The Norfolk County Council (Norwich Northern Distributor Road (A1067 to A47(T))) Order

Applicant's comment on Written Representations by Gail Mayhew

Planning Act 2008

Infrastructure Planning

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

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Introduction

This document provides the Applicant's responses in respect of selected issues raised by Gail Mayhew in her Written Representation to the Examining Authority dated 30 June 2014. The Written Representation covers many issues. Some of these have been addressed elsewhere (including the Applicant's comments on Relevant Representations, and the Applicant's comments on other Written Representations). Therefore a limited selection of issues raised have been extracted and comments provided.

The points have been responded to where possible in the order they were raised. Each issue, or in some cases a summary of it, is shown in italics.

Applicant's comment on Written Representations

Representation

1.1.	*Detailed Representation regarding developer funded Inner Link Road*

Applicant's comment

1.1.1. Chapter 3 of Volume 1 of the Environmental Statement (Document Ref 6.1) explains the consideration given to potential alternatives. Section 3.15 discusses Alternative 5 which comprises developer link roads between radials (within the growth areas).

1.1.2. Further analysis using the DCO transport model for alternatives is provided in The Traffic and Economic Appraisal of NDR Alternatives (Document Ref 5.12). Section 8 of the report provides an analysis for Alternative 5. Conclusions are summarised in Section 9 and for Alternative 5 this includes:

> *"Alternative 5 (developer link roads) singularly fails to reduce traffic on inappropriate routes and relieve the existing network. Whilst the Alternative includes the city centre traffic management measures the reductions of cross city centre traffic are much smaller compared with the DCO Scheme, especially for trips crossing the Outer Ring Road Cordon. The junction analyses show that North Walsham Road and Wroxham Road junctions would operate substantially over their theoretical capacity with long queues and delays, with delays of over 10 minutes at North Walsham Road Junction in the 2032 AM peak, and 5 minutes in the 2032 PM peak. On these grounds the developer link roads would not operate satisfactorily and they would cause particularly severe difficulties in implementing the proposed shared use high street-type design envisaged in the development proposals. The delays would also mean that the Alternative would fail to meet the improved transport connectivity objective for the Scheme".*

1.1.3. The Norwich Area Transport Plan (NATS) sets out to reduce rat running in north Norwich. This is explained in 3.5.4 (policies 5 and 6) of the Environmental Statement (Document Ref 6.1) but it would not be possible to achieve this without an alternative to serve these movements given the constraints in the network which are explained in section 3.4.

1.1.4. For the Beyond Green planning permission for North Sprowston, Old Catton the development is proposed to provide an internal east west street which will ultimately span four radial routes from St Faiths Road to Wroxham Road. All the roads within this development, including the east west route, will have a 20mph speed limit to make it easier for pedestrians to cross streets at any point. Speeds will be kept low through design rather than enforcement, using features such as short lengths of street between junctions, narrow carriageways, on street parking, limiting forward visibility and the use of shared space on some tertiary streets.

Representation

1.2.	*Detailed Representation regarding Local Rail Strategy*

Applicant's comment

1.2.1. In 2003 a study was undertaken on Light Rapid Transit Study for Norwich as part of the evidence base to inform the review of NATS which led to the adoption of a revised NATS including the NDR. Modes considered included guided bus, ultra light rail and tram. The study considered conceptual route options, with appraisal undertaken to examine outline economic feasibility of preferred route and mode options.

1.2.2. The 2003 study informed the work on strategy options documented in the 2005 NATS Options Assessment Report and is referenced within the report in Section 4.3.1(see appendix A). These included light rail as a strategy option, which was recommended for rejection on affordability and financial sustainability grounds.

1.2.3. Further consideration was given to light rail in 2007 - 2008 during the development of public transport options for the NDR Major Scheme Business Case (MSBC) refer to Technical note on the assessment of public transport options included in Appendix B. Four options were assessed against the NATS and NDR objectives, including:

1.2.4. Option 2A - A Bus Rapid Transit (BRT) system linking key housing and employment growth locations and the city centre, complemented by road user charging or workplace parking charging within the Inner Ring Road, implementation of physical measures to remove through traffic from the city centre and improvements to junctions on the Inner and Outer Ring Roads.

1.2.5. Commentary on this option - “This option is proposed as a more affordable alternative to the light rapid transit option considered and appraised during the 2002-2004 NATS Review. If a light rail option is likely to be discarded on affordability and financial sustainability grounds, it would be appropriate to consider BRT as an intermediate mode between conventional bus and light rail. “

1.2.6. Option 2B - A Light Rail Transit (LRT) system linking key housing and employment growth locations and the city centre, complemented by road user charging or workplace parking charging within the Inner Ring Road, implementation of physical measures to remove through traffic from the city centre and improvements to junctions on the Inner and Outer Ring Roads.

1.2.7. Commentary on this option - “There is a case to be made that sufficient work has already been done on this option to justify discarding it on affordability and financial sustainability grounds, but it has been retained at this stage of the process to enable a comparative assessment of Bus Rapid Transit and Light Rail Transit.”

1.2.8. The assessment concluded that Options 2A and 2B performed similarly against both the NATS and NDR objectives and thus Option 2A (Bus Rapid Transit) should be preferred over Option 2B (Light Rail) on grounds of

practicality and affordability, as it was considered that BRT was more likely than LRT to be economically viable to serve a city of the scale of Norwich.

1.2.9. It is thus possible to demonstrate that the potential for light rail was considered at a strategy level during the period 2003-2005 and prior to the adoption of a revised NATS including the NDR. Light rail was also considered at a plan level as a potential alternative to the NDR during the preparation of the MSBC. The outcome of this process was the inclusion of proposals for Bus Rapid Transit within the NATS Implementation Plan in preference to Light Rail Transit, with BRT being identified as complementary to the NDR rather than an alternative to it.

Representation

1.3. *At present the proposed route of the NDR cuts the Marriott's Way, and unless redesigned, would foreclose on the potential for this route to be reopened as a rail or light rail corridor in the future.*

Applicant's comment

1.3.1. Norfolk County Council does not consider that the NDR forecloses on any future proposal for light rail along Marriott's Way although it acknowledges that this is likely to require a replacement bridge over the NDR.

1.3.2. NCC is unaware of any formal proposals for light rail on Marriott's Way, the feasibility of such a proposal or the level of its support. It considers that Marriott's Way is important recreational route for pedestrians, cyclists and horse riders and well as wildlife. It forms part of National Cycle Route No. 1 and has been identified as a significant route for local bat populations. Accordingly where it crosses the NDR it has been designed as a green bridge to accommodate these users.

Appendix A

Norwich Area Transportation Strategy

Options Assessment Report

August 2005

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Norwich Area Transportation Strategy

Options Assessment Report

Issue and Revision Record

Rev	Date	Originator	Checker	Approver	Description
A	04/10/04	M Payne & M Frith	B Witten	J Skillings (NCC)	First Issue
B1	08/10/04	M Payne & M Frith	B Witten	J Skillings (NCC)	Revised to address further NCC comments
B2	15/10/04	M Payne & M Frith	B Witten	J Skillings (NCC)	Costs and benefits for Option 1 updated
C	30/11/04	M Payne & M Frith	B Witten	J Skillings (NCC)	Updated with additional NCC comments
D	10/08/05	M Frith	M Payne	B Witten	Revised to show new NDR costings
E	11/08/05	M Frith	M Payne	B Witten	Revised to add new environmental information

Executive Summary

This report has been compiled to assess options for updating the current Norwich Area Transportation Strategy (NATS) in order to address the problems and issues identified within the NATS area. In accordance with the updated aims and objectives adopted for the new strategy, the options considered look to build on the strengths of the present transportation system in a sustainable manner, seeking to maintain the economic health of the Norwich area whist minimising the impact on its environmental resource.

Over 30 possible interventions have been considered. These have been assessed against the current problems and issues, and the updated NATS aims and objectives. The assessment results have then been used for a coarse sieving process, leading to the identification of interventions to be assessed in more detail.

These interventions have been combined to produce the following six strategy options for further appraisal:-

- Northern Distributor Route (NDR) and complementary transport measures
- Half length NDR and complementary transport measures
- Three quarter length NDR and complementary transport measures
- Orbital bus route with associated traffic management measures
- Light rapid transit scheme with associated traffic management measures
- Measures to encourage modal shift to sustainable modes of transport

Assessment has been carried out to ascertain the beneficial and adverse impacts of each strategy option, in accordance with the Department for Transport's Transport Analysis Guidance. Options have been assessed against the Government's five transport objectives: Environment, Safety, Economy, Accessibility and Integration, and also against local and regional objectives.

The assessment indicates that the strategy options including the NDR and complementary transport measures give the most economic benefit, to varying degrees dependant on length, but would also give the most adverse impacts in relation to environmental objectives. These options also best answer the problems and issues identified within the NATS area.

The two public transport options considered, i.e. those including the orbital bus route and the light rapid transit scheme, would both provide some benefit to the areas they are applied to, but would not fully address the problems and issues across the whole NATS area.

The combination of an orbital bus route with the NDR and complementary measures option would ensure that the new NATS strategy is socially inclusive by improving accessibility to sites around the periphery of Norwich for both those with and without

access to a car. Enhancement of the existing non-motorised user policies would further ensure that alternative transport options are fully integrated within the NATS strategy.

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1 Introduction

The current Norwich Area Transportation Strategy (NATS) was adopted in 1997, replacing the strategy that had been in place since 1991. It set out a transportation strategy for the Norwich area (see Figure 1.1) to the year 2011, and sought to improve accessibility by building on the strengths of the present transport system. Growth in trips was to be accommodated by alternatives to the car by providing improved facilities for cycling and walking, improving bus services and continuing the development of Park and Ride.

The 1997 strategy has now been reviewed with the aim of providing an updated set of policies and programmes for transport investment and management in the Norwich Area to 2016, and to give an indication of transport options to 2025.

The purpose of this report is to bring together the individual strands of work undertaken for the NATS Review in a concise document that will inform the final decision to adopt a preferred strategy.

The report outlines the work carried out by Norfolk County Council and Mott MacDonald to assess transportation interventions that could be considered for adoption as part of the overall review of NATS. It explains the process through which the long list of interventions initially considered was distilled into a smaller number of strategy options combining the most effective interventions with other complementary measures, and presents an assessment of these options against national, regional and local objectives.

Chapter 2 looks at the current problems and issues with transportation within the Norwich area.

Chapter 3 outlines the updated aims and objectives adopted for the new NATS strategy.

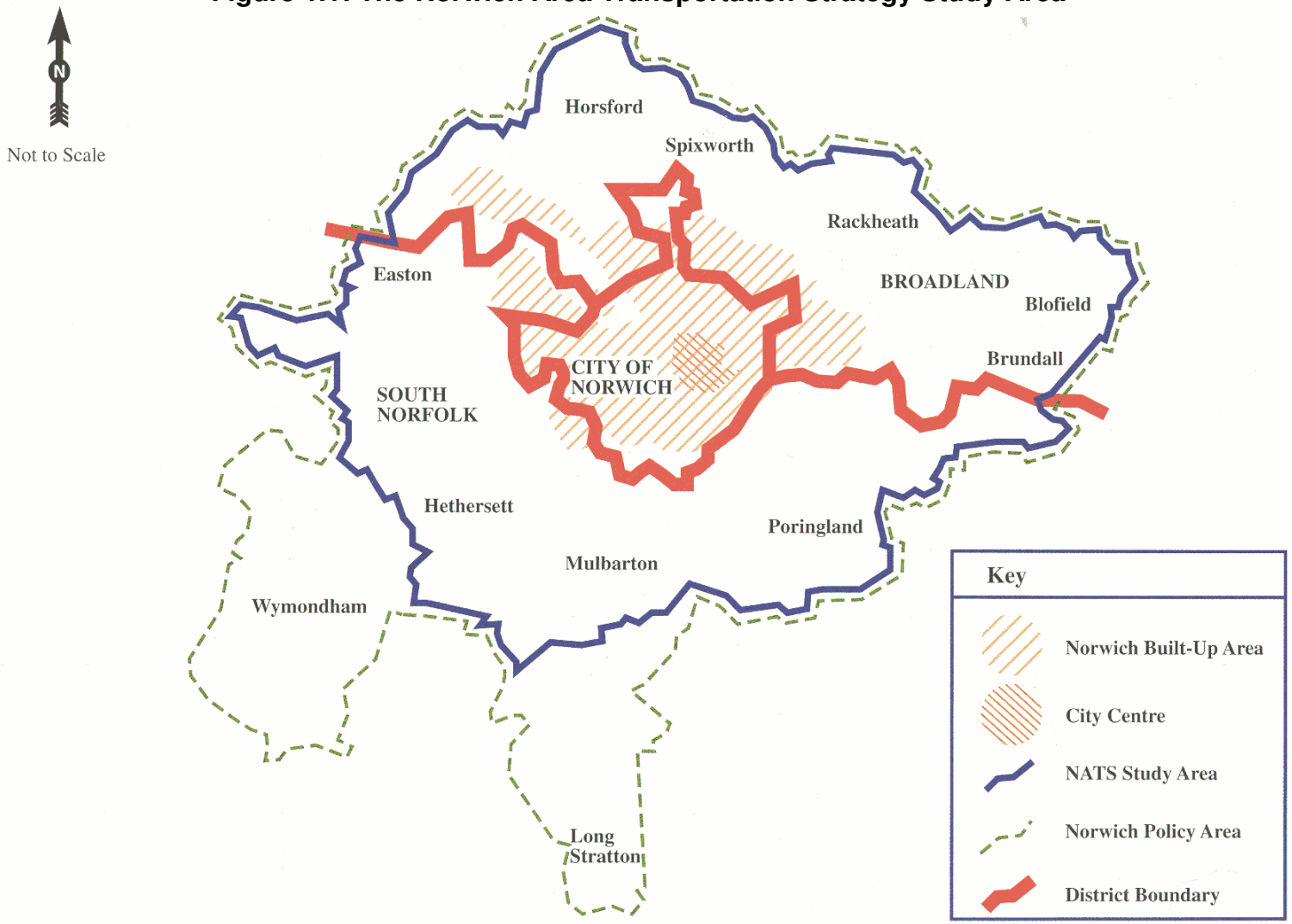
Chapter 4 discusses possible interventions available and presents an assessment of these against the current problems and issues, and the updated NATS aims and objectives. The assessment results are then used for a coarse sieving process, leading to the identification of interventions to be assessed in more detail. These interventions are combined to produce four strategy options for further appraisal.

Chapters 5 and 6 then consider how the selected strategy options perform when assessed in accordance with Government guidance. The guidance directs assessment to be carried out against both national and local objectives.

Chapter 7 discusses the key issues arising from the assessment, and Chapter 8 presents the conclusions drawn from the available information and analysis undertaken.

The report is a joint production between Norfolk County Council and Mott MacDonald, under their Strategic Partnership arrangement.

Figure 1.1: The Norwich Area Transportation Strategy Study Area



2 Problems and Issues

2.1 Introduction

This section sets out a summary of the Problems and Issues relating to the NATS area. This summary is based on the report "Transport Related Problems and Issues in the Norwich Area" produced by Norfolk County Council. An outline of the population and growth pressures on the NATS area is followed by a review of problems and issues by transport mode.

2.2 Population and Growth Pressures

The population of the NATS Area is rising faster outside the Norwich City administrative area than within it. There has been much recent house building in wards including Thorpe, Drayton, Horsford, Rackheath, Sprowston and Taverham.

In order to meet central government housing targets some 30,000 additional dwellings will be needed within the Norwich Policy Area by 2025. The Norwich Policy Area includes the whole of the NATS area but extends beyond it to encompass the market towns of Wymondham and Long Stratton (see Figure 1.1). The councils within the Norwich area are bound to comply with these targets. Around 14,000 of these houses are already permitted or allocated, but significant new housing allocations will need to be made to reach the 30,000 target. It is likely that these will include major housing growth concentrated on greenfield land as part of a mixed-use development on the north-east fringe of Norwich, somewhere between the B1150 North Walsham Road and the A47 (East).

Much of this area benefits from reasonable proximity to the city centre and could be well served by public transport. However, there are poor existing road links between the area and the city centre. New housing here would be reasonably close to existing superstores and employment opportunities around the airport and the St. Andrews and Broadland Business Parks. A large new development could also enable the comprehensive provision of transport infrastructure and services and contribute to their funding.

Since adoption of the 1997 NATS strategy, there has been development of Broadland Business Park and the Longwater Employment Area. Development of major superstores outside the city centre has continued: Tesco on Blue Boar Lane, Sainsbury's at Longwater and Pound Lane and expansion of Asda at Hellesdon. There has also been the relocation of the Norfolk & Norwich Hospital from the city centre to Colney. Together with a decline in smaller shops, this has led to changes in travel behaviour. New growth, including edge of city development and more complex commuting patterns, are likely to have replaced, at least in part, traditional in/out flows.

The consequent changes in traffic flows have increased pressure on parts of the existing road network, particularly those used for orbital journeys, and it is difficult for

public transport to cater for the new and more diverse travel patterns that have arisen from these changes in where facilities are concentrated.

Norwich attracts large numbers of people from considerable distances to shop, work and enjoy the many leisure and entertainment attractions. It is over 60 miles to a comparable range of employment opportunities, and 100 miles to a rival retail centre (in terms of overall ranking). Between 1995 and 1999, the number of jobs in the city increased by 3.4% compared to a national figure of 8.9%. In Norfolk, over the 10 years between 2000 and 2010, Business Strategies Ltd predicts that employment will increase by 9%, and as far as the Norwich Area is concerned, much of its share of this growth will occur at the major new employment areas along the A47 Southern Bypass.

2.3 Existing Road Network

The road network in the NATS area is characterised by a pattern of radial routes converging at the city centre. Two ring roads, both well within the built up area, cater for orbital movements and north-south through traffic. The Outer Ring Road is some 2-3kms from the centre with the built-up area extending beyond. The A47(T) Norwich Southern Bypass opened in September 1992 and carries east-west through traffic. The Southern Bypass also acts as an orbital distributor road to the south of Norwich. There is no equivalent in the north of Norwich beyond the Outer Ring Road.

Traffic levels are monitored on cordons at the Inner and Outer Ring Roads. Between 1989 and 1998, traffic crossing the Outer Ring Road has grown by an average of 0.8% per annum. Government forecasts of traffic growth in Norwich from a base year of 1995 range from 9% to 25% by 2006 and 13% to 36% by 2011.

The ring roads are generally single carriageway roads with ‘at-grade’ junctions. Developments, particularly in recent years to the north of the city, have increased the number of junctions and access points onto the ring roads, compromising their ability to cater for traffic movements.

A study of junctions on the Inner and Outer Ring Roads has been carried out as part of the present NATS Review. This work identified junctions and other sites that are, or will be, causing delays. The worst sites are indicated on Plan No. 15 of the Problems and Issues Report. The recommendations of this study led to the inclusion of a programme of works on the Inner and Outer Ring Roads in the current Local Transport Plan (LTP) programme, but extending beyond the period covered by the current LTP to 2008. In addition, the study identified a number of other improvements that could be undertaken, but which would involve work on a greater scale, perhaps involving the acquisition of land. These have not been included in the LTP programme.

Journey time surveys were carried out in 1989 and repeated in 2002. Overall, average speeds in the Norwich built up area are similar to those found in 1989, with journey speeds of 19.2mph in the city centre (inside the Outer Ring Road) in 2002. However, observation would suggest that congestion and delay has worsened since the 1997 NATS strategy was adopted, particularly on the ring roads to the north of the city. It is difficult to verify this from the journey time surveys, although it does

appear that journey times on orbital or cross-city routes have increased, especially in the south-west area of the city.

The roads that link the main radial routes are generally substandard, with limited width and restricted visibility at junctions. Many of the rural junctions have poor accident records. In the built-up area, the links pass through residential areas. Some roads, in particular, experience heavy traffic and severe congestion, such as Middleton's Lane, Hellesdon, which is a residential street with schools and shops.

2.3.1 Traffic in the Periphery of the Built up Area

Most orbital trips around the south of Norwich are made using the Norwich Southern Bypass. Orbital movements around the north, however, cause particular problems on the edge of the built up area. There are a number of particular routes or individual roads on which traffic is a problem including roads through residential areas as well as minor rural roads.

The North West Sector Study was undertaken by Norfolk County Council in 1996 (using traffic count data from 1993). Sixty-five percent of traffic travelling along the outer ring road between the A47 and the A1067 did not have an origin or destination within the north-west sector (i.e. it was through traffic).

2.3.2 Road Safety

Norfolk County Council carried out an assessment in 2002 of possible reduction in accidents at known cluster sites arising from the placement of a new distributor route to the north of Norwich. This showed that provision of a single carriageway road could result in up to 40 fewer accidents per year. Provision of a dual carriageway could result in up to 60 fewer accidents per year.

2.4 Public Transport

2.4.1 Bus services

The majority of bus services in the NATS area are provided by First on a commercial basis with no public subsidy. The bus network is characterised by cross-city routes operating via the radial road network to and from the city centre (Plan No. 12 of the Problems and Issues Report). At present it is necessary to change services in the city centre for many orbital trips, however the County Council has been successful in securing Urban Bus Challenge funding to operate an orbital service at a 30 minute daytime headway on Mondays to Saturdays for a period of up to three years. A contract for this service has been awarded, and it is expected to commence in November 2005.

There are relatively few routes with extensive penetration beyond the suburbs and nearby market towns. Cost pressures within the bus industry have led to operators abandoning the commercial operation of marginal services from the rural hinterland and concentrating their resources on a core network of urban and inter-urban routes.

Approximately 12% of passengers arrive in Norwich by services from outside the NATS area, compared to 88% on city and suburban services.

Bus passengers crossing the Outer Ring Road have been counted annually. Counts show an increase in the numbers of bus passengers. Numbers have increased on both local bus and Park and Ride services.

Increasing levels of congestion are undermining the operation and attractiveness of bus services in the City. Bus journey times are becoming longer and journey times are increasingly unreliable. Some bus operators have reduced the frequency of bus services in order to restore the reliability of the service without having to commit additional resources. This problem is likely to get worse as traffic levels increase in the future.

2.4.2 Park and Ride

There are currently six purpose-built Park and Ride sites in operation around Norwich at Costessey (north west of the City), the Airport (north), Sprowston (north east) Postwick (east), Harford (south) and Thickthorn (west). Park and Ride services experience similar difficulties to local bus services, in terms of getting held up in congestion and the consequent unreliable journey times.

2.4.3 Rail

Rail travel provides an opportunity for commuting and visitor trips from some outlying villages within the NATS area and further afield. Local services provide commuter and visitor links to surrounding towns and villages, to the north along the 'Bittern Line' to Sheringham via Cromer. In the NATS area, there are stations on this line at Norwich and Rackheath. In addition, Brundall and Brundall Gardens stations on the 'Wherry Lines' from Norwich to Great Yarmouth and Lowestoft are also within the NATS area.

The County Council is an active member of the Community Rail Partnerships established for both the Bittern and Wherry Lines. These partnerships have been highly successful in promoting use of these services and delivering passenger growth, but the capacity of the existing rolling stock is a constraint on further growth in patronage.

The recent commencement of the new 10 year Greater Anglia rail franchise should ensure a period of stability for local rail services, but does not offer the prospect of any significant enhancement of existing service levels within the duration of the franchise.

2.5 Cycling

The cycle network in the NATS area comprises a mix of on-road and off-road facilities. A strategic cycle network has been identified and work has been undertaken, albeit often on an ad-hoc basis, to implement this, although opportunities are increasingly being taken to introduce cycle facilities as an integral part of highway

schemes. However, the cycle network is not complete and there are many locations where there is no special provision for cyclists and they have to use the highway. The number of cycle trips has remained at a stable level.

2.6 Pedestrians

Within the built-up area there are generally facilities for pedestrians in terms of footways (pavements). There are many busy roads that are difficult to cross, with only limited pedestrian crossing provision, although greater priority was given in the 1997 NATS strategy to improving pedestrian facilities and the number of schemes implemented in recent years has increased accordingly. At some junctions, pedestrians experience significant delays when crossing.

Many of the rural roads within the NATS area, including those increasingly used by traffic for orbital journeys around the north of Norwich, have no footway provision and pedestrians have to walk in the road.

2.7 Norwich International Airport

Norwich International Airport lies to the north of the built up area of the city at Hellesdon and has about 1,000 full-time employees based on the site. It is designated a 'Regional Connecting and Accessibility Point' under the European Union's guidelines on Trans-European Networks.

Having sought a private sector partner to secure development of the airport, the City and County Councils sold an 80% stake in the airport to Omniport PLC in March 2004. Omniport has provided a commitment for substantial capital investment to make essential infrastructure improvements at the airport. This is expected to secure continued, future growth at the airport.

Currently the airport serves Amsterdam, Aberdeen, Belfast, Cardiff, Dublin, Edinburgh, Glasgow, Jersey and Manchester with scheduled flights. New Flybe scheduled services to Alicante, Chambery, Geneva and Malaga are due to commence in autumn/winter 2005. Holiday services serve 15 locations during the summer and Alicante, Malaga, Malta, Gran Canaria and Tenerife in the winter. Summer 2006 will see the introduction of new charter services to Bodrum in Turkey and Bulgaria.

Norwich is one of the fastest growing airports in the country, seeing an 83% increase in passengers since 1993/4. Some 390,000 passengers used it in 2000/01, and passenger numbers increased to 450,000 in 2004/05. The recent arrival of low-cost carriers Air Wales and Flybe is expected to underpin a significant further increase in passenger numbers at Norwich over the next few years, and the airport is now forecasting around 1.1 million passengers by 2007.

To accommodate this expansion the airport terminal is set to undergo a £4m redevelopment programme to increase capacity from around 700,000 passengers to between 1.2million and 1.5million.

Longer term forecasts produced by Norwich International Airport Limited are for up to 1.57 million passengers per annum (high growth) by 2020.

Travel surveys carried out during 1999 showed that 73% of passengers and visitors to the airport arrived by car – with a further 20% arriving by taxi. Public transport links to the airport are currently limited to hourly daytime bus services from the city centre, Aylsham, Cromer and Sheringham. A study undertaken by Arup Economics and Planning (2002) concluded that surface access is one of the potential constraints on growth at the airport. To achieve a high rate of growth without major investment in road infrastructure would require a significant modal shift. Up to 2.4 million passengers per annum in 2030 could be accommodated on the road network without major road improvements, provided that the car driver modal share was reduced to about 40% from the current 80%. This seems unrealistic, even with improvements to access arrangements for non-car modes and demand management through parking constraints. Failure to achieve such mode targets could restrict the growth of the airport unless major improvements to access are made. Norwich International Airport has completed a draft Surface Access Strategy which includes targets for mode share to the airport.

2.8 Freight

Strategic freight issues include congestion on the road network and access to Norwich from the rest of the country. Of particular interest is access to and around the north of Norwich and beyond to North Norfolk.

Within the urban area of Norwich the presence of large numbers of goods vehicles raises problems including:

- increased congestion and severance
- emissions
- illegal parking and enforcement issues, particularly in the historic streets and pedestrian areas
- noise, vibration and disturbance – particularly from night-time deliveries
- fear and intimidation for pedestrians and cyclists
- visual intrusion

Changes in retail distribution practices such as reduced stock holding and 'just in time' delivery have created increased demand for more frequent, smaller deliveries to retail premises in Norwich.

2.9 Strategic Links into the Area

According to the "Shaping the Future" Strategy (the economic strategy for Norfolk), 20% of Norfolk businesses considered the "lack of communication links/transport infrastructure" to be the principal barrier to growth. The East of England Development Agency's Regional Economic Strategy (East of England 2010) and Shaping the Future view high quality transport infrastructure as being essential to

ensure the future prosperity of Norfolk. Shaping the Future includes the following as strategic priorities:

- A growing regional airport in Norwich – passenger numbers of 466,000 by 2004 and 736,000 by 2010
- Preferred route for a Northern Distributor Road determined by 2004 and built by 2010.

The recent development of low-cost scheduled services could see 700,000 passengers using the airport as early as 2006.

2.10 Existing Environmental Designations

Norwich and its surrounding countryside are very important in terms of the wider environment. The area contains a significant number of environmental designations; which vary from those that protect important international nature conservation areas to those that are local or regionally important in cultural heritage terms such as Conservation Areas and listed buildings.

