

Setting Strategic Direction

Charnwood LDF Core Strategy – Stage 2 Emerging Development Strategy

Report for Charnwood Borough Council

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Executive Summary

Study Background

This report details the transport impacts of the emerging development strategy associated with the Charnwood Borough Council Local Plan Core Strategy. The assessment of this emerging strategy follows a previous assessment of four strategy options undertaken in May 2012. The assessment has been undertaken using the Leicester and Leicestershire Integrated Transport Model (LLITM).

The emerging development strategy includes residential and employment land use at:

- West Loughborough – 3,000 houses and 15.8 hectares of employment;
- West Shepshed – 500 houses;
- Loughborough Science Park – 50 hectares of employment;
- North of Birstall – 1,500 houses and 15 hectares of employment;
- Watermead – 6.2 hectares of employment; and
- North East of Leicester – 4,500 houses and 12.7 hectares of employment.

The emerging development strategy also includes an additional 1,256 houses and 12 hectares of employment spread across the service centres and pieces of land adjoining the urban areas of Loughborough, Shepshed and Leicester (not included in the above).

No Mitigation Assessment

Similar to the previous assessments, the emerging development strategy was initially assessed with no improvements to the highway and public transport networks other than the provision of access junctions to identify the base impact of the development on the transport networks.

This initial assessment assumed that Travel Planning, Smarter Choices measures and local pedestrian/cycle infrastructure provision would form a base requirement for all the sites within the LDF proposals.

The impacts of the general traffic growth and the development strategy are worse in the AM peak than the PM peak.

Public Transport Mitigation

The first stage of transport mitigation that was assessed included the provision of enhanced bus based public transport services accessing each of the sites within the emerging development strategy. In all cases the level of service was improved to provide a minimum of four buses per hour providing access to Loughborough for the developments in the north of the Borough and Leicester for developments to the south of the Borough. New bus routes were also modelled for West Loughborough and North East Leicester SUEs.

The model predicted that the public transport mitigation has a marginal effect on the congestion impact of the developments on the highway network although the levels of public transport usage increased for all major sites as a result of the improved levels of service. Some of the sites are already well served by public transport and therefore the level of mitigation over and above the base scenario is limited. The overall modal shift from highway to public transport (as a result of the public transport mitigation package) for the emerging development strategy sites is 2%.

The sites with the highest levels of patronage include West Loughborough, North East Leicester and North of Birstall.

Highway Mitigation

A series of highway improvement strategies aimed at relieving the congestion resulting from the emerging development strategy were developed by Charnwood in conjunction with Leicestershire County Council, Leicester City Council and the promoters of the development sites. These strategies were based on the individual schemes identified in previous assessments of individual sites as well as more recent proposals.

The highway mitigation builds upon the earlier public transport mitigation and therefore includes all the enhancements to bus services accessing the development sites.

Individual highway mitigation schemes have been identified for each development site and these do not include minor junction improvements that should be identified as part of the detailed appraisal of the individual sites during the planning application process. The identified highway schemes include new routes which provide access to the sites as well as congestion relief to the wider highway network, significant improvements to strategic junctions where congestion problems have been identified, traffic management and bus priority measures and the widening of existing single carriageway routes to dual carriageway.

A range of performance indicators have been used to assess the effectiveness of the mitigation strategy. In terms of Delay, Average Speed and Congested Route Kilometres, the full mitigation package is predicted to provide enough relief to fully mitigate the impacts of the proposed developments across both peaks and also provide improvements to the network conditions that are predicted to occur by 2026 even without the Core Strategy proposals.

Conclusion

The objective of this study was to assess, on a strategic level, the impact of the emerging development strategy and the effectiveness of the mitigation package in reducing those impacts. The analysis of the outputs from the LLITM model runs has shown that across the majority of indicators, the emerging development strategy can be accommodated and mitigated in transport terms.

However, in order to investigate the effectiveness of mitigation measures associated with individual development sites, further work will need to be undertaken at a later stage when detailed development schemes are prepared. It would be advantageous to explore in more detail the relative benefits of the individual mitigation measures to understand where some

might be less effective than others in order to help refine the mitigation package and to possibly carry out some sensitivity testing.

The evidence provided by this study would inform the Core Strategy for Charnwood Borough.

1 Introduction

1.1 Overview

- 1.1.1 The Charnwood 2028 Local Plan is a statutory plan establishing the spatial strategy for the Borough. At the core of the LDF is a need for sustainable transport solutions to meet the pressures of the major growth over the period to 2028. Good transport provision is essential to Charnwood's continuing prosperity but improvements need to be implemented in ways that are sustainable and minimise adverse environmental and social impacts. Car dependency needs to be reduced and the number of people walking, cycling and using public transport increased.
- 1.1.2 MVA were commissioned by Charnwood Borough Council and Leicestershire County Council in August 2011 to undertake a transport assessment of the Charnwood Local Plan Core Strategy, using the 2026 Leicester and Leicestershire Integrated Transport Model (LLITM).
- 1.1.3 This Study, Stage 1, was completed in May 2012 and assessed the transport implications of four potential development strategies and possible mitigation measures. The Study assessed the cumulative impact of growth across the Borough and did not assess growth options on an individual basis. The Stage 1 Study, along with other sources of evidence has helped inform the development of a single emerging development strategy which has been tested as part of this commission – Stage 2.

1.2 Previous Assessments

- 1.2.1 Stages 1 & 2, as explained above, expand on previous transport assessments undertaken by MVA Consultancy. In 2009, MVA undertook two separate studies to examine the transport implications of potential growth options to the South of Charnwood and in and around Loughborough. These parts of the Borough were tested separately due to the coverage of available models at that time.
- 1.2.2 The study focusing on south Charnwood appraised the growth options and complementary mitigation packages close to Thurmaston, north Birstall, Anstey and Glenfield using the 2026 Central Leicestershire Transport Model (CLTM). The study assessed sites on an individual basis and concluded that location and proximity to the strategic transport network was a key component influencing congestion caused by growth options. Mitigation testing concluded that the transport impacts associated with growth points could be minimised through a mixture of public transport and highway mitigation measures.
- 1.2.3 The north Charnwood study appraised potential growth options in and around Loughborough using the 2026 Loughborough Transport Model (LTM). The study concluded that by 2026 Loughborough will be highly congested on most of its radial and orbital routes, and therefore any future growth options will need a comprehensive set of mitigation measures in order to allow the transport network to operate.

1.2.4 Further information on these studies can be found in the following MVA reports (available on Charnwood web page <http://www.charnwood.gov.uk/pages/transportloughborough2009>):

- 'Loughborough Transport Assessments for the Charnwood 2026 LDF' (2009)
- 'Southern Charnwood Transport Assessments for the 2026 LDF' (2009).

1.3 Structure of the Report

1.3.1 The structure of the report is as follows:

- Chapter 2 details the methodology utilised for the study.
- Chapter 3 details the Reference Case results.
- Chapter 4 provides information about the emerging development strategy.
- Chapter 5 provides the modelling results from No Mitigation model runs.
- Chapter 6 details the mitigation packages for the development strategy.
- Chapter 7 provides the results from non-highway mitigation testing.
- Chapter 8 provides results from Highway mitigation testing.
- Chapter 9 provides an assessment of the emerging development strategy in terms of deliverability and cost-effectiveness of the mitigation package.
- Chapter 10 provides a summary of conclusions.

2 Study Methodology

2.1 Overview

2.1.1 This section summarises the approach adopted for Stage 2 to model Charnwood Borough Council's emerging development strategy. The approach and modelling methodology incorporates the following requirements and best practice:

- The impact of all transport modes is assessed;
- All options compared on an equal and consistent basis;
- Both **flows** and **capacities** are included in the assessments and results;
- Non highway mitigation measures are assessed and reported separately from highway mitigation;
- Mitigation is strategically developed from the individual transport issues arising from each development scenario, with variations in option location and access to existing local facilities to be incorporated;
- Mitigation is applied consistently and effectively within a multi-modal framework and cost per dwelling basis; and
- Outputs are provided as a series of clear, concise and comparative set of key indicators that may be transferred to other bodies and organisations such as the Highways Agency.

2.1.2 Robust and comparative analysis has been the key determinate of the overall methodology outlined within this chapter, and adopted within the overall study.

2.1.3 The following tasks have been undertaken in the course of this assessment, and will be explained in further detail within this chapter;

- Future year Reference Case development;
- Future year with emerging development strategy (no mitigation);
- Development of Non Highway Mitigation scenarios; and
- Development of the Highway Mitigation scenarios.

2.2 Revised Validation of the Model along Strategic Road Network

- 2.2.1 Using the *Loughborough Local Model Validation Report (AECOM, 2011)*, validation spreadsheets provided by LCC (Sept 2011) and the *Public Transport LMVR (Scott Wilson 2011)* the highway and public transport elements of LLITM were assessed in order to determine their suitability for testing development strategies within Loughborough and the wider Charnwood Borough. The full technical note was provided as part of the Stage 1 report issued in May 2012.
- 2.2.2 However, the Stage 1 study revealed that the base year highway model validation was less good on the Strategic Road Network (SRN). A review of the SRN coding has been undertaken as part of Stage 2 work in order to improve the validation levels along those roads, without compromising good levels of validation in other areas.
- 2.2.3 The review resulted in improved validation for the base year highway model along SRN.
- 2.2.4 Two technical notes '*Analysis of Strategic Road Network in LLITM (July 2012)*' and '*Revised Validation Statistics for LLITM Strategic Road Network (July 2012)*' were issued in 2012 to demonstrate the revised validation statistics for the base year model.
- 2.2.5 The highway network changes made to the base year were then incorporated into the 2026 Reference Case.

