

REPORT N° 001 REVC

WAVENEY LOCAL PLAN

SUFFOLK COUNTY TRANSPORT MODEL (SCTM)
FORECAST MODEL REPORT

PUBLIC

JULY 2017

WAVENEY LOCAL PLAN

FORECAST HIGHWAY MODELLING REPORT

Suffolk County Council

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GLOSSARY

- **Adjusted Planning Data** – TEMPro (see below) allows for the use of alternative assumptions which are different to the standard set of assumptions. This allows for specific allocated developments to be discounted from the assumptions or to adjust the overall assumptions to tie in with alternative data sources.
- **AM Peak** – the morning peak hour (08:00 – 09:00)
- **Assignment** – A Traffic Assignment Model, in this case SATURN, has been used. An assignment model requires two general inputs – a “trip matrix” and a “network” (thought of as the “demand” and “supply” inputs – provided by the user). These are input into a “route choice” model which allocates or assigns trips to “routes” through the network, as a result total flows along links in the network may be summed and the corresponding network “costs” (e.g. times) calculated.
- **Committed Development** – All land with current planning permission or allocated for development in adopted development plans (particularly residential development) (Planning Portal Glossary).
- **Local Plan** - A Local Plan is a set of documents that determine how development will be planned over time.
- **LPA** – Local Planning Authority
- **Matrix** – see Trip Matrix
- **Network** – specifies the physical structure of the roads, etc upon which trips take place and the parameters within it. In this report, parameters is being used as a generic descriptor of all of the pieces of information / options that go into the Saturn network, it is not a specific modelling term.
- **NTEM** – National Trip End Model, Latest version 7.2. The National Trip End Model produces estimates of person travel by all modes based on 2011 Census boundaries. The model outputs trip productions (e.g. homes) and trip attractions (e.g. sites of employment) in each zone (collectively known as trip-ends), which may be separated by mode, journey purpose, household car ownership category and time period.
- **NTM** – National Transport Model provides a means of comparing the consequences of national transport policies or widely-applied local transport policies, against a range of background scenarios which take into account the major factors affecting future patterns of travel. The model produces future forecasts of road traffic growth, vehicle tailpipe emissions, congestion and journey time (Department for Transport website).
- **PCU** – Passenger Car Unit, is a method used in Transport Modelling to allow for the different vehicle types within a traffic flow group to be assessed in a consistent manner. Measured to be 5.75 m. Factors used in the SCTM are 1 for a car or light goods vehicle and 2.3 for heavy goods vehicle.
- **Permitted Development** - Permission to carry out certain limited forms of development without the need to make an application to a local planning authority, as granted under the terms of the Town and Country Planning (General Permitted Development) Order (Planning Portal Glossary).
- **Person Trip Rate** – The number of people making a given trip as opposed to the number of vehicles making a trip.
- **PM Peak** – Afternoon Peak (17:00 – 18:00)

- **SATURN** – Simulation and Assignment of Traffic to Urban Road Networks is a suite of network analysis programs used to assess the impact of road-investment schemes. Current version 11.3.12U. See also assignment. Further information can be found here: <https://saturnsoftware.co.uk/>
- **SCC** – Suffolk County Council
- **SCTM** – Suffolk County Transport Model
- **TEMPro** - TEMPro is the Trip End Model Presentation Program. The National Trip End Model (NTEM) forecasts and the TEMPro software are used for transport planning purposes. The forecast includes: population, employment, households by car ownership, trip ends, and simple traffic growth factors based on data from the National Transport Model. The current version, and the version used for this work, is NTEM 7.2. Further information can be found at: <https://www.gov.uk/government/collections/tempo>
- **Trip Matrix** – the “Trip Matrix” T_{ij} specifies the number of trips from zone i to zone j
- **V/C Ratio** – Volume / Capacity Ratio. The assigned model flow is the volume of traffic in PCUs per hour, with the V/C percentage calculated as the volume relative to the capacity in percentage terms.
- **WDC** – Waveney District Council
- **WebTAG** – Web Transport Appraisal Guidance. Documentation produced by the Department for Transport (DfT) to assist in transport appraisal and modelling to ensure consistency and robustness.
- **Windfall Sites** – sites for housing that have yet to be identified, accounted for through background growth.
- **Zone Loading Point** – the origins and destinations of trips within a network

A further glossary of planning terms can be found here:
<https://www.planningportal.co.uk/directory/4/glossary>

2 EXECUTIVE SUMMARY

2.1 REPORT PURPOSE

- 2.1.1 WSP | Parsons Brinckerhoff have been commissioned to undertake an assessment of the emerging Waveney Local Plan for a forecast year of 2036.
- 2.1.2 The purpose of this report is to assess the impact upon the highway network of the development planned within the Local Plan and to identify junctions that are likely to experience congestion in the future. The assessment has therefore focused upon network performance statistics and individual junction capacity assessments.
- 2.1.3 Network performance statistics give an indication of the overall network stress between different models, and can provide an understanding of how the network is performing relative to the traffic demand. The 2036 forecast models have been compared to the 2016 base year in order to assess the impact on network performance in 2036.
- 2.1.4 For the purpose of the assessment of individual junctions within this report, the volume to capacity (V/C) percentage is used. V/C percentages above 100% show a junction / approach / turn which experiences a traffic flow beyond its capacity. These locations show the greatest network stress and suggest delays are likely. At these locations the network may cease to function efficiently and blocking back from queuing may occur, constraining the capacity and causing congestion on adjacent links and junctions. Locations at which the V/C percentage is between 90-99% are also considered likely to experience congestion and are highlighted within the analysis. Table 2-1 outlines the V/C percentage bands which are considered within this report and how junctions have been categorised into Significant and Potentially Significant impacts.

Table 2-1 V/C percentage bands

DESCRIPTION	V/C PERCENTAGE BAND
Significant	100% +
Potentially Significant	90 – 99%

WHAT HAS BEEN DONE

- 2.1.5 The Suffolk County Transport Model (SCTM) includes a strategic highway model built in SATURN which has been calibrated and validated to reflect traffic conditions for a base year of 2016. Traffic forecasts have been generated from this base year model to reflect a forecast year of 2036.
- 2.1.6 The forecast modelling contained within this report represents the cumulative impact of proposed developments coming forward up to 2036. Waveney Borough Council has a target of delivering 8,920/8,900 houses and 4,850 jobs between 2016 and 2036.
- 2.1.7 A “Reference Case” 2036 forecast has been created based on growth within TEMPro only. Scenarios 1-4 have been devised by Waveney District Council to test different distributions of development within Waveney. Scenarios 1, 3 and 4 are broadly similar in that they concentrate most of the housing in the north of Lowestoft, though Scenario 3 includes an additional 400 dwellings in the south of Lowestoft. Scenario 2 tests locating the majority of housing in the south of Lowestoft with an associated link road between the A146 and A12. Scenario 4 also shows variation in terms of the distribution of housing in Beccles, concentrating it to the west of London Road, whereas the other scenarios have it located south of the existing town relying partially on the Beccles Southern Relief Road.

- 2.1.8 A core element of the demand forecasting assumptions is the use of TEMPro which assumes there will be background growth in jobs and housing. This assessment however adjusts these background assumptions on the basis of the development details received from WDC to ensure consistency with the Local Plan proposals.

WHAT THE RESULTS SHOW

- 2.1.9 This growth in traffic is a result of changing patterns of travel behaviour and predicted future growth in housing and jobs across Suffolk. The transport modelling factors in an element of growth when predicting future traffic impacts and has been adapted for the purposes of this assessment to consider the specific growth locations identified in the Waveney Local Plan. The results cannot therefore be interpreted as simply as 'Local Plan vs no Local Plan', i.e. it could not reasonably be assumed that if there were no Local Plan traffic patterns would be the same in 2036 as they were in 2016.
- 2.1.10 The growth assumptions include for all of the specifically considered development within the Local Plan, but also growth generated through population growth, car ownership and relative vehicle operating costs through the use of the Department for Transport TEMPro software.
- 2.1.11 This analysis has demonstrated that there has been a substantial increase in over capacity queues, total travel time, and total travel distance in 2036. The increase in travel time and distance can largely be attributed to the increase in number of trips. This can be seen by the relatively small reduction in average speed and small additional travel time per vehicle. This is a situation experienced by most other towns and cities across the country given the need to deliver jobs and houses.
- 2.1.12 Numerous locations across the network are shown to have capacity issues, measured using the volume to capacity (V/C) percentage which compares the capacity of the network to the assigned traffic flow. V/C percentage figures above 100% are considered to represent significant levels of congestion, whilst V/C values between 90-99% are considered potentially significant. The analysis in this report splits the junction into the following categories shown in Table 2-2 to better prioritise the junctions showing the greatest stress:

Table 2-2 Volume to capacity ratio categorisation

TYPE	DESCRIPTION
1	100%+ both peaks
2	100%+ in one peak / 90-99% in other peak
3	100%+ in one peak / Less than 90% in other peak
4	90-99% in both peaks
5	90-99% in one peak / Less than 90% in the other peak

- 2.1.13 Analysis has been carried out for all of the major journey time routes within Waveney which the SCTM has been calibrated and validated against. The journey time route travel times are shown to be broadly consistent, except for instances described above where the specifically modelled developments have created additional delay. Routes which are affected by these additional delays include the A12 south of Lowestoft, A12 within Lowestoft, A1117 within Lowestoft and the A146 Beccles Road.

WHAT DOES THIS MEAN

- 2.1.14 The analysis has shown that while many junctions may be close to or exceed capacity in 2036; however, there are also many parts of the network that will operate satisfactorily.

- 2.1.15** Further, the development proposals assessed within the model would as part of their planning applications need to consider additional measures to help mitigate any impact. The analysis within this report has not identified any locations where it is unlikely such mitigation could not be delivered.
- 2.1.16** It is also necessary to remember that improvements in capacity through the removal of bottlenecks whilst desirable in location can have knock on impacts which would be less desirable than the existing congestion. For example, as traffic is more freely able to move into the network, the problem will simply move to another location. Equally, hard engineering and infrastructure solutions are not the only solutions available. Other solutions involve the optimisation of existing infrastructure and an emphasis on sustainable transport, through for example personal travel planning. Over the lifetime of the plan it is reasonable to assume that policies on sustainable transport will help to mitigate some of the increase in stress, and technological changes, such as those associated with Connected and Autonomous Vehicles, have the potential to independently improve traffic flow and conditions.

WHAT IS BEING DONE TO ADDRESS THIS

- 2.1.17** A mitigation scenario has not been considered at this point of assessment. This is because the modelling detailed in the report has been used to determine whether there the level of housing and job growth leads to congestion within Waveney.
- 2.1.18** There are already committed highway infrastructure schemes within Waveney, these have been assumed to be in place in the forecast modelling and include:
- Lake Lothing Third Crossing – a new bridge across Lake Lothing in Lowestoft to reduce congestion on the A14 Orwell Bridge.
 - Beccles Southern Relief Road
 - Denmark Road improvements

WHAT NEEDS TO HAPPEN NEXT

- 2.1.19** Given the coverage of the SCTM it allows tests to be carried out for neighbouring local authorities within Suffolk. Due to the countywide study area it will enable joint planning with neighbouring authorities.
- 2.1.20** It is therefore recommended that this assessment is updated once detailed information has been provided by neighbouring local authorities if the combined impacts of the various local plans need to be considered. Further work may need to be carried out to confirm the extent of any mitigation which may need to be required following the issues highlighted in this report. The impact of specific local plan development sites could also be assessed within the model to identify those areas of mitigation that will be required by developers to mitigate their site impacts.
- 2.1.21** It is recommended that the junctions that have been identified as having the most significant impact are considered in further detail through isolated junction modelling to demonstrate the detailed impact and confirm that appropriate mitigation can be provided where required.

3 INTRODUCTION

3.1 BACKGROUND

- 3.1.1 WSP | Parson Brinckerhoff have been commissioned to undertake an assessment of the impact of the Waveney Local Plan on the highway network for a forecast year of 2036. Waveney District Council (WDC) have provided WSP | Parsons Brinckerhoff with information on different scenarios which have been considered as part of the emerging Waveney Local Plan. These scenarios generally contain consistent assumptions on the level of housing and job growth which will occur across Waveney between 2016 and 2036; however they contain differences in terms of the distribution of the specific developments which will account for this growth.

3.2 TRANSPORT MODEL

- 3.2.1 The Suffolk County Transport Model (SCTM) has been developed by WSP | Parsons Brinckerhoff following support on the Outline Business Case for the Upper Orwell Crossing in Ipswich, and Lake Lothing Third Crossing in Lowestoft.
- 3.2.2 The SCTM comprises a highway assignment model built in SATURN, as well as a public transport and demand model based in VISUM.
- 3.2.3 The SCTM represents a substantial improvement to previous transport modelling tools within Suffolk and allows for a greater range of behavioural responses to be tested than at present. The SCTM will provide a robust evidence base for a range of potential transport schemes and policies. These include:
- Highway scheme appraisal
 - Major public transport scheme appraisal
 - Inputs for transport business cases and funding applications
 - Inputs for environmental appraisals
 - Local plan / core strategy assessment
 - Development impact assessment.
- 3.2.4 The SCTM has been developed to an extent that it is able to serve as a high-level strategic assessment tool for all such applications. However, no strategic model is capable of representing a whole county in fine detail, so the level of detail required for each application is reviewed prior to testing. It may be necessary to enhance a particular local area for a specific testing purpose.
- 3.2.5 A review of the model within Waveney District identified the need for additional network detail and zone disaggregation which has been undertaken as part of this study.
- ## 3.3 MODEL SCENARIOS
- 3.3.1 Updates to the 2016 base year model have been undertaken as part of the modelling detailed in this report including additional road network detail, zoning and traffic survey data to ensure the updated model provides a robust basis for the testing of the Local Plan.
- 3.3.2 It is assumed that the following schemes will be in place by 2036 and have therefore been included within all forecast model scenarios:
- Lake Lothing Third Crossing

- Beccles Southern Relief Road
- Denmark Road improvements, Lowestoft

3.3.3 The forecast modelling contained within this report represents the cumulative impact of proposed developments coming forward up to 2036, from a base year of 2016.

3.3.4 The following details were provided by Waveney District Council (WDC):

- Details of proposed residential and commercial developments (proposed for allocation through the Local Plan)
- Details of committed residential and commercial developments (those with extant planning permission)

3.3.5 The forecast modelling detailed in this report represents the AM peak hour (0800-0900) and PM peak hour (1700-1800) in 2036 for the following scenarios:

- Reference Case: no specifically modelled developments, only TEMPRO growth applied
- Scenario 1
- Scenario 2
- Scenario 3
- Scenario 4

3.3.6 Appendix A contains details of the housing and job number assumed for developments within each scenario.

3.3.7 Scenario 2 includes a link road between the A146 Beccles Road and A12 London Road. WDC deem this is required if the South Lowestoft development comes forward. This link has been coded as a 30mph link with a roundabout close to the west of the Rookery Park Golf Course. The eastern end of the link road joins the western arm of the A12 London Road / Tower Road roundabout.

4 INFORMATION / DATA PROVIDED TO WSP | PARSONS BRINKERHOFF

4.1 INTRODUCTION

4.1.1 This section sets out all of the information that has been provided to WSP | Parsons Brinckerhoff to undertake the assessment of the Local Plan proposals and the methodology for use of the data in the transport modelling. This includes information on residential and commercial developments received from WDC and the other districts, as well as national data sources on planning assumptions. It is therefore consistent with the assumptions used by WDC in the Local Plan.

4.2 STUDY AREA

4.2.1 The main study area focused on in this report is compared to the base year SCTM highway network in Figure 4.1 below.

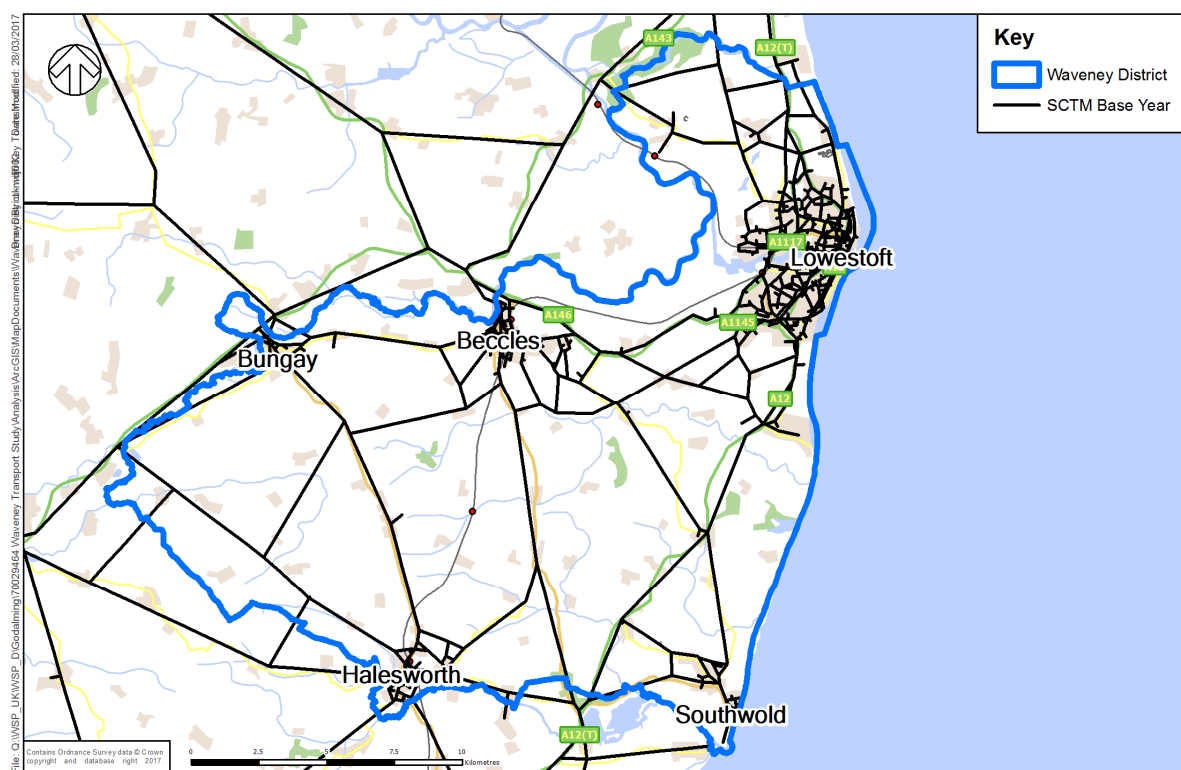


Figure 4.1 Waveney District boundary

4.3 WAVENEY LOCAL PLAN

- 4.3.1 The emerging Waveney Local Plan identifies a need for an increase of 8920-8900 dwellings over the period 2016 – 2036.
- 4.3.2 The emerging Local Plan contains a policy to encourage the provision of approximately 4,850 jobs between 2016 and 2036.

