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Modelling Highway Impacts of Local Plan Developments in Malton, Norton and Pickering

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Contents

1	**Introduction**	**1**
1.1	Overview	1
1.2	Aim of Study	2
1.3	Report Structure	2
2	**Malton and Norton Base Highway Model**	**3**
2.1	Base Highway Model History	3
2.2	Interim Forecast Model 2014	4
3	**Traffic Growth and Forecasting**	**7**
3.1	Overview	7
3.2	Forecast Growth Methodology	7
3.3	Growth Factors – Malton and Norton (Cars)	8
3.4	HGV Growth Factors	9
3.5	Growth Factors – Pickering	9
4	**Development Sites**	**11**
4.1	Introduction	11
4.2	Committed Development Sites	11
4.3	Local Plan Development Sites	11
4.4	Development Trip Generation	12
4.5	Local Plan Development Scenarios	15
4.6	Development Trip Distribution	17
4.7	Highway Network Changes	18
5	**The Effect of Local Plan Development Traffic at Key Junctions**	**19**
5.1	Introduction	19
5.2	Interpretation of Results	20
5.3	Analysis of Results – Malton and Norton	20
5.4	Butcher Corner	22
5.5	Analysis of Results – Pickering	22
6	**Junction Improvements for Over Capacity Junctions**	**24**
6.1	Introduction	24
6.2	Welham Road / Church Street	24
6.3	Railway Street / Yorkersgate	24
6.4	Broughton Road / Mount Crescent Junction	25
6.5	Wold Street / Commercial Street	25
6.6	Mill Street	25
6.7	Westfield Way	26
6.8	Hugden Way Link Road	26
6.9	Complementary Measures - Butcher Corner	27
6.10	Reassessment of Mitigated Junctions in Malton & Norton	27
6.11	Vivis Lane Junction Improvements in Pickering	29

6.12 Reassessment of Mitigated Junctions in Pickering 30

7 Summary & Conclusion 31

7.1 Summary 31

7.2 Development Sites 31

7.3 Mitigation Measures 32

7.4 Scenario Testing Results 32

7.5 Conclusion 33

Tables

Figure 2-1 – Assessed Junctions Location Plan 4
Table 2-1 DfT WebTAG Validation Criteria 5
Table 2-2 2014 Validation Results 6
Table 2-3 2014 Journey Time Validation Results 6
Table 3-1 Final Malton & Norton Growth Factors 9
Table 3-2 Final Pickering Growth Factors 9
Table 4-1 Committed Development Sites 11
*-estimated from a site footprint of 0.73ha, assuming 40% build-out density 11
Table 4-2 Local Plan Development Sites – Malton and Norton 12
Table 4-3 Local Plan Development Sites – Pickerng 12
Table 4-4 Committed Development Trip Generation (AM Peak) 13
Table 4-5 Local Plan Car Trip Generation – Malton & Norton Sites 14
Table 4-6 Local Plan Car Trip Generation – Pickering Sites 14
Table 4-7 Local Plan Development Scenarios – Malton and Norton 16
Table 4-8 Local Plan Development Scenarios - Pickering 16
Table 4-9 Trips Generated by Malton and Norton Local Plan Development Scenarios 17
Table 4-10 Trips Generated by Pickering Local Plan Development Scenarios 17
Table 4-11 Highway Schemes likely to be delivered by Local Plan year end 2027 18
Table 5-1 Assessed Junctions 19
Figure 5-1 Assessed Junctions Malton and Norton – Location Plan 19
Table 5-2 Junction Assessment Results – Malton and Norton 21
Table 5-3 Junction Assessment Results – Pickering 22
Table 6-1 Junction Assessment Results – Malton & Norton with Mitigation 28
Table 6-2 Junction Assessment Results Summary – Malton & Norton – Maximum RFC Values 29
Table 6-3 Junction Assessment Results – Pickering with Mitigation 30
Table 6-4 Junction Assessment Results Summary – Pickering – Maximum RFC Values 30

Figures

Figure 2-1 – Assessed Junctions Location Plan 4
Figure 5-1 Assessed Junctions Malton and Norton – Location Plan 19

1 Introduction

1.1 Overview

1.1.1 The Ryedale Plan consists of two elements: the Local Plan Strategy (LPS) and accompanying site allocation documents. The LPS was adopted in September 2013 and sets out strategic policies to shape spatial and economic development to 2027. It includes setting the settlement hierarchy and the level and type of new developments across Ryedale, in particular the major settlement centres of Malton, Norton and Pickering, which are the focus of this study.

1.1.2 Previous modelling work to evidence the Local Plan Strategy (LPS) was undertaken in 2010, and is set out in the Malton and Norton Strategic Transport Assessment (STA)[1] and Addendum (June/October 2010). It assessed various groups of potential sites at a strategic level, examining the impacts on key sensitive junctions and recommending potential improvements to provide additional capacity for the increase in development related traffic.

1.1.3 The conclusions of the 2010 STA informed the choice of strategic patterns of development in Malton and Norton through the LPS – essentially that a spread of sites in Malton and Norton could be accommodated on the highway network if a number of internal highway junction improvements were put in place.

1.1.4 The results and recommendations of this and the previous 2010 study are supported, in part, by outputs from the Malton and Norton strategic transport model, which enables development impacts and proposed transport solutions on the highway network, to be thoroughly scrutinised. Pickering has not been modelled for this purpose previously and therefore for this study, the results are informed by other analytical methods described within this report.

1.1.5 The Council is now advancing its site allocation document known as the Local Plan Sites Document (LPSD). This will allocate specific sites principally for residential and employment purposes across the District[2] in line with the Local Plan Strategy.

1.1.6 The local highway network needs to be assessed to ensure that in the future it remains able to cope with the additional traffic associated with different combinations of potential new Local Plan developments. It also needs to take into account committed development since the last work was undertaken. Where the evidence suggests this is not the case, measures will be considered to mitigate the impacts, upon criteria such as congestion and air quality.

1 Malton and Norton Strategic Transport Assessment – Documents TE5/TE6
http://www.ryedaleplan.org.uk/local-plan-strategy/local-plan-strategy-examination
2 Excluding Helmsley which is covered by the Helmsley Plan which is currently at Examination.

1.2 Aim of Study

1.2.1 This document seeks to provide evidence on the prospective highway impacts of development proposals in the Malton, Norton and Pickering areas, within the Local Plan period to the year 2027.

1.2.2 The purpose of the analysis is to examine the overall impact of development in terms of travel demands and network performance, with a view to identifying the need for potential mitigation measures and junction improvements to complement the growth strategy and ensure its sustainability in support of the plan objectives of the Local Plan Strategy.

1.2.3 The analysis is an essential element of the evidence base underpinning the preparation and justification of site allocations that will be identified in the Local Plan Sites Document. Key considerations during the study are:

- Identification of any major constraints on the local roads network as a result of Local Plan proposals.
- Assessment of any improvement measures to support the above.
- Provide feedback and allow for consultation between key stakeholders, including Ryedale District Council, North Yorkshire County Council (as the Local Highway Authority), and the Highways Agency (for impacts upon the A64 trunk road).
- Provide a transport evidence base to aid development of a robust developer contributions funding mechanism, to deliver the transport infrastructure to support the Local Plan.

1.3 Report Structure

1.3.1 The remainder of this report is structured as follows:

- Chapter 2 details the base traffic model utilised for the study.
- Chapter 3 details the forecasting methodology.
- Chapter 4 details the Local Plan development sites modelled.
- Chapter 5 contains the results of the junction assessments.
- Chapter 6 discusses further junction assessments should improvements be put in place.
- Chapter 7 contains the impacts on the strategic road network cross boundary traffic, network statistics and network utilisation.
- Chapter 8 presents the final summary and conclusion.

2 Malton and Norton Base Highway Model

2.1 Base Highway Model History

2.1.1 The development of the Malton and Norton traffic model was originally commissioned by North Yorkshire County Council (NYCC) in 2004 to assess the transport implications of strategic developments and packages of transport improvements on the existing highway network.

2.1.2 The model was built using SATURN software, which is capable of modelling both the impacts of new development and proposed transport improvements both on the overall highway network and at individual roads and junctions.

2.1.3 The traffic model covers the majority of the built-up area of Malton and Norton, to the extent of, and including, the A64 along the northern edge of the town. Key routes through the town are represented, including the B1248 York Road, B1258 Scarborough Road, B1257 Broughton Road and B1248 Beverley Road.

2.1.4 As part of the initial model development, an extensive data collection exercise was undertaken in 2004 to include roadside interview surveys, manual and automatic link flow counts and junction turning counts.

2.1.5 The data collected was used to calibrate and validate the 2004 base year model for the AM (0800-0900hrs) and PM (1700-1800hrs) peak periods and an averaged inter-peak period between 0900-1700hrs.

2.1.6 The 2004 base model was subsequently revalidated by Jacobs to a base year of 2008, in preparation for assessing the impacts of the Ryedale Local Development Framework plan, to the year 2026. In this case, the AM peak – the busier of the two periods – was chosen to produce a robust assessment.

