



HARROGATE DISTRICT SITES & POLICIES DPD

Strategic Traffic Assessment of
Development Growth in Harrogate
and Knaresborough: 2009 to 2024
Draft Site Allocations

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November 2013



Harrogate District Sites and Policies DPD

Strategic Traffic Assessment of Development Growth in Harrogate and Knaresborough: 2009 to 2024

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Document control sheet

BPP 04 F8
version 15; Mar 2013

Project: Harrogate LDF
Client: Harrogate Borough Council **Project No:** B1688100
Document title: Harrogate District Sites and Policies DPD

Ref. No:

| | Originated by | Checked by | Reviewed by |
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1 Introduction

1.1 Overview

1.1.1 In April 2013 Jacobs provided Harrogate Borough Council (HBC) with a report which assessed the strategic traffic impacts of development growth in Harrogate and Knaresborough between 2009 and 2024 for the preferred Site Options Stage of the Plan. The report, the Harrogate District Sites and Policies DPD Strategic Traffic Assessment of Development Growth in Harrogate and Knaresborough: 2009 to 2024 Preferred Site Options was published by the Council as part of the evidence base for the Draft Plan Publication Consultation in May 2013 and can be viewed at

http://www.harrogate.gov.uk/plan/Documents/Planning%20Policy/Publication%20Consultation/DS-P-LP_TraffMod_PC.pdf

1.1.2 Following the publication of the above report, an updated traffic modelling report which details the outcomes from a re run of the model for the final package of development sites agreed by HBC Members in October 2012 and March 2013 has been produced. As a result this further report includes some alterations to development sites and their sizes, together with some modifications to the model inputs. The impacts identified and the detailed information presented, has therefore in some cases changed. Where there have been significant changes from the April 2013 report these are also explained in the text.

1.1.3 Jacobs have again used the Harrogate and Knaresborough traffic model, commissioned by North Yorkshire County Council (as the Local Highway Authority), to assess the revised set of development sites. The model has a base year of 2009 and represents evening peak traffic (1700-1800) for a neutral month. The model contains three types of vehicle; cars, light goods vehicles (LGV) and heavy goods vehicles (HGV).

1.1.4 The impact of the 2024 forecast traffic upon 28 strategic junctions on the Harrogate and Knaresborough network has been assessed, along with the effects on rat running, and changes in cross boundary traffic. The Highways Agency have undertaken modelling work to assess the cumulative traffic impacts of the draft site allocations at junction 47 A1(M).

1.1.5 Where 2024 traffic levels are forecast to cause congestion, a number of junction improvements have been identified to alleviate the congestion to a level which is considered to be satisfactory by North Yorkshire County Council as the local highway authority.

1.2 Aim of Study

1.2.1 The aim of the study is to produce a strategic transport assessment detailing the impact of the Draft Site Allocations for housing and employment in Harrogate and Knaresborough on the highway network.

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 Sites and Policies DPD: draft allocation sites and trip generation rates;
- 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 and rat running; and
- Chapter 8 presents the final summary and conclusion

2 Harrogate and Knaresborough Traffic Model

2.1 Harrogate and Knaresborough Model

2.1.1 The Harrogate and Knaresborough traffic model was developed for North Yorkshire County Council (NYCC) as the Local Highway Authority using specialist VISUM modelling software. The model was completed in 2010 and forms the basis for the appraisal. The base model represents a PM peak (17:00-18:00) on an average weekday (Monday to Friday) with a base year of 2009. The evening peak has been selected by Jacobs and North Yorkshire County Council as the worst of the two peak hours and this has been based on actual traffic flows from the County Council's automatic traffic counters and journey times on the network.

2.1.2 The model extent is sufficient to analyse in detail the impacts of developments within Harrogate and Knaresborough. The extent of the model area is shown in Figure 2.1 and the detailed highway network within Harrogate and Knaresborough is shown in Figure 2.2.

Figure 2.1 *Extent of Model showing the Detailed Model Area*

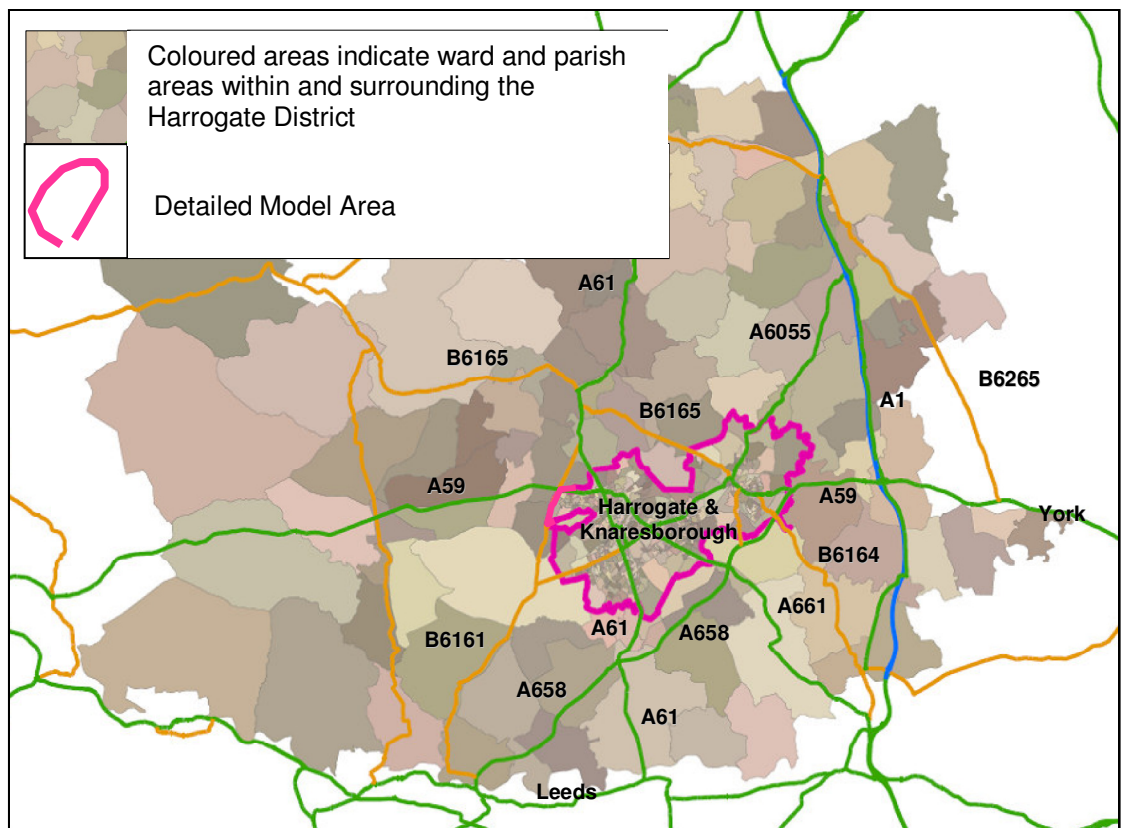
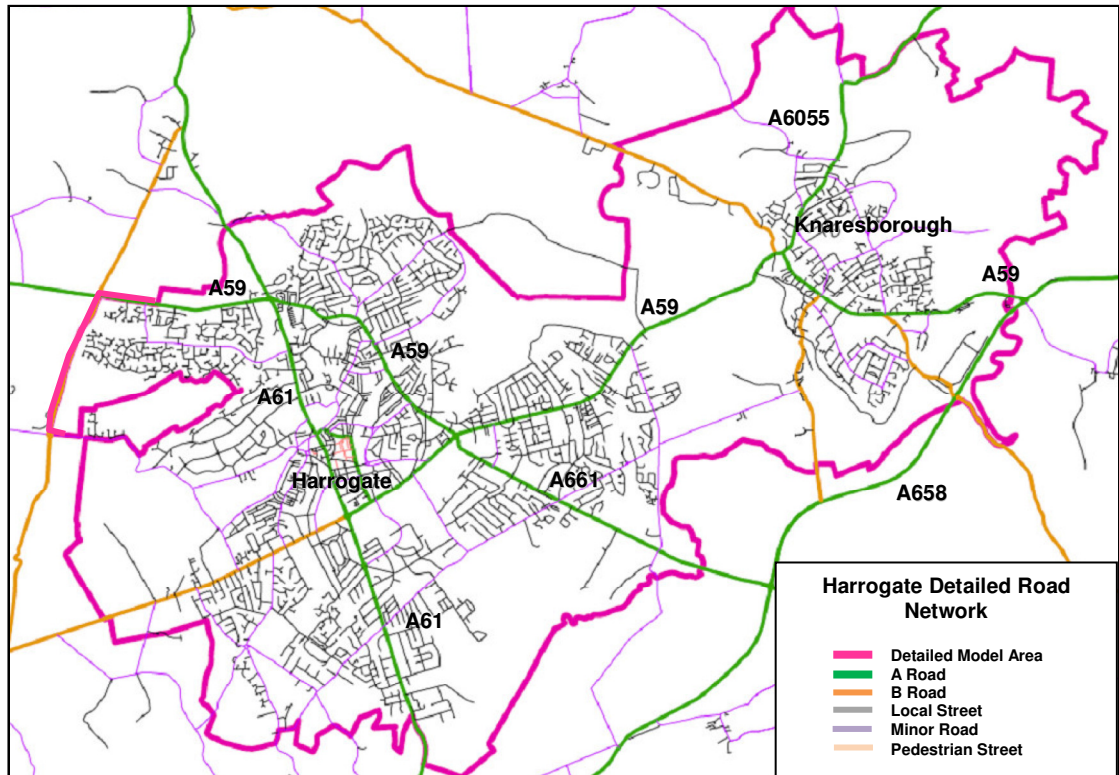


Figure 2.2 Highway Network



2.1.3 The model consists of a highways only assignment and contains three separate vehicle types:

- Private Car
- Light Goods Vehicles (LGV)
- Heavy Goods Vehicles (HGV)

2.2 Model Validity

2.2.1 Upon construction of the Harrogate and Knaresborough traffic model in 2009, a Local Model Validation Report (LMVR) was produced for NYCC, as the Local Highway Authority, which details the methods used to construct the model and shows the comparison of modelled traffic flows against observed traffic flows. The report was written to guidelines and nationally recognised standards as specified by the Department for Transport's (DfT) Design Manual for Roads and Bridges (DMRB).