Examples of these constraints are detailed below:

- The River Wensum has been designated as a SAC (Special Area of Conservation) through the Habitats Regulations 1994 which implements the Conservation (Natural Habitats) Regulations 1994 and the Birds Directive in the UK.
- The same area of the River Wensum has also been classified as a Site of Special Scientific Interest (SSSI). This is implemented through the Wildlife and Countryside Act and the Countryside and Rights of Way Act.
- County Wildlife Sites (CWS) have been classified throughout the county. A significant number fall with in the study area– these sites are protected through the implementation of local plan policies.
- Protected species such as otter, great crested newt, hobby, barn owl and bat receive protection through European and UK legislation.
- Listed buildings, conservation areas and the built environment create constraints to development. These constraints are enforced through the Town and Country Planning Act 1990.
- Ancient Monuments and archaeological sites have been scheduled by English Heritage and as such warrant protection and give rise to constraints on possible strategy options.
- Much of the area is designated within the Broadland District Local Plan as an ‘Area of Landscape Value’, with a general presumption against allowing development in these areas.
- National Planning Policy Guidance provides guidance of features that require protection which cover the aspects already mentioned. Guidance is also provided on developments in floodplains, planning and the historic environment and archaeology and planning, all of which create constraints on development.

2.11 Noise and Visual Intrusion from traffic

The existing impacts of traffic and the transport infrastructure in terms of noise and visual intrusion are widespread across the NATS area. Particular problem locations include residential areas and rural area, as listed below.

2.11.1 Residential Areas

Noise is a problem principally in residential areas where there is a high traffic density, especially on routes where there is a high proportion of heavy goods traffic. Previous work, completed in 1990, showed that noise exceeded a 75dB(A) threshold on Boundary Road and 70dB(A) threshold on most sections of the outer ring road, several of the radial roads, part of the Inner Ring Road and several roads within the city centre itself. (These thresholds were considered appropriate by the consultants who undertook the work on behalf of the Council. The World Health Organisation guidelines, 1995, to avoid sleep disturbance are 30LaEq measured in the bedroom and for reported moderate annoyance as 50LaEq. Other guidelines are given in, for example, Planning Policy Guidance note 24 – Planning and Noise.)

2.11.2 Rural Areas on the fringe of Norwich

High volumes of traffic using inappropriate minor rural roads around the north of Norwich have adverse impacts on these areas in terms of noise and visual intrusion.

2.12 Summary of Problems

The most significant current transport problems in the NATS area are:

- The pressure on parts of the existing road network, particularly those used for orbital journeys, arising from ongoing housing growth in the north of Norwich, together with changes in travel patterns associated with recent new development (out of town superstores, Broadland Business Park, Longwater employment area, new Norfolk and Norwich University Hospital etc.)
- Delay and congestion on the Outer Ring Road and the radial routes that cross it
- Poor public transport provision for orbital journeys
- The impact of increasing levels of congestion on the attractiveness of local bus and Park and Ride services
- Limited pedestrian crossing provision and the absence of a comprehensive cycle network
- Strategic access from the main trunk road network, including for freight, to locations in the north of Norwich, including Norwich International Airport, and beyond to North Norfolk
- Noise and visual intrusion from traffic using inappropriate roads including residential roads in the built-up area, village streets and minor rural roads

Committed development around the north of Norwich, including new housing allocations at Sprowston and West Costessey will exacerbate many of these problems.

Within the period to 2016 covered by the new NATS strategy there is the prospect of significant additional growth around the north of Norwich. Growth at Norwich International Airport has accelerated with the development of new low-cost scheduled services, and forecast future growth is such that major improvements to access are likely to be required. Further new housing allocations will need to be made to meet housing targets for the Norwich Policy Area. It is likely that these will include a major mixed-use development on the north-east fringe of Norwich, somewhere between the B1150 North Walsham Road and the A47 (East).

3 Aims and Objectives

The updated Aims and Objectives for the new NATS strategy as listed below were agreed by the Norwich Area Strategic Transport Joint Forum on 08 January 2003. This forum is made up of Members from the local authorities covered by the NATS area, including representatives from Norwich City Council, Broadland and South Norfolk Districts and Norfolk County Council. It was set up to feed Members' views into the decision making process of the County Council.

Vision
To provide the highest possible level of access to and within the strategy area to benefit people's individual needs and enhance the economic health of the strategy area. To ensure that journeys minimise any adverse impact on people and the built and natural environment.

Objectives	
Environment	
1	Reduce CO2 emissions from transport by encouraging sustainable modes of travel and vehicles using fuels derived from renewable sources or waste.
2	Promote the use of alternative modes of transport and less polluting fuels, particularly within Air Quality Management Areas.
3	Minimise noise, vibration and visual intrusion from transport, particularly in the public, urban open spaces in the historic city centre.
4	Implement transport solutions that protect open space, wildlife habitats and water resources.
Economy	
1	Minimise congestion and delays for all modes of transport by improving the efficiency of the transport network
2	Promote a vibrant city centre, and other commercial centres, by improving accessibility for people and goods.
3	Cater for the travel consequences arising from growth aspirations. In particular accommodate transport needs arising from future growth of the airport and the cluster of the Norwich Research Park, university and hospitals at Colney.
4	Improve the competitiveness of the Norwich area as a retail, tourist and business centre, whilst enhancing its image and maintaining a high quality environment.
Safety	
1	Maximise safety and security for everyone
2	Minimise the number and severity of road traffic accidents
3	Lower the incidence of crime experienced on the transport system and remove the perception of fear of crime for vulnerable people
4	Minimise fear and intimidation from traffic

Accessibility	
1	Maximise transport choice for all travellers.
2	Reduce social exclusion through transport solutions and promote equal access to jobs, goods and services.
3	Protect and enhance residential amenity and minimise community severance
4	Enhance access for non-car modes
Integration	
1	Promote sustainable means of travel, minimise the length of trips and encourage reduced car-use through land use policies, layout of development and promotion of travel plans
2	Improve integration and interchange
3	Reduce the need to travel

4 Assessment of Interventions

4.1 Introduction

A long list of potential interventions that could be considered for inclusion in the new NATS strategy was compiled by a working group of County and District Council officers. These are described in Sections 4.2 to 4.8. Section 4.9 presents the results of a qualitative assessment of these interventions against the problems and issues considered in Section 2 and the NATS aims and objectives (Section 3).

This initial assessment demonstrated that a number of the interventions performed poorly in terms of effectiveness in addressing the problems and issues and/or consistency with the aims and objectives. These were therefore dismissed and are listed in section 4.10. Section 4.11 outlines the options carried forward from this stage of the assessment, leading to the identification of the six strategy options for further appraisal listed in Section 4.12.

4.2 New Road Construction

4.2.1 Northern Distributor Road

A Northern Distributor Road (NDR) would involve construction of a new road to distribute traffic around the north of Norwich, linking with the trunk road network to the east and west. If taken forward this intervention would provide a dual carriageway all purpose (D2AP) road. An NDR would improve strategic accessibility, economic vitality and go some way to reducing traffic impacts around the north of Norwich. It would be likely to lead to an increase in the use of the car meaning that in some sections of the network relief may be only temporary.

An NDR has the potential to improve conditions for people living in and around the north of Norwich, and access for motorists and businesses. Its negative impacts on the environment would include impacts on the valley of the River Wensum north west of Norwich. It would also pass through areas of high landscape quality.

An NDR would create opportunities for complementary measures, such as reducing through traffic within the city centre and public transport improvements on radial routes.

4.2.2 Part Northern Distributor Road – Easton to Airport

Building only the western half of an NDR would improve strategic accessibility, economic vitality and go some way to reducing traffic impact around the north-west of Norwich. It would be likely to lead to an increase in the use of the car meaning that in some sections of the network relief may be only temporary.

The western half of an NDR has the potential to improve conditions for people living in and around the north west of Norwich, and access for motorists and businesses. It would have negative impacts on the environment north west of Norwich, including the valley of the River Wensum and other areas of high landscape quality.

This intervention may create some opportunities for complementary traffic management measures and public transport improvements.

4.2.3 Part Northern Distributor Road – Postwick to Airport

Building only the eastern half of an NDR would improve strategic accessibility, economic vitality and go some way to reducing traffic impact around the north-east of Norwich. It would be likely to lead to an increase in the use of the car meaning that in some sections of the network relief may be only temporary.

The eastern half of an NDR has the potential to improve conditions for people living in and around the north east of Norwich, and access for motorists and businesses. It would have negative impacts on the environment north east of Norwich, including areas of high landscape quality.

This intervention may create some opportunities for complementary traffic management measures and public transport improvements.

4.2.4 Northern Distributor Road Option – Improve Outer Ring Road

An alternative to building a new distributor road around the north of Norwich would be to improve the northern section of the existing Outer Ring Road to dual carriageway standard.

Improving the Outer Ring Road would have some effect on economic vitality, but would be less effective in improving strategic accessibility than an NDR on a new alignment north of Norwich. It would be likely to lead to an increase in the use of the car meaning that in some sections of the network relief may be only temporary.

The negative impacts on the environment would include increased noise, vibration and visual intrusion on properties adjacent to the route. There would also be an increase in community severance.

This intervention may create some opportunities for complementary traffic management measures and public transport improvements.

4.2.5 Completion of Outer Ring Road

This intervention would improve strategic accessibility and address some of the worst problems on the ring roads south east of the city. It also has potential to open up areas for regeneration. Improvements may be short-term as additional traffic may be encouraged onto the network.

Benefits would be limited to the south east sector. The scheme would complement an NDR or part-NDR, Postwick to Airport. It would affect priorities for junction improvements elsewhere on the ring roads, reducing the need for schemes in the south.

4.2.6 A47 – A1067 Link

This new road link would run from the A47 in the vicinity of Longwater Business Park north across the countryside adjacent to Ringland to meet the A1067 near Taverham. It would have limited impact except on improving strategic accessibility between the A47 and A1067. It would go some way to improving economic vitality for parts of North Norfolk.

The link has the potential to improve conditions for people living in and around the north west sector of Norwich, which is seen as having the most severe problems, and for motorists and businesses. It would have negative impacts on the environment north west of Norwich, including the valley of the River Wensum. If it was funded through development, there would be impacts from the development itself.

4.2.7 Inner and Outer Ring Road Junction Schemes

Interventions to improve junction capacity would have some effect on economic vitality but improvements may be short-term as they may encourage more car trips. Weighed against this, there may be longer-term improvements because improvements to the ring roads may encourage development to be located nearer the centre of Norwich. There may be disbenefits from these works for pedestrians and cyclists crossing the ring roads.

Benefits would be restricted to car drivers, goods vehicles and, to a lesser extent, bus passengers. These benefits would be distributed widely over all sectors of the NATS area. Individual schemes have been considered in three different scales. The larger scale schemes would be relatively unaffordable, at least in the short term, although the works can be implemented in phases. Schemes would be likely to conflict with other aspirations, such as improving local accessibility. Completion of the Outer Ring Road may reduce the need for schemes in the south. Building all or part of an NDR may reduce the need for schemes in the north.

4.2.8 Completion of Inner Ring Road

This intervention would involve construction of a new road from Queens Road, south east of All Saints Green, to Thorpe Road.

The scheme is not considered publicly or politically acceptable since it was rejected at Public Inquiry in the early 1990s.

4.2.9 Area-wide Road Building/Capacity Improvements

Major road building/capacity improvements throughout the NATS area, as opposed to a more focused approach based on improving strategic accessibility, alleviating congestion and reducing the amount of traffic using inappropriate roads, would be extremely costly and would not be consistent with the NATS aims and objectives. Such an approach would have large negative impacts on the environment.

Improvements delivered may be short-term as they may encourage more car trips.

4.2.10 Widening Ketts Hill – Plumstead Road Corridor

Ketts Hill and Plumstead Road form one of the key radial routes into the city from the east. The section of the corridor within the Outer Ring Road is also an important bus route, with 10 to 12 daytime buses per hour in each direction.

Road widening would create the potential for introduction of bus priority measures on the corridor, or measures to reduce traffic across Mousehold Heath, which is an important area of open space within the city. It is also a County Wildlife site, and part of it is a Site of Special Scientific Interest. However, it would increase the disturbance from traffic on a predominantly residential corridor.

4.2.11 Reducing Bus Priority

There are bus lanes on a number of the key radial routes within Norwich, including Dereham Road, Newmarket Road and Wroxham Road. All except Dereham Road are currently used by both local bus and Park and Ride services.

Removing bus lanes would create additional road space for general traffic. Although congestion may be reduced, at least in the short term, the overall efficiency of the transport network is unlikely to be improved.

Increases in bus journey times would reduce the attractiveness of both local bus and Park and Ride services. There may be adverse impacts on both the reliability and frequency of services.

A reduction in the level of bus service provision would increase social exclusion by reducing access to jobs, goods and services for those without access to a car.

4.2.12 Three Quarter Northern Distributor Road – Postwick to A1067

This option would be to provide a dual carriageway to current standards between the A47 at Postwick and the A1067 Fakenham Road to the north of Taverham. This option would follow the half route option to the west of Norwich Airport, where it would then proceed north-west, pass to the north of Thorpe Marriott and finish at the A1067. Whilst one possible route option is shown on Figure A-3 in Appendix A, there are actually a number of possible route corridors for this option. Junctions would be provided with the major roads crossed by any option, with landscape mitigation provided where possible by use of cuttings and soft planting. Traffic management

measures within the Wensum Valley are included within this option to help tackle the existing rat-running problems within the Costessey area.

A three quarter length NDR would improve strategic accessibility, economic vitality and goes some way to reducing traffic impact around the north of Norwich. However, it is likely to lead to an increase in the use of the car and so its benefits may only be short term. Unless it attracts traffic onto it, it may not solve all the problems of rat-running, especially in the Wensum Valley. It has negative impacts on the environment, some of which it may not be possible to mitigate.

A three quarter NDR has the potential to improve conditions for people living in and around the north and east of Norwich, and access for motorists and businesses. It would have negative impacts on the environment north and east of Norwich, including areas of high landscape quality.

This intervention may create some opportunities for complementary traffic management measures and public transport improvements.

4.3 Provision for Public Transport

4.3.1 Light Rapid Transit

Light Rapid Transit (LRT) is a term used to cover a range of passenger transport modes falling between conventional bus services and heavy rail systems. Public transport in the NATS area is currently mainly provided by buses. LRT could provide a higher quality form of public transport on corridors where passenger volumes are sufficiently high. LRT can operate both on-highway and on segregated alignments. Segregation and priority at junctions would be necessary to ensure an efficient and reliable service offering journey time savings relative to existing modes.

A study to review the potential for LRT in the Norwich area was undertaken by Mott MacDonald in partnership with the County Council in 2003 as part of the NATS Review.

This study concluded that the corridor most likely to justify investment in LRT was that linking the Thickthorn Park and Ride site, Norfolk and Norwich University Hospital, Norwich Research Park and the University of East Anglia with the city centre and railway station. This could be extended to Thorpe St. Andrew and Postwick using the existing rail alignment to create a cross-city route, and could also potentially serve future major new housing development on the north-east fringe of Norwich.

The study also considered an LRT link between the city centre and Norwich International Airport, but concluded that the expected passenger growth at the Airport would not generate sufficient demand to and from the city centre to justify this.

LRT is likely to be effective in delivering modal shift from the car, but benefits would be limited to passengers on corridors served by LRT. The cost of LRT is such that provision of a comprehensive network of routes is unrealistic, and resources would have to be concentrated on one or two corridors within the NATS area. Accessibility

benefits are therefore likely to be limited. There may be some negative local environmental impacts, particularly where new alignments are created.

LRT links between existing Park and Ride sites and the city centre would complement the continuing development of Park and Ride. Road user charging or workplace parking charging would complement LRT by creating a revenue stream that could be used to help fund its implementation. An LRT alignment through the city centre would necessitate additional physical restrictions on car access.

4.3.2 Guided Bus on Marriott's Way

A guided busway on this corridor would provide limited benefits for local accessibility, and for the environment in terms of encouraging modal shift. The busway infrastructure would have adverse impacts on the natural environment along the valley of the River Wensum, an area of high landscape quality.

Benefits are limited to public transport passengers in the north-west sector. The scheme would have adverse impacts on the existing (and widely used) provision for walking and leisure/utility cycling on Marriott's Way. This intervention would complement an additional Park and Ride site at Drayton/Taverham. Benefits without this complementary scheme are generally small, the main winners being passengers on express bus services from Fakenham to Norwich. There may be a need for on-going revenue support for services using the scheme.

4.3.3 Orbital Bus Routes

Orbital bus routes assist with local accessibility and can reduce social exclusion by providing easier, cheaper and quicker travel on previously unavailable routes. They have potential to provide transport to employment and retail sites on the periphery of Norwich.

Benefits are distributed across the NATS population. Orbital bus services at the frequency required to provide an attractive service are likely to require public subsidy, funded by the County Council.

For the purpose of this assessment it was assumed that the route of an orbital bus service would be similar to the proposed route shown in the County Council's September 2003 bid for Urban Bus Challenge funding for a Norwich Orbital Route. Locations served by this route include the Norfolk and Norwich University Hospital, the University of East Anglia, Norwich International Airport, Rail Station, County Hall, Broadland Business Park, Park and Ride sites and industrial estates around the Outer Ring Road.

Other interventions including the NDR/part NDR, ring road junction works, completion of the outer ring road, bus priority, and demand management schemes would complement the service as they could all help to improve the reliability of bus services. The service would also be complemented by improved interchange facilities at key locations where existing radial bus routes intersect with it.

4.3.4 Linking up Park and Ride Sites

Each of the six Norwich Park and Ride site is currently served by a dedicated bus service to and from the city centre. There is also a commercial bus link from the Costessey site to the Norfolk and Norwich University Hospital and UEA.

Linking Park and Ride bus services terminating in the city centre to create new cross-city bus routes, and introducing a small number of additional stops close to key trip attractors would enable a wider range of destinations to be reached by Park and Ride.

Orbital bus routes (see 4.3.3 above) could also serve Park and Ride sites.

This intervention would benefit motorists in all sectors of the NATS area by increasing accessibility and travel options available from Park and Ride sites. Any additional costs would be relatively small and there is potential to generate additional revenue from new users to cover these costs.

4.3.5 New Park and Ride Site at Taverham/Drayton

A new Park and Ride site on the A1067 corridor would improve strategic accessibility and offer motorists a new travel option, encouraging a modal shift away from the car for journeys into the city centre on this congested corridor. However, there is limited scope to provide reliable bus facilities along the A1067 into Norwich.

Direct benefits are limited to motorists travelling into the city from the north. There will be ongoing revenue costs and the new site may abstract from the existing sites at the Airport and Costessey. The scheme could be complemented by a guided busway on Marriott's Way.

4.3.6 Development of Interchange Facilities at UEA, Hospital and Airport

These schemes would benefit public transport users travelling to or interchanging at the locations concerned. Without complementary enhancements to public transport service levels the main impact would be to improve journey quality for existing public transport users rather than generating modal shift.

Interchange facilities at UEA, the hospital and airport would complement an orbital bus route, or LRT on the hospital – UEA – city corridor. An orbital route could serve all three locations and offer opportunities for interchange with radial routes.

4.3.7 Additional Rail Station(s) East of Norwich

An additional rail station provides an additional travel choice and can contribute to improving accessibility into the city centre and delivering modal shift. Depending on the exact site of the station, this intervention could contribute to economic vitality (Broadland Business Park) or assist growth in the north east sector (Dussindale), although both these areas have good bus links to the city centre. A station at Postwick is likely to provide few benefits for the NATS area that are not provided by

the present Park and Ride service, although it would create potential for Park and Rail for travel to Great Yarmouth and Lowestoft (outside the scope of this assessment) .

Benefits of the scheme relate to the eastern corridor. Rail is a comparatively expensive travel option and the benefits of it may not be available for all sections of the community. If the scheme was associated with development, there may be the possibility of funding contributions. A rail station at Postwick may compete with bus based Park and Ride at Postwick.

4.3.8 Revenue Support for Additional Services

Revenue support for additional local rail services would have a very limited impact within the NATS area as large parts of the area have no rail service.

The majority of bus services within the NATS area are currently operated on a commercial basis, and the County Council currently has no control over routes, timetables and fares for these services. The scope for local authorities to intervene by directly funding improvements to existing commercial services is also restricted by a duty not to inhibit competition between operators.

The Transport Act 2000 would allow the Council to apply to Government to introduce a Quality Contract for bus services in all or part of the NATS area. A Quality Contract would enable the Council to plan radical improvements to bus services throughout the NATS area, and to franchise the resulting network to a single operator, but both the revenue costs of the additional services and of administering the franchise would fall on the Council.

However, in order to apply for a Quality Contract the Council would need to successfully argue that the use of a Quality Contract was essential to the implementation of its transport strategy. The Council would also have to demonstrate that this outcome could not be achieved in any other way such as through a statutory Quality Bus Partnership or other form of agreement with bus operators.

The difficulty faced by local authorities in satisfying these tests is reflected in the fact that no local authority has yet made a formal application to Government to introduce a Quality Contract. There is thus no case history on which to judge how an application for a Quality Contract in the Norwich area might be handled by Government.

Rather than taking the radical step of seeking to gain control of the bus network through a Quality Contract, many local authorities have instead sought to create the operating conditions that will facilitate the ability of operators to deliver improvements to the quality, reliability and frequency of their services without the need for additional revenue funding. Such conditions can be created by a combination of options considered elsewhere in this section, such as traffic restraint or congestion relief measures, provision of bus priority at key points on the network to relieve the adverse impact of congestion on bus service reliability, and improvements to passenger interchange facilities.

4.4 Provision for Cyclists and Pedestrians

4.4.1 Cycling Schemes

Cycling schemes encourage increased cycling for local trips in place of car trips, and when integrated with new development can maximise the potential for cycling and accommodate some of the increase in trips generated by the development.

Cycling schemes would not improve strategic access, and it is unlikely that they would have a significant impact on the problems of delay and congestion on the ring roads, or traffic using inappropriate roads.

Cycling schemes would complement school and workplace travel plans, traffic management measures and land use planning measures to reduce the distance between home, work and services. They could also be complementary to new road construction interventions that reduce traffic flows on potential cycle routes, and to public transport improvements.

4.4.2 Pedestrian Footways and Crossings

These schemes encourage increased walking for local trips in place of car trips, and when integrated with new development can maximise the potential for walking and accommodate some of the increase in trips generated by the development.

Pedestrian infrastructure improvements would not improve strategic access, and it is unlikely that they would have a significant impact on the problems of delay and congestion on the ring roads, or traffic using inappropriate roads.

New footways and crossings on key walking routes between homes, schools and workplaces would complement school and workplace travel plans, traffic management measures and land use planning measures to reduce the distance between home, work and services. They could also be complementary to new road construction interventions that reduce traffic flows at crossing points, and to public transport improvements.

A pedestrian bridge has been proposed crossing from the Morrison's supermarket on Koblenz Avenue to Stracey Road. The bridge would provide a link on the pedestrian desire line between Thorpe Hamlet and the Riverside development. Currently pedestrians and cyclists have to either walk around via the railway station or via the road bridge on Carrow Road.

4.5 Management Measures

4.5.1 Restriction of Traffic on Minor Roads to North of City

Traffic management measures could be considered for roads around the north of Norwich. The aim of such measures would be to encourage (or require) traffic to use

the main road network and to mitigate the effects of traffic on unsuitable routes. Measures may range from traffic calming through to road closures.

Traffic management measures have the potential to overcome the problems of traffic using inappropriate roads, particularly when the increases in journey time can be mitigated by other measures. However, restrictions may not be practical or publicly acceptable unless they are introduced in conjunction with measures to improve alternative routes. It should also be recognised that physical closures may not be acceptable if they result in long diversions for traffic wishing to travel between adjacent communities (for example Costessey and Taverham).

Traffic management measures, by themselves, will not help to cater for the transport needs arising from additional growth or help to improve access into and around the area (except for local access by walking and cycling).

This intervention and the NDR or part-NDR interventions are highly complementary as an NDR or part-NDR would provide attractive high standard alternative routes for traffic currently using inappropriate roads around the north of Norwich.

4.5.2 'Ring and Loop' in the City Centre

The 'Ring and Loop' concept is a package of measures to remove through traffic from the city centre. This intervention addresses similar problems to restricting traffic (problems for other modes including accidents, air quality and accessibility), but is likely to have a lesser impact. Whilst it would improve conditions in the city centre it is not known what effect this might have on economic vitality, although it does maintain car access. It is likely to result in displaced traffic causing problems including congestion in adjacent areas.

Benefits are related to the city centre area. The scheme is complemented by other interventions including ring road junction schemes, Park and Ride and other bus measures.

4.5.3 Clear Zone in the City Centre

Clear Zones are designed to encourage solutions to traffic problems in towns and cities while ensuring urban centres retain their accessibility, vitality and economic viability. Schemes usually involve the removal of traffic or access restrictions and improved pedestrian and cycle facilities within the Clear Zone.

Benefits are related to the city centre area. It is likely that traffic reduction within the Clear Zone would have a significant beneficial impact on air quality within the immediate area. Businesses may experience loss of trade in the short term. However, the improved environment is likely to lead to increased trade in the longer term. Displaced traffic may cause problems including congestion in adjacent areas.

4.5.4 Low Emission Zones in the City Centre

A Low Emission Zone (LEZ) is an area designated with the aim of reducing emissions from road vehicles by encouraging the use of cleaner fuels, more efficient vehicles producing lower emissions levels, or reducing the overall number of vehicles in the area. This is typically done by restricting access to certain areas by vehicles that do not meet the minimum emissions standards set for the zone.

Designating such a zone is likely to have a beneficial impact on the environment by improving air quality.

Benefits would be confined to the area covered, and there could be adverse impacts outside the zone due to displaced traffic. Public transport operators may incur additional costs in making their vehicles compliant with the emissions standards for access to the zone, and these may be passed on to customers through increased fares. Car users who can afford modern, clean vehicles are likely to be unaffected, but those who are less well off and have older vehicles may be.

Implementation would be relatively inexpensive, but the zones would require ongoing enforcement.

Due to high levels of nitrogen dioxide emissions from road traffic, Norwich City Council declared three Air Quality Management Areas (AQMAs) in the city centre at St Augustines Street, Grapes Hill and the Castle Area in June 2003. As required under the Environment Act 1995 the City Council has produced an Air Quality Action Plan for these areas.

The plan states that improvements in air quality in the Castle AQMA will be sought through the introduction of a Low Emission Zone on Castle Meadow by incorporating minimum vehicle emissions standards into a Quality Bus Partnership agreement.

4.5.5 Road Pricing

Road pricing addresses similar problems to restricting traffic (problems for other modes including accidents, air quality and accessibility) but is likely to have a lesser impact . Whilst it improves conditions in the city centre it is not known what effect this might have on economic vitality, although it does maintain car access. Again, it is likely to result in displaced traffic causing problems including congestion in adjacent areas.

Benefits are related to the city centre area, but will be available to all visitors. Charging may affect some parts of the community more than it does others. There is likely to be public opposition to the scheme. There will be ongoing needs for enforcement but this could be funded by revenue raised from the scheme, as could other complementary measures. The scheme is complemented by other interventions including ring road junction schemes, Park and Ride and other bus measures.

4.5.6 Home Zones in Residential Areas

Home Zones are residential streets in which the road space is shared between drivers of motor vehicles and other road users, with the wider needs of residents – including people who walk and cycle, the elderly and children – being accommodated.

Beyond improving the safety of road users, the main benefit is a change in people's perceptions of how the street environment within the zone can be used. By encouraging more people to use the streets on foot or by bicycle, Home Zones have the potential to contribute at a local level to a reduction in congestion and noise pollution, and an improvement in air quality. The increase in natural surveillance arising from greater use of the street space can help to reduce crime or fear of crime.

4.5.7 Restricting Car Access to City Centre

Restricting car access in the city centre addresses problems for other modes including accidents, air quality and accessibility. Whilst it improves conditions in the city centre it is not known what effect this might have on economic vitality. It is likely to result in displaced traffic causing problems including congestion in adjacent areas.

Benefits are related to the city centre area, but will be available to all visitors. Whilst access restrictions would be relatively inexpensive to implement there may be ongoing costs associated with enforcement. There is likely to be public opposition to schemes of this nature. This intervention conflicts with the aim to improve transport choice and there are issues relating to access to car parks within the city centre. It would be complemented by other interventions including ring road junction schemes, Park and Ride and other bus measures.

4.5.8 Closure of St Stephens Street / Tombland / Exchange Street

Closure of specific streets to general traffic improves the built environment of the areas concerned and improves local accessibility for other modes. There may be improvements to economic vitality of the areas. Closures are likely to lead to displacement of traffic and could lead to congestion and increased journey times on alternative routes. If buses are prohibited, these will incur the same problems. If the streets remain open to buses, there will be improvements in bus reliability.

Benefits are confined to the local street but will be available to all visitors – and to public transport users if buses are not prohibited. Ring and Loop (or other access restrictions to the city centre) would complement this intervention.

4.5.9 Reduce Long Stay Car Parking Provision in City Centre

Reducing long-stay parking in the city centre would contribute to objectives including improving the environment, local accessibility, modal shift and reducing accidents. However this would be at variance with the view expressed by some city centre businesses that there is a need for more parking in the city centre.

