

A47/A12 Corridor Feasibility Study

Stage 2: Option Assessment Report

A Report by AECOM for the Highways Agency

February 2015

EXECUTIVE SUMMARY

AECOM is working on behalf of the Highways Agency (HA) to identify the issues that relate to the A47/A12 corridor and potential locations for investment into improvements along the corridor.

The study was completed in three stages and followed DfT's Transport Analysis Guidance (WebTAG). This report broadly constitutes Steps 5 – 9 of the that process.

This is the second of three study reports. This report documents the identification and sifting of a range of infrastructure proposals likely to achieve the objectives agreed in the previous stage of work. Step 5 included the generation of measures or interventions that could potentially achieve the objectives of the study. Step 5 included the consideration of interventions that had been developed in the past and interventions suggested by stakeholders.

Following the identification of intervention objectives and priority challenges, the study reviewed previous work to verify the severity of the challenge before identifying infrastructure proposals that could address the problems identified. The study built on work done to date wherever possible, drawing upon a range of completed or recent related studies and strategies including the Thickthorn Interchange Improvements undertaken by Norfolk County Council in June 2013¹, and the A47 Blofield to North Burlingham Dualling Scheme that was withdrawn following the 2010 spending review.

22 locations were identified as having either current or imminent problems and these were considered further at a high level. At this stage a range of possible measures were developed for comparison.

The options were then assessed using criteria from the DfT's Early Assessment and Sifting Tool (EAST). In total approximately 66 options (22 challenges) were assessed in this way. Only those which met most of the defined objectives and high level deliverability and feasibility criteria were taken forward. The 12 prioritised options were then assessed against the DfT's Option Assessment Framework, with evidence presented against the best practice Treasury five case model (which assesses the strategic, economic, financial, management/delivery and commercial cases). The 'economic case' requires consideration of environmental and social as well as economic impacts of options.

¹ Norfolk Council Engineering Report for Thickthorn: <http://www.gndp.org.uk/content/wp-content/uploads/downloads/2013/06/Final-Engineering-Report-P3-reduced-size.pdf> – Accessed November 2014

12 options scored beneficially against the majority of intervention objectives and were therefore prioritised for further assessment. The results of the prioritising resulted in the following link and junction schemes to be taken through for further assessment:

- A1 Sutton to Peterborough
- Easton to Tuddenham
- Blofield to North Burlingham
- A47/A141 Guyhirn
- A47/A11 Thickthorn Junction
- Acle Straight Remedial Safety Measures

The challenges identified in Great Yarmouth have been combined into two packages recognising their interaction with each other and their potential to provide a cohesive strategy, potentially enhancing the status of the options in Great Yarmouth:

A12 Package 1

- Vauxhall Roundabout and Station/Asda access junction

A12 Package 2

- Gapton Roundabout
- Harfreys Roundabout
- Bridge Road
- James Paget Hospital

1 INTRODUCTION AND PURPOSE

INTRODUCTION

This is the second of three reports relating to the A47/A12 Corridor Feasibility Study. This report aims to substantiate the evidence and confirm the issues identified. Following confirmation, potential solutions to those issues are derived and the best solutions taken forward, with the aim of identifying infrastructure proposals likely to best achieve the intervention objectives as set out in the Stage 1 report.

STUDY STAGES

The study was undertaken in three stages and is guided by the DfT's Transport Analysis Guidance (WebTAG) 2014.

This report constitutes the second of three reports. **Table 1.1** provides a summary for each stage of the process and the related WebTAG steps that the report follows.

Table 1.1 Study stage process

Stage	Task
1	Step 1 – Understanding the current situation
	Step 2 – Understanding the future situation
	Step 3 – Establishing the need for intervention
	Step 4a – Identifying the objectives
	Step 4b – Define the geographic area of impact to be addressed by the intervention
2	Step 5 – Generating options
	Step 6 – Initial sifting of options
	Step 7 – Development and assessment of potential options
3	Step 8 – Produce an option assessment report
	Step 9 – Clarify modelling and appraisal methodology for further appraisal (Stage 2 of WebTAG)

REPORT PURPOSE AND CONTENT

This report is the second of a suite of three study reports. The aim of this report is to document the processes adopted to generate and sift options as well as checking the overall performance of each emerging option and thus prioritising those options for the third study report. The content of this report is as follows:

- **Chapter 2:** Summary of Stage 1 Report – summary of the findings from Stage 1
- **Chapter 3:** Generating Options and Initial Sifting – discussion on the development of a range of alternative measures and interventions that look likely to achieve the corridor's objectives and sets out the process for sifting a potential solution and identify those measures that should be taken to the next step for Option Development
- **Chapter 4:** Development and Assessment of Potential Options – development of potential options to a sufficient level and the collection of sufficient evidence to be able to distinguish between the relative costs, benefits and impacts. Identification of the best performing option to be investigated in the next stage of the study.



2 SUMMARY OF STAGE 1 REPORTING

INTRODUCTION

The first stage of the study reviewed evidence from other relevant studies and analysis to form a view as to the nature and scale of current and future performance on the A47 route. The first stage also established the non-availability of a suitable strategic transport model.

CURRENT SITUATION

The road is a mix of dual and single carriageway, with a dualled bypass to Norwich and a handful of other short dualled sections. On single carriageway sections of the route, traffic flows are between 14,000 and 22,000 vehicles a day, or extremely busy. The dualled section

around Norwich is of higher quality, and accommodates higher traffic volumes.

Fluctuation in flows along the route suggests that a significant proportion of trips are made along relatively short sections of the route, rather than long-distance trips along the entire route.

The overall collision and casualty rates appear to be decreasing over time with the exception of hotspots such as Wansford to Sutton and Blofield to North Burlingham where the collision rate is above the route and national averages².

The analysis of available traffic data and evidence from other studies indicated a number of problems along the route that impact on the efficient and safe movement of people and goods and

have consequential effects on the environment and local communities.