2.2.2 Table 2.1 shows an extract of the validation results from the LMVR. 20 count sites were used across the model to check how well modelled flows matched observed flows. The model validates well against cars (the largest user group) and for all vehicles, which includes light and heavy goods vehicles.

Table 2.1 Model Validation Results from Local Model Validation Report

| Validation Criteria | Total Counts | % Compliant | Number not Compliant |
|---------------------------------|--------------|-------------|----------------------|
| Individual Flows – All Vehicles | 20 | 75% | 5 |
| Individual Flows – Cars | 20 | 85% | 3 |

2.2.3 In addition to traffic counts, journey time information was used to validate modelled journey times with observed. As shown in Table 2.2 the journey times validate well with 11 out of 12 routes meeting the DMRB criteria. This dictates that 85% of the modelled journey times should be within 15% of the observed journey times. The results show the model accurately represents delay along busy routes such as the A59. It is not always possible to validate 100% of the routes and as such the single route which is not compliant with DMRB validation criteria (A61 northbound) has 6 minutes of additional model delay. This is spread over a 6 mile journey length. This is the reason why Route 1 (A61) A658 to Killinghall did not validate.

Table 2.2 Journey Time Survey PM Peak Validation Results

| Route | Survey Time (min:sec) | Modelled Time (min:sec) | Difference (min:sec) | % Difference | DMRB Compliance |
|--|-----------------------|-------------------------|----------------------|--------------|-----------------|
| R1 – A61, Killinghall to A658 | 26:59 | 26:06 | 00:53 | 3% | YES |
| R1 – A61, A658 to Killinghall | 26:24 | 32:24 | 06:00 | 23% | NO |
| R2 - A658 Bypass e/b | 08:47 | 08:46 | 00:01 | 0% | YES |
| R2 - A658 Bypass w/b | 09:11 | 09:03 | 00:08 | 1% | YES |
| R3 - A59 Otley Road to Manse Farm | 25:13 | 25:49 | 00:36 | 2% | YES |
| R3 - A59 Manse Farm to Otley Road | 26:45 | 27:44 | 00:59 | 4% | YES |
| R4 - A661 Spofforth to Starbeck | 08:34 | 09:39 | 01:05 | 13% | YES |
| R4 - A661 Starbeck to Spofforth | 08:19 | 09:13 | 00:54 | 11% | YES |
| R5 - Hookstone Road, Forest Moor Road, B6163 | 09:17 | 09:50 | 00:33 | 6% | YES |
| R5 - B6163, Forest Moor Road, Hookstone Road | 10:47 | 09:28 | 01:19 | 12% | YES |
| R6 - Pannal Road, Rudding Lane | 18:39 | 16:18 | 02:21 | 13% | YES |
| R6 - Rudding Lane, Pannal Road | 18:11 | 15:28 | 02:43 | 15% | YES |
| Total Compliant | | | | | 11/12 |
| % Compliant (DMRB guideline is 85%) | | | | | 92% |

2.3 2011 Model Validation Check

- 2.3.1 For further confidence in the model's ability to replicate more recent flows the model flows have been checked against independent manual traffic counts undertaken at 17 junctions in October and November 2011 in Harrogate and Knaresborough.
- 2.3.2 This check showed that of the 114 entry links at junctions, 97 counts validated and 17 did not validate, giving a validation score of 85%. This is compliant with DfT validation criteria meaning the flows are considered to be robust. This demonstrates the model remains fit for purpose in assessing traffic conditions in addition to the high level of calibration/ validation as part of the LMVR described earlier.

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 base year model (2009) and the future year model (2024). The forecasting process was agreed with North Yorkshire County Council and the Highways Agency prior to commencement of the work and is the same as that used in the April 2013 report.
- 3.1.2 To determine the impact of development on the Harrogate and Knaresborough highway network, it was agreed that analysis should be undertaken in the forecast year 2024 as this represents the end of the DPD plan period.
- 3.1.3 This assessment required the 2009 base model to be factored up from 2009 to 2024 to represent the forecast growth in traffic. Growth has been calculated using the Department for Transport's Trip End Model Presentation pROgram (TEMPRO) and the National Traffic Model (NTM).
- 3.1.4 Forecasting requires the consideration of uncertainty. WebTAG Unit 3.15.5: The Treatment of Uncertainty in Model Forecasting discusses the treatment of uncertainty in forecasting the impacts of a transport project, with particular reference to the use of transport models. The guidance says '*Uncertainty in forecasting derives from the possibility of more than one outcome occurring during the period being forecasted and the forecast materially differing under these different outcomes. This would be represented by an input, or several inputs, to the forecast differing in the different views of the future*'. The guidance discusses the need for a Core scenario and the option of a range of sensitivity tests and/or alternative scenarios to account for future uncertainty.
- 3.1.5 For the assessment of development growth in Harrogate and Knaresborough a Core scenario has been developed to test the most realistic levels of traffic growth and development site trip generation. High and low growth sensitivity tests usually associated with major infrastructure schemes have not been undertaken as they would not provide the most realistic results.
- 3.1.6 The DfT TEMPRO traffic growth is a nationally derived figure, but one which takes account of traffic growth due to local forecasts of changes to car ownership, income, population and jobs.
- 3.1.7 The traffic model used for this report is refined further because it takes account of the site specific impacts of known larger development sites and the population and jobs emanating from these site developments.
- 3.1.8 To avoid double counting of development trips in the model the nationally derived TEMPRO traffic growth figures are reduced to take account of the growth accounted for through the development site information.

3.1.9 The methodology adopted allows the following comparisons and these are given in the tabulated results of the traffic modelling later in this report:-

- The results of the traffic impact of the traffic survey undertaken in 2009. This is called the baseline 2009.
- The results of the traffic impact of the growth attributed to increases in car usage by the existing population and increases in car usage from the implementation of major extant planning permissions. This is called the baseline 2024.
- The addition of the traffic impact of the draft site allocations proposed for Harrogate and Knaresborough in the Sites and Policies DPD.

3.1.10 This approach allows the effect of the DPD sites to be identified in isolation and compared against the baseline 2024.

3.1.11 The three vehicle types in the model (Cars, LGVs and HGVs) were each considered separately. TEMPRO growth was applied to cars, and NTM growth was applied to LGVs and HGVs.

3.2 Application of Growth Factors

3.2.1 The default TEMPRO planning assumptions, contained in the software, were adjusted to account for the number of households predicted in the forecast year, as a result of site specific and larger development proposals from extant planning permissions and DPD 'Draft Allocations, which were updated for this report.

3.2.2 The increase in the number of jobs accounted for in TEMPRO approximately matched the level created by the DPD so this was not adjusted in the TEMPRO planning assumptions. The resultant growth factors are shown in Table 3.1.

Table 3.1 TEMPRO Planning Assumptions

| | Default | | Predicted by Committed and DPD | |
|---------------------------|------------|--------|--------------------------------|--------|
| | Households | Jobs | Households | Jobs |
| 2009 Base | 39,064 | 52,668 | 39,064 | 52,668 |
| 2024 Future | 42,424 | 58,952 | 42,775 | 58,952 |
| Difference | 3,360 | 6,284 | 3,711 | 6,284 |
| Origin Growth Factor | 1.1198 | | 1.1220 | |
| Destination Growth Factor | 1.0754 | | 1.0811 | |

3.2.3 The TEMPRO factors above were then fine tuned to account for future fuel cost changes and income growth. These factors were derived from Table 1 of the DfT's Traffic Appraisal Guidance (TAG) Unit 3.15.2 (which can be accessed on the DfT's website) and are shown in Table 3.2.

Table 3.2 Income and Fuel Factors

| Factor | Value |
|----------|--------|
| Income | 1.0436 |
| Fuel | 1.0628 |
| Combined | 1.1092 |

3.2.4 Applying the TEMPRO growth factors to the base 2009 traffic, results in the following trip totals as presented in Table 3.3.

Table 3.3 Trip Totals from Applying TEMPRO Factors

| Scenario | Total |
|-------------------|---------------|
| 2009 Base | 109,251 |
| 2024 TEMPRO Only | 141,202 |
| Difference | 31,951 |

3.2.5 The 2024 trips were then factored down to avoid double counting. The site specific development trips are then added back in so the total trips in the DPD scenario do not exceed that presented above. The trip totals for the baseline (2024) and for the baseline with the addition of the DPD ‘Draft Allocations’ are shown in Table 3.4.

Table 3.4 Trip Totals for Each Scenario Modelled (Number of Vehicles)

| Scenario | Harrogate and Knaresborough | External to External | Total | Difference to 2009 | Percentage increase from 2009 |
|----------------|-----------------------------|----------------------|---------|--------------------|-------------------------------|
| Baseline: 2024 | 38,785 | 98,582 | 137,367 | 26,798 | 25.7% |
| DPD Scenario | 42,620 | 98,582 | 141,202 | 31,951 | 28.0% |

3.3 Growth in LGV and HGV

3.3.1 LGV and HGV growth factors have been taken from the DfT’s National Trip End Model (NTM) developed in 2011. This provides growth factors for all vehicle types on either a regional basis or by road classification.