Benefits of this intervention relate to the city centre, but will be available to all visitors. Reducing long-stay parking through pricing policies may have a disproportionate impact on people on low incomes, but reducing it through other means is more equitable. There will be an impact on revenue raised from parking by changing the existing stock from long to short stay and a reduction in revenue if total numbers of spaces are reduced. There are a number of private car parks in the city where it would not be possible to exert strong influence over their parking policies. Implementation could be phased. This intervention would be complemented by other measures that improve accessibility - Park and Ride, additional bus services and improved facilities for cyclists and pedestrians.

4.5.10 Allowing High Occupancy Vehicles to use Bus Lanes

There are bus lanes on a number of the key radial routes within Norwich, including Dereham Road, Newmarket Road and Wroxham Road. All except Dereham Road are currently used by both local bus and Park and Ride services.

Allowing high occupancy vehicles to use bus lanes would create an incentive for car sharing which might lead to a marginal reduction in car traffic. However, allowing even a small amount of other traffic into bus lanes is likely to have an adverse impact on bus journey times.

Effective enforcement of a high occupancy vehicle lane would require equipment to detect vehicle occupancy and record the details of offending vehicles. In addition to the cost of this equipment there would be ongoing revenue costs for enforcement.

Increases in bus journey times would reduce the attractiveness of both local bus and Park and Ride services. There may be adverse impacts on both the reliability and frequency of services.

A reduction in the level of bus service provision would increase social exclusion by reducing access to jobs, goods and services for those without access to a car.

4.6 Provision for Freight

4.6.1 Rail Freight Facilities at Deal Ground, Harford

The possible nature and purpose of these facilities, and their impact have yet to be fully investigated. No assessment has therefore been made for this measure.

4.6.2 Trans-shipment Depot

Potential locations for a trans-shipment depot, and the associated benefits have yet to be investigated. No assessment has therefore been made for this measure.

4.6.3 Allowing HGVs to use Bus Lanes

Allowing HGVs to use bus lanes is likely to have similar adverse impacts on local bus and Park and Ride services to high occupancy vehicle lanes (section 4.5.10), but would not offer any traffic reduction benefits.

4.7 Land Use Measures

4.7.1 Restricting Development on Strategic Routes

This intervention would reinforce policies that oppose major traffic-generating developments on main roads.

Whilst the intervention aims to improve strategic accessibility, by ensuring that traffic from new developments or infrastructure requirements (e.g. new junctions) does not interrupt flow on the main routes, it may not achieve this aim. This is because, even if development is sited away from main routes, traffic is still likely to access the main road network at some point, resulting in the same impacts on the network. The intervention is likely to affect local accessibility and neighbourhoods if major developments are sited away from main routes because it will attract traffic onto less suitable routes. It may make such developments even harder to reach for those without a car, as there may be fewer public transport options.

4.8 Attitudinal and Behavioural Measures

4.8.1 Measures to Reduce Crime

This intervention would embrace a range of specific measures, typically including providing maps and signs, clearing litter, removing graffiti, widening footways, improving street lighting, improving the character of the area, encouraging shops to stay open later, managing space and providing space for youth activities (e.g. skateboarding).

These measures are likely to improve the neighbourhoods where people live and make the city a more attractive place – improving economic vitality. They could go some way to reducing social exclusion.

The benefits would be distributed throughout the area and for everyone. The measures are relatively affordable and implementation could be phased. The measures would complement most other interventions, particularly those that may increase crime or the perception of crime; for example those that result in fewer vehicles on the streets.

4.8.2 Car Clubs

Car clubs are schemes where groups of people can use cars when needed, but do not actually have to own the car.

This intervention will reduce social exclusion by improving accessibility for those without access to a car. The impacts of such a scheme are likely to be small.

Benefits of the scheme can be distributed throughout the area, but could be targeted towards those in deprived areas, where car availability is lower. Schemes would need start-up and ongoing funding, although they have potential to become self-financing. Schemes could be phased. This intervention complements many of the other interventions, particularly 'soft' measures such as introduction of travel plans.

4.8.3 Travel Plans

61% of trips to work made by residents of the NATS area in 2000/2001 were by car.

Travel plans are aimed at reducing the number of car journeys to schools, workplaces and other major trip attractors. A plan is typically a package of practical measures to encourage pupils, staff and visitors to choose alternatives to single-occupancy car-use, and to reduce the need to travel at all for their work. A plan should be tailored to a particular site and include a range of measures which will make a positive impact at that site, e.g. setting up a car sharing scheme; providing cycle facilities; negotiating improved bus services; offering attractive flexible-working practices; or offering part subsidies, restricting and/or charging for car parking; setting up video conferencing facilities to cut business travel. The idea is to make the alternatives more feasible and more attractive to employers.

A travel plan can have real benefits to the organisation, employees and local community. It may help to relieve an on-site parking or congestion problem, or it may help to improve public transport services where there was previously a deficiency. In turn it may relieve stress on employees through reduced travel delays around the site, through healthier forms of travel as walking or cycling, or through the opportunity to reduce their amount of travel, perhaps by working at home.

4.9 Assessment

The tables below present a summary of the assessment of the interventions described in Sections 4.2 to 4.8 against the problems and issues and aims and objectives. The purpose of this first stage in the assessment process is to reduce the initial long list of interventions by identifying the most and least effective interventions in each category, enabling those that would be least effective to be discarded, and the most effective interventions to be taken forward for inclusion in the strategy options developed for further appraisal.

This simple assessment methodology is appropriate for the purpose of identifying the most effective interventions within the same broad category - for example comparing the effectiveness of different road schemes or alternative means of improving public transport. It is not well suited to comparing different types of interventions, particularly those for which the nature, scale and distribution of impacts are dissimilar.

The two stage process accords with the Department for Transport's Guidance on the Methodology for Multi-Modal Studies (GOMMMS). Volume 1, paragraph 1.1.15 states

that “the aim should be to carry out the studies at a level of detail that is just sufficient to enable confident decisions about what initiatives to progress.”

The objective numbers that appear across the top of the tables correspond to those used in the table of objectives in Section 3. The Problems and Issues numbers correspond with the table below.

Social	
1	Availability of transport
2	Cost of transport
3	Travel horizons
4	Crime
5	Fear of crime
6	Road safety
7	Rat running
8	Severance of communities
Economy	
1	Strategic links
2	Location of employment and retail sites
3	Housing growth
4	Access to airport, research park and hospital
5	Access for freight
6	Congestion
7	Journey times
8	Car parking
Environment	
1	Noise and visual intrusion from traffic
2	Traffic in periphery of built up area
3	Air quality / greenhouse gases
4	Other health impacts
5	Facilities for pedestrians
6	Facilities for cyclists
7	Facilities for motorcyclists
8	Reliability of buses

The assessment utilises a scoring system based on the following seven point scale:

✔ ✔ ✔	Large positive
✔ ✔	Moderate positive
✔	Slight positive

■	Neutral
✕	Slight negative
✕✕	Moderate negative
✕✕✕	Large negative

The scores are subjective, but represent the collective views of members of a working group formed to carry out the initial assessment, rather than the judgement of a single assessor. They have also been independently reviewed by Mott MacDonald.

Table 4.1: Assessment of new road construction interventions against Problems and Issues

	Problems and Issues																									
	Social								Economy								Environment									
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	Score	Rank
Northern Distributor Road (NDR)	■	■	■	■	■	✓	✓✓✓	■	✓✓	×	✓	✓✓✓	✓	✓	✓	■	■	✓✓	××	×	×	×	■	■	9	1
A1067 - A47 Link	■	■	■	■	■	✓	✓	■	✓	×	■	✓	✓	✓	✓	■	■	✓	×	×	■	■	■	■	5	2
Part NDR - Postwick to Airport	■	■	■	■	■	✓	✓✓	■	✓	×	✓	✓	✓	✓	✓	■	■	✓	××	×	×	×	■	■	4	3=
IRR and ORR Junction Schemes	■	■	■	■	■	■	✓	■	■	✓	✓	✓	✓	✓	✓	■	×	✓	×	×	×	×	■	✓	4	3=
Three Quarter length NDR	■	■	■	■	■	✓	✓✓	■	✓	×	✓	✓	✓	✓	✓	■	■	✓	××	×	×	×	■	■	4	3=
Part NDR - Easton to Airport	■	■	■	■	■	✓	✓	■	✓	×	■	✓✓	✓	✓	✓	■	■	✓	××	×	×	×	■	■	3	6=
NDR option - Improve Outer Ring Road	■	■	■	■	■	✓	✓	■	✓	✓	✓	✓	✓	✓	✓	■	××	✓	××	×	×	×	■	✓	3	6=
Completion of Outer Ring Road	■	■	■	■	■	■	■	■	■	■	■	✓	✓	✓	✓	■	×	■	××	×	■	✓	■	✓	2	8

Table 4.2: Assessment of public transport interventions against Problems and Issues

	Problems and Issues																									
	Social								Economy								Environment									
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	Score	Rank
Orbital Bus Routes	✓✓	✓	✓	■	■	✓	✓	✓	■	✓	✓	✓	■	✓	✓	■	✓	✓	✓	■	■	■	■	■	15	1
Light Rapid Transit (LRT)	✓✓	■	✓	■	■	✓	■	×	■	✓	✓	✓✓	■	✓	✓	✓	×	✓	✓	■	■	■	■	■	11	2
Park & Ride Site at Taverham/Drayton	✓	✓	✓	■	■	■	✓	✓	■	■	■	■	■	✓	✓	✓	✓	■	✓	■	■	■	■	■	10	3
Marriott's Way guided bus + new P&R site	✓	✓	✓	■	■	✓	✓	■	■	■	■	■	■	✓	✓	✓	■	✓	✓	×	×	×	■	✓	8	4
Additional rail station E of Norwich	✓	■	■	■	■	✓	■	■	■	✓	✓	■	■	✓	✓	✓	■	■	■	■	■	■	■	■	7	5
Guided bus on Marriott's Way	✓	■	■	■	■	■	■	×	■	■	■	■	■	✓	✓	■	×	✓	✓	×	×	×	■	✓	1	6

Table 4.3: Assessment of management measures against Problems and Issues

	Problems and Issues																									
	Social								Economy								Environment									
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	Score	Rank
Restricting car access to City Centre	×	■	■	■	×	✓✓	■	■	■	■	■	■	✓	×	■	■	✓✓	■	✓✓	✓✓	✓	✓	✓	✓	10	1
Restrictions on Minor Roads to N of City	×	■	■	■	×	✓✓	✓✓	✓	■	■	■	■	■	×	×	■	✓✓	✓✓	✓	✓	✓	✓	■	■	9	2
Road Pricing	■	×	×	■	×	✓	■	■	■	■	■	■	✓	■	×	■	✓	■	✓	✓✓	✓	✓	✓	✓	6	3
Ring and Loop within City Centre	×	■	■	■	■	✓	×	■	■	■	■	■	■	×	×	■	✓	■	✓	✓	✓	✓	✓	✓	4	4
Closure of individual roads in City Centre	■	■	■	×	×	✓	■	■	■	■	■	■	×	×	×	■	✓	■	✓	✓	✓	✓	■	✓	2	5
Reduce car parking in City Centre	×	■	■	■	×	✓	■	×	■	×	■	■	■	✓	■	×	✓	■	✓	✓	■	■	■	✓	1	6
Reduce bus priority	×	■	■	■	■	■	■	■	■	■	■	■	■	✓	■	■	■	■	■	■	■	×	■	××	-3	7

Table 4.4: Assessment of new road construction interventions against Aims and Objectives

	Aims and Objectives																				
	Environment				Economy				Safety				Accessibility				Integration				
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	Score	Rank
Northern Distributor Road (NDR)	××	××	■	×××	✓✓	✓	✓✓✓	✓✓	■	✓✓	■	✓	✓	■	✓	■	××	✓	■	5	1
Part NDR - Postwick to Airport	××	××	■	×	✓	✓	✓✓	✓	■	✓	■	✓	✓	■	✓	■	××	✓	■	3	2
Three quarter length NDR	××	××	■	×	✓	✓	✓✓	✓	■	✓	■	✓	✓	■	✓	■	××	✓	■	3	2=
Part NDR - Easton to Airport	××	××	■	××	✓	✓	✓	✓	■	✓	■	✓	✓	■	✓	■	××	✓	■	1	4
IRR and ORR Junction Schemes	×	×	■	■	✓	✓	✓	✓	■	■	■	×	■	■	■	×	■	■	■	0	5=
A1067 - A47 Link	×	×	■	×	✓	✓	■	■	■	✓	■	■	■	■	✓	■	×	■	■	0	5=
Completion of Outer Ring Road	××	××	■	×	✓	✓	✓	■	■	■	■	■	■	■	✓	✓	×	■	■	-1	7
NDR option - Improve Outer Ring Road	××	××	×	×	✓	✓	✓	✓	■	✓	■	×	■	■	×	■	×	■	■	-4	8

Table 4.5: Assessment of public transport interventions against Aims and Objectives

	Aims and Objectives																				
	Environment				Economy				Safety				Accessibility				Integration				
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	Score	Rank
Light Rapid Transit (LRT)	✓✓	✓✓	■	×	✓	✓	✓✓	✓	■	✓	■	✓	✓	✓	×	✓	✓	✓	■	14	1
Orbital Bus Routes	✓	✓	■	✓	✓	✓	✓	✓	■	■	■	■	✓✓	✓✓	■	■	■	✓	■	12	2
Additional rail station E of Norwich	✓	✓	✓	■	✓	✓	✓	■	■	■	■	■	✓	■	■	✓	✓	✓	■	10	3=
Marriott's Way guided bus + new P&R site	✓	✓	✓	××	✓	✓	✓	✓	■	■	■	✓	✓	■	■	✓	✓	✓	■	10	3=
Guided bus on Marriott's Way	✓	✓	■	××	✓	✓	✓	✓	■	■	■	■	■	■	■	✓	✓	✓	■	7	5=
Park & Ride Site at Taverham/Drayton	✓	✓	✓	■	✓	✓	■	■	■	■	■	■	✓	■	■	■	■	✓	■	7	5=

Table 4.6: Assessment of management measures against Aims and Objectives

	Aims and Objectives																				
	Environment				Economy				Safety				Accessibility				Integration				
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	Score	Rank
Restricting car access to City Centre	✓	✓	✓✓	■	×	■	■	✓	✓	✓	■	✓	×	✓	■	✓	■	✓	■	9	1
Ring and Loop within City Centre	✓	✓✓	✓✓	■	×	■	■	✓	✓	✓	■	✓	×	■	■	✓	■	■	■	8	2
Road Pricing	✓✓	✓✓	✓	■	✓	■	■	×	✓	✓	■	✓	×	■	■	✓	×	■	■	7	3
Reduce car parking in City Centre	✓	✓	✓	■	✓	×	■	■	■	■	■	✓	×	■	■	✓	■	■	■	4	4
Closure of individual roads in City Centre	■	✓	✓	■	×	×	■	■	■	✓	×	✓	■	■	■	✓✓	■	■	■	3	5
Restrictions on Minor Roads to north of City	■	■	✓	■	×	■	■	■	■	✓	■	■	×	■	✓	✓	■	■	■	2	6
Reduce bus priority	××	××	×	■	×	×	■	×	■	■	■	■	××	×	■	××	■	×	■	-14	7

4.10 Interventions Dismissed

4.10.1 Part NDR – Easton to Airport

This intervention would be less effective in meeting the economy and safety objectives of NATS than the NDR or the part NDR - Postwick to Airport. It scores slightly better than the full NDR, but worse than the part NDR - Postwick to Airport, against the environment objectives. It would not address the problems and issues in the north-east sector of the NATS area. In particular it does not link with potential housing growth on the north east fringe of Norwich.

4.10.2 NDR Option – Improve Outer Ring Road

This intervention would be less effective in meeting the Economy and Accessibility objectives of NATS than a rural NDR route, and does not score significantly better against the Environment objectives than the other NDR interventions due to the noise, vibration and visual intrusion from the additional traffic introduced into built-up areas.

4.10.3 Completion of Outer Ring Road

This intervention scored lower against the aims and objectives of NATS than the full NDR and Part NDR - Postwick to Airport, and would not address the problems and issues in the north of the NATS area.

4.10.4 A1067 to A47 Link

This intervention would be effective in addressing some of the local problems and issues in the north west sector, but is less effective in meeting the overall aims and objectives of NATS than the full and part NDR.

4.10.5 Guided Bus on Marriott's Way

This intervention would be less effective in meeting the NATS aims and objectives than the Light Rapid Transit and Orbital Bus Routes options, and fails to address many of the problems and issues.

It scores better when considered in conjunction with a new Park and Ride site at Taverham/Drayton by offering a solution to the problem of providing bus priority measures along the A1067 corridor into Norwich, but is not worth further consideration in isolation.

4.10.6 New Park & Ride Site at Taverham/Drayton

This intervention has not been taken forward in the light of the recommendation of the NATS Park and Ride Review report that no decision should be made on provision of further sites until all six existing sites have become well established.

4.10.7 Closure of Individual Roads in City Centre

This intervention would be less effective in meeting the NATS aims and objectives, and addressing the problems and issues, than the alternative management measures for the city centre included in the assessment.

4.10.8 Reduce Bus Priority

Reducing the limited existing level of bus priority would not contribute to any of the NATS aims and objectives, and would exacerbate the problem of the impact of increasing levels of congestion on the attractiveness of local bus and Park and Ride services.

4.10.9 Reduce Long Stay Parking Provision in City Centre

This intervention would be less effective in meeting the NATS aims and objectives, and addressing the problems and issues, than the alternative management measures for the city centre included in the assessment.

Parking restraint is already in place through the existing policy to provide no more long stay parking in the city centre. New long stay demand is to be met through the development of Park and Ride, but adequate short and medium term parking maintained to avoid adverse impacts on the vitality of the city centre.

4.11 Options Carried Forward

4.11.1 Northern Distributor Route

Based on the initial assessment against aims and objectives, and against problems and issues, the most effective new road construction intervention was the full NDR.

4.11.2 Part NDR - Postwick to Airport

One of the next most effective interventions was the ‘Half NDR’, Postwick to Airport. Although this intervention scored lower on Economy than the full NDR, it also has a lesser environmental impact.

4.11.3 Three Quarter NDR - Postwick to A1067

The other next effective intervention is the three quarter NDR option. This option would have the potential to improve conditions for people living in and around the north of Norwich, as well as motorists.

Both the Half NDR, Postwick to Airport and Three Quarter NDR, Postwick to A1067 options have been included in the appraisal of alternative strategies in order to examine in detail the incremental case for the western section of any NDR across the Wensum Valley.

4.11.4 Public Transport

Based on assessment against aims and objectives, and against problems and issues, the most effective public transport interventions are LRT and Orbital Bus Routes. It would be logical for a strategy including LRT to also include road pricing as a means of delivering the local funding contribution required by Government to an LRT scheme. An LRT route through the city centre will also necessitate and result in some reductions in car access to the city centre.

Orbital bus routes could form the centrepiece of a strategy for bus-based public transport improvements.

4.11.5 Management and Restraint Measures

Based on assessment against aims and objectives, and against problems and issues, the most effective interventions are restricting car access to the city centre and road pricing, followed by 'Ring and Loop' and traffic management measures on minor roads to the north of the city. However, significant restriction of car access to the city centre is unlikely to be accepted by the public and city centre businesses without measures to significantly improve access by alternative modes.

It is logical to include restricting car access to the city centre in the alternative strategy featuring LRT, as this is the intervention that does most to provide an alternative means of access to the city centre, and an LRT route through the city centre will not be practical without some restrictions on car access.

It is recommended that the strategy options that do not feature specific measures to improve access to the city centre should include traffic management measures to reduce through traffic in the city centre or Ring and Loop.

4.11.6 Other Measures

Enhanced provision for pedestrians and cyclists would contribute to most of the NATS aims and objectives, whilst addressing the problems of limited pedestrian crossing provision and the absence of a comprehensive cycle network

Land use measures could assist the NATS aims and objectives by reducing the need to travel and helping to minimise the travel consequences arising from growth.

Attitudinal and behavioural measures, in particular travel plans, would assist the NATS aims and objectives by maximising transport choice and encouraging and promoting the use of sustainable modes of travel.

4.12 Alternative Strategies for Further Appraisal

Having carried out initial assessment of all the feasible transportation options, the following six strategies, consisting of measures identified in Section 4.11 either individually or in combination, were selected to be taken forward for further appraisal:-

Option 1 – Northern Distributor Road and complementary transport measures

Option 2 – Half length NDR and complementary transport measures

Option 3 – Three quarter length NDR and complementary transport measures

Option 4 – Orbital bus route with associated traffic management measures

Option 5 – Light rapid transit scheme with associated traffic management measures

Option 6 – Measures to encourage modal shift to sustainable modes of transport

5 Modelling of Road Options

5.1 The NATS Model

The strategy options incorporating an NDR or part NDR have been modelled using the SATURN based 2002 Norwich Area Transport Strategy Model.

Features of the 2002 NATS model are:

- A 250 zone matrix based on some 63 Roadside Interview Survey sites with the validated area covering the urban area of Norwich;
- Simulation network coding including, and extending beyond, the urban area of Norwich;
- Buffer network including the county of Norfolk;
- Centroid connectors and zoning system covering the whole of England; and
- Assigned light vehicle and heavy vehicle user classes.

5.2 Do Minimum Model

The network coding for the assumed opening year of the NDR includes the following changes to the base year model to form the Do-Minimum model:

- Committed or likely major network improvements in the Norwich Area including:
  - Completion of the dualling of the A47 between Dereham and Acle;
  - Dualling of the A11 Attleborough bypass;
  - The Cringleford Housing Link Road between a new roundabout on the A11 east of Thickthorn and the Hospital Roundabout on Colney Lane;
  - The signalisation scheme for Thickthorn (A11/A47) interchange agreed with the Highways Agency;
- Completion of the Public Transport Major Scheme in the city centre;
- The programmed improvements to the Inner and Outer Ring Road junctions;
- Additional Park and Ride site at Thickthorn (Sprowston and Harford already implemented since 2002);
- Some form of city centre restraint, representing a Ring and Loop scheme;
- Other access proposals to developments identified within the Norwich, South Norfolk and Broadland Local Plans.

5.3 Do Something Models

The NDR options were then coded into the opening year and design year networks, together with traffic calming in the northern suburbs and on the minor roads across the Wensum Valley in the Costessey area.

Traffic growth to the opening and design years has been based on the National Trip End Model (NTEM) through use of the TEMPRO reference flow factors at district level (December 2002 dataset). Income and fuel price factors (April 2003 values) have then subsequently been applied.

Elastic assignments have been undertaken, allowing the volume of traffic on the network to reduce under congestion conditions or to increase with improved journey times due to the NDR.

5.4 Effects on Traffic Flows

The new road is predicted to attract a significant volume of traffic under all options, with predicted traffic flows generally within the economic design rage of a dual carriageway. All options provide an alternative north-south Norwich city bypass route to routing though the city centre. All options also attract orbital traffic that would otherwise route via the northern suburbs. The full NDR option also provides a more convenient route for many north-south trips than the half or three quarter route options and also provides a more appropriate route for traffic between the A1074 and the A1067 than the minor roads crossing the Wensum Valley.

6 Option Assessment

6.1 Introduction

This section considers the strategy options brought forward from Section 4. Each option is comprised of combinations of the retained elements discussed in Section 4. These strategy options are: -

Option 1 - Northern Distributor Route around the north of Norwich, linking with the trunk road network on both the east and west sides of the strategy area. Complementary measures to reduce impact of traffic on minor roads and residential streets around the north of Norwich. Improvements to junctions on Inner and Outer Ring Roads. Improvements to radial bus services. Measures to reduce through traffic in the City Centre.

Option 2 - Half length NDR from the A47 at Postwick around to the A140 Cromer Road adjacent to Norwich International Airport. Complementary measures to reduce impact of traffic on minor roads and residential streets around the north of Norwich. Improvements to junctions on Inner and Outer Ring Roads. Improvements to radial bus services. Measures to reduce through traffic in the City Centre.

Option 3 - Three quarter length NDR from the A47 Postwick, past Norwich International Airport to the A1067 Fakenham Road. Complementary measures to reduce impact of traffic on minor roads and residential streets around the north of Norwich. Improvements to junctions on Inner and Outer Ring Roads. Improvements to radial bus services. Measures to reduce through traffic in the City Centre.

Option 4 - New orbital bus route around Norwich. Major improvements to existing radial bus services. Improvements to junctions on Inner and Outer Ring Roads. Ring and Loop to prevent car drivers making through trips within the Inner Ring Road.

Option 5 - Light Rapid Transit route linking Thickthorn Park and Ride, Hospital, UEA, City Centre, Railway Station, Postwick Park and Ride, Broadland Business Park, new housing on north east fringe of Norwich. Improvements to junctions on Inner and Outer Ring Roads. Road user charging or workplace parking charging within the Inner Ring Road. Ring and Loop to prevent car drivers making through trips within the Inner Ring Road, plus additional physical restrictions on car access to the City Centre as a consequence of LRT alignment through City Centre.

Option 6 - Planning new development to reduce the distance between home, work and services. Financial incentives for implementation of workplace travel plans, including targets for reduced car use, by existing businesses as well as those expanding or relocating. Infrastructure improvements to walking and cycling networks, including measures to support safer and healthier journeys to school. Promotion of alternative modes, alternative fuels and delivery of individualised marketing campaigns in support of travel plans.

Each strategy option has been assessed to understand the benefits and disbenefits arising not only from the major element of each option (such as a new road, or new bus route) but also from the complementary measures contained within each option.

6.2 Methodology

The Government's White Paper, *A New Deal for Transport* (DETR, 1998) announced a new approach to the appraisal of different solutions to transport problems. The New Approach To Appraisal (NATA) includes the identification and assessment of problems, the identification of options for solving problems, and the appraisal of those options. First used during the Roads Review, the New Approach has been adapted to provide the framework within which Multi-Modal Studies should be taken forward, appraisal of which is now undertaken using the Department for Transport's Transport Analysis Guidance (TAG).

TAG requires that an Appraisal Summary Table (AST) is produced for each option, to assess its impact against Government objectives. The objectives considered are Environment, Safety, Economy, Accessibility and Integration. The aim of the AST is not to allow direct comparison of option against option, but rather to allow comprehension of the benefits and disbenefits of each option individually.

The Appraisal Summary Tables are beneficial for assessing the impacts of a discrete option, such as a highway scheme or a light rapid transit scheme. They have less application in fully detailing the additional benefits and disbenefits of complementary measures such as improvements of junctions on Inner and Outer Ring Roads or major improvements to existing radial bus services. Therefore for each strategy options the additonal benefits and disbenefits of complementary measures have been assessed where appropriate in addition to the ASTs, which are presented in Appendix B.

As this is an assessment of alternative strategies, rather than detailed options, the assessment against some objectives is qualitative only, and quantitative measures have not been produced. Also, the economic benefits of non road-based options have not been quantified, but their perceived costs have been calculated and are presented in the ASTs. The Present Value of Costs (PVC) is the whole life cost of the option discounted to today's prices (construction and land costs, future maintenance, operating costs, and also an allowance for optimism bias). Similarly, the Present Value of Benefits (PVB) is the monetary value of the total benefits of the option over the appraisal period of 60 years, discounted to today's prices, including savings in journey times, fuel and other operating costs

TAG also requires assessment of affordability, financial sustainability, practicality, public acceptability and distribution and equity. These areas are discussed later in this section.

6.3 Option 1

6.3.1 AST Results

(i) Environment

The full Northern Distributor Route option gives a mixture of adverse and beneficial impacts. The environmental benefits afforded by the full NDR are potential improvements to the air quality along the existing congested routes; reduced noise impact on residents in the north of the NATS area; improvements in townscape in the northern suburbs of Norwich by removing a proportion of the traffic from it; and improvements in journey ambience for drivers. The reduction in congestion and enhancement of public transport options should also produce environmental benefits within the city centre, in relation to reduced severance, noise and air pollution.

Due to the environmental designations within the Wensum valley, any road option through this area is likely to have a significant adverse environmental effect, although some of these effects could be offset by suitable mitigation measures. Of particular concern are effects on the ecology and landscape character of the Wensum valley.

If a full NDR is taken forward as part of NATS it is as worth noting the requirement under the Habitats Regulations 1994 to undertake an Appropriate Assessment. As a result of the designation of the River Wensum as a Special Area of Conservation (SAC) it would be necessary to gain approval for any development through this valley. In addition, the tie-in with the A47 at Postwick may also impact on The Broads SAC and the Broadland Special Protection Area (SPA). Information must be provided to the satisfaction of the competent authorities that would enable them to be certain that an adverse effect on the integrity of the European nature conservation site would not arise. Extensive mitigation measures and replacement habitat would more than likely be required, possibly including the provision of compensation land to offset potential effects on the SACs. Any replacement habitat would have to be provided well in advance of the construction works.

