to the town, the scheme will provide the missing link between the UK trunk road network and the new and expanding port.

6.2 Town

Congestion around the existing bridges currently restricts access into the town centre which has been experiencing decline. Great Yarmouth remains a popular seaside resort and in the summer months the population effectively doubles, adding to the demands on the transport network. However, the seafront can only be accessed via the congested bridges at the northern end of the peninsula. Recent investment in the public realm has led to major improvements to the northern part of the seafront; by contrast, the southern, less accessible part, is isolated and unfrequented by visitors. A third crossing would be an opportunity to complement the recent and planned investment by improving access for all modes of transport, whilst reducing the impact of traffic in key areas.

Detailed classified traffic counts and queue length surveys were undertaken by Norfolk CC at key locations in the vicinity of the Haven Bridge and the town centre (Figure 6-1) on Thursday 15 October 2015.

Figure 6-1 – MCC and Queue Length Survey Locations



Results from the survey (Table 6-1) illustrate the high levels of traffic on key roads in the centre of Great Yarmouth, especially around the existing bridges, and the high levels of queuing which result from the limited capacity of the local road network. One consequence of this for road users is that journey times in peak periods are significantly longer than in the off peak.

Table 6-1 - Survey Results

Location	Direction	Maximum queue (veh)
1A	From Pasteur Road	>150
1A	From Bridge Road	>150
1A	From Southtown Road	100
2	From North Quay	127
2	From South Quay	>150
2	From Bridge Road	142
3	From the north	137
3	From the south	92
8	From Acle New Road	>150
8	From North Quay (north)	>150
8	From Fullers Hill	40
8	From North Quay (south)	>150

The analyses of queuing illustrates and supports the body of anecdotal evidence which has consistently highlighted the problems of congestion in Great Yarmouth, especially that which is associated with the constrained access to the peninsula. These problems are further exacerbated by the large seasonal variation arising from

Yarmouth’s role as a major resort attracting both staying and day visitors at holiday times.

6.3 Wider Area

The scheme would provide a much needed additional link across the River Yare to connect the strategic road network and wider urban area to the key economic growth hub in the southern part of Great Yarmouth. The scheme will result in better integration of freight and local traffic with the strategic road network which is a key element of achieving a sustainable distribution of freight journeys to and from the port.

7 OPTIONS

7.7.1 *Option Assessment*

The Option Assessment Report previously prepared and submitted considered a range of locations for the Great Yarmouth Third River Crossing (GYTRC), as well as whether the crossing should be a bridge or tunnel. Within the area of interest, three broad alignment corridors were considered: northern, central and southern. In each corridor, a high level and low level bridge option (on similar alignments) and a tunnel option were devised, giving nine different main options. Both the high and low level bridge options were to be for lifting bridges.

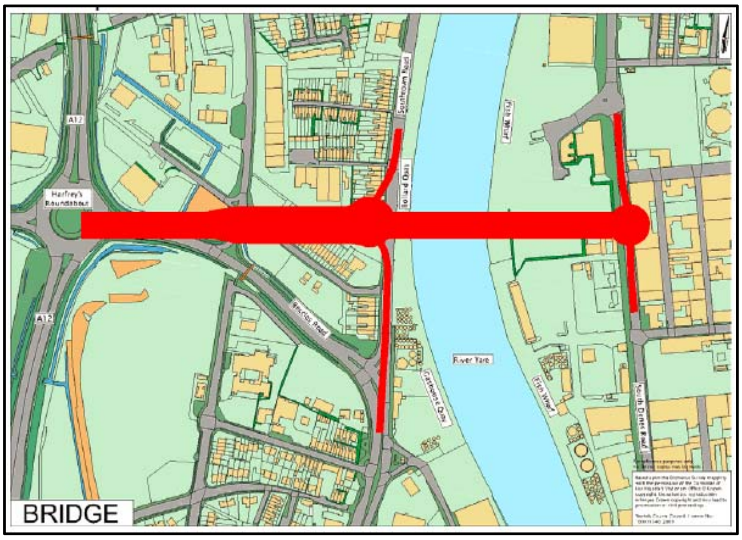
Results from the economic assessment carried out in the Option Assessment Report (OAR) showed that although the economic benefits of the tunnel option are nearly as high as those for the bridge options, its cost is much higher at three times that of the bridge. The resulting Benefit to Cost Ratio (BCR) was less than 2.0, confirming that a tunnel option is unlikely to become a viable solution.

A Stage 2 Assessment gave further consideration to the options which had emerged from the Stage 1 Assessment.

It was found that a bridge in the southern corridor was found to offer the greatest monetised benefits and, because it was also likely to be the least expensive option, generated the highest BCR. Further to this, detailed data on commercial vessel movements within the inner harbour were used to determine the likely number of bridge openings required for different locations. It concluded that a bridge on the shortest route across the river, would require about 6 openings each day. Further south, the number of openings would be greater. Further north, the cost of construction would be higher.

The OAR therefore concluded that the crossing should be located between Harfrey's Roundabout and South Denes Road (Figure 7-1).

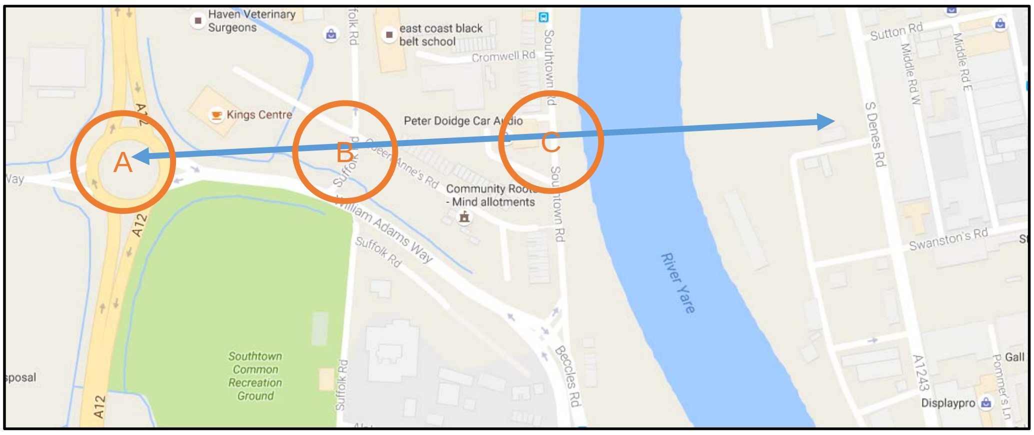
Figure 7-1 - Preferred Route



Based on this location, a long list of 40 options has subsequently been produced based on different criteria including the location, form and geometry of the western and eastern tie-ins to the local road network, bridge height and carriageway standard.

These 40 options were predominantly variants at three different tie-in locations (Figure 7-2)

Figure 7-2 - Three possible western tie-in locations



8 SIFTING

8.1 Process

Each of the options in the long list were put through an initial sift in order to narrow down to a selection of preferred options. This approach quickly reduced the initial list of options by removing those that did not make significant contributions to meeting the defined objectives, did not resolve the identified problems, or are not deliverable or feasible.

For each objective and identified problem, a score was allocated based on the anticipated impact of the option being assessed. The total score for each option was then calculated by summing the individual scores for each function, thus enabling a comparison between options.

The long list then became 9 primary options following the initial sift which are variants of 3 different western tie-in forms and locations outlined in the OAR and are summarised in Section 8.2 (Table 8-1).

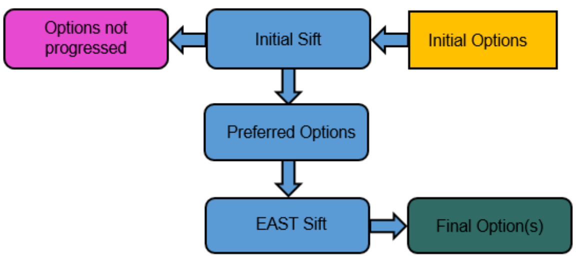
8.2 EAST

DfT's Early Assessment Sifting Tool (EAST) is a decision support tool that has been developed to quickly summarise and present evidence on options in a clear and consistent format. It provides decision makers with relevant, high level, information to help them form an early view of how options perform and compare.

EAST has been designed to be consistent with Transport Business Case principles and follows the same five cases as the DfT Business Case model.

The 9 options which successfully met the evaluation criteria within the initial sifting process were taken forward to the final stage of sifting, using the EAST decision support tool. This assessment identified the high level economic, environmental and social impacts of all nine options based on DfT's five case model approach.

Figure 8-1 - Sifting Process



It is considered poor practice to sum scores across each of the cases and assess an average score for each scheme. Reviewing a scheme's performance across all of the cases is the preferred approach and therefore a Red/Amber/Green (RAG) score was applied to each of the top nine options to provide a visual guide to the respondent as to the option's impact (Table 8-1).