3.3.2 Growth factors for the Yorkshire and Humber region were extracted and were further adjusted to more accurately represent North Yorkshire by comparing North Yorkshire county growth and Yorkshire and Humber regional growth calculated using TEMPRO factors. LGV and HGV growth is shown in Table 3.5.

Table 3.5 Matrix Totals for LGV and HGV Growth

| Matrix | 2009 | NTM Growth | 2024 | Increase |
|--------|-------|------------|--------|----------|
| LGV | 7,506 | 1.472 | 11,048 | 3,542 |
| HGV | 769 | 1.270 | 977 | 208 |

4 Development Sites

4.1 Introduction

4.1.1 The site specific information used in the traffic modelling for this report is divided into two types:

- Major development in Harrogate and Knaresborough with planning permission, built or likely to be built after Sept 2009, but before March 2024. (Committed development sites)
- Draft site allocations in Harrogate and Knaresborough included in the Draft Sites and Policies DPD Publication Draft.

4.2 Committed Development Sites

4.2.1 Planning permissions that have been taken into account are shown in Table 4.1 below. The relocation of the Police Headquarters took place after the 2009 model was developed and so has been included as a committed development.

Table 4.1 Harrogate and Knaresborough Committed Development Sites (Spring 2013)

| Town | Site Name | Class | GFA / Dwellings |
|---------------|---|--------------------|-----------------------|
| Harrogate | 1 Cardale Park | B1 (employment) | 4,460 m ² |
| Harrogate | Westmoreland St, Harrogate | Medical Centre | 3,646 m ² |
| Harrogate | Bogs Lane, Starbeck, Harrogate | Residential | 29 dwellings |
| Harrogate | Harrogate International Centre, Kings Road | Exhibition Hall | 1,600 m ² |
| Harrogate | Claro Road | B8 (employment) | 1,855 m ² |
| Harrogate | Old Swan Hotel | B1(employment) | 3,556 m ² |
| Harrogate | Relocation of Police Headquarters to Cardale Park | Police Station | 5,198 m ² |
| Harrogate | Tesco | Retail | 6,502 m ² |
| Harrogate | The Majestic Hotel | Hotel | 107 beds |
| Harrogate | H104 Land at Cornwall Road | Residential | 38 dwellings |
| Harrogate | H105(1)Land West Harlow Moor Road | Residential | 51 dwellings |
| Harrogate | H18 Land north of Eastville Terrace, Ripon Road | Residential | 14 dwellings |
| Harrogate | Asda, Bower Road extension | Retail | 1042 m ² |
| Harrogate | Crimple House, Hornbeam Park | Hospice | 10 bedrooms |
| Harrogate | M&S Nidd Vale Motors, Leeds Road | Retail | 3142 m ² |
| Harrogate | Harrogate Rugby Union Football Club | Residential | 126 dwellings |
| Harrogate | 11 Ripon Road, Harrogate | Residential | 13 dwellings |
| Harrogate | Harrogate Hospital | Community use | 1417 m ² |
| Harrogate | Harrogate Hospital | Community use | 978 m ² |
| Harrogate | Harrogate Hospital | Community use | car park |
| Knaresborough | Wetherby Road | B8 (employment) | 1,760 m ² |
| Knaresborough | St James Retail, Business and Industrial Park | B1 (employment) | 2,000 m ² |
| Knaresborough | St James Retail, Business and Industrial Park | B2 (employment) | 14,000 m ² |
| Knaresborough | St James Retail, Business and Industrial Park | B8 (employment) | 20,000 m ² |
| Knaresborough | St James Retail, Business and Industrial Park | Car Showroom | 6,000 m ² |
| Knaresborough | St James Retail, Business and Industrial Park | Furniture Retail | 3,060 m ² |
| Knaresborough | St James Retail, Business and Industrial Park | Furniture Retail | 2060 m ² |
| Knaresborough | BHS, St James Retail Park | Retail | 1858 m ² |
| Knaresborough | Land West of Halfpenny Lane | Residential | 13 dwellings |
| Knaresborough | 7 new units B1/B2/B8 Grimbold Crag Close | Industry/warehouse | 1036 m ² |
| Knaresborough | Halfpenny Lane, (former Nurseries Site) | Residential | 33 dwellings |
| Flaxby | Hotel and Leisure Development | Hotel | 300 beds |
| Flaxby | Chippindale Foods, Egg Packing Plant | B8 | 4,310 m ² |

4.3 Sites and Policies DPD: Draft Allocations

4.3.1 The DPD sites are listed below in Tables 4.2 and 4.3. It should be noted that for traffic modelling purposes B1 land use is defined as office only and B2 land use as light industry only. B8 land use is associated with warehousing and A1 land use is retail.

Table 4.2 Harrogate and Pannal: Draft Allocations (Spring 2013)

| Site ID | Site Name | Size |
|---------|--|--------------------------|
| H1004 | Harrogate College, Hornbeam Park | 3,480 m ² B1 |
| H1004 | Harrogate College, Hornbeam Park | 3,480 m ² B2 |
| H1012a | Knapping Mount, Harrogate | 52 Dwellings |
| H102(1) | Kingsley Farm, Bilton Triangle | 85 Dwellings |
| H1023 | Spa Tennis Club, Kent Drive, Harrogate | 13 Dwellings |
| H107a | Station Parade & Cophall Bridge House, Harrogate | 1,000 m ² B1 |
| H107a | Station Parade & Cophall Bridge House, Harrogate | 4,500 m ² A1 |
| H2002 | Harrogate Police Station, Harrogate | 24 Dwellings |
| H27(2) | Land to South of Cardale Park (7.9ha) | 16,000 m ² B1 |
| H27(2) | Land to South of Cardale Park | 13,600 m ² B2 |
| H3(1) | Land North of Penny Pot Lane | 500 dwellings |
| H3021 | Land North of Skipton Road, Harrogate | 290 dwellings |
| H32(2) | Land at Cardale Park West | 680 dwellings |
| H39 | B.T. Training Centre St. George's Walk | 90 dwellings |
| H400 | Land South of Bogs Lane | 74 dwellings |
| H4007 | Police Training Centre | 130 dwellings |
| H74a | Former Dunlopillo site, Pannal | 120 dwellings |
| H74a | Former Dunlopillo site, Pannal(2.7ha) | 13,200 m ² B1 |
| H74a | Former Dunlopillo site, Pannal | 15,400 m ² B2 |
| H74a | Former Dunlopillo site, Pannal | 600 m ² A1 |

Table 4.3 Knaresborough: Draft Allocations (Spring 2013)

| Site ID | Site Name | Size |
|---------|---|-------------------------|
| K18 | Former Timber Yard, Hambleton Road, Knaresborough | 10 Dwellings |
| K16 | Former Cattle Market, Stockwell Road, Knaresborough | 20 Dwellings |
| K16 | Former Cattle Market, Stockwell Road, Knaresborough | 1,000 m ² B2 |
| K4001 | York Place Car Park | 28 dwellings |
| K2b | Manse Farm Residential | 700 dwellings |
| K2b | Manse Farm Offices | 4,000 m ² B1 |
| K2b | Manse Farm Industrial | 6,000 m ² B2 |
| K2b | Manse Farm Warehousing | 4,000 m ² B8 |
| K2b | Manse Farm Retail | 2788 m 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 TRICS¹ database based upon the number of dwellings and employment areas put forward as the Council's Draft Allocations. A trip rate summary table is contained in Appendix A.
- 4.4.2 The trip rates calculated using TRICS are average trip rates which have been refined for the location and size of the site. The trip rates used are shown in Table 4.4 and Table 4.5 below. Each development has been modelled as a worst case scenario where the trip generation may differ from trip generations documented in individual Transport Assessments.

**Table 4.4 Trips Generated by Harrogate and Pannal: Draft Allocations
(PM Peak 17:00-18:00)**

| Site ID | Name | Type | Trip Rate In | Trip Rate Out | Trips In | Trips Out | Total Trips |
|---------|---|--------------|--------------|---------------|----------|-----------|-------------|
| H1004 | Harrogate College, Hornbeam Park | B1 | 0.159 | 1.664 | 6 | 58 | 63 |
| | | B2 | 0.141 | 0.455 | 5 | 16 | 21 |
| | | <i>Total</i> | | | 11 | 74 | 84 |
| H1012a | Knapping Mount, Harrogate | C3 | 0.419 | 0.282 | 22 | 15 | 36 |
| H102(1) | Kingsley Farm, Bilton Triangle | C3 | 0.413 | 0.246 | 35 | 21 | 56 |
| H1023 | Spa Tennis Club, Kent Drive, Harrogate | C3 | 0.419 | 0.282 | 5 | 4 | 9 |
| H107a | Station Parade & Copthall Bridge House, Harrogate | B1 | 0.397 | 2.029 | 4 | 20 | 24 |
| | | A1 | 5.743 | 5.697 | 227 | 234 | 461 |
| | | <i>Total</i> | | | 231 | 254 | 485 |
| H2002 | Harrogate Police Station, Harrogate | C3 | 0.419 | 0.282 | 10 | 7 | 17 |
| H27a | Land to South of Cardale Park | B1 | 0.147 | 1.663 | 24 | 266 | 290 |
| | | B2 | 0.141 | 0.455 | 19 | 62 | 81 |
| | | <i>Total</i> | | | 43 | 328 | 371 |
| H3(1) | Land North of Penny Pot Lane | C3 | 0.428 | 0.251 | 214 | 126 | 340 |
| H3021 | Land North of Skipton Road, Harrogate | C3 | 0.428 | 0.251 | 124 | 73 | 197 |
| H32(2) | Land at Cardale Park West | C3 | 0.428 | 0.251 | 291 | 171 | 462 |
| H39 | B.T. Training Centre St. George's Walk | C3 | 0.419 | 0.282 | 38 | 25 | 63 |
| H400 | Land South of Bogs Lane | C3 | 0.413 | 0.246 | 31 | 18 | 49 |
| H74a | Former Dunlopillo site, Pannal | C3 | 0.413 | 0.246 | 50 | 30 | 80 |
| | | B1 | 0.147 | 1.663 | 19 | 220 | 239 |
| | | B2 | 0.141 | 0.455 | 22 | 70 | 92 |
| | | A1 | 5.743 | 5.697 | 34 | 34 | 68 |
| | | <i>Total</i> | | | 125 | 353 | 478 |
| H4007 | Police Training Centre | C3 | 0.413 | 0.246 | 53 | 32 | 85 |

¹ TRICS – Trip Rate Information Computer System, the national standard for trip generation analysis.