The problems along the route were identified as being:

- Congestion at a number of locations particularly at peak periods
- inconsistent carriageway standards leading to problems where standards reduce
- lack of overtaking opportunities
- poor resilience owing to difficulty in passing incidents and lack of alternative routes
- collision hotspots where the collision rate is above the national average
- lack of alternative east-west rail connections.

² Highways Agency Area 6 Quarterly Safety Report (Q4) 2012 – October 2013

FUTURE SITUATION

The cities and districts continue to plan for significant growth with over 50,000 new jobs and 100,000 new homes planned for the next 15 years. Analysis indicates that as a result of such development congestion expected to worsen particularly on the Wansford to Sutton section of the A47, Guyhirn Roundabout leading into Wisbech, Thickthorn Interchange and junctions in Great Yarmouth.

The data analysis and identification of current problems and future issues informed the definition of a set of intervention objectives that were subsequently used in generating and assessing options to improve the route.

These objectives were to:

- Support economic growth:
- Facilitate growth in employment at key centres and locations along the A47/A12 corridor
- Facilitate growth in housing at key development hotspots along the corridor
- Improve capacity, resilience and safety:
- Reduce delay and queues that occur during the peak hours and seasonal times of the year
- Improve the resilience of the route, such that the number of incidents and the effects of incidents is reduced
- Reduce the number of collisions on the A47/A12 at key hotspots on the corridor
- Environment: Minimise unacceptable impacts on the surrounding natural environment and landscape and optimise the environmental opportunities and mitigation that the intervention could bring.

The study prioritised challenges to be addressed along the route. It did so by drawing upon the Route Strategy Evidence Report³ to identify 32 challenges along the route and categorising these as either current problems or future problems. By prioritising the current and those future problems identified as being imminent based on forecast growth in the area, the study prioritised 22 locations.

³ East of England Route Strategy: <http://assets.highways.gov.uk/our-road-network/route-strategies/East%20of%20England.pdf> – Accessed November 2014

3 GENERATION OF OPTIONS

INTRODUCTION

This chapter specifies the approach adopted to generating a number of options that meet the intervention objectives. A long list of options were developed during this stage which were then eventually sifted and before being taken forward for further assessment.

APPROACH

The development of the options has utilised a range of previous studies and relevant reports completed by the Highways Agency and local planning authorities, considered the outcomes of discussions with Stakeholders, used AECOM's experience and professional judgement to assist the Highways Agency with developing options. This approach enabled a range of possible measures to be developed in a robust, transparent and auditable manner.

Following investigation a number of options have been developed for each challenge taken forward from Stage 1 'Review of Evidence and Identification of Problems' report.

The generation of options was based on feedback from the earlier stakeholder consultations, supported by evidence gathered during the problem identification stage. At this stage, the options identified were presented as concept drawings to assist discussions during a workshop. At this stage 66 options was developed for 22 locations along the corridor.

A sifting process was then applied to those 66 options that were developed for the 22 locations identified and carried through for further consideration.

The methodology for sifting was based on the criteria used in the DfT Early Assessment and Sifting Tool (EAST). Adopting the EAST criteria as a basis at this stage is important because the EAST

is consistent with the Transport Business Case principles for assessing the benefits of the emerging options and is similar to the processes that could potentially be addressed in a Transport Business Case.

INITIAL SIFTING PROCESS

The expectation from the sifting stage is that challenges and their corresponding options will involve discarding those options that do not meet the resolution of the issue, achievement of study objectives and is deliverable and technically sound. Those options which are removed due to an excessive delivery timescale may be rolled forward into Route Strategies.

A scoring system was used during the workshop where aspects of the options were appraised, and assigned a negative or positive score. This scoring facilitated an initial ranking of options to assist in decision making. It should be noted that this stage of the study considered

a very broad assessment based largely on professional judgement.

Each option was assessed to determine whether or not it was suitable for further consideration within the study. Unsuitable options were then set aside. The reason for setting proposals aside was justified and recorded to provide an auditable trail.

This section provides a brief explanation of the criteria that was used to assess the options generated.

The scoring system assessed the extent to which each option:

- Addresses the problem identified;
- Satisfies route specific objectives;
- Is deliverable ; and
- Is feasible.

Table 3.1 details the scoring system used to inform decision making.

Table 3.1 Initial Sifting – Scoring System

Qualitative assessment against identified problem	Qualitative assessment against identified route specific objectives
2 Large beneficial impact	2 Large beneficial impact
1 Beneficial impact	1 Beneficial impact
0 Neutral / marginal impact	0 Neutral / marginal impact
-1 Adverse impact	-1 Adverse impact
-2 Large adverse impact	-2 Large adverse impact
Deliverability (e.g. political, planning, timescale or third party issues) Deliverable in theory Deliverable but with challenges Very difficult to deliver	Feasibility (e.g. physical constraint, land availability and design standards) Feasible in theory Feasible but with challenges Not feasible / significant challenges

The scores/categories awarded were based on qualitative assessments and quantitative estimates where impacts had been assessed against each option developed for a particular challenge. Thus in most cases one option was for each challenge was identified for further assessment.

The scoring system and discussions served a number of purposes:

- It facilitated comparison;
- It helped the reviewers understand large amounts of data/information; and
- It focussed the assessment on the relative issue, rather than consideration of absolute values. (At this stage quantitative assessments may not exist or may not have been validated or corroborated.)

Table 3.2 lists the EAST based criteria that informed the assessment of the options considered. These criteria were used to consider the ability of each option to resolve the problem identified.