Table 8-1 - 9 Preferred Options

Option	Width	Tie-in location (West)	Tie-in form (West)	Tie-in location (East)	Tie-in form (East)	Cost (£M)	Sifting RAG Score
4	Single Carriageway	A12 Harfrey's Roundabout	Existing four-arm Roundabout	South Denes Road	T-junction	**£65**	
5	Dual Carriageway	A12 Harfrey's Roundabout	Existing four-arm Roundabout	South Denes Road	T-junction	**£102**	
6	Three-lane Carriageway	A12 Harfrey's Roundabout	Existing four-arm Roundabout	South Denes Road	T-junction	**£87**	
31	Single Carriageway	Suffolk Road	New four-arm roundabout	South Denes Road	T-junction	**£62**	
32	Dual Carriageway	Suffolk Road	New four-arm roundabout	South Denes Road	T-junction	**£97**	
33	Three-lane Carriageway	Suffolk Road	New four-arm roundabout	South Denes Road	T-junction	**£83**	
37	Single Carriageway	Southtown Road	At-grade junction	South Denes Road	T-junction	**£62**	
38	Dual Carriageway	Southtown Road	At-grade junction	South Denes Road	T-junction	**£95**	
39	Three-lane Carriageway	Southtown Road	At-grade junction	South Denes Road	T-junction	**£81**	

It should be noted that this method is not intended for the purposes of aggregating or averaging to provide a final RAG status for each economic indicator. The overall impact will depend on the strength of individual impacts and the final recommendations balance the individual RAGs and form a view as to the likely overall impact of each option.

8.3 Summary

The EAST sifting process is intended to inform a decision, not to make one. As the nine primary options are fundamentally variants of the three eastern tie-in form and locations, there is little to differentiate between them at this stage of the process in advance of detailed modelling, other than considerations of cost and operational performance. Options 5, 32 and 38 are all dual carriageway options and received a higher score in the Strategic Case (scale of impact) than the single lane and three lane variants, however, these are amongst the most expensive options with estimated construction prices ranging between £95m and £102m. Option 37 is the cheapest option and therefore scores higher than all other options in the Financial Case. Option 32 scored better than Options 5 and 38 in the Managerial and Financial cases and was therefore provided with a higher RAG score.

For the current EAST assessment cost decisions are made on the basis of a £100m threshold and on that threshold it appears that the low level bridge option falls below that level and the high level option above it.

9 ENGINEERING

9.1 Mode Consideration

A third crossing would be an opportunity to improve access to the town centre for all modes of transport. Currently, without the scheme, non-motorised users travelling between Southtown Road and South Denes Road (in the vicinity of the proposed bridge location) would be required to travel over 3km via Haven Bridge. With an additional crossing on the other hand, non-motorised users would only be required to travel approximately 250m, a significant time and distance saving.

9.2 Public Transport

Bus priority at the crossing and at the terminal junctions will need to be considered along with the necessary public transport infrastructure and signage close to the bridge. A key consideration will be how any bus priority fits within the future wider strategy within the town.

Additional public transport services along with existing public transport routes would be provided to take advantage of the new proposed crossing.

9.3 Road Freight

The development of the Outer Harbour is of strategic importance to the borough's economy and is a key driver for the regeneration of Great Yarmouth. It complements the existing river port and increases its overall operating capacity.

Both the Area Action Plan (AAP) and the Local Transport Plan (LTP) note that a third river crossing would provide a further opportunity to access the port from the strategic network (A12 / A47) without the need for port-related traffic to pass through the town centre and with a focus on achieving a sustainable distribution of freight journeys to and from the port.

9.4 Docks

Jobs are anticipated to be created on the Peninsula as a result of an expansion of the Port and surrounding industrial area and travel demands from the tourist industry in the town continuing to rise. The new bridge crossing will therefore not only allow these industries to continue to develop but will also facilitate easier movement within the Town because of the operational benefits that arise from reduced congestion.

It is estimated that the Enterprise Zone as a whole will create up to 9,000 direct jobs and 4,500 indirect jobs by 2025. A third crossing, providing a direct, high standard access into the employment areas and Enterprise Zone, presents an opportunity to attract more investment, and could be a catalyst for much needed regeneration and further growth which would also help to re-balance the local economy and the reliance on tourism.

9.5 Cars

Manual Classified Count (MCC) 2016 data has been acquired from AECOM providing AM Peak, PM Peak and 12 hour weekday traffic flows (with seasonal variations). These data were converted to a weekday of the neutral month of May. The AM peak hour flow is 2,001 vehicles across the A1243 Haven Bridge and 2,382 vehicles across the A12 Breydon Bridge. The PM peak hour flow is 2,321 vehicles across the A1243 Haven Bridge and 2,972 vehicles across the A12 Breydon Bridge. With a new crossing close to Harfrey's Roundabout and connecting to South Denes Road, there would be an anticipated transfer of traffic (around 1,000 and 200 vehicles on Haven Bridge and Breydon Bridge respectively) from the existing two bridges during the AM and PM peak hours, resulting in a significant reduction in the peak hour traffic at these locations. The Outline Business Case will detail these aspects.

9.6 Pedestrians and Cyclists

Currently, pedestrians and cyclists travelling from the south or west have to use the existing bridges to access the town centre, sea front and employment areas. The area immediately to the west of Haven Bridge is dominated by a heavily trafficked dual carriageway, Bridge Road, with a poor pedestrian and cycle environment. Similarly, Breydon Bridge has a lack of cycling and walking provision and is not a viable route for non-motorised users.

Pedestrians and cyclists would benefit from the construction of a new bridge across the river, and journeys by foot or cycle are likely to replace some of those currently made by car. The new proposed crossing will provide shared use footway/cycle paths in both directions. Existing routes would generally experience negligible impacts.

A third crossing with dedicated cycle facilities could enable existing cycle routes to be linked in the future to form a greatly improved cycle network, offering potential relief from the existing severance that the River Yare creates.

9.7 Crossing Options

The three possible locations where new bridge infrastructure could be connected to the existing highway network on the western side of the river are as follows:

- Location A: Harfrey's Roundabout
- Location B: Suffolk Road
- Location C: Southtown Road

Connecting the bridge infrastructure directly to the existing junction (Location A) offers the most direct access to the Strategic Road Network (SRN), but may make local connections difficult.

A connection to a new roundabout at Location B would enable more direct access to the local road network whereas tying the bridge in at Location C would provide immediate connection to the local road network.

Two different likely bridge heights were identified in the OAR for the three different tie-in locations. Both bridge options that tie-in to the existing A12 Harfrey's roundabout and a new roundabout on Suffolk Road (on the eastern side of the scheme) have a proposed height of circa 7.0 metres above the mean high level water. These are both high level bridge options as a connection at this location would require the bridge to oversail Southtown Road. The option that ties in at grade to Southtown Road only requires a proposed bridge height of circa 3.0m above mean high level water, providing immediate connection to the local road network.

Whilst the location of the tie-in on the western side of the river will inform the likely junction form, the decision as to whether to provide a roundabout or traffic signal connection on the eastern side to connect into South Denes Road is a stand-alone consideration. All 9 high priority options assume that the junction form on the eastern side of the scheme are all signalised junctions.

It should be noted that prior to discounting as an alternative, the location of the central tunnel option that was assessed as part of the Stage 1 work in the OAR crossed the river in a north-west to south-east direction between Beccles Road and Salmon Road/South Beach Parade.

Consideration was given to realigning the tunnel into a southwest to northeast alignment during the stage 2 assessment. The purpose of this was to better fit the desire line of traffic wishing to access the peninsular, although it is recognised that the desire lines may change if a potential opening of the outer harbour for development is realised.

9.8 Land Availability

There would be an additional requirement for bridge or embankment structures to be constructed between Harfrey's roundabout and the river (Location A)

Similarly, a bridge at Location B would require bridge or embankment structures to span from Harfrey's roundabout to the river on the west bank and the bridge structure on the eastern side of the river would also be extended to ensure acceptable gradients.

Tying the bridge at Location C would require additional road infrastructure to be built to connect in to William Adams Way, in order to provide effective connection to the strategic road network and also to enable long vehicles to travel to/from the west.

9.9 Structures

The proposed low level double-leaf Bascule Bridge with underslung counterweights requires chambers in order to accommodate counterweight and the mechanical and electrical systems below deck level at either end. The construction of chambers/pits and their foundations below ground and below water level will lead to more complicated construction methods and are relatively expensive in comparison to the construction of chamber above or at ground level. This also imposes increased level of health and safety risks and may impact on the construction programme. It may also lead to further design considerations for maintenance issues within the bascule chamber/pit in the future.

A bascule bridge at-grade or with an elevated approach, where chambers can be built above or around the existing ground level, mitigates the above issues.

An elevated approach is considered more practical in terms of buildability, despite the requirement for an increased length of earth retaining structures.

9.10 Environmental Assessment

An initial assessment has now been carried out to identify potential townscape and visual constraints relating to two of the potential tie-in locations being considered for the scheme (at-grade on Southtown Road and the new roundabout at Suffolk Road). This early desk top assessment has been undertaken in order to inform the design and to identify opportunities for the development of options. Townscape

Both alternatives pass through an area of relatively low quality industrial townscape with low sensitivity and would result in similar townscape impacts.

The demolition of properties along Queen Anne's Road and Southtown Road applies to both option locations and would have an impact on the perception of the immediate local residential townscape. However at a broader scale, the demolition of these residential properties alone would not significantly alter the feeling of the surrounding environment of Great Yarmouth.

A crossing at the Suffolk Road tie-in would require a larger land take at the junction with William Adams Way and more extensive loss of existing mature vegetation than a tie-in at Southtown Road. The elevated crossing would be more prominent along the waterfront and create a greater barrier to the open nature of the river. This would alter the linear appreciation of the River Yare looking north and south, albeit along an industrial waterfront. Although there would be the removal of rows of residential properties there is a low likelihood this would result in significant adverse townscape effects overall.