Table 4.5 Trips Generated by Knaresborough Draft Allocations (PM Peak 17:00-18:00)

| Site ID | Name | Type | Trip Rate In | Trip Rate Out | Trips In | Trips Out | Total Trips |
|--------------|---|--------------|--------------|---------------|----------|-----------|-------------|
| K18 | Former Timber Yard, Hambleton Road, Knaresborough | C3 | 0.413 | 0.246 | 4 | 2 | 7 |
| K16 | Former Cattle Market, Stockwell Road, Knaresborough | C3 | 0.413 | 0.246 | 8 | 5 | 13 |
| | | B2 | 0.141 | 0.455 | 1 | 5 | 6 |
| | | <i>Total</i> | | | 9 | 10 | 19 |
| K2b | Manse Farm | C3 | 0.428 | 0.251 | 300 | 176 | 475 |
| | | B1 | 0.159 | 1.664 | 6 | 67 | 73 |
| | | B2 | 0.141 | 0.455 | 8 | 27 | 36 |
| | | B8 | 0.065 | 0.176 | 3 | 7 | 10 |
| | | A1 | 5.743 | 5.697 | 160 | 159 | 319 |
| <i>Total</i> | | | 461 | 420 | 882 | | |
| K4001 | York Place Car Park | C3 | 0.419 | 0.282 | 12 | 8 | 20 |

4.4.3 The trip generation in the above tables differs from the trip generation in the same tables contained within the Preferred Site Options Report published in April 2013. The reasons why the trip generation is different to the Preferred Site Options is shown in Table 4.6 below.

Table 4.6 Explanation for Differences between Preferred Site Allocations Trip Generation and Draft Allocations Trip Generation

| Site | Type | Draft Allocations Trips | Preferred Site Options Trips | Draft Allocations Development Size | Preferred Site Options Development Size | Reason for Change in Trip Generation |
|---------------------------------------|------|-------------------------|------------------------------|------------------------------------|---|--------------------------------------|
| Kingsley Farm | C3 | 56 | 68 | 85 Dwellings | 103 Dwellings | Site reduced by 18 dwellings |
| Station Parade & Cophall Bridge House | A1 | 461 | 515 | 4500 m ² A1 | 4500 m ² A1 | Revised trip rates |
| Land North of Skipton Road | C3 | 197 | 293 | 290 dwellings | 432 dwellings | Site reduced by 142 dwellings |
| Cardale Park West | C3 | 462 | 523 | 680 dwellings | 770 dwellings | Site reduced by 90 dwellings |
| Dunlopillo site, Pannal | C3 | 80 | 13 | 120 dwellings | 20 Dwellings | Site increased by 100 dwellings |
| Dunlopillo site, Pannal | A1 | 68 | 229 | 600 m ² A1 | 2,000 m ² A1 | Site reduced by 1,400 m ² |
| Police Training Centre | C3 | 85 | 0 | 130 dwellings | 0 | Additional site |
| Manse Farm | A1 | 319 | 0 | 2788 m ² | 0 | Additional site |
| York Place Car Park | C3 | 20 | 0 | 28 dwellings | 0 | Additional site |

4.4.4 Table 4.7 shows the total number of trips generated by the DPD draft site allocations. The total number of trips has reduced by 265 trips when compared to the Preferred Site Allocations. This reduction is due to the net reduction in development size.

Table 4.7 DPD Draft Allocations Trip Totals

| Scenario | Trips In | Trips Out | Total Trips |
|----------|----------|-----------|-------------|
| DPD | 1,719 | 1,942 | 3,661 |

4.4.5 The trip rates used do not take account of any reduction in traffic due to public transport improvements, or measures included in travel plans to encourage modal shift. In reality, public transport improvements will be implemented as part of the developments, but with limited information on the likely effect of these measures, no reduction in trip rates have been applied to modelled trips. Therefore, the developments modelled represent a worst case scenario in terms of traffic generation.

4.4.6 Linked trips for mixed use developments were considered. This was dealt with by analysing the number of trips out from the employment development and into the residential development and taking 10% of the smaller of these two numbers from both the inbound and outbound trips as the linked trips. This approach was used for the two mixed use developments at Manse Farm and the former Dunlopillo site.

4.5 Development Trip Distribution

4.5.1 The development trips have been added to the model to represent 2024 traffic conditions. The development trips were added to the model in the locations they will be built with assumed access points onto the highway network. These assumed access points were agreed with NYCC as the local highway authority.

4.5.2 Each development required a trip distribution to dictate where trips are going to and where they are coming from. This was obtained by the use of existing development distribution in the traffic model for sites with similar land use characteristics located close to the site. For example, trips to and from a proposed residential development have been distributed onto the highway network based on the distribution of base model residential trips in the vicinity of the proposed site.

4.6 Highway Network Changes

4.6.1 The changes to the highway network included in this model run are those associated with the permission for a Tesco retail store off Skipton Road:

- Changes to the roundabout at the junction of A59 Skipton Road and A61 Ripon Road;
- A new roundabout on the A59 at the junction with the new access road to the Tesco store;
- A new signalised junction on the A61 at the junction with the new access road to the Tesco store; and
- Changes to the signalised junction of A61 Ripon Road and Jenny Field Drive.

4.6.2 In addition to these, other known network changes also include the following changes to accommodate, or which are associated with, the Draft Site Allocations:

- New roundabout access on Princess Royal Way, Leeds Road, Pannal, to accommodate the proposed development at the former Dunlopillo site (H74a).
- Junction changes at Leeds Road / Hookstone Road;
- Traffic lights at Bogs Lane / Forest Moor Road;

5 The Effect of DPD Development Traffic at Key Junctions

5.1 Introduction

5.1.1 This chapter provides the results of the assessment of the impact of traffic growth on key junctions in Harrogate and Knaresborough.

5.1.2 A total of 28 junctions were assessed. A list of the junctions is shown in Table 5.1 and a location plan of the junctions is shown in Figure 5.1 below. The junction type is also indicated. Traffic flows for each of the junction models were extracted from the Harrogate and Knaresborough model for the base 2009, baseline 2024 scenario and the DPD 2024 scenario.

