


JCS Transport Strategy Report

January 2010
Norfolk County Council

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Mott MacDonald

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1. Introduction

This report provides an update to the 'NATS Plus Implementation Plan: Strategic Modelling of Joint Core Strategy' submitted to the Greater Norwich Development Partnership in September 2009, which presented the findings of the initial transport modelling based on the indicative NATS Implementation Plan. Work has been and is continuing to develop and assess the NATS Implementation Plan and this report presents the outcomes to date.

The structure of this report is as follows:-

Section 2 – identified problems;

Section 3 – outline of NATS strategy including NNDR and complementary measures;

Section 4 – transport assessment of NATS and the NNDR; and

Section 5 – conclusions and evidence that the proposed NNDR facilitates other elements of the NATS Strategy.

2. Identified Problems

The transport proposals referred to in the JCS have emerged in response to problems and issues identified over several years through the development of NATS. This information has been drawn from a wide range of sources and is available in a 'Baseline Conditions' report. Documents presented in **Appendix F** provide a list and summary of key documents that have been produced to evidence the current position.

3. Outline of NATS Strategy including NNDR and Complementary Measures

Implementation of the transportation policy within the Norwich Policy Area is being developed by Norfolk County Council in partnership with the GNDP through the Norwich Area Transportation Strategy (NATS), which is founded on the principles of increasing accessibility through widening transport choice and enabling growth through the provision of sustainable development.

NATS has already benefited thousands of people who live, shop and work in and around Norwich. However, the transport system is under strain and this pressure will increase over time. A step-change in transport provision is therefore needed for the full benefits of NATS to be realised and cater for all the transport needs of a vibrant and growing regional centre.

The next step in the development of NATS is the production of a more detailed Implementation Plan. The key features of this emerging Implementation Plan are to bring specific detail to the strategy requirements for city centre improvements, a bus rapid transit (BRT) network and the Norwich Northern Distributor Road (NNDR).

Alongside these main elements, a significant number of smaller but important interventions are being developed. These include highway capacity improvements at specific junctions, improvements to the transport network to facilitate cycling and walking, Smarter Choices type initiatives such as travel planning, integrated public transport ticketing and improved information, and improvements to rail services. The Implementation Plan aims to provide high-quality alternatives to the car and reduce the impact of transport on the environment and our communities. However, the Implementation Plan also recognises that for many people the car will remain essential, particularly for those who live in more rural areas.

3.1 City Centre Proposals

It is important that Norwich's reputation as a key destination for shopping, entertainment and a centre of business excellence is enhanced to encourage further economic growth and investment. As such, Norfolk County Council is working with Norwich City Council and key stakeholders on developing proposals for the city centre. These aim to reduce the dominance of traffic in certain areas of the city and improve the experience for shoppers and visitors by enhancing safety and improving air quality. In addition, these proposals aim to increase the accessibility of the city for public transport and provide safer routes for cyclists and pedestrians.

A map outlining the proposals is shown in Figure 3.1.

Figure 3.1: Map outlining the proposals

The city centre measures include proposals to:

- Introduce a number of pedestrian and access only roads;
- Restrict a number of roads to bus, cycle and access only;
- Introduce some additional one way routes;
- Provide improved, more direct access to and from car parks; and
- Ensure that where through routes for general traffic exist, they are as efficient as possible.

Feasibility work is on-going to enable the delivery of these measures, which includes an assessment of impacts on the local and surrounding highway network, linkages between the different city centre schemes and linkages with other NATS schemes such as walking and cycling, BRT and the NNDR.

There are significant complementary benefits arising from the city centre proposals to other sustainable modes. There are opportunities to deliver a range of improvements to walking and cycling networks, particularly in areas such as Westlegate and Exchange Street where pedestrianisation is proposed.

The removal of general traffic from roads such as St Stephens Street and Theatre Street will create the conditions needed for additional bus stops to be provided to support BRT and core bus routes providing much needed capacity, and, bringing significant improvements to the reliability of bus services.

Other NATS measures that support city centre proposals include the principle of freight consolidation and a review of existing access restrictions.

The NNDR has a critical role to play in the delivery of city centre proposals by reducing the amount of through-traffic affecting roads in and around the city centre and surrounding roads. Without this reduction in traffic, roads are at capacity and important elements of the city centre measures cannot proceed without an unacceptable impact on the highway network.

These factors will provide the opportunity for initiatives across different modes to be delivered together in such a way that modal shift to more sustainable modes is achieved. A noticeable increase in the number of people using sustainable modes is envisaged.

3.2 Cycling and Walking

There is significant scope for improving walking and cycling networks throughout the city centre and on key routes in and out of Norwich that link growth areas. In addition to facilitating modal shift to more sustainable modes, this will help promote health benefits associated with a more active lifestyle.

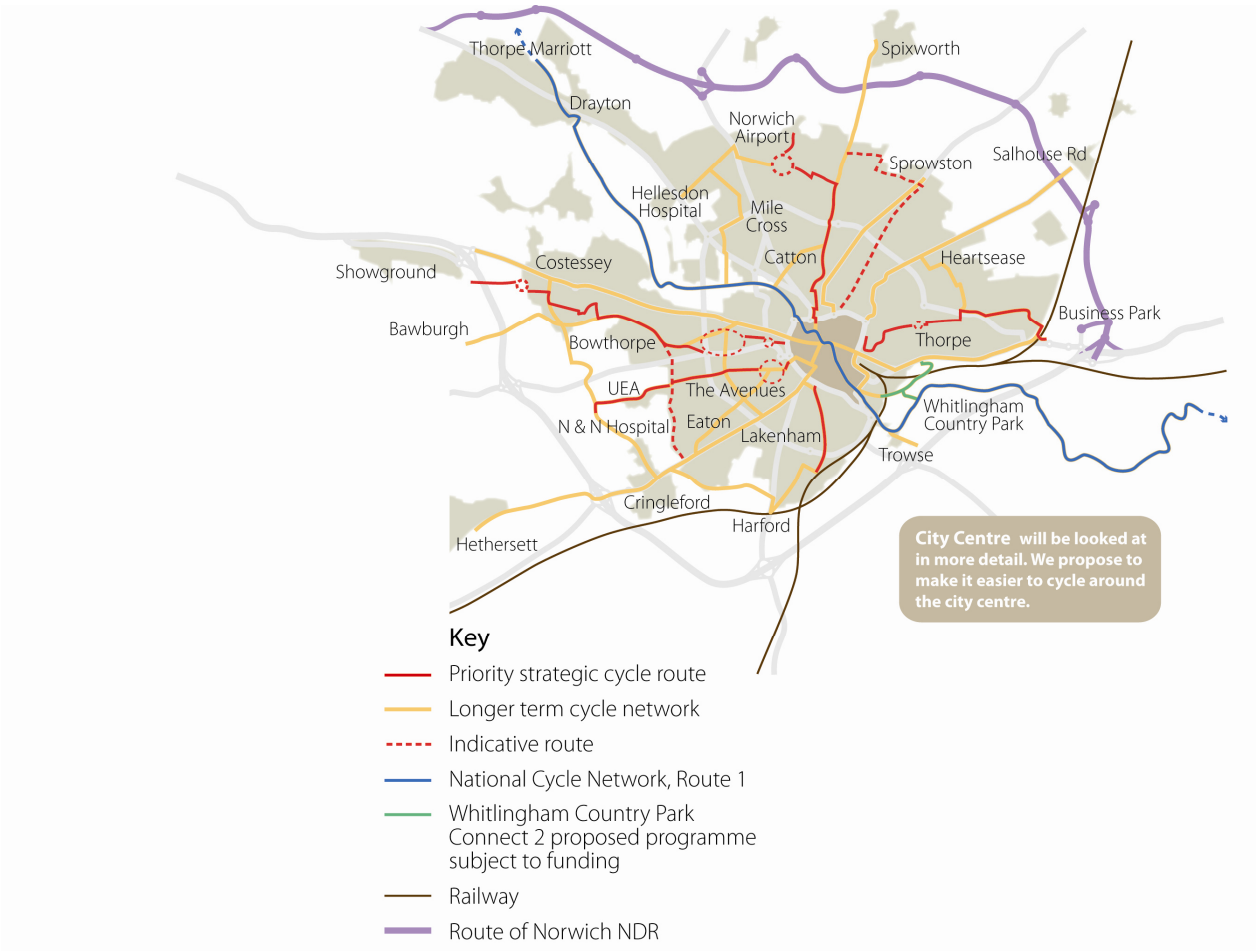
In terms of walking facilities, reduction of general traffic in busy city centre streets brought about by city centre proposals will bring local air quality and noise reduction benefits. Areas of the city that could benefit include Tombland, St Stephens Street and Prince of Wales Road. A network of walking routes can be developed supported by appropriate information provision and crossing facilities. There are opportunities for pedestrians to be given additional priority at signalised crossings where there are significant reductions in general traffic. This could include areas such as the city centre and radial routes into the city.

For cycling, a key element of the proposals relates to the development of a core cycle network linking key employment and growth locations across the city. Typical routes being considered could link the city centre with areas such as the Norwich Research Park, Broadland Business Park and Norwich Airport. There is strong support for a network to be developed that is more comprehensive and joined up than that currently provided where short separate lengths of cycleway are often provided. Other proposals in the Implementation Plan include the provision of contra-flow cycle lanes on some one-way streets, advanced stop lines at junctions, additional cycle parking facilities and a review of restrictions related to use of pedestrianised streets by cyclists. In a similar way to pedestrians, there are opportunities for cyclists to be given additional priority at signalised crossings where there are significant reductions in general traffic.

The development of Smarter Choice initiatives will play an important complementary role to this.

The following map in Figure 3.2 outlines some initial proposals for a cycling network.

Figure 3.2: Initial proposals for a cycling network



3.3 Bus Rapid Transit (BRT)

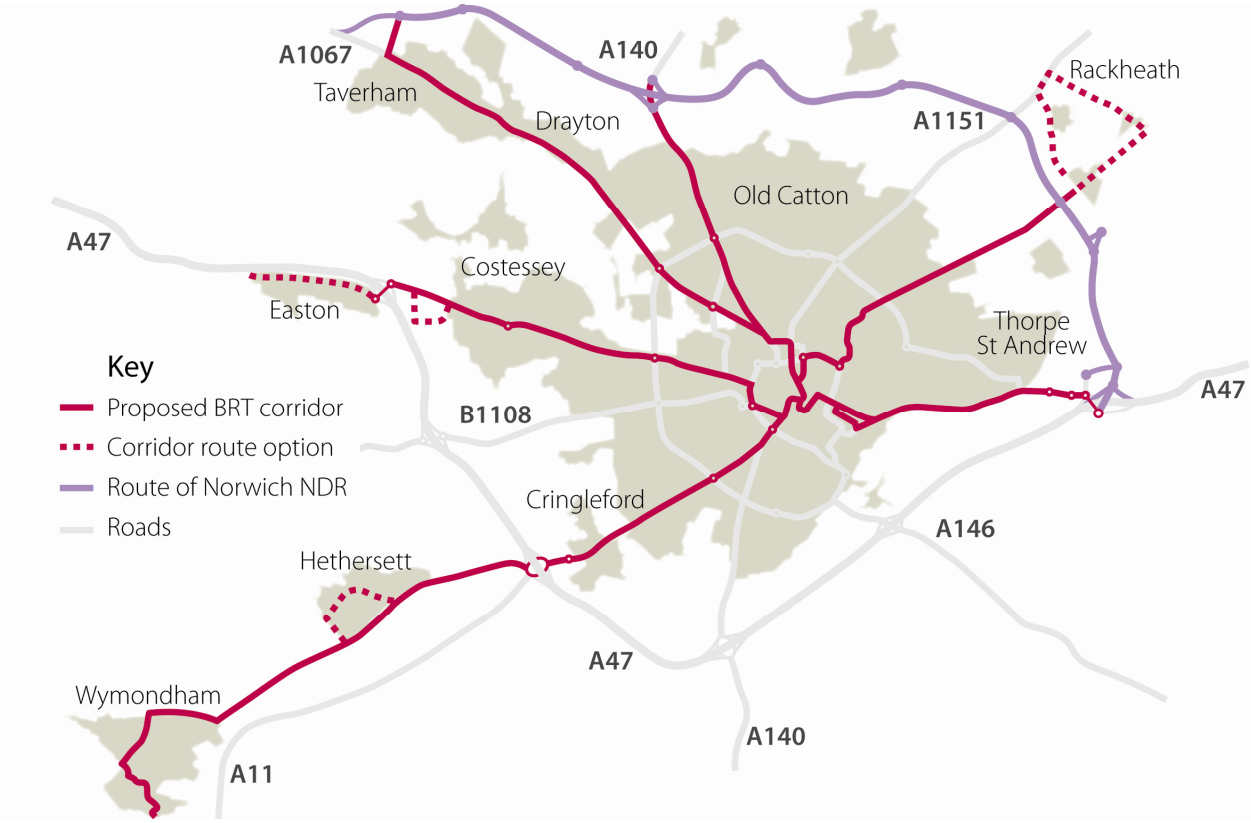
BRT aims to provide a step change in bus service provision by providing a faster, more frequent and reliable service along key routes into the city. This would be supplemented by high quality vehicles and infrastructure such as shelters, information and ticketing. Linking key growth and employment areas will be an important part of developing a BRT network, as well as ensuring complementary benefits with other initiatives such as walking, cycling, rail, smarter choices and city centre circulation are realised.