A tie-in at Southtown Road would also create a new feature on the river but would not be as prominent as a tie-in at Suffolk Road. The new road being at grade would also have less of a townscape impact. As a result of the low elevation of the proposed bridge there is a reduced likelihood of views up and down the river being significantly impacted when compared to a tie-in at Suffolk Road. There would be a low likelihood overall of significant adverse effects on townscape character.

For both alternatives, there is a high capacity for the existing townscape character to accept change of the type and scale that is proposed. The existing components of residential terraced properties and roadside vegetation would not represent a significant degradation to the character of the broader Great Yarmouth townscape and the likely effect on townscape for both option locations based on their current design would be no more than Slight Adverse.

9.10.1 Visual

It is anticipated that there would be a low likelihood of significant adverse visual effects on receptors at the eastern side of the River Yare, as the associated sensitivity is relatively low. Whilst the bridge options would be conspicuous, the magnitude of impact would likely be moderate. The combination of low sensitivity and moderate magnitude of impact is therefore unlikely to give rise to significant effects. This conclusion is consistent with the earlier work that identified significant likely environmental impact with a bridge option to the north of the Town.

10 ASSESSMENT OF OPTIONS

10.1 Description

A range of options have been considered from bridge and tunnel alternatives, north and south of Town alignments and junction, bridge height and capacity variants. Historic traffic and highway evidence has been assessed to help evolve a series of likely alternatives that have then been sifted to derive the preferred solution.

Following the initial option development (OAR, 2016), consideration of engineering constraints and outputs, initial sifting and EAST assessment, 9 primary options were considered for further appraisal, all assuming an eastern tie-in to a signalised junction at South Denes Road:

- Option 4: A12 Harfrey's Roundabout tie-in; min 7.0m clearance; single carriageway
- Option 5: A12 Harfrey's Roundabout tie-in; min 7.0m clearance; dual carriageway
- Option 6: A12 Harfrey's Roundabout tie-in; min 7.0m clearance; 3-lane carriageway
- Option 31: Suffolk Road tie-in; min 7.0m clearance; single carriageway
- Option 32: Suffolk Road tie-in; min 7.0m clearance; dual carriageway
- Option 33: Suffolk Road tie-in; min 7.0m clearance; 3-lane carriageway
- Option 37: Southtown Road tie-in; min 3.0m clearance; single carriageway
- Option 38: Southtown Road tie-in; min 3.0m clearance; dual carriageway
- Option 39: Southtown Road tie-in; min 3.0m clearance; 3-lane carriageway

10.2 Appraisal Methods

The initial stage of appraisal involved identifying the need for an intervention, and developing options to address a clear set of locally defined objectives. These options were subsequently put through an initial sift to enable the better performing options to be taken on to further, more detailed, appraisal.

In the early stages of appraisal, it is not cost-effective or feasible to assess a large number of options in great detail as informed by DfT guidance. The option assessment process ensured that proposals were developed in a robust manner, supported by a fit-for-purpose and proportionate analysis.

Stage 1 appraisal was a limited exercise, based on advance design work and a number of simplifying assumptions. Land costs were excluded. Only a representative sample of options was subject to modelling and economic assessment at Stage 1.

Though simplified, Stage 1 appraisal served to show that a third river crossing was feasible, and highlighted the main design and environmental issues involved. Although a bridge was likely to be more cost-effective than a tunnel, the appraisal showed that both bridge and tunnel options would produce benefits in excess of their likely costs.

Stage 1 appraisal did not differentiate between high and low bridge heights, nor did it assess the impact of the higher frequency of openings required for a southern bridge option.

The next stage of the appraisal is described in detail in the Stage 2 Assessment Report1 (2009) and dealt with alternative forms of crossing. The detailed investigation of these options was described in a Structural Options Working Paper2 (2009), and summarised in the OAR (2016).

This investigation led to the rejection of the fixed bridge, swing bridge and lift bridge options on grounds including construction and maintenance costs, visual impact, and risks from collision by ships. The study concluded that a bascule bridge would the most appropriate type of bridge for this scheme.

Following the development of the 9 primary options, further operational appraisal was carried out as described in the modelling and forecasts section of this report.

10.3 Value for Money

Although no in-depth economic appraisal has yet been undertaken, as reported in the previous Stage 2 Scheme Assessment Report (2009), estimates from the economic assessment showed that a bridge option at the proposed corridor location produces a BCR greater than 4.0. Based on the criteria in the DfT guidance, the scheme was found to offer a very high value for money.

10.4 Financial Case

Given that the level of scheme detail confirmed at the early stages of sifting is at concept-level, it was only possible to identify indicative costs, and it is therefore premature to make detailed comparison of all option variants in respect of the value for money and financial assessments.

However, for the current work preliminary scheme costs for the preferred options have been compared based on unit costs for bridge construction and junction form and the aggregates used to inform the EAST process relative to the earlier cost – benefit work and in advance of the current update of the transport and economic models. This is the appropriate level of detail required by the EAST process and the

[1] Great Yarmouth Third River Crossing – Stage 2 Scheme Assessment Report, September 2009. Mott Macdonald for Norfolk County Council

[2] Great Yarmouth Third River Crossing – Structural Options Working Paper, 2009. Mott Macdonald for Norfolk County Council

estimates will then be refined for the preferred option in the presentation of the Outline Business Case.

The current scheme costs estimates are summarised in Appendix G.

10.5 Delivery Case

The construction programme is based on a forecast start of works in 2020 leading to the bridge opening in 2023. The construction activities and programme would be subject to modification during both the detailed design and the construction phases. The timings indicated are a best estimate based on the current stage of planning and design activity and are used as a guide to highlight any constraints or opportunities for the options that are considered.

In the interim, over the next six years, the construction programme and planned sequence of operations will include:

- Land purchase
- Land clearance/planning/detailed design
- Early construction/piling
- Main construction
- Scheme opening

11 MODELLING AND FORECASTS

Following completion of the EAST assessment, and in accordance with the earlier work that indicated that a dual carriageway may be preferable. Options 32, 5 and 38 were taken forward for further consideration.

- Option 32 – Suffolk Road tie-in
- Option 5 – Harfrey's roundabout tie-in
- Option 38 – Southtown Road tie-in

The next step of the DfT's Transport Appraisal process is to consider these higher priority options in more detail and make recommendations within the DfT's Option Assessment Framework.

Based on existing traffic projections, junction design tools have been used to explore the operational aspects of the three key options.

Preliminary network performance testing has been undertaken using the Mott MacDonald 2008 SATURN model, with adjustments to the network coding to reflect the alternative bridge tie-in arrangements on either side of the river.

SATURN model outputs relating to overall journey times, distance travelled, queueing and total trips on the network for morning, evening and inter-peak periods for 2030 are summarised in **Error! Not a valid bookmark self-reference.**.

Table 11-1 - Do-min v Options 32, 5 & 38 (2030) Forecast Year

Period	Scenario	Total Distance Travelled (pcukm)	Total Travel Time (pcuhr)	Transient Queueing (pcuhr)	Over-Capacity Queueing (pcuhr)	Total Trips on Network (pcu)
AM	Do-min	131,869	2,948	458	280	19,363
	Option 32	131,363	2,709	454	65	19,363
	Option 5	131,092	2,727	466	77	19,363
	Option 38	130,090	2,830	454	217	19,363
IP	Do-min	127,824	3,165	495	501	21,171
	Option 32	128,981	2,882	503	192	21,171
	Option 5	128,980	2,888	516	189	21,171
	Option 38	127,210	3,093	480	464	21,171
PM	Do-min	143,393	3,853	542	870	22,553
	Option 32	145,664	3,360	579	299	22,553
	Option 5	145,734	3,386	597	307	22,553
	Option 38	143,150	3,716	533	764	22,553

Notes: The data contained in the table are presented as passenger car units (pcu's) as per the industry standard methodology.
The data contained in the table refer to the simulated time periods only.

For all options, total travel time is reduced compared with a "do minimum" position. Total distance travelled is also reduced for the morning peak period for all options, although this trend is not reflected during the other time periods. It is considered that these apparently counter-intuitive results can be attributed to suboptimal signal timing optimisation at specific junctions in the town centre to the east of the Haven Bridge and this issue will be addressed in the updated traffic model.

In addition Option 32 was developed to reflect different carriageway standards for the bridge, as summarised in Table 11-2. The results, based on the current as yet unimproved traffic model, show little variation and confirm that the final choice of carriageway standard will need to be made in wide consideration of cost and of the traffic management potential of each variant once traffic issues in relation to the local roads and most importantly the strategic road network have been assessed and particularly in respect of the need to accommodate queuing traffic when the bridge is open.

Table 11-2 - Option 32 Lane Tests (2030 forecast year)

Period	Scenario	Total Distance Travelled (pcukm)	Total Travel Time (pcuhr)	Transient Queueing (pcuhr)	Over-Capacity Queueing (pcuhr)	Total Trips on Network (pcu)
AM	4 lanes (2EB, 2 WB)	131,363	2,709	454	65	19,363
	3 lanes (2 EB, 1 WB)	131,417	2,700	457	53	19,363
	2 lanes (1 EB, 1 WB)	131,326	2,697	463	46	19,363
IP	4 lanes (2EB, 2 WB)	128,981	2,882	503	192	21,171
	3 lanes (2 EB, 1 WB)	129,063	2,887	509	190	21,171
	3 lanes (1 EB, 2 WB)	129,090	2,900	513	198	21,171
	2 lanes (1 EB, 1 WB)	129,036	2,894	511	196	21,171
PM	4 lanes (2EB, 2 WB)	145,664	3,360	579	299	22,553
	3 lanes (2 EB, 1 WB)	145,782	3,373	591	299	22,553
	2 lanes (1 EB, 1 WB)	145,817	3,385	600	301	22,553

Notes: The data contained in the table are presented as passenger car units ('pcu's) as per the industry standard methodology.
The data contained in the table refer to the simulated time periods only.