Figure 5.1 28 Assessed Junctions – Location Plan

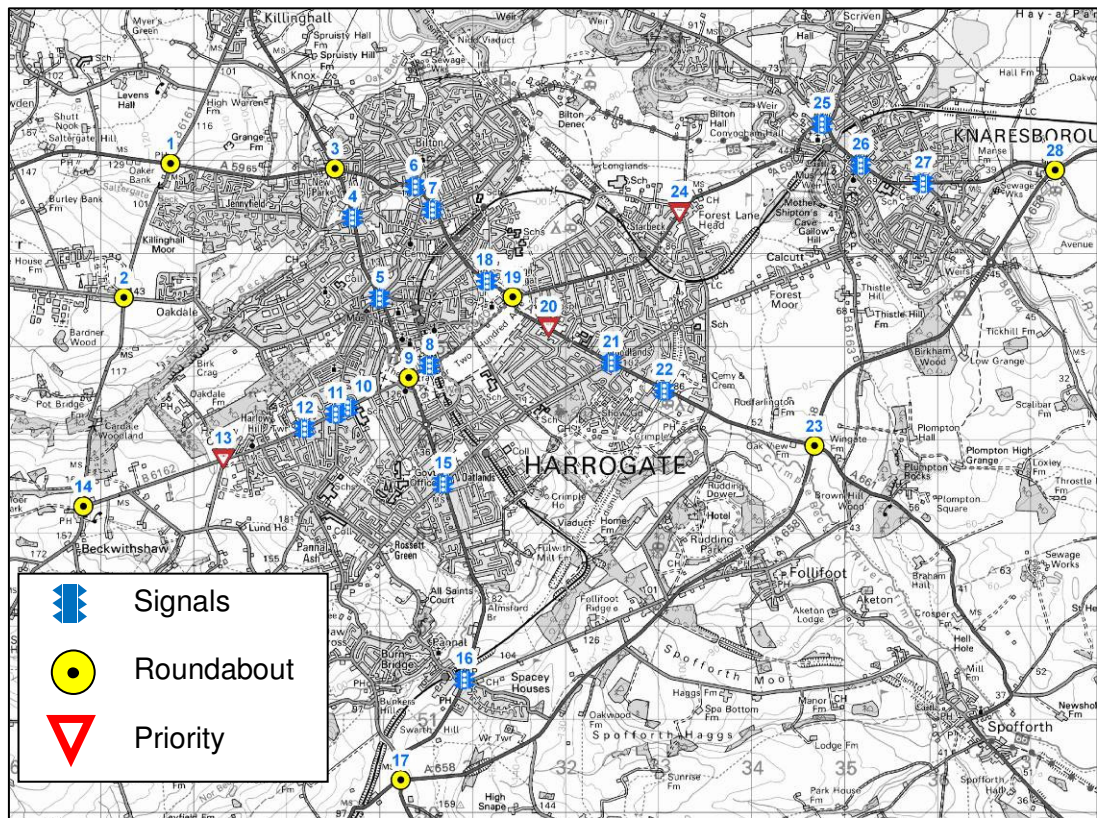






























Table 5.1 Assessed Junctions in Harrogate and Knaresborough

| Junction Number | Junction Name | Control Type |
|-----------------|--|--|
| 1 | A59 Skipton Road / B6161 Otley Road | Roundabout  |
| 2 | B6161 Oaker Bank / Penny Pot Lane | Roundabout  |
| 3 | A59 Skipton Road / A61 Ripon Road | Roundabout  |
| 4 | A61 Ripon Road / Jenny Field Drive | Signals  |
| 5 | A61 Parliament Street / A61 Ripon Road / King's Road / Crescent Road | Signals  |
| 6 | A59 Skipton Road / Bilton Lane | Signals  |
| 7 | A59 Skipton Road / King's Road / Woodfield Road | Signals  |
| 8 | A61 Station Parade / A6040 York Place | Signals  |
| 9 | A61 Prince of Wales Roundabout | Roundabout  |
| 10 | B6162 Otley Road / Cold Bath Road / Arthurs Avenue | Signals  |
| 11 | B6162 Otley Road / Pannal Ash Road | Signals  |
| 12 | B6162 Otley Road / Harlow Moor Road | Signals  |
| 13 | B6162 Otley Road / Beckwith Head Road | Give-Way  |
| 14 | B6162 Otley Road / Pot Bank | Roundabout  |
| 15 | A61 Leeds Road / Hookstone Road / Leadhall Lane | Signals  |
| 16 | Spacey Houses Junctions | Signals  |
| 17 | A61 / Southern Bypass | Roundabout  |
| 18 | A59 Skipton Road / Claro Road | Signals  |
| 19 | A59 Empress Roundabout | Roundabout  |
| 20 | A661 Wetherby Road / Lancaster Park Road | Give-Way  |
| 21 | A661 Wetherby Road / Hookstone Chase / Hookstone Drive | Signals  |
| 22 | A661 Wetherby Road / Railway Road | Signals  |
| 23 | A661 / Southern Bypass | Roundabout  |
| 24 | A59 / Bogs Lane / Forest Lane | Give-Way  |
| 25 | Bond End Junctions | Signals  |
| 26 | A59 High Street / A59 York Place / B6163 Gracious Street / Park Row | Signals  |
| 27 | A59 York Road / B6164 Wetherby Road / Chain Lane | Signals  |
| 28 | A59 / Southern Bypass | Roundabout  |

5.2 Junction Assessment Results

Introduction

- 5.2.1 The 28 strategic junctions identified are modelled using the nationally accepted ARCADY for roundabouts, PICADY for give-way junctions, or LinSig for traffic signals. Flows at each junction are fed into the individual junctions.
- 5.2.2 The junctions are assessed using the ratio of flow to capacity (RFC), which shows the demand flow compared to the available capacity. The junction models present an RFC figure for each arm of the junction during the model period and so the RFCs on each arm of the junction were taken forward for comparison. This ensured that problems at junctions are not overlooked by using an average RFC over all arms. RFC is a standard nationally accepted way of measuring the congestion at a junction.
- 5.2.3 The RFCs are reported using a nationally accepted traffic light colouring system which has been used 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 at which a junction is starting to approach its 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.
- 5.2.4 Perceived congestion at junctions may be worse than that shown in the modelling results; this is due to a range of factors. Video evidence of junction performance was analysed to assess driver and queuing behaviour. At Empress Roundabout it was observed that exits from the junctions were blocked due to queuing traffic. 'Upstream' queuing was attributed to pedestrian crossings being activated during the peak hours particularly on Knaresborough Road. Video evidence of queuing behaviour at the A61/ A59 roundabout and the A59/ Westmoreland Street traffic signals were also analysed and queuing behaviour was considered to be accurately represented in the base year junction models.
- 5.2.5 A further issue is that of the ability of the traffic model to identify what may be perceived as queuing. Queues at signalised junctions, especially on Skipton Road, include stationary vehicles and also vehicles in a 'rolling queue'. The modelling software used to undertake the assessment of the junction cannot measure rolling queues and so only static queues are reported. If static queues clear when given a green light at the signals, the junction is judged to be performing under 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.

Results

5.2.7 The results of the junction assessments for the 2009 base, 2024 baseline and 2024 DPD scenario are shown in Table 5.2, which displays maximum RFC values for each junction.

Table 5.2 Junction Assessment Results (Maximum RFC)

| Junction | Base 2009 | Baseline 2024 | DPD Scenario 2024 |
|--|-----------|---------------|-------------------|
| 1 - Skipton Road / Otley Road | 0.84 | 1.20 | 1.28 |
| 2 - Oaker Bank / Penny Pot Lane | 0.39 | 0.43 | 0.51 |
| 3 - Skipton Road / Ripon Road | 0.72 | 0.85 | 0.93 |
| 4 - Ripon Road / Jenny Field Drive | 1.17 | 0.91 | 0.93* |
| 5 - Parliament St / Ripon Rd / King's Rd | 1.21 | 2.23 | 2.31 |
| 6 - Skipton Road / Bilton Lane | 0.68 | 0.84 | 0.77* |
| 7 - Skipton Road / King's Road | 0.76 | 0.86 | 0.91 |
| 8 - Station Parade / York Place | 0.77 | 0.80 | 0.83 |
| 9 - Prince of Wales Roundabout | 0.88 | 1.09 | 1.20 |
| 10 - Otley Road / Cold Bath Road | 0.74 | 0.97 | 0.93 |
| 11 - Otley Road / Pannal Ash Road | 0.71 | 0.83 | 1.32 |
| 12 - Otley Road / Harlow Moor Road | 0.89 | 0.90 | 0.90 |
| 13 - Otley Road / Beckwith Head Road | 0.29 | 0.46 | 0.48 |
| 14 - Otley Road / Pot Bank | 1.26 | 1.91 | 2.17 |
| 15 - Leeds Road / Hookstone Road | 0.77 | 0.74 | 0.84 |
| 16 - Spacey Houses Junctions | 1.04 | 1.15 | 1.01* |
| 17 - A61 / Southern Bypass | 0.67 | 0.78 | 0.94 |
| 18 - Skipton Road / Claro Road | 0.70 | 0.74 | 0.75 |
| 19 - Empress Roundabout | 0.73 | 0.67 | 0.71 |
| 20 - Wetherby Road / Lancaster Park Road | 0.39 | 0.05 | 0.11 |
| 21 - Wetherby Road / Hookstone Chase | 1.20 | 1.30 | 1.34 |
| 22 - Wetherby Road / Railway Road | 0.97 | 1.05 | 1.15 |
| 23 - A661 / Southern Bypass | 0.65 | 0.78 | 0.83 |
| 24 - A59 / Bogs Lane / Forest Lane | 0.19 | 0.24 | 0.30 |
| 25 - Bond End Junctions | 1.13 | 1.24 | 1.34 |
| 26 - High Street / Gracious Street | 1.00 | 1.28 | 1.37 |
| 27 - York Rd / Wetherby Rd / Chain Lane | 3.11 | 3.10 | 2.95 |
| 28 - A59 / Southern Bypass | 0.72 | 0.86 | 0.93 |

*Signal times have been optimised to achieve maximum capacity to reduce RFC value.

5.2.8 The results from Table 5.2 show that left unimproved, 11 of the 28 junctions are forecast to operate over capacity in 2024 when the DPD Draft Allocations have been completed. A further 7 are forecast to operate at approaching capacity, and 10 to operate below capacity.

5.2.9 The results shown for the DPD Scenario 2024 at junctions 4, 6 and 16 have been calculated based on optimised signal timings. This means the length of the green times associated with the different traffic movements have been calculated to add the maximum amount of capacity to the junction to reduce queues and delay.

5.2.10 The results of the Baseline 2024 assessment in Table 5.2 differ from the Baseline 2024 assessment results in the Preferred Site Options Report because

of the change in the Harrogate and Knaresborough committed development sites between autumn 2011 and spring 2013.

- 5.2.11 The results of the DPD Scenario 2024 assessment in Table 5.2 differ from the DPD Scenario 2024 assessment results in the Preferred Options Report because the draft allocations DPD development trip generation differs from the trip generation within the Preferred Site Options Report published in April 2013. The reasons why the trip generation is different to the Preferred Site Options is shown in Table 4.6 in Section 4 of this report.
- 5.2.12 The results of the assessment of the Spacey Houses signalised junction (Junction 16) show a reduction in RFC when compared to the Preferred Site Options Report. The Transport Assessment for the Dunlopillo development site, immediately adjacent to Junction 16, has assessed the trip generation for the site in some detail and has determined that the net increase in trips as a result of the site will be minimal. This is due to the existing trips using the site which will be removed and as such the net trips will be less. This net difference in trips has been applied to the traffic model, and to the assessment of Junction 16, which has shown the development traffic does not have any significant impact at the junction.