The gaining of consents under the Habitats Regulations is likely to prove time consuming and costly. Without this consent the construction of an NDR could not proceed.

(ii) Safety

There will be significant road safety benefits afforded by this option, due to the transfer of traffic from congested roads and existing accident cluster sites. There is an estimated reduction of up to 60 accidents per year.

(iii) Economy

A full length NDR could deliver significant economic benefits to consumers through congestion relief and journey time savings. In addition, it may give rise to moderate benefits in relation to driver stress.

An NDR could assist economic development along its route, but not regeneration directly. Existing traffic congestion within the NATS area does not assist regeneration. Although Option 1 is not specifically intended to assist regeneration, parts of the NATS area are designated as regeneration areas. The City of Norwich is a 'Tier 3' Assisted Area. In addition, the North Norfolk Coast has European Structural Funds Objective 2 status. A new distributor road around the north of Norwich linking with the trunk road network would improve transport links to the North Norfolk Coast, which may ultimately assist regeneration of the Objective 2 area.

The range of benefit/cost ratios for this option is displayed in the following table. It should be noted that the Highways Agency schemes now require a benefit/cost ratio of more than 2. .

Option	Present Value Cost[1]	Present Value Benefit	Ratio
1	£131.4m - £179.6m	£395.0m - £698.5m	2.9 – 4.2

(iv) Accessibility

This option affords substantial relief of severance in the northern suburbs of Norwich. In addition, the measures to reduce through traffic in the city centre should provide slight relief of severance.

An NDR would provide additional transport links to any future housing growth in the north east of the NATS area. An NDR would also facilitate public transport links to these housing areas.

(v) Integration

Draft Regional Planning Guidance for the East of England (RPG14) seeks to facilitate the role of the Norwich sub-region as the major focus for sustainable growth in the north east of the region, and to sustain and develop the regional role of Norwich, ensuring it realises its full growth potential. Policy NSR4 (Housing) provides for 29,500 net additional dwellings in the Norwich Policy Area in the period to 2021. The supporting text refers to a major urban expansion in the north east sector of the urban fringe linked to major transport improvements. Draft RPG14 supports provision of an NDR. The NDR may encourage further out-of-centre development along the new road, as well as facilitating development of the Airport.

Conversely, this option hinders protection of environmental assets of the Wensum Valley and the character and quality of the countryside to the north of Norwich.

[1] Costs shown are those for the option's present value cost at 2002 prices over the sixty year appraisal period

6.3.2 Complementary Measures

The complementary measures listed within the AST table as part of this option include:-

- Reducing the impact of traffic on minor roads and residential streets around the north of Norwich
- Improvements to junctions on Inner and Outer Ring Roads
- Improvements to radial bus services
- Implementation of measures to reduce through traffic in the City Centre

(i) Reducing the Impact of Traffic

The provision of an NDR will help to alleviate many of the problems and issues relating to level of traffic in the north of the strategy area. The reduction in traffic in this area will enhance the northern suburbs and, in addition, will provide additional capacity within the existing traffic network to allow for expansion of public transport provision.

Beyond improving the safety of road users, an additional benefit is a change in people's perceptions of how the street environment within the northern suburbs could be used. The reduction of traffic within the northern suburbs may make the creation of home zones (Section 4.5.6) possible. By encouraging more people to use the streets on foot or by bicycle, home zones have the potential to contribute at a local level to a reduction in congestion and noise pollution, and an improvement in air quality. The increase in natural surveillance arising from greater use of the street space can help to reduce crime or fear of crime.

(ii) Improvements to Junctions on Inner and Outer Ring Roads

The provision of an NDR will alleviate some of the congestion currently experienced at junctions on the inner and outer ring roads. The removal of some traffic will help free up capacity for the implementation of public transport improvements, resulting in quicker and more reliable public transport journey times. This may help entice car drivers to change their mode of transport.

(iii) Improvements to Radial Bus Services

The freeing up of capacity within the existing traffic network in the northern part of the study area will, as discussed in section (ii) above, allow for improvements to be made to bus services. Radial routes can then be targeted for improvement to give a viable alternative to the use of the car for journeys along these radial roads. In addition, interchanges with ring road routes could be considered to improve strategic public transport links. This measure would benefit residents in all sectors of the NATS area by increasing accessibility and travel options available from Park and Ride sites.

(iv) Implementation of Measures to Reduce Through Traffic in City Centre

There are currently a number of considerations for reducing through traffic within the city centre. As discussed in Section 4.5.8, restricting car access in the city centre addresses problems for other modes including accidents, air quality, noise and accessibility. However, whilst it improves conditions in the city centre it is not known what effect this might have on economic vitality. It is likely to result in displaced traffic causing problems including congestion in adjacent areas. Closure of streets improves the built environment of the areas and improves local accessibility in these areas. If the streets remain open to buses, there will be improvements in bus reliability.

6.4 Option 2

6.4.1 AST Results

(i) Environment

The half Northern Distributor Route option gives a mixture of adverse and beneficial impacts. The environmental benefits afforded by the half NDR are potential improvements to the air quality along the existing congested routes; reduced noise impact on residents within the congested area; improvements in townscape in the northeast suburbs of Norwich by removing a proportion of the traffic from it; and improvements in journey ambience for drivers. The reduction in congestion and enhancement of public transport options should also produce some environmental benefits within the city centre, in relation to reduced severance, noise and air pollution.

The tie-in with the A47 at Postwick may also impact on The Broads SAC and the Broadland Special Protection Area (SPA). Information must be provided to the satisfaction of the competent authority/s that would enable them to be certain that an adverse effect on the integrity of the European nature conservation site would not arise. Extensive mitigation measures and replacement habitat would more than likely be required, possibly including the provision of compensation land to offset potential effects on the SPA. Any replacement habitat would have to be provided well in advance of the construction works.

The gaining of consents under the Habitats Regulations is likely to prove time consuming and costly. Without this consent the construction of an NDR could not proceed.

(ii) Safety

There will be road safety benefits afforded by this option, due to the transfer of traffic from congested roads and existing accident cluster sites.

(iii) Economy

A half NDR could deliver significant economic benefits to consumers through congestion relief and journey time savings. In addition, it may give rise to moderate benefits in relation to driver stress.

A half NDR could assist economic development along its route, but not regeneration directly. Existing traffic congestion within the NATS area does not assist regeneration. Although Option 2 is not specifically intended to assist regeneration, parts of the NATS area are designated as regeneration areas. The City of Norwich is a 'Tier 3' Assisted Area. In addition, the North Norfolk Coast has European Structural Funds Objective 2 status. A new distributor road around the north of Norwich linking with the trunk road network would improve transport links to the North Norfolk Coast, which may ultimately assist regeneration of the Objective 2 area.

The range of benefit/cost ratios for this option is displayed in the following table. It should be noted that the Highways Agency schemes now require a benefit/cost ratio of more than 2.

Option	Present Value Cost[2]	Present Value Benefit	Ratio
2	£85.2m - £88.1m	£269.3m - £276.9m	3.1-3.2

(iv) Accessibility

This option affords substantial relief of severance in the north eastern suburbs of Norwich. In addition, the measures to reduce through traffic in the city centre should provide slight relief of severance in this area.

A half NDR would provide additional transport links to any future housing growth in the north east of the NATS area. A half NDR would also facilitate public transport links to these housing areas.

(v) Integration

Draft Regional Planning Guidance for the East of England (RPG14) seeks to facilitate the role of the Norwich sub-region as the major focus for sustainable growth in the north east of the region, and to sustain and develop the regional role of Norwich, ensuring it realises its full growth potential. Policy NSR4 (Housing) provides for 29,500 net additional dwellings in the Norwich Policy Area in the period to 2021. The supporting text refers to a major urban expansion in the north east sector of the urban fringe linked to major transport improvements. Draft RPG14 supports provision of an NDR. The NDR may encourage further out-of-centre development along the new road, as well as facilitating development of the Airport.

[2] Costs shown are those for the option's present value cost at 2002 prices over the sixty year appraisal period

Conversely, this option hinders protection of the character and quality of the countryside to the north east of Norwich.

6.4.2 Complementary Measures

The complementary measures listed within the AST table as part of this option include:-

- Reducing the impact of traffic on minor roads and residential streets around the north of Norwich
- Improvements to junctions on Inner and Outer Ring Roads
- Improvements to radial bus services
- Implementation of measures to reduce through traffic in the City Centre

(i) Reducing the Impact of Traffic

The provision of a half NDR will help to alleviate many of the problems and issues relating to the level of traffic in the northeast of the strategy area. The reduction in traffic in this area will enhance the northern suburbs and, in addition, will provide additional capacity within the existing traffic network to allow for expansion of public transport provision.

Beyond improving the safety of road users, an additional benefit is a change in people's perceptions of how the street environment within the northern suburbs could be used. The reduction of traffic within the northern suburbs may make the creation of home zones (Section 4.5.6) possible. By encouraging more people to use the streets on foot or by bicycle, home zones have the potential to contribute at a local level to a reduction in congestion and noise pollution, and an improvement in air quality. The increase in natural surveillance arising from greater use of the street space can help to reduce crime or fear of crime.

(ii) Improvements to Junctions on Inner and Outer Ring Roads

The provision of a half NDR will alleviate some of the congestion currently experienced at junctions on the inner and outer ring roads, but this would be limited to a greater extent to the eastern side of the city. The removal of some traffic will help free up capacity for the implementation of public transport improvements, resulting in quicker and more reliable public transport journey times. This may help entice car drivers to change their mode of transport.

(iii) Improvements to Radial Bus Services

The freeing up of capacity within the existing traffic network in the north eastern part of the study area will, as discussed in section (ii) above, allow for improvements to be made to bus services. Radial routes can then be targeted for improvement to give a

viable alternative to the use of the car for journeys along these radial roads. In addition, interchanges with ring road routes could be considered to improve strategic public transport links. This measure would benefit residents in all sectors of the NATS area by increasing accessibility and travel options available from Park and Ride sites.

(iv) Implementation of Measures to Reduce Through Traffic in City Centre

There are currently a number of considerations for reducing through traffic within the city centre. As discussed in Section 4.5.8, restricting car access in the city centre addresses problems for other modes including accidents, air quality, noise and accessibility. However, whilst it improves conditions in the city centre it is not known what effect this might have on economic vitality. It is likely to result in displaced traffic causing problems including congestion in adjacent areas. Closure of streets improves the built environment of the areas and improves local accessibility in these areas. If the streets remain open to buses, there will be improvements in bus reliability.

6.5 Option 3

6.5.1 AST Results

(i) Environment

The Three Quarter Northern Distributor Route option gives a mixture of adverse and beneficial impacts. The environmental benefits afforded by the NDR are potential improvements to the air quality along the existing congested routes; reduced noise impact on residents in the north of the NATS area; improvements in townscape in the northern suburbs of Norwich by removing a proportion of the traffic from it; and improvements in journey ambience for drivers. The reduction in congestion and enhancement of public transport options should also produce environmental benefits within the city centre, in relation to reduced severance, noise and air pollution.

The tie-in with the A47 at Postwick may also impact on The Broads SAC and the Broadland Special Protection Area (SPA). Information must be provided to the satisfaction of the competent authority/s that would enable them to be certain that an adverse effect on the integrity of the European nature conservation site would not arise. Extensive mitigation measures and replacement habitat would more than likely be required, possibly including the provision of compensation land to offset potential effects on the SPA. Any replacement habitat would have to be provided well in advance of the construction works.

The gaining of consents under the Habitats Regulations is likely to prove time consuming and costly. Without this consent the construction of an NDR could not proceed.

(ii) Safety

There will be significant road safety benefits afforded by this option in the north and north east suburbs, due to the transfer of traffic from congested roads and existing accident cluster sites.

(iii) Economy

A three quarter NDR could deliver significant economic benefits to consumers through congestion relief and journey time savings. In addition, it may give rise to moderate benefits in relation to reduction of driver stress.

A three quarter NDR could assist economic development along its route, but not regeneration directly. Existing traffic congestion within the NATS area does not assist regeneration. Although Option 3 is not specifically intended to assist regeneration, parts of the NATS area are designated as regeneration areas. The City of Norwich is a 'Tier 3' Assisted Area. In addition, the North Norfolk Coast has European Structural Funds Objective 2 status. A new distributor road around the north of Norwich linking with the trunk road network would improve transport links to the North Norfolk Coast, which may ultimately assist regeneration of the Objective 2 area.

The range of benefit/cost ratios for this option is displayed in the following table. It should be noted that the Highways Agency schemes now require a benefit/cost ratio of more than 2.

Option	Present Value Cost[3]	Present Value Benefit	Ratio
3	£111.4m - £114.2m	£352.1m - £362.6m	3.1-3.3

(iv) Accessibility

This option affords substantial relief of severance in the northern suburbs of Norwich, and some measure of relief to Taverham and Drayton. In addition, the measures to reduce through traffic in the city centre should provide slight relief of severance.

A three quarter NDR would provide additional transport links to any future housing growth in the north east of the NATS area. A three quarter NDR would also facilitate public transport links to these housing areas.

(v) Integration

Draft Regional Planning Guidance for the East of England (RPG14) seeks to facilitate the role of the Norwich sub-region as the major focus for sustainable growth in the north east of the region, and to sustain and develop the regional role of Norwich,

[3] Costs shown are those for the option's present value cost at 2002 prices over the sixty year appraisal period

ensuring it realises its full growth potential. Policy NSR4 (Housing) provides for 29,500 net additional dwellings in the Norwich Policy Area in the period to 2021. The supporting text refers to a major urban expansion in the north east sector of the urban fringe linked to major transport improvements. Draft RPG14 supports provision of an NDR. The three quarter NDR may encourage further out-of-centre development along the new road, as well as facilitating development of the Airport.

Conversely, this option hinders protection of environmental assets such as the character and quality of the countryside to the north of Norwich.

6.5.2 Complementary Measures

The complementary measures listed within the AST table as part of this option include:-

- Reducing the impact of traffic on minor roads and residential streets around the north of Norwich
- Improvements to junctions on Inner and Outer Ring Roads
- Improvements to radial bus services
- Implementation of measures to reduce through traffic in the City Centre

(i) Reducing the Impact of Traffic

The provision of a three quarter NDR would help to alleviate many of the problems and issues relating to the level of traffic in the north of the strategy area. The reduction in traffic in this area will enhance the northern suburbs and, in addition, would provide additional capacity within the existing traffic network to allow for expansion of public transport provision.

Beyond improving the safety of road users, an additional benefit is a change in people's perceptions of how the street environment within the northern suburbs could be used. The reduction of traffic within the northern suburbs may make the creation of home zones (Section 4.5.6) possible. By encouraging more people to use the streets on foot or by bicycle, home zones have the potential to contribute at a local level to a reduction in congestion and noise pollution, and an improvement in air quality. The increase in natural surveillance arising from greater use of the street space can help to reduce crime or fear of crime.

(ii) Improvements to Junctions on Inner and Outer Ring Roads

The provision of a three quarter NDR would alleviate some of the congestion currently experienced at junctions on the inner and outer ring roads. The removal of some traffic would help free up capacity for the implementation of public transport improvements, resulting in quicker and more reliable public transport journey times. This may help entice car drivers to change their mode of transport.

(iii) Improvements to Radial Bus Services

The freeing up of capacity within the existing traffic network in the northern part of the study area would, as discussed in section (ii) above, allow for improvements to be made to bus services. Radial routes can then be targeted for improvement to give a viable alternative to the use of the car for journeys along these radial roads. In addition, interchanges with ring road routes could be considered to improve strategic public transport links. This measure would benefit residents in all sectors of the NATS area by increasing accessibility and travel options available from Park and Ride sites.

(iv) Implementation of Measures to Reduce Through Traffic in City Centre

There are currently a number of considerations for reducing through traffic within the city centre. As discussed in Section 4.5.8, restricting car access in the city centre addresses problems for other modes including accidents, air quality, noise and accessibility. However, whilst it improves conditions in the city centre it is not known what effect this might have on economic vitality. It is likely to result in displaced traffic causing problems including congestion in adjacent areas. Closure of streets improves the built environment of the areas and improves local accessibility in these areas. If the streets remain open to buses, there will be improvements in bus reliability.

6.6 Option 4

6.6.1 AST Results

(i) Environment

The Orbital Bus Route option would have little impact upon the environment due to the fact that the majority of works would take place upon the existing road network. There may be a slight benefit in relation to physical fitness by promoting public transport rather than private vehicle usage.

(ii) Safety

There are perceived benefits within the city centre by reducing private vehicle access, but there are no other accident reduction benefits related to this option.

(iii) Economy

No transport modelling has been undertaken for this option to enable the economic benefits to be quantified. The benefits of this option are likely to be significantly lower that for Options 1-3 as there are no road user benefits to either consumers or businesses. It does, however, give the potential to deliver journey time savings for existing public transport users and mode switchers.

This option may assist economic development to a limited extent.

The costs of this option are tabulated below.

Option	Cost[4]	Benefit	Ratio
4	£29m	-	-

(iv) Accessibility

A new orbital bus route would increase the option values for over 2000 people along its length, but will give no benefit to the other sectors within the NATS area.

This option will not have a material impact upon severance within the NATS area, but may improve severance along the route corridor.

An orbital bus route would improve access to the public transport system, and enable orbital journeys to be made by public transport without the need to change services in the city centre. It would be of particular benefit in improving accessibility to employment areas on the periphery of Norwich.

(v) Integration

Existing passenger interchange facilities would be improved, with additional interchanges being provided at key locations.

This option promotes the use of more sustainable transport modes, but is unlikely to deliver significant modal shift. In addition, it does not facilitate policies to improve the environment in the northern suburbs.

The proposed route runs within the existing residential areas on the periphery of Norwich and does not therefore significantly facilitate draft sub-regional policies for housing growth in the Norwich Policy Area.

6.6.2 Complementary Measures

The complementary measures listed within the AST table as part of this option include:-

- Major improvements to existing radial bus services.
- Improvements to junctions on Inner and Outer Ring Road.
- Implementation of measures to reduce through traffic in the City Centre

[4] Costs shown are those for the option's present value cost at 2002 prices over the sixty year appraisal period

(i) Major Improvements to Existing Radial Bus Services

It would be logical to improve radial routes to link in to the proposed orbital route, thereby maximising accessibility. Whilst this would be feasible it would be considerably more difficult to accomplish than for Options 1-3, as the amount of traffic would not have been reduced to any significant extent.

(ii) Improvements to Junctions on Inner and Outer Ring Roads

Improvements to junctions on the Inner and Outer Ring Roads will assist in the reduction of congestion at these points. In contrast to Options 1-3 there are no complementary measures that will significantly reduce the volume of traffic using the ring roads.

(iii) Implementation of Measures to Reduce Through Traffic in City Centre

There are currently a number of considerations for reducing through traffic within the city centre. As discussed in Section 4.5.8, restricting car access in the city centre addresses problems for other modes including accidents, air quality, noise and accessibility. However, whilst it improves conditions in the city centre it is not known what effect this might have on economic vitality. It is likely to result in displaced traffic causing problems including congestion in adjacent areas. Closure of streets improves the built environment of the areas and improves local accessibility in these areas. If the streets remain open to buses, there will be improvements in bus reliability.

6.7 Option 5

6.7.1 AST Results

(i) Environment

The Light Rapid Transport option would probably have some adverse environmental effects, arising primarily from the proposed section of the LRT that passes to the north-east of Norwich. These would primarily be felt in terms of landscape, noise and severance, and would vary in magnitude depending on any particular route corridor chosen. In addition, the noise envelope along the corridor would alter, with reductions arising in traffic noise, but with the introduction of new LRT vehicle noise. The restrictions imposed on traffic may result in feelings of severance along the LRT corridor for those reliant on car usage.

(ii) Safety

This option gives potential accident savings in the city centre. In addition the LRT should generate sufficient modal shift from the car to reduce accidents within its route corridor.

(iii) Economy

No transport modelling has been undertaken for this option to enable the economic benefits to be quantified. The benefits of this option are likely to be significantly lower that for Options 1-3. It does, however, give the potential to deliver journey time savings for existing public transport users and mode switchers.

This option may assist economic development to a limited extent.

The costs of this option are tabulated below.

Option	Cost[5]	Benefit	Ratio
5	£364m	-	-

(iv) Accessibility

More than 2000 people would have their option values increased by provision of a cross-city LRT route.

Segregated sections of LRT may cause a hindrance to pedestrian movement. In addition, this option will increase traffic on the ring roads. The introduction of charging within the inner ring road, combined with measures to prevent through car trips will provide moderate relief of severance within the city centre.

(v) Integration

New or improved interchange facilities will be provided at key locations

This option fulfils policy objectives that seek to promote the use of more sustainable modes of transport. In addition, the LRT route would support a major urban expansion in the north east sector of the urban fringe and provide high quality public transport access to the city centre, research park and other strategic employment areas. It would therefore facilitate draft sub-regional policies for housing growth in the Norwich Policy Area.

6.7.2 Complementary Measures

The complementary measures listed within the AST table as part of this option include:-

- Improvements to junctions on Inner and Outer Ring Road.
- Road user charging or workplace parking charging within the Inner Ring Road.
- Implementation of measures to reduce through traffic in the City Centre

[5] Costs shown are those for the option's present value cost at 2002 prices over the sixty year appraisal period

- Additional physical restrictions on car access to the City Centre as a consequence of the LRT alignment through the City Centre.

(i) Improvements to Junctions on Inner and Outer Ring Roads

Improvements to junction on the Inner and Outer Ring Roads will assist in the reduction of congestion at these points. In contrast to Options 1-3 there are no complementary measures that will significantly reduce the volume of traffic using the ring roads. Impacts on congestion would depend on the approach adopted to segregation and priority at junctions.

(ii) Road User Charging or Workplace Parking Charging within the Inner Ring Road

Road user charging provides an alternative to restricting traffic and would address similar problems, including accidents, air quality, noise and accessibility, but to a lesser extent. Whilst it improves conditions in the city centre it is not known what effect this might have on economic vitality, although it does maintain car access to the city centre. Again, it is likely to result in displaced traffic exacerbating problems including congestion in adjacent areas.

Benefits are related to the city centre area, but will be available to all visitors. Charging may affect some parts of the community more than it does others.

The revenue stream created by charging could provide the significant local funding contribution towards an LRT system that would be required by Government.

(iii) Implementation of Measures to Reduce Through Traffic in City Centre

There are currently a number of considerations for reducing through traffic within the city centre. As discussed in Section 4.5.8, restricting car access in the city centre addresses problems for other modes including accidents, air quality, noise and accessibility. However, whilst it improves conditions in the city centre it is not known what effect this might have on economic vitality. It is likely to result in displaced traffic exacerbating problems including congestion in adjacent areas. Closure of streets to general traffic improves the built environment of the areas and improves local accessibility for other modes in these areas. If the streets remain open to buses, there would be improvements in bus reliability.

(iv) Additional Physical Restrictions on Car Access to City Centre as a consequence of LRT Alignment through City Centre

An LRT alignment through the city centre will result in the displacement of traffic from the route to other areas. This will result in benefits in terms of air quality, noise and accessibility within and along the LRT corridor, but may increase traffic impacts in other areas.

6.8 Option 6

6.8.1 AST Results

(i) Environment

This option promotes sustainable modes of transportation, which will have a beneficial impact on physical fitness. In addition, the possible reduction of private vehicles within the NATS area will improve the townscape, air quality and noise pollution within this area.

(ii) Safety

Modal shift from private vehicles is unlikely to be sufficient to have a significant impact on accidents.

(iii) Economy

No transport modelling has been undertaken for this option to enable the economic benefits to be quantified. The benefits of this option are likely to be significantly lower that for Options 1-3. However, impacts of this option on congestion and journey times are likely to be relatively minor.

This option does not directly assist regeneration or economic development.

The costs of this option are tabulated below.

Option	Cost[6]	Benefit	Ratio
6	£24.7m	-	-

(iv) Accessibility

This option does not change the transport service options available. Measures to support safer and healthier journeys to schools and other walking infrastructure improvements may alleviate current severance problems.

(v) Integration

Strong integration of land-use and transportation planning is fundamental to this option, although it may be difficult to reconcile this option with Government targets for housing growth in the Norwich Policy Area.

[6] Costs shown are those for the option's present value cost at 2002 prices over the sixty year appraisal period

6.8.2 Complementary Measures

There are no additional complementary measures that have not been assessed within the AST for this option, as the option is a suite of complementary interventions.

6.9 Affordability and Financial Sustainability

6.9.1 Option 1

The present value cost at 2002 prices of the new Northern Distributor Route that forms the key element of this option ranges from £131.4m to £179.6m.

The full NDR option would need to be funded mainly from Government grant, in the form of a major-scheme bid through the LTP process, although there is limited scope for sections to be part-funded from development.

The present Government financial support for large schemes is 50% grant (TSG) and, 50% Supported Capital Expenditure (Revenue). If the Government were to fund the scheme in this way, there would still be some cost to the County Council to meet some of the costs of repaying debt.

Under the Prudential Borrowing system, the County Council is able to borrow to fund capital expenditure, provided it can afford the debt repayment costs, and the borrowing is 'prudent'.

Although only one Local Authority road has been funded through the Private Finance Initiative (PFI) to date, the Highways Agency has used the PFI in a significant number of road schemes. If the Government were to fund the NDR scheme through the PFI, the County Council would receive support in the form of a Special Grant and would pay a unitary charge to the PFI contractor. Annual surpluses and shortfalls in grant receipts would be managed by the Council.

The key issue with this options is whether it is likely to gain Government funding for implementation.

Once built, the cost of maintaining the road would fall on the Council's highway maintenance budget for which capital funding is provided through the LTP process, however the ongoing costs of these options should be relatively affordable.

6.9.2 Option 2

The present value cost at 2002 prices of the half NDR route that forms the key element of this option ranges from £85.2m to £88.1m.

The half NDR option would need to be funded mainly from Government grant, in the form of a major-scheme bid through the LTP process, although there is limited scope for sections to be part-funded from development.

The present Government financial support for large schemes is 50% grant (TSG) and, 50% Supported Capital Expenditure (Revenue). If the Government were to fund the scheme in this way, there would still be some cost to the County Council to meet some of the costs of repaying debt.

Under the Prudential Borrowing system, the County Council is able to borrow to fund capital expenditure, provided it can afford the debt repayment costs, and the borrowing is 'prudent'.

Although only one Local Authority road has been funded through the Private Finance Initiative (PFI) to date, the Highways Agency has used the PFI in a significant number of road schemes. If the Government were to fund the NDR scheme through the PFI, the County Council would receive support in the form of a Special Grant and would pay a unitary charge to the PFI contractor. Annual surpluses and shortfalls in grant receipts would be managed by the Council.

The key issue with this option is whether it is likely to gain Government funding for implementation

Once built, the cost of maintaining the road would fall on the Council's highway maintenance budget for which capital funding is provided through the LTP process, however the ongoing costs of these options should be relatively affordable.

6.9.3 Option 3

The present value cost at 2002 prices of the three quarter NDR route that forms the key element of this option ranges from £111.4m to £114.2m.

The three quarter NDR option would need to be funded mainly from Government grant, in the form of a major-scheme bid through the LTP process, although there is limited scope for sections to be part-funded from development.

The present Government financial support for large schemes is 50% grant (TSG) and, 50% Supported Capital Expenditure (Revenue). If the Government were to fund the scheme in this way, there would still be some cost to the County Council to meet some of the costs of repaying debt.

Under the Prudential Borrowing system, the County Council is able to borrow to fund capital expenditure, provided it can afford the debt repayment costs, and the borrowing is 'prudent'.

Although only one Local Authority road has been funded through the Private Finance Initiative (PFI) to date, the Highways Agency has used the PFI in a significant number of road schemes. If the Government were to fund the NDR scheme through the PFI, the County Council would receive support in the form of a Special Grant and would pay a unitary charge to the PFI contractor. Annual surpluses and shortfalls in grant receipts would be managed by the Council.

The key issue with this option is whether it is likely to gain Government funding for implementation

Once built, the cost of maintaining the road would fall on the Council's highway maintenance budget for which capital funding is provided through the LTP process, however the ongoing costs of these options should be relatively affordable.

6.9.4 Option 4

The present value cost of the orbital bus route that forms the key element of this strategy option is estimated at £29.0m (2002 prices).

This total cost consists of capital costs of £5.0m for vehicles and improved passenger interchange facilities, and revenue costs of £24.0m to cover the estimated operating deficit incurred by the service over the appraisal period.

While the capital cost of implementing the orbital route is clearly affordable, and LTP funding could be allocated for this, the high ongoing revenue cost of supporting the service presents a problem for the County Council as there is currently no revenue funding available from Government through the LTP process.

Although the County Council has recently secured Urban Bus Challenge funding to support an orbital bus route at a lower frequency than that envisaged for this strategy option, this funding is limited to a period of three years.