Table 3.2 Scale of Impact Against Identified Problem

EAST Based Criteria		Description
1	Strategic Impacts	<ul style="list-style-type: none"> ■ To what extent does the option alleviate the identified problem? ■ Might the option impact negatively on other modes or types of transport? To what extent does the option make better use of existing infrastructure or demonstrate innovation in terms of 'doing more with less'?
2	Economic Impacts	<p>Connectivity</p> <ul style="list-style-type: none"> ■ Will journeys get shorter, quicker and/or cheaper? ■ In some cases, options will have opposite impacts on time and cost, therefore an overall judgment will need to be made by weighing up the individual impacts. <p>Reliability</p> <ul style="list-style-type: none"> ■ Will the option impact on the day to day variability in journey times or the average minutes of lateness? ■ Will there be any impact on the number of incidents? <p>Social and Distributional</p> <ul style="list-style-type: none"> ■ Impacts that need to be considered when assessing the option will include noise, air quality, severance, accessibility, accidents and user benefits. <p>Local Environment</p> <ul style="list-style-type: none"> ■ How will the option impact on features such as countryside, water environment, air quality, noise, heritage and landscaping? <p>Well Being</p> <ul style="list-style-type: none"> ■ Consideration will be given to the impacts on the pedestrian environment.
3	Deliverability/ Managerial	<p>Implementation timetable from inception to delivery</p> <ul style="list-style-type: none"> ■ Respondents will need to give an estimate of the timescales for implementing the option, from inception to delivery (this might include construction timescales or time for bringing legislation into force). <p>Public acceptability</p> <ul style="list-style-type: none"> ■ An assessment of whether there are likely to be any issues around public acceptability of the option. For example, will the option require a long period for public consultation? <p>Practical feasibility</p> <ul style="list-style-type: none"> ■ Has the option been tested and proven to be practical and effective? ■ Is there certainty regarding the governance and legal feasibility of the option? ■ Does the operator have the required statutory powers? Are there planning implications?

EAST Based Criteria		Description
4	Financial Considerations	<ul style="list-style-type: none"> No information recorded at this time of sifting. Commercial managers from the Highways Agency will feed into the process at Step 7.
5	Funding Considerations	<p>Flexibility of option</p> <ul style="list-style-type: none"> To what extent can the option be scaled up or down depending on the level of funding available? How easily could the scheme be amended to fit with changing circumstances? <p>Enhanced funding coming from?</p> <ul style="list-style-type: none"> Has alternative funding been secured? Can funding be secured through developer S106 contributions?

Table 3.3 guided the assessment of the solution against route specific objectives.

Table 3.3 Scale of Impact Against Route Specific Objectives

Route Specific Objectives		Definition
1	Unlock Development Housing	Information based on the number of houses expected to be delivered at proposed developments and the location of developments relative to the option identified in the Stage 1 report. Quantum of traffic that assigns to the network at a specific junction for a specific development will be quantified and considered on this basis. In some cases, new development requires some form of transport development to support it.
2	Unlock Development Growth	Stimulate economic growth and access to gateways, enterprise zones and local designated employment areas from proposed developments identified in the Stage 1 report. Quantum of traffic that assigns to the network at a specific junction for a specific development will be quantified and considered on this basis. Questions will be posed, with the intention of screening whether there may be an impact that could potentially need to be considered in more detail later on in the appraisal process, should the option progress.
3	Capacity	Latest traffic data and summaries of the Congestion Reference Flow (CRF) and link stresses
		Junction modelling to be communicated for each option developed and the improvements in RFC and journey time reliability
4	Resilience	The expected number of incidents and the effects of incidents are reduced. Does the option have an impact on the vulnerability of the network to severe weather events, accidents or the effects of climate change?
5	Safety	Safety statistics for the route and an assessment made of the options being developed and its mitigation.

The Deliverability of each option was assessed against the potential likelihood of political and planning timescale or third party issues to arise. The aim was to identify solutions that can be delivered by 2021. The Feasibility of each option was assessed against the criteria of physical constraints, land availability and design standards.

RESULTS OF SIFTING

For each option a summary of the workshop discussion, the outcome of that discussion and the decision made are given. **Table 3.4** provides a summary of the options selected for further development. In most cases one option was taken through for each challenge for further assessment and development.

Table 3.4 Summary of options selected for further assessment development

	Location	Emerging Option	Key Points
1	A1 Wansford and Sutton (West of Peterborough)	Dedicated left turn at A1 junction - Dual carriageway with at-grade junctions	Offline dualling with new roundabout at Sutton Heath Road. Adverse impact on Sutton Heath SSSI. Possible beneficial effect on scheduled monument. Significant increase in capacity.
2	A1 Wansford and Sutton (West of Peterborough)	Dedicated left turn at A1 junction - Dual carriageway with at-grade junctions - partly online	Offline dualling, with new roundabout at the Drift. Lesser impact on Sutton Heath SSSI than Option A, but larger overall land take. Possible beneficial effect on scheduled monument. Road closure between A47 and Upton. Significant increase in capacity.
3	A47/A1260 Nene Parkway	General widening to circulatory carriageway and alteration of A47 eastbound merges	Capacity benefits on northbound circulatory. On the eastbound offslip unequal queuing could potentially persist, posing a risk to the operation of the A47 eastbound mainline.
4	A47/A15 Paston Parkway 'Dogsthorpe Junction'	A47 arms/opposing links - widen A47 west approach to accommodate third flared lane	Capacity benefits especially to the A47. Does require land outside the highway boundary. Could provide shorter term benefit. This option presents a potentially more affordable solution (up to 2021) with relatively minor alterations to the junction (albeit a 3 lane flare on the A47 west may require a retaining wall and/or land outside the highway boundary which could be a challenge. Modelling work indicates that widening is necessary otherwise traffic signals may not work as efficiently.
5	A47/A141 Guyhirn	Enlarged uncontrolled roundabout	Recorded impact on Nene Washes SSSI. Mitigation will be required for effects on local residents. Larger capacity benefit than other options identified. Improved safety due to geometry and compliant with standards. Possible widening of bridge to allow for a larger roundabout may further increase capacity.
6	A47/A17 Pullover Junction	Partial signalisation of the A47 westbound approach and associated movements	Capacity benefits to A47 arms (A17 and King's Lynn arms will however experience queues)
7	A47 North Tuddenham to Easton (incl. Honingham)	Online dualling of existing A47 corridor with associated improvements	Significant capacity improvements. Potentially the least environmental impacts to online alignment. However, alignment restricts safety benefit and makes construction more difficult.