6 Junction Improvements for Over Capacity Junctions

6.1 Introduction

6.1.1 Of the 28 junctions assessed 11 junctions are forecast to operate over capacity, and 9 are forecast to operate over capacity and experience congestion greater than the baseline of 2024. Of these 9 junctions, 8 need measures to mitigate the impacts of the 2024 traffic flows and options are available to implement these measures.

6.1.2 These 8 junctions are:

- Junction 1 - Skipton Road / Otley Road;
- Junction 5 - Parliament Street / Ripon Road / King's Road / Crescent Road;
- Junction 9 - Prince of Wales Roundabout;
- Junction 10 - Otley Road / Cold Bath Road; (also mitigation of junction 11).
- Junction 14 - Otley Road / Pot Bank;
- Junction 26 - High Street / Gracious Street; and
- Junction 27 - A59 / Wetherby Rd / Chain Lane.

6.1.3 Junction 11 - Otley Road / Pannal Ash Road is not forecast to operate over capacity but mitigation is required as part of the same measures to mitigate the impact at junction 10. This is because Junction 10 and 11 are adjacent signalised junctions which when combined into a single signal operated junction will provide additional capacity.

6.1.4 The above junctions, for which mitigation measures are required, are the same junctions listed in the Preferred Site Allocations Report. This is because the Draft Allocations development traffic is of a similar order of magnitude to that in the Preferred Site Allocations and therefore has a similar impact on the network and junctions. The exception to this is the Spacey Houses junction, which due to a more detailed assessment using the Transport Assessment for the development, does not require any mitigation.

6.1.5 The mitigation measures proposed are as follows.

- Junction 1 – Localised widening of entry arms on Skipton Road and on Oaker Bank.
- Junction 5 – Signalised junction to incorporate enhanced and improved pedestrian facilities and optimised signal timings. Montpellier Road to be widened to form part of the junction for trips between Crescent Road and Ripon Road.
- Junction 9 – To accommodate additional traffic flows the roundabout is to be widened on Otley Road, York Place and Leeds Road.
- Junction 10 & 11 – Small amount of widening on Cold Bath Road to increase queuing space and combination of the two junctions with optimised signal timings.

- Junction 14 – Existing mini roundabout converted to a normal roundabout.
- Junction 26 – Signal timings to be optimised to provide additional capacity.
- Junction 27 – B6164 realigned to improve the performance of the junction.

6.1.6 Two signalised junctions (Junctions 21 and 22) are due to be upgraded with MOVA² by North Yorkshire County Council, as the Local Highway Authority, and have been excluded from requiring further mitigation at this stage. The implementation of MOVA is anticipated to add capacity to these junctions by balancing flows and available green time.

6.1.7 The other junction over capacity is at Bond End. HBC has declared an air quality management area at the Bond End Junction due to exceedence 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, HBC is working with the Local Highway Authority to develop an Air Quality Action Plan which aims to identify measures to reduce emissions to within the permitted level.

6.1.8 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.

6.1.9 The junction has also been considered as part of the Local Highway Authority's traffic signal health check which has shown there is some potential for improvements whilst acknowledging localised spatial constraints. However, if additional capacity were to be released at Bond End as a result of these initiatives then some of this capacity is likely to be absorbed by latent traffic demand.

6.1.10 For this reason work will be necessary to further assess the impact of development generated traffic at this junction. As detailed in Core Strategy Policy TRA1 and draft Sites and Policies DPD Policy TRA4, HBC Planning Authority and the Local Highway Authority would expect to see that future Transport Assessments, Travel Plans and Air Quality Assessments, supporting development in the area, consider the impact of the development on Bond End and alternative routes, such as Forest Moor Road, and identify necessary mitigation measures.

6.1.11 NYCC as the Local Highway Authority, and Harrogate Borough Council, have secured in excess of £1.65 million of funding from the Department for Transport towards sustainable transport initiatives in Harrogate town centre through the Local Sustainable Transport Fund (LSTF). The funding was allocated specifically for a package of measures and initiatives to support the continued economic development of Harrogate through a reduction in traffic congestion and the promotion and implementation of sustainable travel options to improve:

- Sustainable access to the town centre and to major conference and exhibition facilities in the town; and

² MOVA - **M**icroprocessor **O**ptimised **V**ehicle **A**ctuation. Designed by TRL during the 1980s, it is now a very well established strategy for the control of traffic light signals at isolated junctions.

- Sustainable access and journey time reliability along the A661 corridor

6.2 Changes to RFCs brought about by Junction Improvements

6.2.1 Mitigation measures to the junctions listed above are likely to change travel behaviour and as far as possible this has been assessed using the traffic model.

6.2.2 The RFC estimates from this assessment are shown in Table 6.1. The baseline results and the results of the junction assessments with no junction improvement are included for comparison.

6.2.3 For mitigation options utilising signals (e.g. Junction 16 and Junction 26), timings were optimised for 2024 levels of traffic.

6.2.4 Table 6.1 is summarised as follows

- Of the 28 junctions 22 will operate under capacity with an RFC less than 1.
- 6 Junctions will operate over capacity.
- Of the 6 over capacity junctions, 5 junctions will operate over capacity but with an RFC less than the baseline RFC. These are Junction 1 Skipton Road / Otley Road, Junction 16 Spacey Houses, Junction 21 Wetherby Road / Hookstone Chase due to be upgraded with MOVA, Junction 22 due to be upgraded with MOVA and Junction 27 Wetherby Road.
- Bond End (Junction 25) will operate over capacity and will have a higher RFC than the baseline.

6.2.5 The results of the DPD Scenario 2024 with improvement assessment in Table 6.1 differ from the DPD Scenario 2024 with improvement assessment results in the Preferred Site Options Report because the draft allocations DPD development trip generation differs from the trip generation within the Preferred Site Options Report published in April 2013. The reasons why the trip generation is different to the Preferred Site Options are shown in Table 4.6. Post publication of the Preferred Site Options Report some changes have been made to the modelling of signalised junctions (Junctions 4, 5, 6, 16, 21 and 22) to improve or optimise the signal timings at these junctions to increase available capacity.

6.2.6 A sensitivity test has been undertaken for Junction 28 to establish the changes required to be made to the roundabout to add enough capacity to enable the maximum RFC to be reduced to 0.85 or below. The results are that the entry width and flare length on the A59 York Road (North) would need to be increased by 0.7m and 7m respectively to give an RFC value of 0.84.

Table 6.1 Junction Assessment Results Including Junction Improvement (Maximum RFC)

| Junction* | Base 2009 | Baseline 2024 | DPD Scenario No Improvement | DPD Scenario with Improvement |
|--|-----------|---------------|-----------------------------|-----------------------------------|
| 1 - Skipton Road / Otley Road | 0.84 | 1.20 | 1.28 | 1.05 |
| 2 - Oaker Bank / Penny Pot Lane | 0.39 | 0.43 | 0.51 | 0.55 |
| 3 - Skipton Road / Ripon Road | 0.72 | 0.85 | 0.93 | 0.95 |
| 4 - Ripon Road / Jenny Field Drive | 1.17 | 0.91 | 0.93 ⁺⁺⁺ | 0.92 ⁺⁺⁺ |
| 5 - Parliament St / Ripon Rd / King's Rd | 1.21 | 2.23 | 2.31 | 0.98 ⁺⁺⁺ |
| 6 - Skipton Road / Bilton Lane | 0.68 | 0.84 | 0.77 ⁺⁺⁺ | 0.78 ⁺⁺⁺ |
| 7 - Skipton Road / King's Road | 0.76 | 0.86 | 0.91 | 0.86 |
| 8 - Station Parade / York Place | 0.77 | 0.80 | 0.83 | 0.84 |
| 9 - Prince of Wales Roundabout | 0.88 | 1.09 | 1.20 | 0.79 |
| 10 - Otley Road / Cold Bath Road | 0.74 | 0.97 | 0.93 | 0.91 |
| 11 - Otley Road / Pannal Ash Road | 0.71 | 0.83 | 1.32 | 0.89 |
| 12 - Otley Road / Harlow Moor Road | 0.89 | 0.90 | 0.90 | 0.91 |
| 13 - Otley Road / Beckwith Head Road | 0.29 | 0.46 | 0.48 | 0.44 |
| 14 - Otley Road / Pot Bank | 1.26 | 1.91 | 2.17 | 0.76 |
| 15 - Leeds Road / Hookstone Road | 0.77 | 0.74 | 0.84 | 0.81 |
| 16 - Spacey Houses Junctions | 1.04 | 1.15 | 1.17 | 1.01 ⁺⁺⁺ |
| 17 - A61 / Southern Bypass | 0.67 | 0.78 | 0.94 | 0.88 |
| 18 - Skipton Road / Claro Road | 0.70 | 0.74 | 0.75 | 0.75 |
| 19 - Empress Roundabout | 0.73 | 0.67 | 0.71 | 0.72 |
| 20 - Wetherby Road / Lancaster Park Road | 0.39 | 0.05 | 0.11 | 0.11 |
| 21 - Wetherby Road / Hookstone Chase | 1.20 | 1.30 | 1.34 | 1.14 ^{**} ⁺⁺⁺ |
| 22 - Wetherby Road / Railway Road | 0.97 | 1.05 | 1.15 | 1.04 ^{**} ⁺⁺⁺ |
| 23 - A661 / Southern Bypass | 0.65 | 0.78 | 0.83 | 0.82 |
| 24 - A59 / Bogs Lane / Forest Lane | 0.19 | 0.24 | 0.30 | 0.37 |
| 25 - Bond End Junctions | 1.13 | 1.24 | 1.34 | 1.36 ⁺⁺ |
| 26 - High Street / Gracious Street | 1.00 | 1.28 | 1.37 | 0.79 |
| 27 - York Rd / Wetherby Rd / Chain Lane | 3.11 | 3.10 | 2.95 [*] | 1.06 |
| 28 - A59 / Southern Bypass | 0.72 | 0.86 | 0.93 | 0.94 |

* Junction 27 is congested with a high proportion of flows on one arm in 2009. Changes and rerouting of traffic in 2024 changes the proportion of traffic on the arms of the junction which reduces the maximum RFC.