4.4 PROPOSED DEVELOPMENTS

- 4.4.1 The assessment of the proposed development has been split into two distinct sections:
- Specifically assessed development, for sites where development location and size (numbers of houses or jobs) are known or can be calculated
 - Background traffic growth, for development which is planned, but the details or locations is not yet known (e.g. windfall sites).
- 4.4.2 Each is considered in detail in the following sections.

4.5 SPECIFICALLY ASSESSED DEVELOPMENT

- 4.5.1 WDC provided information on specific housing developments across Waveney District. These included proposed developments for a period between 2016 and 2036 including developments under construction, sites with planning permission or a planning application pending, and sites which were proposed allocations or allocations but for which no planning application had been submitted.
- 4.5.2 The specifically assessed development totals based upon these sources / calculations are shown in Table 4-1. Details of all housing and employment sites are provided in Appendix A.

Table 4-1 Total dwellings by scenario – 2016 to 2036

SETTLEMENT	SCENARIO 1	SCENARIO 2	SCENARIO 3	SCENARIO 4
North Lowestoft	1700	600	1300	1700
South Lowestoft	400	1500	800	400
Beccles	1400	1400	1400	1380
Bungay	350	350	350	350
Halesworth	610	610	610	610
Southwold & Reydon	250	250	250	250
Rural Areas	670	670	670	670
Total housing - Scenario developments	5380	5380	5380	5360
Total housing – All Scenarios	3540	3540	3540	3540
Overall housing totals	8920	8920	8920	8900

- 4.5.3 Figure 4.2 to Figure 4.5 shows the dispersal of developments which are included in each modelled scenario.

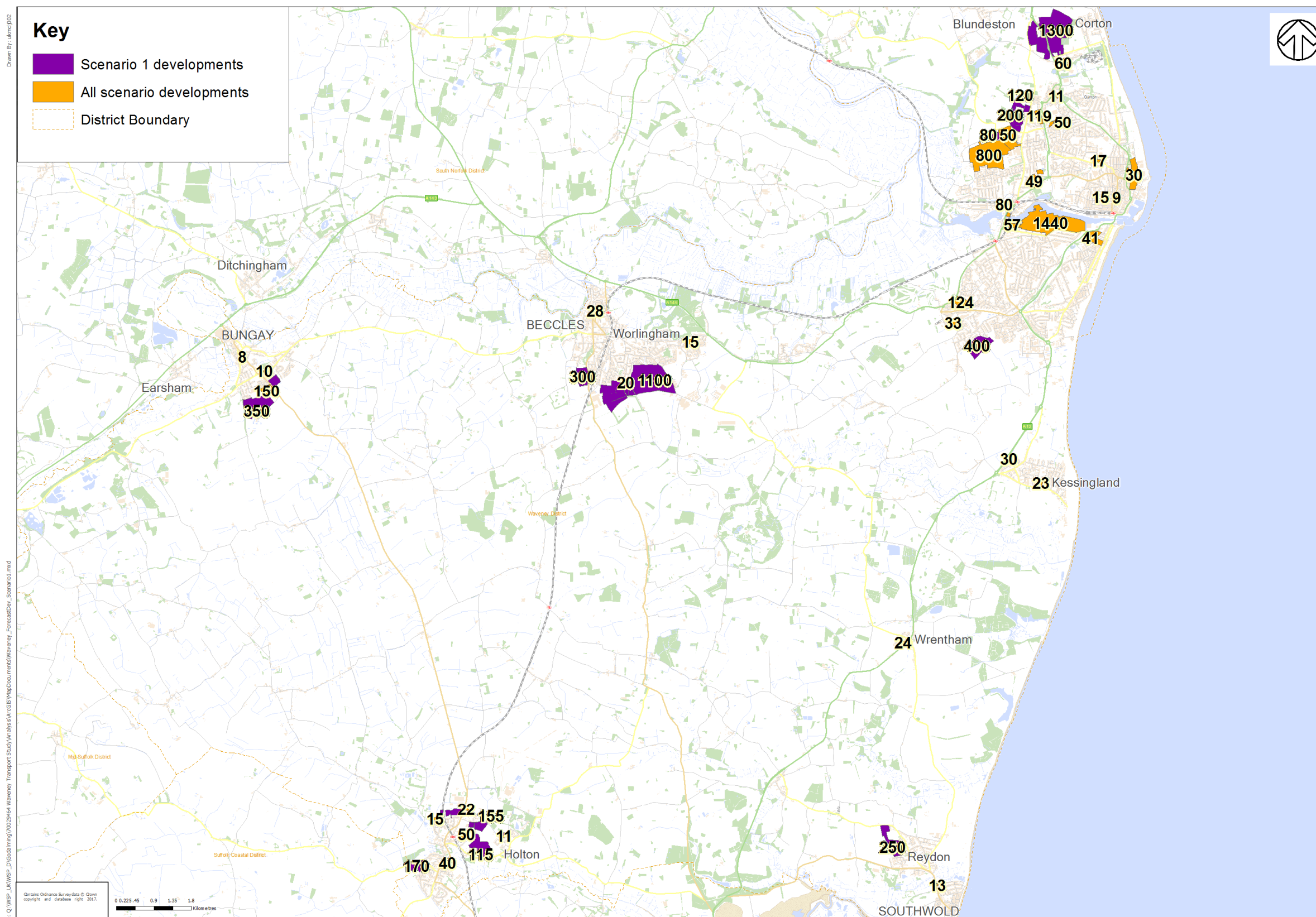


Figure 4.2 Scenario 1 developments

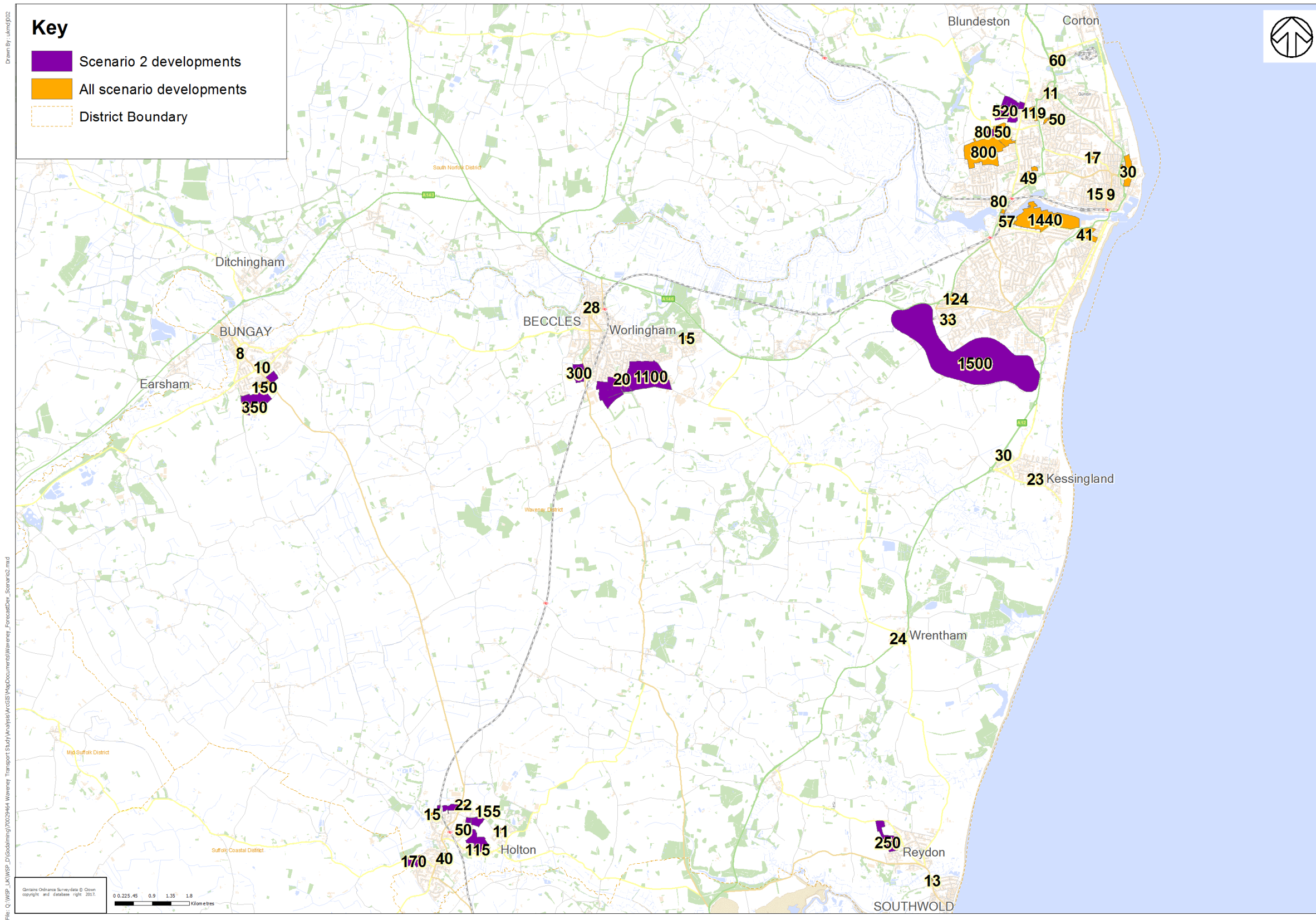


Figure 4.3 Scenario 2 developments

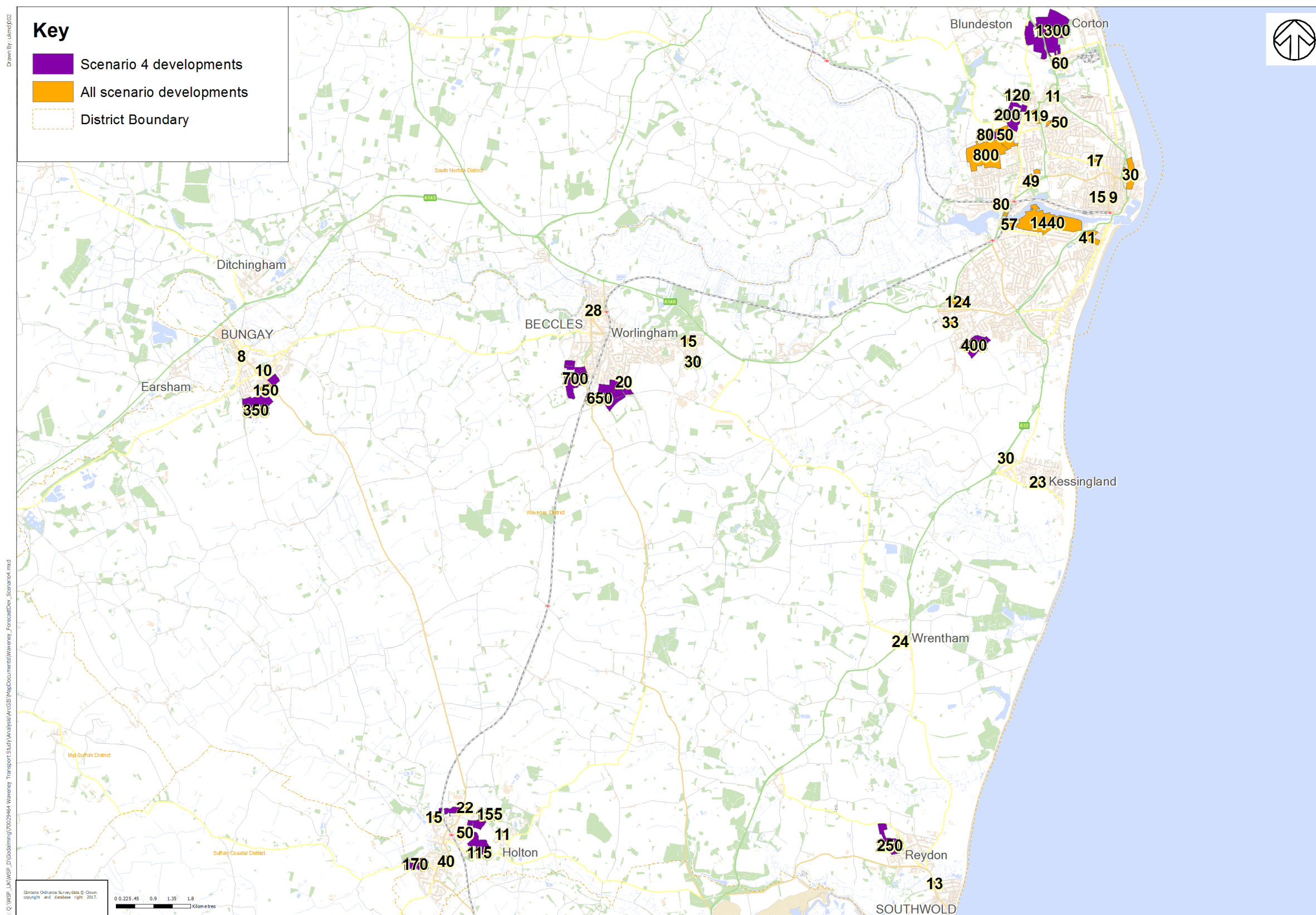


Figure 4.5 Scenario 4 developments

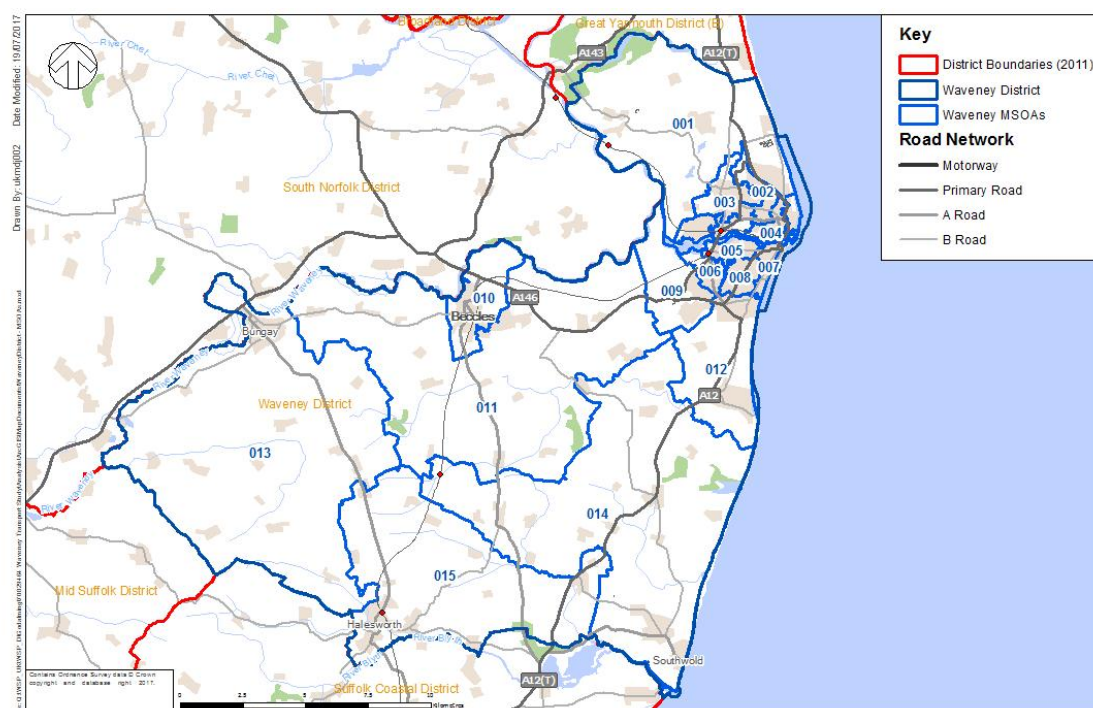
- 4.5.4 WDC advised the only specifically modelled commercial development should be in Sites 165/166 in North Lowestoft in scenarios 1, 3 and 4. In Scenario 2 the employment was located in the South Lowestoft development area. Table 4-2 shows the commercial development land uses which have been assumed by scenario.

Table 4-2 Total commercial development by scenario – 2016 to 2036

SCENARIOS	COMMERCIAL DEVELOPMENT
Scenarios 1 / 3 / 4	10ha B2 employment; 420m2 community facilities; 315 pupil primary school
Scenario 2	10ha B2 employment

4.6 BACKGROUND TRAFFIC GROWTH

- 4.6.1 The 2016 – 2036 Local Plan contains policies which seek to deliver 8920 dwellings and 4850 jobs over this period. The developments specifically allowed for in Table 4-1 account for a considerable number of these dwellings and jobs but not all of them. It is therefore necessary to apply background growth to account for the difference to ensure the total impacts of the plan proposals are assessed. The model has a base year of 2016 so adjustments were necessary to account for the housing and job development between 2016 and 2036.
- 4.6.2 TEMPRO Version 7.2 has been used to derive the background growth in car traffic. This version provides a significant upgrade to the previous version of TEMPRO including significant increases to the detail of the zones boundaries which are now based on 2011 Census Middle Super Output Areas (MSOAs).
- 4.6.3 Figure 4.6 details the MSOA boundaries within Waveney District.



4.6.4

Table 4-3 provides a comparison of the household and job growth between 2016 and 2036 advised within TEMPRO 7.2 and information provided by WDC used within the scenario modelling within this report. The growth in housing and jobs is generally shown to be higher than the increases shown in TEMPRO.

Table 4-3 Comparison of TEMPRO and WDC data household & job growth – 2016 to 2036

SOURCE	HOUSEHOLD GROWTH (2016 TO 2036)	JOB GROWTH (2016 TO 2036)
TEMPRO 7.2	8,569	3,836
Waveney District Council	8,920 / 8,900	4,850
Difference	351 / 331	1014

4.6.5

670 houses were designated as being in rural areas. Waveney District Council provided details of which 2011 Census MSOA this housing would fall within. Table 4-4 shows the split of the 670 houses by MSOA.