	Location	Emerging Option	Key Points
8	A47/A11 Thickthorn Interchange	Mott Macdonald By-Pass alternatives	Significant capacity and resilience benefits at significant cost. Negative visual impact for residents on Cantley Ln S if new link crosses A47 via bridge. Existing overhead power lines could potentially require undergrounding at significant expense. Tunnelling the new link under the A47 could potentially address both issues.
9	A47 Blofield to North Burlingham	Development of previous scheme proposals	
10	A47/A12 Vauxhall Roundabout Great Yarmouth and Station Access	Great Yarmouth Station approach improvements and full signalisation of Vauxhall Roundabout	Significant capacity and resilience benefit at significant cost. But also some major improvements to Acle Straight and local traffic.
11	A12/Breydon Bridge	Dualling from Vauxhall Roundabout to Gapton Roundabout. Additional bridge structure required.	Significant capacity benefit if A12 is dualled from Vauxhall Roundabout to Gapton Roundabout. However significant cost and environmental impact. Third River Crossing may provide capacity, safety and resilience benefit with more value and lesser environmental impact than option A. Further assessment required to determine economic benefit.
12	A12 Gapton Roundabout	Full signalisation of roundabout	Significantly increases capacity with no environmental impacts
13	A12 Harfreys Roundabout	Enlarged signalised roundabout	Significantly increases capacity and potential to accommodate additional traffic related to the possible Third River Crossing
14	A12/Bridge Road	Junction and technology improvements	Significantly increases capacity with no environmental impacts
15	A12/James Paget Hospital	Junction and technology improvements	Significantly increases capacity with no environmental impacts
16	A12 Beacon Park Roundabout	Enlarged signalised roundabout	Alternative option if the necessary circulatory stacking space cannot be found for a signalised roundabout. Additional speed limits and traffic calming measures could potentially be required on approach to the junction to reduce rear end shunts.

In addition further assessment during the sifting exercise were also recommended on the following four locations:

- **A1 Wansford and Sutton (West of Peterborough)** – Assess the need for free-flow left turn from A1 to A47 (East);
- **Acle Straight** – Analyse road safety data, consider need and form of measures which may improve existing safety record;
- **A12/Breydon Bridge** – Assess economic benefits of Third River Crossing in Great Yarmouth. A study by Norfolk County Council completed work in 2009 on the benefits of the Third River Crossing; and
- **A12/Station Square/Waveney Road** – Investigate the effect of temporary traffic management measures associated with Suffolk County Council highway works where certain movements had been banned.

A total of 16 emerging options have been selected for further development. These 16 options relate to 15 locations.

Certain options and locations was not taken through following the initial sifting process as they did not meet the intervention objectives, excessive costs associated with development of the solution which could potentially reduce the overall benefits of the scheme and in addition in terms of deliverability due to there being potentially significant impacts to cultural and heritage designations.

4 DEVELOPMENT AND ASSESSMENT OF POTENTIAL OPTIONS

INTRODUCTION

This chapter sets out how we developed and assessed the options prioritised. This involved developing potential options to a sufficient level of design and collecting sufficient evidence to be able to distinguish the relative costs, initial benefits and impacts of the options under consideration.

There are a number of potential options that are under consideration that require development. A number of the options will be reduced further with the identification of the better performing options.

The study built on work done to date on potential proposals wherever possible, drawing upon a range of completed or recent related studies and strategies including the Thickthorn Interchange Improvements completed by Norfolk County Council in June 2013, and the A47 Blofield to North Burlingham Dualling Scheme that was withdrawn in the 2010 spending review.

APPROACH

An outline illustrative solution was developed for each of the options prioritised at the 15 locations. The options were developed in sufficient detail in accordance with the Highways Agency Commercial Cost Estimation Manual to provide Order of Magnitude Costs. This could potentially provide an assessment of proposals for entry to the forward programme of schemes and Project Lifecycle.

They were also assessed against additional criteria which included:

- how best the identified solution meets the intervention objectives;
- initial environmental appraisal of the option to inform the decision making process against the environmental and historical designations and the potential for impact;

- an indication of the emerging options deliverability and feasibility;
- initial consideration of the road safety key strengths and weaknesses that each illustrative solution could provide;
- initial capacity assessments of emerging options in terms of their journey time savings; and
- initial checking of emerging options drew upon work produced previously and also checked against conceptual designs.

A traffic light rating system of red, amber and green has been used to denote at this stage of the study the performance of each option, to allow a comparison to be made:

There are significant issues with the option that cannot currently be resolved.

The option has some negative aspects which potentially could be resolved.

The anticipated overall performance meets objectives set by the study.

RESULTS

A47 A1 Wansford and Sutton (West of Peterborough)

Option A

<p>Scheme Description: Upgrade of single carriageway to dual carriageway with at grade junctions and underpass to provide for a local access movements. Part offline/online dualling. Local route accesses provision assisted through the retention of part of the existing single carriageway.</p>	
<p>Key Strengths:</p> <p>Capacity: It is expected that there could potentially be overall improvement to capacity. Also expected to capacity improve through the improvement of the roundabout at the Wansford junction.</p> <p>Growth: Potentially enables growth in the City of Peterborough where growth is anticipated.</p> <p>Public acceptability: Overall this option could achieve public acceptability due to the upgrading of an isolated single carriageway section to a dual carriageway, and provides a better route consistency than the existing.</p> <p>Well Being: This option could potentially could have limited/no impact on the pedestrian environment.</p> <p>Road Safety: This option should improve road safety through the conversion of the route from single to dual carriageway The proposed scheme targets the collision clusters identified, particularly by restricting right turn movements and by providing safe access and egress to/from the route</p>	<p>Key Weaknesses:</p> <p>Implementation timetable from inception to delivery: Due to requirement for land take, other environmental constraints and construction of significant infrastructure, this option may take a longer time period for delivery and incur significant costs.</p> <p>Buildability: Overhead power cable needs to be considered at detailed design. Contractor needs to undertake advance planning of construction phases as the proposed alignment overlaps the existing and there is a need for A47 to remain operational during construction.</p> <p>Environmental: There are three Grade II Listed Buildings within close proximity to both options and two Scheduled Monuments in close proximity of the proposed works for both options. Consultations with England Heritage will be needed at the next stage of assessment. This option is within close proximity to Sutton Heath and Bog SSSI.</p>
<p>Cost Estimates: £66.0m to £94.0m</p>	<p>OVERALL PERFORMANCE</p>

Option B

Scheme Description: Upgrade of single carriageway to dual carriageway with at grade junctions and underpass to provide a free for a local access –variation to alignment to Option A. This is a partly offline dualling of the single carriageway. It proposes connectivity with the local roads through a new junction and a new at-grade junction.