**MOVA to be employed at Junction 21 and 22 which may reduce the RFC. MOVA not taken into account in results.

+ Shaded junctions are those with proposed mitigation measures.

** Junction 25 Bond End – See above text in 6.1.6 for description.

+++ Optimised signal timings to increase capacity.

6.2.7 The mitigation of the 8 junctions highlighted in the Table 6.1 means some trips will be diverted in the model due to journey time changes. Re-routing traffic causes the RFC on some junctions with no proposed mitigation to increase.

6.2.8 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.

7 Additional Network Assessments

7.1 Introduction

7.1.1 In addition to the assessment of junction capacity a number of further assessments have been undertaken using the Harrogate and Knaresborough traffic model. These are as follows:

- Traffic flows to and from the A1(M)
- Cross boundary traffic
- Rat running

7.2 Effect on Strategic Road Network

7.2.1 As part of this assessment, Harrogate Borough Council has requested that the effect of the development traffic on the Strategic Road Network is analysed. Traffic from Harrogate and Knaresborough would access the A1(M) at one of five junctions: J45, J46, J47, J48, or J50. Junction 49 (A168 Thirsk) cannot be accessed from Harrogate and so development traffic would not join the A1(M) at this junction.

7.2.2 The Harrogate and Knaresborough traffic model detailed simulation area does not include the A1 and junctions with the A1. This means the traffic flows in the model were not validated on the A1 or A1 junctions so confidence or reliance on these flows cannot be guaranteed.

7.2.3 For this reason, and to aid in other assessments, the Highways Agency have undertaken an independent assessment of the likely impact of the proposed allocations within the Harrogate DPD using a census model. This HA assessment has shown that the census modelled results are similar to those obtained from the Harrogate and Knaresborough model with the following exceptions:

- The Harrogate and Knaresborough model shows higher traffic impact at J48 Boroughbridge than the census model
- The Harrogate and Knaresborough model shows lower traffic impact at J47 than the census impact and
- The Harrogate and Knaresborough model shows a higher traffic impact at J45 than the census model impact.

7.2.4 Table 7.1 below shows the Highways Agency Census Model results.

Table 7.1 PM Peak – Highways Agency’s Census Model Development Traffic using A1(M)

| Junction | Additional Vehicles from Developments | Additional Vehicles to Developments | Total Additional Vehicles |
|--------------------------|---------------------------------------|-------------------------------------|---------------------------|
| J50 A61 Ripon | 15 | 7 | 22 |
| J48 Boroughbridge | 7 | 18 | 25 |
| J47 A59 Harrogate / York | 103 | 142 | 245 |
| J46 Wetherby North | 1 | 1 | 2 |
| J45 Wetherby South | 61 | 19 | 80 |
| Total | 187 | 187 | 374 |

- 7.2.5 This mainly comes about from traffic generated in Knaresborough and travelling to the north having the choice of using J48 or J47. It is believed that due to capacity constraints within Knaresborough and the location of the largest site in this area that traffic is more likely to use the A59 to J47.
- 7.2.6 It has been shown that the impact predicted by the Harrogate and Knaresborough model is very similar to the impact the census model predicts for the cross movements along the A59.
- 7.2.7 Flows at J45 are likely to be related to the route choice for Harrogate West and Central sites which can travel south either along the A61 or by travelling across to the A1(M). This choice will be destination dependent, but given the specific details of the junction and the distance from this junction of the developments, it is not felt that the level of impact of the developments will be significant.
- 7.2.8 NYCC (as the Local Highway Authority) and the Highways Agency agreed that the traffic model was not appropriate for assessing the traffic impact on the A1 Junction 47 and the trunk road network and that further work would be required. As a result the HA commissioned a bespoke traffic model to assess the cumulative impacts of the draft site allocations at J47 A(1)M. The modelling work undertaken has shown that mitigation is not required and that the impacts of the draft site allocations can be accommodated.

7.3 Analysis of Cross-Boundary Traffic

- 7.3.1 The analysis of cross-boundary traffic reviews the volume of DPD Draft Allocations traffic which has an origin or destination outside of the Harrogate District. The differences in traffic volumes between the Harrogate Borough and Hambleton, Craven, Selby, York, Wetherby, Leeds, Bradford, and Wakefield have been analysed using the traffic model.
- 7.3.2 The analysis of the cross-boundary traffic is presented in Table 7.2. These values have been calculated using the traffic model.

Table 7.2 PM Peak Cross-Boundary Traffic using Traffic Model

| External Zone | Vehicles from Harrogate Developments | Vehicles to Harrogate Developments | Total | Percentage Increase |
|-----------------------------|--------------------------------------|------------------------------------|------------|---------------------|
| Hambleton | 50 | 55 | 105 | 2% |
| Craven | 25 | 15 | 40 | 1% |
| Selby | 37 | 16 | 53 | 1% |
| York | 64 | 23 | 87 | 1% |
| Wetherby | 56 | 23 | 79 | 7% |
| Leeds | 182 | 130 | 312 | 1% |
| Bradford | 119 | 139 | 258 | 1% |
| Wakefield | 2 | 1 | 3 | 0% |
| Total External Trips | 535 | 402 | 937 | 13% |

- 7.3.3 The results show that 13% of new development trips in the PM peak have an origin or destination outside the Harrogate Borough. Wetherby sees the greatest increase in trips, with a total of 7% of trips travelling to or from Harrogate development sites. These results show that the change in cross boundary travel as a result of the development is minimal.

7.4 Rat Running

- 7.4.1 The impact of rat running due to increased traffic flows is detailed in Appendix B. The rat running analysis demonstrates that some rat running will occur with the introduction of the DPD Draft Allocations in Harrogate and Knaresborough.
- 7.4.2 Rat running mainly occurs on Oaker Bank and on local roads to the south of Cardale Park. Oaker Bank is used as an alternative route for traffic travelling north or south in order to avoid travelling through the centre of Harrogate. The local roads to the south of Cardale Park are used as an alternative route to access the A61 to the south of Harrogate. If traffic were not to use these local roads, there would be a greater impact on the junctions on the B6261 and A61.
- 7.4.3 The analysis also shows that improvements to the Otley Road / Beckwith Head Road junction may be required in order to reduce rat running on Howhill Road and Pannal Ash Road.

8 Summary

8.1 Summary

- 8.1.1 The aim of this report is to produce a strategic transport assessment detailing the impacts of the draft housing and employment allocations in Harrogate and Knaresborough. In doing so this report has taken into account forecast increases in car usage up to 2024 and the likely growth in traffic from those planning permissions likely to be built after the traffic survey was undertaken in 2009.
- 8.1.2 The Harrogate and Knaresborough Traffic Model commissioned in 2009 by North Yorkshire County Council, as the Local Highway Authority, and built by Jacobs in 2009/2010 has been utilised to assess the traffic impacts of the Sites and Policies DPD draft site allocations.
- 8.1.3 The primary output of the study is an assessment of the impact on 28 strategic junctions across the Harrogate and Knaresborough highway network. This assessment forecast that, without improvement, 11 of these junctions would operate over capacity as a result of the estimated traffic flows in 2024.
- 8.1.4 Indicative junction mitigation options are available for measures to be implemented at 8 junctions in Harrogate and Knaresborough. Section 6.1 of this report sets out the position in relation to the other junctions which are over capacity at 2024. The mitigation measures proposed are discussed in Section 6.1.
- 8.1.5 The traffic models were also used to assess the impact of the increased traffic flows on rat running, and changes in cross boundary traffic on the wider highway network. Section 7 and Appendix B set out the results of this work.
- 8.1.6 Further work has been undertaken by the Highway Agency to assess the impact of the District's Draft Site Allocations on Junction 47 of the A1(M) and has concluded that mitigation at this junction is not required.
- 8.1.7 The modelling work undertaken on the impact of the Draft Allocations for the Sites and Policies DPD shows that the proposed level of development can be accommodated within Harrogate and Knaresborough if junction improvement measures are implemented. Work to date on the necessary changes to 8 key junctions on the network indicates that improvements to the traffic flows at these junctions can be made.