Table 4-4 Rural housing designated to 2011 Census MSOAs within Waveney

AREA	TOTAL HOUSING
Waveney 001	217
Waveney 011	166
Waveney 012	10
Waveney 013	34
Waveney 014	164
Waveney 015	80
Total	670

4.6.6

Table 4-5 details a comparison between the assumed growth in households between 2016 and 2036 assumed within 2011 Census MSOAs in TEMPRO 7.2 compared to the household numbers included in each scenario.

Table 4-5 Distribution of household growth within 2011 Census MSOAs within Waveney

AREA	TEMPRO 7.2 DISTRIBUTION	SCENARIO 1 DISTRIBUTION	SCENARIO 2 DISTRIBUTION	SCENARIO 3 DISTRIBUTION	SCENARIO 4 DISTRIBUTION
Waveney 001	494	1,592	292	1,592	1,592
Waveney 002	544	147	147	147	147
Waveney 003	563	1,355	1,555	955	1,355
Waveney 004	697	9	9	9	9
Waveney 005	547	1,651	1,651	1,651	1,651
Waveney 006	541	0	0	0	0
Waveney 007	599	79	79	79	79
Waveney 008	510	0	0	0	0
Waveney 009	560	557	907	957	557
Waveney 010	654	328	328	328	728
Waveney 011	621	1,301	1,301	1,301	881
Waveney 012	771	63	813	63	63
Waveney 013	505	560	560	560	560
Waveney 014	448	451	451	451	451
Waveney 015	515	828	828	828	828
Total	8,569	8,920	8,920	8,920	8,900

4.6.7

Figure 4.7 shows the distribution of household growth between 2016 and 2036 within NTEM 7.2 for MSOAs within Waveney District.

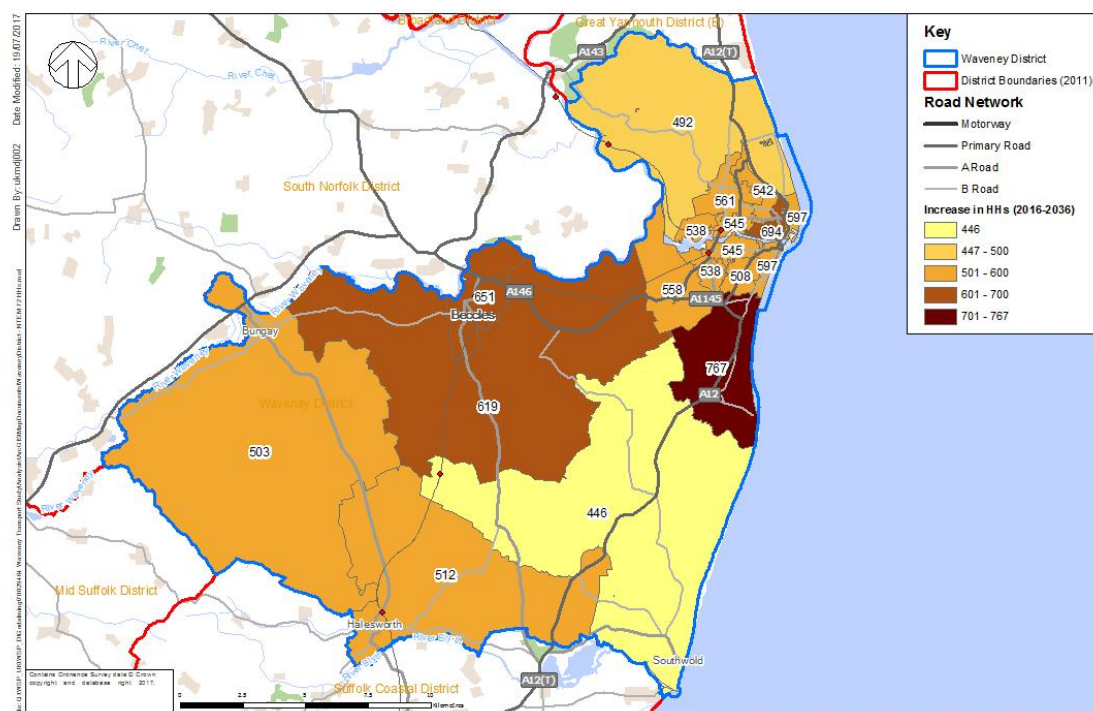


Figure 4.7 NTEM 7.2 Household Growth in Waveney (2016 to 2036)

4.6.8

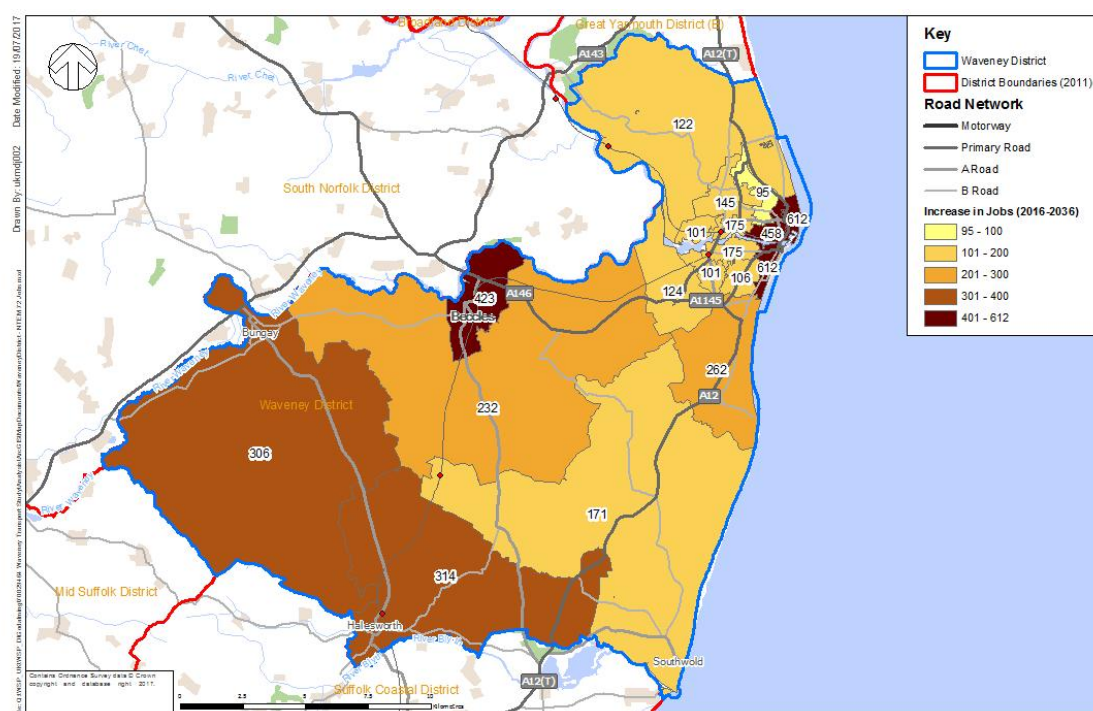
WDC advised 1,050 jobs should be allocated to North Lowestoft development in Scenarios 1, 3, and 4. In Scenario 2, this quantum of jobs was allocated to the South Lowestoft development. This meant from the overall target of 4,850 jobs within the Local Plan, a remainder of 3,800 jobs needed to be distributed. WDC do not yet have details of specific sites which would make up this job allocation, therefore the distribution of job growth between 2016 and 2036 within TEMPRO for Waveney was utilised. Within TEMPRO, the default planning assumptions assume there will be growth in jobs of 3,836 between 2016 and 2036, therefore the unallocated 3,800 jobs created a distribution which was very similar, shown in Table 4-6.

Table 4-6 Distribution of job growth within 2011 Census MSOAs within Waveney

AREA	TEMPO 7.2 DISTRIBUTION	ADJUSTED DISTRIBUTION
Waveney 001	215	213
Waveney 002	129	128
Waveney 003	128	127
Waveney 004	445	441
Waveney 005	233	231
Waveney 006	98	97
Waveney 007	634	628
Waveney 008	101	100
Waveney 009	117	116
Waveney 010	406	402
Waveney 011	218	216
Waveney 012	332	329
Waveney 013	284	281
Waveney 014	198	196
Waveney 015	298	295
Total	3,836	3,800

4.6.9

Figure 4.8 details the variation in job growth between 2016 and 2036 in NTEM 7.2 for MSOAs within Waveney District

**Figure 4.8 NTEM 7.2 Job Growth in Waveney (2016 to 2036)**

- 4.6.10 The specifically assessed development advised by Waveney District Council has then been subtracted from the 2036 planning data totals within TEMPRO via the alternative planning assumptions tool. Table 4-7 shows the growth in housing and job growth between 2016 and 2036 which has been applied.

Table 4-7 Adjusted growth in housing & jobs within Waveney between 2016 & 2036

AREA	2016	2036	DIFFERENCE
Households	53,069	53,739	670
Jobs	49,834	53,634	3800

- 4.6.11 The above adjustments to the planning data were used to generate revised background growth factors for car traffic within Waveney. The adjusted TEMPRO growth factors are detailed in Section 5.

5 METHODOLOGY

5.1 INTRODUCTION

5.1.1 This section sets out the methodology used and assumptions made in the assessment of the various forecast model scenarios.

5.2 SPECIFICALLY ASSESSED DEVELOPMENT TRIPS

5.2.1 For the specifically modelled developments within Waveney, trip rates were generated using TRICS version 7.3.4. Residential trip rates were based on an assumption of 65% of dwellings being privately owned housing, 35% being local affordable housing. Table 5-1 details the TRICS trip rates which were applied to each of the land uses for the specifically assessed developments.

Table 5-1 TRICS trip rates

LAND USE TYPE	UNIT	AM ARRIVALS	AM DEPARTURES	PM ARRIVALS	PM DEPARTURES
Residential	per dwelling	0.1431	0.3444	0.30605	0.19395
B2 Employment	per job	0.17	0.041	0.021	0.136
Community Centre	per 100sqm	0.934	0.417	0.442	0.657
Primary School	per pupil	0.291	0.216	0.03	0.045

5.2.2 Appendix B provides details of the trip generation for each development included in the scenarios.

5.3 TEMPRO GROWTH FACTORS

5.3.1 TEMPRO growth factors were applied at a district level within Suffolk for model zones outside of Waveney. For external zones outside of Suffolk, a growth rate was based on the East of England (excluding Suffolk). The growth factors were derived from the latest version of TEMPRO, version 7.2, detailed in Table 5-2.

Table 5-2 TEMPRO growth factors – 2016 to 2036

AREA	AM - ORIGIN	AM - DESTINATION	PM - ORIGIN	PM - DESTINATION
East of England	1.182	1.188	1.191	1.188
Babergh	1.036	1.163	1.139	1.059
Forest Heath	1.215	1.204	1.212	1.219
Ipswich	1.204	1.188	1.189	1.197
Mid Suffolk	1.040	1.157	1.136	1.060
St. Edmundsbury	1.179	1.195	1.195	1.184
Suffolk Coastal	1.121	1.175	1.169	1.137

5.3.2 Table 5-3 details the adjusted growth factors which were applied to 2011 Census MSOAs within TEMPRO in Waveney. Correspondence between SCTM zones and 2011 MSOAs was carried out based on the centroid of the SCTM zone. These factors represent the background growth in car traffic which was applied to SCTM zones within Waveney.

Table 5-3 Waveney adjusted TEMPRO growth factors – 2016 to 2036

AREA	AM - ORIGIN	AM - DESTINATION	PM - ORIGIN	PM - DESTINATION
Waveney 001	1.045	1.180	1.157	1.069
Waveney 002	1.021	1.146	1.101	1.015
Waveney 003	0.990	1.147	1.088	0.996
Waveney 004	1.061	1.179	1.152	1.079
Waveney 005	1.011	1.160	1.119	1.023
Waveney 006	0.956	1.129	1.060	0.964
Waveney 007	1.100	1.185	1.166	1.115

AREA	AM - ORIGIN	AM - DESTINATION	PM - ORIGIN	PM - DESTINATION
Waveney 008	1.007	1.160	1.104	1.016
Waveney 009	0.958	1.140	1.072	0.966
Waveney 010	1.049	1.178	1.149	1.060
Waveney 011	0.975	1.138	1.090	0.986
Waveney 012	1.012	1.169	1.132	1.037
Waveney 013	0.973	1.139	1.102	0.994
Waveney 014	1.063	1.174	1.159	1.090
Waveney 015	1.019	1.157	1.129	1.040

5.4 NATIONAL TRANSPORT MODEL (NTM) GROWTH FACTORS

5.4.1 Traffic growth for Light Goods Vehicles (LGVs) and Heavy Goods Vehicles (HGVs) were calculated based on the National Transport Model (NTM), following the guidance within WebTAG Unit M.4, para 7.3.18. This provides road traffic forecasts by different vehicle types. Factors were available by region, with the East of England factors derived and extrapolated to create growth factors between 2016 and 2036.

5.4.2 Table 5-4 details the LGV and HGV factors which were applied to the 2016 base year matrices to generate 2036 LGV and HGV matrices.

Table 5-4 NTM Growth Factors – 2016 to 2036

AREA	LGV FACTOR	HGV FACTOR
East of England	1.566	1.213

5.5 MATRIX DEVELOPMENT

5.5.1 Table 5-5 shows the increase in the size of the matrix from the 2016 base year to the 2036 reference case.

Table 5-5 2036 Reference Case matrix compared to 2016 Base Year matrix – AM and PM peak

MODEL RUN	BASE YEAR (AM 2016)	REFERENCE CASE (AM 2036)	INCREASE (AM 2016 To 2036)	BASE YEAR (PM 2016)	REFERENCE CASE (PM 2036)	INCREASE (PM 2016 To 2036)
Reference Case	131172	159070	21.3%	141484	170292	20.4%

5.5.2 Applying TEMPRO growth to the car user classes and NTM growth to the LGV / HGV user classes leads to an increase of 20-21% between 2016 and 2036.

5.5.3 Table 5-6 compares the matrix totals for each of the scenarios in the AM peak, compared to the 2016 base year and 2036 reference case.

Table 5-6 2036 scenario matrix total comparisons – AM peak

USER CLASS	BASE YEAR (AM 2016)	BACKGROUND GROWTH (AM 2016 To 2036)	MODELLED DEVELOPMENT TRIPS (AM 2036)	FINAL MATRIX TOTAL (AM 2036)	REFERENCE CASE (AM 2036)	DIFFERENCE Sc1 vs RC (AM 2036)
Scenario 1	131172	158183	4409	162591	159070	3522
Scenario 2	131172	158183	4243	162426	159070	3356
Scenario 3	131172	158183	4409	162591	159070	3522
Scenario 4	131172	158183	4399	162582	159070	3512

5.5.4 The background growth in the matrix remains the same; the only variation is in terms of the trips related to specifically modelled developments. Due to the use of TRICS to generate trips for the specific developments in Waveney, this leads to an increase in the size of the matrix of between around 3,350 and 3,500 trips compared to the reference case.

5.5.5 Table 5-7 compares the matrix totals for each of the scenarios in the PM peak, compared to the 2016 base year and 2036 reference case.

Table 5-7 2036 scenario matrix total comparisons – PM peak

USER CLASS	BASE YEAR (AM 2016)	BACKGROUND GROWTH (AM 2016 To 2036)	MODELLED DEVELOPMENT TRIPS (AM 2036)	FINAL MATRIX TOTAL (AM 2036)	REFERENCE CASE (AM 2036)	DIFFERENCE Sc1 vs RC (AM 2036)
Scenario 1	141484	169082	4318	173400	170292	3108
Scenario 2	141484	169082	4290	173372	170292	3080
Scenario 3	141484	169082	4318	173400	170292	3108
Scenario 4	141484	169082	4318	173400	170292	3108

5.5.6 The background growth remains unchanged between each of the scenarios; the matrices vary due to the level of trips generated by the specifically modelled developments. In the PM peak, the use of TRICS leads to an increase of around 3,100 trips compared to the reference case.

5.5.7 Tables in Appendix C-1 provide a breakdown of the increase in matrix totals by vehicle user class.

5.6 FUEL AND INCOME FACTOR ADJUSTMENTS

5.6.1 Given the Waveney Local Plan forecasting detailed in this report is a highway only assessment, guidance in WebTAG Unit M4 – Forecasting and Uncertainty (November 2014) has been followed. Paragraph 7.4.13 stipulates for highway only assessments that the car matrix should be multiplied by two factors, based on growth in income and fuel. The latest version November 2016 version of the WebTAG databook was used as the basis for the fuel and income factors

5.6.2 Table 5-8 shows the combined fuel and income factors which were applied to the car user classes. Appendix C-2 provides details of these matrix adjustments by matrix user class.

Table 5-8 Fuel and Income Factor Adjustments – 2016 to 2036

TIME PERIOD	FUEL FACTOR	INCOME FACTOR	COMBINED FACTOR
2016 to 2036	1.053	1.022	1.075

5.6.3 Fuel and income factor adjustments lead to the following final matrix totals shown in Table 5-9. The comparison below shows the overall forecast traffic growth which has been applied to the base year matrix to produce the final forecast matrices.

Table 5-9 2036 Reference Case with fuel and income factor adjustments – AM peak & PM peak

USER CLASS	REFERENCE CASE (AM 2036)	REFERENCE CASE WITH F & I ADJ (AM 2036)	INCREASE (AM 2036)	REFERENCE CASE (PM 2036)	REFERENCE CASE WITH F & I ADJ (PM 2036)	INCREASE (PM 2036)
Reference Case	131171.5	168310.9	28.3%	141483.9	180940.9	27.9%
Scenario 1	131171.5	172096.6	31.2%	141483.9	184282.2	30.2%
Scenario 2	131171.5	171918.8	31.1%	141483.9	184251.9	30.2%
Scenario 3	131171.5	172096.6	31.2%	141483.9	184282.2	30.2%
Scenario 4	131171.5	172086.1	31.2%	141483.9	184271.5	30.2%

- 5.6.4 In the reference case, the final matrices represent an increase of 28% compared to the base year. With the inclusion of trips derived from TRICS for the specifically modelled developments in the scenario modelling, the increase in the size of the matrix is 31% in the AM peak, and 30% in the PM peak.