2.1.7 Following revalidation of the base model to 2008, the following studies were commissioned and completed:

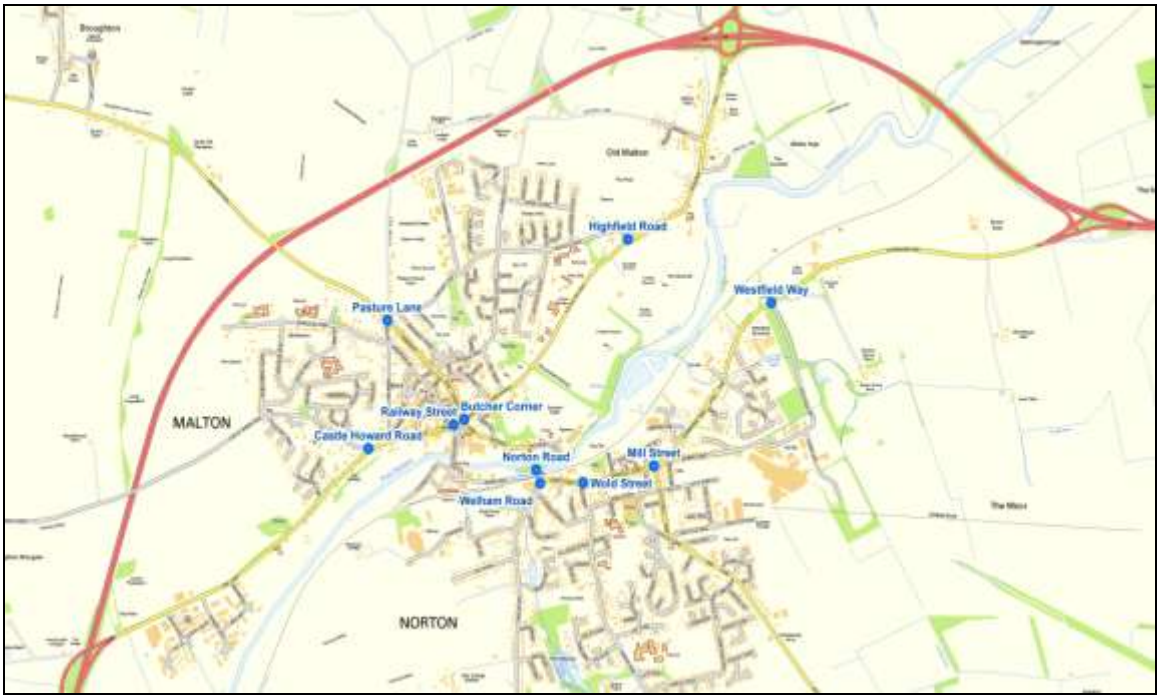
- Brambling Fields and Butcher Corner restrictions.
- Malton and Norton Transportation Review and Strategy.
- Malton and Norton Service Centre Transport Strategy.
- Malton and Norton Strategic Transport Assessment.

2.2 Interim Forecast Model 2014

2.2.1 To provide further confidence of its ability to replicate more recent traffic flows, the Malton and Norton highway model was volumetrically updated from its base year of 2008 to the interim forecast year of 2014. This would ensure a platform to develop robust forecast models of development and transport packages and their impacts upon key junctions and the wider highway network.

2.2.2 Traffic count surveys were carried out in May 2014 at key locations across the Malton and Norton area for the purposes of revalidating the base model to the interim forecast year of 2014. Figure 2-1 below shows their locations.

Figure 2-1 – Assessed Junctions Location Plan



2.2.3 The updated traffic counts were analysed to assess the most appropriate time period to model development and transport packages in the forecast year 2027. The criteria for assessment were overall traffic volumes at the key junctions in Malton and Norton. The outcome indicated that whilst there was some variation on a junction-by-junction basis, there was a tendency towards the AM peak being marginally the busier time period. Given this was also the period modelled in the previous Malton and Norton Strategic Transport Assessment, the AM peak was deemed suitable to be taken forward for this study.

2.2.4 The SATURN model network was checked against significant highway improvement schemes completed between 2008 and 2014, to ensure the network was as accurate as currently possible. Upon completion of this exercise, the A64 eastbound off-slip at Brambling Fields scheme was included as part of the 2014 interim forecast network.

2.2.5 Traffic demand in the model was generated in two ways: by applying National Trip End Model[3] (NTEM) and National Transport Model[4] (NTM) growth factors to car and HGV trips in the 2008 base matrix, respectively, and by explicitly modelling the demand of key developments in the detailed model area completed between 2008 and 2014.

2.2.6 From a supplied list of developments completed between 2008 and 2014, only one had trip-generation significant enough to warrant its explicit modelling. The methodology for this is detailed in Section 3. The development in question is Bells Yard, Scarborough Road, 218 residential dwellings.

2.2.7 NTEM growth factors between 2008 and 2014 were produced for cars from TEMPRO[5] software at the model zone and county level. To avoid the double counting of trips, the Ryedale growth factor was factored down to account for the explicitly modelled development at Bells Yard. This was achieved by amending the planning assumption data within TEMPRO to generate the revised figure.

2.2.8 NTM growth factors between 2008 and 2014 were applied to the HGV demand matrix using datasets for large urban areas in the Yorkshire and Humber region.

2.2.9 Forecast fuel price and income adjustment factors[6], from 2008 to 2014, were applied to the TEMPRO adjusted car and HGV demand matrices, to produce the final 'prior' interim forecast matrices.

2.2.10 A process of matrix estimation was used to accurately calibrate the 2014 forecast demand matrices against the AM peak count data. This was conducted using the SATURN software suite.

The new AM peak demand matrices created through the matrix estimation process were re-assigned process were re-assigned to the SATURN network and the modelled flows compared against compared against corresponding observed count data, to ensure they met the WebTAG WebTAG minimum validation criteria[7] for link flows. Table 2-1 and

2.2.11 Table 2-2 show the criteria and validation results, respectively.

Table 2-1 DfT WebTAG Validation Criteria

Link Flow Criteria	% of Cases	Acceptability Guideline	GEH Statistic
Individual Link Flows < 700 veh/hr	> 85% of cases	± 100 vehicles	< 5
Individual Link Flows 700 – 2700 veh/hr		± 15%	< 5
Individual Link Flows > 2700 veh/hr		± 400 vehicles	< 5

[3] The National Trip End Model (NTEM) forecasts and the TEMPro (Trip End Model Presentation Program) software are used for transport planning purposes. The forecasts include population, employment, households by car ownership, trip ends and simple traffic growth factors based on data from the National Transport Model (NTM).

[4] The National Transport Model (NTM) provides a systematic means of comparing the national consequences of alternative 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.

[5] Trip End Model Presentation Program

[6] WebTAG Data Book, Table M4.2.1, May 2014

[7] WebTAG Unit M3-1 Highway Assignment Modelling, Table 2, October 2013

Table 2-2 2014 Validation Results

All Link Calibration Sites (10 sites, 72 counts)	Car	Total Vehicles
No. within DMRB Flow criteria	72	72
No. within GEH of 5	70	69
% within DMRB Flow criteria	100%	100%
% within GEH of 5	97%	96%

2.2.12 As well as ensuring modelled traffic counts match observed counts as closely as possible, it is also crucial that traffic delays are accurately represented. To achieve this, updated journey time surveys were carried out during the AM peak along two key routes in Malton and Norton.

2.2.13 The observed journey times were then compared with the equivalent modelled times for the same route and, if any fell outside of minimum WebTAG compliancy, adjustments were made to the model network to bring them into back into line, whilst also ensuring link flow validation was maintained.

2.2.14 The minimum criteria for compliancy is that modelled end-to-end journey times should be within 15%, or one minute, of the corresponding observed times, in at least 85% of cases. Table 2-3 shows the results of the journey time revalidation.

Table 2-3 2014 Journey Time Validation Results

Route	Observed Time (s)	Modelled Time (s)	Diff. (s)	% Diff.	WebTAG Compliant
York Rd to Old Malton Rd	448	413	35	8	**Pass**
Old Malton Rd to York Rd	379	319	60	16	**Pass**
Broughton Rd to Scarborough Rd	519	457	62	12	**Pass**
Scarborough Rd to Broughton Rd	552	536	16	3	**Pass**

2.2.15 The results in Table 2.2 and Table 2.3 show that the 2014 interim forecast year model is WebTAG compliant and provides a robust representation of 2014 traffic flows and journey times in Malton and Norton.

2.2.16 The 2014 interim forecast year model is therefore suitable for use as a base for forecasting and future testing of the Local Plan development traffic in 2027.

3 Traffic Growth and Forecasting

3.1 Overview

3.1.1 This section describes the methodology and assumptions used for forecasting traffic growth between the interim forecast year model (2014) and the future year model (2027).

3.1.2 The Ryedale Plan covers the period to the year 2027. It was agreed, therefore, that this would also determine the forecast modelling year, to ensure a thorough impact of built-out development on the highway network, by the end of that period.

3.1.3 This assessment required factoring the 2014 interim forecast model to a 2027 model to represent the forecast growth in background traffic. This was calculated using the Department for Transport's Trip End Model presentation PROgram (TEMPRO) for cars, and the National Traffic Model (NTM), for HGV's.

3.1.4 Forecasting entails a degree of uncertainty. WebTAG Unit M4: Forecasting and Uncertainty (May 2014), stipulates the use of a Core planning scenario and alternative High and Low Growth scenarios, with respect to appraising a specific transport scheme. Whilst not directly relevant to this study, it is still prudent to assess a number of strategic forecast scenarios, with a mix of development options, and potential highway mitigation measures, to ensure the network is thoroughly stress tested.

3.1.5 A Baseline 2027 forecast was established for background traffic growth and committed development sites in Ryedale, i.e. minus any Local Plan development options. This would enable comparisons of traffic volumes and junction performance against the Baseline, once the Local Plan scenarios were plugged into the forecast model.