Appendix A Trip Rates Summary Table

| Land Use | Sub Land Use | Location | Size Range | Category | Class | No of Surveys | Average (Mean) | | OGV (Mean) | |
|---------------------|--|--------------------------------------|------------|-------------|-------|---------------|----------------|------------|------------|------------|
| | | | | | | | Arrivals | Departures | Arrivals | Departures |
| 03 - Residential | A - Houses Privately Owned | Edge of Town | <200 | Residential | C3 | 15 | 0.413 | 0.246 | 0.000 | 0.000 |
| 03 - Residential | A - Houses Privately Owned | Edge of Town | 150-1500 | Residential | C3 | 9 | 0.428 | 0.251 | 0.000 | 0.000 |
| 03 - Residential | A - Houses Privately Owned | Suburban | <200 | Residential | C3 | 18 | 0.419 | 0.282 | 0.000 | 0.000 |
| 02 - Employment | A - Office | Edge of Town Centre | 0-5500 | Office | B1 | 9 | 0.397 | 2.029 | 0.000 | 0.000 |
| 02 - Employment | A - Office | Edge of Town | 0-5500 | Office | B1 | 6 | 0.159 | 1.664 | 0.000 | 0.000 |
| 02 - Employment | A - Office | Edge of Town | 5500-17000 | Office | B1 | 5 | 0.147 | 1.663 | 0.000 | 0.000 |
| 02 - Employment | A - Office | Suburban | 0-5500 | Office | B1 | 7 | 0.236 | 1.882 | 0.000 | 0.000 |
| 02 - Employment | D - Industrial Estate | Edge of Town | 0-25000 | Industrial | B2 | 4 | 0.141 | 0.455 | 0.005 | 0.007 |
| 02 - Employment | F - Warehousing (Commercial) | Edge of Town | 0-20000 | Storage | B8 | 5 | 0.065 | 0.176 | 0.023 | 0.010 |
| 01 - Retail | I - Shopping Centre – Local Shops | Edge of Town/ Edge of Town Centre | 0-5000 | Retail | A1 | 4 | 5.743 | 5.697 | 0.000 | 0.046 |
| 01 - Retail | G - Other Individual Non-Food Superstore | Edge of Town/ Edge of Town Centre | 0-5000 | Retail | A1 | 4 | 1.332 | 1.352 | 0.010 | 0.010 |
| 14 - Car Show Rooms | A - Car Show Rooms | Edge of Town | 3000-9000 | Other | SG | 5 | 0.208 | 0.542 | 0.000 | 0.000 |
| 07 - Leisure | S - Exhibition Centre | Town Centre/ Edge of Town Centre | 0-3000 | Leisure | D1 | 2 | 0.281 | 0.943 | 0.000 | 0.000 |
| 05 - Health | G - GP Surgeries | Suburban | 0-1000 | Leisure | D1 | 7 | 1.992 | 3.384 | 0.000 | 0.000 |

Appendix B Rat Running Assessment

1. Overview

This appendix provides information from the traffic model on some of the potential traffic flows on minor roads in the year 2024 for Harrogate and Knaresborough. This form of traffic movement is commonly known as rat running.

Rat running traffic has been taken account of in the assessment of the 28 junctions in the main report using the flows extracted from the traffic model.

It should be noted that using rat running flows extracted from the traffic model should be used with caution as the model is limited in its ability to judge what actions may be taken by drivers in reality in order to avoid congestion.

2. Harrogate Analysis

Analysis of the difference in flows between the DPD scenario and the baseline (Figure 1), and the traffic from the DPD development site (Figure 2) shows trips from the developments using Oaker Bank to travel north and south to avoid using the centre of Harrogate. Rat running on local roads to the south of Cardale Park occurs, but to a lesser extent. Table 3 shows the increase in rat running on local roads around Cardale Park.

Table 3 Increase in Flows Around Cardale Park in Comparison to the 2024 Baseline Scenario

| Road | Direction | Increase in Flow | Percent Increase |
|---------------------|------------------|------------------|------------------|
| Pannal Ash Road | northbound | 106 | 55% |
| | southbound | 24 | 10% |
| Howhill Road | north-west bound | 4 | 2% |
| | south-east bound | 0 | 0% |
| Hill Top Lane | northbound | 13 | 29% |
| | southbound | 101 | 96% |
| Yew Tree Lane | northbound | 91 | 25% |
| | southbound | 57 | 24% |
| Main Street, Pannal | north-west bound | 44 | 16% |
| | south-east bound | -49 | -16% |
| Burn Bridge Road | northbound | 154 | 36% |
| | southbound | 172 | 67% |

Traffic from the developments at Cardale Park uses Pannal Ash Road to access Otley Road due to delays at the Beckwith Head Road / Otley Road give-way junction.

The development at Land North of Penny Pot Lane causes some rat running issues for traffic wishing to access Harrogate. This traffic uses either Penny Pot Lane and Cornwall Road or Penny Pot Lane and Harlow Moor Road, then Harlow Moor Drive and Cold Bath Road. This is due to the volume of traffic at the Otley Road / Harlow Moor Road junction and resultantly it is more effective for traffic to divert using Cold Bath Road instead. Traffic intending to access the North and West from the Penny Pot Lane development uses Oaker Bank.

Table 4 shows the increases in traffic on Cornwall Road, Cold Bath Road and Harlow Moor Road. The increases on Duchy Road are very small, less than 10 vehicles in each direction and are not reported.

Table 4 *Increased traffic flows on Cornwall Road, Cold Bath Road, and Harlow Moor Road in Comparison to the 2024 Baseline Scenario*

| Road | Direction | Increase in Flow | Percent Increase |
|------------------|------------------|------------------|------------------|
| Cornwall Road | east bound | 48 | 49% |
| | west bound | 49 | 18% |
| Cold Bath Road | north-east bound | -9 | -5% |
| | south-west bound | 89 | 17% |
| Harlow Moor Road | north bound | 31 | 11% |
| | south bound | 17 | 8% |

Traffic from the development at Land North of Skipton Road has a relatively minor impact on Harrogate town centre and the surrounding roads, with the majority of traffic distributed northwards and westwards. A small amount of traffic uses Oaker Bank (c.60 vehicles) and the A59 and A661 (c.50 vehicles).

3. Knaresborough

The major development in Knaresborough is at Manse Farm. Figure 3 shows there is some rat running in Knaresborough with traffic from Manse Farm using Chain Lane and Halfpenny Lane to avoid using Knaresborough High Street and Bond End.

An additional 125 vehicles use Halfpenny Lane (40 northbound and 85 southbound). Subsequent improvements to junctions in Knaresborough may reduce the volumes of traffic using Halfpenny Lane. This is in comparison to the 2024 Baseline Scenario.

4. Summary

This technical note demonstrates that some rat running will occur with the introduction of DPD developments in Harrogate and Knaresborough.

Rat running mainly occurs on Oaker Bank and on local roads to the south of Cardale Park. Oaker Bank is used as an alternative route for traffic travelling north or south in order to avoid travelling through the centre of Harrogate. The local roads to the south of Cardale Park are used as an alternative route to access the A61 to the south of Harrogate. If traffic were not to use these local roads, there would be a greater impact on the junctions on the B6261 and A61.

Figure2 DPD Origin and Destination Traffic in West Harrogate

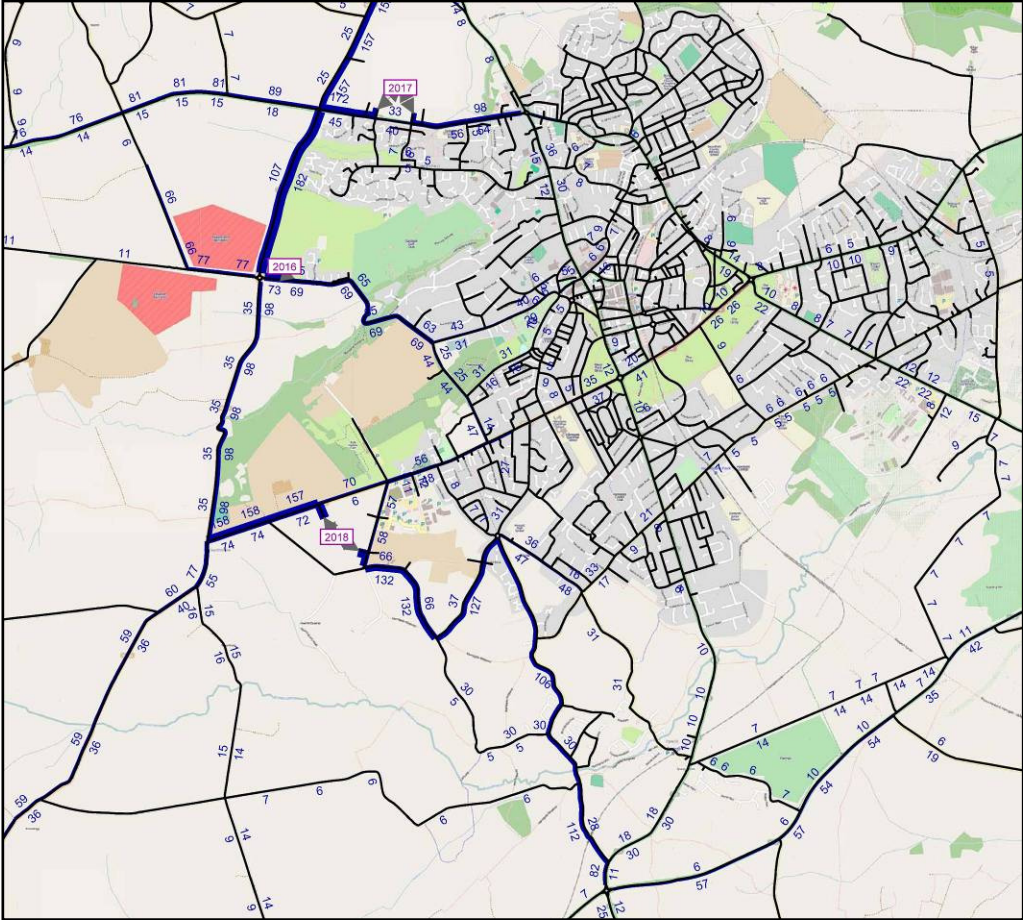


Figure 3 Manse Farm Origin and Destination Traffic