5.7 SATURN VERSION

- 5.7.1 SATURN version 11.3.12U, the latest version available to WSP | Parsons Brinckerhoff was used for assigning the 2036 forecast matrices as described above and is consistent with the version used in the building of the SCTM.

5.8 GENERALISED COST PARAMETERS

- 5.8.1 Generalised costs have been defined by peak for a forecast year of 2036.

- 5.8.2 Generalised cost is defined in keeping with the guidance in section 2.8 of WebTAG Unit M3.1, and is as follows:

$$\text{Generalised cost} = \text{Time} + \left(\frac{\text{Vehicle operating cost}}{\text{Value of time}} \right) \text{Distance}$$

- 5.8.3 Value of time is calculated in pence per minute (PPM) and vehicle operating cost is calculated in pence per kilometre (PPK). The adopted parameters were calculated from the TAG databook published in July 2016, as this is the version used for the validation and calibration of the SCTM.

- 5.8.4 The parameters adopted are shown in Appendix D. For the HGV class, manual classified count data (2016) was used to determine the split of vehicles which could be classified as OGV1 and OGV2 by peak hour. This split was used to calculate average generalised cost parameters for HGVs.

6 RESULTS

6.1 INTRODUCTION

- 6.1.1 This section provides an assessment of the model output data in terms of network summary statistics and junction capacity assessments to assess the impact of the plan proposals on the highway network.

6.2 OVERALL NETWORK PERFORMANCE

- 6.2.1 Network performance statistics give an indication of the overall network stress between different models, and can provide an understanding of how the network is performing relative to the traffic demand. Given the scale of the area covered by the SCTM, network summary statistics should only be considered as a very general check of the overall model performance. The 2036 reference case forecast models have been compared to the 2016 base year in order to assess the impact on network performance in 2036.

- 6.2.2 Table 6-1 shows the comparison of network performance between the 2016 base year and 2036 Reference Case for the AM and PM peak.

Table 6-1 Network performance comparison – Reference Case

SUMMARY STATISTIC	UNIT	2016 AM BY	2036 AM RC	2016 PM BY	2036 PM RC
Transient Queues	PCU - Hrs	4097.7	6912.3	4369.7	7358.4
Over-capacity Queues	PCU - Hrs	573.7	2286.4	851.1	3340.7
Link Cruise Time	PCU - Hrs	30078.9	39476.7	31172.6	40452.4
Total Travel Time	PCU - Hrs	34750.3	48675.4	36393.5	51151.4
Total Travel Distance	PCU - kms	2012785.0	2526138.0	2078267.0	2577797.0
Average Speed	kph	57.9	51.9	57.1	50.4

- 6.2.3 Table 6-1 shows that in the AM and PM peak there is a substantial increase in queuing which is to be expected as increased traffic levels leads to greater congestion. Link cruise time, total travel time and total travel distance all increase in 2036 due to the substantial increase in traffic levels on the network. The average network speed decreases in 2036 due to the increased congestion, by around 10% in the AM peak, and 12% in the PM peak.

- 6.2.4 Table 6-2 to Table 6-5 provide a comparison of the overall network performance for each 2036 scenario against the 2036 Reference Case.

Table 6-2 Network performance comparison – Scenario 1

SUMMARY STATISTIC	UNIT	2036 AM RC	2036 AM	2036 PM RC	2036 PM
Transient Queues	PCU - Hrs	6912.3	7146.0	7358.4	7531.6
Over-capacity Queues	PCU - Hrs	2286.4	2404.9	3340.7	3661.2
Link Cruise Time	PCU - Hrs	39476.7	40373.3	40452.4	41066.6
Total Travel Time	PCU - Hrs	48675.4	49924.3	51151.4	52259.4
Total Travel Distance	PCU - kms	2526138.0	2574059.0	2577797.0	2611403.0
Average Speed	kph	51.9	51.6	50.4	50.0

Table 6-3 Network performance comparison – Scenario 2

SUMMARY STATISTIC	UNIT	2036 AM RC	2036 AM	2036 PM RC	2036 PM
Transient Queues	PCU - Hrs	6912.3	7132.6	7358.4	7531.6
Over-capacity Queues	PCU - Hrs	2286.4	2321.6	3340.7	3648.9
Link Cruise Time	PCU - Hrs	39476.7	40361.2	40452.4	41051.1
Total Travel Time	PCU - Hrs	48675.4	49815.5	51151.4	52231.7
Total Travel Distance	PCU - kms	2526138.0	2573384.0	2577797.0	2611108.0
Average Speed	kph	51.9	51.7	50.4	50.0

Table 6-4 Network performance comparison – Scenario 3

SUMMARY STATISTIC	UNIT	2036 AM RC	2036 AM	2036 PM RC	2036 PM
Transient Queues	PCU - Hrs	6912.3	7156.1	7358.4	7548.6
Over-capacity Queues	PCU - Hrs	2286.4	2394.7	3340.7	3682.9
Link Cruise Time	PCU - Hrs	39476.7	40357.5	40452.4	41073.0
Total Travel Time	PCU - Hrs	48675.4	49908.3	51151.4	52304.5
Total Travel Distance	PCU - kms	2526138.0	2573245.0	2577797.0	2611591.0
Average Speed	kph	51.9	51.6	50.4	49.9

Table 6-5 Network performance comparison – Scenario 4

SUMMARY STATISTIC	UNIT	2036 AM RC	2036 AM	2036 PM RC	2036 PM
Transient Queues	PCU - Hrs	6912.3	7148.4	7358.4	7546.7
Over-capacity Queues	PCU - Hrs	2286.4	2406.6	3340.7	3668.2
Link Cruise Time	PCU - Hrs	39476.7	40387.7	40452.4	41075.9
Total Travel Time	PCU - Hrs	48675.4	49942.7	51151.4	52290.8
Total Travel Distance	PCU - kms	2526138.0	2574965.0	2577797.0	2611776.0
Average Speed	kph	51.9	51.6	50.4	49.9

- 6.2.5 Table 6-2 to Table 6-5 shows across both peak hours the 2036 scenario forecasts produce consistent results in terms of network summary statistics.
- 6.2.6 Queuing, travel time and distance all increase in the modelled scenarios compared to the Reference Case, with subsequent decreases in average speed. These changes occur due to the increased levels of traffic which the TRICS-based trip generation produces in the scenario forecasts.
- 6.2.7 The network summary statistics show the SCTM performs consistently across all of the modelled scenarios.

6.3 JUNCTION CAPACITY ASSESSMENT

- 6.3.1** In terms of determining specific junctions at which there are congestion problems in the modelled scenarios, SATURN is able to provide an overall volume to capacity (V/C) ratio by junction. As described in Table 2-1, junctions which have an overall V/C of over 90% are considered to potentially show significant congestion in future. Junctions which achieve a V/C over 100% are predicted to be likely to show significant congestion problems.
- 6.3.2** In terms of overall junction V/C the Bloodmoor Roundabout (A12 Tom Crisp Way / Stradbroke Road / A12 Bloodmoor Road / Ribblesdale / A1145 Castleton Avenue / A1117 Bloodmoor Road) reaches around 90% V/C in the AM peak and 95% V/C in the PM peak in each of the modelled scenarios. Figure 6.1 shows the existing layout for the Bloodmoor Roundabout. This represents an increase compared to the Reference Case, where the overall junction V/C reaches 85% in the AM peak, and 92% in the PM peak.
- 6.3.3** In the AM peak scenario modelling, the A12 Tom Crisp Way arm operates well within capacity with a V/C of around 66%; all other arms of the junction return a V/C of over 100%, except the A12 Bloodmoor Road approach which is between 93-95%. The A12 Bloodmoor Road reaches 99% in the AM in Scenario 2.
- 6.3.4** In the PM peak scenario modelling, the Ribblesdale approach is within capacity, at around 51%. All other arms of the junction show congestion issues with the approaches at 100% V/C or over, except A1145 Castleton Avenue which is between 92-95% V/C.



Figure 6.1 Bloodmoor Roundabout

6.4 LINK BASED DELAYS

- 6.4.1 Considering the overall V/C of a junction can mask locations where there may be congestion problems on a link at the approach to a particular junction. In practice, few junctions in SATURN will show a high overall V/C when this averaged across the junction unless congestion is very severe. Therefore analysis has been undertaken to determine which junctions have an approach arm which shows congestion problems. These junctions are assigned a V/C ratio based on the worst-performing approach arm.
- 6.4.2 Table 6-6 describes the typology used to distinguish between whether junctions show congestion problems in both peak hours, and a single peak hour, and takes into account the severity of the congestion.

Table 6-6 Volume to capacity ratio categorisation

TYPE	DESCRIPTION
1	100%+ both peaks
2	100%+ in one peak / 90-99% in other peak
3	100%+ in one peak / Less than 90% in other peak
4	90-99% in both peaks
5	90-99% in one peak / Less than 90% in the other peak

- 6.4.3 Appendix E provides a comparison of the V/C value for the worst performing arm of all junctions which fall within the categorisation defined in Table 6-6. Comparisons are provided showing the 2016 base year compared to the 2036 reference case and modelled scenarios.

BASE YEAR JUNCTIONS WITH APPROACHES NEAR / OVER CAPACITY

- 6.4.4 The following junction is shown to have a V/C over 90% in the 2016 AM base year:

→ A12 Waveney Road / A12 Station Square / Station Square (node 6010)

- 6.4.5 In the 2016 PM peak, the following junctions are shown to have high V/C values:

- Tower Road / Cooke Road (node 5340)
- A12 Tom Crisp Way / Blackheath Road (node 6314)
- A146 Bridge Road / Cotmer Road (node 2030)

FORECAST YEAR JUNCTIONS WITH APPROACHES NEAR / OVER CAPACITY

- 6.4.6 Analysis of the junctions in the forecast modelling which are shown to have congestion issues have been split into the following areas which are shown to contain junctions with capacity problems:

- South Lowestoft
- North Lowestoft
- Beccles
- A12 rural junctions

6.4.7 Bungay, Halesworth, Southwold and Reydon are not discussed in detail as none of these locations show significant congestion problems as a result of the forecast growth in traffic. All of the junctions within these towns return volume to capacity ratios below 90% in both the AM & PM peak in 2036, and therefore do not fit the typology in Table 6-6 for junctions considered likely to show congestion problems in the future.

6.4.8 The performance of junctions in terms of the worst V/C arm are shown to be broadly consistent across all forecast modelled scenarios, therefore Figure 6.2 to Figure 6.5 provides details of the junctions showing congestion issues as representative across all scenarios. In instances where there is variation in terms of a particular scenario showing less of a congestion issue this is outlined.

SOUTH LOWESTOFT – JUNCTIONS WITH APPROACHES NEAR / OVER CAPACITY

6.4.9 Figure 6.2 shows the junctions in South Lowestoft by V/C type

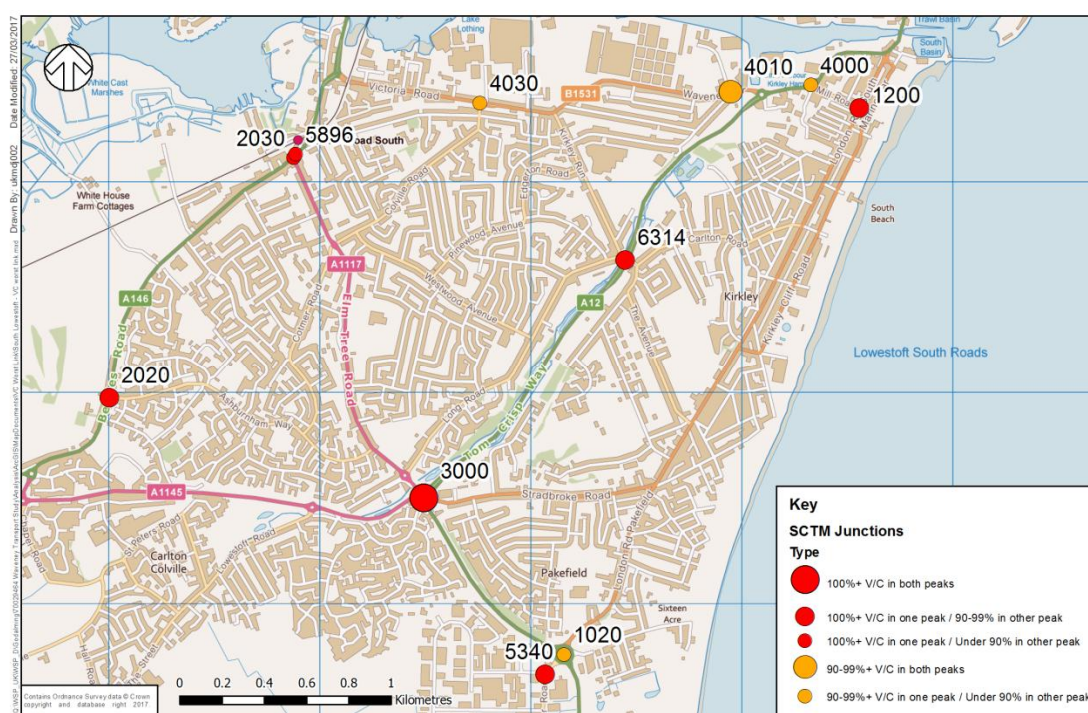


Figure 6.2 South Lowestoft – Junctions with approaches over / near capacity

6.4.10 The Bloodmoor Roundabout (node 3000) is the only junction which has an approach over 100% V/C in both the AM and PM peak for all scenarios. This junction operates within capacity in the 2016 base year; return a worst arm V/C of 74% in the AM peak and 65% in the PM peak.

6.4.11 The following junctions are over 100% V/C in the PM peak, and between 90-99% V/C in the AM peak:

- B1532 London Road S / Mill Road (node 1200)
- A146 Beccles Road / Hollow Grove Way (node 2020)
- Tower Road / Cooke Road (node 5340)
- A12 Tom Crisp Way / Blackheath Road (node 6314)

- 6.4.12 These junctions show variation with regards to Scenario 2. A146 Beccles Road / Hollow Grove Way (node 2020) and Tower Road / Cooke Road (node 5340) are shown to operate with a V/C of 85% and 80% respectively in the AM peak, congestion at these locations is reduced by the additional link road between the A146 and A12.
- 6.4.13 The following junctions reach over 100% V/C in the PM peak, but operate within capacity in the AM peak:
- A146 Bridge Road / Cotmer Road (node 2030)
 - A1117 Bridge Road / Bridge Road; to Oulton Broad South rail station (node 5896)
- 6.4.14 Waveney Drive / Durban Road / Riverside Road (node 4010) reaches a V/C of around 98% in the AM peak across all three scenarios, and between 91-92% in the PM peak.
- 6.4.15 Victoria Road / Colville Road (node 4030) operates well within capacity in the AM peak, however it reaches between 92-93% V/C in all scenarios in the PM peak.
- 6.4.16 The following junctions show capacity issues with V/C of 90-99% in Scenario 2 in the PM peak only, in all other scenarios these junctions return a V/C of 85% or lower in the PM peak:
- A12 Bloodmoor Road / London Road Pakefield / Arbor Lane / Tower Road (node 1020)
 - A12 Horn Hill / Kirkley Rise / Asda Access (node 4000)
- 6.4.17 Compared to the 2016 base year, only the A12 Tom Crisp Way / Blackheath Road (node 6314) and A146 Bridge Road / Cotmer Road (node 2030) operate at close to capacity in the AM peak, reaching a V/C of 89% and 87% respectively.

SOUTH LOWESTOFT JUNCTION ANALYSIS SUMMARY

- 6.4.18 South Lowestoft is shown to be the location in Waveney with the highest number of junctions showing stress in terms of their V/C values. The Bloodmoor Roundabout returns V/C values above 100% across multiple arms. It is recommended detailed junction modelling is carried out for this junction to determine whether mitigation may be required at this location. Scenarios 1, 3 and 4 show a similar level of performance in terms of the junctions in Lowestoft which flag up as an issue. Scenario 2 shows that with the inclusion of the link road between the A146 and A12, alleviates the congestion experienced at the A146 Beccles Road / Hollow Grove Way (node 2020) and Tower Road / Cooke Road (node 5340) in the AM peak.

NORTH LOWESTOFT – JUNCTIONS WITH APPROACHES NEAR / OVER CAPACITY

6.4.19 Figure 6.3 shows the junctions in North Lowestoft by V/C type



Figure 6.3 North Lowestoft – Junctions with approaches over / near capacity

- 6.4.20 The A1117 Millennium Way / Grasmere Drive (node 7080) operates within capacity in the AM peak at around 85% in all scenarios. However, in the PM peak it reaches a V/C of 100% in Scenarios 1, 3 and 4. In Scenario 2, the congestion at this junction in the PM peak is less at 97%.
- 6.4.21 The A12 Waveney Road / A12 Station Square / Station Square (node 6010) reaches 91% V/C in all scenarios in the AM peak, but operates within capacity in the PM peak.
- 6.4.22 The following junctions show a V/C of between 92-93% in the PM peak, but operate within capacity in the AM peak for all scenarios.

- A12 Yarmouth Road / Holingsworth Road (node 6220)
- A12 Yarmouth Road / A12 Foxburrow Hill / Weston Road (node 10234)

- 6.4.23 In Scenario 2, due to the greater concentration to development in South Lowestoft, these junctions show less congestion issues, returning a V/C of 83% in the PM peak.
- 6.4.24 Only the A1117 Millennium Way / Grasmere Drive (node 7080) junction shows V/C approaching capacity, reaching 82% in the AM peak, and 86% in the PM peak.

NORTH LOWESTOFT JUNCTION ANALYSIS SUMMARY

- 6.4.25 North Lowestoft shows a fewer number of junctions showing high V/C values compared to the south. The same junctions consistently show pressure across all scenarios, with the exception of the named junctions along the A12 Yarmouth Road in Scenario 2 which operate within capacity due to the major housing development in Lowestoft being concentrated in the south.