3.2 Forecast Growth Methodology

3.2.1 The methodology used for developing forecast traffic flows for 2027 involves developing three trip matrices which when added together will form the total amount of traffic likely to be present. These matrices are

- Background traffic growth (not related to any development trips)
- Committed development trips
- Local Plan development trips

3.2.2 DfT guidance states that the total growth between the 2014 model and the 2027 full development model should be no more than the traffic growth dictated by TEMPRO. This has been achieved for the total amount of traffic likely to be present in 2027.

3.2.3 Traffic growth forecasts from TEMPRO take into account changes to car ownership, income, population and jobs, at a national, regional and local level. As local development planning forms an integral part of this base data, it is necessary to remove any TEMPRO growth associated with it, so as to avoid the double-counting of development trips. This adjusted growth is known as the background traffic growth.

3.2.4 The background growth demand is added to the committed development trips to get the Baseline demand matrix. This represents the minimum level of traffic growth in the forecast year and does not include any Local Plan development trips.

3.2.5 Development trip only demand matrices are developed for each of the Local Plan scenarios, with each one added to the Baseline demand matrix to create separate full growth forecast matrices representing each scenario. This allows comparison of the highway impacts of the Local Plan scenarios against the equivalent Baseline, for the 2027 AM peak period.

3.2.6 Heavy Goods Vehicles (HGVs) were considered separately from cars and used growth factors derived from the National Travel Model (NTM) for Yorkshire and Humber. These are considered to be more representative of the longer distances that HGVs usually travel, than similar figures from TEMPRO. The methodology for deriving Baseline and Local Plan demand matrices is the same as for light vehicles.

3.3 Growth Factors – Malton and Norton (Cars)

3.3.1 Growth factors were obtained from the default planning assumptions in TEMPRO between the forecast years 2014-2027, for four specific NTEM zones, or aggregation of zones. These were:

- Norton and Malton – 36UF1
- North Yorkshire – County area
- Humberside – County area
- Yorkshire/Humber – Regional area

3.3.2 Each NTEM zone, county or region, represented a zone in the Malton and Norton Highway model. Those for county or regional areas represent the external zones, or those zones where traffic originates or travels to, outside of Malton and Norton.

3.3.3 The default TEMPRO planning assumptions were adjusted to account for the number of households predicted in the 2027 forecast year. This was informed by the committed and proposed Local Plan developments within Ryedale to be explicitly modelled and, therefore, not part of general background traffic growth.

3.3.4 Planning adjustments were not carried out to the combined areas of North Yorkshire, Humberside and Yorkshire/Humberside as these were considered external to the detailed study area of Malton and Norton. Background traffic growth for these areas, therefore, was unadjusted from 2014 to 2027.

3.3.5 Both unadjusted and adjusted TEMPRO growth factors were then fine-tuned to account for future fuel cost changes and income growth between 2014 and

2027. The factors come from Table 4.2.1 of the WebTAG Data Book (May 2014) which can be accessed at: https://www.gov.uk/transport-analysis-guidance-webtag.

3.3.6 Table 3-1 shows the final growth factors applied to the 2014 AM peak matrix for cars, to generate the background demand for the 2027 Baseline Forecast. Committed development trips would subsequently be added to this demand and Local Plan trips on top of that, for those modelling scenarios.

Table 3-1 Final Malton & Norton Growth Factors

TEMPRO Area	Growth Factor	Income Factor	Fuel Factor	Final Growth Factor
Norton & Malton	1.3087	1.0324	1.0627	1.4357
North Yorkshire	1.0850	1.0324	1.0627	1.1904
Humberside	1.07565	1.0324	1.0627	1.1801
Yorks/Humber	1.1185	1.0324	1.0627	1.2271

3.4 HGV Growth Factors

3.4.1 LGV and HGV growth factors were taken from the DfT's National Trip End Model (NTM) developed in 2013. This provides growth factors for all vehicle types on either a regional basis or by road classification.

3.5 Growth Factors – Pickering

3.5.1 The Malton and Norton traffic model does not cover Pickering. Instead, the effect of background and development-led traffic growth in Pickering was based around two key junctions in the town centre, for which turning count data was collected, at the same time as the survey counts were carried out in Malton and Norton. These junctions are:

- A170/A169 roundabout
- A170/The Ropery/Vivis Lane signalised junction

3.5.2 It is acknowledged there is planning history associated with the two junctions in Pickering, notably the Lidl application and subsequent development of that site, at the A170/Vivis Lane/Ropery junction. A condition of that application was the introduction of a MOVA based signal system.

3.5.3 Growth factors, between 2014 and 2027 were derived by data from the National Travel Model (NTM) database, and adjusted by local and regional TEMPRO growth factors, as shown in Table 3-2. This was to ensure a more robust figure than from TEMPRO alone, given the lack of a traffic model for Pickering.

Table 3-2 Final Pickering Growth Factors

Mode	Pickering		Yorkshire & Humberside		Final Growth Factor
	NTM	TEMPRO	NTM	TEMPRO	
Car	-	1.100	1.251	1.118	**1.230**
HGV	-	1.100	1.133	1.118	**1.114**

3.5.4 The formula for deriving the Final Growth Factor is as shown below:

*Final Growth Factor = (TEMPRO Pickering/TEMPRO Y&H) * NTM Factor*

3.5.5 The Final Growth Factors for cars and HGV's were applied to the turning count data for both junctions to derive indicative turn volumes for the Baseline 2027 scenario, in the AM peak. For the Local Plan scenarios, development-specific traffic was added to the turning volumes, based on their location and potential distribution as detailed later in this report.

4 Development Sites

4.1 Introduction

4.1.1 Developments specifically taken into consideration for the purposes of this report are divided into two types:

- Committed development sites - Significant developments in Malton, Norton and Pickering completed, under construction, or with planning permission, between 2008 and 2027.
- Potential allocations in the Local Plan sites Document in Malton, Norton and Pickering, which would be expected to be delivered by 2027.

4.2 Committed Development Sites

4.2.1 Committed development sites were those considered to be of sufficient size and trip-making capability to warrant explicit modelling, in order to assess the traffic impacts upon the network. For residential developments, a figure of 100no dwellings was considered the minimum quantity to warrant inclusion as a specific site; smaller developments were incorporated as background growth. Employment sites were considered on a case-by-case basis. This approach is consistent with other studies undertaken across North Yorkshire.

4.2.2 Table 4-1 shows the explicitly modelled committed development sites, from 2008 onwards, as selected by the criteria outlined above.

Table 4-1 Committed Development Sites

Town	Site Name/Location	Reference	Dwellings/GFA
Norton	Bells Yard, Scarborough Road	05/00307/MREM	218no
Norton	Cheesecake Farm, off Beverley Rd	10/00977/MFUL	99no
Norton	Westfield Nurseries, off Scarborough Rd	09/00829/MFUL	197no
Norton	Former Dewhirsts factory, off Welham Rd	13/00166/MOUT	2,920m^2*
Malton	Broughton Road	11/01182/MREM	267no
Malton	Wentworth Street Car Park site (retail)	11/00927/MOUT	5,010m^2
Malton	Livestock Market, off Horsemarket Rd	11/00412MOUT	3,795m^2
Malton	West of York Rd Industrial Estate	08/00128/MOUT	18,000m^2
Pickering	Crossgates Lane residential institution	13/00016/MOUT	168

**-estimated from a site footprint of 0.73ha, assuming 40% build-out density*

4.3 Local Plan Development Sites

4.3.1 Ryedale District Council provided a list of potential Local Plan sites for allocation. These are listed below in Table 4-2. It should be noted that standard planning codes apply for proposed land use, and subsequent trip generation purposes – B1 office only, B2 light industry, B8 warehousing, A1 retail and C3 for residential only schemes.

Table 4-2 Local Plan Development Sites – Malton and Norton

ID	Name	Type	Size (dwellings/GFA)
1	Coronation Farm & former depot, Malton	C3 residential	35no
2	Showfield, Pasture Lane, Malton	C3 residential	227no
3	Rainbow Lane, Old Malton	C3 residential	45no
4	Allotments, Outgang Lane, Malton	C3 residential	83no
5	Land north of Castle Howard Road, Malton	C3 residential	500no
6	Land south of Castle Howard Road, Malton	C3 residential	237no
7	Land north of Green Lane, Malton	C3 residential	241no
8	Land at Edenhouse Rd, Old Malton	Mixed Use	27,900m^2
9	Land west of York Industrial Estate, Malton	B1/B2/B8	21,200m^2
10a	Land east of Beverley Road, Norton	C3 residential	500no
10b	Land east of Beverley Road, Norton	C3 residential	650no
11	Land west of Welham Road, Norton	C3 residential	200no
12	Land east of Welham Road, Norton	C3 residential	100no
13	Land east of Westfield Way, Norton	B1/B2/B8 Ind.	25,600m^2
14	Land at Edenhouse Road (East), Old Malton	B1/B2/B8	32,000m^2
15	Land East of Norton Grove Industrial Estate	B1/B2/B8	24,000m^2
16	Ryedale House	C3 residential	40 flats, 50 retirement flats

Table 4-3 Local Plan Development Sites – Pickering

ID	Name	Type	Size (dwellings/GFA)
1	Land south of Firthland Road	C3 residential	250no
2	Land east of Whitby Road	C3 residential	150no
3	Land west of Malton Road	C3 residential	80no
4	Land north of Ruffa Lane	C3 residential	55no
5	Land south of Middleton Rd/Keld Rd	C3 residential	40no
6	Land north of Middleton Road	C3 residential	80no
7	Land at Outgang Lane	B1/B2/B8 Ind.	16,880m^2
8	Land south of Thornton Road	B1/B2/B8 Ind.	3,120m^2
9	Land south of Thornton Rd Ind. Est.	B1/B2/B8 Ind.	26,800m^2
10	Land east of Malton Road (part)	B1/B2/B8 Ind.	27,320m^2

4.4 Development Trip Generation

4.4.1 The number of trips generated by the individual sites was estimated using trip rates calculated using the nationally accepted TRICS[8] database. The rates are based on the number of dwellings and employment areas put forward as the Council's Draft Allocations.