Key Strengths:

Capacity: It is expected that there could potentially be overall improvement to capacity. Also expected to capacity improve through the improvement of the roundabout at the Wansford junction.

Growth: potentially enables growth in the City of Peterborough where growth is anticipated.

Public acceptability: Overall this option could achieve public acceptability due to the upgrading of an isolated single carriageway section to a dual carriageway, and provides a better route consistency than the existing.

Well Being: This option could potentially have limited/no adverse impact on the pedestrian environment.

Buildability: Compared to option 4A, due to at grade improvements, this scheme has better buildability attributes and presents low risk to the overhead power cable.

Road Safety: This option should improve road safety through the conversion of the route from single to dual carriageway. The proposed scheme targets the collision clusters identified, particularly by restricting right turn movements and by providing safe access and egress to/from the route.

Key Weaknesses:

Implementation timetable from inception to delivery: Due to requirement of land take, other environmental constraints and construction of significant infrastructure, this option may take longer time period for delivery and incur significant cost.

Buildability: Where the scheme ties into the A47, significant traffic management will be required. A47 to remain operational during construction.

Public acceptability: The proposed relocation of the roundabout near to Nene Way realigns the associated local access routes which may result in longer journey distance/ times, the local community may resist such proposals.

Environmental: There are three Grade II Listed Buildings within close proximity to both options and two Scheduled Monuments in close proximity of the proposed works for both options. Neither of the options impact upon these. Consultations with England Heritage will be needed at the next stage of assessment. This option is within close proximity to Sutton Heath and Bog SSSI.

Cost Estimates: £66.0m to £94.0m

OVERALL PERFORMANCE

A47 Nene Parkway

Scheme Description: Widen northbound circulatory carriageway to 3 lanes.	
<p>Key Strengths:</p> <p>Well Being: This option could potentially have limited/no adverse impact on the pedestrian environment.</p> <p>Buildability: As this option is within the highway boundary, this option does not appear to have any buildability issues.</p> <p>Implementation timetable from inception to delivery: As the option only includes localised junction improvement, it could be possible to deliver within a short timescale.</p> <p>Public Acceptability: As the proposal could potentially be within highway boundaries and there could potentially be no need to take land from adjoining properties, it could be acceptable to the public.</p>	<p>Key Weaknesses:</p> <p>Capacity: there potentially could be an expected improvement to the A47 but not the local approaches.</p> <p>Growth: potentially would not enable growth in the City of Peterborough where growth is anticipated.</p> <p>Road Safety: The proposed scheme does not target any of the collision patterns</p>
Cost Estimates: £600k to £900k	OVERALL PERFORMANCE

A15/A47 Dogsthorpe Interchange

Scheme Description: Partial signalisation - A47 arms/opposing links. Widen A47 west arm to provide short 3 lane flare.	
<p>Key Strengths:</p> <p>Capacity: there could potentially be an expected overall improvement to capacity.</p> <p>Growth: potentially enables growth in the City of Peterborough where growth is anticipated.</p> <p>Well Being: This option could potentially have limited/no adverse impact on the pedestrian environment.</p> <p>Implementation timetable from inception to delivery: As the option only includes localised junction improvement, it could be possible to deliver within a short timescale.</p> <p>Public Acceptability: As the proposal could potentially be within highway boundaries and there could potentially be no need to take land from adjoining properties, it could be acceptable to public.</p>	<p>Key Weaknesses:</p> <p>Road Safety: The proposed scheme is for partial signalisation which will address some of the collision problems but the data analysis recommends full signalisation but with supporting measures.</p> <p>Environmental: Potential impact to an important habitat located within 20 metres of the option. Potential air and noise impacts.</p>
Cost Estimates: £2.0m to £4.0m	OVERALL PERFORMANCE

A47/A141 Guyhirn Junction

<p>Scheme Description: Significantly enlarged roundabout than the existing. This option includes a significantly larger diameter roundabout, significant widening of all three approach arms, repositioning of the NE arm and widening the bridge over the river on both sides.</p>	
<p>Key Strengths:</p> <p>Capacity: The larger roundabout and entry/exit widening could potentially improve capacity</p> <p>Growth: potentially enables growth in the City of Peterborough where growth is anticipated.</p> <p>Well Being: Realignment of footways could potentially be required. However, this could potentially have a negligible impact on the pedestrian desire lines.</p> <p>Road Safety: The proposed scheme targets the collision clusters identified, by closing many of the existing accesses which are considered as conflict points.</p>	<p>Key Weaknesses:</p> <p>Capacity: Relatively expensive for capacity gains achieved</p> <p>Public Acceptability: The proposal could potentially reduce the existing landscaping buffer separating the A47 and local dwellings. It therefore might not win public acceptability.</p> <p>Buildability: This option requires widening of the bridge on both sides and significant earthworks on what is reputed to be soft ground.</p> <p>Implementation timetable from inception to delivery: As the option includes widening of the bridge on both sides and repositioning of the NE arm along with significant land take, this option could require a substantial timescale to deliver. There will also potentially be the acquisition of Third Party Land.</p> <p>Environmental: Potential impact to an important habitat within 20 metres of the option. Potential air and noise impacts.</p> <p>Road Safety: The proposed scheme is not targeted to the area where collisions are occurring.</p>
<p>Cost Estimates: £11.0m to £17.0m</p>	<p>OVERALL PERFORMANCE</p>