The introduction of a road user charging or workplace parking charging scheme would provide a revenue stream to fund public transport improvements such as an orbital bus service. Local authorities have powers to introduce such schemes as part of a package of measures in a Local Transport Plan that includes improving public transport.

6.9.5 Option 5

The present value cost of the cross-city light rapid transit route that forms the key element of this strategy option is estimated at £364.2m (2002 prices).

Government guidance on the funding of light rail schemes states that:

- a local funding contribution of at least 25% of scheme costs is generally expected
- approval is unlikely to be given for schemes requiring operating subsidy

On the basis of the above cost estimate a local funding contribution of £91.0m would be required to support a Major Scheme bid for Government funding of a cross-city light rapid transit route.

There will be some scope to secure developer funding for a light rapid transit route, particularly for sections of route serving areas where significant future growth is planned or under consideration, such as the north east fringe of Norwich, but a strategy to secure contributions over a period of several years would need to be developed.

Even if it is assumed that significant developer contributions can be secured, a high proportion of the local funding requirement will remain to be found from other sources. It is considered that the only realistic means of raising this level of funding locally would be the revenue stream generated by a road user charging or workplace parking charging scheme.

For this reason a charging scheme within the Inner Ring Road has been included as part of this strategy. Local authorities have powers to introduce such schemes as part of a package of measures in a Local Transport Plan that includes improving public transport, and the cost of introducing and operating the scheme would be funded from the revenue it generated.

The level of confidence that a light rapid transit operation in Norwich would be viable without operating subsidy is also fundamental to the affordability and financial sustainability of the option.

Current levels of public transport patronage on the corridors to be served by LRT in this option are at best only 70% of those needed to support an LRT system. The viability of LRT would be dependent on sustained underlying growth in public transport patronage and a high level of transfer from existing bus services. Unrestrained competition for LRT from parallel bus services would represent a significant threat to the viability and financial sustainability of this strategy, although it might be possible to mitigate this risk through a Quality Contract for bus services on corridors served by LRT.

Given the high cost of this strategy both in absolute terms, and relative to other options, and the risk of the levels of patronage required to support an LRT not being achieved, it must be questioned whether this strategy is either affordable or financially sustainable.

6.9.6 Option 6

The present value cost of the various measures included in this strategy option is estimated at £24.7m (2002 prices).

This total cost consists of capital costs of £12.7m for walking and cycling infrastructure improvements over and above the level of spend on such measures under the existing NATS strategy, and revenue costs of £12.0m to cover the estimated cost of employing additional travel plan co-ordinators, promotion of alternative modes and fuels, and delivery of personalised marketing campaigns over the appraisal period. These costs may appear high, but it must be recognised that these measures will have minimal impact without a step change in funding.

While the capital cost of implementing this strategy is clearly affordable, and LTP funding could be allocated for this, the ongoing revenue cost of supporting the strategy is significant. This presents a problem for the County Council as there is currently no revenue funding available from Government through the LTP process.

6.9.7 Measures Common to More Than One Option

Improvements to junctions on the Inner and Outer Ring Roads would need to be funded from LTP integrated transport allocations. The larger scale schemes are relatively unaffordable, at least in the short term, although the works can be implemented in phases.

6.10 Practicality and Public Acceptability

6.10.1 Option 1

Studies have identified that there a number of route options for a full length Northern Distributor Route that are practical in engineering terms.

There is a high level of public support for a full length NDR.

An NDR was supported or strongly supported by 77.6% of all respondents to the NATS public consultation.

13.9% of respondents opposed or strongly opposed an NDR for Norwich.

6.1% of respondents expressed no strong view and 2.4% did not answer the question.

6.10.2 Option 2

Studies have identified that there a number of route options for a half length Northern Distributor Route that are practical in engineering terms.

Public support for a half length NDR option has not been sought.

6.10.3 Option 3

Studies have identified that there a number of route options for a three quarter length Northern Distributor Route that are practical in engineering terms.

Public support for a three quarter length NDR option has not been sought.

6.10.4 Option 4

There are no significant practical obstacles to the implementation of a new orbital bus route. The route would use the existing highway network. Orbital services would be largely complementary to the existing commercial bus network of cross-city radial routes, and would not adversely affect the viability of existing services.

The County Council has powers under the 1985 Transport Act to secure the service by competitive tender.

The successful Urban Bus Challenge bid submitted by the County Council in 2003 will lead to the implementation during 2005 of an orbital bus route offering a lower level of service than that assumed for this option, but providing a base for further development.

A strong majority, 91.3% of respondents to the NATS public consultation, supported or strongly supported improving bus, rail and other passenger transport.

Just 2.6% of respondents opposed or strongly opposed improving passenger transport.

6.10.5 Option 5

There are currently serious practical obstacles to the implementation of light rapid transit systems in the UK.

The escalation of costs for schemes in Manchester, Merseyside, South Hampshire and West Yorkshire that had previously been approved by central government has resulted in the withdrawal of Government support. Government currently appears to favour funding a greater number of more modest schemes to deliver improvements to public transport in order to spread the benefits of investment more widely.

Obtaining the powers to construct a new LRT system can also be a formidable obstacle to implementation. This is a complex and costly process involving application for an Order under the Transport and Works Act 1992.

Public support for the introduction of light rapid transit in Norwich is by no means as clear cut as support for the more general proposition of improving passenger transport. The reasons for this are unclear, but may include concern about the affordability of LRT, or noise and visual intrusion if tram routes pass close to residential properties.

65.5% of respondents to the NATS public consultation supported or strongly supported the introduction of trams.

17.8% of respondents opposed or strongly opposed introducing trams.

Road user charging within 5 years was supported or strongly supported by a total of 15.9% of respondents, and opposed or strongly opposed by 73.6% of respondents (Q.7a).

With reference to introducing road user charging within 5 to 10 years; 14.3% of respondents were in favour and a total of 70.7% of respondents were in opposition (Q.7b).

Introducing workplace charging within 5 years had the support/strong support of 23.3% of respondents (Q.7c).

61.7% of respondents were opposed or strongly opposed to introducing workplace parking charging within 5 years.

Workplace charging within 5 to 10 years was supported or strongly supported by 19.9% of the respondents and opposed by a total of 60.0% of respondents (Q.7d).

Of the respondents who expressed opposition to road user charging, 77.3% were also opposed or strongly opposed to workplace charging (both within 5 years).

Support for trams is higher amongst those who support charging than amongst those who oppose it.

	Support Trams	Oppose Trams
Support workplace parking charging with 5 years	74%	14%
Oppose workplace parking charging with 5 years	64%	21%
Support road user charging with 5 years	81%	9%
Oppose road user charging with 5 years	63%	21%

6.10.6 Option 6

The main practical problem in implementing this strategy is the protracted nature of the land-use planning process and the time lag before changes to local plan policies impact on the location of new development as allocations made and consents granted under previous policies are taken up.

Education and encouragement measures to promote sustainable travel feature strongly in this strategy.

74.9% of respondents to the NATS public consultation supported or strongly supported 'education, encouragement and enforcement measures'.

11.5% of respondents strongly opposed or opposed this measure, and a further 13.6% of respondents either expressed no strong view or did not answer the question.

6.10.7 Measures Common to More Than One Option

Inner and Outer Ring Road junction improvements - A large majority of 90.8% of respondents to the NATS public consultation supported or strongly supported measures to improve traffic flow on the main road network.

2.8% of respondents were opposed or strongly opposed to these measures.

Opinion was divided on the issue of access restrictions on roads around the north of Norwich, with 39.4% of respondents supporting or strongly supporting the measure, and a total of 39.6% of respondents in opposition (Q.5a).

Small-scale traffic measures in the city centre were supported/strongly supported by 65.3% of respondents (Q.6a)

Small-scale traffic measures were opposed or strongly opposed by a total of 21.6% of respondents.

13.1% of respondents either did not answer question 6a or they held no strong view.

Over half the respondents (52.2%) were in favour of stopping traffic driving straight through the city centre, but a total of 38.7% of respondents were opposed or strongly opposed to this measure (Q.6b).

9.1% of respondents either held no strong view or did not answer this question.

6.11 Distribution and Equity

Modal share monitoring research undertaken by MAP Research for Norfolk County Council (2001) provides a socio-economic profile of transport users resident in the Norwich City Council area.

Table (number) shows that 64% of bus journeys made by Norwich residents are undertaken by people in socio-economic groups C2, D and E, who represent only 51% of journeys by all modes.

Socio-economic Profile of Norwich Transport Users

Socio-economic group	Percentage of sample making trips involving:		
	Bus	Car	All modes
ABC1	36	52	49
C2DE	64	48	51
Total	100	100	100

6.11.1 Option 1

An NDR has the potential to improve conditions for people living in and around the north of Norwich, and for motorists throughout the NATS area.

An NDR will also reduce congestion on some of the key radial routes used by bus services in the north of Norwich, assisting their efficient and reliable operation. It will therefore provide some benefits to public transport users, who are predominantly from socio-economic groups C2DE.

6.11.2 Option 2

A half length NDR has the potential to improve conditions for people living in and around the northeast of Norwich, and potentially for motorists throughout the NATS area.

A half length NDR will also reduce congestion on some of the key radial routes used by bus services in the northeast of Norwich, assisting their efficient and reliable operation. It will therefore provide some benefits to public transport users, who are predominantly from socio-economic groups C2DE.

6.11.3 Option 3

A three quarter length NDR has the potential to improve conditions for people living in and around the north and northeast of Norwich, and potentially for motorists throughout the NATS area.

A three quarter length NDR will also reduce congestion on some of the key radial routes used by bus services in the north and east of Norwich, assisting their efficient and reliable operation. It will therefore provide some benefits to public transport users, who are predominantly from socio-economic groups C2DE.

6.11.4 Options 4 and 5

The bus-based public transport improvements delivered by Option 4, and the high quality public transport mode delivered by Option 5 will be of particular benefit to C2DE's, who have less access to cars and are more dependent on public transport to access services, and will help to reduce social exclusion.

Orbital bus services assist with local accessibility and can reduce social exclusion by providing easier, cheaper and quicker travel on previously unavailable routes. They have potential to provide transport to employment and retail sites at the edge of Norwich. Benefits will be relatively widely distributed across the population of the Norwich urban area.

The cross-city LRT route will not reduce social exclusion to the same extent as an orbital bus route as it will in the main serve corridors that already well served by public transport, rather than opening up new routes. However, it will improve local accessibility by offering faster journey times, and in some cases a more frequent service. Benefits will be confined mainly to the corridors served, plus the catchment areas of the Thickthorn and Postwick Park and Ride sites.

The benefits of a charging scheme within the Inner Ring Road are related to the city centre area, but will be available to all visitors. Those making car journeys within Norwich are distributed relatively evenly between socio-economic groups ABC1 (52%) and C2DE (48%), but the charge will have a greater impact on those on low incomes and, depending on the level at which the charge is set, it may increase social exclusion by reducing travel choices for those who cannot afford to pay the charge.

6.11.5 Option 6

Planning new development to reduce the distance between home, work and services will help to reduce social exclusion by improving accessibility to jobs, goods and services for those without access to a car.

Improvements to walking and cycling networks will be of particular benefit to C2DE's, who have less access to cars, but are likely to have a limited impact in improving access to existing employment and retail sites on the periphery of Norwich.

The benefits of this strategy will be distributed throughout the NATS area.

6.11.6 Measures Common to More than One Option

The benefits of Inner and Outer Ring Road junction improvements will be restricted to car drivers and, to a lesser extent, bus passengers. These benefits will be widely distributed across all sectors of the NATS area.

7 Discussion

7.1 Introduction

The following sections discuss and summarise the relative impacts and benefits of each option in respect of the Government's five transport objectives, highlighting where complementary measures would enhance the benefits of the option.

7.2 Environment

Option 1 - It is considered that the adverse environmental aspects of an NDR on the Wensum Valley could not be fully mitigated, as the addition of a major road into this relatively unspoilt area would inevitably change its character. The Special Area of Conservation designation would give rise to a requirement for an Appropriate Assessment to be carried out for any route option that impacts on the SAC. Some mitigation could be provided by a combination of optimising the route alignment and providing substantial tree planting and earth shaping. This option does, however, reduce air and noise pollution for many households in the northern suburbs, improves townscapes, and allows for additional enhancement to public transport options within the northern and central parts of the strategy area, which will give additional environmental benefits.

Option 2 - It is considered that the adverse environmental impacts of a half length NDR could be mitigated through optimising the route alignment and providing substantial tree planting and earth shaping. This option reduces air and noise pollution for many households in the north east suburbs, improves townscapes, and allows for additional enhancement to public transport options within the northern and central parts of the strategy area, which will give additional environmental benefits.

Option 3 - It is considered that the adverse environmental impacts of a three quarter length NDR could be mitigated through optimising the route alignment and providing substantial tree planting and earth shaping. This option reduces air and noise pollution for many households in the northern suburbs, improves townscapes, and allows for additional enhancement to public transport options within the northern and central parts of the strategy area, which will give additional environmental benefits.

Option 4 - This option would have no significant impact upon the environment, either beneficial or adverse. It does nothing to address noise and air quality issues within the NATS area.

Option 5 - This option would have no significant impact upon the environment, either beneficial or adverse. It does nothing to address noise and air quality issues within the NATS area.

Option 6 - It is difficult to determine exact impacts and effects of the measures making up this option as there is no actual physical impact of designs etc. to assess at this stage. It is considered that this option will have little impact on environmental designations.

Summary

- The road-based options address the majority of the problems and issues identified within the NATS area to varying degrees. They would also give the most environmental impact, both adverse and beneficial.

- Options 4, 5 and 6 have no adverse impact upon the environment, but also provide no environmental benefit to the NATS area.

7.3 Safety

Option 1 - The full NDR allows for a consistent, current standard road to be placed around the north of the NATS strategy area. This will allow congestion relief to the majority of the accident sites located in the north of Norwich.

Option 2 - The half length NDR allows for a consistent, current standard road to be placed around the northeast of the NATS strategy area. This will allow congestion relief to a number of the accident sites located in the north of Norwich.

Option 3 - The three quarter NDR allows for a consistent, current standard road to be placed around the north of the NATS strategy area. This will allow congestion relief to the majority of the accident sites located in the north of Norwich.

Option 4 - This option offers no significant reduction in accidents within the NATS area.

Option 5 - This option will give benefit along the route corridor, but will not address accident clusters elsewhere in the NATS area.

Option 6 - It is difficult to determine exact impacts and effects of of the measures making up this option as there is no actual physical impact of designs etc. to assess at this stage.

Summary

- The road-based options would alleviate congestion within parts of the NATS strategy area to varying degrees, and would also reduce accidents at known cluster sites.

- The non-road options would not sufficiently alleviate the current safety problems and issues within the NATS area.

7.4 Economy

Option 1 - The implementation of a complete NDR will deliver substantial economic benefits. As detailed in the ASTs in Appendix B, the NDR would have a benefit/cost ratio ranging from 2.9 - 4.2.

Option 2 - The implementation of a half NDR would deliver large economic benefits. As detailed in the ASTs in Appendix B, the half NDR would have a benefit/cost ratio ranging from 3.1 – 3.2.

Option 3 - The implementation of a three quarter NDR would deliver large economic benefits. As detailed in the ASTs in Appendix B, the three quarter NDR would have a benefit/cost ratio ranging from 3.1 – 3.3.

Option 4 -If revenue funding issues can be resolved, orbital bus routes could make a positive contribution to addressing problems of access around the north of Norwich. However, they could not alone provide the levels of service necessary to accommodate the diverse travel patterns arising from recent and future growth.

Option 5 - This strategy is unlikely to be either affordable or financially sustainable. In the current climate it is highly unlikely that government funding would be forthcoming for an LRT system in Norwich. Even if funding was secured, or raised locally through a charging scheme, a cross-city LRT route would only have a significant impact on congestion relief and promotion of sustainable transport within the corridors served plus the catchment areas of Park and Ride sites.

Without measures to restrain competition from bus services there is a significant risk of the levels of patronage required to support an LRT system not being achieved.

The high cost of this strategy would leave little funding available to address problems elsewhere in the NATS area.

This option represents poor value for money as it does not offer a solution to the full range of problems identified in Section 2, and is significantly more expensive than alternative options that provide a more comprehensive solution.

Option 6 - It is difficult to determine exact impacts and effects of the measures making up this option as there is no actual physical impact of designs etc. to assess at this stage. If revenue funding issues can be resolved, the measures included in this option could make a small but positive contribution to addressing the problems identified by encouraging the replacement of car trips by walking and cycling, however there is limited potential for modal shift other than for local trips.

Summary

- Each of the NDR options would give large to substantial benefit and provide the required strategic link to North Norfolk via the east of Norwich. The full NDR would provide the greatest benefit (if route selection on the western side favours a route close to the city, if practicable). The full NDR option would provide strategic access to Norwich International Airport from both the east and west. The partial route options, whilst providing a strategic access, would not cater for traffic approaching from the west on the A47 corridor.

- The orbital bus option, whilst providing benefit, would not adequately cope with future growth in the NATS area.

- The LRT option, whilst providing benefits to the areas covered, is unlikely to be affordable or financially sustainable

- The modal switch to sustainable transport option would not provide the economic benefits of the road options.

7.5 Accessibility

Option 1 - The full NDR option would provide severance relief within the north of the NATS area. In addition, the complementary measures contained within this option would assist the promotion of public transport options within the NATS area.

Option 2 - The half NDR option would provide severance relief within the northeast of the NATS area. In addition, the complementary measures contained within this option would assist the promotion of public transport options within the NATS area.

Option 3 – The three quarter NDR option would provide severance relief within the north of the NATS area. In addition, the complementary measures contained within this option would assist the promotion of public transport options within the NATS area.

Option 4 - An orbital bus route will increase the options for residents along their proposed route corridors, but the number of people benefiting from these options is less than those benefiting from the road-based options. The combination of an orbital bus route with one of the road options would ensure that the new NATS strategy is socially inclusive by improving accessibility to sites around the periphery of Norwich for both those with and without access to a car.

Option 5 - A cross-city LRT route will provide an additional sustainable mode of transport to residents living along the proposed corridor. It will, however, push traffic from the route corridor on to other streets, and may therefore have a detrimental impact upon these areas. An LRT will only address the accessibility issues within the route corridor, not the whole NATS area.

Option 6 - It is difficult to determine exact impacts and effects of of the measures making up this option as there is no actual physical impact of designs etc. to assess at this stage. Severance and physical fitness should benefit from this option.

Summary

- The road-based options would provide some measure of severance relief and would allow improvements to public transport within the north of the NATS area.

- The orbital bus route and LRT options would provide additional sustainable transport options to residents along the new route corridors, but would do little to answer problems elsewhere within the NATS area.

- The modal shift option would provide some benefit to severance and physical fitness

7.6 Integration

Option 1 - The full NDR option does not explicitly provide improvements to transport interchanges. It does integrate well with draft regional policies to develop the regional role of Norwich and ensure it realises its full growth potential. It would facilitate employment and development opportunities, and would assist in the achievement of housing growth targets for the Norwich Policy Area. In particular it would support a major urban expansion in the north-east sector of the NATS area. This option does not comply with land-use policies protecting the character and quality of the Wensum Valley.

Option 2 – The half NDR option does not explicitly provide improvements to transport interchanges. It does integrate well with draft regional policies to develop the regional role of Norwich and ensure it realises its full growth potential. It would facilitate employment and development opportunities, and would assist in the achievement of housing growth targets for the Norwich Policy Area. In particular it would support a major urban expansion in the north-east sector of the NATS area.

Option 3 - The three quarter NDR option does not explicitly provide improvements to transport interchanges. It does integrate well with draft regional policies to develop the regional role of Norwich and ensure it realises its full growth potential. It would facilitate employment and development opportunities, and would assist in the achievement of housing growth targets for the Norwich Policy Area. In particular it would support a major urban expansion in the north-east sector of the NATS area.

Option 4 - This option provides transport interchange benefits for passengers along the proposed route, but does not impact on the rest of the NATS area. As the route runs within the existing residential areas on the periphery of Norwich this option would not significantly facilitate draft sub-regional policies for housing growth in the Norwich Policy Area.

Option 5 - LRT would provide transport interchange benefits for passengers along the corridors served. This option is consistent with strategies seeking to promote sustainable forms of transport, and will promote growth at strategic employment sites. It would support a major urban expansion in the north-east sector of the NATS area, and therefore facilitate draft sub-regional policies for housing growth in the Norwich Policy Area. It does not, however, alleviate the problems and issues within the western and north-western sectors of the NATS area.

Option 6 - It is difficult to determine exact impacts and effects of of the measures making up this option as there is no actual physical impact of designs etc. to assess at this stage. In the short term, development patterns will not change substantially as a result of this strategy, so there will be limited impacts. Recent research into the effects of land use policies to promote higher densities and mixed uses has shown that these, on their own, have little effect on the demand for travel.

Summary

- The road-based options integrate well with draft regional and sub-regional policies. They would assist in the achievement of housing growth targets for the Norwich Policy Area and would support a major urban expansion in the north-east sector of the NATS area.

- The orbital bus route option would improve transport interchange within the periphery of the existing built up area, but would not significantly facilitate draft regional and sub-regional policies.

- The LRT option would improve transport interchange within the corridors served. It would support a major urban expansion in the north-east sector of the NATS area, and therefore facilitate draft sub-regional policies for housing growth in the Norwich Policy Area.

- It is difficult to reconcile Option 6 with the transport infrastructure improvements that will be required to meet housing growth targets for the Norwich Policy Area.

8 Conclusion

8.1 Option 1

A full NDR option, with a suite of complementary measures made possible by the freeing up of capacity on the existing road network, would help alleviate many of the problems and issues currently highlighted within the NATS area, in particular; congestion on the outer ring road; access to the airport; and accommodation of future housing requirements. It also gives rise to the most economic benefits and is the only strategy option to provide a strategic transport link to North Norfolk. However, whilst a full NDR option affords the most benefits within the NATS area, it also gives rise to the most adverse environmental impacts of all options considered, some of which could not be mitigated. Some of the engineering alignments may not be achievable due to perceived environmental impact. The environmental impacts may in addition give rise to protestor action, although this would depend largely on the route chosen.

8.2 Option 2

A half NDR option, with a suite of complementary measures made possible by the freeing up of capacity on the existing road network, would help alleviate some of the problems and issues currently highlighted within the NATS area, in particular; congestion on the outer ring road; access to the airport; and accommodation of future housing requirements. It provides a strategic transport link to North Norfolk via the east of Norwich. It is felt that the half route option is deliverable.

8.3 Option 3

A three quarter NDR option, with a suite of complementary measures made possible by the freeing up of capacity on the existing road network, would help alleviate many of the problems and issues currently highlighted within the NATS area, in particular; congestion on the outer ring road; access to the airport; and accommodation of future housing requirements. It provides a strategic transport link to North Norfolk via the east of Norwich. It is felt that this option has additional benefits over the half route option, as it tackles the problems and issues over a wider area, without giving rise to the environmental concerns surrounding the Wensum Valley. It is felt that the three quarter route option is deliverable.

8.4 Option 4

The main benefits of the orbital bus option, with its associated complementary measures are in terms of local accessibility and social inclusion. However, this option can not fully accommodate the diverse travel patterns arising from future growth within the NATS area. In addition, this option does not provide the range of economic benefits afforded by Options 1-3.

8.5 Option 5

It is felt that a Light Rapid Transport system within the NATS area is unlikely to be affordable or financially sustainable. Whilst providing benefit along the proposed corridor, it will give little benefit outside of this. In addition, it may exacerbate traffic problems elsewhere within the NATS area.

8.6 Option 6

The overall impact of an option to promote modal shift to sustainable forms of transportation on the problems of the NATS area is simply too limited to make it a viable strategy without other measures to address issues such as strategic access, housing growth, congestion and non-local traffic using inappropriate roads. However, elements of this strategy would be complementary to the public transport and road infrastructure improvements included in the other three options.

8.7 Additional Considerations

From the discussion in Section 7 of this report it can be seen that the non road-based options, whilst providing more public transport orientated outcomes that contribute to the aims and objectives of NATS, do not offer solutions to the full range of problems and issues identified in Section 2. It is only the NDR options that answer the majority of these concerns. In addition, it is only the NDR options that free up capacity on the existing road network to allow the maximum use of complementary measures to make improvements to public transport and better provision for non-motorised users.

The combination of an orbital bus route with the NDR options would ensure that the new NATS strategy is socially inclusive by improving accessibility to sites around the periphery of Norwich for both those with and without access to a car.

Appendix A: Plans of Options

A-1 Option 1 – Full Length Northern Distributor Road

A-2 Option 2 – Half Length NDR

A-3 Option 3 – Three Quarter Length NDR

A-4 Option 4 – Orbital Bus Route with associated traffic management measures

A-5 Option 5 – Light Rapid Transit with associated traffic management measures

Appendix B: ASTs for Options Taken Forward

Option 1 Northern Distributor Route and Complementary Transport Measures	**DESCRIPTION**	**PROBLEMS**	**PVC**
	New distributor road around the north of Norwich, linking with the trunk road network. Complementary measures to reduce impact of traffic on minor roads and residential streets around the north of Norwich. Improvements to junctions on Inner and Outer Ring Roads. Improvements to radial bus services. Measures to reduce through traffic in City Centre.	Population and housing growth around the north of Norwich. Congestion and delays on existing network. Poor public transport provision for journeys around the north of Norwich. Lack of strategic access from trunk road network. Traffic using inappropriate roads.	Present value of costs for full Northern Distributor Route within range £131.4 million to £179.6 million