An initial specification for BRT is as follows:

- Low emission, high quality Disability Discrimination Act (DDA) compliant vehicles
- Turn up and go frequency (every 10 minutes throughout the day)
- Priority measures including bus lanes and bus activated traffic signals
- Off-bus ticketing with a straightforward fare structure
- High quality bus stops with up-to-the-minute bus departure information and printed information
- Fully branded service with clearly identifiable vehicles, infrastructure and information provision

Up to six BRT corridors are being considered for the Implementation Plan covering the routes into the city centre as shown in the map below.

Figure 3.3: BRT corridors covering the routes into the city centre



The provision of priority measures for buses along BRT routes will form an important element of delivering BRT. This could involve reallocation of road space to buses, provision of new bus-only lanes and priority through traffic signals. Where road space is reallocated to buses and where priority is given to buses through junctions, there is a strong linkage to the role the NNDR plays in achieving this by reducing the general traffic on affected roads. An example would include the proposed BRT route from Rackheath to the city centre, where it is proposed that Gurney Road is allocated as bus only. Without the NNDR, traffic flows in surrounding roads would be unacceptably high following this road space reallocation, which would hinder scheme delivery.

To support BRT corridors, complementary measures related to walking and cycling networks will consider ensuring easy access to stops and improved interchange.

Bus priority measures along two of the proposed corridors are currently being developed, which is building on measures already in place. Newmarket Road on the route to Wymondham and Hethersett will benefit during 2010 from works to extend the existing bus lane and detailed feasibility work for Dereham Road is well underway looking to identify locations where maximum benefit can be realised.

3.4 Rail and Bus Services

Norfolk County Council will continue to work with transport operators to further improve journey times and the reliability of bus and rail services and provide additional capacity where required. There is already an existing network for bus and rail services and the Implementation Plan will seek to further develop these to encourage modal shift and interchange with other modes.

Increased seating and frequency on the Norwich to Cambridge line will provide much needed capacity to cater for existing issues of overcrowding during peak periods and to support proposed growth along this corridor. Reduced journey times and enhanced quality of rolling stock on the Norwich to London main line will help support economic growth of Norwich and the surrounding region.

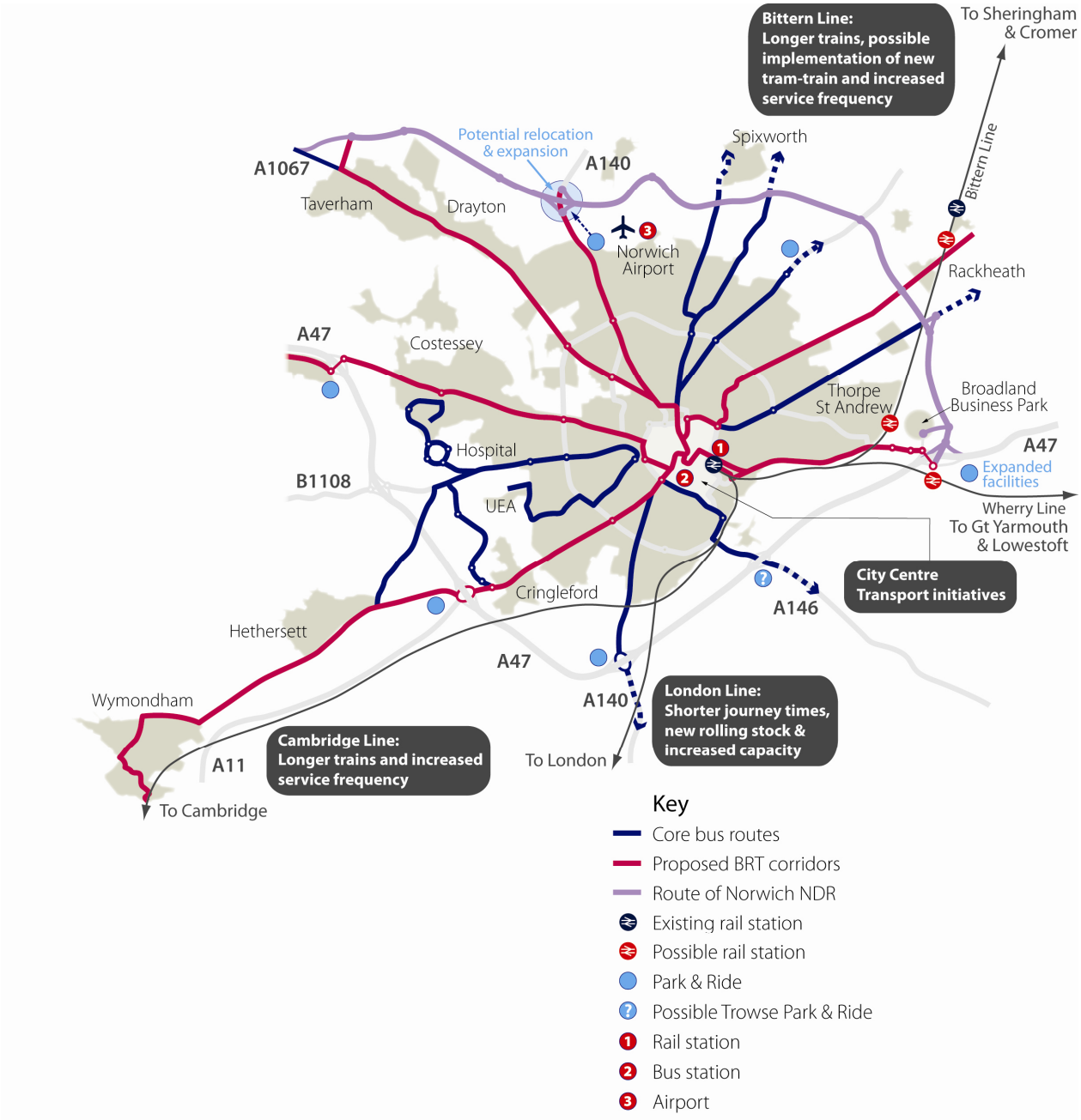
An innovative tram-style train could be implemented on the existing Norwich to Cromer / Sheringham (Bittern) line linking the proposed development at Rackheath with the city centre. This could offer faster journey times, additional services and improved accessibility.

New rail stations at Broadland Business Park and Postwick could play a key role in serving proposed growth along this corridor from wider afield and locally.

The re-franchising of the existing National Express East Anglia rail franchise in 2013 provides an opportunity to implement service and capacity improvements, including the introduction of tram-train services.

A map showing initial proposals for bus and rail is outlined in Figure 3.4.

Figure 3.4: Initial proposals for bus and rail



Linkages between modes need to be enhanced in an attempt to work towards more convenient interchanges. Such interchanges should provide a safe waiting environment that provides accurate and accessible multi-modal travel information as well as features such as seating, lighting and protection from inclement weather.

3.5 Smarter Travel Choices

Smarter travel choices encompass many initiatives designed to encourage more use of non-car travel. They are aimed at influencing people's travel behaviour towards more sustainable modes through schemes such as school, workplace and individualised journey planning. This approach will be particularly important at new developments (residential and employment) where it is important to influence travel behaviour at the earliest possible opportunity.

Within the NATS area, all schools already have a travel plan and there are a number of individual business and area-wide travel plans currently being developed. Evidence indicates that these generate positive shift towards sustainable modes and the Implementation Plan aims to build on this, particularly in terms of new housing and business developments.

Other schemes being considered for promotion through NATS include travel awareness campaigns, encouraging car-share schemes and car-clubs, encouraging tele-working and providing on-line 'tools' that provide a wide range of real-time and accurate travel information across different modes.

Smarter travel choices are complementary to many of the NATS initiatives and will play an important role in influencing the level of modal shift to more sustainable modes. Much work is already underway to deliver smarter travel choices across NATS and the delivery of initiatives such as BRT is likely to improve the effectiveness of this.

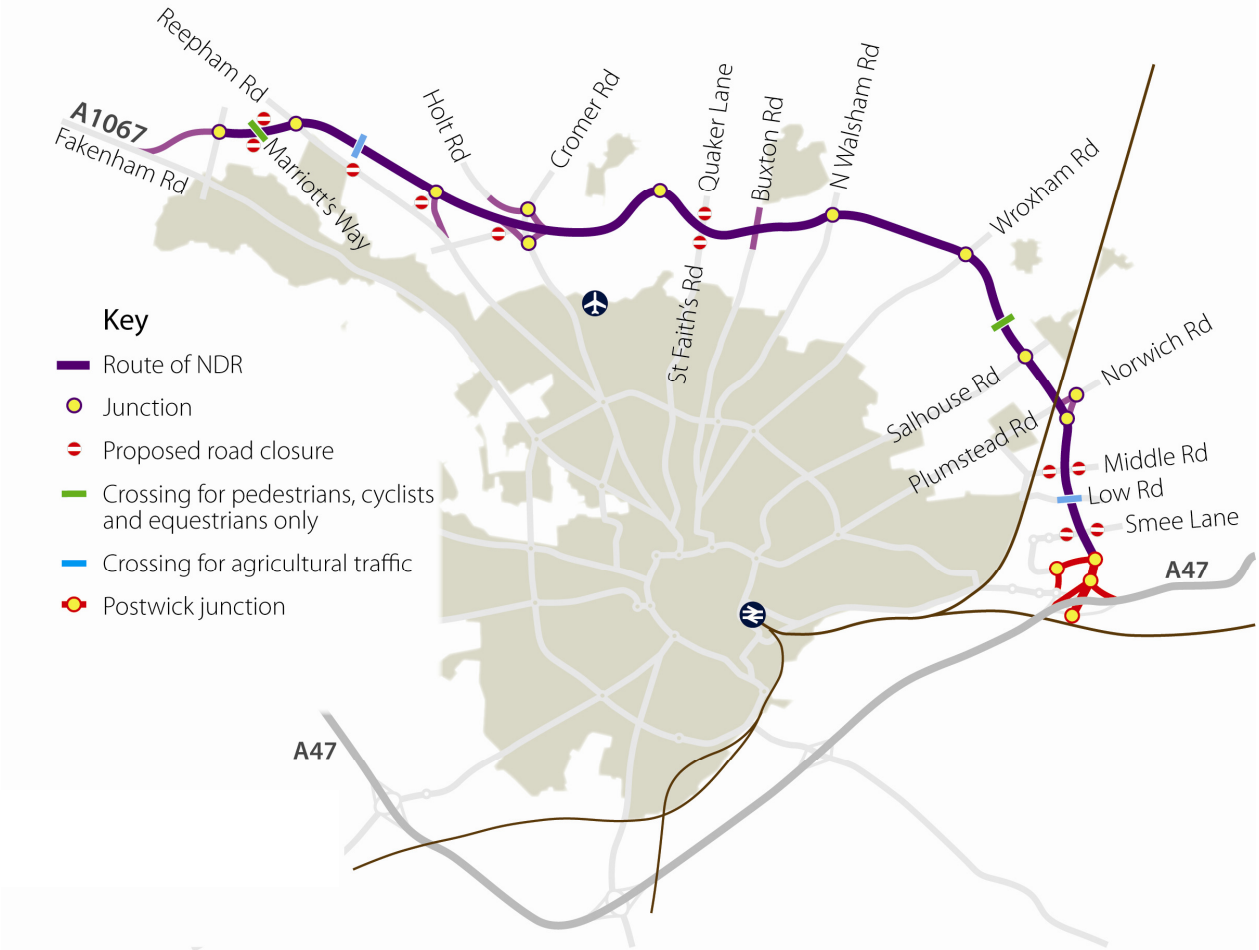
3.6 The Norwich Northern Distributor Road (NNDR)

The NNDR is a key piece of major infrastructure to deliver within NATS as it creates the opportunity to deliver public transport improvements within the city and surrounding areas and assists in the delivery of significant growth in jobs, housing and investment through the JCS. Traffic from areas to the north of Norwich will benefit from improved transport links, and the NNDR will relieve urban areas, particularly in the north-east of Norwich, of 'rat-running' traffic.