4.4.2 Trip rates calculated in TRICS were averages based on specified land uses of various site locations and sizes. However, where an approved Transport

[8] TRICS – Trip Rate Information Computer System, the national standard for trip generation analysis.

Assessment was available for a specific development, that trip generation was used. Table 4-4 shows the trip rates and final trip totals modelled.

Table 4-4 Committed Development Trip Generation (AM Peak)

Town	Site Name/Location	TRICS /TA	Trip Rate In	Trip Rate Out	Trips In	Trips Out	Total Trips
Norton	Bells Yard, Scarborough Road	TRICS	0.151	0.436	33	95	128
Norton	Cheesecake Farm, off Beverley Rd	TA	0.235	0.516	23	51	74
Norton	Westfield Nurseries, off Scarborough Rd	TA	0.175	0.448	34	88	122
Norton	Former Dewhirsts factory, off Welham Rd	TA	mixed	mixed	18	12	30
Malton	Broughton Road	TA	0.099	0.332	26	89	115
Malton	Wentworth Street Car Park site	TA	4.686	2.869	215	133	246
Malton	Livestock Market, off Horsemarket Rd	TA	0.480	0.308	12	55	67
Malton	West of York Rd Industrial Estate	TA	mixed	mixed	89	61	150

4.4.1 The trip rates for car and goods vehicle trips were applied to the relevant development sites to generate car, and HGV trips. These trip rates from TRICS are assumed to be average national rates to be used to calculate trip generation based on the assumption that the proportion of non-car trips generated by development sites is also, by default, a national average.

4.4.2 Malton and Norton has a recognised higher than average number of trips to and from work which are made via non-car modes such as walking or cycling. To account for this difference between the UK average non-car trips and Malton and Norton non-car trips the trip generation associated with development sites in Malton and Norton has been reduced using a reduction factor.

4.4.3 The average non-car trips as a percentage of total trips in Malton, Norton and Pickering have been calculated using Census 2011 statistics. The same statistic has been calculated for the national average, also from the 2011 Census. The difference between the two has been used to calculate the non-car modal shift reduction factor specific to Malton and Norton and Pickering.

4.4.4 For development sites without a dedicated Transport Assessment the origin car trips associated with residential developments had this reduction factor applied and the destination car trips associated with employment developments had the factor applied to account for potential localised modal shift not reflected in the TRICS trip rates.

4.4.5 Derived reduction factors were 16% for Malton and Norton, and 7% for Pickering. The resulting adjustments to trip generation are shown in Table 4-5 and Table 4-6.

Table 4-5 Local Plan Car Trip Generation – Malton & Norton Sites

ID	Name	Trip Rate In	Trip Rate Out	Trip Generation TRICS			Trip Generation Adjusted for Local Non Car Use		
				Trips In	Trips Out	Total Trips	Trips In	Trips Out	Total Trips
1	Coronation Farm & former depot	0.095	0.315	3	11	14	3	11	14
2	Showfield, Pasture Lane	0.099	0.329	10	72	82	10	72	82
3	Rainbow Lane, Old Malton	0.089	0.297	7	24	31	7	24	31
4	Allotments, Outgang Lane	TA	TA	13	32	45	13	32	45
5	Land north of Castle Howard Road	0.151	0.436	76	218	294	75	182	257
6	Land south of Castle Howard Road	0.151	0.436	36	103	139	35	86	121
7	Land north of Green Lane	0.151	0.436	36	105	141	36	88	124
8	Land at Edenhouse Rd, Old Malton	TA	TA	51	207	258	50	207	258
9	Land west of York Industrial Estate	Mixed	Mixed	64	14	78	51	10	61
10a	Land east of Beverley Road (500no)	0.151	0.436	76	218	294	75	182	257
10b	Land east of Beverley Road (600no)	0.151	0.436	98	283	381	97	279	376
11	Land west of Welham Road	0.151	0.436	30	87	117	30	73	103
12	Land east of Welham Road	0.151	0.436	15	44	59	15	36	51
13	Land east of Westfield Way	0.634	0.089	77	16	93	61	13	74
14	Land at Edenhouse Road (East), Old Malton	Mixed	Mixed	103	32	135	102	32	133
15	Land East of Norton Grove Industrial Estate	Mixed	Mixed	81	28	109	80	28	108
16	Ryedale House	Mixed	Mixed	10	15	25	10	15	25

Table 4-6 Local Plan Car Trip Generation – Pickering Sites

ID	Name	Trip Rate In	Trip Rate Out	Trip Generation TRICS			Trip Generation Adjusted for Local Non Car Use		
				Trips In	Trips Out	Trips In	Trips Out	Trips In	Trips Out
1	Land south of Firthland Road	0.151	0.436	38	109	147	37	101	138
2	Land east of Whitby Road	0.151	0.436	23	65	88	22	60	83
3	Land west of Malton Road	0.151	0.436	12	35	47	12	32	44
4	Land north of Ruffa Lane	0.151	0.436	8	24	32	8	22	30
5	Land south of Middleton Rd/Keld Rd	0.151	0.436	6	17	23	6	16	22
6	Land north of Middleton Road	0.151	0.436	12	35	47	12	32	44
7	Land at Outgang Lane	Mixed	Mixed	60	12	72	53	9	63
8	Land south of Thornton Road	Mixed	Mixed	11	2	13	10	2	12
9	Land south of Thornton Rd Ind. Est.	Mixed	Mixed	96	19	115	85	15	99
10	Land east of Malton Road (part)	Mixed	Mixed	98	19	117	86	15	101

4.5 Local Plan Development Scenarios

4.5.1 To enable different combinations of local plan potential development sites to be modelled and impacts tested, a series of scenarios were established. Initially, three test scenarios were modelled for Malton and Norton, and four scenarios for Pickering. These are laid out in Table 4-7 and Table 4-8 respectively. Over the course of the work, further scenarios were modelled at Malton and Norton to reflect some changes to available sites.

4.5.2 It is important to note that the development sites used for the purpose of this modelling do not have any planning status. They represent a selection of sites which are potentially developable and which are not, in themselves, subject to fundamental constraints. They have been used in this work in order to help identify the cumulative impact that potential development sites have on the highway network depending on the location, type and scale of sites at different locations at the Towns.

4.5.3 The Local Plan site allocation process will be informed by a number of factors, including this transport modelling and therefore the inclusion of a site within this work should not be taken as meaning that the development of any of these sites is acceptable in principle (other than those which have, over the course of this work, gained the benefit of planning permission) or that sites included in this work will be allocated in the future. To reflect the fact that the scenarios do not contain the precise combination of sites that will be allocated in the future, they have been complied to be sufficiently distinct to allow some key messages to be drawn from the modelling process and output in order to draw conclusions over the cumulative implications of development arising in different locations.

4.5.4 At Malton and Norton, Scenario 1 models combinations of sites that provide an emphasis on future development sites being located at Malton. Scenario 2 broadly divides residential development sites between Malton and Norton and Scenario 3 places emphasis on residential development sites being located at Norton.

4.5.5 The further development scenarios modelled for Malton and Norton followed similar patterns to Scenario 1 and 3 (a Malton and a Norton emphasis) but with alternative employment sites and some further combinations of residential sites.

4.5.6 The four development scenarios for Pickering are less distinct than those for Malton and Norton in terms of residential site options. Potential employment land choices provide the main differences between in the scenarios.

Table 4-7 Local Plan Development Scenarios – Malton and Norton

ID	Name	Scenario						
		1	2	3	4	5	6	7
1	Coronation Farm & former depot		❷	❸	❹	❺	❻	❼
2	Showfield, Pasture Lane	❶	❷	❸	❹	❺	❻	❼
3	Rainbow Lane, Old Malton	❶	❷	❸	❹	❺	❻	❼
4	Allotments, Outgang Lane	❶	❷	❸	❹	❺	❻	❼
5	Land north of Castle Howard Road	❶	❷		❹		❻	
6	Land south of Castle Howard Road	❶						
7	Land north of Green Lane	❶			❹		❻	
8	Land at Edenhouse Rd, Old Malton	❶	❷	❸	❹	❺	❻	❼
9	Land west of York industrial Estate	❶	❷	❸				
10a	Land east of Beverley Road (500)		❷	❸				
10b	Land east of Beverley Road (650)					❺		❼
11	Land west of Welham Road		❷	❸				
12	Land east of Welham Road			❸				
13	Land east of Westfield Way	❶	❷	❸				
14	Land at Edenhouse Road (East), Old Malton				❹		❻	
15	Land East of Norton Grove Industrial Estate					❺		❼
16	Ryedale House Flats						❻	❼

Table 4-8 Local Plan Development Scenarios - Pickering

ID	Name	Scenario			
		1	2	3	4
14	Land south of Firthland Road	❶	❷	❸	❹
15	Land east of Whitby Road	❶	❷	❸	❹
16	Land west of Malton Road	❶	❷	❸	❹
17	Land north of Ruffa Lane	❶	❷	❸	❹
18	Land south of Middleton Rd/Keld Rd	❶	❷	❸	❹
19	Land north of Middleton Road			❸	❹
20	Land at Outgang Lane	❶			❹
21	Land south of Thornton Road	❶			❹
22	Land south of Thornton Rd Ind. Est.	❶			❹
23	Land east of Malton Road (part)		❷	❸	

4.5.7 Trip totals generated by Local Plan development sites in each scenario are shown in Table 4-9 and Table 4-10, for Malton and Norton, and Pickering, respectively.