11.1 Operational Performance of Junctions

Further detailed operational assessment has been completed for Options 5, 32 and 38 (all four-lane variants).

- Option 5 – Harfrey's Roundabout dual Carriageway tie-in
- Option 32 – Suffolk Road dual carriageway tie-in
- Option 38 – Southtown Road dual Carriageway tie-in

Junction designs have been adjusted to accommodate forecast peak hour turning flows. Both roundabouts and signalised junctions were tested as variants of the 3 options for the purposes of comparing how the performance of the eastern tie-in junction forms compared. A summary table has been included for the AM Peak in Appendix H and the PM Peak in Appendix I.

In order to ensure a robust approach, forecast demand flows from the historic SATURN models have been extracted and a 5% uplift applied to mimic future traffic growth. In addition, the junction designs have been developed to ensure that they operate comfortably within practical capacity under the forecast peak hour turning flows.

Results show that all models predict a future operation within 90% of junction capacity which indicates that conditions across the local road network should experience no additional congestion as a result of the scheme.

However, Option 32 generally performs better than Options 5 and 38 in both the AM and PM peak.

11.2 Consideration of Impact of Bridge Opening

As part of the preliminary operational network performance testing, estimates of the likely length of queues during a 15 minute off peak bridge opening were made. This is based on outputs from the Motts SATURN model at 2030 (with a 5% uplift to account for likely traffic increases to 2038 which is consistent with approach used for operational tests).

Two scenarios were considered (assuming a 4 lane bridge and two stacking lanes on either side) for each of the three main tie-in options:

- only HGVs choose to queue OR
- all traffic chooses to queue

Results show that if only HGVs queue, this can be accommodated fairly comfortably. However, if all traffic queues, this has a significant impact with queues forecast to block back onto the strategic road network and a long way along South Denes Road on the peninsula. Clearly if it is preferred to provide a bridge with 2 or 3 lanes, this would have an additional impact on queueing and dissipation of queueing.

11.3 Outcome of Preliminary Testing

Following the option assessment and findings of the preliminary operational performance testing, Options 32, 33 and 37 are recommended to be carried forward to next stage for further appraisal as discussed below.

Both options 32 and 33 meet all specific, intermediate and operational objectives of the scheme and address a balance of benefits to both the local and strategic road network. Cost estimates show that option 33 is a significantly cheaper scheme than Option 32 and was progressed to the next stage largely for this reason. A three lane option at this preferable western tie-in location will potentially provide many benefits of a four lane scheme and due to it being cheaper, it may also result in a higher BCR. However, there are other considerations including the capacity if the surrounding road network to absorb queueing traffic when the bridge is open and also the ability of the lane management system to safely operate in a tidal manner should traffic forecasts require such an intervention. These aspects will be reflected in the findings of Road Safety Audits at the appropriate later stage.

Option 37 which is a two-lane low bridge that ties in at-grade to Southtown road is to be carried forward as the low cost option. It should be noted however that the assessment thus far does not take full account of the constraints that may be realised with this option, particularly in respect of freight traffic travelling to and from the Port and the impact of increased traffic on the local roads on route to the A12. Such matters will be addressed in detailed traffic modelling, when the 'stacking' benefits of a dual carriageway for queuing traffic may still warrant further appraisal.

SATURN model outputs for Option 38 indicate that whilst the total travel time and distance is likely to be reduced in comparison to the "do minimum" scenario, there may be significant over-capacity queueing issues that arise. During the AM and PM peaks, over-capacity queuing appears much higher than the two-lane scheme which ties in at Suffolk Road (Option 32) and should therefore be withdrawn from any further assessment. Similarly Option 39, would be expected to experience comparable over-capacity queuing issues at the AM and PM peak and again should be discarded.

Structurally, it is also noted that the low-level bridge Options (37, 38 and 39) involve complicated construction methods and are relatively expensive in comparison to the proposed high-level schemes which have a chamber above or at ground level.

Options 4, 5 and 6 tie-in at Harfrey's roundabout and have been ruled out because of significant disbenefit to the wider road network and by not meeting specific operational objectives (to achieve a balance between the needs of road and river traffic and to minimise environmental impact, compulsory purchase and demolition of residential and commercial property).

It is also understood that Highways England is in the process of preparing an improvement scheme for the Harfrey's roundabout with an expected value of £8m to £10m (A47/A12 Corridor Feasibility Study, 2015). The need for the improvements and the nature of the final scheme is unknown, but peak period congestion and traffic signalisation of the roundabout as a solution would seem to be likely. Therefore, because of this possible intervention, its cost and operational inflexibility, further modification of the junction to accept a third river crossing as a direct connection would be less desirable.

Operationally, there may be benefit in having 4 lanes crossing the River Yare which will likely determine the high level tie-in at Suffolk Road (Option 32) to be the best performing solution. It is therefore unlikely that Option 37 will perform as consistently in the next stage of appraisal as the other two options and is expected to be discarded following the microsimulation model assessment.

Despite performing well during the junction assessment, Option 31 should not be taken forward because the four and three lane variants (Options 32 and 33) that tie-in to the same location on Suffolk Road are expected to deliver better resilience to the network and to provide more benefits to the local road network as opposed to a two lane carriageway standard.

The next steps will involve utilising the updated SATURN and microsimulation models to test the operational aspects of three Options (32, 33 and 37) but to concentrate for the OBC on a clear preferred solution.

- **Preferred Option 32** - Suffolk Road tie-in to the west (four lane high level bridge , roundabout as west tie in and traffic signals to the east at South Denes Road)

- **Alternative Option 33** - Suffolk Road tie-in to the west (three lane high level bridge, roundabout as west tie in and traffic signals to the east at South Denes Road)

- **Alternative Option 37** - Southtown Road tie in to the west (Single Carriageway two lane low level bridge with traffic signal junctions to the west and the east at South Denes Road)

12 OPERATIONAL MODELLING OF OPTIONS

12.1 Methodology

The operational performance of the options 32, 33 and 37 has been assessed using a microsimulation model developed by Mouchel utilising Paramics Discovery software.

In order to provide preliminary traffic flow forecasts for the future years both with and without the scheme, the preferred schemes have been coded into the existing SATURN model, which was previously developed by Mott Mac Donald. Cordon matrices have been extracted from the SATURN model and used as a basis to derive future year matrices for 2023 and 2038.

These early microsimulation forecasts help to understand the operational aspects of the three preferred options including the likely build up and dispersal of queues during bridge closures, and to assist in identifying a single preferred option to be taken forward into the SATURN modelling and economic appraisal and reported in the OBC.

It is intended that, following the completion of the SATURN modelling, updated cordon matrices will be fed back into the Paramics model in order to further refine and optimise the design of the preferred option for the OBC.

12.2 SATURN Model updates

Preliminary network performance testing has been undertaken using the Mott MacDonald 2008 SATURN model, with adjustments to the network coding to reflect the alternative bridge tie-in arrangements on either side of the river for the three preferred options 32, 33 and 37. The previously assumed forecast year of 2030 has been retained at this stage.

SATURN model outputs relating to overall journey times, distance travelled, queueing and total trips on the network for morning, evening and interpeak periods for 2030 are summarised in Table 12-1.

The results show that Option 32 has a marginal benefit overall in respect of the total distance travelled in the modelled road network.

Table 12-1 - Do-min v Options 32, 33 & 37 (2030) Forecast Year

Period	Scenario	Total Distance Travelled (pcukm)	Total Travel Time (pcuhr)	Total Trips on Network (pcu)
AM	Do-min			
	Option 32	44920.6	1387.6	14809.5
	Option 33	44988.9	1380.9	14809.5
	Option 37	44857.4	1407.7	14809.5
IP	Do-min			
	Option 32	49019.8	1676.7	17208.2
	Option 33	48129.3	1746.7	17208.2
	Option 37	48271.5	1869.4	17208.2
PM	Do-min			
	Option 32	51424.8	1851.1	17401
	Option 33	51484.5	1853.4	17401
	Option 37	51490.1	2198.2	17401

Notes: The data contained in the table are presented as passenger car units (pcu's)

The data contained in the table refer to the simulated time periods only.

12.3 Microsimulation Model

A summary of the model build processes and working assumptions is summarised below and documented in further detail in the Paramics Discovery LMVR3 and Paramics Discovery Forecasting report[4].

Figure 12-1 shows the microsimulation model area, which includes the town centre, peninsula, existing river crossings and parts of the Highways England network in the vicinity of the town, in order to allow sufficient route choice to model the reassignment impacts of the proposed scheme.

Figure 12-1- Geographic Scope of Microsimulation Model

[3] Document reference 1076653-MOU-GEN-XX-TN-TP-002

[4] Document reference 1076653-MOU-GEN-XX-TN-TP-005

In order to produce the 2016 base model, traffic data from a variety of sources was utilised, including manual classified counts, queue surveys, automatic traffic counts and HE TRADS and journey time data and information on operation of traffic signal junctions. The following time periods were modelled for a neutral weekday:

- Morning peak – 07:30-09:30;
- Inter peak – 12:00-15:00;
- Evening peak- 16:00 – 18:00.