BECCLES – JUNCTIONS WITH APPROACHES NEAR / OVER CAPACITY

- 6.4.26 Figure 6.4 shows the junctions in Beccles and vicinity by V/C type

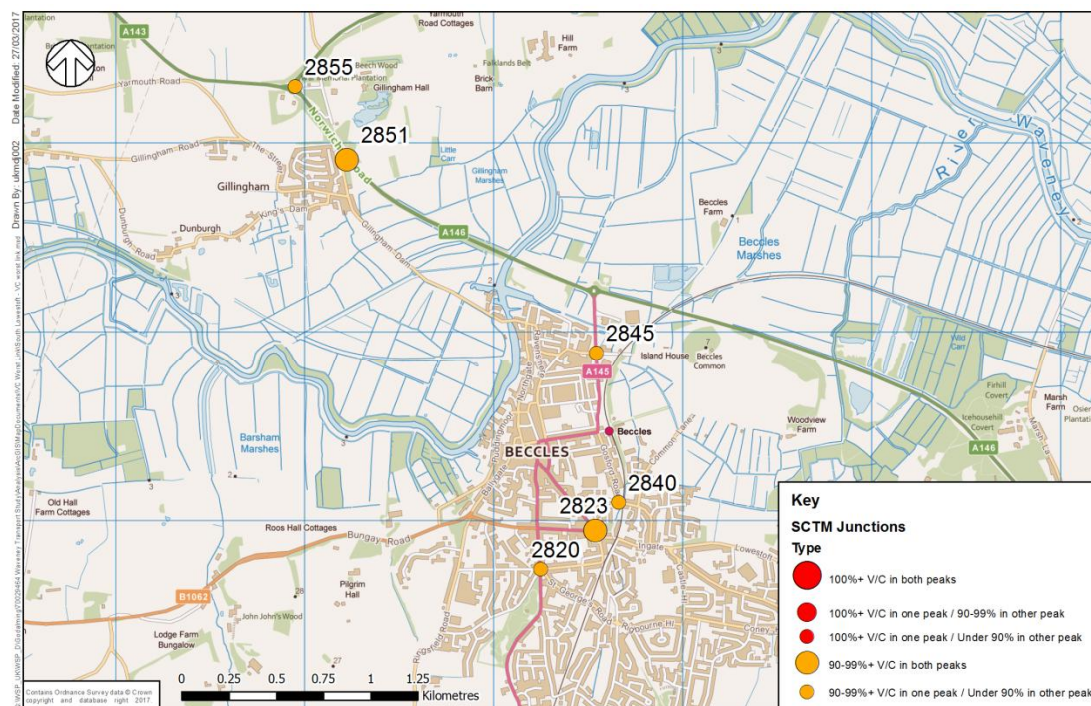


Figure 6.4 Beccles – Junctions with approaches over / near capacity

- 6.4.27 The following junctions are shown to reach a V/C of 90-99% in both peaks across all scenarios:
- A145 Blyburgate / A145 Peddars Lane (node 2823)
 - A146 Norwich / Loddon Road (node 2851)
- 6.4.28 The following junctions become an issue in the PM peak in all scenarios, reaching a V/C of between 90-99%. The A145 and A146 junctions reach a V/C of around 87% in the AM peak.
- A145 / Ashman's Road / Frederick' Road (node 2820)

- Gosford Road / Grove Road (node 2840)
- A146 Norwich Road / A143 Yarmouth Road (node 2855)

6.4.29 The George Westwood Way / Common Lane N (node 2845) junctions shows congestion issues in the AM peak only, reaching 92% V/C, but operating well within capacity in the PM peak.

BECCLES JUNCTION ANALYSIS SUMMARY

6.4.30 Junctions within Beccles which are highlighted as an issue are shown to be consistent across all modelled scenarios. All of the named junctions with Beccles operate within capacity in the 2016 base year with the A145 Blyburgate / A145 Peddars Lane (node 2823) showing coming closest to the V/C threshold, reaching 78% in the AM peak, and 83% in the PM peak.

RURAL A12 – JUNCTIONS WITH APPROACHES NEAR / OVER CAPACITY

6.4.31 Figure 6.5 shows the junctions in rural locations along the A12 by V/C type

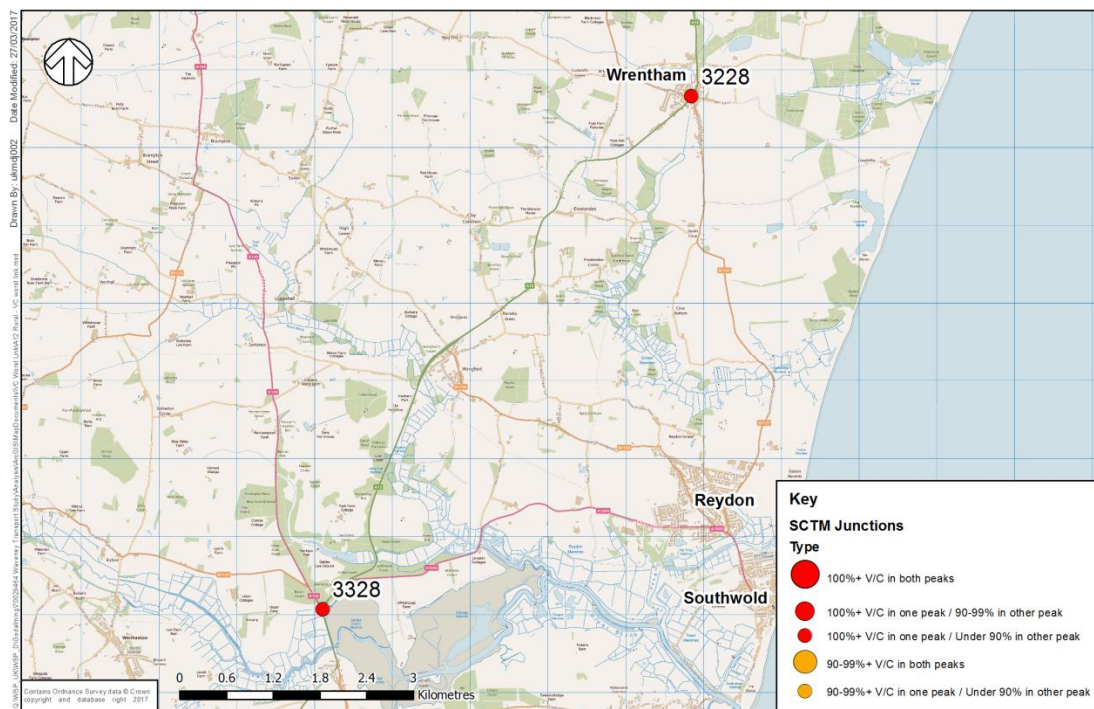


Figure 6.5 Rural A12 – Junctions with approaches over / near capacity

6.4.32 The following junctions are shown to reach a V/C of 104-105% in the AM peak in all three scenarios, but operate within capacity in the PM peak:

- A12 at Wrentham (node 3228)
- A12 / A145 west of Southwold / Reydon (node 3328)

RURAL JUNCTION ANALYSIS SUMMARY

6.4.33

Both of the junctions in rural areas along the A12 which return high V/C values operate within capacity in the 2016 base year, with values no greater than 60% V/C. These junctions are shown to be issues in the Reference Case as well as the modelled scenarios showing it is the general high increase in forecast traffic causing issues at these locations and the cause is not isolated to the specifically modelled developments. Given it is not feasible to include every local road within the SCTM; these junctions may be showing stress given the level of network detail which is included in the rural areas in Waveney. Further analysis would be required to provide more certainty as to whether these junctions would show pressure in the future.

6.5

JOURNEY TIME ROUTE ANALYSIS

6.5.1

Trafficmaster GPS data was obtained from Suffolk County Council covering a period between September 2014 and August 2015. The data was filtered to only include data from neutral months. The data has been used during the validation and calibration of the base year SCTM highway model.

6.5.2

The journey time routes relevant to Waveney have been identified. Journey time routes which have been analysed include those shown within Figure 6.6

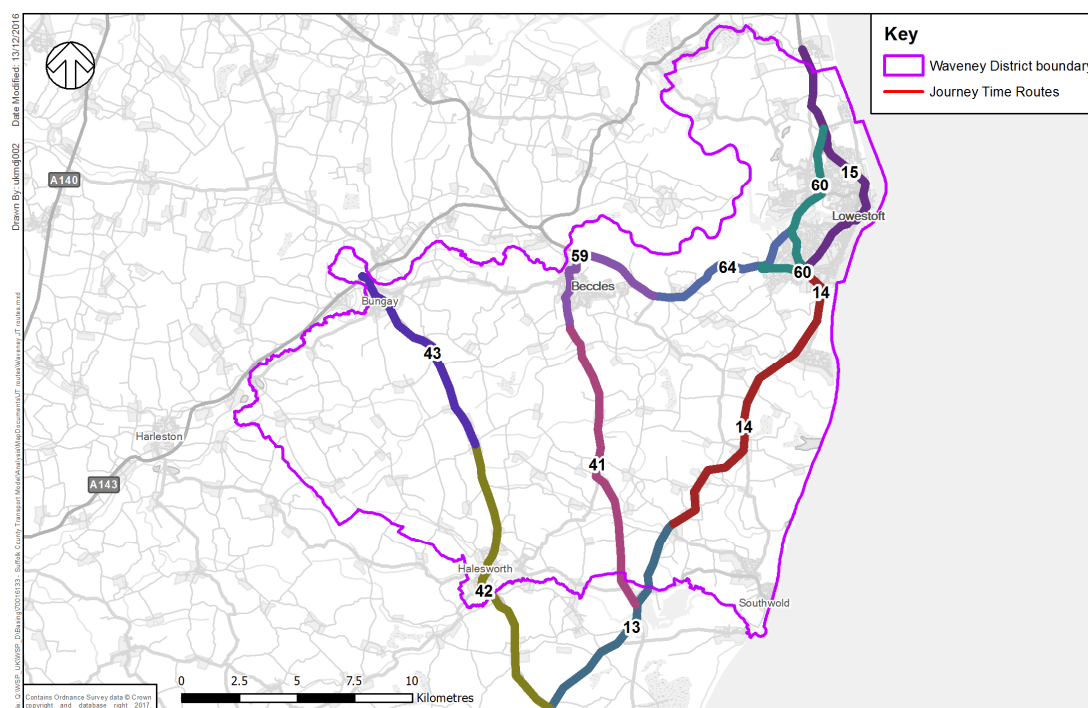


Figure 6.6 Selected journey time routes within Waveney

6.5.3 Comparisons have been carried out between the observed base year journey time, 2016 base year travel time and 2036 forecast model travel time for each scenario across the selected journey time routes.

6.5.4 Table 6-7 provides a comparison of total journey time along each route in the AM peak across all scenarios modelled, detailing the total travel time in minutes and seconds.

Table 6-7 Journey time route comparison – AM peak

JT ROUTE	2016 (OBSERVED)	2016 (MODEL)	2036 RC (MODEL)	2036 Sc1 (MODEL)	2036 Sc2 (MODEL)	2036 Sc3 (MODEL)	2036 Sc4 (MODEL)
13 – NB	08:35	08:38	09:03	09:34	09:33	09:34	09:34
13 – SB	08:49	08:35	08:55	08:41	08:42	08:41	08:40
14 – NB	13:34	12:36	13:44	14:34	14:53	14:38	14:34
14 – SB	13:14	12:30	13:18	13:08	12:58	13:05	13:08
15 – NB	18:33	17:12	17:01	17:47	17:58	17:49	17:48
15 – SB	17:09	15:20	15:27	15:49	15:46	15:51	15:49
41 – NB	11:12	10:48	10:55	11:01	11:02	11:01	11:01
41 – SB	11:54	11:18	11:51	11:41	11:41	11:41	11:42
42 – NB	15:30	14:34	14:55	15:07	15:07	15:07	15:07
42 – SB	16:23	14:29	14:44	14:58	14:58	14:58	14:59
43 – NB	10:07	09:34	09:52	10:00	10:00	10:00	10:00
43 – SB	10:03	11:16	11:55	12:19	12:19	12:19	12:19
59 – EB	09:51	09:48	10:17	10:37	10:37	10:36	10:43
59 – WB	10:50	10:54	11:43	12:09	12:14	12:10	12:10
60 – NB	17:49	13:52	14:41	16:16	15:22	16:48	16:16
60 – SB	16:46	12:52	13:33	14:16	13:54	14:19	14:17
64 – EB	09:49	08:03	08:34	09:21	09:36	09:42	09:22
64 – WB	07:56	07:53	08:18	08:22	08:34	08:23	08:23

6.5.5 The routes highlighted in red show a significant increase in travel time in the scenario modelling when compared to the reference case. Details of why this increase in journey time occurs is provided below:

- Route 14 (A12) – Northbound (A12): increases in delay occur on the A12 northbound between Wangford and Kessingland
- Route 60 (A1117 within Lowestoft) – Northbound & Southbound: increases delays passing through the Bloodmoor Roundabout and on A1117 Bridge Road. The journey time on this route in Scenario 2 is similar to the reference case as the additional link road decreases the delay experienced at the Bloodmoor Roundabout
- Route 64 (A146 Beccles Road) – Eastbound: increased congestion on the A146 Beccles Road and at the A146 / Hollow Grove Way junction.

6.5.6 Table 6-8 provides a comparison of total journey time along each route in the PM peak across all of the modelled scenarios.

Table 6-8 Journey time route comparison – PM peak

JT ROUTE	2016 (OBSERVED)	2016 (MODEL)	2036 RC (MODEL)	2036 Sc1 (MODEL)	2036 Sc2 (MODEL)	2036 Sc3 (MODEL)	2036 Sc4 (MODEL)
13 – NB	08:33	08:48	09:07	08:53	08:55	08:53	08:53
13 – SB	08:40	08:29	08:45	09:05	09:02	09:04	09:05
14 – NB	16:03	12:39	13:29	13:30	13:31	13:38	13:36

JT ROUTE	2016 (OBSERVED)	2016 (MODEL)	2036 RC (MODEL)	2036 Sc1 (MODEL)	2036 Sc2 (MODEL)	2036 Sc3 (MODEL)	2036 Sc4 (MODEL)
14 – SB	12:59	12:19	12:56	13:12	13:04	13:09	13:10
15 – NB	18:18	15:50	15:28	15:48	15:41	15:48	15:47
15 – SB	17:31	15:37	17:08	18:27	18:32	18:49	18:39
41 – NB	11:25	11:08	11:28	11:24	11:23	11:24	11:25
41 – SB	11:21	11:09	11:35	11:45	11:47	11:46	11:45
42 – NB	14:17	14:40	15:03	15:17	15:16	15:17	15:16
42 – SB	14:47	14:25	14:35	14:45	14:45	14:45	14:46
43 – NB	10:14	09:49	10:15	10:27	10:27	10:27	10:28
43 – SB	10:20	11:05	11:23	11:46	11:47	11:46	11:48
59 – EB	09:47	10:29	11:03	11:10	11:07	11:12	11:11
59 – WB	10:23	10:30	11:03	11:32	11:32	11:31	11:37
60 – NB	15:15	15:50	17:30	18:58	18:51	19:12	19:03
60 – SB	16:07	14:02	15:55	17:37	17:44	17:59	17:44
64 – EB	09:34	08:54	09:38	09:44	10:27	09:47	09:47
64 – WB	08:09	07:52	08:13	08:22	08:30	08:22	08:23

6.5.7

The routes highlighted in red show a significant increase in travel time in the scenario modelling when compared to the reference case. Details of why this increase in journey time occurs is provided below:

- Route 15 (A12 within Lowestoft) – Southbound: increases in delay occur on the A12 southbound at the A12 Bloodmoor Road / London Road / Tower Road roundabout
- Route 60 (A1117 within Lowestoft) – Northbound & Southbound: increased delays at the Bloodmoor Roundabout and A1117 Millennium Way / Grasmere Drive signalised junction
- Route 64 (A146 Beccles Road) – Eastbound: this shows an increase in delay on the A146 Beccles Road prior to the southern link road.

JOURNEY TIME ROUTE ANALYSIS SUMMARY

6.5.8

Analysis has been carried out for all of the major routes within Waveney which the SCTM has been calibrated and validated against. The journey time route travel times are shown to be broadly consistent, except for instances described above where the specifically modelled developments have created additional delay. Routes which are affected by these additional delays include the A12 south of Lowestoft, A12 within Lowestoft, A1117 within Lowestoft and the A146 Beccles Road.

7 CONCLUSIONS

7.1 SUMMARY

- 7.1.1** The SCTM has been used to carry out an assessment of proposed levels of development detailed within the emerging Waveney Local Plan for a forecast year of 2036. An increase of 8,920 / 8,900 houses and 4,850 jobs have been modelled across four different scenarios which include variations in the distribution of housing and job growth within Waveney.
- 7.1.2** The levels of traffic included in the forecast modelling represent a substantial increase from the 2016 base year, increasing traffic levels by between 30-31% in the 2036 forecast assignments.
- 7.1.3** Network summary statistics have been analysed for each of the model runs. These indicate the SCTM performs consistently between the various forecast model runs. These statistics show a logical increase in total travel distance and time given the increased levels of traffic, accompanied by an increase in over-capacity queues and reductions in average speeds.
- 7.1.4** Junctions within Waveney have been analysed in terms of the Volume / Capacity (V/C) ratio, with the worst performing arm of a junction used to highlight locations at which congestion is likely to occur in 2036. Analysis of junction V/C has been split between South Lowestoft, North Lowestoft, Beccles and the A12.
- 7.1.5** Bungay, Halesworth, Southwold and Reydon are all shown to have junctions which operate within capacity in both the AM and PM peak in 2036 across all scenarios. The modelling detailed in this report shows there are no significant congestion issues at these locations as a result of the projected growth in traffic and distribution of development in Waveney.
- 7.1.6** South Lowestoft shows the highest numbers of junctions indicating congestion issues. The Bloodmoor Roundabout in particular shows stress with multiple approaches reaching a V/C of over 100%. Other junctions in South Lowestoft showing significant congestion include the following:
- B1532 London Road South / Mill Road
 - A146 Beccles Road / Hollow Grove Way
 - Tower Road / Cooke Road
 - A12 Tom Crisp Way / Blackheath Road
 - A146 Bridge Road / Cotmer Road
 - A1117 Bridge Road / Bridge Road
- 7.1.7** The journey time route analysis has shown the modelled scenarios create additional delays compared to the 2016 base year and 2036 reference case due to higher trip generation for the specific developments within Waveney. The A1117, A12 and A146 are shown to experience increased journey times as a result of the developments modelled in detail.