The NNDR proposals received strong public and business support in earlier consultations and the Government has recently given the go-ahead for funding to be allocated to the main part of the scheme subject to statutory approvals being granted.

The proposed route is shown in the following map.

Figure 3.5: Proposed NNDR route



The NNDR has both direct and indirect benefits in terms of the delivery of NATS schemes. In direct terms, the NNDR will affect decisions on whether bus priority (or other measures that reduce highway capacity) can proceed or not. In indirect terms, by enabling other non-car travel schemes to proceed, benefits to modal shift to more sustainable modes are realised.

3.7 Improving Travel

In addition to the NNDR, a range of interventions are being considered for delivery through the Implementation Plan.

Appropriate tools should be developed to maximise the efficiency of the highway network and these could build on an existing network of advanced traffic signals and associated control systems in Norwich. This aims to keep traffic moving smoothly and efficiently and there are clear linkages with public transport, walking and cycling networks with opportunities to provide additional priority.

Expansion in the use of Variable Message Signage (VMS) through the network is being considered as these signs provide the opportunity to provide motorists and other highway users with up-to-date information relating to congestion and highway incidents, and can be used to reinforce important safety messages. VMS could also be used for the promotion of alternative sustainable modes of transport to support walking and cycling initiatives as well as BRT, core bus routes and Park & Ride.

In terms of Park & Ride, maximising existing facilities is proposed, followed by expansion of sites and the provision of new sites where sufficient demand exists.

3.8 Deliverability

Phasing of the delivery of the final NATS Implementation Plan is dependent on a number of factors. These include timing of funding mechanisms, value for money, phasing of housing and employment growth, public and business acceptability and delivery of complementary schemes.

Funding availability is likely to control the speed at which schemes can be delivered and Norfolk County Council will seek to obtain funding from a number of sources, including funding allocated for transport, contributions from new developments, other grants and European monies.

It will not be possible to deliver all schemes at once and some elements are dependent on the delivery of other schemes. For example, the NNDR would provide the opportunity to implement a number of bus priority schemes, as without the benefit of the NNDR relieving some roads of traffic, there would be insufficient capacity to take bus priority schemes forward.

The JCS produced an 'Infrastructure Topic Paper', which outlined the detailed work done in the preparation and formulation of the JCS to assess the infrastructure requirements of the planned growth. That Topic Paper summarises the main findings of the Greater Norwich Infrastructure and Need Funding Study 2009. The Study included significant transport infrastructure improvements derived from NATS and indicated a need for an Integrated Delivery Programme to co-ordinate the funding and delivery of the required infrastructure. The GNDP is preparing such a Programme as part of its ongoing work on the JCS.

Norfolk County Council and its partners have been progressively delivering NATS measures and have successfully secured funding for various elements of NATS through the RFA process and the Community Infrastructure Fund. Norfolk County Council expects that the elements of NATS outlined in this Report (including the NNDR and the associated interventions) will be delivered through a mixture of public and private sector funding.

Public funding has been sought and secured for the Postwick Hub (CIF funding) and a major part of the NNDR (RFA funding). Developer contributions will be sought from the growth enabled by that transport infrastructure in line with Policy 20. Similar public and private sector contributions will be sought to deliver the sustainable travel improvements which are included in the NATS Implementation Plan. Norfolk County Council acknowledges that there are likely to be increasing constraints on the availability of public funding and that viability issues also need to be considered. These issues will continue to be assessed as Norfolk County Council and its GNDP partners take forward the Integrated Delivery Programme. The delivery of the NATS measures which support the JCS levels of growth will be linked to the delivery of that growth and, depending on the availability of funding, phasing of the growth may be required to allow for the timely delivery of the supporting infrastructure."

3.9 On-going work

Development of the Implementation Plan is on-going. The public consultation during October and November 2009 generated over 11,500 responses and although initial headline outputs are available, more detailed assessment is underway and will be concluded during Jan / Feb 2010. Modelling of different transport scenarios is close to being completed and detailed analysis of outputs will be undertaken and reported as part of the publication of the Implementation Plan. A Strategic Environmental Assessment (SEA) for the Implementation Plan is close to being concluded and the Environmental Report will be issued for consultation with Statutory Environmental Bodies (SEBs) and other key stakeholders during Feb / Mar 2010.

The final Implementation Plan will be issued to Cabinet at Norfolk County Council in April 2010.

4. Transport Assessment of NATS including NNDR

The Norwich Area Transportation Strategy transport model (the NATS model) includes both highway and public transport networks, and Variable Demand Modelling has been carried out in accordance with the Department for Transport's (DfT's) Transport Appraisal Guidance (TAG). The model has been validated against 2006 traffic data. Model base year 2006 results are used as a proxy for current conditions. NATS model forecasts have been made for the years 2016 and 2031, for the reasons given below.

The model takes account of future development that is anticipated to be brought forward in the area, as well as future public transport and highways improvements and alterations. Various future development and transport improvement scenarios have been tested, including a range of sensitivity tests.

Future development has been taken account of in the Core Scenario (see Section 4.1) which has been established through a range of sensitivity tests which were carried out for the DfT as described below.

Tests of possible future NATS transport interventions using the model have been carried out and compared against a background case, called the 'Do Minimum' scenario. This refers to the situation that is forecast to occur if the transport interventions being tested are not progressed.

The case with the future NATS transport interventions being tested is called the 'Do Something' scenario.

The NATS interventions comprise a range of possible measures including the introduction of Bus Rapid Transit (BRT) and city centre traffic management as outlined Section 3.

The main highway schemes in the Do Something scenario are as follows:

- Norwich Northern Distributor Road (NNDR) including complementary traffic management measures
- Postwick Hub
- Western Quadrant – Hospital and Research Park Access Road

The main public transport interventions included in the Do Something scenario are as follows:

- Bus Rapid Transit (BRT)
- Core bus and rail service enhancements
- Bus priority schemes associated with city centre traffic management

Extensive testing and assessment for the NNDR has been carried out using the NATS model. The great majority of benefits of the scheme derived from value for money assessment carried out for the Major Scheme Business Case (MSBC) submission to the DfT were congestion benefits, demonstrating the significant impacts the NNDR will have in removing inappropriate traffic from radial and other routes.

After submission of the MSBC, a series of sensitivity tests were carried out for DfT, following their Transport Assessment Guidance (TAG – Unit 3.15.5 - The Treatment of Uncertainty in Model Forecasting).

Economic assessment of the scheme using the Core Scenario [1] established in conjunction with the sensitivity testing, gave a Cost Benefit Ratio (BCR) of some 6.1. This confirmed the scheme as providing "High Value for Money", and as providing very significant congestion benefits.

After submission of reports detailing the sensitivity tests and their results, the DfT confirmed that the NNDR "will help provide better access to employment locations and proposed new housing growth areas, including the proposed eco-town at Rackheath". They noted that the NNDR is "to help relieve congestion on the inner and outer ring roads and other key routes in Norwich", and that it "will bring faster, more reliable journeys and help attract business, visitors and investment to the area." [2]

Tests carried out for DfT are referenced below. These are the Core Scenario test [3] and the Low Growth test [4] (Sensitivity Test 3A). Further details are given in the relevant reports.

4.1 Core Scenario test - Future development

The Core Scenario test was developed in accordance with DfT's Transport Analysis Guidance on forecasting (TAG Unit 3.15.5). Full details of the test are included in the Core Scenario test report, and some details have been reproduced below. The Do Minimum case for the Core Scenario includes schemes and measures that have been implemented between 2006 (the base year) and 2009, as well as those schemes post-2009 which are classified as 'near certain' or 'more than likely'.

DfT guidance suggests that forecasts in connection with transport schemes are generally produced for two years: the first being at or close to the anticipated opening date of the scheme, and the second being 15 years later (referred to as the design year). After consideration of the programme for the NNDR, it was decided to produce forecasts for the years 2016 and 2031.

The draft Greater Norwich Development Partnership Joint Core Strategy (JCS) considers future development up to the year 2026. As further growth has been assumed from 2026 to 2031, the transport forecasts for 2031 are more onerous in terms of dealing with traffic volumes than forecasts for 2026. It has therefore been considered appropriate to make relevant comparisons with forecasts for the year 2031 to use for consideration of transport aspects of the JCS.

To derive information about forecast traffic growth for use in the Core Scenario test, the uncertainty level (as defined in TAG Unit 3.15.5) was considered for the housing and business development sites included in the Greater Norwich Development Partnership Joint Core Strategy proposed submission document. It was considered that the element planned up to 2016 should be categorised as 'more than likely', but that after this date there is more uncertainty due to the longer term such that a 'reasonably foreseeable' category is appropriate.

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[1] Norwich Northern Distributor Road – Major Schemes Business Case – Sensitivity Tests for DfT - Core Scenario Report – December 2009.

[2] DfT Press Release - 16 December 2009

[3] Norwich Northern Distributor Road – Major Schemes Business Case – Sensitivity Tests for DfT - Core Scenario Report – December 2009.

[4] Norwich Northern Distributor Road – Major Schemes Business Case – Sensitivity Tests for DfT -Sensitivity Tests 2 to 6 Report – December 2009.

DfT forecasts of future trip ends across the country are given in TEMPRO 5.4 and the future traffic forecasts are given in the DfT's National Traffic Model 2008 (NTM08). TEMPRO 5.4 gives forecasts of trip end growth for cars and Light Goods Vehicles (LGVs) on trips for certain purposes in local authority districts. These are derived from the combination of information gathered by DfT at the consultation stage from local authorities together with forecasts of planning data obtained from government departments and future car ownership forecasting. NTM08 gives national traffic forecasts for cars, LGVs and HGVs.

DfT advises that growth elements categorised as 'more than likely' should generally be included in transport models. The advice is that elements categorised as 'reasonably foreseeable' should generally not be specifically included in transport models, but that the effects of such elements are to be dealt with by TEMPRO and NTM08 forecasts. Therefore future growth for the Core Scenario test comprises JCS housing and business development up to 2016, and TEMPRO 5.4 plus NTM08 growth thereafter, up to 2031.

Details of housing and business development growth anticipated in the JCS up to 2016 are given in **Tables A.1** and **A.2** in **Appendix A**. Details of TEMPRO 5.4 and NTM08 growth from 2016 to 2031 are given in **Tables B.1** to **B.4** in **Appendix B**.

Comparisons of growth forecasts of numbers of highway trips are shown in **Table 4.1**. The comparisons are given for the years 2016 and 2031. The JCS Total Highway Trip figures shown for 2031 are derived from the model using a future development assumption with JCS growth up to the year 2026 and assumed Regional Spatial Strategy growth from 2026 to 2031. The comparisons indicate that percentage differences are small, being less than 1% in AM and PM peak periods, and less than 4% in the interpeak period.

Table 4.1: Comparison of JCS and TEMPRO growth

Year	Period	Total Highway Trips		Difference
		TEMPRO	JCS	
2016	AM peak	74,116	74,221	0.1%
	Inter Peak	51,262	50,380	1.7%
	PM peak	67,188	66,629	0.8%
2031	AM peak	87,261	87,305	0.1%
	Inter Peak	60,686	58,458	3.7%
	PM peak	78,056	77,315	0.8%

As the differences in overall numbers of highway trips are small, it is considered appropriate to use the Core Scenario NATS model forecasts as indications of future transport conditions in the situation with JCS growth.

The same future development assumptions were used for both the Core Scenario Do Minimum and Core Scenario Do Something cases.

4.2 Core Scenario test - Future transport interventions

Details of the Core Scenario Do Minimum case are given in the Core Scenario report[5].

For the Core Scenario Do Something case, the proposed NNDR was added to the Do Minimum network.

In conjunction with the NNDR, complementary traffic management measures are proposed for Norwich city centre, and these were detailed in the consultation documents for Transport for Norwich: A summary of our plans for the future: Consultation October 2009. These have been modelled in the Do Something scenario. Details are given in the Core Scenario report[6].

Traffic management measures comprising a road closure at Drayton and 20mph speed limits on selected links in the northern and eastern suburbs of Norwich as well as in Taverham are included. Details are given in the Core Scenario report[7].

4.3 Low Growth Scenario - Future development

The Low Growth Scenario test included lower future traffic growth than the Core Scenario.

Following DfT guidance for Low Growth tests, reductions were made to the Core Scenario forecast of 2.5% for traffic forecasts one year ahead, rising with the square root of the number of years to 15% for forecasts up to 36 years ahead[8].

DfT Low Growth tests are carried out in order to assess impacts of variations to a range of inputs into forecasting including GDP growth, fuel price trends and vehicle efficiency changes. However, the Low Growth results can also be considered as a proxy for forecasts of effects of growth lower than the Core Scenario, and therefore of less than growth proposed in the JCS.