Table 4-9 Trips Generated by Malton and Norton Local Plan Development Scenarios

Scenario	Trips In	Trips Out	Total Trips
1	338	714	1052
2	375	806	1181
3	315	660	975
4	306	663	969
5	270	668	938
6	296	648	944
7	260	653	913

Table 4-10 Trips Generated by Pickering Local Plan Development Scenarios

Scenario	Trips In	Trips Out	Total Trips
1	254	283	537
2	185	269	454
3	197	304	501
4	266	318	584

4.6 Development Trip Distribution

4.6.1 Access arrangements onto the highway network for Local Plan sites were determined by information supplied by Ryedale District Council. For sites where this was still unclear, an assumption was made and agreed with RDC.

4.6.2 Each development requires a trip distribution to dictate the origin and destination point of all generated trips. For Malton and Norton, this was obtained by using existing distribution patterns in the traffic model, for sites with similar land use characteristics and proximity, and adjusting the trip totals according to the Local Plan site in question. This formed the demand matrix for that site which, along with the other sites and background growth, was assigned to the model network to determine the overall routing of traffic.

4.6.3 For Pickering, each Local Plan development required a distribution method to determine where traffic would leave and enter the two junctions being modelled. This was obtained by employing a gravity model, based on travel distance and potential future households and jobs for key settlements and employment areas in and around Pickering. This includes Malton, Norton, Whitby, Scarborough and Thirsk as well as the four quadrants of Pickering and the town centre. Major employment zones within Pickering were also included such as the industrial area on Westgate Carr Road to the west of Pickering and Enterprise Way to the east.

4.7 Highway Network Changes

4.7.1 Along with reflecting demand as accurately as possible, it was necessary to model any significant highway changes that could influence routing choice for vehicles in Malton and Norton.

4.7.2 The model networks for the 2027 Baseline and Local Plan forecast scenarios were coded to include schemes either already completed since 2014, or with a very high likelihood of delivery. These include the Malton and Norton Complementary Measures that are envisaged to accompany the Brambling Fields improvement scheme. The list of schemes is as shown in Table 4-11.

Table 4-11 Highway Schemes likely to be delivered by Local Plan year end 2027

Type of Measure	Description
Constructed pre 2014	Brambling Fields A64 eastbound off-slip – modelled in 2014 model and 2027.
Malton and Norton Complementary Measures	Remove traffic lane at Castlegate approach to Butcher Corner.
	Closure of Norton Road eastbound.
	Additional pedestrian phase at Butcher Corner.
	HGV ban over level crossing.
Development Related	Diversion of Pasture Lane and new roundabout with Broughton Road as part of residential development.
	Priority junction at Highfield Road (Section 106, Wentworth St Development).
Safety	Priority change at the Welham Road / Church Street junction.

4.7.3 The Complementary Measures modelled are based on those assessed as part of the Malton and Norton Strategic Transport Assessment (June 2010) and Option 4 of the Brambling Fields Complementary Measures Option Testing Study (December 2010). With completion of the A64 eastbound off-slip at Brambling Fields, these measures were judged to be potentially the most effective at reducing traffic through Malton and Norton, along with other rat-running prevention measures elsewhere in the town.

4.7.4 In addition to the schemes outlined in Table 4-11, the 2027 Local Plan scenarios also include any highway infrastructure changes designed to support those developments and associated access points.

5 The Effect of Local Plan Development Traffic at Key Junctions

5.1 Introduction

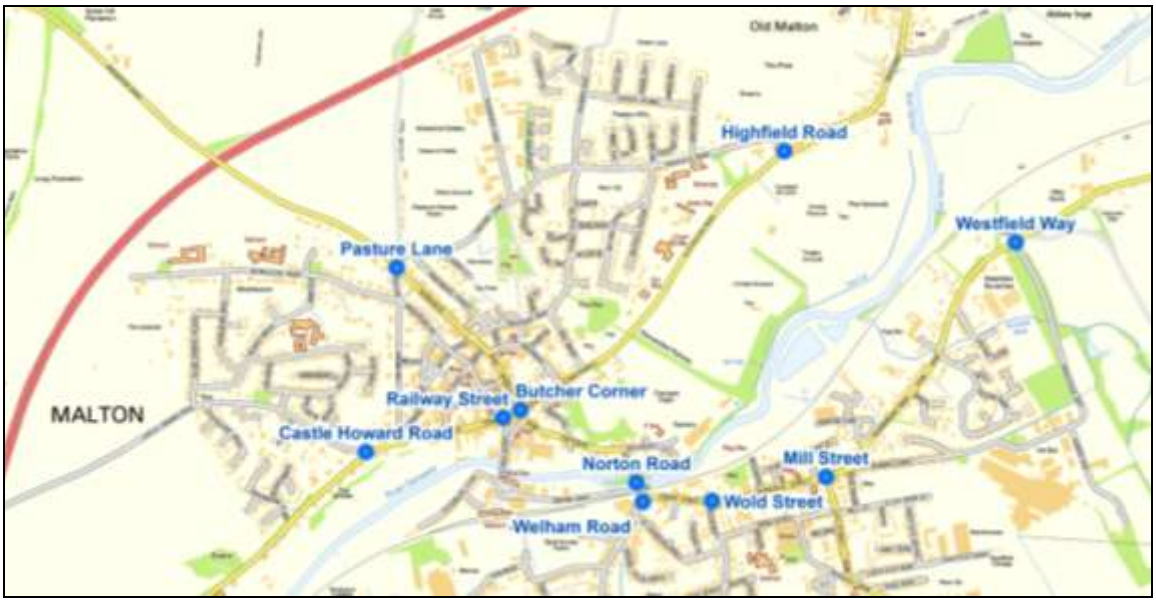
5.1.1 This chapter details the results of the impact assessment of traffic growth on 10 key junctions in Malton and Norton, and two key junctions in Pickering.

5.1.2 The list of junctions assessed is shown in Table 5-1 with an accompanying location plan in Figure 5-1. For Malton and Norton, traffic flows at each junction were extracted from the highway model for the Baseline 2027 and Local Plan scenarios. In Pickering, development flows were added directly as inputs into the two junction models, based on the outputs obtained from the gravity model.

Table 5-1 Assessed Junctions

Town	Junction Number	Junction Name	Type
Malton and Norton	1	Castle Howard Road / Yorkersgate / York Road	Priority
	2	Welham Road / Castlegate / Church Street	Priority
	3	Norton Road / Castlegate / Church Street	Priority
	4	Railway Street / Yorkersgate	Priority
	5	Wold Street Mini Roundabout	Mini Rbt
	6	Mill Street Mini Roundabout	Mini Rbt
	7	Town Street / Old Malton Road / Highfield Road	Mini Rbt
	8	Butcher Corner Junction	Signals
	9	Pasture Lane Junction	Roundabout
	10	Westfield Way Junction	Signals
Pickering	11	A170 / A169 roundabout	Roundabout
	12	Vivis Lane / A170 / The Ropery	Signals

Figure 5-1 Assessed Junctions Malton and Norton – Location Plan



5.2 Interpretation of Results

5.2.1 The 12 strategic junctions identified were assessed through nationally accepted junction modelling software – ARCADY for roundabouts, PICADY for priority, or Give-Way junctions, and LinSig for traffic signals.

5.2.2 Inputs into the junction models are based on traffic flows through the junction. In the case of Malton and Norton, these were extracted directly as turning flows from the 2027 Baseline and Local Plan forecast models, for each scenario. For Pickering, turning movements for both junctions were derived from the gravity distribution model for each Local Plan site and totalled, according to each scenario.

5.2.3 The key output of the junction assessment is the ratio of flow to capacity (RFC), which shows demand compared to the available capacity. The models present an RFC figure for each junction arm during the modelled period, which ensures any RFC 'spike' is captured and not overlooked by an average RFC across all junction arms. This is a standard nationally accepted way of measuring congestion at a junction.

5.2.4 RFCs are reported using a nationally accepted traffic light colouring system which has been used previously by Jacobs for North Yorkshire County Council, as the Local Highway Authority, and Local Authority districts for other strategic transport assessments involving detailed junction analysis. The traffic light colouring system works as follows:

- **Green** - RFC less than 0.85, junction is likely to operate without delays; 0.85 is an industry recognised level of congestion, where a junction starts to approach capacity
- **Amber** - RFC between 0.85 and 1, junction is approaching capacity and may be subject to minor delay
- **Red** - RFC greater than 1, junction is over capacity and delays will occur

5.2.5 Perceived congestion at junctions may be worse than that shown in the modelling results; this is due to a range of factors. A further issue is that of the ability of the junction models to identify what may be perceived as queuing. Queues at signalised junctions include stationary vehicles and also vehicles in a 'rolling queue'. The modelling software used to undertake junction assessment cannot measure rolling queues and so only static queues are reported. If static queues clear when given a green light at signals, the junction is judged to be performing within capacity.

5.2.6 The junction capacity assessment software only models junctions on an individual basis and therefore does not take into account the interaction between adjacent junctions as a result of queuing or 'platooning' traffic. The SATURN traffic model does however model the interaction between adjacent junctions so traffic flows between junctions has been taken into account.