A17/A47 Pullover Junction

<p>Scheme Description: Signalisation of the A47 westbound approach and opposing circulatory carriageway. Carriageway widening on A47 westbound to accommodate segregated left turn lane towards A47 west. Signalisation of the A47 northbound approach and opposing westbound circulatory carriageway.</p>	
<p>Key Strengths:</p> <p>Road Safety: The proposed scheme targets an area where a greater number of collisions occurred.</p> <p>Implementation timetable from inception to delivery: As the option only includes localised junction improvement, it could be delivered within a short timescale.</p> <p>Public Acceptability: As the proposal could potentially be within highway boundaries and there could potentially be no need to take land from adjoining properties, it could be acceptable to public</p>	<p>Key Weaknesses:</p> <p>Capacity: there could potentially be an expected improvement to the A47 but not on the A17 in the forecasted years.</p> <p>Growth: remote from the City of Peterborough where growth is anticipated.</p> <p>Environmental: Potential impact to an important habitat. Potential air and noise impacts. Further assessment work required.</p>
<p>Cost Estimates: £1.0m to 2.0m</p>	<p>OVERALL PERFORMANCE</p>

A47 North Tuddenham to Easton (incl. Honingham)

Scheme Description: Upgrade of single carriageway to mostly online dual carriageway with some off-line sections. It could potentially require a number of culverts and new roundabouts. Existing roads could potentially be adjusted to provide smooth alignment. Six existing junctions could potentially be amended to 'Left in/Left out' arrangement. A roundabout junction could potentially be introduced to link the scheme with the existing routes.

Key Strengths:

Capacity: there could potentially be an expected overall improvement to capacity and reduction in delays.

Growth: potentially enables growth in the Norwich where growth is anticipated.

Implementation timetable from inception to delivery: Due to land take requirements, this option may require a longer timescale and significant cost to deliver.

Buildability: The scheme is not expected to have any major buildability issues. However, contractor could potentially be a need to give due considerations to traffic management at construction stage. A number of new culverts and new roundabouts are required.

Environment: The proposed carriageway and junctions are not expected to result in impacts to statutory protected ecological sites, however it could result in landtake from BAP habitats. An EIA will be required at the next stage.

Road Safety: The proposed scheme targets the collision clusters identified, by closing many of the existing accesses which are considered as conflict points. Conversion to dual carriageway with the elimination of at-grade crossroads junctions should significantly improve accident rates

Key Weaknesses:

Public acceptability: This Option includes significant land take and some property demolition. Some objections may therefore be anticipated. As considerable length of the route is proposed as an online widening, this may result in to high levels of disruption to public. 'Left in/Left out' junctions could result in significant inconvenience to local users including pedestrians/cyclists and drivers of agricultural vehicles.

Well being: In subsequent design stages, an NMU audit should be undertaken and appropriate mitigation measures should be adopted.

Cost Estimates: £110m to £155m

OVERALL PERFORMANCE

A47/A11 Thickthorn Interchange

Scheme Description: Off-line bypass with half dumbbell junction with A11. This option includes provision of an offline bypass with bridges over the A47 and A11 and a new roundabout forming a 'half-dumbbell' junction with the A11 and the Park & Ride site. Existing overhead power lines present a significant risk to the project cost. The scheme could potentially require acquisition of third party land. Scheme located very close to two scheduled ancient monuments.

Key Strengths:

Capacity: by removing a significant amount of A11 traffic from the Thickthorn Interchange, this option should significantly improve capacity.

Growth: potentially enables growth in the Norwich and surrounding area where significant growth is anticipated.

Well Being: Little or no adverse impact on pedestrian amenity. Enhanced access to Park and Ride.

Key Weaknesses:

Implementation timetable from inception to delivery: As this option require significant highways, structural construction and diversion of overhead cables, it could take a long time to deliver. Acquisition of third party land could add significantly to the time taken to deliver.

Public Acceptability: This proposal could potentially require land take and therefore might potentially not win public acceptability. It runs particularly close to, and at a higher level than, the group of houses in Cantley Lane and may provoke objections from local residents.

Buildability: Overhead power cables could potentially require diversions. There could potentially be disruption to users of both A47 and A11 whilst the scheme is built.

Departures/Relaxations: Relaxations for weaving lengths could potentially be required between Station Lane and bypass merge/diverge.

Environmental: The proposed interchange improvements will have potential adverse air and noise impacts to residential properties and to habitats.

Cost Estimates: £67m to £103m

OVERALL PERFORMANCE

A47 Blofield/Burlingham: Adoption of previous scheme proposals

Scheme Description: Widening of 4km single carriageway to dual status.	
<p>Key Strengths:</p> <p>Capacity: there could potentially be an expected overall improvement to the link stress.</p> <p>Growth: potentially enables growth in the Norwich where significant growth is anticipated.</p> <p>Public acceptability: Severance could potentially be increased due to higher flows and speeds on the dual carriageway. However, improvements in the form of an overbridge at White House Junction could potentially improve the ease and safety of crossing the A47.</p> <p>Environmental: There are negligible/minor increases in noise over parts of the scheme.</p> <p>Road Safety: This option should improve road safety through the conversion of the route from single to dual carriageway</p>	<p>Key Weaknesses:</p> <p>Implementation timetable from inception to delivery: Due to requirement for acquisition of third party land, other environmental constraints and construction of significant infrastructure, this option may take longer time period for delivery and add significant cost.</p> <p>Environmental: There are a number of prehistoric Saxon and medieval artefacts found. Further work required to understand the mitigation measures required.</p>
Cost Estimates: £54.0 to £80.0m	OVERALL PERFORMANCE