In order to produce preliminary future year forecasts for the anticipated opening year of 2023 and future design year of 2038, Tempro growth factors have been applied to the 2016 traffic data. In order to allow a comparison with SATURN, a 2030 forecast has also been produced, using a cordoned matrix from SATURN.

The highway network and zoning system for the Paramics model is based upon that of the SATURN model, with further disaggregation of zones and additional links and nodes in order to provide more accurate forecasts of turning flows within the model area.

Data relating to actual river vessel movement for a typical day (average case scenario) and high usage day (worst case scenario) have been obtained from the Port Authority and used to derive a timetable of likely opening timings, frequencies and durations for the Third River Crossing.

A detailed description of the model outputs is included in the Paramics Forecasting Report5. In summary, all key indicators suggest that Option 32 performs better than either option 33 or 37.

The predicted maximum queue lengths for the three options are shown as follows:

Table 12-2 - 2023 Max Queue (m) for Average Case Scenario and Worst Case Scenario

ACS 2023	Option 32	Option 33	Option 37
Western side	154	341	407
Eastern side	189	182	397

WCS 2023	Option 32	Option 33	Option 37
Western Side	296	329	424
Eastern Side	245	249	445

Similarly, Table 12-3 and Table 12-4 demonstrate that option 32 provides the highest forecast journey time and distance savings.

[5] Document reference 1076653-MOU-GEN-XX-TN-TP-0005

Table 12-3 - Forecast Journey Time and Distance Savings 2023

2023	Vehicles	Total Distance (m)	Reduction (m)	Total Journey Time (s)	Reduction (s)
Do Min	109,170	284,144,403	-	30,656,804	-
Option 32	109,267	277,221,279	6,923,124	29,375,070	1,281,734
Option 33	109,281	277,366,867	6,777,536	29,400,413	1,256,391
Option 37	109,246	276,572,017	7,572,386	30,231,789	425,015

Table 12-4 - Forecast Journey Time and Distance Savings 2038

2038	Vehicles	Total Distance (m)	Reduction (m)	Total Journey Time (s)	Reduction (s)
Do Min	121,984	319,680,152	-	40,219,537	-
Option 32	122,756	313,060,558	6,619,593	35,786,851	4,432,686
Option 33	122,738	312,980,112	6,700,039	35,872,101	4,347,436
Option 37	122,424	312,103,104	7,577,048	38,090,568	2,128,968

13 CONCLUSIONS

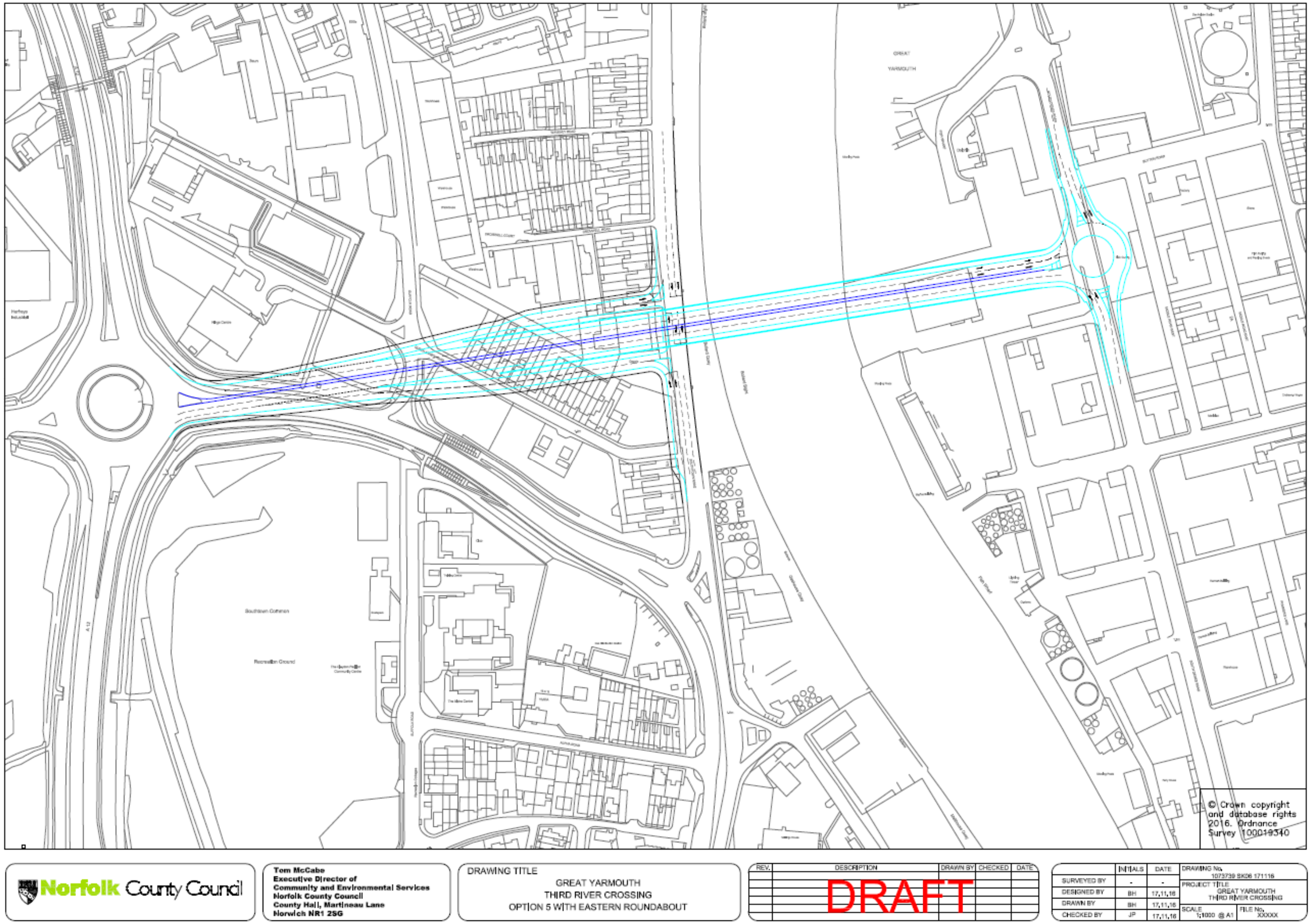
An extensive option sifting and selection process has been undertaken in order to identify the preferred option to be carried forward into the Outline Business Case for the Proposed Great Yarmouth Third River Crossing.

The initial long list of forty options were reduced down to a list of nine by removing those that were not deliverable or feasible, or did not significantly contribute to meeting the defined scheme objectives.

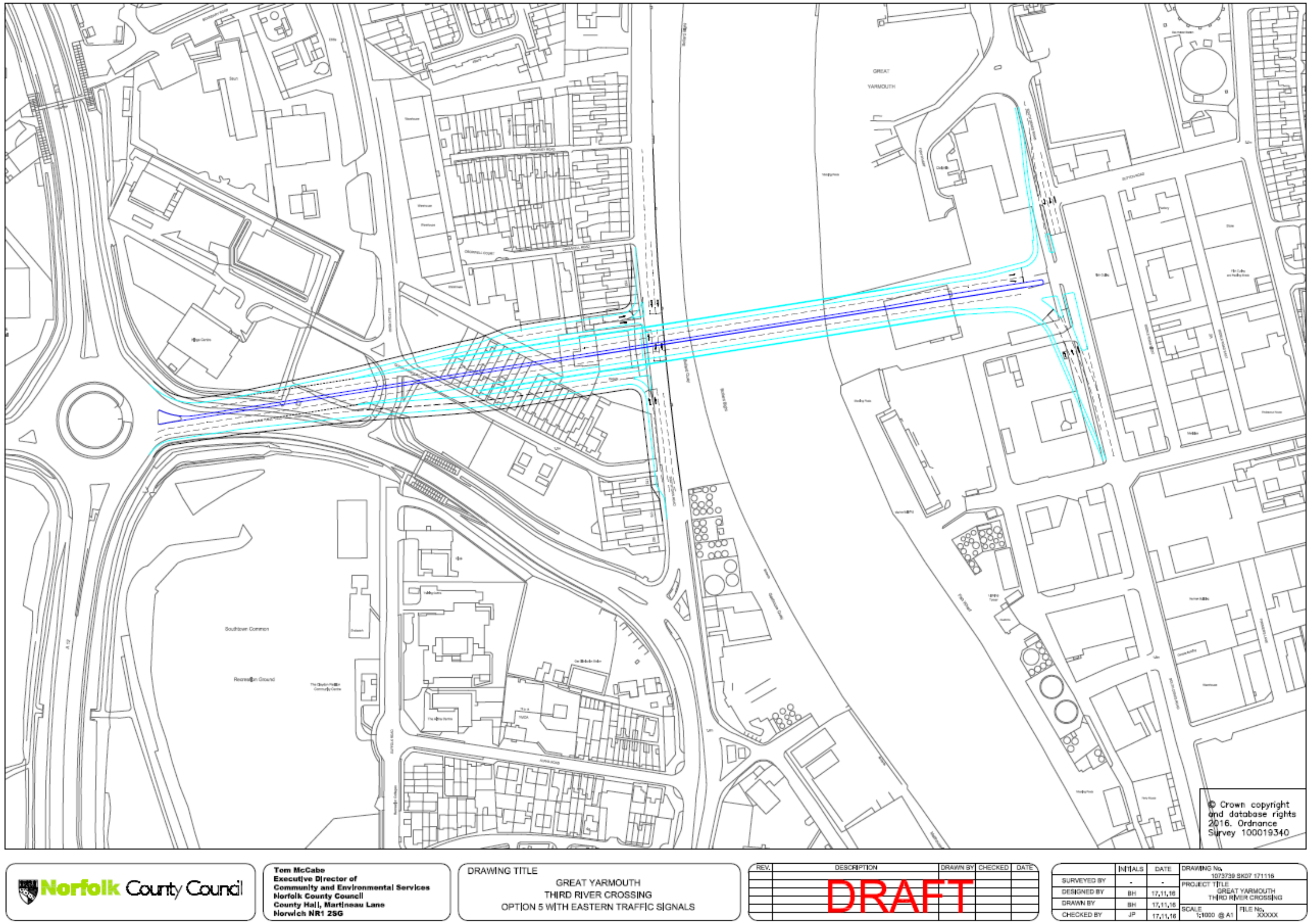
The DfT Early Assessment Sifting Tool (EAST) was then applied to inform the decision to further reduce the list. Consideration was given to financial, engineering, land and environmental constraints and the likely benefits and impact of the scheme options for potential users and stakeholders.