5.3 Analysis of Results – Malton and Norton

5.3.1 Results of the assessments for the 2027 Baseline and 2027 Local Plan scenarios for junctions in Malton and Norton are shown in Table 5-2 . The

figures represent the maximum RFC, per junction arm, of any 15-minute period between the 0800hrs and 0900hrs AM peak modelling period.

Table 5-2 Junction Assessment Results – Malton and Norton

Junction	Arm	Base-line	Scenario						
			1	2	3	4	5	6	7
Castle Howard Rd / Yorkersgate / York Rd	Castle Howard Right	0.244	0.561	0.381	0.239	0.530	0.250	0.540	0.250
	Castle Howard Left	0.242	0.729	0.538	0.251	0.370	0.230	0.390	0.230
	Yorkersgate	0.413	0.562	0.548	0.433	0.510	0.420	0.570	0.470
Welham Rd / Castlegate / Church St	Welham Road Right	1.762	1.799	1.892	1.892	1.790	1.940	1.910	1.970
	Welham Road left	0.198	0.235	0.273	0.273	0.230	0.230	0.230	0.230
	Church Street	0.483	0.433	0.675	0.675	0.450	0.470	0.430	0.460
Norton Rd / Castlegate	Norton Road	0	0	0	0	0	0	0	0
	Castlegate	0	0	0	0	0	0	0	0
Railway St / Yorkersgate	Railway Street	1.124	1.165	1.089	1.085	1.080	1.070	1.100	1.100
	Yorkersgate west	0.005	0.011	0.011	0.008	0.010	0.010	0.010	0.010
Wold St	Commercial St	0.716	0.781	0.912	0.870	0.780	0.780	0.780	0.780
	Wold St	1.293	1.291	1.342	1.274	1.170	1.190	1.160	1.180
	Church St	0.361	0.409	0.48	0.491	0.680	0.690	0.640	0.680
Mill St	Commercial East	0.645	0.744	0.744	0.749	0.750	0.660	0.760	0.650
	Mill St	0.845	0.953	0.951	0.868	0.990	0.970	0.950	0.930
	Commercial West	0.643	0.742	0.904	0.935	0.750	0.750	0.670	0.710
Town St / Old Malton Rd / Highfield Rd	Highfield Rd - Old Malton Rd	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Highfield Rd - Town Street	0.36	0.398	0.386	0.290	0.400	0.380	0.400	0.380
	Town Street	0.707	0.876	0.709	0.559	0.780	0.750	0.770	0.730
Butcher Corner Junction	Wheelgate	0.898	0.998	0.989	0.954	0.986	0.964	0.998	0.955
	Old Malton Road	0.932	0.999	0.967	0.961	0.876	0.899	0.966	0.961
	Castlegate Rd	2.095	5.164	3.611	3.118	4.081	3.575	3.142	2.374
	Yorkersgate	1.501	1.79	1.596	1.548	1.304	1.380	1.495	1.550
Broughton Rd Mount Crescent Junction	Broughton Road	1.267	1.35	2.031	1.879	1.928	1.850	1.993	1.840
	Pasture Lane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	New Biggin	1.064	1.119	1.554	1.463	1.444	1.436	1.548	1.529
	Mount Crescent	0.665	0.681	0.708	0.708	0.708	0.705	0.705	0.712
Westfield Way	Scarborough Road WB	0.826	0.967	1.119	1.083	1.052	1.102	1.063	1.102
	Westfield	0.094	0.102	0.431	0.433	0.102	0.435	0.102	0.427
	Scarborough Road EB	0.757	0.858	0.873	0.878	0.916	0.834	0.844	0.798

*Cells highlighted where Scenario RFC is greater than 0.85 and greater than Baseline RFC. Red >1, Amber<1.

5.3.2 The results from Table 5-2 show that if left unimproved, six of the ten junctions are forecast to operate over capacity in 2027 with Local Plan developments in place. A further two would be approaching capacity. Only two remain below capacity.

5.3.3 The results indicate that up to eight junctions will operate with RFCs above 0.85. All RFCs are higher than the 2027 Baseline scenario, indicating the effect of Local Plan traffic generation.

5.3.4 Outputs from the junction capacity analysis indicate the following junctions in Malton and Norton which will require increased capacity to mitigate congestion caused by the Local Plan traffic:

- Welham Road
- Railway Street
- Wold Street
- Mill Street
- Broughton Road / Mount Crescent Junction
- Westfield Way

5.3.5 Improvements designed to mitigate congestion at the listed junctions in Malton and Norton, caused by Local Plan generated traffic, are detailed and assessed in Chapter 6 of this report.

5.4 Butcher Corner

5.4.1 The Butcher Corner junction will operate with increased congestion with the Local Plan development traffic but the complimentary measures associated with the Brambling Fields junction will act to prevent undue traffic flows through the town centre where possible.

5.5 Analysis of Results – Pickering

5.5.1 Results of the assessments for the 2027 Baseline and 2027 Local Plan scenarios for junctions in Pickering are shown in Table 5-3 The figures represent the maximum RFC, per junction arm, of any 15-minute period between the 0800hrs and 0900hrs AM peak modelling.

Table 5-3 Junction Assessment Results – Pickering

Junction	Arm	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
A170 / A169 roundabout	Kirkham Lane	0.448	0.597	0.581	0.595	0.611
	Eastgate	0.436	0.483	0.489	0.498	0.491
	Malton Road	0.554	0.642	0.623	0.628	0.647
	A170	0.677	0.757	0.743	0.768	0.782
Vivis Lane / A170 / The Ropery	The Ropery	0.478	0.58	0.572	0.573	0.581
	A170 Hungate	1.231	3.311	3.311	3.311	3.311
	Vivis Lane	0.816	0.816	0.816	0.816	0.816
	A170 Southgate	0.998	1.17	1.161	1.219	1.228

*Cells highlighted where Scenario RFC is greater than 0.85 and greater than Baseline RFC. Red >1, Amber<1.

5.5.2 The results show that the Vivis Lane junction operates over-capacity in the Baseline 2027 scenario, and is exacerbated further in all Local Plan scenarios, due to the additional generated traffic. The A169/A170 roundabout remains below capacity in all forecast scenarios.

5.5.3 Improvements designed to mitigate congestion at the Vivis Lane junction, caused by Local Plan generated traffic, are detailed and assessed in Chapter 6 of this report.

6 Junction Improvements for Over Capacity Junctions

6.1 Introduction

6.1.1 When assessed in the 2027 Baseline and Local Plan scenarios, 9 of the 12 junctions assessed in Malton, Norton and Pickering were forecast to operate over-capacity. In all of those cases, junction performance was worse in the Local Plan scenarios than in the Baseline, evidenced by a higher RFC figure.

6.1.2 This chapter details the measures proposed to cope with the extra demand placed on these junctions, in Malton/Norton, and Pickering, respectively and presents the results of further capacity assessments modelled with the improvements in place.

6.1.3 All the mitigation measures conceptualised have no adverse impacts for pedestrians and other non-motorised traffic users. All designs have catered for pedestrians and include footways and crossings where appropriate. This includes putting footways back where proposed improvements extend the carriageway width.

6.2 Welham Road / Church Street

6.2.1 The existing Welham Road junction is a priority junction with Welham Road as the minor arm. There is a segregated left turn between Church Street and Welham Road which is segregated by a traffic island.

6.2.2 Immediately to the north of the junction the railway line crosses Castlegate over a level crossing and there is the junction between Norton Road and Castlegate just north of the railway line.

6.2.3 North Yorkshire County Council will be undertaking works on the existing Welham Road/Church Street junction to change the priority of the junction so that Church Street becomes the minor road and Welham Road and Castlegate become the major roads giving Castlegate priority. This is predominantly a safety-led scheme and has been modelled in the Baseline scenario. As a result of this no further mitigation measures to relieve any congestion resulting from Local Plan traffic have been tested for this junction.

6.2.4 The 2010 Local Plan assessment suggested a hybrid mini roundabout would be deliverable at this junction and would reduce congestion. This scheme has however been discounted as it will require DfT approval and a safety audit as it is not a standard junction type.

6.3 Railway Street / Yorkersgate

6.3.1 It is not possible to directly add any physical operational capacity to this junction as there is no land or space available for junction widening.

6.3.2 The junction cannot be signalised due to the constrained nature of the junction and due to the access road directly opposite Railway Street.

As part of the complementary measures associated with the town centre HGVs will be banned from using Railway Street and Norton Road, and other physical modifications introduced to ensure it is not attractive as a rat run.

6.4 Broughton Road / Mount Crescent Junction

6.4.1 The Broughton Road / Mount Crescent junction has been modelled as a 3 arm signalised junction with associated signal timings which is the expected junction layout to be implemented as part of the committed Taylor Wimpey development proposals. In the Baseline scenario the junction is expected to operate above capacity on Broughton Road (127%) and on New Beggin (106%).

6.4.2 Testing the junction with the Local Plan development traffic in place shows that the junction will continue to operate above capacity on Broughton Road (203%) and on New Beggin (155%) in the worst case Scenario 2.

6.4.3 Optimising the signal timings of this junction will bring RFCs below capacity and below the Baseline scenario.

6.5 Wold Street / Commercial Street

6.5.1 The Wold Street junction is a 3 arm mini roundabout. The junction is expected to operate approximately 29% over capacity on the Wold Street arm in 2027 without any Local Plan development traffic.

6.5.2 The Scenario 2 Local Plan development is expected to increase the congestion on Wold Street so it becomes 34% over capacity, so an additional 5 percentage points. The Scenario 1 and Scenario 3 Local Plan development traffic will not have any detrimental effect on Wold Street.