4.4 Low Growth Scenario - Future transport interventions

Sensitivity Test 3A carried out for the DfT as referred to in the introduction to this section of the report, was based around a low growth scenario.

The future transport interventions for the Low Growth Scenario are exactly the same as those discussed in the Core Scenario.

[5] Norwich Northern Distributor Road – Major Schemes Business Case – Sensitivity Tests for DfT - Core Scenario Report – December 2009 – Table 2.3 and Section 2.1.2.

[6] Norwich Northern Distributor Road – Major Schemes Business Case – Sensitivity Tests for DfT - Core Scenario Report – December 2009 – Section 3.2.

[7] Norwich Northern Distributor Road – Major Schemes Business Case – Sensitivity Tests for DfT - Core Scenario Report – December 2009 – Section 3.3.

[8] Norwich Northern Distributor Road – Major Schemes Business Case – Sensitivity Tests for DfT -Sensitivity Tests 2 to 6 Report – December 2009 – Section 3.2.

4.5 Test Results

In order to demonstrate the proposed NNDR is needed to accommodate the JCS growth, comparisons have been made between the results of Low Growth DM with Core Scenario DS.

4.6 Total vehicle trips

A comparison of Low Growth forecasts of vehicle trips with Core Scenario forecasts is given in **Table 4.2**.

Table 4.2: Summary of Trip Totals (PCUs)

Scenario	Year	Total Trips (PCUs)			% Difference from Base Year		
		AM	IP	PM	AM	IP	PM
Base year	2006	64480	44560	59441	-	-	-
Low Growth	2016DM	67516	47013	61321	5%	6%	3%
Core Scenario	2016DM	73174	51040	66518	13%	15%	12%
Low Growth	2031DM	75730	53000	67941	17%	19%	14%
Core Scenario	2031DM	86346	60587	77563	34%	36%	30%

It can be seen from **Table 4.2** that forecasts of vehicle trips for the Core Scenario are significantly greater than those for the Low Growth scenario, in both 2016 and 2031.

4.7 Network average speeds

Table 4.3 contains average speeds over the whole network (in km/h) for the low growth scenario and for the core scenario together with percentage changes in respect to the base year.

Table 4.3: Network Average Speeds

Scenario	Year	Average speed (km/h)			% Difference from Base Year		
		AM	IP	PM	AM	IP	PM
Base year	2006	49	57	52	-	-	-
Low Growth	2016DM	47	57	52	-4%	1%	-1%
Core Scenario	2016DM	45	56	50	-8%	-1%	-4%
	2016DS	47	58	52	-4%	2%	1%
Low Growth	2031DM	45	57	50	-8%	0%	-3%
Core Scenario	2031DM	41	55	47	-16%	-3%	-9%
	2031DS	43	57	49	-12%	0%	-5%

It can be seen from **Table 4.3** that in 2016 the forecast effects of additional growth in the Core Scenario DM (over the Low Growth scenario) are decreases in average speeds forecast for each time period. These decreases are negated by the addition of the NNDR to the Core Scenario in 2016 AM and PM peak period – forecast average speeds for Low Growth DM and Core Scenario DS being equal at 47km/h (AM peak) and 52 km/h (PM peak). For the Inter Peak period the effects are more than negated, with forecast average speeds for Low Growth DM and Core Scenario DS being 57 km/h and 58 km/h respectively.

In 2031 the forecast decreases in average speeds from the Low Growth scenario to the Core Scenario DM, from 45 km/h to 41 km/h in the AM peak, and from 50 km/h to 47 km/h in the PM peak, are mitigated by the addition of the NNDR to the Core Scenario. For the AM peak period the forecast average speeds for the Core Scenario DS is 43 km/h, and for the PM peak 49 km/h. The decrease in average speeds forecast for the Inter Peak period is negated - forecast average speeds for Low Growth DM and Core Scenario DS being equal at 57km/h.

From the above it can be seen that the NNDR has a significant effect on forecast average speeds, which are a measure of network operation and congestion. By comparing forecasts for Low Growth and Core Scenario, it can be seen that the NNDR negates decreases in average speeds resulting from the additional numbers of vehicle trips in 2016, and provides significant mitigation in 2031.

4.8 Flows on radial routes

To assess forecast effects on traffic flows on radial routes, comparisons have been made of traffic flows at points on radial routes close to the Outer Ring Road (ORR) to the north of the city. Points have been selected both inside and outside the ORR, and are referenced in **Figure C.1** in **Appendix C**.

Forecast traffic flows for the year 2031 have been obtained from the NATS model for 3 scenarios: Do Minimum Low Growth, Do Minimum Core Scenario, and Do Something (i.e. with the NNDR) Core Scenario. Flows have been obtained for AM Peak, Inter Peak, and PM Peak periods. These flows and differences between them are given in **Tables C.1** to **Table C.3** in **Appendix C**.

In all the three peak periods, it can be seen from these tables that generally Do Something Core Scenario forecast flows are less than Do Minimum Core Scenario forecast flows, although there are a small number of flows which are greater – 6 flows out of a total of 42 flows over the three modelled periods.

In comparing the Do Something Core Scenario with Do Minimum Low Growth, on most locations, the flows in the DS scenario are less than the Low Growth scenario with the exception of 13 flows out of a total 42 flows over the three modelled periods.

In the AM peak, the reduction of flows in the Do Something Core Scenario in comparison to the Do Minimum Core Scenario vary between 83 Passenger Car Units (PCUs) on A1607 Drayton Road (39a) and 492 PCUs on A1042 Yarmouth Road (site 45b). Only on B1150 Constitution Hill (41a) and on Plumstead Road (44a) traffic flows increase by 5 PCUs and 102 PCUs respectively in the Do Something scenario compared to the Do Minimum Core Scenario.

In comparing the AM flows between the Do Something Core Scenario and the Do Minimum Low Growth scenario, in 10 sites traffic flows reduce by between 13 PCUs on A1151 Sprowston Road (site 42a) to 335 PCUs on A1042 Yarmouth Road (site 45b). Traffic flow increases in the Do Something Scenario in comparison to the Do Minimum Low Growth are shown on 4 sites, which vary between 6 PCUs on A1067 Drayton Road (site 39a) and 131 PCUs on Plumstead Road (site 44a).

In the PM peak, 10 out of 14 sites see a reduction in traffic flows in the Do Something Core Scenario compared to the Do Minimum Core Scenario of between 52 PCUs on Salhouse Road (site 43b) and 492 PCUs on A1042 Yarmouth Road (site 45b). Five out of 14 sites show an increase in traffic flows in the Do

Something Core Scenario compared to Do Minimum Low Growth of between 1 PCUs on Plumstead Road (site 44b) and 127 PCUs on B1150 North Walsham Road (site 41b).

In general across all time periods, all sites show a decrease in traffic flows in the Do Something Scenario in comparison to the Do Minimum Core Scenario, with the largest decrease of 757 PCUs on A1042 (site 45b). Reduction in traffic flows in the Do Something Core Scenario compared to the Do Minimum Low growth of between 37 PCUs on A140 Holt Road (site 40b) and 544 PCUs on A1042 Yarmouth Road (site 45a) are shown. Small increases in traffic flows in the Do Something in comparison to the Low Growth of between 36 PCUs and 68 PCUs are shown.

These differences in forecast flows indicate that the inclusion of the proposed NNDR in the Do Something Scenario provides reductions over the Do Minimum with the largest flow decreases in the interpeak period.

It can also be seen from **Table C.1** to **Table C.3** that generally Do Something Core Scenario forecast flows are less than Do Minimum Low Growth forecast flows, although there are a number of flows which are greater – 12 flows out of a total of 42 flows over the three modelled periods.

These differences in forecast flows indicate that the proposed NNDR more than consumes generation from additional development in JCS (proxy) over Low Growth. This capacity will be used to provide enhanced priority for buses, cyclists and pedestrians.

4.9 Junction operation

The term V/C is a measure of junction operation. It represents the modelled traffic flow entering the junction divided by the theoretical capacity of the junction, expressed as a percentage. Hence a V/C value of 100% indicates that the modelled traffic flow equals the theoretical capacity. In general, allowance is made for various factors by assuming that a junction's practical capacity is 90% of its theoretical capacity. Therefore a V/C value greater than 90% indicates that the junction's practical capacity is exceeded, and in this situation there are likely to be significant queues and delays.

Table 4.4 shows a summary of NATS+ junction V/Cs and **Figure D.1** to **Figure D.5** in **Appendix D** show the location of junctions on a map background. The results shown are for the morning peak which is considered to be the busiest peak.

Table 4.4: NATS model junction V/Cs, AM Peak

Ref	Year	Scenario	Network	Number of junctions with V/C 90% - 100%	Number of junctions with V/C >100%
1	2006	Base	Do Minimum (without NNDR)	8	1
2	2016	Low growth	Do Minimum (without NNDR)	9	3
3	2031	Low growth	Do Minimum (without NNDR)	11	7
4	2031	Core scenario	Do Minimum (without NNDR)	20	8
5	2031	Core scenario	Do Something (with NNDR)	14	7

In the 2006 base year, eight junctions on the Outer Ring Road (ORR) have V/C values of between 90% and 100% and only one junction on the eastern section of Inner Ring Road (IRR) has a V/C value of over 100%. In 2016 Do Minimum Low growth, five junctions on the ORR, two junctions on the IRR, one junction

on the Southern bypass and one on the North East sector have V/C values of between 90% and 100%. In this scenario, two junctions on the eastern part between IRR and ORR and one junction on the Eastern section of A47 have V/C values of 100%.

In 2031 Do Minimum Low Growth, 11 junctions have V/C values of between 90% and 100% and seven junctions have V/C values of 100%. In comparison to the 2016 Do Minimum Low growth, in 2031, the additional junctions with V/C values of 100% include two junctions on the A47 Southern Bypass, and one junction on the ORR.

In 2031 Do Minimum Core Scenario, 20 junctions have V/C values of between 90% to 100% and 8 junctions have V/C values of over 100%. The 20 junctions with V/C values of 90% to 100% include the IRR, the ORR and the eastern sector of A47. Junctions with V/C values of 100% include the IRR, the ORR and the A47 Southern Bypass.

The inclusion of the proposed NNDR in the 2031 Do Something Core Scenario results in the number of junctions with V/C values of between 90% and 100% reducing to 14 junctions. The junctions benefiting from the schemes are those located on the northern sector and the eastern section of the A47.

Similar to the results obtained before, the above figures indicate that the proposed NNDR more than consumes generation from additional development in JCS (proxy) over Low Growth. This capacity will be used to provide enhanced priority for buses, cyclists and pedestrians.

4.10 Conclusions

Comparisons of results for the Low Growth Do Minimum scenario, the Core Scenario Do Minimum case, and the Core Scenario Do Something case have been made. Forecasts of total vehicle trip numbers indicate the additional trips resulting for the Core Scenario, used as a proxy for JCS development, over those resulting from the Low Growth scenario, used as a proxy for significantly less development. Comparisons of forecasts of network average speeds, traffic flows on radial routes, and junction operation demonstrate that the NNDR either provides significant mitigation of, or in many cases negates completely, the adverse transport effects of the additional JCS growth and provides capacity to implement complementary proposals on the highway network.

5. Evidence that the Proposed NNDR facilitates other elements of the NATS Strategy

The NNDR is forecast to enable other elements of the NATS strategy. In particular, by mitigating the adverse transport effects of the JCS development, it would enable improvement of public transport which would otherwise cause unacceptable impact on the highway network.

Two elements of the tests detailed in Section 4 above are relevant.

5.1 Flows on radial routes

The forecast traffic flows on radial routes given in **Appendix D** indicate that provision of the NNDR generally results in lower traffic flows on radial routes adjacent to the ORR than would occur in the Low Growth scenario, that is with significantly lower growth than is proposed in the JCS.

The resulting lower traffic flows would enable public transport improvements to take place with less adverse effects on general traffic conditions than would otherwise occur. Without these lower traffic flows, introduction of public transport improvements would not be as effective or attractive as otherwise in terms of encouraging mode shift to more sustainable alternatives.

5.2 Junction operation

The forecast junction operation information in **Figure D.5** in **Appendix D** indicates that the NNDR results in significant mitigation of the adverse effects of the JCS development on the forecast operation of junctions.

The improved operation of junctions would enable public transport improvements to take place with less adverse effects on general traffic conditions than would otherwise occur.

5.3 NATS Plus tests

NATS model tests have been carried out on what has been termed “NATS Plus”, representing transport measures in the NATS Implementation Plan. The tests are described in outline below, and their results are also referenced below.