OBJECTIVE	SUB-OBJECTIVE	QUALITATIVE IMPACTS	QUANTITATIVE MEASURE	ASSESSMENT
ENVIRONMENT	**Noise**	The addition of the new distributor road to the network is likely to take traffic away from the centre of Norwich and northern suburbs, bringing noise benefits to the majority of residents. However properties close to the distributor road are likely to experience an increase in noise levels. From traffic figures provided for changes in flows for 2010 and 2025, it can be seen that no existing routes suffer more than a 25% increase in flow (the greatest shown is a 3% increase), so there will be no perceptible increase in traffic noise along the existing road system. The traffic figures have also highlighted that roads in the Northern Suburbs and Northern Rural areas will experience a reduction in traffic flows by up to 70%. This equates to a possible drop of 3dB. This may give rise to a perceivable change in traffic noise along certain routes.		Not possible at this stage
	Local Air Quality	In the northern suburbs of Norwich there is likely to be a reduction in traffic flows giving an improvement in local air quality. However properties along the alignment of the distributor road would experience a reduction in air quality.		Not possible at this stage
	Greenhouse Gases	Levels of carbon dioxide are likely to increase as the new distributor road will reduce the suppression of road traffic demand in Norwich, resulting in an increase in the use of motorised transport.	Not applicable	Not possible at this stage
	Landscape	Significant adverse effects on the landscape character of the River Wensum valley as well as adverse effects on the landscape character of the historic parkland and substantial visual intrusion on properties close to the new distributor road. However if reductions in traffic flows in the northern suburbs are maintained benefits to residences in these areas are likely.	Not applicable	Large adverse
	Townscape	Beneficial effects on the scale and appearance of townscapes resulting from the reduction in traffic from the centre of Norwich and northern suburbs.	Not applicable	Slight beneficial
	Heritage of Historic Resources	There is likely to be an adverse impact upon the known cultural heritage sites, but this impact could be adequately mitigated. Adverse impacts are likely to arise on the context of the historic parkland and listed buildings. Increases or decreases in traffic will not have a significant impact on context.	Not applicable	Moderate adverse
	Biodiversity	Detrimental effects on the River Wensum SAC - a European designated nature conservation site, and other local nature conservation designations. Loss of habitat supporting protected species and severance of wildlife corridors. Implications for flora and fauna due to the reduction in localised air quality and increase in noise levels.	Not applicable	Large adverse
	Water Environment	Assuming construction impacts are mitigated, the beneficial impacts of decreased traffic in the Norwich urban area on daily pollution concentrations and risk of accidents causing severe pollution events are on the whole balanced by the adverse impacts of increased traffic in other areas. The exception to this is where the new distributor road crosses the Rivers Tas and Wensum where without specific measures the consequences of pollution are significant.	Not applicable	Moderate adverse
	Physical Fitness	Significant reductions in traffic flow on roads within the northern suburbs will encourage increased walking/cycling trips to local shops and facilities, although the duration of many of these trips is likely to be below the 30 minute threshold for significant health benefits to be realised. The size of the study area precludes quantification as detailed pedestrian and cyclist flows are not available for the entire study area.	Change over do minimum: No of peds: Data not available No cyclists: Data not available	Minor health benefits
	Journey Ambience	The western section of the northern distributor road will enable more people to see the landscape features of the Wensum Valley. The northern distributor road will reduce traveller stress by removing traffic from existing orbital routes around the north of Norwich, and offering a new high quality route for orbital journeys that is easy to follow, thus reducing route uncertainty.	More than 10,000 travellers a day will benefit	Large beneficial
SAFETY	**Accidents**	There will be significant road safety benefits arising from the transfer of traffic from congested roads in the northern suburbs, and rural roads around the north of Norwich on which there are several accident cluster sites, to a high standard purpose built road. Ring road junction schemes unlikely to have an impact on accidents. Potential accident savings in the City Centre.	Estimated reduction in annual number of casualties =40 to 60	Beneficial
	Security	The northern distributor road will provide the opportunity for improved facilities in its immediate vicinity but other affected roads would remain unchanged.	Not applicable	Neutral
ECONOMY	**Public Accounts**	Present values of costs derived from Norfolk County Council 2002 cost model for northern distributor road using TUBA.	Central Govt PVC £131.4m to £179.6m Local Govt PVC £0.0m	PVC £131.4m to £179.6m
	Transport Economic Efficiency: Business Users & Transport Providers	Option would deliver significant economic benefits to businesses through relief of congestion on radial routes and journey time savings arising from the provision of a high standard road for orbital journeys.	Business Users PVB £224.7m to £394.0m Transport Providers PVB £0.0m Other PVB £0.0m	PVB £224.7m to £394.0m
	Transport Economic Efficiency: Consumers	Option would deliver significant economic benefits to consumers through relief of congestion on radial routes and journey time savings arising from the provision of a high standard road for orbital journeys.	Consumers PVB £170.3m to £304.5m	PVB £170.3m to £304.5m
	Reliability	Assessments based upon 2010 Low Growth results only. Separate assessments made for two key orbital links in north east and north west Norwich (A140 Sweet Briar Road, A1042 Mousehold Lane). Overall assessment score for the two key links taken together, based upon their Do-Minimum and Do-Something percentage stresses, is Moderate		Moderate Benefit
	Wider Economic Impacts	The option does not directly assist regeneration, although it will assist economic development.	Not applicable	Neutral
ACCESSIBILITY	**Option Values**	No new public transport services are included in this strategy, with improvements confined to enhanced frequency and reliability on existing radial bus services – hence there are no additional options being made available.	Not applicable	Neutral
	Severance	There would be a substantial relief of severance in the northern suburbs of Norwich as a result of this option due to reductions in traffic flow of over 50% on existing orbital routes. Reductions in traffic flow on rural roads around the north of Norwich are offset by severance caused by the closure of some minor rural roads where they cross the new road. Measures to reduce through traffic in the city centre provide slight relief of severance, offset by the impact of displaced traffic.	Not applicable	Slight beneficial
	Access to the Transport System	No changes being made to public transport systems that will affect the number of corridors within the study area with a daytime hourly public transport service, therefore impacts are neutral.	Not applicable	Neutral
INTEGRATION	**Transport Interchange**	No changes being made to interchanges, therefore impacts are neutral.	Not applicable	Neutral
	Land-Use Policy	Draft RPG14 supports a northern distributor route. Option facilitates promotion of economic development. It may encourage further out-of-centre development along the new road. Facilitates urban expansion on the north east fringe of Norwich. Facilitates development of airport by improving surface access. Hinders protection of environmental assets of the Wensum Valley, and the character and quality of the countryside to the north of Norwich.	Not applicable	Neutral
	Other Government Policies	The only other non-transport government policies relevant relate to national health policy and air quality. No others are deemed relevant that are not already covered by this assessment.	Not applicable	Neutral

Option 2 **Postwick - Airport section of Northern Distributor Route and Complementary Transport Measures**	**DESCRIPTION** New distributor road around the north east of Norwich, linking the Airport with the trunk road network at Postwick. Complementary measures to reduce impact of traffic on minor roads and residential streets around the north east of Norwich. Improvements to junctions on Inner and Outer Ring Roads. Improvements to radial bus services. Measures to reduce through traffic in City Centre.	**PROBLEMS** Population and housing growth around the north of Norwich. Congestion and delays on existing network. Poor public transport provision for journeys around the north of Norwich. Lack of strategic access from trunk road network. Traffic using inappropriate roads.	**PVC** Present value of costs for half Northern Distributor Route, Postwick - Airport within range £85.2 million to £88.1 million

OBJECTIVE	SUB-OBJECTIVE	QUALITATIVE IMPACTS	QUANTITATIVE MEASURE	ASSESSMENT
ENVIRONMENT	**Noise**	The addition of the new distributor road to the network is likely to take traffic away from the centre of Norwich and north eastern suburbs, bringing noise benefits to the majority of residents in these areas. However properties close to the distributor road are likely to experience an increase in noise levels. From traffic figures provided for changes in flows for 2010 and 2025, it can be seen that no existing routes suffer more than a 25% increase in flow (the greatest shown is a 3% increase), so there will be no perceptible increase in traffic noise along the existing road system. The traffic figures have also highlighted that roads in the Northern Suburbs and Northern Rural areas will experience a reduction in traffic flows by up to 50%. This equates to a possible drop of 2dB. This may give rise to a perceivable change in traffic noise along certain routes.		Not possible at this stage
	Local Air Quality	Air quality in the north eastern suburbs of Norwich may improve although significant improvements are unlikely. A reduction in air quality is likely for properties along the alignment of the distributor road.		Not possible at this stage
	Greenhouse Gases	Levels of carbon dioxide are likely to increase as the new distributor road will reduce the suppression of road traffic demand in Norwich, resulting in an increase in the use of motorised transport.	Not applicable	Not possible at this stage
	Landscape	Substantial visual intrusion on properties close to the new distributor road can be expected as well as adverse effects on the landscape character of the historic parkland.	Not applicable	Moderate to large adverse
	Townscape	On the assumption that there is likely to be a reduction in traffic flow in the north eastern suburbs, there may be benefits to the townscape in these areas.	Not applicable	Slight beneficial
	Heritage of Historic Resources	There is likely to be an adverse impact upon the known cultural heritage sites, but this impact could be adequately mitigated. Adverse impacts are likely to arise on the context of the historic parkland and listed buildings. Increases or decreases in traffic will not have a significant impact on context.	Not applicable	Moderate adverse
	Biodiversity	Loss of habitat supporting protected species and severance of wildlife corridors. Implications for flora and fauna due to the reduction in localised air quality and increase in noise levels. Adverse effects on local nature conservation designations are also predicted.	Not applicable	Moderate adverse
	Water Environment	Assuming construction impacts are mitigated, the beneficial impacts of decreased traffic in the Norwich urban area on daily pollution concentrations and risk of accidents causing severe pollution events are on the whole balanced by the adverse impacts of increased traffic in other areas.	Not applicable	Neutral
	Physical Fitness	Reductions in traffic flow on roads within the north eastern suburbs will encourage increased walking/cycling trips to local shops and facilities, although the duration of many of these trips is likely to be below the 30 minute threshold for significant health benefits to be realised. The size of the study area precludes quantification as detailed pedestrian and cyclist flows are not available for the entire study area.	Change over do minimum: No of peds: Data not available No cyclists: Data not available	Minor health benefits
	Journey Ambience	The half northern distributor road will reduce traveller stress by removing traffic from existing orbital routes around the north east of Norwich, and offering a new high quality route for orbital journeys that is easy to follow, thus reducing route uncertainty.	More than 10,000 travellers a day will benefit	Large beneficial
SAFETY	**Accidents**	There will be some road safety benefits arising from the transfer of traffic from congested roads in the north eastern suburbs, and rural roads around the north east of Norwich, to a high standard purpose built road. However this option does not remove traffic from accident cluster sites north west of Norwich. Ring road junction schemes unlikely to have an impact on accidents. Potential accident savings in the City Centre.	Not presented	Beneficial
	Security	The half northern distributor road will provide the opportunity for improved facilities in its immediate vicinity but other affected roads would remain unchanged.	Not applicable	Neutral
ECONOMY	**Public Accounts**	Present values of costs derived from Norfolk County Council 2002 cost model for northern distributor road using TUBA.	Central Govt PVC £85.2m to £88.1m Local Govt PVC £0.0m	PVC £85.2m to £88.1m
	Transport Economic Efficiency: Business Users & Transport Providers	Option would deliver economic benefits to businesses through relief of congestion on radial routes in north east Norwich and journey time savings arising from the provision of a high standard road for orbital journeys.	Business Users PVB £149.7m to £154.6m Transport Providers PVB £0.0m Other PVB £0.0m	PVB £149.7m to £154.6m
	Transport Economic Efficiency: Consumers	Option would deliver economic benefits to consumers through relief of congestion on radial routes in north east Norwich and journey time savings arising from the provision of a high standard road for orbital journeys.	Consumers PVB £119.7m to £122.2m	PVB £119.7m to £122.2m
	Reliability	Assessments based upon 2010 Low Growth results only. Separate assessments made for two key orbital links in north east and north west Norwich (A140 Sweet Briar Road, A1042 Mousehold Lane). Overall assessment score for the two key links taken together, based upon their Do-Minimum and Do-Something percentage stresses, is Slight to Moderate		Slight to Moderate Benefit
	Wider Economic Impacts	The option does not directly assist regeneration, although it will assist economic development.	Not applicable	Neutral
ACCESSIBILITY	**Option Values**	No new public transport services are included in this strategy, with improvements confined to enhanced frequency and reliability on existing radial bus services – hence there are no additional options being made available.	Not applicable	Neutral
	Severance	There would be a moderate relief of severance in the north eastern suburbs of Norwich as a result of this option due to reductions in traffic flow on existing orbital routes. Reductions in traffic flow on rural roads around the north east of Norwich are offset by severance caused by the closure of some minor rural roads where they cross the new road. Measures to reduce through traffic in the city centre provide slight relief of severance, offset by the impact of displaced traffic.	Not applicable	Slight beneficial
	Access to the Transport System	No changes being made to public transport systems that will affect the number of corridors within the study area with a daytime hourly public transport service, therefore impacts are neutral.	Not applicable	Neutral
INTEGRATION	**Transport Interchange**	No changes being made to interchanges, therefore impacts are neutral.	Not applicable	Neutral
	Land-Use Policy	Draft RPG14 supports a northern distributor route. Option facilitates promotion of economic development to a limited extent. It may encourage further out-of-centre development along the new road. Facilitates urban expansion on the north east fringe of Norwich. Facilitates development of airport by improving surface access from south and east. Hinders protection of the character and quality of the countryside to the north east of Norwich.	Not applicable	Beneficial
	Other Government Policies	The only other non-transport government policies relevant relate to national health policy and air quality. No others are deemed relevant that are not already covered by this assessment.	Not applicable	Neutral

Option 3 Postwick - A1067 Fakenham Road section of Northern Distributor Route and Complementary Transport Measures	**DESCRIPTION**	**PROBLEMS**	**PVC**
	New distributor road around the north east of Norwich, linking the A1067 and Airport with the trunk road network at Postwick. Complementary measures to reduce impact of traffic on minor roads and residential streets around the north east of Norwich. Improvements to junctions on Inner and Outer Ring Roads. Improvements to radial bus services. Measures to reduce through traffic in City Centre.	Population and housing growth around the north of Norwich. Congestion and delays on existing network. Poor public transport provision for journeys around the north of Norwich. Lack of strategic access from trunk road network. Traffic using inappropriate roads.	Present value of costs for three quarter Northern Distributor Route Postwick - A1067 within range £111.4 million to £114.2 million

OBJECTIVE	SUB-OBJECTIVE	QUALITATIVE IMPACTS	QUANTITATIVE MEASURE	ASSESSMENT
ENVIRONMENT	**Noise**	The addition of the new distributor road to the network is likely to take traffic away from the centre of Norwich and northern suburbs, bringing noise benefits to the majority of residents. However properties close to the distributor road are likely to experience an increase in noise levels. From traffic figures provided for changes in flows for 2010 and 2025, it can be seen that no existing routes suffer more than a 25% increase in flow (the greatest shown is a 3% increase), so there will be no perceptible increase in traffic noise along the existing road system. The traffic figures have also highlighted that roads in the Northern Suburbs and Northern Rural areas will experience a reduction in traffic flows by up to 50%. This equates to a possible drop of 2dB. This may give rise to a perceivable change in traffic noise along certain routes.		Not possible at this stage
	Local Air Quality	Air quality in the north eastern suburbs of Norwich may improve although significant improvements are unlikely. A reduction in air quality is likely for properties along the alignment of the distributor road.		Not possible at this stage
	Greenhouse Gases	Levels of carbon dioxide are likely to increase as the new distributor road will reduce the suppression of road traffic demand in Norwich, resulting in an increase in the use of motorised transport.	Not applicable	Not possible at this stage
	Landscape	Substantial visual intrusion on properties close to the new distributor road can be expected as well as adverse effects on the landscape character of the historic parkland.	Not applicable	Moderate to large adverse
	Townscape	On the assumption that there is likely to be a reduction in traffic flow in the north eastern suburbs, there may be benefits to the townscape in these areas.	Not applicable	Slight beneficial
	Heritage of Historic Resources	There is likely to be an adverse impact upon the known cultural heritage sites, but this impact could be adequately mitigated. Adverse impacts are likely to arise on the context of the historic parkland and listed buildings. Increases or decreases in traffic will not have a significant impact on context.	Not applicable	Moderate adverse
	Biodiversity	Loss of habitat supporting protected species and severance of wildlife corridors. Implications for flora and fauna due to the reduction in localised air quality and increase in noise levels. Adverse effects on local nature conservation designations are also predicted.	Not applicable	Moderate adverse
	Water Environment	Assuming construction impacts are mitigated, the beneficial impacts of decreased traffic in the Norwich urban area on daily pollution concentrations and risk of accidents causing severe pollution events are on the whole balanced by the adverse impacts of increased traffic in other areas.	Not applicable	Neutral
	Physical Fitness	Reductions in traffic flow on roads within the north eastern suburbs will encourage increased walking/cycling trips to local shops and facilities, although the duration of many of these trips is likely to be below the 30 minute threshold for significant health benefits to be realised. The size of the study area precludes quantification as detailed pedestrian and cyclist flows are not available for the entire study area.	Change over do minimum: No of peds: Data not available No cyclists: Data not available	Minor health benefits
	Journey Ambience	The three quarter northern distributor road will reduce traveller stress by removing traffic from existing orbital routes around the north and north east of Norwich, and offering a new high quality route for orbital journeys that is easy to follow, thus reducing route uncertainty.	More than 10,000 travellers a day will benefit	Large beneficial
SAFETY	**Accidents**	There will be some road safety benefits arising from the transfer of traffic from congested roads in the north and north eastern suburbs, and rural roads around the north of Norwich, to a high standard purpose built road. However this option does not remove traffic from accident cluster sites west of the A1067. Ring road junction schemes unlikely to have an impact on accidents. Potential accident savings in the City Centre.	Not presented	Beneficial
	Security	The three quarter northern distributor road will provide the opportunity for improved facilities in its immediate vicinity but other affected roads would remain unchanged.	Not applicable	Neutral
ECONOMY	**Public Accounts**	Present values of costs derived from Norfolk County Council 2002 cost model for northern distributor road using TUBA.	Central Govt PVC £111.4m to £114.2m Local Govt PVC £0.0m	PVC £111.4m to £114.2m
	Transport Economic Efficiency: Business Users & Transport Providers	Option would deliver economic benefits to businesses through relief of congestion on radial routes in north and north east Norwich and journey time savings arising from the provision of a high standard road for orbital journeys.	Business Users PVB £199.2m to £204.9m Transport Providers PVB £0.0m Other PVB £0.0m	PVB £199.2m to £204.9m
	Transport Economic Efficiency: Consumers	Option would deliver economic benefits to consumers through relief of congestion on radial routes in North and north east Norwich and journey time savings arising from the provision of a high standard road for orbital journeys.	Consumers PVB £153.0m to £157.7m	PVB £153.0m to £157.7m
	Reliability	Assessments based upon 2010 Low Growth results only. Separate assessments made for two key orbital links in north east and north west Norwich (A140 Sweet Briar Road, A1042 Mousehold Lane). Overall assessment score for the two key links taken together, based upon their Do-Minimum and Do-Something percentage stresses, is Moderate		Moderate Benefit
	Wider Economic Impacts	The option does not directly assist regeneration, although it will assist economic development.	Not applicable	Neutral
ACCESSIBILITY	**Option Values**	No new public transport services are included in this strategy, with improvements confined to enhanced frequency and reliability on existing radial bus services – hence there are no additional options being made available.	Not applicable	Neutral
	Severance	There would be a moderate relief of severance in the northern and north eastern suburbs of Norwich as a result of this option due to reductions in traffic flow on existing orbital routes. Reductions in traffic flow on rural roads around the north and north east of Norwich are offset by severance caused by the closure of some minor rural roads where they cross the new road. Measures to reduce through traffic in the city centre provide slight relief of severance, offset by the impact of displaced traffic.	Not applicable	Slight beneficial
	Access to the Transport System	No changes being made to public transport systems that will affect the number of corridors within the study area with a daytime hourly public transport service, therefore impacts are neutral.	Not applicable	Neutral
INTEGRATION	**Transport Interchange**	No changes being made to interchanges, therefore impacts are neutral.	Not applicable	Neutral
	Land-Use Policy	Draft RPG14 supports a northern distributor route. Option facilitates promotion of economic development. It may encourage further out-of-centre development along the new road. Facilitates urban expansion on the north east fringe of Norwich. Facilitates development of airport by improving surface access from south and east. Hinders protection of the character and quality of the countryside to the north of Norwich.	Not applicable	Beneficial
	Other Government Policies	The only other non-transport government policies relevant relate to national health policy and air quality. No others are deemed relevant that are not already covered by this assessment.	Not applicable	Neutral

Option 4 **Bus-based Public Transport Improvements**	**DESCRIPTION** New orbital bus route around Norwich. Major improvements to existing radial bus services. Improvements to junctions on Inner and Outer Ring Road. Ring and Loop to prevent car drivers making through trips within the Inner Ring Road.	**PROBLEMS** Population and housing growth around the north of Norwich. Congestion and delays on existing network. Poor public transport provision for journeys around the north of Norwich. Lack of strategic access from trunk road network. Traffic using inappropriate roads.	**PVC** Present value of costs for orbital bus route £29.0m

OBJECTIVE	SUB-OBJECTIVE	QUALITATIVE IMPACTS	QUANTITATIVE MEASURE	ASSESSMENT
ENVIRONMENT	**Noise**	No significant changes in noise levels are likely to arise as a result of the improvements to the local bus network and the level of modal shift from the car they are expected to generate.		Insignificant change
	Local Air Quality	No significant changes in local air quality are likely.		Insignificant change
	Greenhouse Gases	If traffic flows are reduced overall there may be a reduction in greenhouse gases however it is more likely that a reduction in the number of car journeys would be offset by an increase in bus network mileage giving an overall neutral effect.	Not applicable	Insignificant change
	Landscape	No significant changes are likely as the orbital routes would use the existing road network.	Not applicable	Neutral
	Townscape	Beneficial effects as a result of a reduction in the number of car journeys offset by an increase in bus network mileage is likely to give an overall neutral effect.	Not applicable	Neutral
	Heritage of Historic Resources	As no additional land take is proposed, there is unlikely to be any significant impact on listed buildings and archaeological features.	Not applicable	Neutral
	Biodiversity	No significant changes are expected.	Not applicable	Neutral
	Water Environment	No significant changes are predicted but improvements to the ring road junctions would ensure improvements to the road drainage pollution prevention measures.	Not applicable	Slight beneficial
	Physical Fitness	Significant improvements to the local bus network are likely to increase the number of pedestrian journeys to/from bus stops, although the duration of many of these trips is likely to be below the 30 minute threshold for significant health benefits to be realised. The size of the study area precludes quantification as detailed pedestrian and cyclist flows are not available for the entire study area.	Change over do minimum: No of peds: Data not available No cyclists: Data not available	Minor health benefits
	Journey Ambience	Assuming public transport vehicle attributes remain substantially unchanged, the overall assessment is neutral. However orbital bus services will reduce route uncertainty for some public transport users by obviating the need to change buses in the city centre.	Not applicable	Neutral
SAFETY	**Accidents**	New and improved bus services unlikely to generate sufficient modal shift from the car to reduce accidents. Ring road junction schemes unlikely to have an impact on accidents. Potential accident savings in the City Centre.	Not presented	Neutral
	Security	Increased service levels would improve security for bus users by reducing wait time at bus stops, but the road network would remain largely unchanged.	Not applicable	Neutral
ECONOMY	**Public Accounts**	Present value of costs based on estimated capital cost of bus stop infrastructure improvements and new buses for orbital route, plus estimated operating subsidy required for a frequent orbital service.	Central Govt PVC £5.0m Local Govt PVC £24.0m	PVC £29.0m
	Transport Economic Efficiency: Business Users & Transport Providers	No transport modelling has been undertaken to enable the economic benefits to businesses of bus-based public transport improvements to be quantified. This strategy has the potential to deliver journey time savings for existing public transport users and mode switchers, but only a small proportion of these benefits will accrue to business users. Impacts on congestion would depend on the extent of any new bus priority measures implemented as part of this strategy.	Business Users PVB Not presented Transport Providers PVB Not presented Other PVB Not presented	PVB Not presented
	Transport Economic Efficiency: Consumers	No transport modelling has been undertaken to enable the economic benefits to consumers of bus-based public transport improvements to be quantified. However this strategy has the potential to deliver journey time savings for existing public transport users and mode switchers. A high proportion of these benefits will accrue to consumers. Impacts on congestion would depend on the extent of any new bus priority measures implemented as part of this strategy.	Consumers PVB Not presented	PVB Not presented
	Reliability	Introduction of the proposed Orbital Bus route and Traffic Management improvements are intended to reduce some of the private vehicle usage, but the extent of modal shift is unlikely to be sufficient to produce more consistent and reliable journey times. For this reason, the "neutral" assessment score derived above is considered to be appropriate.		Neutral
	Wider Economic Impacts	The option does not directly assist regeneration, although it may to a limited extent assist economic development.	Not applicable	Neutral
ACCESSIBILITY	**Option Values**	More than 2,000 people would have their option values increased by the new orbital bus routes.	Not applicable	Large beneficial
	Severance	New and improved bus services would not have a material impact on overall traffic flows along the routes served. The impact of additional traffic on the ring roads is likely to be offset by the attraction of traffic onto the ring roads from residential streets. Measures to prevent through car trips within the Inner Ring Road provide moderate relief of severance, offset by the impact of displaced traffic.	Not applicable	Neutral
	Access to the Transport System	The impact of the new orbital bus routes will be to increase the number of people having access to the public transport system by introducing a daytime hourly or better public transport service to additional corridors within the study area, and to enable orbital journeys to be made by public transport without the need to change services in the city centre	Change in accessibility index estimated to be within the range 5 to 10%	Slight to moderate beneficial
INTEGRATION	**Transport Interchange**	Improved passenger interchange facilities in the form of high quality bus shelters and real time information displays will be provided at bus stops, including 10 locations where the new orbital route intersects existing radial bus routes.	1500 to 3000 travellers affected Improvements at 10 locations	Passengers: Slight beneficial Freight: Neutral
	Land-Use Policy	Option supports policy objectives that seek to promote the use of more sustainable transport modes, but unlikely to deliver significant modal shift. Improves local access to the airport and strategic employment development sites, but will have a limited overall impact in terms of facilitating economic development or housing and employment growth. Does not facilitate policies to improve the environment in the northern suburbs, but has no adverse impact on the character and quality of the surrounding countryside.	Not applicable	Neutral
	Other Government Policies	The only other non-transport government policies relevant relate to national health policy and air quality. No others are deemed relevant that are not already covered by this assessment.	Not applicable	Neutral

Option 5 **High quality public transport plus traffic restraint**	**DESCRIPTION**	**PROBLEMS**	**PVC**
	Light Rapid Transit route linking P&R, Hospital, UEA, City Centre, Railway Station, Postwick P&R, Broadland Business Park, new housing on north east fringe of Norwich. Improvements to junctions on Inner and Outer Ring Road. Road user charging or workplace parking charging within the Inner Ring Road. Ring and Loop to prevent car drivers making through trips within the Inner Ring Road, plus additional physical restrictions on car access to City Centre as a consequence of LRT alignment through City Centre.	Population and housing growth around the north of Norwich. Congestion and delays on existing network. Poor public transport provision for journeys around the north of Norwich. Lack of strategic access from trunk road network. Traffic using inappropriate roads.	Present value of costs for LRT route £364.2m

OBJECTIVE	SUB-OBJECTIVE	QUALITATIVE IMPACTS	QUANTITATIVE MEASURE	ASSESSMENT
ENVIRONMENT	**Noise**	An LRT would not decrease traffic flows by more than 20%, so it is reasonable to assume that there will be no perceivable change in traffic noise. However, the parking and driving restrictions may reduce traffic noise perceptibly within the inner city, but the traffic will be displaced to the zones in between the inner and outer ring roads, which may experience an increase in traffic noise. The LRT itself will also produce a clearly perceptible change in the noise envelope, but it is not possible at this strategy stage to assess the impact of this change.		Insignificant change
	Local Air Quality	Significant changes in local air quality are unlikely, however if the LRT system is powered by electricity, properties along the route could experience an improvement in local air quality.		Insignificant change
	Greenhouse Gases	If the introduction of an LRT system leads to a reduction in traffic flows and if the system is electrically powered, a reduction in levels of CO_2 could occur.	Not applicable	Insignificant change
	Landscape	Significant changes are unlikely except in the River Yare valley and north east of Norwich where the alignment of the LRT route is not along the existing road or heavy rail network.	Not applicable	Slight to Moderate adverse
	Townscape	Changes in the townscape will occur with the implementation of LRT, most noticeably from the installation of overhead power cables but also from road closures to cars. Overall this effect is likely to be minor.	Not applicable	Slight adverse
	Heritage of Historic Resources	As there is little additional land take proposed within the city, it is considered that any impacts on listed buildings are unlikely to be significant. However where the route passes around the north east of Norwich adverse impact on the historic parkland would occur.	Not applicable	Moderate adverse
	Biodiversity	Biodiversity is unlikely to be affected except where the LRT route crosses the River Yare, where significant effects on flora and fauna are likely. These effects could be reduced if the existing river crossing is utilised.	Not applicable	Slight to moderate adverse
	Water Environment	Assuming construction impacts are mitigated, the overall impact of the potential decrease in traffic would have beneficial impacts on the water environment through reduced daily pollution concentrations and reduced risk of accidents causing severe pollution events.	Not applicable	Slight beneficial
	Physical Fitness	Significant improvements to the quality and frequency of public transport on corridors served by LRT are likely to increase the number of pedestrian and cyclist journeys to LRT stops and interchanges, although the duration of many of these trips is likely to be below the 30 minute threshold for significant health benefits to be realised. The size of the study area precludes quantification as detailed pedestrian and cyclist flows are not available for the entire study area.	Change over do minimum: No of peds: Data not available No cyclists: Data not available	Minor health benefits
	Journey Ambience	LRT would provide a higher level of traveller care for public transport users on corridors served – new vehicles, smoothness of ride, additional capacity. A fixed track system would reduce route uncertainty for users.	More than 500 but less than 10,000 travellers a day will benefit	Moderate beneficial
SAFETY	**Accidents**	Improvements in the quality and frequency of public transport on corridors served by LRT are likely to generate sufficient modal shift from the car to reduce accidents. Ring road junction schemes unlikely to have an impact on accidents. Potential accident savings in the City Centre.	Not presented	Slight Beneficial
	Security	Security standards would be raised by provision of facilities such as CCTV and help points at LRT stops, but the road network would remain largely unchanged. Potential adverse impact if vehicles excluded from quiet streets within City Centre.	Not applicable	Slight beneficial
ECONOMY	**Public Accounts**	Present value of costs based on capital cost estimates from NATS Light Rapid Transit Study, with 25% local funding contribution. Assumes no operating subsidy required.	Central Govt PVC £273.2m Local Govt PVC £91.0m	PVC £364.2m
	Transport Economic Efficiency: Business Users & Transport Providers	No transport modelling has been undertaken to enable the economic benefits to businesses of the Light Rapid Transit route to be quantified. This option has the potential to deliver significant journey time savings for existing public transport users and mode switchers, but only a small proportion of these benefits will accrue to business users. Impacts on congestion would depend on the approach adopted to segregation and priority at junctions. The economic impact of Road User Charging or Workplace Parking Charging has not been assessed.	Business Users PVB Not presented Transport Providers PVB Not presented Other PVB Not presented	PVB Not presented
	Transport Economic Efficiency: Consumers	No transport modelling has been undertaken to enable the economic benefits to consumers of the Light Rapid Transit route to be quantified. However this option has the potential to deliver significant journey time savings for existing public transport users and mode switchers. A high proportion of these benefits will accrue to consumers. Impacts on congestion would depend on the approach adopted to segregation and priority at junctions. The economic impact of Road User Charging or Workplace Parking Charging has not been assessed.	Consumers PVB Not presented	PVB Not presented
	Reliability	The introduction of the proposed LRT and Traffic Management improvements are intended to reduce some of the private vehicle usage, but the extent of modal shift is unlikely to be sufficient to produce more consistent and reliable journey times. For this reason, the "neutral" assessment score derived above is considered to be appropriate.		Neutral
	Wider Economic Impacts	The option does not directly assist regeneration, although it will assist economic development.	Not applicable	Neutral
ACCESSIBILITY	**Option Values**	More than 2,000 people would have their option values increased by the new Light Rapid Transit route.	Not applicable	Large beneficial
	Severance	Segregated sections of the Light Rapid Transit route are likely to cause some hindrance to pedestrian movement, although it is assumed that mitigation measures will be implemented where crossing flows are high. The impact of additional traffic on the ring roads is likely to be offset by the attraction of traffic onto the ring roads from residential streets. Charging within the Inner Ring Road, combined with measures to prevent through car trips, and the physical restrictions on car access as a consequence of LRT will provide moderate relief of severance within the City Centre.	Not applicable	Slight beneficial
	Access to the Transport System	The main impact of the Light Rapid Transit route would be to increase the quality and frequency of the public transport service on corridors that already have an hourly or better service. With the possible exception of the section serving the new housing on the north east fringe of Norwich, it will have minimal impact on the number of people having access to the public transport system	Change in accessibility index estimated to be within the range 0 to 5%	Neutral to slight beneficial
INTEGRATION	**Transport Interchange**	New or improved interchange facilities will be provided at key locations for interchange between LRT, local bus and heavy rail services	> 500 but < 10,000 travellers affected Improvements at 6 locations	Passengers: Moderate beneficial Freight: Neutral
	Land-Use Policy	Option fulfils policy objectives that seek to promote the use of more sustainable transport modes and is likely to be effective in delivering modal shift on corridors served. LRT provides high quality public transport access to the city centre, research park and other strategic employment development sites. Facilitates urban expansion on the north east fringe of Norwich. LRT route crosses the Yare Valley and could hinder protection of this area.	Not applicable	Beneficial
	Other Government Policies	The only other non-transport government policies relevant relate to national health policy and air quality. No others are deemed relevant that are not already covered by this assessment.	Not applicable	Neutral