A47/A12 Vauxhall Roundabout Great Yarmouth

Scheme Description: Station approach signalisation and full signalisation of Vauxhall Roundabout. The station approach option could potentially introduce right hand turns from station approach road onto Acle New Road (existing arrangement does not allow right hand turn). Larger roundabout, fully signalised with dedicated left turn for A149 to A12, will require a new bridge over the railway alongside the existing A12 bridge. Significant earthworks/retaining walls could potentially be required.	
<p>Key Strengths:</p> <p>Capacity: Larger roundabout with signal control should provide overall improvement to capacity.</p> <p>Growth: potentially enables growth in the Great Yarmouth where growth is anticipated.</p> <p>Well being: No significant changes for NMUs.</p>	<p>Key Weaknesses:</p> <p>Practical feasibility: By removing the significant U-turn, this option should improve both the capacity and safety of the Vauxhall roundabout. However, it could potentially increase delays to users of the A149 Acle New Road from Vauxhall towards Fullers Hill.</p> <p>Buildability: Ownership of the former petrol station access to A149 needs to be established.</p> <p>Implementation timetable from inception to delivery: The construction of a new bridge adjacent to the existing A12 bridge will involve acquisition of third party land. Construction of a new bridge over the railway potentially could also result in a longer construction timetable.</p> <p>Public acceptability: Potential disruption to local residents and businesses. Significant land-take could potentially be required from the Vauxhall Holiday Park.</p> <p>Buildability: Proposed works are very close to railway line which may present additional complexity. Ground conditions are reputed to be poor potentially requiring special construction methods and therefore the risk of post construction differential settlements could potentially be considered during detailed design and construction stage.</p> <p>Environment: Are within close proximity to a National Park and are located within close proximity to Breydon Water Ramsar, SPA and SSSI.</p>
Cost Estimates: £20.0m to £29.0m	OVERALL PERFORMANCE

A12 Breydon Bridge – Second Bridge

Scheme Description: Additional bridge alongside existing bridge. This option provides a dual carriageway link between Vauxhall and Gapton Hall roundabouts. It includes a new bridge over the railway line and an additional bridge over Breydon Water alongside the existing bridge.

Key Strengths:

Capacity: Conversion of this link from single to dual carriageway should significantly improve both safety and capacity.

Growth: potentially enables growth in the Great Yarmouth where growth is anticipated.

Well Being: Negligible adverse impact on pedestrian areas

Key Weaknesses:

Implementation timetable from inception to delivery: Due to existing ground conditions, there are significant buildability issues and special geotechnical measures could potentially be required to address them. In addition, there could potentially be major works required on the existing carriageway. Therefore, this option may take significantly longer timescale than typical for delivery.

Public Acceptability: This proposal could potentially require acquisition of third party land. Highly sensitive environmental area and therefore might not win public acceptability.

Environment: The Breydon Water complex (SPA, Ramsar, SSSI, Local Nature Reserve) is an important habitat which will be directly affected by the proposed works. A second river crossing and extended carriageway will potentially impact priority habitats and protected species, such as birds and otters. Possible replacement of habitats.

Cost Estimates: £150m to £300m

OVERALL PERFORMANCE

A12 Gapton Roundabout

Scheme Description: Conversion of roundabout to full signal control with selective entry and exit widening. This option comprises full signalisation of the existing roundabout. The benefit of signal control could potentially be maximised by providing additional lengths of entry and exit taper where appropriate to make best use of the existing traffic lanes

Key Strengths:

Capacity: Signalisation and widening should improve both the capacity and safety the junction.

Growth: potentially enables growth in the Great Yarmouth where growth is anticipated. Potential to facilitate possible Third River Crossing proposals and potential traffic reassignment.

Implementation timetable from inception to delivery: As the option only includes localised junction improvement, it could be delivered within a short timescale.

Public Acceptability: As the proposal could potentially be within highway boundaries and there could potentially be no need to take land from the adjoining properties, it could be acceptable to the public.

Key Weaknesses:

Buildability: Some disruption to existing road users during construction.

Cost Estimates: £3.0m to £4.0m

OVERALL PERFORMANCE

A12 Harfreys Roundabout

Scheme Description: Enlarged signalised 'lozenge' roundabout (all arms signalised). Enlarge the diameter of the roundabout. Carriageway widening on A12 north approach to provide 4 lanes (2 lanes plus nearside and offside flares). Carriageway widening on A12 south approach to provide 4 lanes (2 lanes plus nearside and offside flares). North and southbound circulatory carriageway widened to three lanes (included dedicated right turn lane)

Key Strengths:

Capacity: Signalisation and widening should improve both the capacity and safety the junction.

Growth: potentially enables growth in the Great Yarmouth where growth is anticipated. Potential to facilitate possible Third River Crossing proposals and potential traffic reassignment.

Implementation timetable from inception to delivery: As the option only includes localised junction improvement, it should be delivered within a short timescale.

Public Acceptability: As the proposal could potentially be within highway boundaries and there could potentially be no impact on the adjoining properties, it should be acceptable to public.

Cost Estimates: £8.0 to £10.0m

Key Weaknesses:

Buildability: Some disruption to existing road users during construction.

OVERALL PERFORMANCE

A12/Bridge Road

Scheme Description: Northbound A12 widening to provide an additional left turn lane into Brasenose Avenue. This option includes provision of left turn lane into Brasenose Avenue and requires realignment of footway to accommodate additional widening.

Key Strengths:

Capacity: there could be an expected overall improvement to capacity.

Growth: potentially enables growth in the Great Yarmouth where growth is anticipated.

Road Safety: Due to reduction in queuing traffic, the safety along the route and for the right turning traffic into the hospital could improve. As A12 queuing along the northbound could reduce, the capacity of the junction could improve.

Well Being: Realignment of footways/cycleway potentially be required. However, there should be no adverse impact on the pedestrian desire lines.

Cost Estimates: £300k to £500k

Key Weaknesses:

Public Acceptability: This proposal could potentially require a small amount of acquisition of third party land and therefore might not have public acceptability.