The shortlisted options were subjected to preliminary operational testing using both SATURN and Paramics Discovery model platforms. The results showed that Option 32 was forecast to provide the greatest potential benefit in terms of total travel distance and time saved across the modelled road network. In addition, Option 32 was also forecast to present the best operational performance at the junctions adjacent to the bridge, with the lowest levels of queueing and most efficient dissipation of these queues once the bridge re-opens for vehicular traffic.

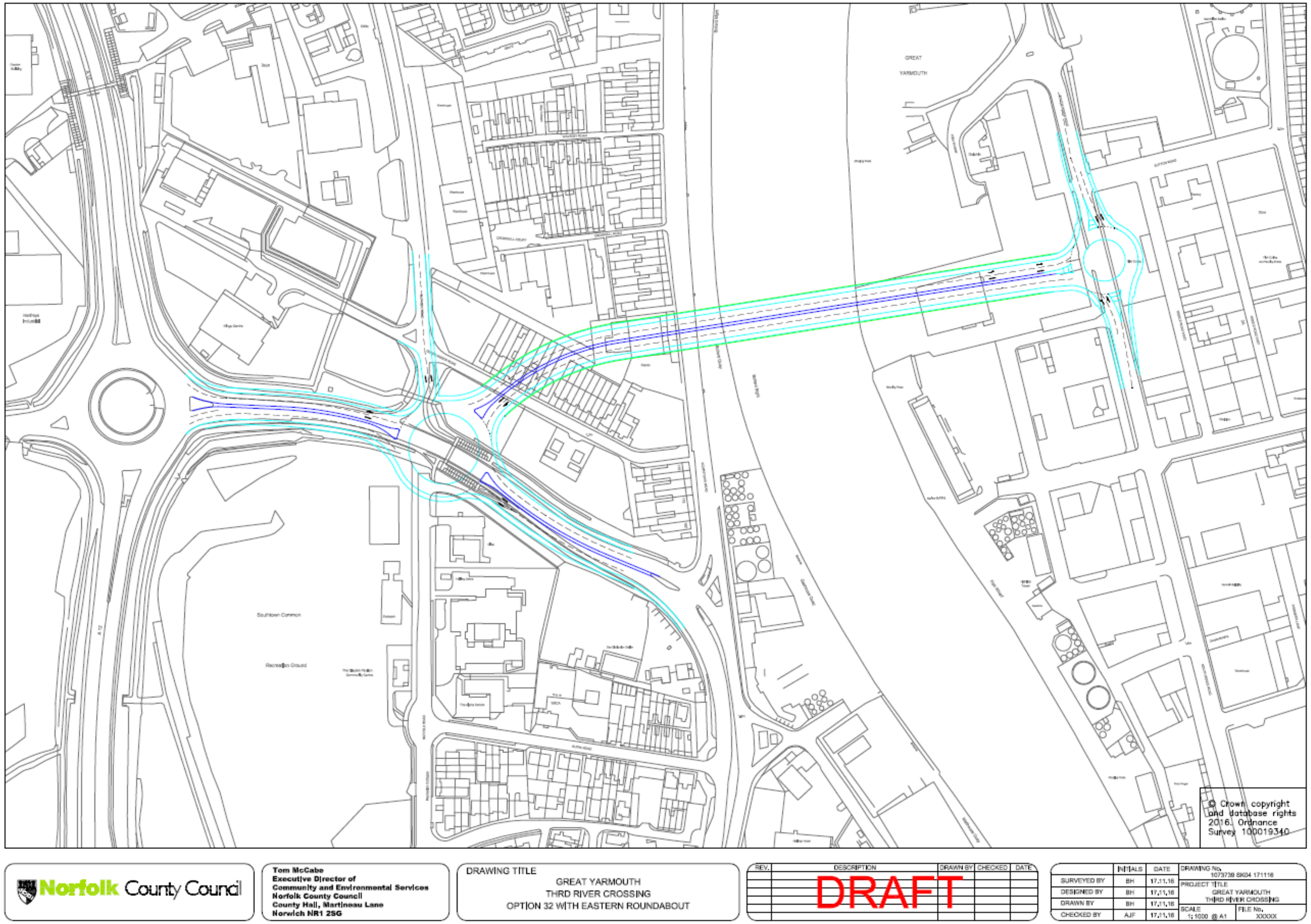
Appendix A - Option 5 with roundabout on eastern side of scheme



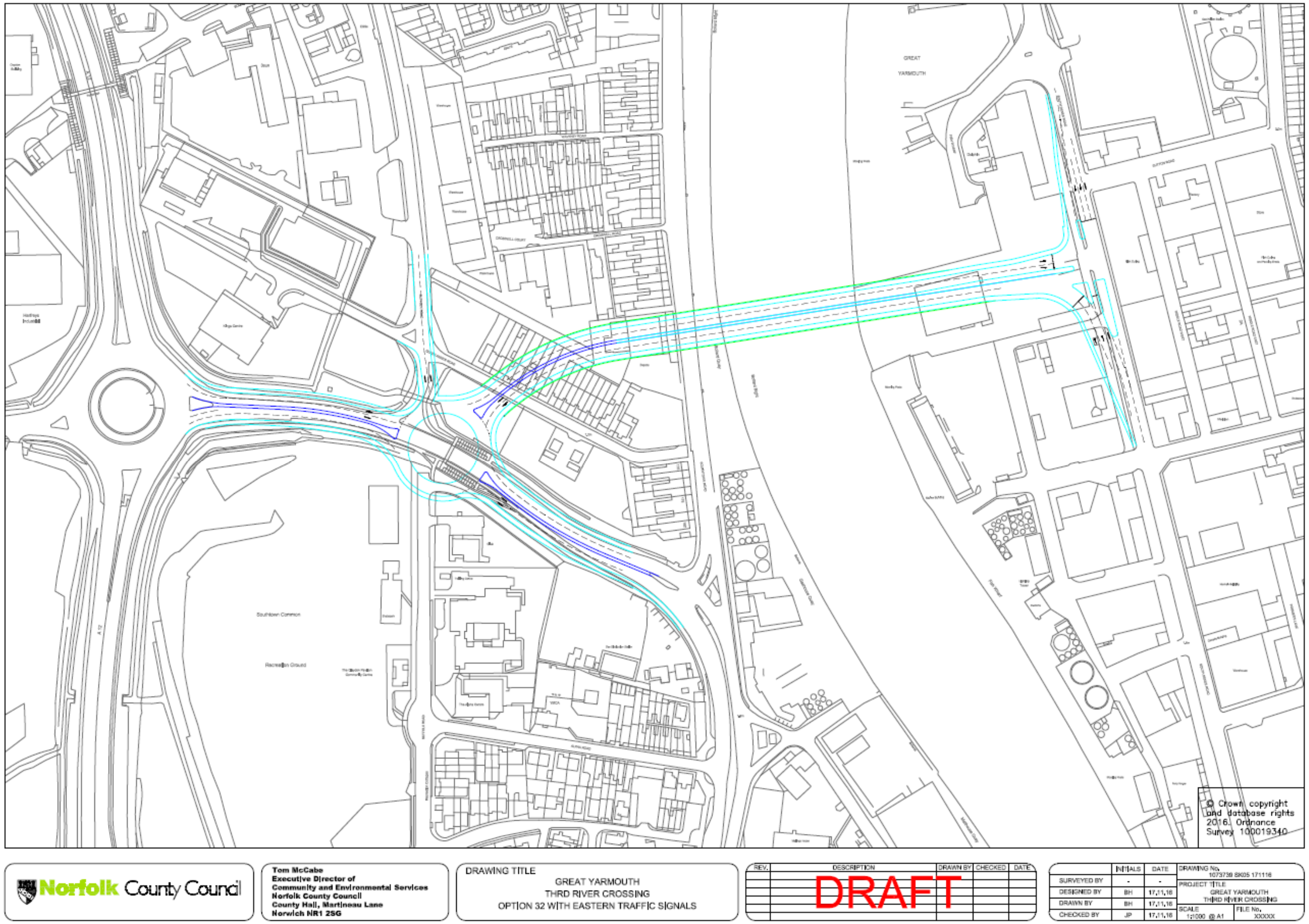
Appendix B - Option 5 with signals on eastern side of scheme