6.5.3 The Scenario 2 and 3 Local Plan development traffic is expected to increase congestion on Commercial Street so that this arm of the roundabout is approaching capacity (91% and 87% respectively). In the Baseline scenario Commercial Street will operate at 72% of capacity.

6.5.4 If the entry widths of the Wold Street and Commercial Street arms are widened, it will add enough capacity to reduce congestion to levels below the Baseline RFC figure on Wold Street however Commercial Street will continue to operate below capacity but at a level which is approaching capacity. A detailed design would be required to define a proposed new junction layout which would require some kerb realignment and land take within the highway boundary.

6.5.5 A signalised junction has been tested at Wold Street but the results showed that signals would worsen the congestion when compared to the Baseline scenario.

6.6 Mill Street

6.6.1 The Mill Street junction is a 3 arm mini roundabout to the west of the Wold Street junction.

6.6.2 The junction assessments of the existing junction layout showed that Mill Street operates with RFCs higher than the Baseline, particularly in Local Plan

Scenarios 2 and 3. This is due to traffic from the Beverley Road residential development turning left and right from Mill Street towards Butcher Corner or the A64.

6.6.3 Potential solutions to add capacity to this type of junction would be to signalise the junction, change the junction to a priority junction or keep the roundabout in place but widen the entry arms to add operational capacity. A signalised junction and a priority junction were tested at Mill Street but results indicated these would worsen congestion due to the magnitude of trips using Mill Street travelling to and from the Beverley Road development. The kerb alignment, footpath widths and the building line at the Mill Street junction make it difficult if not impossible to widen any of the arms, particularly the Mill Street arm.

6.6.4 The solution to reducing congestion at this junction is to reduce the amount of traffic turning to and from Mill Street. This could be achieved by implementing a potential link road between Beverley Road and Hugden Way. This link Road is discussed later in this report.

6.7 Westfield Way

6.7.1 The Westfield Way junction is a 3 arm signalised junction. The junction is expected to operate well below capacity in the Baseline scenario but will operate above capacity as a result of Scenario 1 and Scenario 2 Local Plan development traffic. Scenario 1 Local Plan development traffic is expected to cause the junction to operate just below capacity (97% on Scarborough Road west bound).

6.7.2 Optimising the signal timings of the junction will bring RFCs well below capacity and below the Baseline. This is however assuming there will be no traffic associated with the potential link road through Hugden Way to Beverley Road.

6.8 Hugden Way Link Road

6.8.1 The proposed Hugden Way Link Road is a link between Beverley Road and Hugden Way which will allow traffic to and from the proposed Beverley Road residential development to avoid Mill Street and to access Scarborough Road and the A64 at Brambling Fields. Similarly traffic from the A64 can access the proposed development and Beverley Road without the need to use Mill Street.

6.8.2 This is the most suitable improvement that enables potential mitigation of traffic flows through Mill Street in Scenario 2 and Scenario 3 which are the two scenarios containing the Beverley Road development. The link road has therefore been modelled in Scenario 2 and 3.

6.8.3 The models show that traffic both to and from the Beverley Road development and a proportion of traffic on Beverley Road will use the link road and the Westfield Way junction to get to and from Scarborough Road and the A64.

6.8.4 The results of this are that the reduction in traffic turning from Mill Street will cause congestion on Mill Street junction in Scenario 1 and Scenario 2 to fall so that the junction will operate below capacity on all arms.

6.8.5 The Westfield Way junction will also operate below capacity even though the traffic increases as a result of the link road.

6.9 Complementary Measures - Butcher Corner

6.9.1 The complementary measures to reduce the capacity of the Butcher Corner junction have been modelled in the Baseline scenario. The resulting RFCs are high in the Baseline and in all three Local Plan scenarios.

6.9.2 The Butcher Corner junction has been declared an air quality management area due to exceedance of the permitted legal standard for NO2. As a significant proportion of these high emissions are attributable to transport sources, and in particular from buses and HGVs, RDC is working with the Local Highway Authority to implement the Air Quality Action Plan which aims to identify measures to reduce emissions to within the permitted level.

6.9.3 Current mitigation measures being considered include the management and reduction of traffic through measures such as encouraging sustainable travel, by re-routing HGV's to the wider road network, and other measures involving consultation and working with bus operators and HGV companies. It is however acknowledged that there could be potential issues associated with rerouting the traffic and that consultation with local hauliers is essential.

6.9.4 Butcher Corner is a sensitive junction which has to balance the competing demands of the movement of internal traffic and ensuring that air pollution levels are reduced to acceptable levels in combination with other measures.

6.9.5 The reduction in capacity at Butcher Corner is likely to reduce the overall number of trips using the junction which will have a positive contribution towards the improvement of air quality.

6.10 Reassessment of Mitigated Junctions in Malton & Norton

6.10.1 The mitigation measures identified above, including the Hugden Way Link Road, were coded into the Malton and Norton traffic model, as accurately as possible, and the model re-run with the same demand, for the 2027 Baseline and Local Plan scenarios. The updated vehicle flows were then assessed through the junction models to produce amended RFC figures, which demonstrated the effect of mitigation on all the strategic junctions in the town.

6.10.2 Results of the junction performance assessment for Malton and Norton, with mitigation measures as detailed, is shown in Table 6-1, and summarised in Table 6-2. It indicates that some trips will re-route due to journey time changes, causing an impact to RFC values on the junctions with no current proposed improvements.

6.10.1 The Castle Howard Road, Norton Road / Castlegate, Town Street and Westfield Way junctions will all operate below 85% capacity with minimal queueing and delay in all three Local Plan development scenarios.

6.10.2 The Welham Road junction will operate with congestion on Welham Road but this congestion will be slightly less than in the Baseline scenario.

6.10.3 Railway Street will continue to operate above capacity but with less congestion than the Baseline scenario, as will the Wold Street roundabout.

6.10.4 The Pasture Lane signals will operate below capacity but above 85% of capacity. This is however less than the Baseline scenario where the signals will operate above capacity.

6.10.5 Scenario 1 development traffic will cause Mill Street to operate above capacity with congestion worse than the Baseline scenario but with the introduction of the Hugden Way Link Road in Scenario 2 and Scenario 3 the junction will operate below 85% capacity.

6.10.6 It is evident from Table 6-2 that the tested junction improvements at Mill Street do not provide enough capacity to fully mitigate all congestion caused by Scenario 1 Local Plan development traffic.

6.10.7 Overall, Local Plan Scenario 3, with mitigation, offers the least highway impact in comparison to the unmitigated 2027 Baseline scenario.

Table 6-1 Junction Assessment Results – Malton & Norton with Mitigation

Junction	Arm	Base-line	Scenario with Mitigation						
			1	2	3	4	5	6	7
Castle Howard Rd / Yorkersgate / York Rd	Castle Howard Right	0.244	0.554	0.398	0.300	0.520	0.250	0.530	0.250
	Castle Howard Left	0.242	0.726	0.545	0.253	0.410	0.280	0.420	0.240
	Yorkersgate	0.413	0.57	0.617	0.552	0.620	0.520	0.640	0.490
Welham Rd / Castlegate / Church St	Welham Road Right	1.762	1.723	1.717	1.734	1.780	1.940	1.800	1.930
	Welham Road left	0.198	0.235	0.271	0.283	0.230	0.240	0.230	0.240
	Church Street	0.483	0.444	0.707	0.798	0.600	0.590	0.620	0.490
Norton Rd / Castlegate	Norton Road	0	0	0	0	0.000	0.000	0.000	0.000
	Castlegate	0	0	0	0	0.000	0.000	0.000	0.000
Railway St / Yorkersgate	Railway Street	1.124	1.059	1.116	1.076	1.060	1.040	1.020	1.060
	Yorkersgate west	0.005	0.011	0.008	0.008	0.010	0.010	0.010	0.010
Wold St	Commercial St	0.716	0.876	0.911	0.875	0.930	0.850	0.930	0.830
	Wold St	1.293	1.286	1.095	1.117	0.960	1.160	0.930	1.160
	Church St	0.361	0.430	0.508	0.518	0.740	0.740	0.740	0.680
Mill St	Commercial East	0.645	0.858	0.798	0.779	0.870	0.700	0.860	0.670
	Mill St	0.845	1.105	0.838	0.718	0.930	1.120	0.890	1.120
	Commercial West	0.643	0.821	0.848	0.851	0.780	0.820	0.750	0.730
Town St / Old Malton Rd / Highfield Rd	Highfield Rd - Old Malton Rd	0	0	0	0	0.000	0.000	0.000	0.000
	Highfield Rd - Town Street	0.36	0.394	0.385	0.37	0.400	0.380	0.400	0.390
	Town Street	0.707	0.822	0.762	0.717	0.780	0.760	0.790	0.820
Butcher Corner Junction	Wheelgate	0.898	0.998	0.989	0.954	1.041	1.072	1.027	1.039
	Old Malton Road	0.932	0.999	0.967	0.961	0.927	0.869	0.879	0.923
	Castlegate Rd	2.095	5.164	3.611	3.118	4.406	3.972	3.647	2.600
	Yorkersgate	1.501	1.79	1.596	1.548	0.850	0.909	0.789	1.195
Broughton Rd Mount Crescent Junction	Broughton Road	1.267	0.893	0.895	0.907	0.919	0.918	0.911	0.866
	Pasture Lane	0	0	0	0	0.000	0.000	0.000	0.000
	New Biggin	1.064	0.443	0.44	0.485	0.500	0.505	0.518	0.490
	Mount Crescent	0.665	0.688	0.696	0.705	0.729	0.721	0.729	0.729
Westfield Way	Scarborough Road WB	0.826	0.552	0.753	0.74	0.750	0.797	0.741	0.772
	Westfield	0.094	0.335	0.695	0.698	0.255	0.394	0.255	0.378
	Scarborough Road EB	0.757	0.657	0.774	0.808	0.704	0.790	0.676	0.741

*Cells highlighted where Scenario RFC is greater than 0.85 and greater than Baseline RFC. Red >1, Amber<1.