Option 6 **Measures to encourage modal shift to sustainable modes and to reduce the need to travel**	**DESCRIPTION** Planning new development to reduce the distance between home, work and services. Financial incentives for implementation of workplace travel plans, including targets for reduced car use, by existing businesses as well as those expanding or relocating. Infrastructure improvements to walking and cycling networks, including measures to support safer and healthier journeys to school. Promotion of alternative modes, alternative fuels and delivery of individualised marketing campaigns in support of travel plans.	**PROBLEMS** Population and housing growth around the north of Norwich. Congestion and delays on existing network. Poor public transport provision for journeys around the north of Norwich. Strategic access from trunk road network. Traffic using inappropriate roads.	**PVC** Present value of costs for strategy measures £24.7m

OBJECTIVE	SUB-OBJECTIVE	QUALITATIVE IMPACTS	QUANTITATIVE MEASURE	ASSESSMENT
ENVIRONMENT	**Noise**	Potential decreases in traffic are likely to be below the threshold at which significant changes in noise levels will arise.		Insignificant change
	Local Air Quality	Significant changes in local air quality are unlikely. Possible localised adverse impacts where junctions that are at or over capacity in the do-minimum remain unimproved.		Insignificant change
	Greenhouse Gases	Potential for reduction in the use of motorised transport leading to a reduction in the level of CO_2 emissions.	Not applicable	Insignificant change
	Landscape	The strategy involves no new road building or major new public transport infrastructure, and is likely to encourage development within the urban area rather than on greenfield sites on the urban fringe. Significant changes are therefore unlikely.	Not applicable	Neutral
	Townscape	Potential beneficial effects on the scale and appearance of townscapes as a result of a reduction in the number of car journeys.	Not applicable	Slight beneficial
	Heritage of Historic Resources	Any impacts on listed buildings are unlikely to be significant.	Not applicable	Neutral
	Biodiversity	Biodiversity is unlikely to be affected.	Not applicable	Neutral
	Water Environment	The overall impact of the potential decrease in traffic would have beneficial impacts on the water environment through reduced daily pollution concentrations and reduced risk of accidents causing severe pollution events.	Not applicable	Slight beneficial
	Physical Fitness	The strategy is likely to have a positive impact on physical fitness by encouraging an increase in the number of pedestrian and cyclist journeys, including regular journeys to schools and workplaces. The duration of at least some of these trips is likely to be above the 30 minute threshold for significant health benefits to be realised. The size of the study area precludes quantification as detailed pedestrian and cyclist flows are not available for the entire study area.	Change over do minimum: No of peds: Data not available No cyclists: Data not available	Moderate health benefits
	Journey Ambience	No impact on journey quality for private vehicle and public transport users. Improvements to walking and cycling infrastructure will improve journey quality for pedestrians and cyclists. Potential decrease in traffic unlikely to be sufficient to reduce traveller stress. No impact on travellers' views.	Not applicable	Neutral
SAFETY	**Accidents**	Modal shift from the car unlikely to be sufficient to have a significant impact on accidents.	Not presented	Neutral
	Security	The security characteristics of the road network and security standards for public transport users would both remain largely unchanged.	Not applicable	Neutral
ECONOMY	**Public Accounts**	Present value of costs based on doubling of current NATS capital programme spend on walking and cycling measures, plus estimated revenue costs for soft measures.	Central Govt PVC £12.7m Local Govt PVC £12.0m	PVC £24.7m
	Transport Economic Efficiency: Business Users & Transport Providers	No transport modelling has been undertaken to enable the economic benefits to businesses of these measures to be quantified. However impacts on congestion and journey times are likely to be relatively minor.	Business Users PVB Not presented Transport Providers PVB Not presented Other PVB Not presented	PVB Not presented
	Transport Economic Efficiency: Consumers	No transport modelling has been undertaken to enable the economic benefits to consumers of these measures to be quantified. However impacts on congestion and journey times are likely to be relatively minor.	Consumers PVB Not presented	PVB Not presented
	Reliability		Not possible at this stage	
	Wider Economic Impacts	The strategy does not directly assist regeneration or economic development.	Not applicable	No
ACCESSIBILITY	**Option Values**	The strategy includes no measures that will change the transport service options available to users	Not applicable	Neutral
	Severance	Potential decreases in traffic are likely to be below the threshold at which there will be a beneficial impact on severance. Measures to support safer and healthier journeys to school and other improvements to walking infrastructure likely to include improved pedestrian crossing facilities at key locations.	Not applicable	Neutral to Slight beneficial
	Access to the Transport System	No changes being made to public transport systems that will affect the number of corridors within the study area with a daytime hourly public transport service, therefore impacts are neutral.	Not applicable	Neutral
	Transport Interchange	No changes being made to interchanges, therefore impacts are neutral.	Not applicable	Neutral
	Land-Use Policy	Strong integration of land use and transportation planning is fundamental to this strategy, although it may be difficult to reconcile this strategy with Government targets for housing growth. Strategy fulfils policy objectives that seek to promote the use of more sustainable transport modes.	Not applicable	Beneficial
	Other Government Policies	The only other non-transport government policies relevant relate to national health policy and air quality. No others are deemed relevant that are not already covered by this assessment.	Not applicable	Neutral

References

NATS Public Consultation Analysis Report Mott MacDonald May 2004

Problems and Issues Consultation Report

NATS Review: Light Rapid Transit Study, Mott MacDonald October 2003

Norwich Inner and Outer Ring Road Junctions Review – Final Report, Norfolk County Council, February 2003

Appendix B

NDR Major Scheme Business Case

Technical Note on Assessment of Public Transport Options

Issue and Revision Record

Rev	Date	Originator	Checker	Approver	Description
P1	11/02/08	MEP			Draft for internal review by MM NDR team
A	13/02/08	MEP	GGW	GAK	Draft for review by client
B	27/02/08	MEP	GGW	GAK	First Issue

NDR Major Scheme Business Case

Technical Note on Assessment of Public Transport Options

Option Development

The background to the development of public transport options for the NDR Major Scheme Business Case (MSBC) is outlined in detail in the technical note 'Position Statement on Development of Public Transport Option' issued on 6 December 2007.

This note was reviewed by NCC and following discussion it was agreed that the basis for developing public transport options for the NDR MSBC should be:

- The strategy options considered and appraised during the 2002-2004 NATS Review
- A reassessment of what constitutes a realistic do-minimum scenario in the light of developments since 2004
- Consideration of alternative options that may be viable in the light of policy and technology developments since 2004
- The vision and objectives for the adopted Norwich Area Transportation Strategy (NATS)
- The scheme-specific objectives of the NDR as set out in Norfolk's Local Transport Plan 2006-2011
- The requirement that public transport options for the MSBC should sit on a logical continuum between the do-minimum and more radical public transport improvements which might form part of a future TIF package

The outcome of this process should be the identification of a preferred public transport option that would, as far as possible, achieve or at least contribute to the same scheme objectives as those of the NDR.

Starting with the two public transport strategy options appraised in the NATS Options Assessment Report (October 2004), variations of the original options were developed to cover the full range of public transport inventions that could realistically be considered as potential alternatives to the NDR within the context of NATS and would contribute to the NDR scheme objectives. This produced a total of four options for initial consideration, namely:

Option 1A

A bus-based package of public transport improvements focused on improvements to existing radial bus services delivered through statutory Quality Partnership Schemes, implementation of measures to reduce through traffic in the city centre and improvements to junctions on the Inner and Outer Ring Roads.

This option represents a level of enhancement to the existing bus network which could be deliverable without recourse to Quality Contracts or franchising of the bus network. Also, given the lessons learnt from the operation of an orbital bus service between November 2005 and March 2007, it would be advisable to consider an option that does not include such a service.

Option 1B

A bus-based package of public transport improvements centred on the provision of an orbital bus route serving the northern suburbs (in a different form to that provided through Urban Bus Challenge), and also including major improvements to existing radial bus services. All of these improvements would be delivered through a Quality Contracts Scheme (QCS) to ensure full integration between orbital and radial services. Implementation of measures to reduce through traffic in the city centre and improvements to junctions on the Inner and Outer Ring Roads as per Option 1A.

The logic of including a Quality Contracts Scheme within this option is that this would permit some rationalisation of existing bus services where on-road competition currently exists, which could free up sufficient resources to provide an orbital service and improvements elsewhere on the network. The lack of integration with radial services emerged as a key barrier to the success of the Urban Bus Challenge orbital service and a QCS would also effectively address this issue.

Option 2A

A Bus Rapid Transit (BRT) system linking key housing and employment growth locations and the city centre, complemented by road user charging or workplace parking charging within the Inner Ring Road, implementation of physical measures to remove through traffic from the city centre and improvements to junctions on the Inner and Outer Ring Roads.

This option is proposed as a more affordable alternative to the light rapid transit option considered and appraised during the 2002-2004 NATS Review. If a light rail option is likely to be discarded on affordability and financial sustainability grounds, it would be appropriate to consider BRT as an intermediate mode between conventional bus and light rail. This option will also demonstrate that the benefits of delivering a step change in the quality of public transport on a limited number of key corridors have been compared against those of more widespread improvements to conventional bus services across the NATS area.

This option involves a greater degree of traffic restraint within the city centre than Options 1A and 1B in order to provide priority for BRT.

For assessment purposes it has been assumed that the key growth areas are located in the north east and south west of Norwich, and that a cross-city BRT route would link these areas via the city centre.

Option 2B

A Light Rail Transit (LRT) system linking key housing and employment growth locations and the city centre, complemented by road user charging or workplace parking charging within the Inner Ring Road, implementation of physical measures to remove through traffic from the city centre and improvements to junctions on the Inner and Outer Ring Roads.

There is a case to be made that sufficient work has already been done on this option to justify discarding it on affordability and financial sustainability grounds, but it has been retained at this stage of the process to enable a comparative assessment of Bus Rapid Transit and Light Rail Transit.

This option also involves a greater degree of traffic restraint within the city centre than Options 1A and 1B in order to provide priority for LRT.

For assessment purposes it has been assumed that the key growth areas are in the north east and south west of Norwich, and that a cross-city LRT route would link these areas via the city centre.

Option Assessment

The four options outlined above have been assessed firstly against the strategic objectives of NATS, followed by assessment against the NDR scheme objectives.

The purpose of this process was to move towards the identification of a preferred public transport option by:

- Enabling the least effective and practicable public transport options to be discarded
- Identifying where elements of individual options would be complementary
- Identifying the option or combination of options that would be most effective in meeting the NATS objectives while also, as far as possible, achieving or at least contributing to the same scheme objectives as those of the NDR.

The assessment utilises a system based on the following seven point scale:

✔ ✔ ✔	Large positive impact
✔ ✔	Moderate positive impact
✔	Slight positive impact
■	Neutral
✕	Slight negative impact
✕✕	Moderate negative impact
✕✕✕	Large negative impact

The assessments are subjective, but represent the collective views of a small team, rather than the judgement of a single assessor.

This qualitative assessment methodology is appropriate at this stage of the process and for the purpose of identifying the most effective options within the same broad category - for example alternative means of improving public transport.

This process accords with the Department for Transport's original Guidance on the Methodology for Multi-Modal Studies (GOMMMS). Volume 1, paragraph 1.1.15 stated that:

"The aim should be to carry out the studies at a level of detail that is just sufficient to enable confident decisions about what initiatives to progress."

It is also in accordance with current DfT Guidance for Local Authorities seeking Government funding for major transport schemes. Paragraph 2.5.1 of this document states:

"It is important to start with current and future strategic priorities, and then generate a wide range of options covering different types of interventions or measures including all modes, infrastructure, regulation, pricing and other ways of influencing behaviour and consider all modes and then undertake a high level of assessment of these options."

Paragraph 2.5.2 states:

"Only following this high level analysis should more detailed analysis be undertaken on specific options and detailed schemes."

Assessment of Public Transport Options against NATS Objectives

Option 1A

A bus-based package of public transport improvements focused on improvements to existing radial bus services delivered through statutory Quality Partnership Schemes (1), implementation of measures to reduce through traffic in the city centre (2) and improvements to junctions on the Inner and Outer Ring Roads (3).

Objectives	
Environment	
Reduce CO2 emissions from transport by encouraging sustainable modes of travel and vehicles using fuels derived from renewable sources or waste.	1■ 2✔ 3✖ Overall ■ - Quality Partnership Schemes have the potential to deliver improvements in the quality and frequency of bus services in conjunction with bus infrastructure improvements on individual radial routes, but are unlikely to have a substantive impact on modal split. It would not be appropriate to stipulate provision of vehicles using renewable fuels in a QPS. Traffic reduction in city centre may lead to reduced CO2 emissions. Improvement schemes on ring roads likely to encourage increased car use.
Promote the use of alternative modes of transport and less polluting fuels, particularly within Air Quality Management Areas.	1✔ 2✔ 3✖ Overall ✔ - Quality Partnership Schemes would enable promotion of improved bus services on individual routes, but would not deliver an integrated bus network or a step change in service quality across the network. A QPS stipulating use of less polluting fuels would require strong justification based on existing environmental conditions. Reducing through traffic in city centre will lead to reduced emissions in existing Air Quality Management Areas, but benefits will be partially offset by emissions from additional buses. Improvement schemes on ring roads likely to encourage increased car use.

Minimise noise, vibration and visual intrusion from transport, particularly in the public, urban open spaces in the historic city centre.	1✗ 2✓ 3■ Overall ■ - Reducing through traffic in city centre will have beneficial impacts, but likely to be offset by adverse impacts of increase in number of bus movements within the historic city centre.
Implement transport solutions that protect open space, wildlife habitats and water resources.	1■ 2■ 3■ Overall ■ - Improved bus services will use existing highway network but their impact on car use is unlikely to be sufficient to make a real contribution to protecting these resources.
Economy	
Minimise congestion and delays for all modes of transport by improving the efficiency of the transport network	1✓ 2✗ 3✓ Overall ✓ - Limited potential to improve efficiency of bus services using existing highway network. Traffic reduction in city centre likely to increase congestion on alternative routes. Improvement schemes on ring roads will improve efficiency of network, but gains may only be realised in short term.
Promote a vibrant city centre, and other commercial centres, by improving accessibility for people and goods.	1✓ 2■ 3✓ Overall ✓ - Improvements to radial bus services will have beneficial impact on accessibility of city centre. Improvement schemes on ring roads will facilitate access to city centre by car.
Cater for the travel consequences arising from growth aspirations. In particular accommodate transport needs arising from future growth of the airport and the cluster of the Norwich Research Park, university and hospitals at Colney.	1■ 2■ 3✓ Overall ■ - Quality Partnership Schemes likely to focus on routes where there is a business case for operators to invest now rather than on catering for future growth.
Improve the competitiveness of the Norwich area as a retail, tourist and business centre, whilst enhancing its image and maintaining a high quality environment.	1■ 2✓ 3■ Overall ■ - Improved conventional bus services will not enhance the image of Norwich in the way that a new public transport mode (BRT/LRT) would. Reducing through traffic will enhance the city centre environment.

Safety	
Maximise safety and security for everyone	1■ 2✔ 3■ Overall ✔ - Reducing through traffic in the city centre will improve safety within this area.
Minimise the number and severity of road traffic accidents	1■ 2✔ 3■ Overall ✔ - A QPS is unlikely to contribute to accident reduction. Reducing through traffic in the city centre likely to reduce accidents.
Lower the incidence of crime experienced on the transport system and remove the perception of fear of crime for vulnerable people	1■ 2■ 3■ Overall ■ - No impact
Minimise fear and intimidation from traffic	1■ 2✔ 3✖ Overall ■ - A QPS is unlikely to have any impact on fear and intimidation from traffic. Beneficial impact of reducing through traffic in city centre. Likely increase in traffic on ring roads will lead to more fear and intimidation.
Accessibility	
Maximise transport choice for all travellers.	1■ 2■ 3✖ Overall ✖ - Improved bus services on existing radial routes will not provide a new transport choice. Measures to reduce through traffic in city centre will reduce route choice for drivers.
Reduce social exclusion through transport solutions and promote equal access to jobs, goods and services.	1■ 2■ 3■ Overall ■ - Improved bus services on existing radial routes are unlikely to have a significant impact on social exclusion. Quality Partnership Schemes likely to focus on routes where there is a business case for operators to invest rather than those serving areas of social exclusion.
Protect and enhance residential amenity and minimise community severance	1■ 2■ 3■ Overall ■ - No impact

Enhance access for non-car modes	1■ 2✔ 3✔ Overall ✔ - Reduced traffic levels within city centre will improve access for other modes. Potential to incorporate public transport priority and improved pedestrian/cycle facilities within Inner and Outer Ring Road junction improvements.
Integration	
Promote sustainable means of travel, minimise the length of trips and encourage reduced car-use through land use policies, layout of development and promotion of travel plans	1✔ 2■ 3■ Overall ✔ - Quality Partnership Schemes would facilitate short to medium term planning of the bus network to support land use policies and travel plans.
Improve integration and interchange	1✔ 2■ 3■ Overall ■ - No impact
Reduce the need to travel	1■ 2■ 3■ Overall ■ - No impact

Option 1B

A bus-based package of public transport improvements centred on the provision of an orbital bus route serving the northern suburbs (1), and also including major improvements to existing radial bus services. All of these improvements would be delivered through a Quality Contracts Scheme (QCS) (2) to ensure full integration between orbital and radial services. Implementation of measures to reduce through traffic in the city centre (3) and improvements to junctions on the Inner and Outer Ring Roads (4) as per Option 1A.

Objectives	
Environment	
Reduce CO2 emissions from transport by encouraging sustainable modes of travel and vehicles using fuels derived from renewable sources or waste.	1 ✔ 2 ✔ ✔ 3 ✔ 4 ✖ Overall ✔ - A quality contracts scheme has the potential to deliver improvements in quality, frequency and integration of bus services sufficient to stimulate some modal shift from the car. A QCS could specify use of low emission vehicles and/or biofuels derived from renewable sources. Traffic reduction in city centre may lead to reduced CO2 emissions. Improvement schemes on ring roads likely to encourage increased car use.
Promote the use of alternative modes of transport and less polluting fuels, particularly within Air Quality Management Areas.	1 ✔ 2 ✔ 3 ✔ 4 ✖ Overall ✔ - QCS would enable promotion of an integrated bus network offering a high quality service. QCS could specify use of less polluting fuels in bus fleet. Reducing through traffic in city centre will lead to reduced emissions in Air Quality Management Areas, but benefits will be partially offset by emissions from additional buses. Improvement schemes on ring roads likely to encourage increased car use.
Minimise noise, vibration and visual intrusion from transport, particularly in the public, urban open spaces in the historic city centre.	1 ■ 2 ✖ 3 ✔ 4 ■ Overall ■ - Reducing through traffic in city centre will have beneficial impacts, but likely to be offset by adverse impacts of increase in number of bus movements within the historic city centre.

Implement transport solutions that protect open space, wildlife habitats and water resources.	1■ 2✔ 3■ 4 ■ Overall ✔ - Integrated quality bus network will use existing highway network and may make some contribution to protecting these resources to the extent that it is successful in reducing car use.
Economy	
Minimise congestion and delays for all modes of transport by improving the efficiency of the transport network	1■ 2✔ 3✖ 4 ✔ Overall ✔ - Limited potential to improve efficiency of bus services using existing highway network. Traffic reduction in city centre likely to increase congestion on alternative routes. Improvement schemes on ring roads will improve efficiency of network, but gains may only be realised in short term.
Promote a vibrant city centre, and other commercial centres, by improving accessibility for people and goods.	1✔ 2✔ 3■ 4 ✔ Overall ✔ ✔ - Orbital bus route will improve accessibility of commercial centres on the periphery of Norwich. Major improvements to radial bus services will have beneficial impact on accessibility of city centre. Improvement schemes on ring roads will facilitate access to city centre by car.
Cater for the travel consequences arising from growth aspirations. In particular accommodate transport needs arising from future growth of the airport and the cluster of the Norwich Research Park, university and hospitals at Colney.	1✔ 2✔ 3■ 4 ✔ Overall ✔ - Orbital bus route could serve airport and Norwich Research Cluster and meet some of the demand for travel to these locations. QCS would facilitate planning of the bus network to accommodate future growth. Improvement schemes on ring roads will facilitate growth at least in short term.
Improve the competitiveness of the Norwich area as a retail, tourist and business centre, whilst enhancing its image and maintaining a high quality environment.	1■ 2■ 3✔ 4■ Overall ■ - Improved conventional bus services will not enhance the image of Norwich in the way that a new public transport mode (BRT/LRT) would. Reducing through traffic will enhance the city centre environment.

Safety	
Maximise safety and security for everyone	1■ 2■ 3✔ 4■ Overall ✔ - Reducing through traffic in the city centre will improve safety within this area.
Minimise the number and severity of road traffic accidents	1■ 2✔ 3✔ 4■ Overall ✔ - QCS may make some contribution to accident reduction to the extent that it is successful in reducing car use and securing greater investment in bus driver training. Reducing through traffic in the city centre likely to reduce accidents.
Lower the incidence of crime experienced on the transport system and remove the perception of fear of crime for vulnerable people	1■ 2✔ 3■ 4■ Overall ✔ - QCS could specify CCTV on buses operating in areas where crime or fear of crime is a problem.
Minimise fear and intimidation from traffic	1■ 2■ 3✔ 4✕ Overall ■ - QCS unlikely to have significant impact on fear and intimidation from traffic. Beneficial impact of reducing through traffic in city centre. Likely increase in traffic on ring roads will lead to more fear and intimidation.
Accessibility	
Maximise transport choice for all travellers.	1✔ 2✔ 3■ 4✕ Overall ✔ - Orbital bus route would provide new choice for orbital trips. Integrated quality bus network may make public transport a viable choice for more people. Measures to reduce through traffic in city centre will reduce route choice for drivers.
Reduce social exclusion through transport solutions and promote equal access to jobs, goods and services.	1✔ ✔ 2✔ 3■ 4■ Overall ✔ ✔ - Orbital bus routes can help to reduce social exclusion by linking deprived areas to employment growth areas. QCS would facilitate planning of the bus network to meet social inclusion objectives, but potential conflict between meeting social inclusion and modal shift objectives.
Protect and enhance residential amenity and minimise community severance	1■ 2■ 3■ 4■ Overall ■ - No impact

Enhance access for non-car modes	1■ 2■ 3✔ 4✔ Overall ✔ - Reduced traffic levels within city centre will improve access for other modes. Potential to incorporate public transport priority and improved pedestrian/cycle facilities within Inner and Outer Ring Road junction improvements.
Integration	
Promote sustainable means of travel, minimise the length of trips and encourage reduced car-use through land use policies, layout of development and promotion of travel plans	1✔ 2✔ ✔ 3■ 4■ Overall ✔ ✔ - Orbital bus routes would support travel plans for sites on the periphery of Norwich. QCS would enable promotion of a fully integrated bus network offering a high quality service and facilitate longer term planning of the bus network to support land use policies and travel plans.
Improve integration and interchange	1✔ 2✔ ✔ ✔ 3■ 4■ Overall ✔ ✔ ✔ - Orbital bus routes would enable many orbital trips to be made by public transport without need to interchange in the city centre. QCS provides a means of delivering a fully integrated bus network throughout the NATS area including integrated ticketing between orbital and radial services
Reduce the need to travel	1■ 2■ 3■ 4■ Overall ■ - No impact

Option 2A

A Bus Rapid Transit system linking key housing and employment growth locations and the city centre (1), complemented by road user charging or workplace parking charging within the Inner Ring Road (2), implementation of physical measures to remove through traffic in the city centre (3) and improvements to junctions on the Inner and Outer Ring Roads (4).

Objectives	
Environment	
Reduce CO2 emissions from transport by encouraging sustainable modes of travel and vehicles using fuels derived from renewable sources or waste.	1 ✔ 2 ✔ ✔ 3 ✔ 4 ✖ Overall ✔ - Limited evidence of effectiveness of BRT in delivering significant modal shift from the car. BRT system would use low emission vehicles, could use biofuels derived from renewable sources or electric power (i.e. trolleybus). Traffic reduction in city centre may lead to reduced CO2 emissions. Improvement schemes on ring roads likely to encourage increased car use.
Promote the use of alternative modes of transport and less polluting fuels, particularly within Air Quality Management Areas.	1 ✔ ✔ 2 ✔ ✔ 3 ✔ ✔ 4 ✖ Overall ✔ ✔ - BRT likely to be more effective in delivering modal shift from the car than a high quality conventional bus service. System could potentially use electric power (i.e. trolleybus). Traffic reduction in city centre will lead to reduced emissions in Air Quality Management Areas. Improvement schemes on ring roads likely to encourage increased car use.
Minimise noise, vibration and visual intrusion from transport, particularly in the public, urban open spaces in the historic city centre.	1 ■ 2 ✔ 3 ✔ ✔ 4 ■ Overall ✔ - Beneficial impacts of traffic reduction in city centre, but adverse impact of BRT within the historic city centre. BRT less likely to be visually intrusive than LRT, but likely to generate more noise unless electrically powered.
Implement transport solutions that protect open space, wildlife habitats and water resources.	1 ✖ 2 ■ 3 ■ 4 ■ Overall ✖ - BRT route across Yare Valley will adversely affect this area. Extension of BRT route to serve potential housing growth area in NE sector may adversely affect these resources.

Economy	
Minimise congestion and delays for all modes of transport by improving the efficiency of the transport network	1✔ 2 ✔ 3✖ 4✔ Overall ✔ - partially segregated BRT alignments will provide efficient public transport routes, but BRT priority at junctions may increase delays for other modes. Traffic reduction in city centre likely to increase congestion on alternative routes Improvement schemes on ring roads will improve efficiency of network, but gains may only be realised in short term.
Promote a vibrant city centre, and other commercial centres, by improving accessibility for people and goods.	1✔ 2■ 3■ 4✔ Overall ✔ - BRT will improve accessibility of city centre from corridors served. Road user charging will facilitate accessibility within city centre for pedestrians, cyclists and public transport users. Improvement schemes on ring roads will facilitate access to city centre by car.
Cater for the travel consequences arising from growth aspirations. In particular accommodate transport needs arising from future growth of the airport and the cluster of the Norwich Research Park, university and hospitals at Colney.	1✔ ✔2■ 3■ 4 ✔ Overall ✔ ✔ - Proposed BRT corridors serve Norwich Research Park, University of East Anglia and Norfolk & Norwich University Hospital. Improvement schemes on ring roads will facilitate growth at least in short term.
Improve the competitiveness of the Norwich area as a retail, tourist and business centre, whilst enhancing its image and maintaining a high quality environment.	1✔ 2 ✖ 3✔ 4■ Overall ✔ - If promoted as a new public transport mode BRT could enhance the image of Norwich. BRT will improve access to employment growth areas. Road user charging may have adverse impact on competitiveness of the city centre, but traffic reduction will enhance the city centre environment.
Safety	
Maximise safety and security for everyone	1■ 2✔ 3✔ 4■ Overall ✔ - Traffic reduction in the city centre will improve safety within this area.