2.3 Overview of Reference Case Development

- 2.3.1 The 2026 reference case provides a single do-minimum scenario that the emerging development strategy is tested against. This has been based on the 2026 reference case developed by Leicestershire County Council used for the assessment of the Loughborough Integrated Transport Scheme major scheme business case.
- 2.3.2 The forecast years available in LLITM model are 2016, 2021, 2026 and 2031. Therefore, 2026 has been used as a reference case for this study being nearest to the Core Strategy year (2028).
- 2.3.3 This reference case builds on the 2008 base model that incorporates the enhancements to the strategic road networks within the model.

Transport Networks

- 2.3.4 The following committed schemes in the Charnwood vicinity have been included in the 2026 networks:
- Loughborough Integrated Transport Scheme;
 - Loughborough Eastern Gateway; and
 - Birstall Park and Ride (already operational).
- 2.3.5 A series of network checks were carried in the vicinity of each development to ensure the network was suitable for testing developments. During this process access points for each

development were reviewed and refined where necessary in both the highway and public transport networks.

Land Use

- 2.3.6 Within Charnwood, the reference case includes committed developments only which reflects the situation should planning permission not been obtained for any future development. This is based on the situation in September 2011.
- 2.3.7 Outside the Charnwood area the reference case includes representations of the core strategies for the boroughs and districts with in the remaining parts of Leicestershire based on information from the various councils that has been presented to Leicestershire County Council. The overall growth within the fully modelled area has been constrained to TEMPRO 6.2.
- 2.3.8 Outside Leicestershire land-use and transport growth has been taken from a combination of TEMPRO 6.2 and NTEM based on the reference cases used in the assessment of the Loughborough Integrated Transport Scheme.

2.4 Emerging Development Strategy Proposals

- 2.4.1 The emerging development strategy land use proposals to be appraised as part of this study are shown in Table 2.1. Figure 2.1 shows the locations of main development sites contained within the strategy and service centres. This scenario contains around 11,000 residential dwellings and 111.7 Ha of employment development.
- 2.4.2 The locations shown in Figure 2.1 are for illustrative purposes only and in no way reflect the exact plan or layout of the sites.
- 2.4.3 A large proportion of the employment site data was described in terms of hectares of land available for development. As the unit of measurement within the land use model is square metres of floorspace a conversion factor was applied to convert site area (in hectares) to square metres of floorspace. Unless the local authority indicated otherwise then a standard conversion factor that assumed the amount of floorspace would equate to 50% of the site area.
- 2.4.4 The site modeled for West Shepshed is a site which has been promoted through Charnwood's Strategic Housing Land Availability Assessment (SHLAA). A site specific location for this direction for growth has not yet been identified and will be considered on through the planning process.
- 2.4.5 The share of housing and employment identified for the service centres has been split equally amongst the service centres. Residential and employment uses within and adjoining Loughborough and Shepshed have been split 80% share to Loughborough and 20% to Shepshed. Residential and employment uses for development within and adjacent to the PUA has been split equally between Birstall, Hamilton and Thurmaston.

Table 2.1 Emerging Development Strategy

	Residential (dwellings)	Employment (ha)
West of Loughborough	3,000	15.8
West Shepshed	500	-
North of Birstall	1,500	15
Science Park	-	50
Watermead	-	6.2
North East Leicester	4,500	12.7
Service Centres	200	7
Additional development within and adjoining Loughborough and Shepshed	613	5

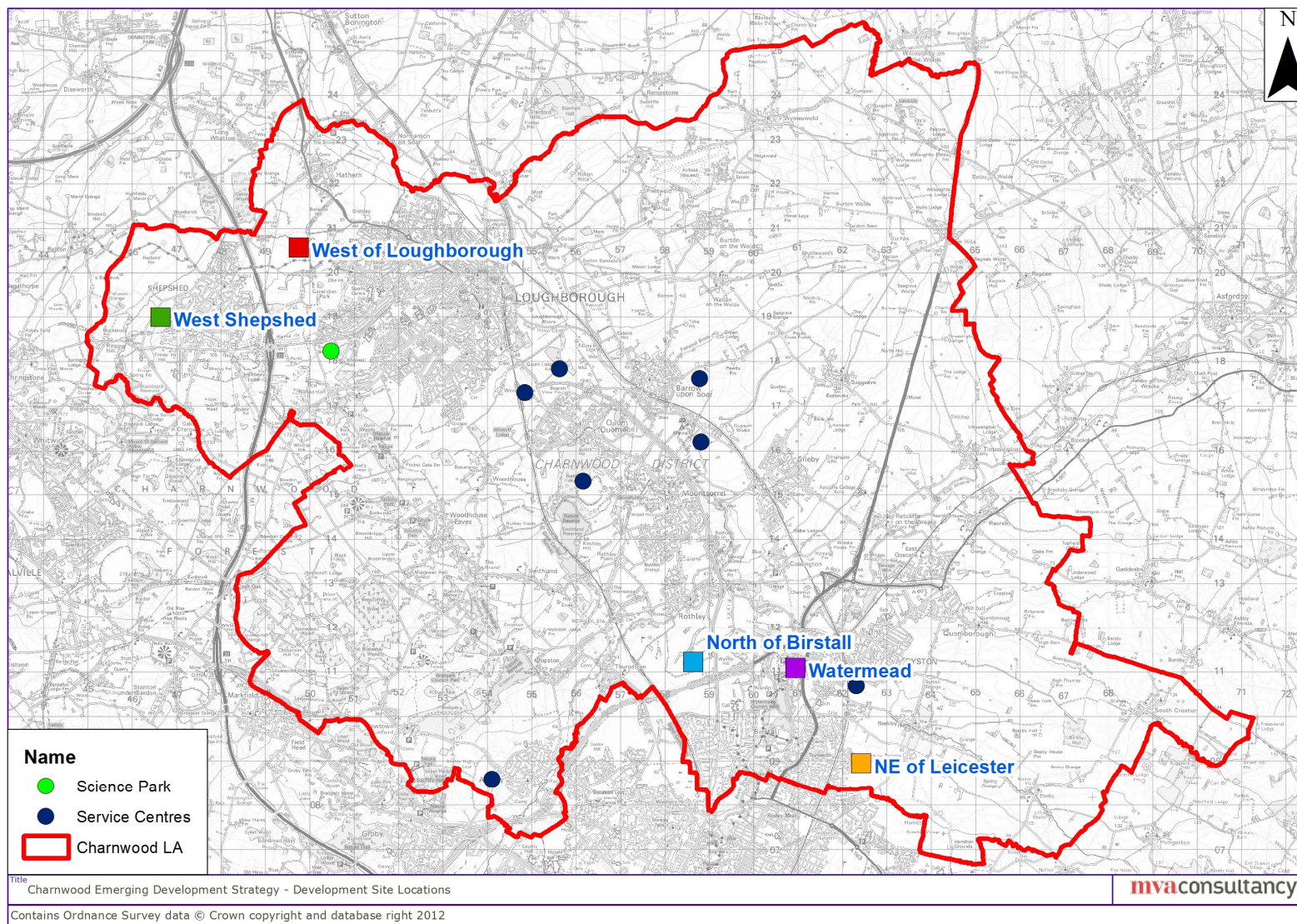
	Residential (dwellings)	Employment (ha)
Additional development within and adjacent to PUA	643	-
Total	10,956	111.7

- 2.4.6 In the initial stages of the study the emerging development strategy has been assessed with no public transport or highway mitigation in place to establish a worst case scenario. The traffic generations for each development site have been derived by LLITM based on the proposed land use detailed previously and the local area transport characteristics, taken from the LLITM base model, for the area within which the individual development resides.
- 2.4.7 This approach and the resultant levels of peak hour generation have been agreed with Leicestershire County Council for use in the analysis of the core strategy proposals.
- 2.4.8 The traffic generations derived by LLITM include a representation for intra-site trips between various land uses within an individual site and also take account of 'active modes' and smarter choices mitigation. As a result these impacts have not been reassessed within the formal mitigation assessments.
- 2.4.9 Site specific employment splits between Office, Industry and warehousing have been assumed and are shown in Table 2.2.
- 2.4.10 For three out of six major sites, the employment mix was based on Experian's proposed split for Loughborough. For the rest, the split was provided by Charnwood Borough Council after consultation with the project board.

Table 2.2 Site Specific Employment Splits

Site	Office	Industry	Warehousing	Basis
North East Leicester	13%	44%	43%	Experian's proposed split
West of Loughborough	14%	43%	43%	CBC's proposed split
Science Park	100%			CBC's proposed split
North of Birstall	11%	45%	44%	Experian's proposed split
West Shepshed	15%	25%	60%	Experian's proposed split
Watermead	30%	70%		CBC's proposed split

Figure 2.1 Location of sites tested in Emerging Development Strategy



2.5 With Mitigation Assessments

- 2.5.1 A list of mitigation measures (mitigation package) has been developed for the emerging development strategy based on the results of the 'without mitigation' model runs, information from previous studies and a series of discussions with Charnwood Borough Council, Leicestershire County Council, Leicester City Council, the Highways Agency and developers.
- 2.5.2 Indicative costs for mitigation measures have been updated based on current information. Where this has not been available, indicative costs identified as part of the previous studies and have been included. A 15% risk and 40% optimism bias has been applied to all costs.
- 2.5.3 The mitigation has been assessed in two stages first with public transport measures (for example new or enhanced bus services) and then with public transport and highway mitigation measures combined.