7.2 MITIGATION

- 7.2.1** The only mitigation which has been considered specific to the developments detailed in the Waveney Local Plan is included in Scenario 2. This mitigation includes a link road between the A146 Beccles Road and A12 Tower Road.
- 7.2.2** The modelling suggests mitigation may be required at the Bloodmoor Roundabout.
- 7.2.3** The modelling highlights other locations which show congestion in 2036. It is recommended more detailed modelling and/or junction modelling is carried out to determine how significant the congestion is which has been highlighted at the specific locations within this report.

7.3 AREAS FOR FURTHER STUDY

- 7.3.1** The SCTM will be updated in future with the local plan assumptions for neighbouring authorities. Further, due to the countywide study area it will enable joint planning with neighbouring authorities.
- 7.3.2** It is therefore recommended that this assessment is updated once that local plan assessments have been carried out for neighbouring authorities and that mitigation proposals identified in the studies are included to confirm the extent of any mitigation required. The impact of specific local plan development sites could also be assessed within the model to identify those areas of mitigation that will be required by developers to mitigate their site impacts.

Appendix A

FORECAST DEVELOPMENTS

APPENDIX A-1

DEVELOPMENTS INCLUDED IN ALL SCENARIOS

Site Code	Location	Easting (X)	Northing (Y)	Primary Source	Policy	Description (All major land uses)	Dwellings Total	SCTM Zone
LOW3 DC/15/4547/FUL	Town Hall, offices and car parks, Mariners Street, Lowestoft	655074	293881	SSA	LOW3		8	764
LOW4 DC/14/2322/FUL	Council offices, Clapham Road, Lowestoft	654799	293246	SSA	LOW4		9	562
LOW6	Neeves Pit, Normanston Drive, Lowestoft	652823	293643	SSA	LOW6	Housing (retirement lodges)	49	582
LOW7	Guntton Park, off Old Lane, Lowestoft	653527	296466	SSA	LOW7	Housing	60	408
LOW9	Monckton Avenue Nursery, Lowestoft	653030	293819	SSA	LOW9	Housing	45	419
BEC2	Land off Gresham Road, Beccles	642466	290512	SSA	BEC2		28	550
BEC3	Land at Cucumber Lane / Oak Lane, Beccles	643028	288809	SSA	BEC3	Housing	20	457
BUN1 DC/14/4193/OUT	Land west of A144, St John's Road, Bungay	634403	288607	SSA	BUN1	Outline Application with all matters reserved apart from access for up to 150 new dwellings (including affordable housing), associated infrastructure, open space and up to 3ha of employment land (comprising uses within use class B1 (including starter units) and use class B2)	150	470
BUN2	Telephone Exchange, Lower Olland Street	633814	289432	SSA	BUN2		8	818
BUN3	Community Centre, Upper Olland Street, Bungay	633769	289321	SSA	BUN3	Housing	8	818
HAL3	Dairy Hill Playing Fields, Halesworth	639129	277449	SSA	HAL3		50	111
HAL4	Dairy Farm, Saxons Way, Halesworth	638766	277278	SSA	HAL4		40	809
SSP3	Kirkley Waterfront and Sustainable Urban Neighbourhood, Lowestoft	653233	292651	AAP	SSP3	Approx 9.8ha remaining of 12 ha of reconfigured employment land comprising: Predominantly B1 office floorspace, research and development and workshop space in the area surrounding Riverside Road and adjacent to residential areas	157	589
SSP3	Kirkley Waterfront and Sustainable Urban Neighbourhood, Lowestoft	653233	292651	AAP	SSP3	Approx 9.8ha remaining of 12 ha of reconfigured employment land comprising: Predominantly B1 office floorspace, research and development and workshop space in the area surrounding Riverside Road and adjacent to residential areas	83	431
SSP3	Kirkley Waterfront and Sustainable Urban Neighbourhood, Lowestoft	653233	292651	AAP	SSP3	Approx 9.8ha remaining of 12 ha of reconfigured employment land comprising: Predominantly B1 office floorspace, research and development and workshop space in the area surrounding Riverside Road and adjacent to residential areas	365	856
SSP3	Kirkley Waterfront and Sustainable Urban Neighbourhood, Lowestoft	653233	292651	AAP	SSP3	Approx 9.8ha remaining of 12 ha of reconfigured employment land comprising: Predominantly B1 office floorspace, research and development and workshop space in the area surrounding Riverside Road and adjacent to residential areas	522	857
SSP3	Kirkley Waterfront and Sustainable Urban Neighbourhood, Lowestoft	653233	292651	AAP	SSP3	Approx 9.8ha remaining of 12 ha of reconfigured employment land comprising: Predominantly B1 office floorspace, research and development and workshop space in the area surrounding Riverside Road and adjacent to residential areas	209	858
SSP3	Kirkley Waterfront and Sustainable Urban Neighbourhood, Lowestoft	653233	292651	AAP	SSP3	Approx 9.8ha remaining of 12 ha of reconfigured employment land comprising: Predominantly B1 office floorspace, research and development and workshop space in the area surrounding Riverside Road and adjacent to residential areas	104	859
SSP5	Kirkley Rise, Lowestoft	654227	292286	AAP	SSP5	All land identified for employment use in the AAP on this site is currently in use. Development of Horn Hill frontage for employment-led mixed uses; Residential/employment in sites adjacent to Kirkley Rise/Horn Hill; Employment will be retained within existing sites	41	441
SSP6	Western End of Lake Lothing, Lowestoft	652280	292586	AAP	SSP6	Waterfront tourism; Small-scale residential development of 57 homes; Employment, with a focus on marine activities	57	431
SSP7 DC/15/3748/FUL	Oswald's Boatyard, Lowestoft	652206	292826	AAP	SSP7	80 flats; replacement library; A3 coffee shop	80	583
SSP8 DC/15/4311/FUL	The Scores, Lowestoft	655217	293816	AAP	SSP8	Small scale residential and employment development will be supported in the "Scores" area east of the historic High Street	30	760
DC/01/0977/OUT DC/14/1755/ARM DC/14/2515/ARM DC/15/2953/ARM	Woods Meadow, Oulton	652555	294796	PP	Historic allocation	Historic allocation - mixed use development comprising of residential (800 dwellings), neighbourhood shopping centre, community hall, primary school, play areas and country park	556	865
DC/01/0977/OUT DC/14/1755/ARM DC/14/2515/ARM DC/15/2953/ARM	Woods Meadow, Oulton	652555	294796	PP	Historic allocation	Historic allocation - mixed use development comprising of residential (800 dwellings), neighbourhood shopping centre, community hall, primary school, play areas and country park	244	866
DC/86/0517/OUT	Dunston, Oulton	652173	294874	PP	Historic allocation	Historic allocation - approximately 50 dwellings can be accommodated on remaining land	50	568
DC/96/0058/OUT	Carlton Hall Farm, Carlton Colville	651077	290719	PP	Historic allocation	Historic allocation - approximately 124 dwellings can be accommodated on remaining land	124	639
DC/05/0540/FUL	Hillside Garage Hillside Road East Bungay NR35 1RX	634356	289064	PP	Windfall	Housing	10	468
DC/14/2252/FUL	Carlton Hall Chapel Road Carlton Colville NR33 8AT	650943	290294	PP	Windfall	Housing (sheltered housing)	33	782
DC/14/2046/OUT	Land at Fairview Road and Norwich Road Halesworth	639219	278526	PP	Windfall	Demolition of Existing Workshop and Construction of 22 no. dwellings and 1 no. B1 Commercial Unit and associated works	22	477
DC/13/0383/FUL	Land at Lodge Road Holton [IP19 8RZ]	640107	277905	PP	Windfall	Housing	11	812
DC/12/1105/FUL	Land off Heritage Green Kessingland NR33 7UP	652229	286964	PP	Windfall	Housing	30	465
DC/13/2169/FUL	Land adjacent The Nordalls Kessingland	652998	286393	PP	Windfall	Housing	23	463
DC/02/0878/FUL	Oulton Broad Caravan Site Saltwater Way Lowestoft	652131	292582	PP	Historic allocation	Highways works keep planning permission live - Construction of 8 terraced houses, 16 flats, upto 5 shop units, 31 sheltered housing units and a wardens flat and provision of car parking	25	431
DC/11/0264/FUL	Plots 1-11 Rodber Way Lowestoft	653366	295684	PP	Windfall	Housing	11	416
DC/13/0649/OUT	Land off Foxborough Road Lowestoft	653339	294844	PP	Historic allocation	Housing	50	420
DC/13/3638/FUL	Longs Dairy St Margarets Road Lowestoft NR32 4HU	654365	294130	PP	Windfall	Housing (sheltered housing)	17	413
DC/05/0524/ARM	Phase 4 land at Foxborough Road Lowestoft	653383	293009	PP	Windfall	Housing	40	420
DC/15/0417/FUL	Tyndale Press, Wollaston Road Lowestoft	654591	293263	PP	Windfall	Housing	15	587
DC/03/0366/ARM	Phase 3 Park Meadows Oulton	652935	295209	PP	Historic allocation		119	586
DC/06/0271/FUL	Service Station Site Might's Road Southwold	650499	276728	PP	Windfall	Housing	13	814
DC/15/0213/FUL	Former Worlingham Primary School, Rectory Road Worlingham	644564	289784	PP	Windfall	15 dwellings and community centre [site of former primary school]	15	549
DC/15/0712/FUL	Former Meadowlands, Walker Gardens Wrentham	649685	282575	PP	Windfall	Housing	24	475
DC/15/3221/OUT	Land rear of 34-48 Old Station Road Halesworth	638469	278323	PP	Windfall	Housing	15	809
Total							3540	

APPENDIX A-2

SCENARIO 1 DEVELOPMENTS

Town	Site Code	Location	Easting (X)	Northing (Y)	Location Details	Jobs Total	Dwellings Total	SCTM Zone
North Lowestoft	Site 165/166	Yarmouth Road	652904 (165) 653298 (166)	297012 (165) 297258 (166)	Access point from A12 between Rackhams Corner and New Roundabout	1050	1300	855
North Lowestoft	Site 169/180	Land off Hall Lane	652430 (169) 652398 (180)	295094 (169) 294923 (180)	Access off Parkhill	0	200	417
North Lowestoft	Site 17/84	Land off Parkhill	652458 (17) 652648 (84)	295471 (17) 295389 (84)	Access off Parkhill	0	120	417
North Lowestoft	Site 40	Hall Lane, Oulton	651899	294745	Access from Hall Lane	0	80	867
South Lowestoft	Site 34/35	South of The Street, Carlton Colville	651507	289718	Primary access from The Street.	0	400	449
Beccles	Site 43/156	West of London Road	641731	289200	Access from London Road	0	300	860
Beccles	Site 8/9/81/82/205	Land north of the Beccles Southern Relief Road	642769	288605	1) Access from Beccles Southern Relief Road (west part of the site)	0	550	864
Beccles	Site 8/9/81/82/205	Land north of the Beccles Southern Relief Road	642769	288605	2) Access from Ellough Road (east part of the site into existing road network) - this scenario is need will act as a baseline	0	550	547
Bungay	Site 45/206/209	Land east and west of St Johns Road	634666	288559	Access onto St Johns Road	0	350	470
Halesworth	Site 65	Land north of Holton Road	639609	277608	Access from Hill Farm Road	0	115	811
Halesworth	Site 151/152	Land south of Harrisons Lane	639493	278154	Access from Harrisons Lane and Bungay Road	0	155	861
Halesworth	Site 89	Land west of Lodge Road and North of Bungay Road	640082	277939	Access from Lodge Road	0	15	812
Halesworth	Site 163/203	Land south of Chediston Street	638051	277211	Access from Chediston Street and Roman Way	0	170	862
Halesworth	Site 122	Land north of Old Station Road and east of the railway line	638891	278465	Access from Old Station Road and Norwich Road	0	120	477
Halesworth	Site 140/141	Land north of Old Station Road and west of the railway line	638597	278369	Access from Old Station Road	0	35	477
Southwold & Reydon	Site 189/202 Fountain Way	Land north of Kingfisher Crescent	649496	277625	Access from Copperwheat Avenue (Wangford Road)	0	250	863
Rural Areas	N/A	Various	-	-		0	670	Various
Total						1050	5380	

APPENDIX A-3

SCENARIO 2 DEVELOPMENTS

Town	Site Code	Location	Easting (X)	Northing (Y)	Location Details	Jobs Total	Dwellings Total	SCTM Zone
North Lowestoft	Site 17/84/169/170/171/181	Land surrounding Union Lane	652461	295353	Access off Parkhill	0	260	855
North Lowestoft	Site 17/84/169/170/171/181	Land surrounding Union Lane	652461	295353	Access from Hall Lane	0	260	417
North Lowestoft	Site 40	Hall Lane, Oulton	651899	294745	Access from Hall Lane	0	80	417
South Lowestoft	South Lowestoft development area	South of Carlton Colville between the A12 and A146			a new access from the A146 west of Oakes Farm.	525	750	867
South Lowestoft	South Lowestoft development area	South of Carlton Colville between the A12 and A146			Access from existing A12 roundabout south of Morrisons supermarket	525	750	868
Beccles	Site 43/156	West of London Road	641731	289200	Access from London Road	0	300	860
Beccles	Site 8/9/81/82/205	Land north of the Beccles Southern Relief Road	642769	288605	1) Access from Beccles Southern Relief Road (west part of the site)	0	550	864
Beccles	Site 8/9/81/82/205	Land north of the Beccles Southern Relief Road	642769	288605	2) Access from Ellough Road (east part of the site into existing road network)	0	550	547
Bungay	Site 45/206/209	Land east and west of St Johns Road	634666	288559	Access onto St Johns Road	0	350	470
Halesworth	Site 65	Land north of Holton Road	639609	277608	Access from Hill Farm Road	0	115	811
Halesworth	Site 151/152	Land south of Harrisons Lane	639493	278154	Access from Harrisons Lane and Bungay Road	0	155	861
Halesworth	Site 89	Land west of Lodge Road and North of Bungay Road	640082	277939	Access from Lodge Road	0	15	812
Halesworth	Site 163/203	Land south of Chediston Street	638051	277211	Access from Chediston Street and Roman Way	0	170	862
Halesworth	Site 122	Land north of Old Station Road and east of the railway line	638891	278465	Access from Old Station Road and Norwich Road	0	120	477
Halesworth	Site 140/141	Land north of Old Station Road and west of the railway line	638597	278369	Access from Old Station Road	0	35	477
Southwold & Reydon	Site 189/202 Fountain Way	Land north of Kingfisher Crescent	649496	277625	Access from Copperwheat Avenue (Wangford Road)	0	250	863
Rural Areas	N/A	Various	-	-		0	670	Various
Total						1050	5380	

APPENDIX A-4

SCENARIO 3 DEVELOPMENTS

Town	Site Code	Location	Easting (X)	Northing (Y)	Location Details	Jobs Total	Dwellings Total	SCTM Zone
North Lowestoft	Site 165/166	Yarmouth Road	652904 (165) 653298 (166)	297012 (165) 297258 (166)	Access point from A12 between Rackhams Corner and New Roundabout	1050	1300	855
South Lowestoft	Site 34/35/additional	South of The Street, Carlton Colville	651507	289718	Primary access from The Street.	0	800	449
Beccles	Site 43/156	West of London Road	641731	289200	Access from London Road	0	300	860
Beccles	Site 8/9/81/82/205	Land north of the Beccles Southern Relief Road	642769	288605	1) Access from Beccles Southern Relief Road (west part of the site)	0	550	864
Beccles	Site 8/9/81/82/205	Land north of the Beccles Southern Relief Road	642769	288605	2) Access from Ellough Road (east part of the site into existing road network)	0	550	547
Bungay	Site 45/206/209	Land east and west of St Johns Road	634666	288559	Access onto St Johns Road	0	350	470
Halesworth	Site 65	Land north of Holton Road	639609	277608	Access from Hill Farm Road	0	115	811
Halesworth	Site 151/152	Land south of Harrisons Lane	639493	278154	Access from Harrisons Lane and Bungay Road	0	155	861
Halesworth	Site 89	Land west of Lodge Road and North of Bungay Road	640082	277939	Access from Lodge Road	0	15	812
Halesworth	Site 163/203	Land south of Chediston Street	638051	277211	Access from Chediston Street and Roman Way	0	170	862
Halesworth	Site 122	Land north of Old Station Road and east of the railway line	638891	278465	Access from Old Station Road and Norwich Road	0	120	477
Halesworth	Site 140/141	Land north of Old Station Road and west of the railway line	638597	278369	Access from Old Station Road	0	35	477
Southwold & Reydon	Site 189/202 Fountain Way	Land north of Kingfisher Crescent	649496	277625	Access from Copperwheat Avenue (Wangford Road)	0	250	863
Rural Areas	N/A	Various	-	-		0	670	Various
Total						1050	5380	

APPENDIX A-5

SCENARIO 4 DEVELOPMENTS

Town	Site Code	Location	Easting (X)	Northing (Y)	Location Details	Jobs Total	Dwellings Total	SCTM Zone
North Lowestoft	Site 165/166	Yarmouth Road	652904 (165) 653298 (166)	297012 (165) 297258 (166)	Access point from A12 between Rackhams Corner and New Roundabout	1050	1300	855
North Lowestoft	Site 169/180	Land off Hall Lane	652430 (169) 652398 (180)	295094 (169) 294923 (180)	Access off Parkhill	0	200	417
North Lowestoft	Site 17/84	Land off Parkhill	652458 (17) 652648 (84)	295471 (17) 295389 (84)	Access off Parkhill	0	120	417
North Lowestoft	Site 40	Hall Lane, Oulton	651899	294745	Access from Hall Lane	0	80	867
South Lowestoft	Site 34/35	South of The Street, Carlton Colville	651507	289718	Primary access from The Street.	0	400	449
Beccles	Site 24/43/145/156/174	East of Ringsfield Road	641840	288950	Access from London Road	0	700	860
Beccles	Site 44	Land at Sandpit Lane	644693	289293	Access from Manor Close	0	30	461
Beccles	Site 8/9/81/205	South of Nicholson Drive and west of Cucumber Lane	641765	288775	Access from Beccles Southern Relief Road	0	650	864
Bungay	Site 45/206/209	Land east and west of St Johns Road	634666	288559	Access onto St Johns Road	0	350	470
Halesworth	Site 65	Land north of Holton Road	639609	277608	Access from Hill Farm Road	0	115	811
Halesworth	Site 151/152	Land south of Harrisons Lane	639493	278154	Access from Harrisons Lane and Bungay Road	0	155	861
Halesworth	Site 89	Land west of Lodge Road and North of Bungay Road	640082	277939	Access from Lodge Road	0	15	812
Halesworth	Site 163/203	Land south of Chediston Street	638051	277211	Access from Chediston Street and Roman Way	0	170	862
Halesworth	Site 122	Land north of Old Station Road and east of the railway line	638891	278465	Access from Old Station Road and Norwich Road	0	120	477
Halesworth	Site 140/141	Land north of Old Station Road and west of the railway line	638597	278369	Access from Old Station Road	0	35	477
Southwold & Reydon	Site 189/202 Fountain Way	Land north of Kingfisher Crescent	649496	277625	Access from Copperwheat Avenue (Wangford Road)	0	250	863
Rural Areas	N/A	Various	-	-		0	670	Various
Total						1050	5360	