Table 6-2 Junction Assessment Results Summary – Malton & Norton – Maximum RFC Values

Junction	Baseline	Scenario With Mitigation						
		1	2	3	4	5	6	7
Castle Howard Road / Yorkersgate / York Road	0.41	0.73	0.62	0.55	0.62	0.52	0.64	0.49
Welham Road / Castlegate / Church Street	1.76	1.84	1.72	1.73	1.78	1.94	1.80	1.93
Norton Road / Castlegate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Railway Street / Yorkersgate	1.12	1.06	1.12	1.08	1.06	1.04	1.02	1.06
Wold Street	1.29	1.38	1.16	1.18	0.96	1.16	0.93	1.16
Mill Street	0.85	1.11	0.93	0.97	0.93	1.12	0.89	1.12
Town Street / Old Malton Road / Highfield Road	0.71	0.82	0.76	0.72	0.78	0.76	0.79	0.82
Butcher Corner Junction	2.10	1.60	2.26	1.91	4.41	3.97	3.65	2.60
Pasture Lane	1.27	0.89	0.90	0.91	0.92	0.92	0.91	0.87
Westfield Way	0.83	0.66	0.77	0.81	0.75	0.80	0.74	0.77

*Cells highlighted where Scenario RFC is greater than 0.85 and greater than Baseline RFC. Red >1, Amber<1.

6.11 Vivis Lane Junction Improvements in Pickering

6.11.1 Optimising the signal timings brings the RFCs of this junction below capacity in all Local Plan scenarios and, most crucially, below the Baseline RFC shown in Table 5-3.

6.11.2 An important consideration is that this study is based on AM peak traffic flows (0800-0900hrs), as this time period was generally shown to have the highest traffic volumes over an average 24 hour period. It is acknowledged that Pickering is affected by seasonal flow trends, particularly peaking during the summer holiday period. However, given the strategic nature of the study is to support long-term housing and economic growth, seasonal traffic volumes were not specifically addressed.

6.11.3 It is assumed, at this stage, that signal optimisation to mitigate traffic growth from Local Plan scenarios will also mitigate, to an extent, seasonal traffic spikes.

6.11.4 Whilst not modelled or assessed in this report, there are a number of other potential link road improvements that could assist in mitigating the impact of new development as well as providing local traffic congestion alleviation.

6.12 Reassessment of Mitigated Junctions in Pickering

6.12.1 Given there is no strategic traffic model that covers Pickering, the extent of mitigation at Vivis Lane was through the optimisation of signal timings in the Linsig model.

6.12.2 Table 6-3 shows the outcome of the reassessment in the Baseline and Local Plan scenarios, with the same vehicle flow inputs as used in the unmitigated junction. Table 6-4 summarises the information based on the maximum RFC reported at that junction, in each scenario, with and without mitigation.

Table 6-3 Junction Assessment Results – Pickering with Mitigation

Junction	Arm	Baseline	Scenario 1 With Mitigation	Scenario 2 With Mitigation	Scenario 3 With Mitigation	Scenario 4 With Mitigation
A170 / A169 roundabout	Kirkham Lane	0.448	0.597	0.581	0.595	0.611
	Eastgate	0.436	0.483	0.489	0.498	0.491
	Malton Road	0.554	0.642	0.623	0.628	0.647
	A170	0.677	0.757	0.743	0.768	0.782
Vivis Lane / A170 / The Ropery	The Ropery	0.478	0.827	0.753	0.816	0.828
	A170 Hungate	1.231	1.065	1.089	1.165	1.184
	Vivis Lane	0.816	0.805	0.837	0.837	0.837
	A170 Southgate	0.998	0.727	0.732	0.747	0.751

*Cells highlighted where Scenario RFC is greater than 0.85 and greater than Baseline RFC. Red >1, Amber<1.

Table 6-4 Junction Assessment Results Summary – Pickering – Maximum RFC Values

Junction	No Mitigation					Local Plan – with mitigation			
	Baseline	1	2	3	4	1	2	3	4
A170/A169 roundabout	**0.68**	**0.76**	**0.74**	**0.77**	**0.78**	**0.76**	**0.74**	**0.77**	**0.78**
Vivis Lane / A170 / The Ropery	**1.23**	**3.31**	**3.31**	**3.31**	**3.31**	**1.07**	**1.09**	**1.17**	**1.18**

6.12.3 In Pickering, only one major signalised junction showed capacity issues in the 2027 Baseline and Local Plan scenarios. Section 6.4 detailed that optimising those signals resulted in improved junction performance in all forecast scenarios, though the Vivis Lane signalised junction remained overcapacity, albeit less so than the Baseline scenario. This consequence of this would be to explore further options to relieve congestion at this junction.

7 Summary & Conclusion

7.1 Summary

7.1.1 The aim of this report is to produce a strategic transport assessment detailing the impacts of the Local Plan housing and employment allocations in Malton, Norton and Pickering. In doing so this report has taken into account forecast increases in car usage up to 2027 and the likely growth in traffic from those planning permissions likely to be built after the traffic survey was undertaken in 2014.

7.1.2 The Malton and Norton Traffic Model commissioned by North Yorkshire County Council, as the Local Highway Authority, has been utilised to assess the traffic impacts of the Local Plan development sites.

7.1.3 The primary output of the study is an assessment of the impact on 10 strategic junctions across the Malton and Norton highway network and 2 junctions in Pickering. This assessment forecast that, without improvement, 8 of the ten junctions in Malton and Norton and 1 junction in Pickering would operate over capacity and with congestion more than the Baseline as a result of the estimated traffic flows in 2027.

7.1.4 Indicative junction mitigation options are available for measures to be implemented at 6 of the 12 junctions. Section 6 of this report sets out the position in relation to the other junctions which are over capacity at 2027. The mitigation measures proposed are discussed in Section 6.

7.2 Development Sites

7.2.1 A total of thirteen Local Plan development sites have been modelled in Malton and Norton and a further ten Local Development sites in Pickering.

7.2.2 The Malton and Norton sites have been divided into 7 development scenarios and the Pickering sites have been divided into 4 scenarios.

7.2.3 The modelling demonstrates that in conjunction with committed (Broughton Road/ Pasture Lane) and potential (complimentary measures) highway improvements that it is possible to accommodate planned level of growth without taking existing Junctions (currently operating under capacity) over capacity.

7.2.4 In view of the committed development sites, future development scenarios that look to spread residual development requirements between the twin towns will place increased pressure on Butcher Corner

7.2.5 Development close to full movement junctions on the A64 (Brambling Fields and Eden Camp) will help to increase the use of these junctions and provide an alternative to travel through the central road network for some trips. This is evident in the modelling as the A64 provides a quicker and less congested route to destinations and allows traffic access to the strategic road network without having to use local roads and junctions within Malton and Norton.

7.2.6 The scenarios which have the majority of development within Malton and not Norton will have implications for junctions in Norton (most notably Mill Street) as the Hugden Link is not provided under these scenarios. Although this junction is in Norton it will be used by Malton based development traffic travelling to and from the A64.

7.2.7 It is therefore evident and is shown by the traffic modelling outputs that the Hugden Road Link is a key measure necessary to mitigate site specific and cumulative development requirements across both Malton and Norton.

7.3 Mitigation Measures

7.3.1 To add capacity to the highway network in order to reduce the congestion caused by the Local Plan development traffic the following measures have been proposed.

- Link road between Beverley Road and Hugden Way.
- Optimised signal timings at the Pasture Lane junction.
- Increased right turning lane width at the proposed Town Street junction.
- Optimised signal timings at the Westfield Way junction.
- Optimised signal timings at the Vivis Lane junction.

7.4 Scenario Testing Results

7.4.1 The modelling work has shown that the Local Plan development traffic for all 7 scenarios in Malton and Norton and all 4 scenarios in Pickering will cause additional congestion on the highway network when compared to the Baseline congestion.

7.4.2 With the above mitigation measures in place the modelling work shows that with the Malton and Norton Scenario 2 and Scenario 3 Local Plan development traffic the key junctions of the Malton and Norton network will either operate below capacity or will have less congestion than in the Baseline scenario if not below capacity.

7.4.3 The Malton and Norton Scenario 1 Local Plan development traffic will cause the Mill Street junction to operate with more congestion than the baseline.

7.4.4 Butcher corner will operate above capacity in each scenario as a result of the complementary measures to be implemented.

7.4.5 All four Pickering Local Plan development scenarios can be accommodated at the two junctions assessed in Pickering. These junctions will either operate below capacity or will have less congestion than in the Baseline scenario if not below capacity.

7.5 Conclusion

7.5.1 The modelling work undertaken on the impact of the Local Plan traffic shows that the proposed level of development associated with Scenario 2 and Scenario 3 can be accommodated within Malton and Norton and traffic associated with all four scenarios Pickering if junction improvement measures are implemented.

7.5.2 This is reliant on the Hugden Way Link Road in Malton and Norton to relieve congestion at the Mill Street roundabout.

7.5.3 Work to date on the necessary changes to key junctions on the network indicates that improvements to the traffic flows at these junctions are achievable. Further potential improvements as part of or related to new development would enable further mitigation of key junctions as well as wider benefit to the local network.