3 Reference Case Results

3.1 Overview

- 3.1.1 This section details the assumption in creating the 2026 Reference Case and a comparison of this Reference Case with the 2008 Base within Charnwood area for AM and PM peaks.
- 3.1.2 It is not possible to report on all the assumptions made within the different components of LLITM and the transport assessment. Further information on what assumptions have been used within LLITM can be obtained from Leicestershire County Council.

3.2 Land Use

- 3.2.1 The 2026 Reference Case excludes the developments associated with the emerging development strategy. It is used as a benchmark to compare the development strategy against.
- 3.2.2 The 2026 Reference Case contains:
 - Commitments and land use allocations across other parts of Charnwood that were supplied by Charnwood Borough Council (CBC) based on information known as of September 2011.
 - The commitments and allocations provided by other local planning authorities both in Leicestershire and those parts of the Fully Modelled Area which include adjacent authorities' areas.
 - A topping up of development, in the other local planning authority areas, to ensure that the scale of development is consistent with the levels of growth assumed in the NTEM forecasts.
- 3.2.3 Over the period to 2026, Charnwood BC had identified commitments and allocations for development amounting to:
 - 3,876 dwellings;
 - 3,165 sqm of retail floorspace;
 - 63,587 sqm of office floorspace;
 - 149,000 sqm of industrial floorspace; and
 - 214,963 sqm of warehouse floorspace.
- 3.2.4 Charnwood BC also identified four sites in the Watermead area where development was likely to take place. These include:
 - Hope Park (c 5.5Ha) with potential for B1 Business;
 - Former Country Club (c 5.5Ha) with potential for B1, B2, hotel and leisure;
 - Costco site; and
 - Pinfold industrial site.

3 Reference Case Results

- 3.2.5 Between 2008 and 2026, the model forecasts the total number of households in Charnwood will increase by 13.7% from 68,156 in 2008 to 77,156 in 2026.
- 3.2.6 The population of Charnwood is forecast to increase by 7.7% over the period from 2008 to 2026 in the Reference Case. This smaller percentage (compared to the growth in households) reflects the continuing decline in average household size.
- 3.2.7 The number of jobs within Charnwood is forecast to rise over the period from 2008 to 2026 by 0.6%.

3.3 Traffic Growth

- 3.3.1 Table 3.1 shows the trip matrix totals for the Base Year as well as the Reference Case. Over a period of 18 years, the model predicts a traffic growth of 16% in the AM peak and 15% in the PM peak within Charnwood.

Table 3.1 Traffic Growth within Charnwood

	2008 Base	2026 Reference	Growth
AM Peak	75,351	87,360	16%
PM Peak	78,122	90,155	15%

3.4 Flow Difference and Congestion

- 3.4.1 Figure 3.1 shows flow difference plot for the 2026 Reference Case, compared against the 2008 Base, for the AM peak. Red lines represent roads forecast to increase in traffic whereas decreases in traffic are shown in green. Figure 3.2 shows the similar information for the PM peak.
- 3.4.2 A vast majority of routes within the study area are forecast to be affected by traffic growth between 2008 and 2026, including less suitable routes through rural areas.
- 3.4.3 Figure 3.3 identifies the junctions which were not congested in the AM peak in the 2008 Base but become congested in the 2026 Reference Case. Figure 3.4 shows the similar information for the PM peak.