Appendix B

TRIP GENERATION

APPENDIX B-1

DEVELOPMENTS INCLUDED IN ALL SCENARIOS – TRIP GENERATION

Site Code	Location	Dwellings Total	SCTM Zone	AM - Origin Trips	AM - Dest Trips	PM - Origin Trips	PM - Dest Trips
LOW3 DC/15/4547/FUL	Town Hall, offices and car parks, Mariners Street, Lowestoft	8	764	1	3	2	2
LOW4 DC/14/2322/FUL	Council offices, Clapham Road, Lowestoft	9	562	1	3	3	2
LOW6	Neeves Pit, Normanston Drive, Lowestoft	49	582	7	17	15	10
LOW7	Gunton Park, off Old Lane, Lowestoft	60	408	9	21	18	12
LOW9	Monckton Avenue Nursery, Lowestoft	45	419	6	15	14	9
BEC2	Land off Gresham Road, Beccles	28	550	4	10	9	5
BEC3	Land at Cucumber Lane / Oak Lane, Beccles	20	457	3	7	6	4
BUN1 DC/14/4193/OUT	Land west of A144, St John's Road, Bungay	150	470	21	52	46	29
BUN2	Telephone Exchange, Lower Olland Street	8	818	1	3	2	2
BUN3	Community Centre, Upper Olland Street, Bungay	8	818	1	3	2	2
HAL3	Dairy Hill Playing Fields, Halesworth	50	811	7	17	15	10
HAL4	Dairy Farm, Saxons Way, Halesworth	40	809	6	14	12	8
SSP3	Kirkley Waterfront and Sustainable Urban Neighbourhood, Lowestoft	157	589	22	54	48	30
SSP3	Kirkley Waterfront and Sustainable Urban Neighbourhood, Lowestoft	83	431	12	29	25	16
SSP3	Kirkley Waterfront and Sustainable Urban Neighbourhood, Lowestoft	365	856	52	126	112	71
SSP3	Kirkley Waterfront and Sustainable Urban Neighbourhood, Lowestoft	522	857	75	180	160	101
SSP3	Kirkley Waterfront and Sustainable Urban Neighbourhood, Lowestoft	209	858	30	72	64	41
SSP3	Kirkley Waterfront and Sustainable Urban Neighbourhood, Lowestoft	104	859	15	36	32	20
SSP5	Kirkley Rise, Lowestoft	41	441	6	14	13	8
SSP6	Western End of Lake Lothing, Lowestoft	57	431	8	20	17	11
SSP7 DC/15/3748/FUL	Oswald's Boatyard, Lowestoft	80	583	11	28	24	16
SSP8 DC/15/4311/FUL	The Scores, Lowestoft	30	760	4	10	9	6
DC/01/0977/OUT DC/14/1755/ARM DC/14/2515/ARM DC/15/2953/ARM	Woods Meadow, Oulton	556	865	80	191	170	108
DC/01/0977/OUT DC/14/1755/ARM DC/14/2515/ARM DC/15/2953/ARM	Woods Meadow, Oulton	244	866	35	84	75	47
DC/86/0517/OUT	Dunston, Oulton	50	568	7	17	15	10
DC/96/0058/OUT	Carlton Hall Farm, Carlton Colville	124	639	18	43	38	24
DC/05/0540/FUL	Hillside Garage Hillside Road East Bungay NR35 1RX	10	468	1	3	3	2
DC/14/2252/FUL	Carlton Hall Chapel Road Carlton Colville NR33 8AT	33	782	5	11	10	6
DC/14/2046/OUT	Land at Fairview Road and Norwich Road Halesworth	22	477	3	8	7	4
DC/13/0383/FUL	Land at Lodge Road Holton [IP19 8RZ]	11	812	2	4	3	2
DC/12/1105/FUL	Land off Heritage Green Kessingland NR33 7UP	30	465	4	10	9	6
DC/13/2169/FUL	Land adjacent The Nordalls Kessingland	23	463	3	8	7	4
DC/02/0878/FUL	Oulton Broad Caravan Site Saltwater Way Lowestoft	25	431	4	9	8	5
DC/11/0264/FUL	Plots 1-11 Rodber Way Lowestoft	11	416	2	4	3	2
DC/13/0649/OUT	Land off Foxborough Road Lowestoft	50	420	7	17	15	10
DC/13/3638/FUL	Longs Dairy St Margarets Road Lowestoft NR32 4HU	17	413	2	6	5	3
DC/14/2524/ARM	Phase 4 land at Foxborough Road Lowestoft	10	420	1	3	3	2
DC/15/0417/FUL	Tyndale Press, Wollaston Road Lowestoft	15	587	2	5	5	3
DC/03/0366/ARM	Phase 3 Park Meadows Oulton	119	586	17	41	36	23
DC/06/0271/FUL	Service Station Site Mights Road Southwold	13	814	2	4	4	3
DC/15/0213/FUL	Former Worlingham Primary School, Rectory Road Worlingham	15	549	2	5	5	3
DC/15/0712/FUL	Former Meadowlands, Walker Gardens Wrentham	24	475	3	8	7	5
DC/15/3221/OUT	Land rear of 34-48 Old Station Road Halesworth	15	809	2	5	5	3
	Total	3540		507	1219	1083	687

APPENDIX B-2

SCENARIO 1 DEVELOPMENTS – TRIP GENERATION

Town	Site Code	Location	Jobs Total	Dwellings Total	SCTM Zone	AM - Origin Trips	AM - Dest Trips	PM - Origin Trips	PM - Dest Trips
North Lowestoft	Site 165/166	Yarmouth Road	1050	1300	855	460	561	431	412
North Lowestoft	Site 169/180	Land off Hall Lane	0	200	417	29	69	61	39
North Lowestoft	Site 17/84	Land off Parkhill	0	120	417	17	41	37	23
North Lowestoft	Site 40	Hall Lane, Oulton	0	80	867	11	28	24	16
South Lowestoft	Site 34/35	South of The Street, Carlton Colville	0	400	449	57	138	122	78
Beccles	Site 43/156	West of London Road	0	300	860	43	103	92	58
Beccles	Site 8/9/81/82/205	Land north of the Beccles Southern Relief Road	0	550	864	79	189	168	107
Beccles	Site 8/9/81/82/205	Land north of the Beccles Southern Relief Road	0	550	547	79	189	168	107
Bungay	Site 45/206/209	Land east and west of St Johns Road	0	350	470	50	121	107	68
Halesworth	Site 65	Land north of Holton Road	0	115	811	16	40	35	22
Halesworth	Site 151/152	Land south of Harrisons Lane	0	155	861	22	53	47	30
Halesworth	Site 89	Land west of Lodge Road and North of Bungay Road	0	15	812	2	5	5	3
Halesworth	Site 163/203	Land south of Chediston Street	0	170	862	24	59	52	33
Halesworth	Site 122	Land north of Old Station Road and east of the railway line	0	120	477	17	41	37	23
Halesworth	Site 140/141	Land north of Old Station Road and west of the railway line	0	35	477	5	12	11	7
Southwold & Reydon	Site 189/202	Land north of Kingfisher Crescent	0	250	863	36	86	77	48
	Fountain Way								
Rural Areas	N/A	Various	0	670	Various				
		Total	1050	5380		948	1735	1475	1073

APPENDIX B-3

SCENARIO 2 DEVELOPMENTS – TRIP GENERATION

Town	Site Code	Location	Jobs Total	Dwellings Total	SCTM Zone	AM - Origin Trips	AM - Dest Trips	PM - Origin Trips	PM - Dest Trips
North Lowestoft	Site 17/84/169/170/171/181	Land surrounding Union Lane	0	260	855	49	117	104	66
North Lowestoft	Site 17/40/84/169/170/171/181	Land surrounding Union Lane / Hall Lane, Oulton	0	340	417	37	90	80	50
South Lowestoft	South Lowestoft development area	South of Carlton Colville between the A12 and A146	525	750	867	107	258	230	145
South Lowestoft	South Lowestoft development area	South of Carlton Colville between the A12 and A146	525	750	868	107	258	230	145
Beccles	Site 43/156	West of London Road	0	300	860	43	103	92	58
Beccles	Site 8/9/81/82/205	Land north of the Beccles Southern Relief Road	0	550	864	79	189	168	107
Beccles	Site 8/9/81/82/205	Land north of the Beccles Southern Relief Road	0	550	547	79	189	168	107
Bungay	Site 45/206/209	Land east and west of St Johns Road	0	350	470	50	121	107	68
Halesworth	Site 65	Land north of Holton Road	0	115	811	16	40	35	22
Halesworth	Site 151/152	Land south of Harrisons Lane	0	155	861	22	53	47	30
Halesworth	Site 89	Land west of Lodge Road and North of Bungay Road	0	15	812	2	5	5	3
Halesworth	Site 163/203	Land south of Chediston Street	0	170	862	24	59	52	33
Halesworth	Site 122	Land north of Old Station Road and east of the railway line	0	120	477	17	41	37	23
Halesworth	Site 140/141	Land north of Old Station Road and west of the railway line	0	35	477	5	12	11	7
Southwold & Reydon	Site 189/202	Land north of Kingfisher Crescent	0	250	863	36	86	77	48
	Fountain Way								
Rural Areas	N/A	Various	0	670	Various				
Total			1050	5380		674	1622	1441	914

APPENDIX B-4

SCENARIO 3 DEVELOPMENTS – TRIP GENERATION

Town	Site Code	Location	Jobs Total	Dwellings Total	SCTM Zone	AM - Origin Trips	AM - Dest Trips	PM - Origin Trips	PM - Dest Trips
North Lowestoft	Site 165/166	Yarmouth Road	1050	1300	855	186	448	398	252
South Lowestoft	Site 34/35/additional	South of The Street, Carlton Colville	0	800	449	114	276	245	155
Beccles	Site 43/156	West of London Road	0	300	860	43	103	92	58
Beccles	Site 8/9/81/82/205	Land north of the Beccles Southern Relief Road	0	550	864	79	189	168	107
Beccles	Site 8/9/81/82/205	Land north of the Beccles Southern Relief Road	0	550	547	79	189	168	107
Bungay	Site 45/206/209	Land east and west of St Johns Road	0	350	470	50	121	107	68
Halesworth	Site 65	Land north of Holton Road	0	115	811	16	40	35	22
Halesworth	Site 151/152	Land south of Harrisons Lane	0	155	861	22	53	47	30
Halesworth	Site 89	Land west of Lodge Road and North of Bungay Road	0	15	812	2	5	5	3
Halesworth	Site 163/203	Land south of Chediston Street	0	170	862	24	59	52	33
Halesworth	Site 122	Land north of Old Station Road and east of the railway line	0	120	477	17	41	37	23
Halesworth	Site 140/141	Land north of Old Station Road and west of the railway line	0	35	477	5	12	11	7
Southwold & Reydon	Site 189/202	Land north of Kingfisher Crescent	0	250	863	36	86	77	48
	Fountain Way								
Rural Areas	N/A	Various	0	670	Various				
		Total	1050	5380		674	1622	1441	914

APPENDIX B-5

SCENARIO 4 DEVELOPMENTS – TRIP GENERATION

Town	Site Code	Location	Jobs Total	Dwellings Total	SCTM Zone	AM - Origin Trips	AM - Dest Trips	PM - Origin Trips	PM - Dest Trips
North Lowestoft	Site 165/166	Yarmouth Road	1050	1300	855	186	448	398	252
North Lowestoft	Site 169/180	Land off Hall Lane	0	200	417	29	69	61	39
North Lowestoft	Site 17/84	Land off Parkhill	0	120	417	17	41	37	23
North Lowestoft	Site 40	Hall Lane, Oulton	0	80	867	11	28	24	16
South Lowestoft	Site 34/35	South of The Street, Carlton Colville	0	400	449	57	138	122	78
Beccles	Site 24/43/145/156/174	East of Ringsfield Road	0	700	860	100	241	214	136
Beccles	Site 44	Land at Sandpit Lane	0	30	461	4	10	9	6
Beccles	Site 8/9/81/205	South of Nicholson Drive and west of Cucumber Lane	0	650	864	93	224	199	126
Bungay	Site 45/206/209	Land east and west of St Johns Road	0	350	470	50	121	107	68
Halesworth	Site 65	Land north of Holton Road	0	115	811	16	40	35	22
Halesworth	Site 151/152	Land south of Harrisons Lane	0	155	861	22	53	47	30
Halesworth	Site 89	Land west of Lodge Road and North of Bungay Road	0	15	812	2	5	5	3
Halesworth	Site 163/203	Land south of Chediston Street	0	170	862	24	59	52	33
Halesworth	Site 122	Land north of Old Station Road and east of the railway line	0	120	477	17	41	37	23
Halesworth	Site 140/141	Land north of Old Station Road and west of the railway line	0	35	477	5	12	11	7
Southwold & Reydon	Site 189/202	Land north of Kingfisher Crescent	0	250	863	36	86	77	48
	Fountain Way								
Rural Areas	N/A	Various	0	670	Various				
Total			1050	5360		671	1615	1435	910

Appendix C

MATRIX TOTALS

APPENDIX C-1

MATRICES WITH TEMPRO 7.2 & NTM GROWTH

Table C-1 2036 Reference Case matrix compared to 2016 Base Year matrix – AM and PM peak

USER CLASS	BASE YEAR (AM 2016)	REFERENCE CASE (AM 2036)	INCREASE (AM 2016 To 2036)	BASE YEAR (PM 2016)	REFERENCE CASE (PM 2036)	INCREASE (PM 2016 To 2036)
UC1 – Car	52243.0	60618.6	16.0%	47831.9	55666.7	16.4%
UC2 – Car	20244.2	23538.5	16.3%	22063.0	25697.7	16.5%
UC3 – Car	33638.4	39057.2	16.1%	52089.9	60626.9	16.4%
UC4 – LGV	14267.4	22339.4	56.6%	12343.4	19326.8	56.6%
UC5 – HGV	10778.5	13516.1	25.4%	7155.9	8973.4	25.4%
Total	131171.5	159069.8	21.3%	141483.9	170291.5	20.4%

Table C-2 2036 Scenario 1 matrix comparisons – AM peak

USER CLASS	BASE YEAR (AM 2016)	BACKGROUND GROWTH (AM 2016 To 2036)	MODELLED DEVELOPMENT TRIPS (AM 2036)	FINAL MATRIX TOTAL (AM 2036)	REFERENCE CASE (AM 2036)	DIFFERENCE Sc1 vs RC (AM 2036)
UC1 – Car	52243.0	60167.2	2170.2	62337.39	60618.6	1719
UC2 – Car	20244.2	23389.6	841.0	24230.67	23538.5	692
UC3 – Car	33638.4	38770.3	1397.6	40167.84	39057.2	1111
UC4 – LGV	14267.4	22339.4	0.0	22339.38	22339.4	0
UC5 – HGV	10778.5	13516.1	0.0	13516.12	13516.1	0
Total	131171.5	158182.6	4408.8	162591.4	159069.8	3522

Table C-3 2036 Scenario 1 matrix comparisons – PM peak

USER CLASS	BASE YEAR (PM 2016)	BACKGROUND GROWTH (PM 2016 To 2036)	MODELLED DEVELOPMENT TRIPS (PM 2036)	FINAL MATRIX TOTAL (PM 2036)	REFERENCE CASE (PM 2036)	DIFFERENCE Sc1 vs RC (PM 2036)
UC1 – Car	47831.9	55209.4	1693.1	56902.5	55666.7	1236
UC2 – Car	22063.0	25492.9	781.0	26273.9	25697.7	576
UC3 – Car	52089.9	60079.2	1844.1	61923.2	60626.9	1296
UC4 – LGV	12343.4	19326.8	0.0	19326.8	19326.8	0
UC5 – HGV	7155.9	8973.4	0.0	8973.4	8973.4	0
Total	141483.9	169081.7	4318.1	173399.8	170291.5	3108

Table C-4 2036 Scenario 2 matrix comparisons – AM peak

USER CLASS	BASE YEAR (AM 2016)	BACKGROUND GROWTH (AM 2016 To 2036)	MODELLED DEVELOPMENT TRIPS (AM 2036)	FINAL MATRIX TOTAL (AM 2036)	REFERENCE CASE (AM 2036)	DIFFERENCE Sc1 vs RC (AM 2036)
UC1 – Car	52243.0	60167.2	2088.8	62256.0	60618.6	1637
UC2 – Car	20244.2	23389.6	809.5	24199.1	23538.5	661
UC3 – Car	33638.4	38770.3	1345.2	40115.4	39057.2	1058
UC4 – LGV	14267.4	22339.4	0.0	22339.4	22339.4	0
UC5 – HGV	10778.5	13516.1	0.0	13516.1	13516.1	0
Total	131171.5	158182.6	4243.4	162426.0	159069.8	3356