Implementation timetable from inception to delivery: As the option could potentially require acquisition of third party land and realignment of the footways/cycleway, this option should be delivered within short to medium timescale

OVERALL PERFORMANCE

A12/James Paget Hospital

<p>Scheme Description: Four lane A12 northbound with a long left turn lane and a short right turn flare. This option comprises the provision of a long left turn lane and a short right turn flare on the A12 northbound approach.</p>	
<p>Key Strengths:</p> <p>Capacity: The reconfiguration of the junction could potentially result in a significant improvement to capacity.</p> <p>Growth: potentially enables growth in the Great Yarmouth where growth is anticipated.</p> <p>Well Being: Negligible adverse impact on pedestrian areas.</p> <p>Road Safety: The proposed scheme will target collision types at this location involving access and approach to the junction, however the collision number is low</p>	<p>Key Weaknesses:</p> <p>Public Acceptability: This proposal could potentially require acquisition of third party land (to be confirmed) and therefore might not have public acceptability</p> <p>Implementation timetable from inception to delivery: As the option could potentially require acquisition of third party land and realignment of the footways/cycleway, this option should be delivered within short to medium timescale.</p>
<p>Cost Estimates: £400k to £600k</p>	<p>OVERALL PERFORMANCE</p>

A12 Beacon Park Roundabout

<p>Scheme Description: Enlarged signalised roundabout. This option comprises a significantly enlarged roundabout. It includes provision of full signalisation of all approaches and additional lanes on both Beaufort Way and Links Road.</p>	
<p>Key Strengths:</p> <p>Capacity: The signalisation and enlargement of the roundabout should improve capacity.</p> <p>Deliverability: Subject to land being available, there appears to be no significant constraints to delivery.</p> <p>Road Safety. It should be noted that there are currently no significant safety issues that have been identified in this area.</p> <p>Well Being: Realignment of footways/cycleway could potentially be required. However there appear to be no negative impact on the pedestrian/cyclist desire lines due to the realignment</p>	<p>Key Weaknesses:</p> <p>Implementation timetable from inception to delivery: The large-scale scheme combined with potentially complex traffic management during construction may result in a medium to long timescale for delivery.</p> <p>Public Acceptability: This proposal could potentially require acquisition of third party land and therefore might not have public acceptability.</p> <p>Road Safety: The proposed scheme has the potential to increase the number of collisions recorded at this location from current, however it is considered a preventative measure due to ongoing developments in the area.</p> <p>Environment: The proposed improvements to the Beacon Park Roundabout will potentially have noise and air quality adverse impacts due the carriageway moving closer to residential properties. There is one property within 5m to the west of the junction, and a number of properties within 50m. Precautionary at this stage.</p>
<p>Cost Estimates: £7.0m to £12.0m</p>	<p>OVERALL PERFORMANCE</p>

ACLE STRAIGHT: REMEDIAL MEASURES IN THE SHORT TERM

The evidence gathered suggests that the A47 between Acle and Great Yarmouth will potentially not reach capacity until about 2031. It is therefore premature to consider capacity improvements in detail at this time.

Environmental constraints could potentially need to be overcome in order to progress significant capacity improvements and in the short term it could potentially be beneficial to investigate appropriate mitigation measures that may be required. This will be carried out working with Natural England and the National Park Authority

In addition measures will continue to be delivered to reduce collisions, and their severity, where “appropriate.”

A12/STATION SQUARE/WAVENEY ROAD

During 2014 Suffolk County Council (SCC) appointed consultants to provide a comparative assessment of the 3 indicative locations for a new crossing of Lake Lothing shown in the Lowestoft Transport and Infrastructure prospectus 2013-2025.

The study included a consultation exercise to engage stakeholders and the public to obtain their views on a road crossing.

At their Cabinet meeting on 27 January 2015 the County Council agreed to forward the conclusions of the work to government for consideration when drawing up their programme of improvements for the A47/A12.

SUMMARISING FINDINGS

Listed in **Table 4.1** is a summary of the options qualitative performance against key criteria

* NB: Acle Straight – safety improvements at key hotspots have not been assessed against this criteria. Planned joint working with Natural England to be arranged to establish the environmental impacts and mitigation of relocating the dykes. Station Square, Waveney Road, Lowestoft – this has also not been assessed against this criteria. Suffolk County Council (SCC) are considering a forward plan as indicated above.

Table 4.1 Identification of best performing options

Challenge	Strategic	Economic	Financial	Delivery	Commercial	Overall Performance
A1 Wansford and Sutton	✓	-	✓	✓	✓	
A1 Wansford and Sutton	✓	-	✓	✓	✓	
A47/A1260 Nene Parkway	✗	-	✓	✗	✓	
A47/A15 Dogsthorpe Interchange	✗	-	✓	✓	✓	
A47/A141 Guyhirn	✓	-	✓	✓	✓	
A47/A17 Pullover Junction	✗	-	✓	✗	✓	
A47 North Tuddenham to Easton (incl. Honingham)	✓	-	✓	✓	✓	
A47/A11 Thickthorn Interchange	✓	-	✓	✗	✓	
A47 Blofield/Burlingham	✓	-	✓	✓	✓	
A47/A12 Vauxhall Roundabout Great Yarmouth (ASDA)	✓	-	✓	✓	✓	
A47/A12 Vauxhall Roundabout Great Yarmouth	✓	-	✓	✓	✓	
A12 Breydon Bridge	✓	-	✓	✗	✓	
A12 Gapton Roundabout	✓	-	✓	✓	✓	
A12 Harfreys Roundabout	✓	-	✓	✓	✓	
A12/Bridge Road	✓	-	✓	✓	✓	
A12/James Paget Hospital	✓	-	✓	✓	✓	
A12 Beacon Park Roundabout	✓	-	✓	✗	✓	

CONCLUSION

On the basis of these results we have prioritised the following. The emerging options were examined and scrutinised against set criteria as set out in section 4.2. Following this the link and junction challenges that have an overall performance of green and amber have been prioritised for further assessment which are:

- A1 Wansford to Sutton
- Easton to Tuddenham
- Blofield to North Burlingham
- A47/A141 Guyhirn
- A47/A11 Thickthorn Junction
- A47 Acle Straight

Also the challenges identified in Great Yarmouth has been grouped into two packages as this recognised their interaction with each other and could potentially provide a cohesive strategy, potentially enhancing the status of the options in Great Yarmouth:

A12 Package 1

- Vauxhall Roundabout and Station/Asda access junction

A12 Package 2

- Gapton Roundabout
- Harfreys Roundabout
- Bridge Road
- James Paget Hospital