Figure 3.1 AM Flow Difference – 2026 Reference Case vs 2008 Base

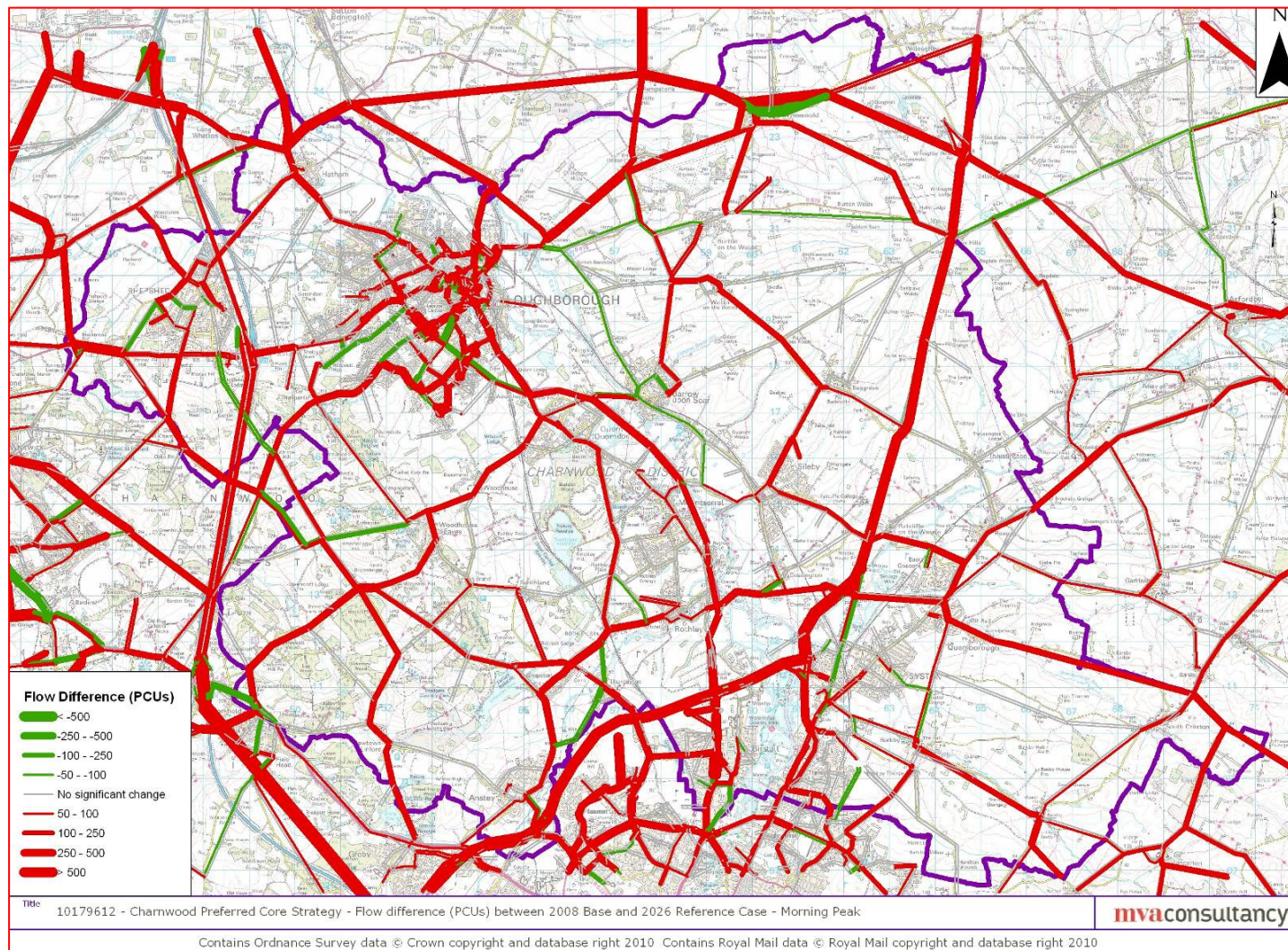


Figure 3.2 PM Flow Difference Profile – 2026 Reference Case vs 2008 Base

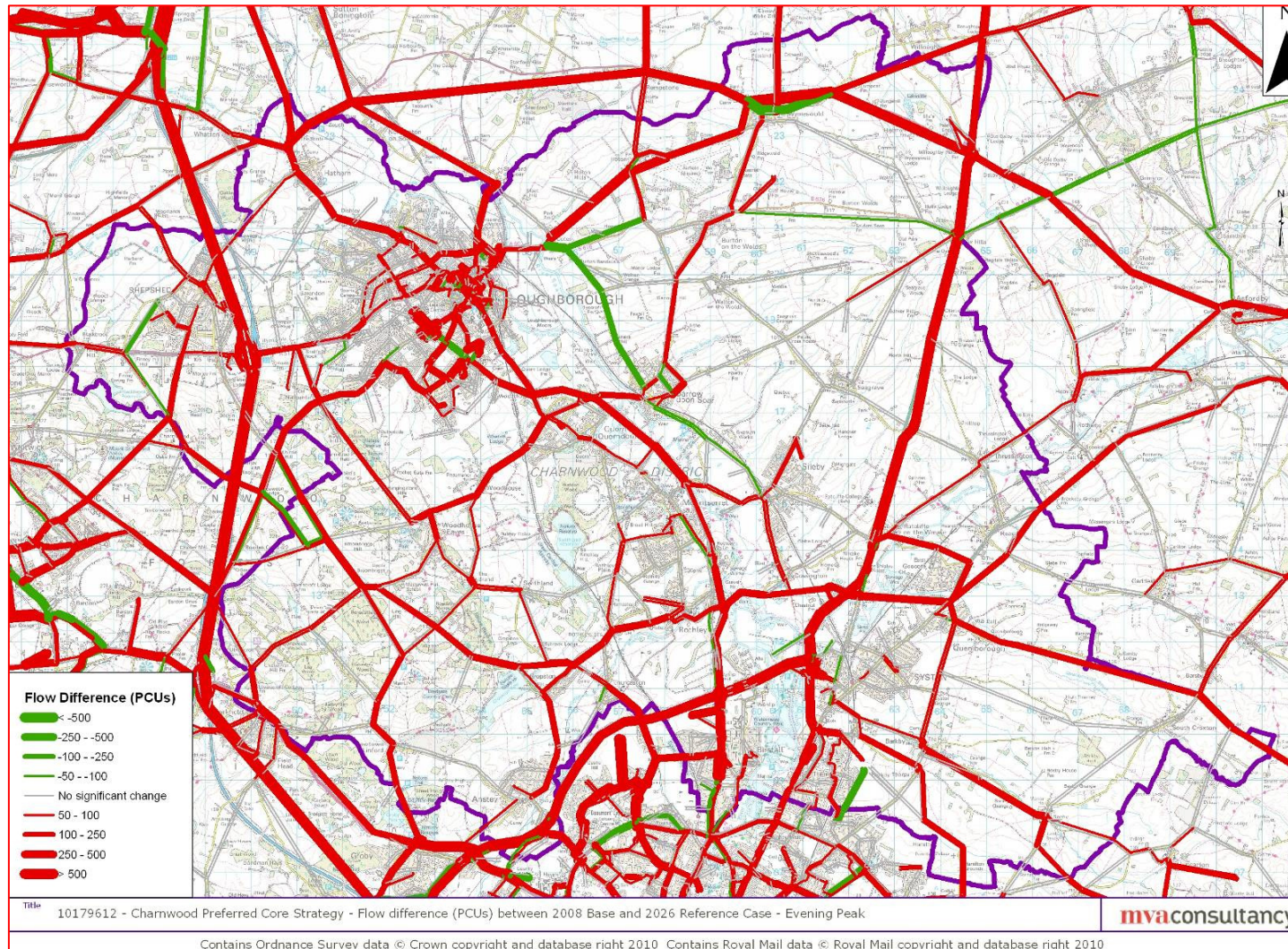


Figure 3.3 AM Congestion Profile – 2026 Reference Case vs 2008 Base

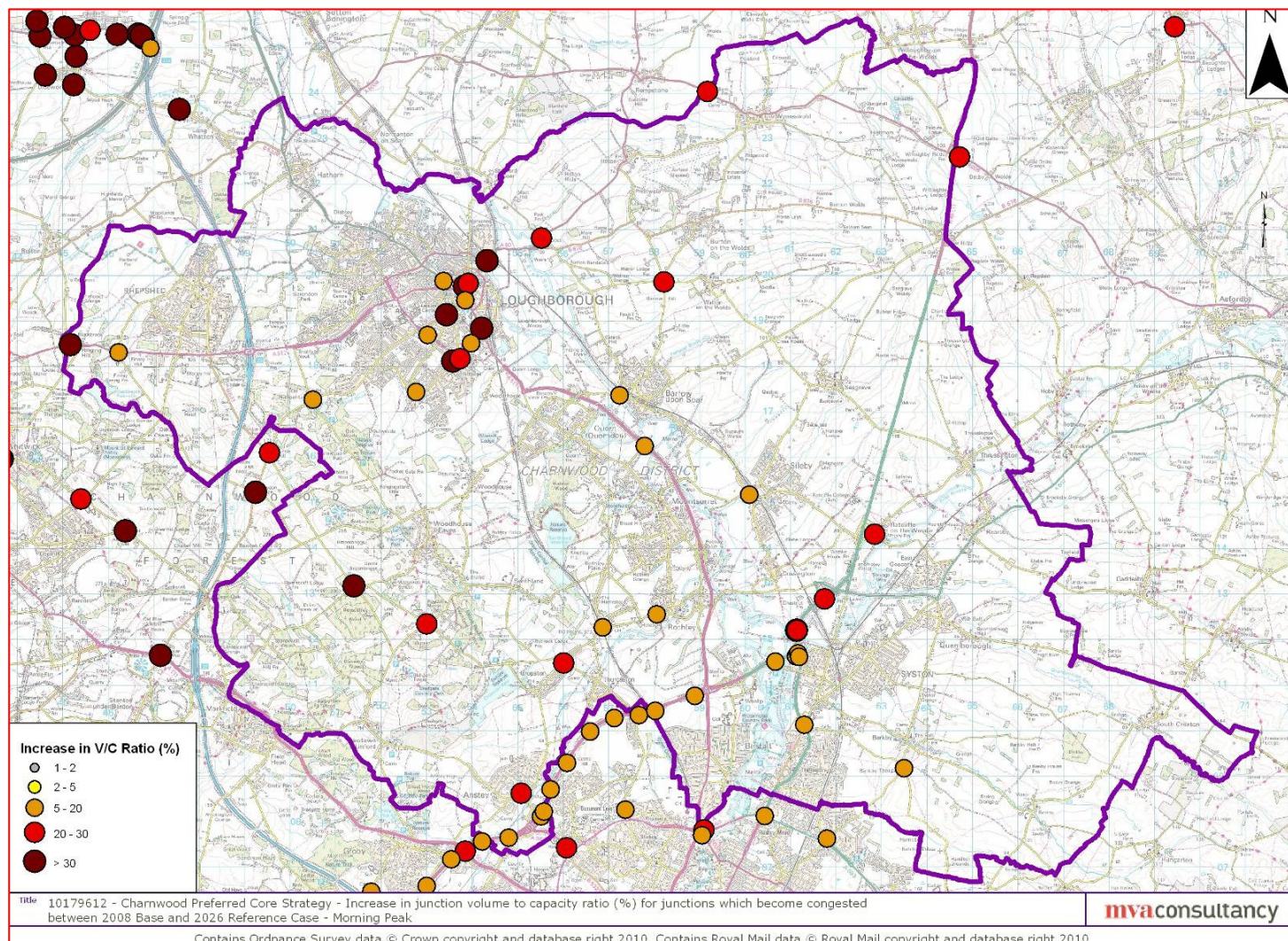
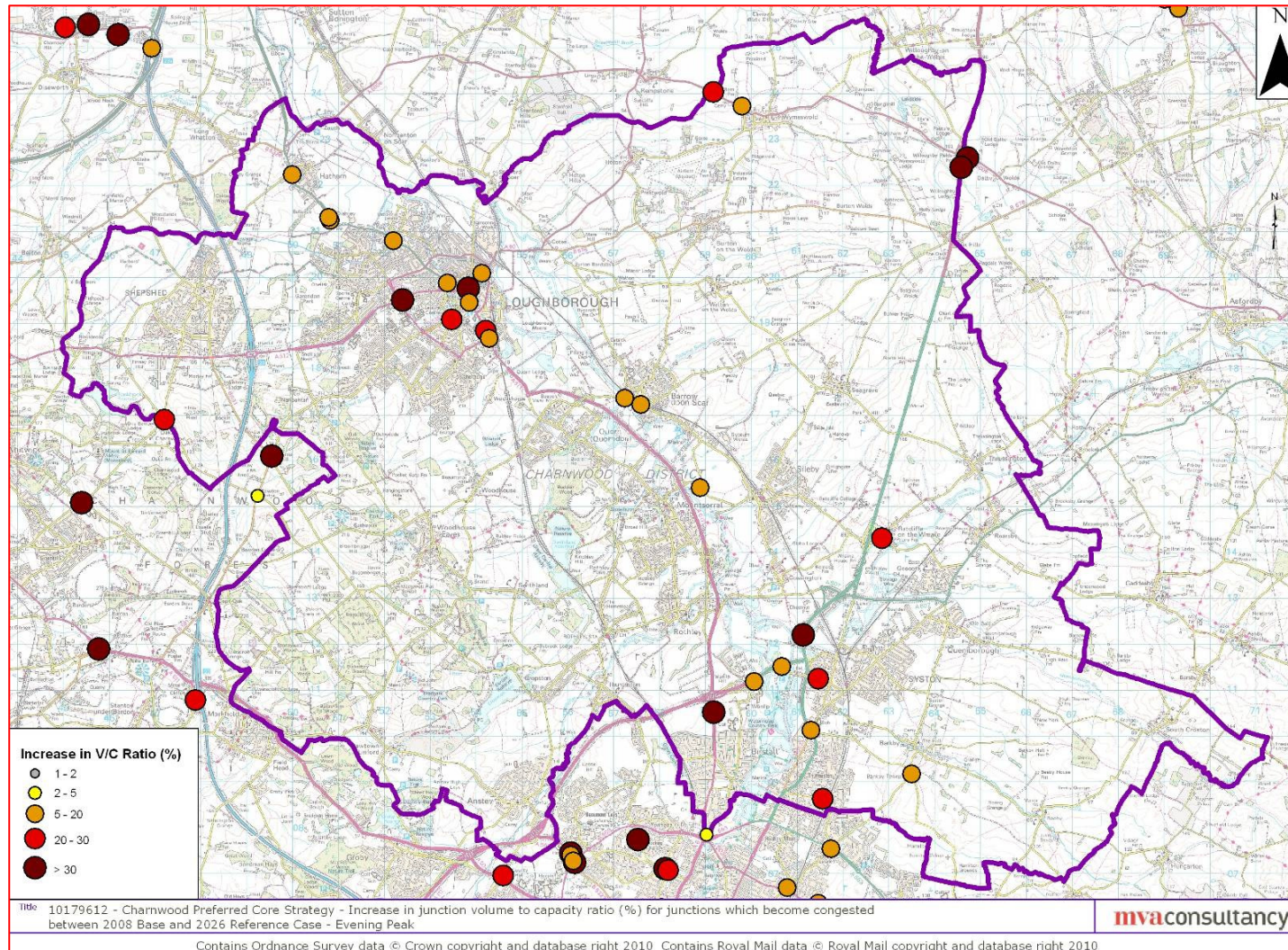


Figure 3.4 PM Congestion Profile – 2026 Reference Case vs 2008 Base



3.5 Network-wide Congestion Statistics

- 3.5.1 Table 3.2 shows a comparison of 2026 Reference Case against the 2008 Base in terms of congestion statistics for Charnwood.
- 3.5.2 It can be seen that the delay based congestion is forecast to increase by 116% in the AM peak and 78% in the PM peak.
- 3.5.3 Travel times also increase by 25% in both AM and PM peaks.
- 3.5.4 The increases in delays results in decreases in average speeds by around 8% in both peaks.
- 3.5.5 This means that, even without the development strategy, the traffic conditions in the Borough are forecast to deteriorate significantly.