Table C-5 2036 Scenario 2 matrix comparisons – PM peak

USER CLASS	BASE YEAR (PM 2016)	BACKGROUND GROWTH (PM 2016 To 2036)	MODELLED DEVELOPMENT TRIPS (PM 2036)	FINAL MATRIX TOTAL (PM 2036)	REFERENCE CASE (PM 2036)	DIFFERENCE Sc1 vs RC (PM 2036)
UC1 – Car	47831.9	55209.4	1682.0	56891.4	55666.7	1225
UC2 – Car	22063.0	25492.9	775.9	26268.8	25697.7	571
UC3 – Car	52089.9	60079.2	1832.0	61911.2	60626.9	1284
UC4 – LGV	12343.4	19326.8	0.0	19326.8	19326.8	0
UC5 – HGV	7155.9	8973.4	0.0	8973.4	8973.4	0
Total	141483.9	169081.7	4289.9	173371.5	170291.5	3080

Table C-6 2036 Scenario 3 matrix comparisons – AM peak

USER CLASS	BASE YEAR (AM 2016)	BACKGROUND GROWTH (AM 2016 To 2036)	MODELLED DEVELOPMENT TRIPS (AM 2036)	FINAL MATRIX TOTAL (AM 2036)	REFERENCE CASE (AM 2036)	DIFFERENCE Sc1 vs RC (AM 2036)
UC1 – Car	52243.0	60167.2	2170.2	62337.4	60618.6	1719
UC2 – Car	20244.2	23389.6	841.0	24230.7	23538.5	692
UC3 – Car	33638.4	38770.3	1397.6	40167.8	39057.2	1111
UC4 – LGV	14267.4	22339.4	0.0	22339.4	22339.4	0
UC5 – HGV	10778.5	13516.1	0.0	13516.1	13516.1	0
Total	131171.5	158182.6	4408.8	162591.4	159069.8	3522

Table C-7 2036 Scenario 3 matrix comparisons – PM peak

USER CLASS	BASE YEAR (PM 2016)	BACKGROUND GROWTH (PM 2016 To 2036)	MODELLED DEVELOPMENT TRIPS (PM 2036)	FINAL MATRIX TOTAL (PM 2036)	REFERENCE CASE (PM 2036)	DIFFERENCE Sc1 vs RC (PM 2036)
UC1 – Car	47831.9	55209.4	1693.1	56902.5	55666.7	1236
UC2 – Car	22063.0	25492.9	781.0	26273.9	25697.7	576
UC3 – Car	52089.9	60079.2	1844.1	61923.2	60626.9	1296
UC4 – LGV	12343.4	19326.8	0.0	19326.8	19326.8	0
UC5 – HGV	7155.9	8973.4	0.0	8973.4	8973.4	0
Total	141483.9	169081.7	4318.1	173399.8	170291.5	3108

Table C-8 2036 Scenario 4 matrix comparisons – AM peak

USER CLASS	BASE YEAR (AM 2016)	BACKGROUND GROWTH (AM 2016 To 2036)	MODELLED DEVELOPMENT TRIPS (AM 2036)	FINAL MATRIX TOTAL (AM 2036)	REFERENCE CASE (AM 2036)	DIFFERENCE Sc1 vs RC (AM 2036)
UC1 – Car	52243.0	60167.2	2165.4	62332.6	60618.6	1714
UC2 – Car	20244.2	23389.6	839.2	24228.8	23538.5	690
UC3 – Car	33638.4	38770.3	1394.5	40164.8	39057.2	1108
UC4 – LGV	14267.4	22339.4	0.0	22339.4	22339.4	0
UC5 – HGV	10778.5	13516.1	0.0	13516.1	13516.1	0
Total	131171.5	158182.6	4399.1	162581.6	159069.8	3512

Table C-9 2036 Scenario 4 matrix comparisons – PM peak

USER CLASS	BASE YEAR (PM 2016)	BACKGROUND GROWTH (PM 2016 To 2036)	MODELLED DEVELOPMENT TRIPS (PM 2036)	FINAL MATRIX TOTAL (PM 2036)	REFERENCE CASE (PM 2036)	DIFFERENCE Sc1 vs RC (PM 2036)
UC1 – Car	47831.9	55209.4	1693.1	56902.5	55666.7	1236
UC2 – Car	22063.0	25492.9	781.0	26273.9	25697.7	576
UC3 – Car	52089.9	60079.2	1844.1	61923.2	60626.9	1296
UC4 – LGV	12343.4	19326.8	0.0	19326.8	19326.8	0
UC5 – HGV	7155.9	8973.4	0.0	8973.4	8973.4	0
Total	141483.9	169081.7	4318.1	173399.8	170291.5	3108

APPENDIX C-2

FINAL MATRICES WITH FUEL & INCOME FACTOR ADJUSTMENTS

Table C-10 2036 Reference Case with fuel and income factor adjustments – AM peak & PM peak

USER CLASS	REFERENCE CASE (AM 2036)	REFERENCE CASE WITH F & I ADJ (AM 2036)	INCREASE (AM 2036)	REFERENCE CASE (PM 2036)	REFERENCE CASE WITH F & I ADJ (PM 2036)	INCREASE (PM 2036)
UC1 – Car	60618.6	65165.0	7.5%	55666.7	59841.7	7.5%
UC2 – Car	23538.5	25303.9	7.5%	25697.7	27625.0	7.5%
UC3 – Car	39057.2	41986.5	7.5%	60626.9	65173.9	7.5%
UC4 – LGV	22339.4	22339.4	0.0%	19326.8	19326.8	0.0%
UC5 – HGV	13516.1	13516.1	0.0%	8973.4	8973.4	0.0%
Total	159069.8	168310.9	5.8%	170291.5	180940.9	6.3%

Table C-11 2036 Scenario 1 with fuel and income factor adjustments – AM peak & PM peak

USER CLASS	REFERENCE CASE (AM 2036)	REFERENCE CASE WITH F & I ADJ (AM 2036)	INCREASE (AM 2036)	REFERENCE CASE (PM 2036)	REFERENCE CASE WITH F & I ADJ (PM 2036)	INCREASE (PM 2036)
UC1 – Car	62337.4	67012.7	7.5%	56902.5	61170.2	7.5%
UC2 – Car	24230.7	26048.0	7.5%	26273.9	28244.4	7.5%
UC3 – Car	40167.8	43180.4	7.5%	61923.2	66567.5	7.5%
UC4 – LGV	22339.4	22339.4	0.0%	19326.8	19326.8	0.0%
UC5 – HGV	13516.1	13516.1	0.0%	8973.4	8973.4	0.0%
Total	162591.4	172096.6	5.8%	173399.8	184282.2	6.3%

Table C-12 2036 Scenario 2 with fuel and income factor adjustments – AM peak & PM peak

USER CLASS	REFERENCE CASE (AM 2036)	REFERENCE CASE WITH F & I ADJ (AM 2036)	INCREASE (AM 2036)	REFERENCE CASE (PM 2036)	REFERENCE CASE WITH F & I ADJ (PM 2036)	INCREASE (PM 2036)
UC1 – Car	62256.0	66925.2	7.5%	56891.4	61158.3	7.5%
UC2 – Car	24199.1	26014.1	7.5%	26268.8	28239.0	7.5%
UC3 – Car	40115.4	43124.1	7.5%	61911.2	66554.5	7.5%
UC4 – LGV	22339.4	22339.4	0.0%	19326.8	19326.8	0.0%
UC5 – HGV	13516.1	13516.1	0.0%	8973.4	8973.4	0.0%
Total	162426.0	171918.8	5.8%	173371.5	184251.9	6.3%

Table C-13 2036 Scenario 3 with fuel and income factor adjustments – AM peak & PM peak

USER CLASS	REFERENCE CASE (AM 2036)	REFERENCE CASE WITH F & I ADJ (AM 2036)	INCREASE (AM 2036)	REFERENCE CASE (PM 2036)	REFERENCE CASE WITH F & I ADJ (PM 2036)	INCREASE (PM 2036)
UC1 – Car	62337.4	67012.7	7.5%	56902.5	61170.2	7.5%
UC2 – Car	24230.7	26048.0	7.5%	26273.9	28244.4	7.5%
UC3 – Car	40167.8	43180.4	7.5%	61923.2	66567.5	7.5%
UC4 – LGV	22339.4	22339.4	0.0%	19326.8	19326.8	0.0%
UC5 – HGV	13516.1	13516.1	0.0%	8973.4	8973.4	0.0%
Total	162591.4	172096.6	5.8%	173399.8	184282.2	6.3%

Table C-14 2036 Scenario 4 with fuel and income factor adjustments – AM peak & PM peak

USER CLASS	REFERENCE CASE (AM 2036)	REFERENCE CASE WITH F & I ADJ (AM 2036)	INCREASE (AM 2036)	REFERENCE CASE (PM 2036)	REFERENCE CASE WITH F & I ADJ (PM 2036)	INCREASE (PM 2036)
UC1 – Car	62332.6	67007.6	7.5%	56902.5	61166.0	7.5%
UC2 – Car	24228.8	26046.0	7.5%	26273.9	28242.5	7.5%
UC3 – Car	40164.8	43177.1	7.5%	61923.2	66562.9	7.5%
UC4 – LGV	22339.4	22339.4	0.0%	19326.8	19326.8	0.0%
UC5 – HGV	13516.1	13516.1	0.0%	8973.4	8973.4	0.0%
Total	162581.6	172086.1	5.8%	173399.8	184271.5	6.3%

Appendix D

GENERALISED COSTS

Table D-1 Generalised cost parameters 2036 – Pence per Minute (PPM)

VEHICLE CLASS	AM PEAK	INTERPEAK	PM PEAK
Car Work	67.62	66.32	65.05
Car Commuting	19.88	19.75	19.56
Car Others	24.41	25.34	26.29
LGV	30.87	30.87	30.87
HGV	62.54	62.54	62.54

Table D-2 Generalised Cost Parameters 2031 – Pence per KM (PPK)

VEHICLE CLASS	AM PEAK	INTERPEAK	PM PEAK
Car Work	11.92	11.92	11.92
Car Commuting	5.17	5.17	5.17
Car Others	5.17	5.17	5.17
LGV	12.93	12.93	12.93
HGV	58.57	59.86	63.07

Appendix E

V/C RESULTS

Comparison of Junction V/C by worst performing arm

Node Number	Description	Location	Type	AM Peak											
				BY		RC		Sce1		Sce2		Sce3		Sce4	
				V/C	Flow	V/C	Flow	V/C	Flow	V/C	Flow	V/C	Flow	V/C	Flow
3000	Bloodmoor Roundabout	South Lowestoft	1	74.11	487	101.56	269	105.18	270	102.41	294	106.93	263	105.19	271
1200	B1532 London Road S / Mill Road	South Lowestoft	2	61.35	338	81.94	292	92.48	329	91.87	327	92.32	328	92.72	329
2020	A146 Beccles Road / Hollow Grove Way	South Lowestoft	2	33.06	166	61.82	291	93.3	388	85.33	340	98.86	399	93.41	387
5340	Tower Road / Cooke Road	South Lowestoft	2	72.46	514	94.39	660	97.61	677	80.08	505	97.77	678	97.63	677
6314	A12 Tom Crisp Way / Blackheath Road	South Lowestoft	2	88.59	143	89.12	124	97.05	137	100	124	97.57	137	98.74	136
2030	A146 Bridge Road / Cottmer Road	South Lowestoft	3	86.63	261	72.96	229	78.38	760	80.84	784	81.53	791	78.73	764
3228	A12 at Wrentham	Rural (at Wrentham)	3	51.85	119	100.17	157	104.8	155	104.31	155	104.93	156	104.91	155
3328	A12 / A145	Rural (North of Blythburgh)	3	59.81	186	99.98	246	104.29	238	104.04	235	104.41	238	104.26	242
5896	A1117 Bridge Road / Bridge Road (to Oulton Broad South)	South Lowestoft	3	39.15	775	41.23	814	50.74	1001	51.4	1014	52.14	1029	50.9	1004
7080	A1117 Millenium Way / Grasmere Drive	North Lowestoft	3	81.67	94	82.56	106	84.55	106	84.21	101	84	108	84.6	106
2823	A145 Blyburgate / A145 Peddars Lane	Beccles	4	77.54	394	88.15	465	91.96	510	92.42	520	91.97	509	91.29	489
2851	A146 Norwich Road / Loddon Road	Beccles	4	53.78	264	91.9	398	97.77	413	98.15	412	97.49	410	97.44	412
4010	Waveney Drive / Durban Road / Riverside Road	South Lowestoft	4	55.66	416	72.82	308	97.57	225	97.4	223	98.54	224	97.7	225
1020	A12 Bloodmoor Rd / London Road Pakefield / Arbor Lane / Tower Road	South Lowestoft	5	53.72	240	73.42	304	82.72	753	88.28	879	84.02	752	82.69	752
2820	A145 / Ashman's Road / Frederick's Rd	Beccles	5	69.21	366	79.35	394	87.04	398	87.14	386	86.94	393	86.79	414
2840	Gosford Road / Grove Road	Beccles	5	42.65	236	56.7	286	67.43	333	69.37	331	67.41	333	62.73	306
2845	George Westwood Way / Common Lane N	Beccles	5	63.04	250	83.21	283	90.32	290	91.54	299	90.11	287	91.08	296
2855	A146 Norwich Road / A143 Yarmouth Road	Beccles	5	57.73	894	75.46	1139	86.64	1264	87.61	1274	86.57	1259	86.05	1256
4000	A12 Horn Hill / Mill Rd / Kirkley Rise / Asda Access	South Lowestoft	5	69.73	1029	55.34	757	63.69	827	65.04	851	63.89	831	63.67	827
4030	Victoria Road / Colville Road	South Lowestoft	5	35.78	280	59.9	580	55.92	474	57.91	481	55.19	468	55.86	475
6010	A12 Waveney Road / A12 Station Square / Station Square	North Lowestoft	5	90.52	689	87.18	664	90.82	691	91.52	697	90.88	692	90.83	691
6220	A12 Yarmouth Road / Holingsworth Road	North Lowestoft	5	40.31	216	63.96	308	69.84	312	63.69	311	69.96	312	69.85	312
10234	A12 Yarmouth Road / A12 Foxburrow Hill / Weston Road	North Lowestoft	5	45.98	201	65.67	249	73.13	235	61.39	227	71.94	235	73.13	235

Node Number	Description	Location	Type	PM Peak											
				BY		RC		Sce1		Sce2		Sce3		Sce4	
				V/C	Flow	V/C	Flow	V/C	Flow	V/C	Flow	V/C	Flow	V/C	Flow
3000	Bloodmoor Roundabout	South Lowestoft	1	65.48	462	102.04	122	108.79	135	106.05	158	109.44	144	109.43	138
1200	B1532 London Road S / Mill Road	South Lowestoft	2	66.35	339	89	471	102.73	546	98.71	615	102.67	530	103.12	531
2020	A146 Beccles Road / Hollow Grove Way	South Lowestoft	2	62.08	184	93.53	194	101.71	214	102.68	226	102.45	210	101.93	216
5340	Tower Road / Cooke Road	South Lowestoft	2	101.94	663	131	837	138	888	140.57	855	137.98	897	137.6	891
6314	A12 Tom Crisp Way / Blackheath Road	South Lowestoft	2	90.73	276	93.7	282	103.94	315	101.53	302	103.98	315	104.31	316
2030	A146 Bridge Road / Cottmer Road	South Lowestoft	3	98.15	376	102.58	392	105.38	404	106.41	410	106.23	409	105.66	405
3228	A12 at Wrentham	Rural (at Wrentham)	3	39.5	123	66.99	160	74.98	169	75.5	171	74.31	168	74.9	169
3328	A12 / A145	Rural (North of Blythburgh)	3	43.24	182	69.94	151	83.12	174	85.7	177	83.66	176	83.88	176
5896	A1117 Bridge Road / Bridge Road (to Oulton Broad South)	South Lowestoft	3	46.7	923	100.05	628	101.25	433	101.96	429	101.7	428	101.26	428
7080	A1117 Millenium Way / Grasmere Drive	North Lowestoft	3	85.57	351	95.49	416	100.31	458	97.25	403	100	461	100.34	460
2823	A145 Blyburgate / A145 Peddars Lane	Beccles	4	83.17	380	89.37	441	92.45	448	92.43	449	92.27	448	92.68	428
2851	A146 Norwich Road / Loddon Road	Beccles	4	53.29	874	84.83	325	91.62	311	91.44	314	91.69	314	93.47	324
4010	Waveney Drive / Durban Road / Riverside Road	South Lowestoft	4	58.24	416	80.75	981	91.33	1061	90.6	1035	91.72	1053	91.51	1062
1020	A12 Bloodmoor Rd / London Road Pakefield / Arbor Lane / Tower Road	South Lowestoft	5	51.1	401	64.13	281	83.83	343	90.61	406	85.11	348	85.58	348
2820	A145 / Ashman's Road / Frederick's Rd	Beccles	5	63.49	301	77.75	113	90.26	363	90.31	364	89.74	360	94.64	402
2840	Gosford Road / Grove Road	Beccles	5	59.18	198	82.14	241	92.18	239	91.81	239	91.96	236	92.45	247
2845	George Westwood Way / Common Lane N	Beccles	5	35.04	153	39.29	117	48.51	131	55.59	150	48.44	131	48.75	127
2855	A146 Norwich Road / A143 Yarmouth Road	Beccles	5	71.12	1088	91.08	1347	90.73	1335	90.28	1326	90.97	1343	89.75	1320
4000	A12 Horn Hill / Mill Rd / Kirkley Rise / Asda Access	South Lowestoft	5	55.18	870	60.67	341	81.11	378	94.78	377	79.25	376	78.53	377
4030	Victoria Road / Colville Road	South Lowestoft	5	50.64	395	59.41	401	92.81	453	91.68	473	93.67	465	92.74	454
6010	A12 Waveney Road / A12 Station Square / Station Square	North Lowestoft	5	61.71	470	53.74	818	58.72	894	57.78	880	58.93	897	58.71	894
6220	A12 Yarmouth Road / Holingsworth Road	North Lowestoft	5	47.52	240	85.08	377	92.71	366	83.12	356	92.65	364	92.73	366
10234	A12 Yarmouth Road / A12 Foxburrow Hill / Weston Road	North Lowestoft	5	67.38	225	87.21	214	93.42	163	83.41	183	93.42	164	93.51	163

Type	Description
1	100%+ both peaks
2	100%+ in one peak / 90-99% in other peak
3	100%+ in one peak / Less than 90% in other peak
4	90-99% in both peaks
5	90-99% in one peak / Less than 90% in the other peak