5.4 Future development

The assumptions for the Core Scenario test have been used.

5.5 Future transport interventions

In addition to transport interventions in the Core Scenario outlined above, additional interventions have been modelled, including changes of circulation in the city centre, bus priority measures along key radial routes and the provision of additional bus services as part of a BRT network. **Table E.1** in **Appendix E** show the full list of transport interventions in the 2016 and 2031 forecasting years.

A number of transport interventions are not included in the modelling (see **Table E.1** in **Appendix E)** as some cannot be modelled. Their role in delivering the NATS strategy is included in the assessment of the Implementation Plan.

5.6 Conclusions

The proposed NNDR has been assessed using the NATS transport model. The NATS model includes both highway and public transport models, and Variable Demand Modelling has been carried out in accordance with the Department for Transport's (DfT's) Transport Appraisal Guidance (TAG). The model is based on 2006 traffic information, and has been validated against 2006 traffic data.

Extensive tests have been carried out for the NNDR Major Schemes Business Case. A series of sensitivity tests were carried out for DfT, leading to their recognition that the NNDR "will help provide better access to employment locations and proposed new housing growth areas, including the proposed eco-town at Rackheath". They noted that the NNDR is "to help relieve congestion on the inner and outer ring roads and other key routes in Norwich", and that it "will bring faster, more reliable journeys and help attract business, visitors and investment to the area."

The Core Scenario test was developed in accordance with DfT's Transport Analysis Guidance on forecasting (TAG Unit 3.15.5). The Low Growth tests were carried out in order to assess impacts of variations to a range of inputs into forecasting including GDP growth, fuel price trends and vehicle efficiency changes. The Low Growth results can be considered as a proxy for forecasts of effects of growth lower than the Core Scenario, and therefore of less than growth proposed in the JCS.

The differences in forecast flows indicate that the inclusion of the proposed NNDR in the Do Something Scenario provides reductions over the Do Minimum with the largest decrease shown in the interpeak period. These differences in forecast flows indicate that the proposed NNDR more than consumes generation from additional development in JCS (proxy) over Low Growth.

Comparisons of junction V/Cs show the inclusion of the proposed NNDR will cater for generated traffic from additional development in JCS.

Appendices

Appendix A. Housing and Business Development Locations

Development Details

Assumptions of sizes and locations and rates of developments have been obtained from the JCS existing development plans and planning proposals, and are detailed below.

Development up to 2016

The JCS identifies a total of 19,102 additional homes to be provided in the Greater Norwich area between 2006 and 2016 as shown in **Table A.1** and their locations are shown on a map in **Figure A.1**.

Table A.1: 2006-2016 Assumed Housing Development Forecasts in Norwich, Broadland and South Norfolk

Local Plan Development	District	Units	Model Zone
Hellesdon	Broadland	38	119
Hellesdon, Golf Course	Broadland	102	121
Hellesdon Hospital	Broadland	34	122
Hellesdon, A140 corridor	Broadland	34	123
Drayton	Broadland	54	127
Spixworth	Broadland	17	154
Rackheath Eco-Community	Broadland	1,035	157
Blofield	Broadland	33	163
Thorpe St Andrew	Broadland	71	166
Sprowston	Broadland	317	11402
Old Catton	Broadland	75	11702
Taverham	Broadland	41	15101
Blue Boar Lane	Broadland	882	15602
Great and Little Plumstead	Broadland	283	15801
SPROWSTON FRINGE	Broadland		
South of Plumstead Road	Broadland	31	84
Between Wroxham and North Walsham Road	Broadland	91	155
Between Salhouse and Wroxham Road	Broadland	114	15602
Between Plumstead and Salhouse Road	Broadland	114	15801
Sprowston Fringe Total	Broadland	350	
BROADLAND TOTAL		3.366	
St. Andrews Street, Rumsey Wells Court	Norwich	12	8
Castle Meadow, 7-7a (Castle House)	Norwich	22	10
Tombland, Samson and Hercules House	Norwich	17	11
Cathedral Street, 16	Norwich	14	13
Greyfriars Road / Rose Lane	Norwich	130	14
Mountergate, Baltic Wharf	Norwich	11	14

Local Plan Development	District	Units	Model Zone
Mountergate / Rose Lane	Norwich	80	14
Surrey Street, 29-35	Norwich	12	19
Bethel Street, 59 (Labour Club)	Norwich	14	25
Pottergate, 34 (Pottergate / Fishers Lane)	Norwich	50	27
Pottergate, Thorndick and Dawson	Norwich	18	27
St Giles Street, rear 29	Norwich	17	27
Duke Street, Dukes Palace Wharf*	Norwich	35	33
Duke Street, Dukes Wharf [70]	Norwich	16	33
Duke Street, St Mary's Works	Norwich	50	33
Duke Street, Start Rite Site (adj hotel) [21]	Norwich	40	33
Mary Chapman Court	Norwich	40	33
Muspole Street	Norwich	40	33
Fishergate, 17-27	Norwich	13	36
Fishergate, Bulsare Warehouse	Norwich	10	36
Fishergate, Old Millers Wharf	Norwich	31	36
Magdalen Street, Zipfels Court	Norwich	10	36
Quayside / Bedding Lane / Palace Street*	Norwich	25	36
Quayside / Pigg Lane*	Norwich	15	36
St Saviours Lane, Hi Tech House	Norwich	40	36
Whitefriars, Smurfitt Kappa	Norwich	90	36
King Street, 131-133 (King St / Hobrough Lane)	Norwich	35	41
King Street, 148-162	Norwich	22	41
King Street, Paper Mill Yard	Norwich	180	41
King Street, Reads Mill and Cannon Wharf	Norwich	160	41
King Street, St Anne's Wharf [437]	Norwich	200	41
Music House Lane, 1-4	Norwich	40	41
Ber Street, 10-34	Norwich	30	43
Ber Street, 84-104 [25]	Norwich	25	43
Ber Street, 93-101	Norwich	18	43
Foulgers Opening, Foulgers House	Norwich	58	43
Oak Street, L C Jay and Son	Norwich	12	47
Oak Street, Spring Grove Laundry	Norwich	21	47
Oak Street, The Talk / 114	Norwich	40	47
Oak Street / New Mills Yard*	Norwich	38	47
St Crispins Road / Pitt Street	Norwich	25	47
St Martins Road, The Watering	Norwich	21	47
Sussex Street, Sussex House	Norwich	15	47
Edward Street, Hunters Squash Club	Norwich	24	49
St Stephens Road, 54-78	Norwich	18	56
St Stephens Road, Needham Place (Courts)	Norwich	24	56
St Stephens Road, N and N Hospital Site*	Norwich	504	57
Chapelfield	Norwich	116	58
Unthank Road, 124-126	Norwich	10	58

Local Plan Development	District	Units	Model Zone
Greyhound Opening	Norwich	25	60
Haslips Close / Devonshire Street	Norwich	20	60
Aylsham Road, 2-6	Norwich	13	61
Aylsham Road, St Lukes Court	Norwich	20	61
Waterloo Road / Magpie Road	Norwich	10	61
Silver Road / Mousehold Avenue	Norwich	14	62
Cromer Road, Start-Rite (Cobblers Mews)	Norwich	151	63
Pearcefield, 17	Norwich	10	63
Bishop Bridge Road, 27 (Box and Barrel Site)	Norwich	24	64
Bishop Bridge Road, Gas Works	Norwich	15	64
Egyptian Road / Bishop Bridge Road	Norwich	30	64
Rosary Road, Bertram Books	Norwich	113	65
Thorpe Road, 1-5 (Great Eastern Court)*	Norwich	33	65
Thorpe Road, 244 (Cavalier Hotel)	Norwich	10	65
Hall Road, 138	Norwich	10	69
Bowthorpe Road, Norwich Community Hospl.	Norwich	75	75
Earlham Road, Duff Morgan Garage Site	Norwich	53	75
Armes Street, Little John PH	Norwich	10	76
Nelson Street / Armes Street	Norwich	30	76
Northumberland Street, 120-130	Norwich	30	76
Turner Road, Youth Hostel site	Norwich	15	76
Bowers Avenue	Norwich	10	78
Drayton Road, 81-93	Norwich	10	78
Drayton Road, Lime Kiln Mews	Norwich	33	78
Havers Road / Mile Cross Road, Harmers*	Norwich	39	78
Lefroy Road	Norwich	17	78
Old Grove Court	Norwich	24	79
Philadelphia Lane, Crawshay Arms PH	Norwich	13	79
Woodcock Road, Highwayman PH*	Norwich	14	79
Catton Grove Road, Crown and Magpie PH	Norwich	22	80
Aylsham Road, 70	Norwich	14	81
Anthony Drive / Sprowston Road	Norwich	40	83
Wentworth Green, Civil Service Sports Ground	Norwich	78	93
Elizabeth Fry Road / Bacon Road*	Norwich	73	98
Elizabeth Fry Road / Gould Road	Norwich	81	98
Earlham Road, rear 523-527	Norwich	41	99
Dereham Road, The Loke	Norwich	103	100
Barrack Street / Whitefriars	Norwich	200	106
City Road, Corton House	Norwich	34	107
Munnings Road, Heartsease House	Norwich	17	113
Paine Road, garages rear 34-88	Norwich	27	113
Sale Road, adjacent 274-282	Norwich	10	113
Mousehold Lane, 28 (Start Rite Site)	Norwich	35	115

Local Plan Development	District	Units	Model Zone
Ives Road / Bussey Road	Norwich	34	118
Harvey Lane, Morrison Lodge	Norwich	15	166
Rose Lane, 26-36 (Gerald Giles)	Norwich	24	1003
Rose Lane, Tudor Hall	Norwich	10	1003
All Saints Green / Queens Road (Bus Station)	Norwich	104	1903
Theatre Street, Chantry Car Park	Norwich	25	2101
Friars Quay, Colegate	Norwich	20	3601
Anglia Square	Norwich	250	4901
Beckham Place	Norwich	20	4902
Agricultural Hall Plain, Hardwick House	Norwich	24	6701
Wherry Road	Norwich	72	6703
Carrow Road, Riverside Heights*	Norwich	281	6705
Carrow Road / Kerrison Road (HOU9 A42)	Norwich	121	6705
Kerrison Road, Centenary House	Norwich	24	6705
Kerrison Road / Hardy Road (EMP15)	Norwich	52	6705
Kerrison Road / Hardy Road (HOU12 B48)	Norwich	200	6705
Bracondale, Deal Ground	Norwich	40	6803
Bowthorpe Road, Bowthorpe School Site*	Norwich	110	12801
Bowthorpe, Site TS2B Three Score*	Norwich	18	12802
Bowthorpe, Three Score Village	Norwich	750	12802
Bowthorpe, Tolye Road (Old Barn site)	Norwich	24	12802
Dereham Road, 238a (Earl of Leicester PH)	Norwich	12	12803
Dereham Road, 557	Norwich	21	12803
NORWICH (to be distributed over each NATS Zone)	Norwich	500	
TOTAL NORWICH		6,885	
Costessey	South Norfolk	2,271	125
Framingham Earl	South Norfolk	22	136
Poringland	South Norfolk	759	137
A140 corridor sites (Stoke Holy Cross, Swainsthorpe, Newton Flotman, Tasburgh)	South Norfolk	25	138
Mulbarton	South Norfolk	280	140
Swardeston	South Norfolk	18	141
Hethersett	South Norfolk	283	145
Little Melton	South Norfolk	17	146
Easton	South Norfolk	189	149
Long Stratton	South Norfolk	79	193
Wymondham	South Norfolk	1,003	520
Cringleford	South Norfolk	1,162	13003
Trowse	South Norfolk	25	6802
SOUTH NORFOLK TOTAL		6,133	