Table 3.2 Congestion Statistics within Charnwood

	AM Peak		PM Peak	
	2008 Base	2026 Reference	2008 Base	2026 Reference
Delays (pcu-hrs)	331	714	288	513
Total Travel Time (pcu-hrs)	15,848	19,831	15,528	19,429
Total Travel Distance (pcu-kms)	831,930	962,673	826,535	958,347
Average Speed (km/h)	52.5	48.5	53.2	49.3

3.6 Severity Index

- 3.6.1 In addition to the congestion monitoring indicators detailed above, two more indicators have been utilised in this study:
- Length of route kilometres within Charnwood which are forecast to be over capacity (volume capacity ratio > 85%);
 - Severity Index within Charnwood – this indicator not only takes account of the length of the roads affected, but is also based on the number of vehicles affected by congestion as well as the level of congestion.
- 3.6.2 All indicators need to be considered on an equal and consistent basis.
- 3.6.3 Table 3.3 shows these indicators for the 2008 Base and 2026 Reference Case. The length of congested route kilometres within Charnwood is forecast to increase by 140% in the AM peak and 104% in the PM peak.

3 Reference Case Results

- 3.6.4 The severity of congestion (as shown by the severity index) is forecast to increase by 153% in the AM peak and 92% in the PM peak.
- 3.6.5 In the Reference Case, the severity index is higher in the AM peak than the PM peak. This is because the PM peak is more spread out than the AM peak.

Table 3.3 Congested Route Kilometres and Severity Index within Charnwood

	AM Peak		PM Peak	
	2008 Base	2026 Reference	2008 Base	2026 Reference
Congested Route-Kms	25	60	25	51
Severity Index	58	147	62	119

4 Emerging Development Strategy

4.1 Overview

- 4.1.1 This chapter of the report details the trip generations of the individual sites within the emerging development strategy as derived by LLITM. The use of the LLITM trip generation outputs has been agreed with Leicestershire County Council.
- 4.1.2 The LLITM land use model (DELTA) identifies the actual take up of development up to the 2026 assessment year based on economic conditions, the accessibility of the site and the overall attractiveness of the development. From the basic land use inputs (number of households, area of employment and commercial activity) population and employment statistics are developed for each development which also take into account the type and predicted occupancy of the development.
- 4.1.3 As a result there are some small variations between the levels of housing take up when compared to the information provided in section 2.3. The reasons for this are explained in more detail in para 4.2.5.
- 4.1.4 The traffic generations for each development site have been derived by LLITM based on the proposed land use detailed previously and the local area transport characteristics, taken from the LLITM base model, for the area within which the individual development resides.

4.2 Emerging Development Strategy Vehicle Generation

- 4.2.1 Table 4.1 details the predicted residential and employment take up for each of the sites and the levels of vehicle generation as derived by LLITM.
- 4.2.2 Overall, the strategic sites within the emerging development strategy are predicted to generate between 4,600 and 4,850 two-way vehicle trips during the morning and evening peak hours.
- 4.2.3 Table 4.1 does not present trip generations for the service centres or housing adjoining Shepshed & Loughborough and adjoining the PUA. This is because those sites are spread over a wide area.
- 4.2.4 The actual residential take up in the land use model is 99%.

Table 4.1: Emerging Development Strategy – Trip Generation (Vehicles)

Development	Households	Population	Jobs	AM		PM	
				OUT	IN	OUT	IN
West of Loughborough	3,268	7,495	462	1,164	357	603	739
West Shepshed	513	1,150		90	52	55	94
Science Park			6,277	201	895	765	301
North of Birstall	1,466	3,347	630	422	258	298	484
Watermead			458	10	32	10	18
North East Leicester	4,534	8,965	514	772	361	573	786
Totals	9,781	20,957	8,341	2,659	1,955	2,304	2,422

4.2.5 For most of the development sites, the land use model predicts fewer households being taken up in 2026 than the planning policy inputs to the model. The factors influencing the take up of households within DELTA are listed below:

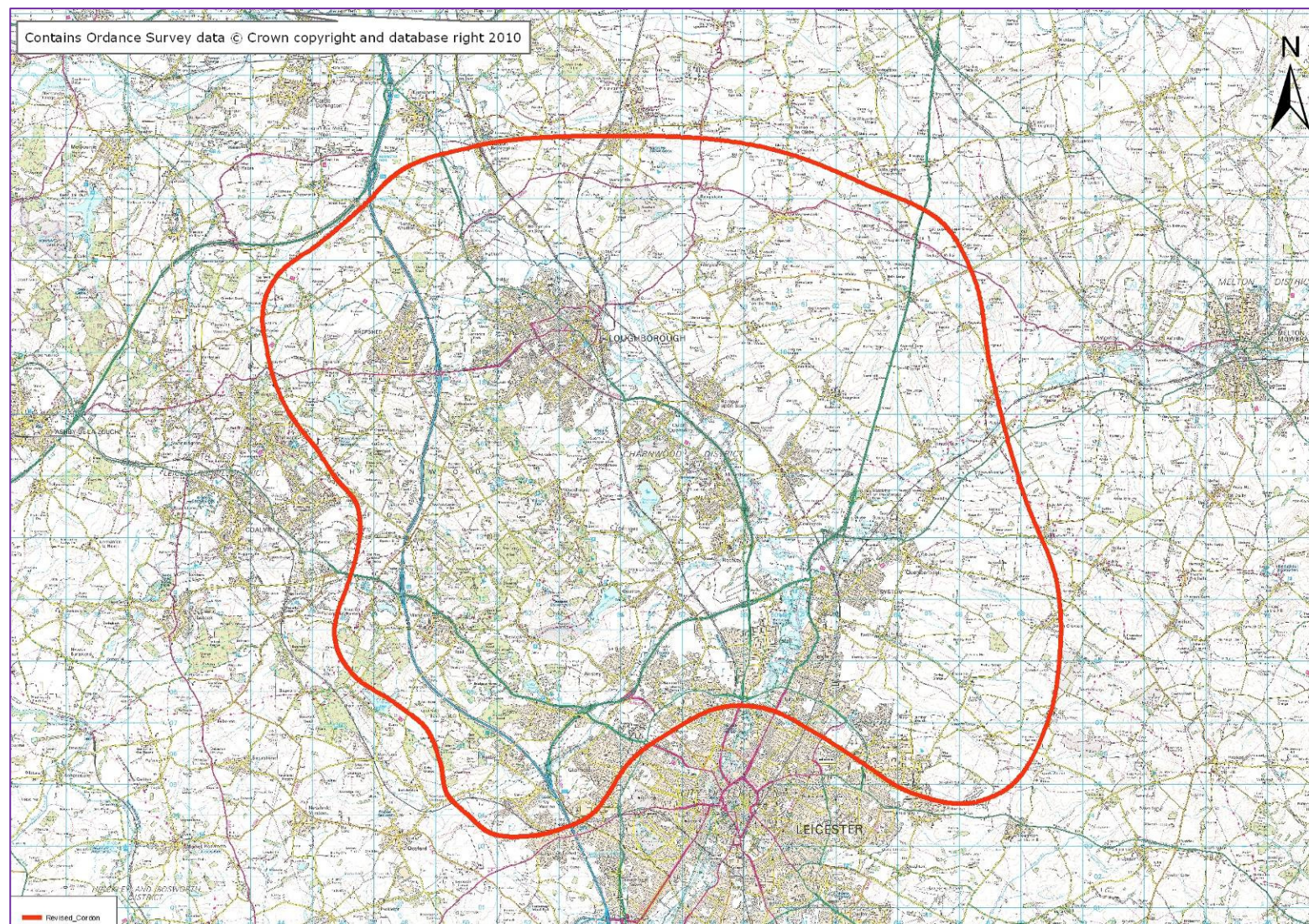
- Within LLITM land use changes are modelled at zone level rather than individual site. In most cases the planned development is an addition to the existing zone stock (i.e., additional dwellings added to an existing stock of dwellings in the zone or additional office floorspace added to the existing office stock). The reporting of changes in household, population, employment, etc. is of the net change between the development scenario and the reference case at zone level. It is not possible to disaggregate between the occupancy of the new residential development and the occupancy of the housing stock that was already located within the zone. It may be that the new development is fully occupied but that there is increased under-occupancy (i.e., vacant premises) in the existing stock, possibly as people move to the newly developed stock.
- Secondly within the Reference Case there is a vacancy rate for residential property (in Charnwood) of c5.6%. This remains roughly unchanged over the forecast period. The value in LLITM's base year would have been based upon 2001 Census vacant dwellings data. LLITM is currently configured so that a proportion of new residential development is vacant; this proportion is based upon the vacancy rate within the zone where the development is located.