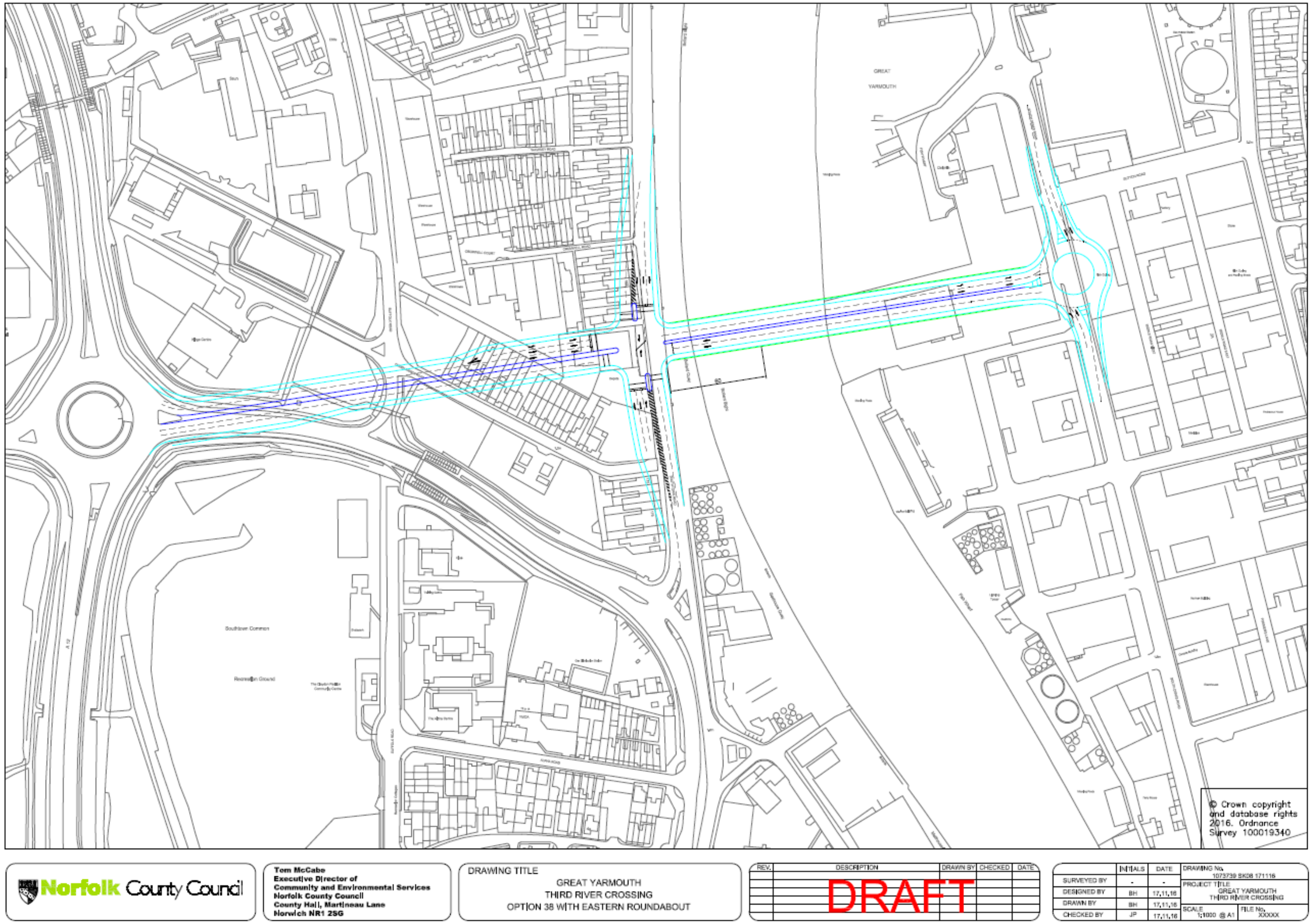
Appendix C - Option 32 with roundabout on eastern side of scheme



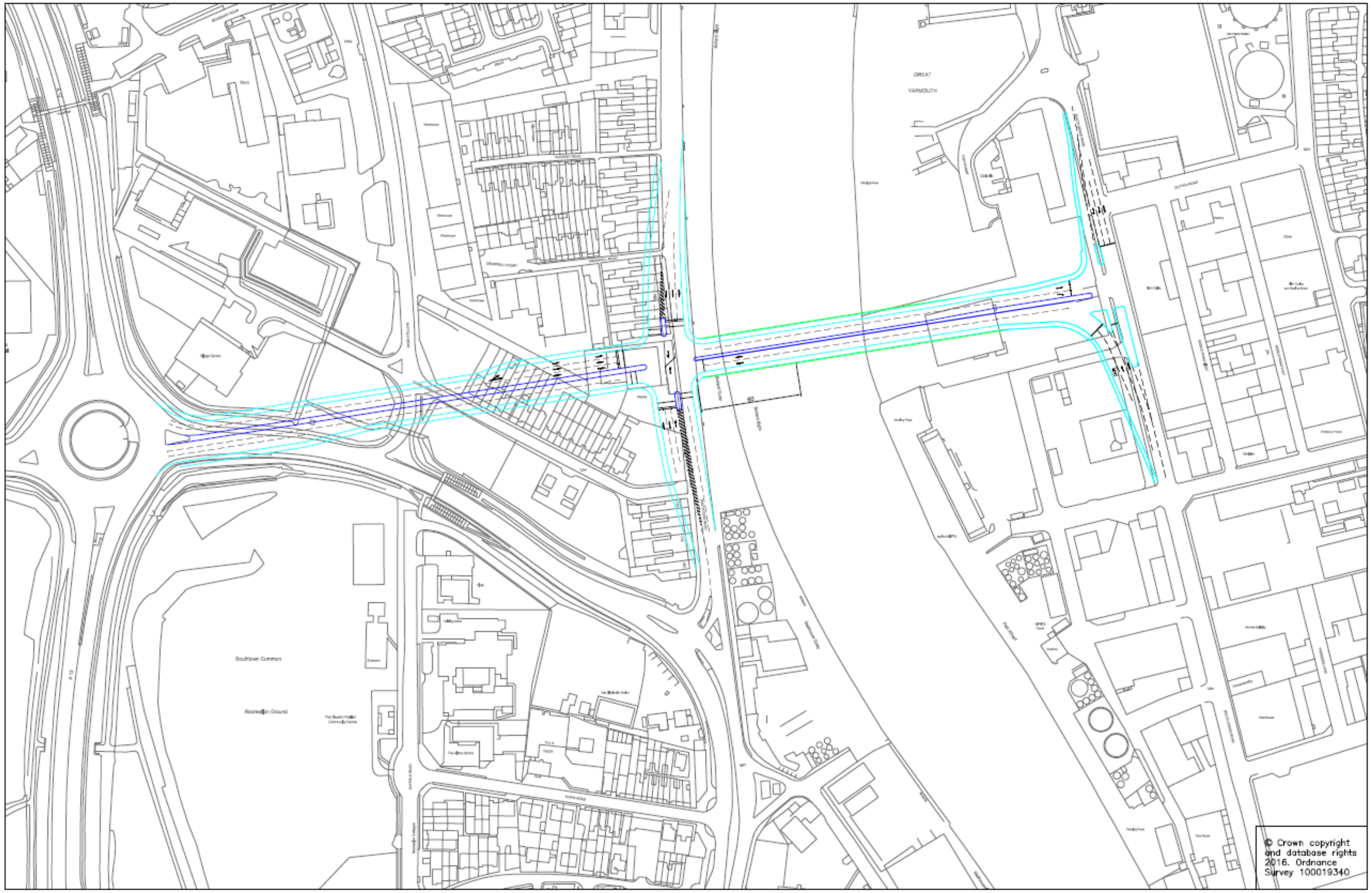
Appendix D - Option 32 with signals on eastern side of scheme



Appendix E - Option 38 with roundabout on eastern side of scheme



Appendix F - Option 38 with signals on eastern side of scheme



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DRAWING TITLE
GREAT YARMOUTH
THIRD RIVER CROSSING
OPTION 38 WITH EASTERN TRAFFIC SIGNALS