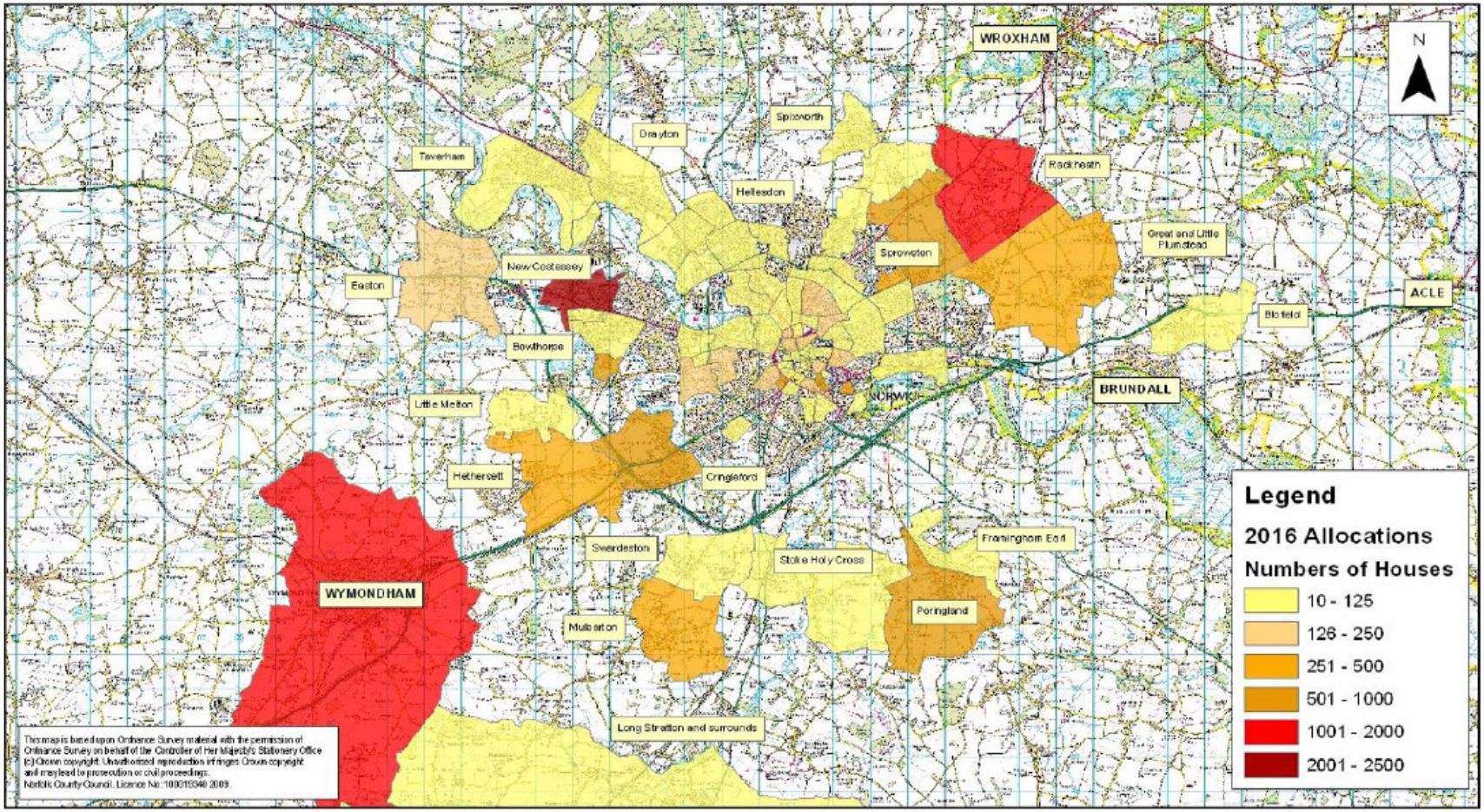
Local Plan Development	District	Units	Model Zone
Windfall	Other	1,680	
Sites under 10 dwellings	Other	1,038	
Total Other		2,718	
Grand Total Housing Development for 2006-2016		19,102	

Table A.2 shows the business developments, types and sizes to be provided in the Greater Norwich area between 2006 and 2016 and their locations are shown in **Figure A.2**.

Table A.2: Business Developments 2006-2016

No	Local Plan Development	TEMPRO Area	Development Type	Size (ha)	Developed (m2)	Model Zone
1	Hellesdon	Broadland	B1 / B2 / B8	0.33	1,155	119
2	Sprowston	Broadland	B1 / B2 / B8	4.49	15,715	11402
3	Horsford	Broadland	B1 / B2 / B8	0.86	3,010	15201
4	Broadland Business Park, Green Lane	Broadland	B1 / B2 / B8	43.23	151,305	15901
5	Broadland Business Park, north	Broadland	B1 / B2 / B8	0.58	2,030	15901
	Total Broadland			49.49	173,215	
6	Old Hall Road	Norwich	B1 / B2 / B8	1.64	5,740	91
7	Site at Kerrison Road	Norwich	B1	1.00	3,500	6705
8	Deal Ground, Trowse	Norwich	B1	4.34	15,190	6803
9	Cremorne Road	Norwich	B1 / B2 / B8	3.45	12,075	6804
10	Livestock Market, Hall Road	Norwich	A1 / B1 / B2 / B8	6.37	22,295	9102
11	Airport	Norwich	B1 / B2 / B8	2.07	7,245	12002
	Total Norwich			18.87	66,045	
12	Wymondham	South Norfolk	B1 / B2 / B8	15.37	53,795	520
13	Longwater (Costessey)	South Norfolk	B1 / B2 / B8	15.79	55,265	12601
14	NRP	South Norfolk	Research	8.00	28,000	12902
15	Colney Conting. (research)	South Norfolk	B1	7.00	24,500	12905
16	Colney Hall	South Norfolk	B1	7.50	26,250	12908
	Total South Norfolk			53.66	187,810	
	Total for all areas			122.02	427,070	

Figure A.1: Indicative Location of Housing Development 2006 - 2016



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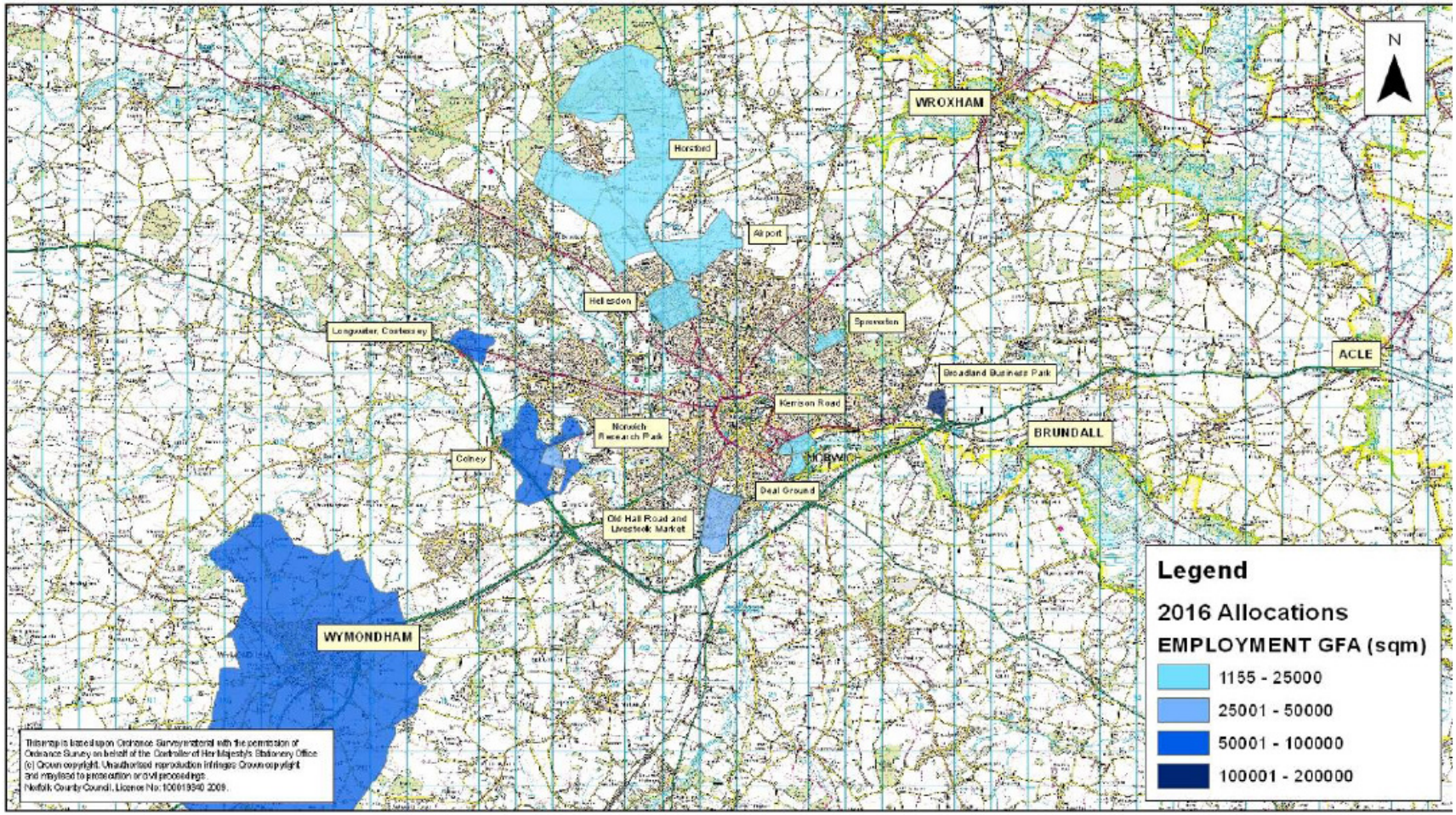
Growth Point Assumptions
Housing Developments 2006-2016

Figure A.2: Indicative Location of Employment Developments, 2006 – 2016



0 1 2 4 6 8 Kilometers

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Appendix B. TEMPRO 5.4 and NTM08 Growth Factors

Table B.1: TEMPRO 5.4 growth, 2016-2031 AM Peak

Area Description		Employer's Business		Other		Work	
Level	Name	Origin	Destination	Origin	Destination	Origin	Destination
Authority	Breckland	1.242	1.1736	1.3809	1.3711	1.267	1.162
Authority	Broadland	1.2358	1.2086	1.3435	1.3566	1.2427	1.1886
Authority	Great Yarmouth	1.209	1.2506	1.3163	1.3179	1.1812	1.231
Authority	King`s Lynn and W Norfolk	1.2596	1.2274	1.2753	1.2576	1.2812	1.1894
Authority	North Norfolk	1.1702	1.2033	1.307	1.3168	1.1506	1.1792
Authority	Norwich	1.3811	1.2758	1.4069	1.3516	1.4423	1.2773
33UG1	Norwich(main)	1.3811	1.2758	1.4069	1.3517	1.4425	1.2773
Authority	South Norfolk	1.2068	1.1745	1.3182	1.3309	1.216	1.1668

Table B.2: TEMPRO 5.4 growth, 2016-2031 IP

Area Description		Employer's Business		Other		Work	
Level	Name	Origin	Destination	Origin	Destination	Origin	Destination
Authority	Breckland	1.2037	1.1973	1.4148	1.4134	1.2062	1.223
Authority	Broadland	1.2217	1.2259	1.3873	1.3844	1.2099	1.2186
Authority	Great Yarmouth	1.2425	1.2542	1.3536	1.3452	1.2113	1.1997
Authority	King`s Lynn and W Norfolk	1.2236	1.2409	1.2933	1.2868	1.2111	1.2269
Authority	North Norfolk	1.1999	1.2082	1.3507	1.345	1.17	1.1607
Authority	Norwich	1.3039	1.2982	1.3906	1.401	1.3116	1.3473
33UG1	Norwich(main)	1.3039	1.2982	1.3906	1.4011	1.3116	1.3474
Authority	South Norfolk	1.1933	1.1891	1.3632	1.3629	1.1858	1.1948

Table B.3: TEMPRO 5.4 growth, 2016-2031 PM Peak

Area Description		Employer's Business		Other		Work	
Level	Name	Origin	Destination	Origin	Destination	Origin	Destination
Authority	Breckland	1.186	1.2469	1.3723	1.3829	1.1627	1.2584
Authority	Broadland	1.2118	1.243	1.3524	1.3513	1.1863	1.2359
Authority	Great Yarmouth	1.2452	1.2195	1.3062	1.3037	1.2258	1.1804
Authority	King`s Lynn and W Norfolk	1.2188	1.2705	1.2779	1.2909	1.1791	1.2619
Authority	North Norfolk	1.1994	1.1811	1.306	1.3073	1.1765	1.1507
Authority	Norwich	1.2902	1.3814	1.3779	1.3852	1.273	1.4153
33UG1	Norwich(main)	1.2902	1.3814	1.378	1.3852	1.273	1.4155
Authority	South Norfolk	1.1832	1.2109	1.3301	1.3319	1.1651	1.2107

Table B.4: NTM08 Light Goods Vehicles and Heavy Goods Vehicles Forecast Growth

AM Peak	2006 -2016	2006 - 2031	IP	2006 -2016	2006 - 2031	PM Peak	2006 -2016	2006 -2031
Adjusted LGV	1.327	1.879	Adjusted LGV	1.311	1.849	Adjusted LGV	1.319	1.856
Adjusted HGV	1.075	1.180	Adjusted HGV	1.068	1.177	Adjusted HGV	1.076	1.189