5 No Mitigation Results

5.1 Overview

- 5.1.1 This chapter details the results of development testing in the absence of any mitigation package.
- 5.1.2 Figure 5.1 shows the area for which we have identified the impacts of the emerging development strategy which effectively covers Charnwood Borough. This extent of the area is the same as the Stage 1 work undertaken during 2012.
- 5.1.3 The no mitigation modelling results for the emerging development strategy have been reported in terms of:
 - Graphical plots showing the changes in flows, delays and congestion in and around the Charnwood Borough; and
 - Network statistics within Charnwood, including as over capacity queues, total travel time, length of congested roads, severity index and carbon emissions.
- 5.1.4 The emerging development strategy has been compared against the Reference Case Scenario.

Figure 5.1 Area of Influence



5.2 Flow Difference

- 5.2.1 Figures 5.2 and 5.3 show the flow difference profiles for the emerging development strategy for the AM and PM peaks. Red lines show increase in flow whereas green colour shows a decrease, the wider the line the greater the flow change.
- 5.2.2 The main areas where a significant increase in flow has been predicted include:
- West Of Loughborough;
 - A512 leading to the motorway;
 - Old Ashby Road;
 - Epinal Way between A512 and Forest Road junctions
 - A512 through Shepshed; and
 - Rural routes to the north and east of Shepshed.
 - North of Loughborough on the A6.
 - South of Loughborough;
 - A6 to the A46; and
 - Rural routes west of the A6.
 - North Leicester;
 - A46 between A607 and A50;
 - Range of radials into the City Centre; and
 - Ring Road.
- 5.2.3 There are a few roads where traffic is forecast to decrease (represented by green lines). This reduction is due to the change in traffic pattern induced by the development traffic, resulting in the displacement of existing traffic from these roads.
- 5.2.4 The level of traffic originating from North East Leicester SUE and going through Queniborough is insignificant.

5.3 Congestion

- 5.3.1 Figures 5.4 and 5.5 show the junctions where the emerging development strategy pushes congestion beyond the recommended threshold of 85% of the available capacity. At these levels drivers will perceive the routes to be congested through delays and queues on the approach to the junction. Junctions where this threshold is reached prior to the implementation of the core strategy are not shown, however there will be areas where the junctions are already congested that are made worse by the development scenario.
- 5.3.2 The main areas where an increase in congestion beyond the 85% threshold has been predicted include:

West Loughborough and Shepshed

- West of Loughborough access junctions although these would be designed to cope with traffic flows;
- Tickow Lane/Anson Road – Shepshed;
- A6/Warwick Way;
- A6 / Shelthorpe road;
- The Epinal way junctions with Forest Road and A512.
- Junctions in Loughborough Town Centre;
- Nanpantan Road / Snell's Nook Lane; and
- A512 / Snell's Nook Lane.

Soar Valley

- A607 / Fosse Way;
- Station Road / Leicester Road
- A607 / Barkby Thorpe Lane;
- Main Street / Syston Road; and
- Station Road / Thurcaston Lane.

South Charnwood and North Leicester

- A607 / Barkby Thorpe Lane;
- Junctions within Barkby village; and
- several junctions along Leicester Ring Road.

5.4 Noise

- 5.4.1 Figure 5.6 portrays the predicted change noise levels as a result of the emerging development strategy. These plots indicate that a change of greater than 1 decibel is only predicted in the immediate vicinity of the new access routes associated with the sites.