REV.	DESCRIPTION	DRAWN BY	CHECKED	DATE
	DRAFT			

	INITIALS	DATE
SURVEYED BY	-	-
DESIGNED BY	BH	17,11,16
DRAWN BY	BH	17,11,16
CHECKED BY	JP	17,11,16

DRAWING No. 1073739 SK09 171116
PROJECT TITLE GREAT YARMOUTH THIRD RIVER CROSSING
SCALE 1:1000 @ A1
FILE No. XXXXX

Appendix G – Cost Estimates

Scheme Element	Option Estimate				
	Option 4 - Single Carriageway from A12 Harfrey's Roundabout Existing Four-Arm Roundabout to South Denes Road T-Junction High	Option 5 - Dual Carriageway from A12 Harfrey's Roundabout Existing Four-Arm Roundabout to South Denes Road T-Junction High	Option 6 - Three-Lane (Tidal) Carriageway from A12 Harfrey's Roundabout Existing Four-Arm Roundabout to South Denes Road T-Junction High	Option 31 - Single Carriageway from Suffolk Road New Four-Arm Roundabout to South Denes Road T-Junction High	Option 32 - Dual Carriageway from Suffolk Road New Four-Arm Roundabout to South Denes Road T-Junction High
Approximate base construction costs;					
West Section (including bridge approach)	£5,296,000	£7,271,000	£6,349,000	£3,310,000	£4,380,000
Bascule Bridge	£22,018,000	£36,030,000	£30,410,000	£22,018,000	£36,030,000
East Section (including bridge approach)	£2,496,000	£3,143,000	£2,886,000	£2,590,000	£3,260,000
Sub-total	**£29,810,000**	**£46,444,000**	**£39,645,000**	**£27,918,000**	**£43,670,000**
Work by Statutory undertakers and others	£2,982,000	£4,644,000	£3,965,000	£2,792,000	£4,367,000
Survey/Investigate/Design/Procure/ Supervise/Manage & Liaise	£4,769,000	£7,431,000	£6,344,000	£4,467,000	£6,988,000
Sub-total including Stats/Others & Design etc. but excluding Risk	**£37,561,000**	**£58,519,000**	**£49,954,000**	**£35,177,000**	**£55,025,000**
Risk/Optimism Bias/Contingency	£18,782,000	£29,260,000	£24,978,000	£17,590,000	£27,513,000
Approximate Indicative Total Budget Estimate	**£56,343,000**	**£87,779,000**	**£74,932,000**	**£52,767,000**	**£82,538,000**
Land (see note below)	£8,985,875	£14,000,000	£11,950,521	£8,950,126	£14,000,000
Estimated Scheme Cost	**£65,328,875**	**£101,779,000**	**£86,882,521**	**£61,717,126**	**£96,538,000**

Scheme Element	Option Estimate			
	Option 33 - Three-Lane (Tidal) Carriageway from Suffolk Road New Four-Arm Roundabout to South Denes Road T-Junction High	Option 37 - Single Carriageway from Southtown At-Grade Junction to South Denes Road T-Junction Low	Option 38 - Dual Carriageway from Southtown At-Grade Junction to South Denes Road T-Junction Low	Option 39 - Three-Lane (Tidal) Carriageway from Southtown At-Grade Junction to South Denes Road T-Junction Low
Approximate base construction costs;				
West Section (including bridge approach)	£3,964,000	£4,987,000	£6,015,000	£5,650,000
Bascule Bridge	£30,410,000	£21,217,000	£34,720,000	£29,303,000
East Section (including bridge approach)	£2,994,000	£1,525,000	£1,907,000	£1,758,000
Sub-total	**£37,368,000**	**£27,729,000**	**£42,642,000**	**£36,711,000**
Work by Statutory undertakers and others	£3,736,000	£2,774,000	£4,265,000	£3,671,000
Survey/Investigate/Design/Procure/Supervise/Manage & liaise	£5,979,000	£4,437,000	£6,822,000	£5,873,000
Sub-total including Stats/Others & Design etc. but excluding Risk	**£47,083,000**	**£34,940,000**	**£53,729,000**	**£46,255,000**
Risk/Optimism Bias/Contingency	£23,542,000	£17,470,000	£26,866,000	£23,129,000
Approximate Indicative Total Budget Estimate	**£70,625,000**	**£52,410,000**	**£80,595,000**	**£69,384,000**
Land (see note below)	£11,979,666	£9,103,841	£14,000,000	£12,052,765
Estimated Scheme Cost	**£82,604,665.67**	**£61,513,841**	**£94,595,000**	**£81,436,765**

Exclusions
Demolitions
Geotech to existing ground band drains stone piling etc. cost assessment ongoing currently to be in next issue
Any works to river beds
Major Stats diversions
Major contamination/ground condition issues
VAT
Legal issues
Inflation

Note
Land cost for options 5, 32 and 38 based on update to previous land cost of £13.7m for Bridge Option 1 (Dec '15) plus allowance of 2.5% for inflation
Land cost for single and three lane options have been adjusted proportionally to the difference in base construction costs for those options

Cost estimates are based on the following:
Option 5 - Drawing No. 1073739-SK07-171116 (with assumptions made for options 4 and 6) and Bridges Drawing Option 2 (with adjusted deck widths for options 4 and 6)
Option 32 - Drawing No. 1073739-SK05-171116 (with assumptions made for options 31 and 33) and Bridges Drawing Option 1 (with adjusted deck widths for options 31 and 33)
Option 38 - Drawing No. 1073739-SK09-171116 (with assumptions made for options 37 and 39) and Bridges Drawing Option 3 (with adjusted deck widths for options 37 and 39)

Appendix H – AM Peak Junction Assessment Summary

AM Peak (incl 5% uplift)														
Option 32		**West - roundabout**					**East - signals**					**East - roundabout (42m ICD)**		
		Queue		**Max RFC**			**MMQ**		**Max DoS**			**Queue**		**Max RFC**
	Bridge Crossing	0.07		0.156		Bridge Crossing	14.4		75.2%		Bridge Crossing	1.36		0.619
	William Adams Way S	0.66		0.430		South Denes Road NB	6.9		57.9%		South Denes Road NB	0.27		0.348
	William Adams Way W	1.27		0.641		South Denes Road SB	12.7		75.2%		South Denes Road SB	2.04		0.728
	Suffolk Rd Exit	Exit Only				**JUNCTION PRC**	**19.6%**							
Option 5		**West - signals**					**East - signals**					**East - roundabout (42m ICD)**		
		MMQ		**Max DoS**			**MMQ**		**Max DoS**			**Queue**		**Max RFC**
	Bridge Crossing	Unsignalised				Bridge Crossing	12.5		79.4%		Bridge Crossing	1.21		0.588
	Southtown Road NB	10.7		87.1%		South Denes Road NB	12.5		62.4%		South Denes Road NB	0.26		0.344
	Southtown Road NB Internal	4.9		68.4%		South Denes Road SB	11.2		76.2%		South Denes Road SB	1.95		0.730
	New Road On-Slip WB -giveway	3.3		58.0%										
	New Road Off-Slip EB	7.4		77.2%										
	Southtown Road SB	5.1		43.4%										
	Southtown Road SB Internal	1.9		42.4%										
	JUNCTION PRC	**3.4%**				**JUNCTION PRC**	**13.3%**							
Option 38		**West - signals**					**East - signals**					**East - roundabout (42m ICD)**		
		MMQ		**Max DoS**			**MMQ**		**Max DoS**			**Queue**		**Max RFC**
	Bridge Crossing	2.7		41.3%		Bridge Crossing	11.1		71.2%		Bridge Crossing	1.79		0.666
	Southtown Road NB	14.4		68.0%		South Denes Road NB	11.2		71.9%		South Denes Road NB	0.34		0.391
	Southtown Road SB	7.5		69.1%		South Denes Road SB	15.1		68.0%		South Denes Road SB	2.28		0.751
	New Road EB	11.4		71.2%										
	JUNCTION PRC	**26.4%**				**JUNCTION PRC**	**25.1%**							

Appendix I – PM Peak Junction Assessment Summary

PM Peak (incl 5% uplift)									
Option 32		**West - roundabout**			**East -signals**			**East - roundabout (42m ICD)**	
		Queue	**Max RFC**		**MMQ**	**Max DoS**		**Queue**	**Max RFC**
	Bridge Crossing	0.93	0.556	Bridge Crossing	14.4	75.2%	Bridge Crossing	0.48	0.360
	William Adams Way S	0.50	0.435	South Denes Road NB	6.9	57.9%	South Denes Road NB	0.93	0.562
	William Adams Way W	1.12	0.606	South Denes Road SB	12.7	75.2%	South Denes Road SB	1.90	0.729
	Suffolk Rd Exit	Exit Only		**JUNCTION PRC**	**19.6%**				
Option 5		**West - signals**			**East -signals**			**East - roundabout (42m ICD)**	
		MMQ	**Max DoS**		**MMQ**	**Max DoS**		**Queue**	**Max RFC**
	Bridge Crossing	Unsignalised		Bridge Crossing	9.9	76.6%	Bridge Crossing	0.50	0.374
	Southtown Road NB	16.3	76.1%	South Denes Road NB	7.8	78.6%	South Denes Road NB	0.68	0.518
	Southtown Road NB Internal	3.1	69.8%	South Denes Road SB	9.6	77.0%	South Denes Road SB	1.47	0.682
	New Road On-Slip WB -giveway	0.5	17.7%						
	New Road Off-Slip EB	11.9	81.6%						
	Southtown Road SB	19.1	77.8%						
	Southtown Road SB Internal	1.2	61.8%						
	JUNCTION PRC	**10.2%**		**JUNCTION PRC**	**14.5%**				
Option 38		**West - signals**			**East -signals**			**East - roundabout (42m ICD)**	
		MMQ	**Max DoS**		**MMQ**	**Max DoS**		**Queue**	**Max RFC**
	Bridge Crossing	12.1	85.5%	Bridge Crossing	11.3	72.1%	Bridge Crossing	0.69	0.412
	Southtown Road NB	16.1	85.5%	South Denes Road NB	12.2	75.2%	South Denes Road NB	1.17	0.629
	Southtown Road SB	12.5	82.3%	South Denes Road SB	10.3	70.6%	South Denes Road SB	1.91	0.732
	New Road EB	10.6	65.4%						
	JUNCTION PRC	**5.3%**		**JUNCTION PRC**	**19.7%**				