Minimise the number and severity of road traffic accidents	1✔ 2✔ 3✔ 4■ Overall ✔ - BRT will potentially reduce accidents if successful in stimulating modal shift. Traffic reduction in city centre likely to reduce accidents within this area.
Lower the incidence of crime experienced on the transport system and remove the perception of fear of crime for vulnerable people	1■ 2■ 3■ 4■ Overall ■ - Could specify CCTV for BRT vehicles and stops, but impact across the public transport network will be limited. BRT may not serve the areas where crime or fear of crime is a particular problem.
Minimise fear and intimidation from traffic	1✔ 2✔ 3✔ 4 ✖ Overall ✔ - Beneficial impact of BRT through reduced car use. Beneficial impact of traffic reduction in city centre. Likely increase in traffic on ring roads will lead to more fear and intimidation.
Accessibility	
Maximise transport choice for all travellers.	1✔ 2✖ 3✖ 4 ■ Overall ■ - BRT will increase choice on corridors served if promoted as a new public transport mode. Charging and other measures to reduce through traffic in city centre will reduce route choice for drivers
Reduce social exclusion through transport solutions and promote equal access to jobs, goods and services.	1✔ 2■ 3■ 4 ■ Overall ✔ - BRT provides a better service for those without access to a car. BRT improves access to employment growth areas, but does not serve most deprived areas of city.
Protect and enhance residential amenity and minimise community severance	1■ 2■ 3■ 4 ■ Overall ■ - No impact

Enhance access for non-car modes	1✔ 2✔ 3✔ 4 ✔ Overall ✔ ✔ - New BRT infrastructure will provide enhanced public transport access on corridors served. Significantly reduced traffic levels within Inner Ring Road will improve access for other modes. Potential to incorporate public transport priority and improved pedestrian/cycle facilities within Inner and Outer Ring Road junction improvements.
Integration	
Promote sustainable means of travel, minimise the length of trips and encourage reduced car-use through land use policies, layout of development and promotion of travel plans	1✔ ✔ 2✖ 3■ 4 ■ Overall ✔ - BRT links to growth areas consistent with promotion of sustainable travel. Integrates with Joint Core Strategy. Road pricing may encourage city centre businesses to relocate to less sustainable areas.
Improve integration and interchange	1✔ 2■ 3■ 4 ■ Overall ✔ - Integration with Park and Ride. Improved interchange at railway station.
Reduce the need to travel	1■ 2■ 3■ 4 ■ Overall■ - No impact

Option 2B

A Light Rail Transit system linking key housing and employment growth locations and the city centre (1), complemented by road user charging or workplace parking charging within the Inner Ring Road (2), implementation of physical measures to remove through traffic in the city centre (3) and improvements to junctions on the Inner and Outer Ring Roads (4).

Objectives	
Environment	
Reduce CO2 emissions from transport by encouraging sustainable modes of travel and vehicles using fuels derived from renewable sources or waste.	1 ✔ ✔ 2 ✔ ✔ 3 ✔ 4 ✖ Overall ✔ ✔ - LRT likely to be effective in delivering modal shift from the car. System likely to use electric power. Traffic reduction in city centre may lead to reduced CO2 emissions. Improvement schemes on ring roads likely to encourage increased car use.
Promote the use of alternative modes of transport and less polluting fuels, particularly within Air Quality Management Areas.	1 ✔ ✔ 2 ✔ ✔ 3 ✔ ✔ 4 ✖ Overall ✔ ✔ - LRT likely to be more effective in delivering modal shift from the car than a high quality bus service. System likely to use electric power. Traffic reduction in city centre will lead to reduced emissions in Air Quality Management Areas. Improvement schemes on ring roads likely to encourage increased car use.
Minimise noise, vibration and visual intrusion from transport, particularly in the public, urban open spaces in the historic city centre.	1 ■ 2 ✔ 3 ✔ ✔ 4 ■ Overall ✔ - Beneficial impacts of traffic reduction in city centre, but visual intrusion of LRT infrastructure within historic city centre.
Implement transport solutions that protect open space, wildlife habitats and water resources.	1 ✖ 2 ■ 3 ■ 4 ■ Overall ✖ - LRT route across Yare Valley will adversely affect this area. Extension of LRT route to serve potential housing growth area in NE sector also likely to adversely affect these resources.

Economy	
Minimise congestion and delays for all modes of transport by improving the efficiency of the transport network	1✔ 2✔ 3✖ 4✔ Overall ✔ - partially segregated LRT alignments will provide efficient public transport routes, but LRT priority at junctions may increase delays for other modes. Traffic reduction in city centre likely to increase congestion on alternative routes Improvement schemes on ring roads will improve efficiency of network, but gains may only be realised in short term.
Promote a vibrant city centre, and other commercial centres, by improving accessibility for people and goods.	1✔ 2■ 3■ 4✔ Overall ✔ - LRT will improve accessibility of city centre from corridors served. Road user charging will facilitate accessibility within city centre for pedestrians, cyclists and public transport users. Improvement schemes on ring roads will facilitate access to city centre by car.
Cater for the travel consequences arising from growth aspirations. In particular accommodate transport needs arising from future growth of the airport and the cluster of the Norwich Research Park, university and hospitals at Colney.	1✔ ✔2■ 3■ 4 ✔ Overall ✔ ✔ - Proposed LRT corridors serve Norwich Research Park, University of East Anglia and Norfolk & Norwich University Hospital. Improvement schemes on ring roads will facilitate growth at least in short term.
Improve the competitiveness of the Norwich area as a retail, tourist and business centre, whilst enhancing its image and maintaining a high quality environment.	1✔ ✔ 2 ✖ 3✔ 4■ Overall ✔ ✔ - LRT will enhance the image of Norwich and improve access to employment growth areas. Road user charging may have adverse impact on competitiveness of the city centre, but traffic reduction will enhance the city centre environment.
Safety	
Maximise safety and security for everyone	1■ 2✔ 3✔ 4■ Overall ✔ - Traffic reduction in the city centre will improve safety within this area

Minimise the number and severity of road traffic accidents	1✔ 2✔ 3✔ 4■ Overall ✔ - Modal shift to LRT will potentially reduce accidents. Traffic reduction in city centre likely to reduce accidents within this area.
Lower the incidence of crime experienced on the transport system and remove the perception of fear of crime for vulnerable people	1■ 2■ 3■ 4■ Overall ■ - Could specify CCTV for LRT vehicles and stops, but impact across the public transport network will be limited. LRT may not serve the areas where crime or fear of crime is a particular problem.
Minimise fear and intimidation from traffic	1✔ 2✔ 3✔ 4 ✕ Overall ✔ - Beneficial impact of LRT through reduced car use. Beneficial impact of traffic reduction in city centre. Likely increase in traffic on ring roads will lead to more fear and intimidation.
Accessibility	
Maximise transport choice for all travellers.	1✔ 2✕ 3✕ 4 ■ Overall ■ - New public transport mode increases choice on corridors served. Charging and other measures to reduce through traffic in city centre will reduce route choice for drivers
Reduce social exclusion through transport solutions and promote equal access to jobs, goods and services.	1✔ 2■ 3■ 4 ■ Overall ✔ - LRT provides a better service for those without access to a car. LRT improves access to employment growth areas, but does not serve most deprived areas of city.
Protect and enhance residential amenity and minimise community severance	1✕ 2■ 3■ 4 ■ Overall ✕ - Some sections of LRT route may have adverse impact on residential amenity

Enhance access for non-car modes	1✔ 2✔ 3✔ 4 ✔ Overall ✔ ✔ - New LRT infrastructure will provide enhanced public transport access on corridors served. Reduced traffic levels within Inner Ring Road will improve access for other modes. Potential to incorporate public transport priority and improved pedestrian/cycle facilities within Inner and Outer Ring Road junction improvements.
Integration	
Promote sustainable means of travel, minimise the length of trips and encourage reduced car-use through land use policies, layout of development and promotion of travel plans	1✔ ✔ 2✖ 3■ 4 ■ Overall ✔ - LRT links to growth areas consistent with promotion of sustainable travel. Integrates with Joint Core Strategy. Road pricing may encourage city centre businesses to relocate to less sustainable areas.
Improve integration and interchange	1✔ 2■ 3■ 4 ■ Overall ✔ - Integration with Park and Ride. Improved interchange at railway station.
Reduce the need to travel	1■ 2■ 3■ 4 ■ Overall■ - No impact

Assessment of Public Transport Options against NATS Objectives - Summary

	Environment				Economy				Safety				Accessibility				Integration		
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
Option 1A	■	✔	■	■	✔	✔	■	■	✔	✔	■	■	✖	■	■	✔	✔	■	■
Option 1B	✔	✔	■	✔	✔	✔ ✔	✔	■	✔	✔	✔	■	✔	✔ ✔	■	✔	✔ ✔	✔ ✔ ✔	■
Option 2A	✔	✔ ✔	✔	✖	✔	✔	✔ ✔	✔	✔	✔	■	✔	■	✔	■	✔ ✔	✔	✔	■
Option 2B	✔ ✔	✔ ✔	✔	✖	✔	✔	✔ ✔	✔ ✔	✔	✔	■	✔	■	✔	✖	✔ ✔	✔	✔	■

Conclusions

Option 1B performs significantly better than Option 1A in terms of contributing to the full range of the NATS objectives.

Options 2A and 2B perform similarly against the full range of the NATS objectives. Option 2A may therefore be preferred over Option 2B on grounds of practicality and affordability.

There are a number of areas where Options 1B and 2A appear to be complementary, either in terms of contributing to different objectives or contributing to the same objective in different ways. This has been investigated by undertaking a further assessment of Options 1B and 2A in combination.

Combination of Options 1B and 2A

A package of public transport improvements centred on a Bus Rapid Transit system linking key housing and employment growth locations and the city centre (1) plus the provision of an orbital bus route serving the northern suburbs (2), and major improvements to existing radial bus services. All of these improvements would be delivered through a Quality Contracts Scheme (QCS) (3) to ensure full integration between orbital and radial services. The public transport package would be complemented by road user charging or workplace parking charging within the Inner Ring Road (4), implementation of measures to remove through traffic from the city centre (5) and improvements to junctions on the Inner and Outer Ring Roads (6).

Objectives	
Environment	
Reduce CO2 emissions from transport by encouraging sustainable modes of travel and vehicles using fuels derived from renewable sources or waste.	1 ✔ 2 ✔ 3 ✔ ✔ 4 ✔ ✔ 5 ✔ 6 ✘ Overall ✔ ✔ - A Quality Contracts Scheme combining BRT on key growth corridors with improvements in the quality, frequency and integration of bus services over a wider area is likely to be effective in delivering modal shift from the car. A QCS could specify use of low emission vehicles and/or biofuels derived from renewable sources. BRT system could use electric power (i.e. trolleybus). Traffic reduction in city centre may lead to reduced CO2 emissions. Improvement schemes on ring roads likely to encourage increased car use.
Promote the use of alternative modes of transport and less polluting fuels, particularly within Air Quality Management Areas.	1 ✔ ✔ 2 ✔ 3 ✔ 4 ✔ ✔ 5 ✔ 6 ✘ Overall ✔ ✔ - A QCS including BRT would strengthen the offer of a high quality integrated public transport network and is likely to be more effective in delivering modal shift than a high quality conventional bus service alone. BRT could potentially use electric power (i.e. trolleybus). QCS could specify use of less polluting fuels in conventional bus fleet. Reducing through traffic in city centre will lead to reduced emissions in Air Quality Management Areas, but benefits will be partially offset by emissions from additional buses. Improvement schemes on ring roads likely to encourage increased car use.

Minimise noise, vibration and visual intrusion from transport, particularly in the public, urban open spaces in the historic city centre.	1■ 2■ 3✗ 4✓ 5✓ 6■ Overall ■ - Reducing through traffic in city centre will have beneficial impacts, but likely to be offset by adverse impacts of increase in number of bus movements within the historic city centre. Use of electric power for BRT may provide some mitigation.
Implement transport solutions that protect open space, wildlife habitats and water resources.	1✗ 2■ 3✓ 4■ 5■ 6■ Overall ■ - BRT route across Yare Valley will adversely affect this area. Extension of BRT route to serve potential housing growth area in NE sector may adversely affect these resources. Integrated quality bus network will otherwise use existing highway network and may make some contribution to protecting these resources to the extent that it is successful in reducing car use.
Economy	
Minimise congestion and delays for all modes of transport by improving the efficiency of the transport network	1✓ 2■ 3✓ 4✓ 5✗ 6✓ Overall ✓ - Partially segregated BRT alignments will provide efficient public transport routes, but BRT priority at junctions may increase delays for other modes. Limited potential to improve efficiency of bus services using existing highway network. Traffic reduction in city centre likely to increase congestion on alternative routes. Improvement schemes on ring roads will improve efficiency of network, but gains may only be realised in short term.
Promote a vibrant city centre, and other commercial centres, by improving accessibility for people and goods.	1✓ 2✓ 3✓ 4■ 5■ 6✓ Overall ✓ ✓ - BRT and major improvements to other radial bus services will have beneficial impact on accessibility of city centre. Road user charging will facilitate accessibility within city centre for pedestrians, cyclists and public transport users. Orbital bus routes will improve accessibility of commercial centres on the periphery of Norwich. Improvement schemes on ring roads will facilitate access to city centre by car.

Cater for the travel consequences arising from growth aspirations. In particular accommodate transport needs arising from future growth of the airport and the cluster of the Norwich Research Park, university and hospitals at Colney.	1✔ ✔ 2✔ 3✔ 4■ 5■ 6✔ Overall ✔ ✔ ✔ - Proposed BRT corridors serve Norwich Research Park, University of East Anglia and Norfolk & Norwich University Hospital. Orbital bus routes could serve airport and Norwich Research Cluster and meet some of the demand for travel to these locations. QCS would facilitate planning of the bus network to accommodate future growth. Improvement schemes on ring roads will facilitate growth at least in short term.
Improve the competitiveness of the Norwich area as a retail, tourist and business centre, whilst enhancing its image and maintaining a high quality environment.	1 ✔ 2■ 3✔ 4✘ 5✔ 6■ Overall ✔ ✔ - If promoted as a new public transport mode within an integrated high quality network, BRT could both enhance the image of Norwich and the impact of improved conventional bus services on other corridors by raising perceptions of the overall quality of public transport in Norwich. BRT will improve access to employment growth areas. Road user charging may have adverse impact on competitiveness of the city centre, but traffic reduction will enhance the city centre environment. Reducing through traffic will enhance the city centre environment.
Safety	
Maximise safety and security for everyone	1■ 2■ 3■ 4✔ 5✔ 6■ Overall ✔ - Traffic reduction in the city centre will improve safety within this area.
Minimise the number and severity of road traffic accidents	1 ✔ 2■ 3✔ 4✔ 5✔ 6■ Overall ✔ - BRT will potentially reduce accidents if successful in stimulating modal shift. QCS may make some contribution to accident reduction to the extent that it is successful in reducing car use and securing greater investment in bus driver training. Traffic reduction in city centre likely to reduce accidents within this area.

Lower the incidence of crime experienced on the transport system and remove the perception of fear of crime for vulnerable people	1 ✔ 2■ 3 ✔ 4■ 5■ 6■ Overall ✔ - CCTV could be specified for BRT vehicles and stops. QCS could specify CCTV on all buses or those operating in areas where crime or fear of crime is a problem.
Minimise fear and intimidation from traffic	1 ✔ 2■ 3 ✔ 4 ✔ 5 ✔ 6✖ Overall ✔ - Beneficial impact of BRT within an integrated high quality network through reduced car use. Beneficial impact of traffic reduction in city centre. Likely increase in traffic on ring roads will lead to more fear and intimidation.
Accessibility	
Maximise transport choice for all travellers.	1 ✔ 2 ✔ 3 ✔ 4✖ 5✖ 6■ Overall ✔ ✔ - BRT will increase choice on corridors served if promoted as a new public transport mode. Orbital bus route would provide new choice for orbital trips. Integrated quality bus network may make public transport a viable choice for more people. Charging and other measures to reduce through traffic in city centre will reduce route choice for drivers.
Reduce social exclusion through transport solutions and promote equal access to jobs, goods and services.	1 ✔ 2 ✔ ✔ 3 ✔ 4■ 5■ 6■ Overall ✔ ✔ - BRT provides a better service for those without access to a car. BRT improves access to employment growth areas, but does not serve most deprived areas of city. Orbital bus routes can help to reduce social exclusion by linking deprived areas to employment growth areas. QCS would facilitate planning of the bus network to meet social inclusion objectives, but potential conflict between meeting social inclusion and modal shift objectives.
Protect and enhance residential amenity and minimise community severance	1■ 2■ 3■ 4■ 5■ 6■ Overall ■ - No impact

Enhance access for non-car modes	1✔ 2■ 3■ 4✔ 5✔ 6✔ Overall ✔ ✔ - New BRT infrastructure will provide enhanced public transport access on corridors served. Reduced traffic levels within city centre will improve access for other modes. Potential to incorporate public transport priority and improved pedestrian/cycle facilities within Inner and Outer Ring Road junction improvements.
Integration	
Promote sustainable means of travel, minimise the length of trips and encourage reduced car-use through land use policies, layout of development and promotion of travel plans	1✔ ✔ 2✔ 3✔ ✔ 4✘ 5■ 6■ Overall ✔ ✔ ✔ - BRT links to growth areas consistent with promotion of sustainable travel. Integrates with Joint Core Strategy. Orbital bus routes would support travel plans for sites on the periphery of Norwich. QCS would enable promotion of a fully integrated bus network offering a high quality service and facilitate longer term planning of the bus network to support land use policies and travel plans. Road pricing may encourage city centre businesses to relocate to less sustainable areas.
Improve integration and interchange	1✔ 2✔ 3✔ ✔ ✔ 4■ 5■ 6■ Overall ✔ ✔ ✔ - BRT would be integrated with Park and Ride and offer improved interchange at railway station. Orbital bus routes would enable many orbital trips to be made by public transport without need to interchange in the city centre. QCS provides a means of delivering a fully integrated bus network throughout the NATS area including integrated ticketing between orbital and radial services.
Reduce the need to travel	1■ 2■ 3■ 4■ 5■ 6■ Overall ■ - No impact

Assessment of Combined Option 1B and 2A against NATS Objectives - Summary

The table below presents a direct comparison of the assessments of Options 1B and 2A individually and in combination. This confirms that the combination of Options 1B and 2A is more effective in meeting the NATS objectives than either of the individual options.

	Environment				Economy				Safety				Accessibility				Integration		
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
Option 1B	✔	✔	■	✔	✔	✔ ✔	✔	■	✔	✔	✔	■	✔	✔ ✔	■	✔	✔ ✔	✔ ✔ ✔	■
Option 2A	✔	✔ ✔	✔	✕	✔	✔	✔ ✔	✔	✔	✔	■	✔	■	✔	■	✔ ✔	✔	✔	■
1B + 2A	✔ ✔	✔ ✔	■	■	✔	✔ ✔	✔ ✔ ✔	✔ ✔	✔	✔	✔	✔	✔ ✔	✔ ✔	■	✔ ✔	✔ ✔ ✔	✔ ✔ ✔	■

Assessment of Public Transport Options against NDR Scheme Objectives

Option 1A

Reduce congestion on strategic routes to the north of the city	Reduce noise, air pollution and accidents for communities in the northern suburbs of Norwich and villages outside	Enable the removal of through traffic from the city centre and implementation of widespread pedestrianisation and bus priority measures	Provide direct access to growth locations, helping to deliver significant housing and employment growth	Support the continued success of the Norwich economy as the driver to growth across the north of the region	Provide improved access to north and north east Norfolk
■ Option unlikely to have sufficient impact on modal split to reduce congestion on strategic routes	■ Option unlikely to have sufficient impact on modal split to reduce noise, pollution or accidents in the northern suburbs and villages to the north of Norwich	✔ Option includes measures to reduce through traffic in the city centre, but limited capacity to accommodate displaced traffic	■ Quality Partnership Schemes likely to focus on corridors where there is an existing business case for operators to invest rather than on facilitating housing and employment growth	■ Option would not deliver the step change in public transport service quality needed to positively support the success of the local economy	■ Improvements to ring road junctions will not have significant beneficial impact on strategic access to north and north east Norfolk

Option 1B

Reduce congestion on strategic routes to the north of the city	Reduce noise, air pollution and accidents for communities in the northern suburbs of Norwich and villages outside	Enable the removal of through traffic from the city centre and implementation of widespread pedestrianisation and bus priority measures	Provide direct access to growth locations, helping to deliver significant housing and employment growth	Support the continued success of the Norwich economy as the driver to growth across the north of the region	Provide improved access to north and north east Norfolk
✔ Integrated quality bus network likely to have slight beneficial impact on congestion on strategic routes, but impact limited by use of existing highway network	✔ Integrated quality bus network including an orbital bus route serving the northern suburbs may make some contribution to accident reduction where successful in reducing car use	✔ Option includes measures to reduce through traffic in the city centre, but limited capacity to accommodate displaced traffic	✔ A Quality Contracts Scheme would facilitate planning of the bus network to accommodate future growth, including the provision of direct services to growth locations	✔ Option would deliver a step change in public transport service quality, but potential to positively support the success of the local economy is limited relative to options involving provision of a new public transport mode	■ Improvements to ring road junctions will not have significant beneficial impact on strategic access to north and north east Norfolk

Option 2A

Reduce congestion on strategic routes to the north of the city	Reduce noise, air pollution and accidents for communities in the northern suburbs of Norwich and villages outside	Enable the removal of through traffic from the city centre and implementation of widespread pedestrianisation and bus priority measures	Provide direct access to growth locations, helping to deliver significant housing and employment growth	Support the continued success of the Norwich economy as the driver to growth across the north of the region	Provide improved access to north and north east Norfolk
✔ BRT system likely to have beneficial impact on congestion on corridors served, including one corridor to NE of Norwich, but BRT priority at junctions may increase delays for other modes	✔ BRT system will have beneficial impacts but these will be limited to the one BRT corridor serving the northern suburbs	✔ Option includes priority for BRT within city centre enabled by measures to remove through traffic from the city centre, but limited capacity to accommodate displaced traffic	✔ ✔ Proposed BRT corridors provide direct public transport access to growth locations including Norwich Research Cluster and potential housing growth area in NE sector	✔ ✔ If promoted as a new public transport mode, BRT would enhance the image of Norwich and positively support the success of the local economy	■ BRT system will not extend beyond the Norwich urban area. Improvements to ring road junctions will not have significant beneficial impact on strategic access to north and north east Norfolk

Option 2B

Reduce congestion on strategic routes to the north of the city	Reduce noise, air pollution and accidents for communities in the northern suburbs of Norwich and villages outside	Enable the removal of through traffic from the city centre and implementation of widespread pedestrianisation and bus priority measures	Provide direct access to growth locations, helping to deliver significant housing and employment growth	Support the continued success of the Norwich economy as the driver to growth across the north of the region	Provide improved access to north and north east Norfolk
✔ LRT system likely to have beneficial impact on congestion on corridors served, including one corridor to NE of Norwich, but LRT priority at junctions may increase delays for other modes	✔ LRT system will have beneficial impacts but these will be limited to the one LRT corridor serving the northern suburbs	✔ ✔ Option includes priority for LRT within city centre enabled by measures to remove through traffic from the city centre. Potential of LRT to deliver modal shift will reduce the problem of accommodating displaced traffic.	✔ ✔ Proposed LRT corridors provide direct public transport access to growth locations including Norwich Research Cluster and potential housing growth area in NE sector	✔ ✔ LRT will enhance the image of Norwich and positively support the success of the local economy	■ LRT system will not extend beyond the Norwich urban area. Improvements to ring road junctions will not have significant beneficial impact on strategic access to north and north east Norfolk.

Assessment of Public Transport Options against NDR Objectives - Summary

	Reduce congestion on strategic routes to the north of the city	Reduce noise, air pollution and accidents for communities in the northern suburbs of Norwich and villages outside	Enable the removal of through traffic from the city centre and implementation of widespread pedestrianisation and bus priority measures	Provide direct access to growth locations, helping to deliver significant housing and employment growth	Support the continued success of the Norwich economy as the driver to growth across the north of the region	Provide improved access to north and north east Norfolk
Option 1A	■	■	✔	■	■	■
Option 1B	✔	✔	✔	✔	✔	■
Option 2A	✔	✔	✔	✔ ✔	✔ ✔	■
Option 2B	✔	✔	✔ ✔	✔ ✔	✔ ✔	■

Conclusions

Option 1A would make a small contribution to only one of the six NDR objectives.

Option 1B would make small contributions to five out of the six NDR objectives.

Option 2A would make a substantial contribution to two, and a small contribution to a further three NDR objectives.

Option 2B performs similarly to Option 2A, apart from making a more substantial contribution to enabling the removal of through traffic from the city centre and implementation of widespread pedestrianisation and public transport priority measures.

A further assessment of Options 1B and 2A in combination against the NDR objectives should be undertaken.

Assessment of Combined Option 1B and 2A against NDR Objectives

Reduce congestion on strategic routes to the north of the city	Reduce noise, air pollution and accidents for communities in the northern suburbs of Norwich and villages outside	Enable the removal of through traffic from the city centre and implementation of widespread pedestrianisation and bus priority measures	Provide direct access to growth locations, helping to deliver significant housing and employment growth	Support the continued success of the Norwich economy as the driver to growth across the north of the region	Provide improved access to north and north east Norfolk
✔ BRT system likely to have beneficial impact on congestion on corridors served, including one corridor to NE of Norwich, but BRT priority at junctions may increase delays for other modes. Integrated quality bus network likely to have slight beneficial impact on congestion on strategic routes, but impact limited by use of existing highway network.	✔ BRT system will have beneficial impacts but these will be limited to the one BRT corridor serving the northern suburbs. Integrated quality bus network including an orbital bus route serving the northern suburbs may make some contribution to accident reduction where successful in reducing car use.	✔ ✔ Option includes priority for BRT within city centre enabled by measures to remove through traffic from the city centre. Although there is limited capacity to accommodate displaced traffic, this option offers the greatest potential to deliver traffic reduction in the city centre through modal shift to public transport.	✔ ✔ ✔ Proposed BRT corridors provide direct public transport access to growth locations including Norwich Research Cluster and potential housing growth area in NE sector. A Quality Contracts Scheme would facilitate planning of the bus network to accommodate future growth, including the provision of direct services to growth locations.	✔ ✔ If promoted as a new public transport mode within an integrated high quality network, BRT could both enhance the image of Norwich and the impact of improved conventional bus services on other corridors by raising perceptions of the overall quality of public transport in Norwich, thus positively supporting the success of the local economy.	■ Improvements to ring road junctions will not have significant beneficial impact on strategic access to north and north east Norfolk

Assessment of Combined Option 1B and 2A against NDR Objectives - Summary

The table below presents a direct comparison of the assessments of Options 1B and 2A individually and in combination. This confirms that the combination of Options 1B and 2A is more effective in meeting the NDR objectives than any of the individual options, and is particularly effective in providing direct access to growth locations, thus helping to deliver significant housing and employment growth.

	Reduce congestion on strategic routes to the north of the city	Reduce noise, air pollution and accidents for communities in the northern suburbs of Norwich and villages outside	Enable the removal of through traffic from the city centre and implementation of widespread pedestrianisation and bus priority measures	Provide direct access to growth locations, helping to deliver significant housing and employment growth	Support the continued success of the Norwich economy as the driver to growth across the north of the region	Provide improved access to north and north east Norfolk
Option 1B	✔	✔	✔	✔	✔	■
Option 2A	✔	✔	✔	✔ ✔	✔ ✔	■
1B + 2A	✔	✔	✔ ✔	✔ ✔ ✔	✔ ✔	■

Conclusions and Recommendations

Option 1A performs poorly against both the NATS and NDR objectives, and should therefore be dismissed from further consideration.

Options 2A and 2B perform similarly against both the NATS and NDR objectives. Option 2A (Bus Rapid Transit) may therefore be preferred over Option 2B (Light Rail) on grounds of practicality and affordability.

The assessment of the individual options against the strategic objectives of NATS demonstrates that Options 1B and 2A have significant complementary elements.

When combined, Options 1B and 2A perform better against both the NATS objectives and the NDR scheme objectives than any of the individual options.

It is recommended that the combination of Options 1B and 2A is adopted as the preferred public transport option for modelling and further appraisal for the NDR Major Scheme Business Case.