Figure 5.2 AM Flow Difference Profile – Emerging Development Strategy

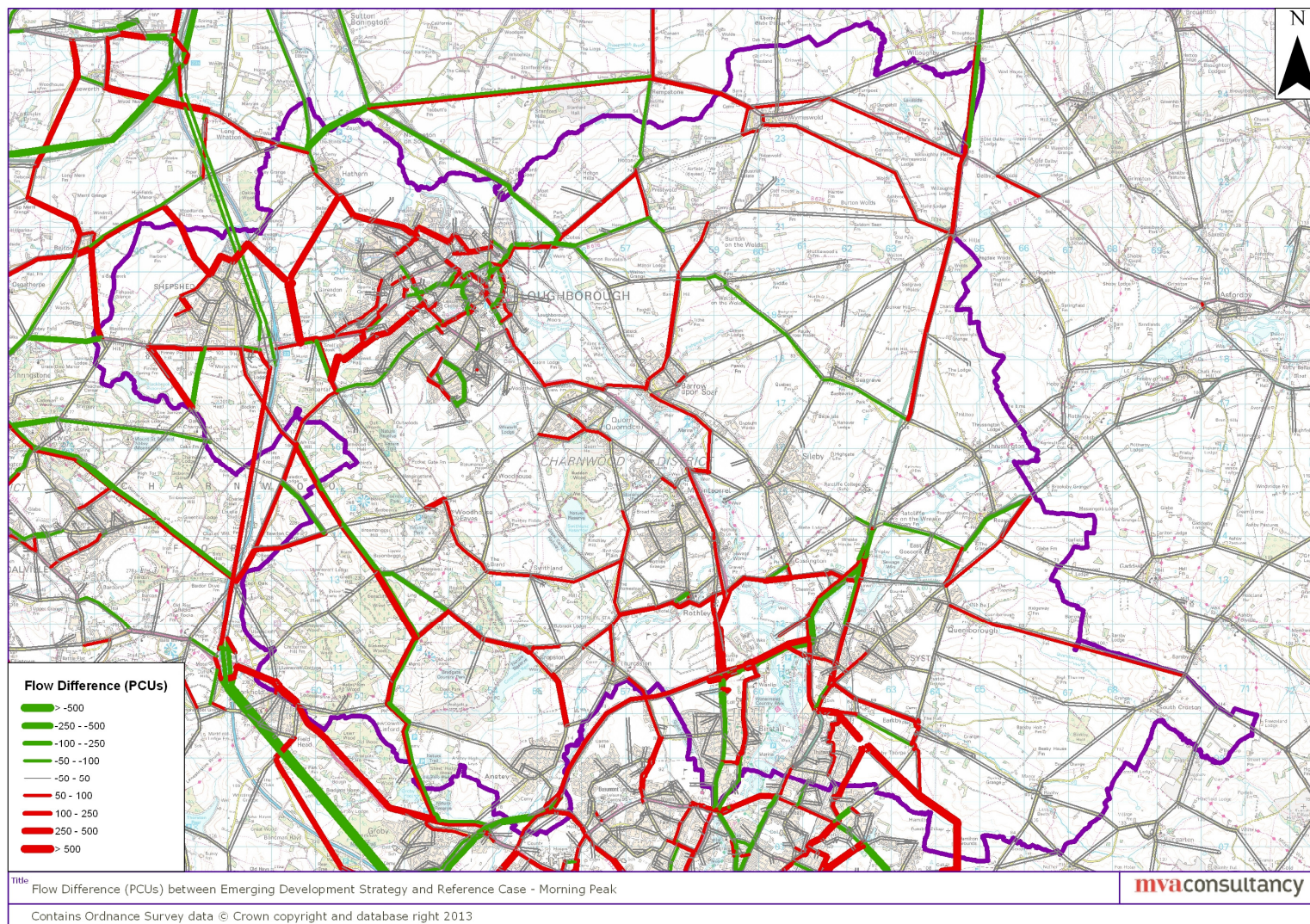


Figure 5.3 PM Flow Difference Profile – Development Strategy

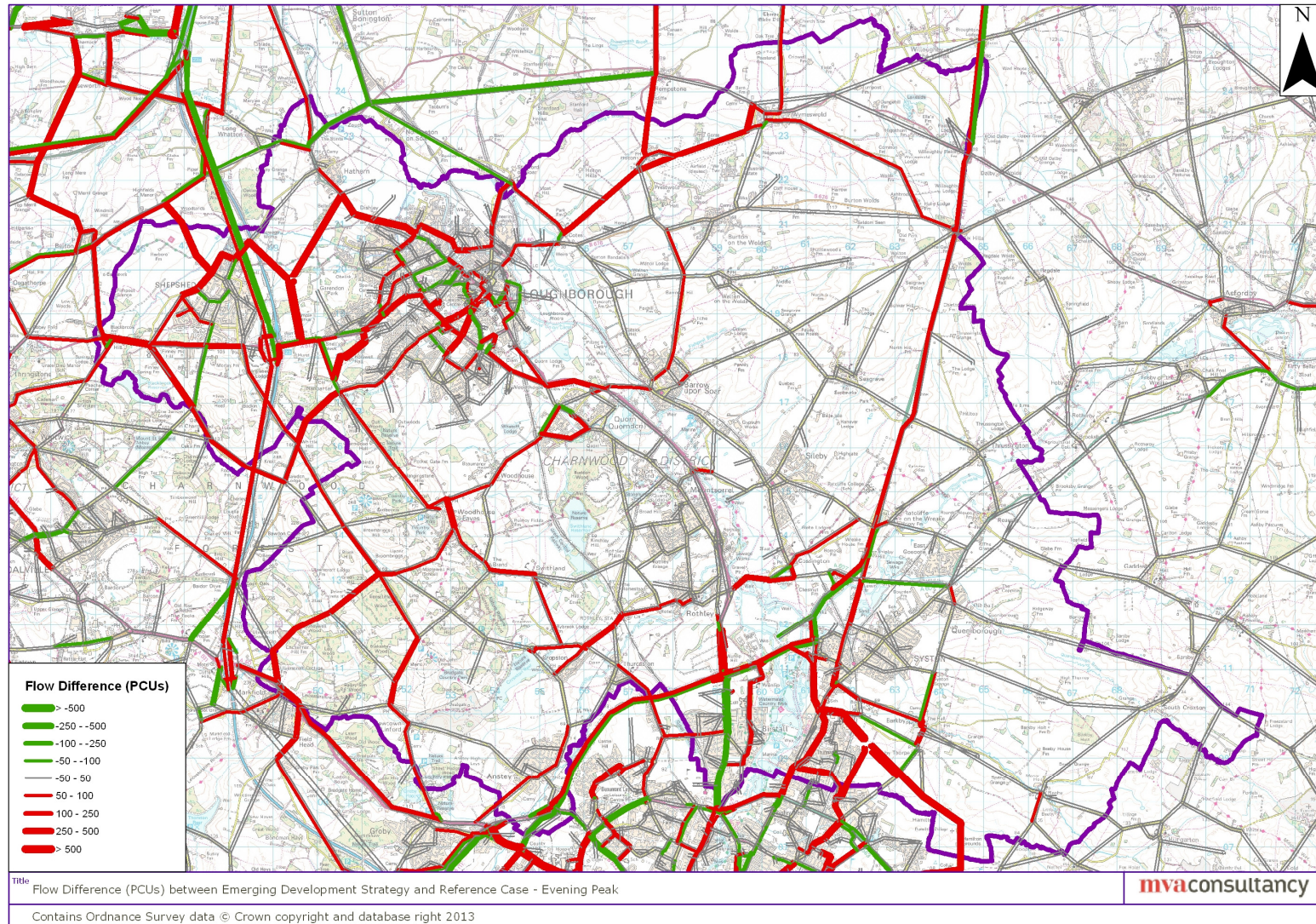


Figure 5.4 Development Strategy - Induced Congestion – AM Peak

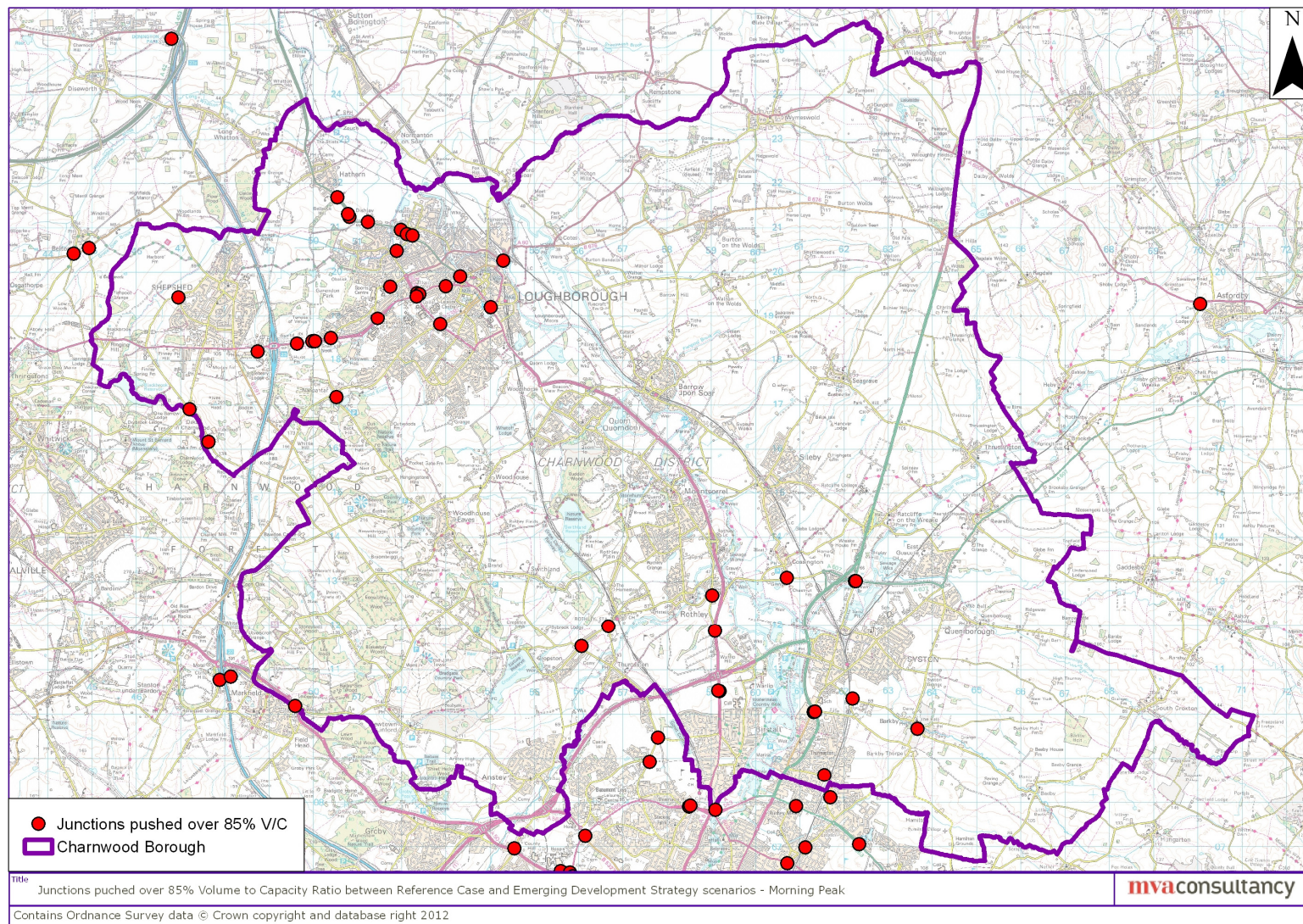


Figure 5.5 Emerging Development Strategy - Induced Congestion – PM Peak

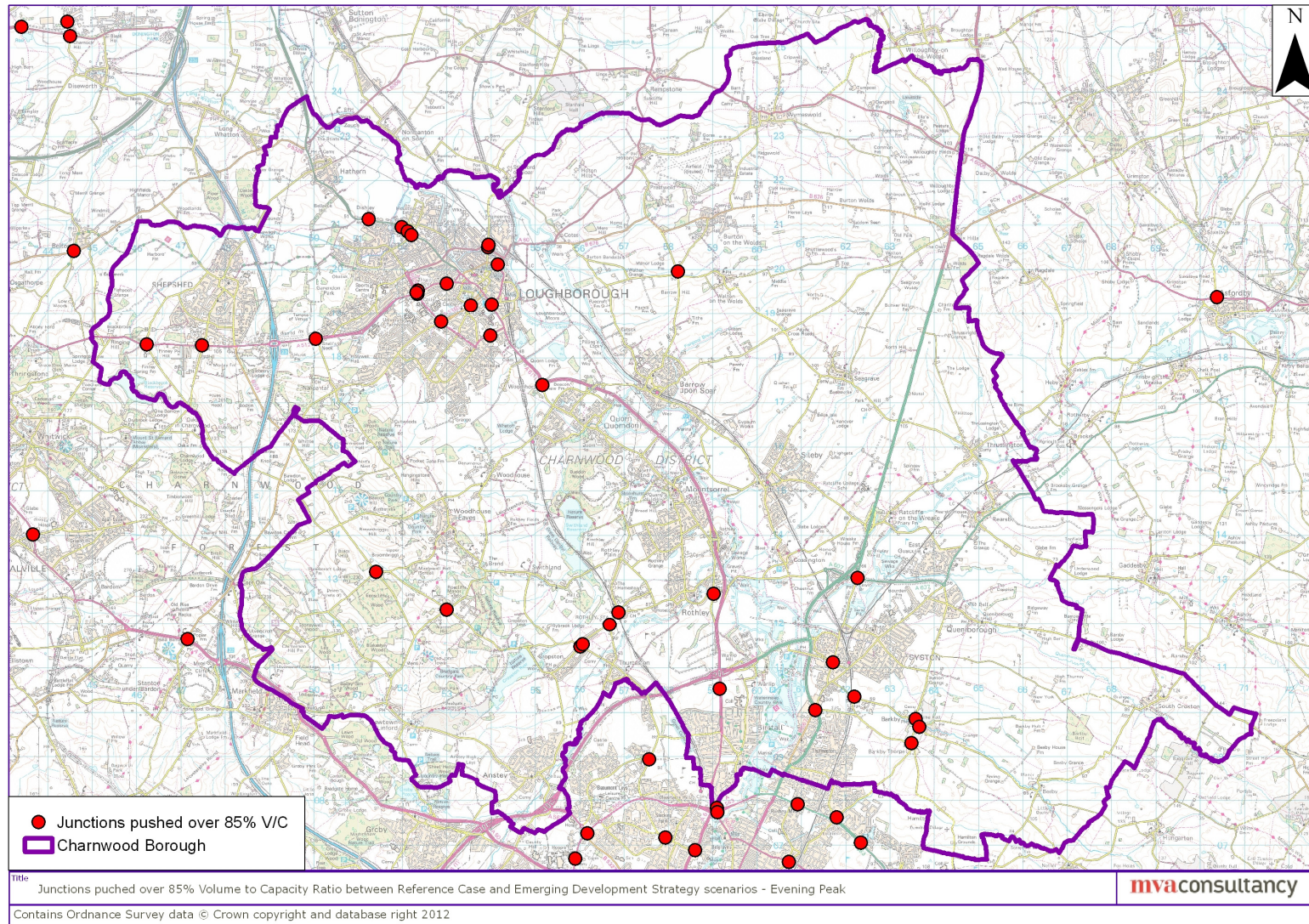
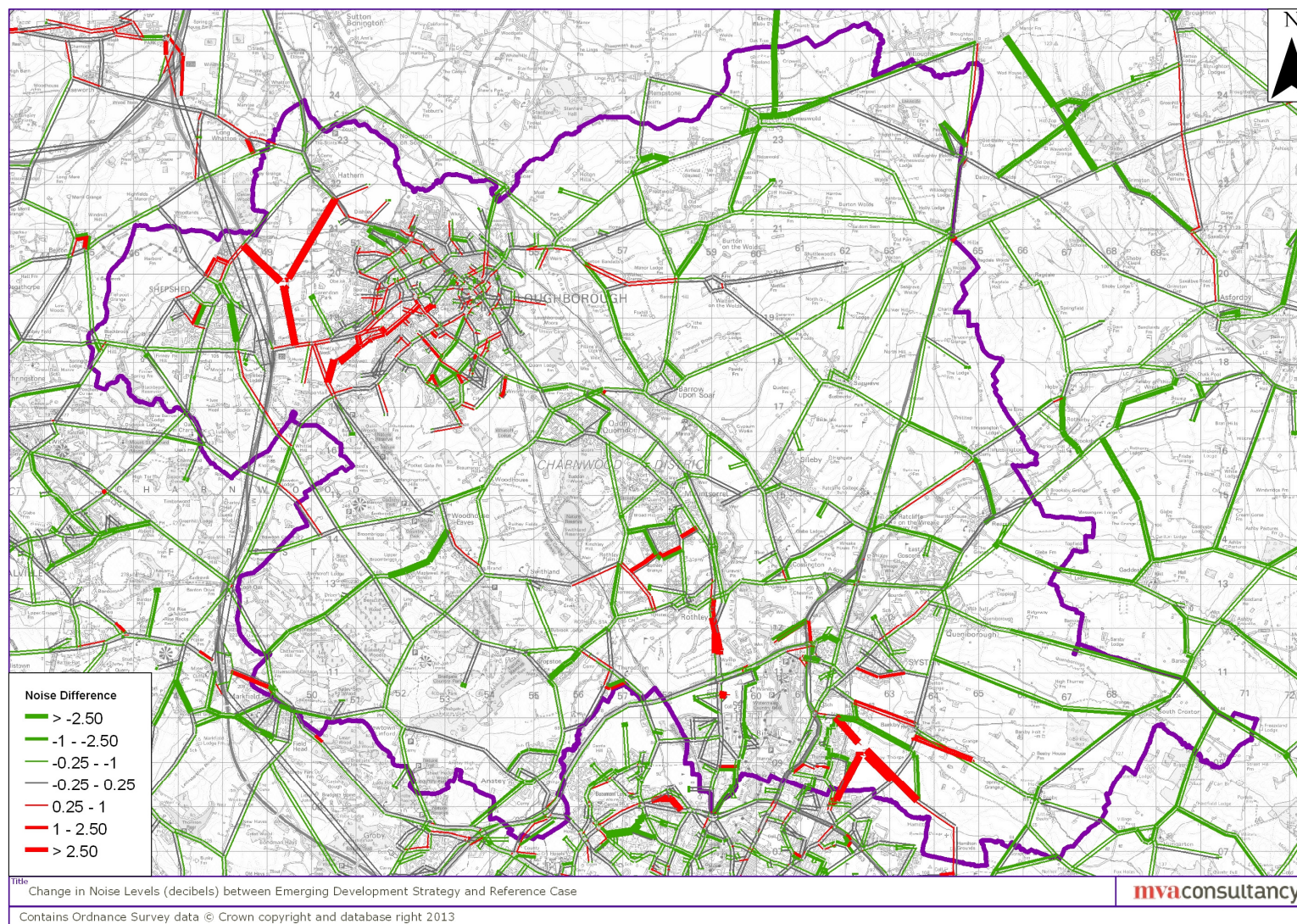


Figure 5.6 Noise Profile – Emerging Development Strategy vs Reference Case



5.5 Network Statistics within the Area of Influence

- 5.5.1 Table 5.1 details a range of network statistics for the Charnwood Borough. These provide an indication of the impact of the emerging development strategy on the overall vehicle delay, travel time, travel distance and average speed within the Charnwood area.
- 5.5.2 For comparison, the network statistics for 2008 Base Year and 2026 Reference Case have also been provided in Table 5.1.

Table 5.1 Network Statistics within the AOI

	Morning Peak			Evening Peak		
	2008 Base	2026 Reference	Development Strategy	2008 Base	2026 Reference	Development Strategy
Delays (pcu-hrs)	331	714	845	288	513	537
Total Travel Time (pcu-hrs)	15,848	19,831	20,337	15,528	19,429	19,942
Total Travel Distance (pcu-kms)	831,930	962,673	973,167	826,535	958,347	973,948
Average Speed (km/h)	52.5	48.5	47.9	53.2	49.3	48.8

- 5.5.3 It can be seen that from the reference case to the with development case the congestion is forecast to increase by 14% in the AM peak and 5% in the PM peak.
- 5.5.4 Travel times increase by 3% in both peak hours.
- 5.5.5 The increases in delays results in decreases in average speeds – going down by almost 1% across both peaks.
- 5.5.6 The impact of the development strategy (compared with reference case) is less than the impact of the reference case (compared with base year).

5.6 Congested Route Kilometres and Severity Index

- 5.6.1 In addition to the congestion monitoring indicators detailed above, two more indicators have been utilised in this study (see Table 5.2):
- Length of route kilometres within Charnwood which are forecast to be over capacity ($v/c > 85\%$);

- Severity Index within Charnwood – this indicator not only takes account of the length of the roads affected, but is also based on the number of vehicles affected by congestion as well as the level of congestion. This indicator needs to be considered on an equal and consistent basis with the range of other indicators.

Table 5.2 Congested Route Kilometres and Severity Index

	AM			PM		
	2008 Base	2026 Ref	2026 DS	2008 Base	2026 Ref	2026 DS
Congested Route Kms	25	60	66	25	51	52
Severity Index	58	147	170	62	119	121

- 5.6.2 Table 5.2 shows these indicators for the 2008 Base, 2026 Reference and the 2026 emerging development strategy. The length of congested route kilometres within Charnwood is forecast to increase between the reference case and the with development case by 10% in the AM peak and 2% in the PM peak.
- 5.6.3 The severity of congestion (as shown by the severity index) is forecast to increase by 16% in the AM peak and 2% in the PM peak.