Appendix C. Comparison of Traffic Flows on Radial Roads

Table C.1: Comparison of traffic flows on radial roads, 2031 AM Peak

Ref	Road	Forecast traffic flow (PCUs)		
		Do Minimum Low Growth	Do Minimum Core Scenario	Do Something Core Scenario
39 (a)	A1067 Drayton Road	1377	1466	1383
39 (b)	A1067 Drayton High Road	1474	1527	1344
40 (a)	A140 Aylsham Road	1433	1473	1306
40 (b)	A140 Holt Road	2154	2304	2135
41 (a)	B1150 Constitution Hill	1105	1086	1091
41 (b)	B1150 North Walsham Road	1281	1372	1185
42 (a)	A1151 Sprowston Road	1853	2010	1881
42 (b)	A1151 Wroxham Road	1551	1665	1397
43 (a)	Gurney Road	876	889	839
43 (b)	Salhouse Road	1408	1555	1421
44 (a)	Plumstead Road	1252	1281	1383
44 (b)	Plumstead Road East	984	905	809
45 (a)	A1242 Yarmouth Road	1246	1451	1184
45 (b)	A1042 Yarmouth Road	2059	2215	1723

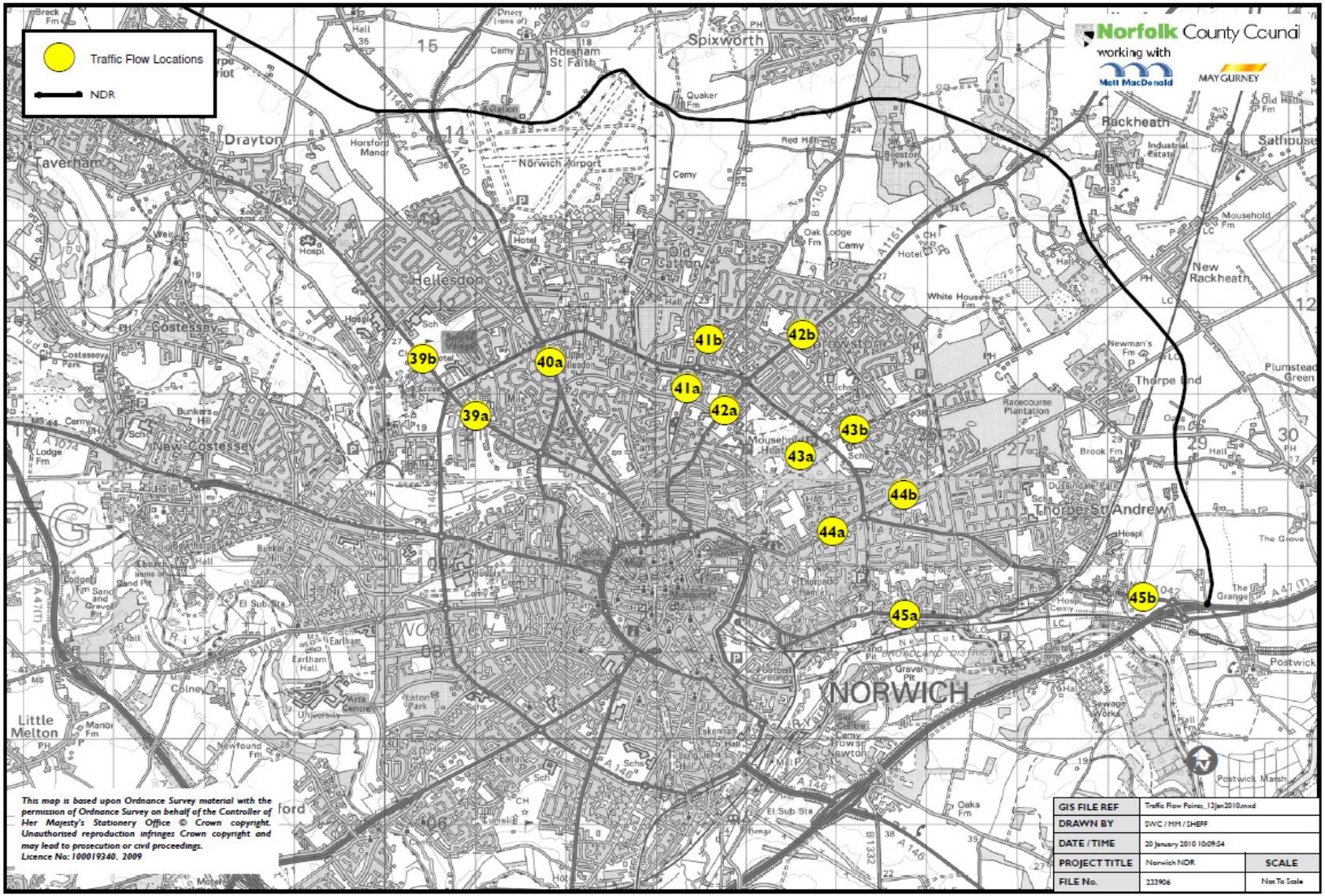
Table C.2: Comparison of traffic flows on radial roads, 2031 IP

Ref	Road	Forecast traffic flow (PCUs)			Differences			
		Do Minimum Low Growth	Do Minimum Core Scenario	Do Something Core Scenario	Do Something - Do Minimum Core Scenario	Percentage Difference	Do Something - Do Minimum Low Growth	Percentage Difference
39 (a)	A1067 Drayton Road	1260	1390	1152	-238	-17%	-108	-9%
39 (b)	A1067 Drayton High Road	1653	1712	1341	-371	-22%	-312	-19%
40 (a)	A140 Aylsham Road	1010	1117	1046	-71	-6%	36	4%
40 (b)	A140 Holt Road	1895	2082	1858	-223	-11%	-37	-2%
41 (a)	B1150 Constitution Hill	785	853	690	-163	-19%	-95	-12%
41 (b)	B1150 North Walsham Road	886	950	635	-314	-33%	-251	-28%
42 (a)	A1151 Sprowston Road	1167	1165	1061	-104	-9%	-106	-9%
42 (b)	A1151 Wroxham Road	1095	1175	994	-181	-15%	-101	-9%
43 (a)	Gurney Road	694	785	730	-55	-7%	37	5%
43 (b)	Salhouse Road	1382	1510	1450	-60	-4%	68	5%
44 (a)	Plumstead Road	1051	1186	1095	-92	-8%	43	4%
44 (b)	Plumstead Road East	1057	1033	954	-79	-8%	-103	-10%
45 (a)	A1242 Yarmouth Road	791	918	692	-226	-25%	-99	-13%
45 (b)	A1042 Yarmouth Road	1889	2102	1345	-757	-36%	-544	-29%

Table C.3: Comparison of traffic flows on radial roads, 2031 PM Peak

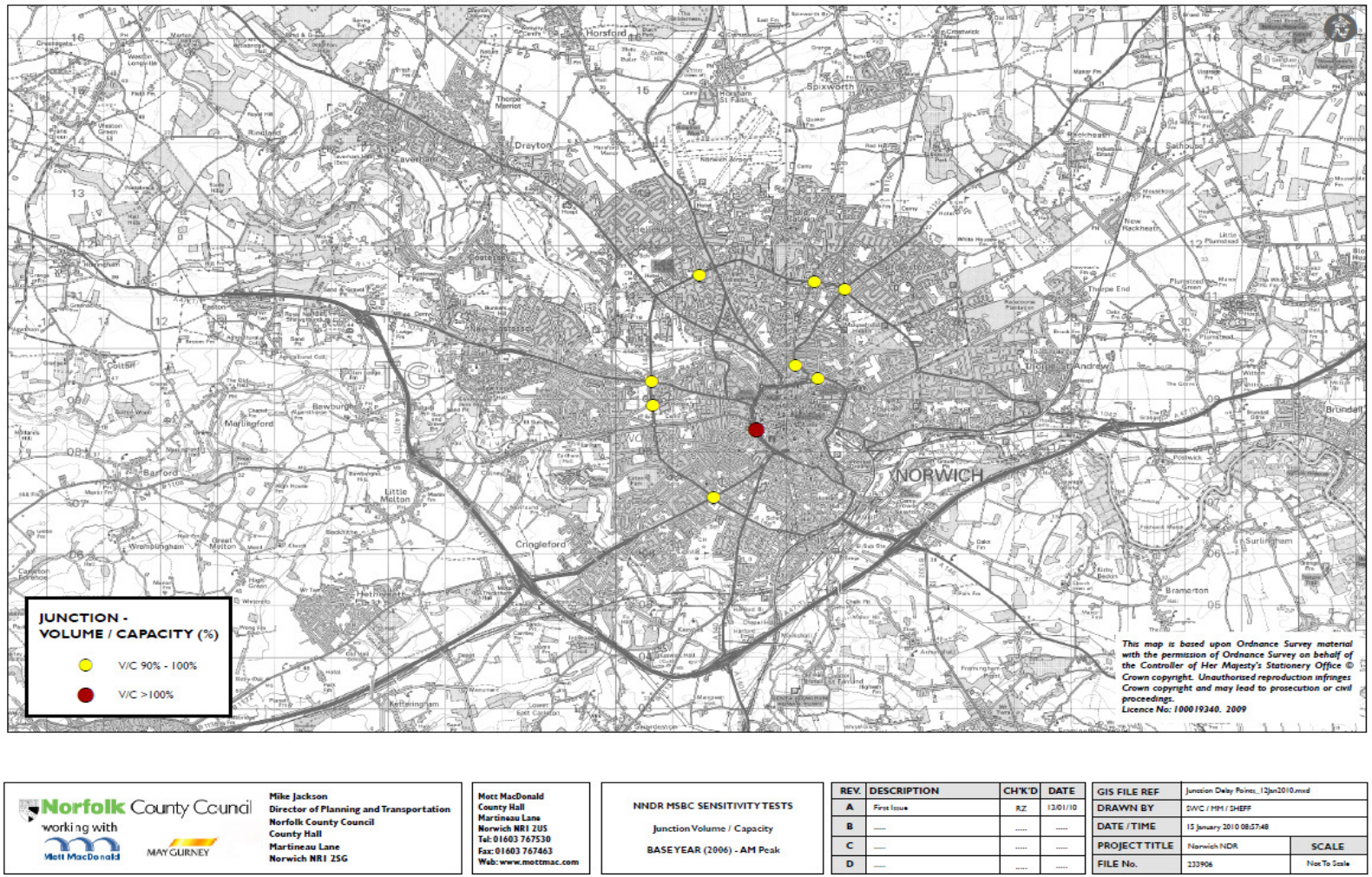
Ref	Road	Forecast traffic flow (PCUs)			Differences			
		Do Minimum Low Growth	Do Minimum Core Scenario	Do Something Core Scenario	Do Something - Do Minimum Core Scenario	Percentage Difference	Do Something - Do Minimum Low Growth	Percentage Difference
39 (a)	A1067 Drayton Road	1745	1907	1662	-245	-13%	-84	-5%
39 (b)	A1067 Drayton High Road	1695	1650	1524	-125	-8%	-171	-10%
40 (a)	A140 Aylsham Road	1270	1382	1202	-180	-13%	-68	-5%
40 (b)	A140 Holt Road	2622	2752	2662	-91	-3%	40	2%
41 (a)	B1150 Constitution Hill	602	610	668	58	10%	66	11%
41 (b)	B1150 North Walsham Road	949	967	1076	109	11%	127	13%
42 (a)	A1151 Sprowston Road	1165	1151	1043	-108	-9%	-123	-11%
42 (b)	A1151 Wroxham Road	1074	1298	1002	-296	-23%	-72	-7%
43 (a)	Gurney Road	951	976	876	-101	-10%	-75	-8%
43 (b)	Salhouse Road	1800	1810	1759	-52	-3%	-41	-2%
44 (a)	Plumstead Road	1300	1381	1455	75	5%	155	12%
44 (b)	Plumstead Road East	1074	1065	1075	10	1%	1	0%
45 (a)	A1242 Yarmouth Road	1103	1418	954	-464	-33%	-148	-13%
45 (b)	A1042 Yarmouth Road	2143	2281	1790	-492	-22%	-354	-17%

Figure C.1: Location of traffic flow points



Appendix D. Junction V/Cs

Figure D.1: 2006 DM Junction V/Cs – AM Peak



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NNDR MSBC SENSITIVITY TESTS
Junction Volume / Capacity
BASE YEAR (2006) - AM Peak

REV.	DESCRIPTION	CH'K'D	DATE
A	First Issue	RZ	13/01/10
B	.....	.....	.....
C	.....	.....	.....
D	.....	.....	.....

GIS FILE REF	Junction Delay Points_12Jan2010.mxd	
DRAWN BY	DWC / MM / SHEFF	
DATE / TIME	15 January 2010 08:57:48	
PROJECT TITLE	Norwich NDR	SCALE
FILE No.	233906	Not To Scale

Figure D.2: 2016 DM Low Growth Junction V/Cs – AM Peak

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NNDR MSBC SENSITIVITY TESTS
Junction Volume / Capacity
Core Scenario 2016: Do Minimum - AM Peak

REV.	DESCRIPTION	CH'K'D	DATE
A	First Issue	RZ	13/01/10
B	.....	.....	.....
C	.....	.....	.....
D	.....	.....	.....

GIS FILE REF	Junction Delay Points_12jan2010.mxd	
DRAWN BY	SWC / MM / SHEFF	
DATE / TIME	15 January 2010 08:57:48	
PROJECT TITLE	Norwich NDR	SCALE
FILE No.	233906	Not To Scale

Figure D.3: 2031 DM Low Growth Junction V/Cs – AM Peak

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NNDR MSBC SENSITIVITY TESTS
Junction Volume / Capacity
Test 3A Low Growth 2031:
Do Minimum - AM Peak

REV.	DESCRIPTION	CH'K'D	DATE
A	First Issue	RZ	13/01/10
B	.....	.....	.....
C	.....	.....	.....
D	.....	.....	.....

GIS FILE REF	Junction Delay Points_12jan2010.mxd	
DRAWN BY	SWC / MM / SHEFF	
DATE / TIME	15 January 2010 08:57:48	
PROJECT TITLE	Norwich NDR	SCALE
FILE No.	233906	Not To Scale

Figure D.4: 2031 DM Core Scenario Junction V/Cs – AM Peak

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NNDR MSBC SENSITIVITY TESTS
Junction Volume / Capacity
Core Scenario 2031: Do Minimum - AM Peak

REV.	DESCRIPTION	CH'K'D	DATE
A	First Issue	RZ	13/01/10
B	.....	.....	.....
C	.....	.....	.....
D	.....	.....	.....

GIS FILE REF	Junction Delay Points_12jan2010.mxd	
DRAWN BY	DWC / MM / SHEFF	
DATE / TIME	13 January 2010 15:04:23	
PROJECT TITLE	Norwich NDR	SCALE
FILE No.	233906	Not To Scale

Figure D.5: 2031 DS Core Scenario Junction V/Cs – AM Peak

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NNDR MSBC SENSITIVITY TESTS

Junction Volume / Capacity

Core Scenario 2031: Do Something - AM Peak

REV.	DESCRIPTION	CH'K'D	DATE
A	First Issue	RZ	13/01/10
B	----	----	----
C	----	----	----
D	----	----	----

GIS FILE REF	Junction Delay Points_12jan2010.mxd	
DRAWN BY	SWC / MM / SHEFF	
DATE / TIME	15 January 2010 08:57:48	
PROJECT TITLE	Norwich NDR	SCALE
FILE No.	233906	Not To Scale

Appendix E. NATS Plus Do Something Modelling Uncertainty Log

The following list outlines schemes that have been assumed for modelling purposes to give a representation of the full NATS Implementation package. The NATS Implementation package has yet to be formally agreed and the appearance of a scheme in the list is simply to show what is modelled and is not a firm commitment to all the proposals. No priority order is implied in the list.

Table E.1: NATS plus Do Something Modelling Uncertainty Log

	Input	Uncertainty	Included in the model	Comment
1	Traffic signal priority for buses for signals on radial routes outside of Inner Ring Road		No	it's difficult to code traffic signal priority for buses into Saturn
2	Bus gate on Gurney Road between Britannia Road and Mousehold Avenue		YES 2016&2031	Part of BRT 1
3	Eastbound bus lane on Dereham Road on the approach to the Inner Ring Road		YES 2016&2031	Change do something junction layout and signal staging/timings to same as do minimum
4	Eastbound bus lane on Dereham Road on the approach to Old Palace Road and Heigham Road		YES 2016&2031	Part of BRT 4
5a	Westbound bus lane on approach to Larkman Rd, Costessey		YES 2016&2031	Part of BRT 4
5b	Westbound bus lane on approach to Norwich Road , Costessey		YES 2016&2031	Part of BRT 4
6	Eastbound bus lane on Dereham Road bypassing Bowthorpe Roundabout		YES 2031 only	
7	Eastbound bus lane on Dereham Road on approach to Longwater Lane junction, Costessey		No	
8	Conversion from priority to signal control of Drayton Road/Aylsham Road junction		YES 2031 only	Part of BRT 5
9	Northbound bus lane on Aylsham Road from Half Mile Road on approach to Mile Cross Road junction		YES 2031 only	Part of BRT 6
10	Northbound bus lane on Aylsham Road from Glenmore Gardens on approach to Boundary junction		YES 2031 only	Part of BRT 6
11	Various traffic calming schemes on outer north city circular suburban minor roads		YES 2016&2031	NDR related
12	Conversion of priority junction at Wroxham Road/Green Lane West, Rackheath, to roundabout		YES 2016&2031	NDR related
13	Removal of traffic from between Norwich Bus Station and St Stephens Street		YES 2016&2031	
14	Removal of non-bus, taxi or cycle through traffic from Rampant Horse Street, Red Lion Street and St Stephens		YES 2016&2031	
14a	Removal of non-bus, taxi or cycle through traffic from Prince of Wales Road (except eastern section)		YES 2031 only	
15	Postwick P&R car park expansions		YES 2016&2031	
16	Northern Distributor Road (NDR)		YES 2016&2031	

	Input	Uncertainty	Included in the model	Comment
17	Removal of some non-bus, taxi or cycle through traffic from Tombland		No	
18	Removal of through traffic from Exchange Street, Little Bethel Street, Thorn Lane and Westlegate		YES 2016&2031	
19	Railway service enhancements		YES 2016 & 2031	
20	Closure of Church Street, Horsford and Broad Lane, Great and Little Plumstead		YES 2016&2031	NDR related
21	Prohibition of right turn from St Faiths Road to Fifers Lane, Old Catton		YES 2016&2031	NDR related
21a	A47 junction with A1042, Postwick (including NDR)		YES 2016&2031	NDR related
22	Various traffic management schemes in villages north of NDR		YES 2016&2031	NDR related
23	Various SMART schemes improving public transport eg through ticketing, pre-boarding purchase		No	Assessment to be conducted outside of the model
24	Newmarket Road inbound on Cringleford Bypass		YES 2016&2031	Part of BRT 3
25	Newmarket Rd changes at Eaton Rd/Leopold Rd		YES 2016&2031	Part of BRT 3
26	Longwater Interchange A47/A1074		No	
27	Salhouse Road inbound bus lane on approach to Outer Ring Road		YES 2016&2031	Part of BRT 1
28	Unthank Road / Colman Road - Traffic Light Priority		YES 2016&2031	
29	Norwich Growth Point - Western Quadrant - Expressway Style Public Transport Corridor Improvements (funding from Norwich Growth Point)		No	
30	Magdalen road/St Clements hill-Pedestrian Facilities		YES 2016&2031	No change to the coding
31	Salhouse Road - Wroxham Road Link Road (To the east of Blue Boar Lane and TESCO)		YES 2031 only	
32	Wilberforce Road/Earlham Rd Speed cushions 20 mph		YES 2016&2031	
33	Closure of Orchard Street		No	Orchard Street has not been modelled as a through route and the links can stay as they are
34	Hellesdon Road 20mph		YES 2016&2031	
35	Heartsease ORR 20mph		YES 2016&2031	
36	Mount Pleasant Area 20mph		YES 2016&2031	
37	White Woman Lane and Barkers Lane Traffic Calming measures to reduce speed and reduce rat running		YES 2016&2031	NDR related
38	Unthank Road 20 mph		YES 2016&2031	

	Input	Uncertainty	Included in the model	Comment
39	The Avenues 20mph		YES 2016&2031	
40	Pedestrianise Exchange Street which would create a St Giles/Bethel Street one way loop; Enhanced version would have two way on Cleveland Road and a new junction arrangement at Cleveland Road/Chapelfield North		YES 2016&2031	
41	Bus only on St Stephens Street		YES 2016&2031	Same as 13
42	Bus only on Theatre Street and Chapelfield North (will significantly reduce traffic on Westlegate)		No	
43	Golden Ball Street and Farmers Avenue two way and closure/pedestrianisation of Westlegate and bus only on Red Lion Street		YES 2016&2031	
44	Bus only on All Saints Green		YES 2016&2031	
45	Remainder to be in by 2026: Bus only on Prince of Wales Road and Agricultural Hall Plain; Limited general traffic movements across Agricultural Hall Plain; Two way general traffic on Rose lane		YES 2031 Only	Same as 14a
46	Westbound bus lane on Chapelfield Rd		YES 2016&2031	
47	Felthorpe - 20mph on The Street, New double mini roundabouts for Mill Lane/ The street		No	
48	20mph zone with traffic calming to all roads in Thorpe Marriott		YES 2016&2031	
49	20mph zone with traffic calming Middleton's Lane		YES 2016&2031	
50	Yarmouth Road Widening		YES 2016&2031	
51	BRT network along 6 radial routes (3 routes in 2016 and 3 additional routes in 2031)		YES 2016 & 2031	

Appendix F. Background Reports

This section provides a brief overview of the development of NATS and specifically the NNDR. In doing so it provides a list and summary of key documents that have been produced to evidence the current position since the latest review of the NATS in 2002.

Norwich Area Transportation Strategy (NATS) review: Transport Related Problems and Issues (April 2003)

This report summarises:
- The characteristics of the Norwich Area;
- Existing and predicted future travel patterns; and
- Transport problems and issues in the Norwich area.

The work was compiled by Norfolk County Council in partnership with Norwich City Council, Broadland District Council and South Norfolk District Council. Extensive use has been made of previous consultations carried out in the Norwich Area.

Norwich Area Transportation Strategy: Public Consultation Analysis (May 2004)

Norwich Area Transportation Strategy: Public Consultation Analysis (June 2004) Supplement

A wide-scale consultation on the preferred strategy, including the NNDR, was undertaken in 2003. A subsequent report was submitted to cabinet setting out results of the consultation on the NATS review and recommending the major elements, including the NNDR, to be included in a revised strategy.

Norwich Area Transportation Strategy: Options Assessment Report (October 2004)

This report was commissioned to assess options for updating NATS and its revised aims and objectives. Six strategy options were assessed:
- NNDR and complementary transport measures
- Half length NNDR and complementary measures
- Three quarter length NNDR 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.

Norwich Northern Distributor Road Traffic and Economic Assessment Report (February 2005)

This report provided the necessary traffic and economic assessment information required at Stage 2 of scheme assessment, which identifies the factors to be taken into account in choosing alternative routes.

NNDR Report to Cabinet – Appendix 03: Statement on Justification of Need (September 2005)
- Significant traffic growth outside the city centre will mean minor changes to highway changes will not cope with level of growth
- The NNDR contributes to national, regional and local policies
- Environmental, economic and accessibility benefits of the scheme are detailed.

Major Scheme Business Case: Norwich Northern Distributor Road (July 2008)

Programme Entry application to Department for Transport.

Postwick Community Infrastructure Fund: Full Business Case (October 2008)

Business case application to the Department of Transport and Communities and Local Government for funding for the Postwick junction improvements

Joint Core Strategy Topic Paper: Transport (November 2009)

Collation of issues relating to transportation that have influenced the development of the Joint Core strategy for Broadland, Norwich and South Norfolk.

Norwich Northern Distributor Road Major Schemes Business Case: Sensitivity Tests for DfT – Core Scenario (December 2009)

Core Scenario Main Document Volume 1 - Rev 01.pdf

Core Scenario Appendices Volume 2 - Rev 01.pdf

Dependent Development Volume 1 - Main Document Rev 01.pdf

Appendices - Volume 2 Rev 01.pdf

Appendices - Volume 3 Rev 01.pdf

Appendices - Volume 4 Rev 01.pdf

Appendices - Volume 5 Rev 01.pdf

Appendices - Volume 6 Rev 01.pdf

Part NNDR Main Report Volume 1 - Rev 01.pdf

Part NNDR Appendices Volume 2 - Rev 01.pdf

Tests 2-6 Main Report Volume 1 - Rev 01.pdf

Tests 2-6 Appendices Volume 2 - Rev 01.pdf

Tests 2-6 Appendices Volume 3 - Rev 01.pdf

Tests 2-6 Appendices Volume 4 - Rev 01.pdf

Tests 2-6 Appendices Volume 5 - Rev 01.pdf

Tests 2-6 Appendices Volume 6 - Rev 01.pdf

Further to Norfolk County Council's submission of the Major Scheme Business Case for the Norwich Northern Distributor Road, the DfT requested that a range of sensitivity test be carried out in order to better understand uncertainties associated with the previous analysis.