5.7 Emissions Statistics

- 5.7.1 Table 5.3 provides a series of roadside emissions statistics for the 2008 Base, the 2026 Reference and 2026 emerging development strategy within Charnwood. These are taken directly from the LLITM EASE suite.
- 5.7.2 The carbon emissions levels in the Emerging Development Strategy Scenario are forecast to be lower than the levels in the 2008 Base Year.
- 5.7.3 Compared with the Reference Case, the Emerging Development Strategy is forecast to increase the levels of environmental pollutants, as summarised below:
- 1% increase in carbon emissions;
 - 2% increase in Nitrogen Oxide (NO_x);
 - 2% increase in particulate matter (PM₁₀) emissions; and
 - 2% increase in particulate matter (PM₂₅) emissions.

Table 5.3 Environment Pollutants

	2008 Base	2026 Ref	2026 DS
Carbon (tonnes / year)	184,933	182,745	184,856
NO _x (g/km/day)	11,508,539	2,835,605	2,879,267
PM ₁₀ (g/km/day)	736,984	513,168	522,156
PM ₂₅ (g/km/day)	554,145	298,154	303,781

6 Mitigation Strategy Development

6.1 Policy Background

- 6.1.1 The public transport and highway mitigation measures for the emerging development strategy have been developed through discussions with key stakeholders including Leicestershire County Council, Leicester City Council, Charnwood Borough Council, the Highways Agency and developers. The mitigation measures are also in line with local, regional and national policy objectives and best practice guidance.
- 6.1.2 Although the assessment year (2026) is beyond the Leicestershire Local Transport Plan (LTP) and the next round of LTPs, it is important that the measures developed for mitigating the impact of the emerging development strategy are still based upon current priorities and local objectives.
- 6.1.3 The Leicestershire Local Transport Plan (LTP3) aims to achieve a transport system meeting requirements for access and economic development in ways which make continuous improvement in sustainability and people's quality of life. The longer-term strategy sets out five objectives to achieve both aims: providing transport conditions for economic growth, improving access to facilities, reducing transport's impact on the environment, keeping transport safe, and maintaining and renewing highway assets.
- 6.1.4 Similar objectives are contained within National Planning Policy Framework (NPPF) and recent guidance on Transport Assessments. Underpinning each of these documents is the shared principle of making cycling, walking and public transport modes of choice. In other words, the aim is to ensure transport solutions are sustainable through:
- Encouraging environmental sustainability (reduce the need to travel especially by car, tackle the environmental impact of traffic, improve accessibility by non car modes, develop measures to influence travel behaviour).
 - Managing the existing network (maximise use of existing infrastructure, manage access)
 - Mitigating residual impacts (maximise use of demand management, public transport, walking and cycling before considering additional road space).
- 6.1.5 It is against this backdrop that the mitigation package has been developed.
- 6.1.6 We have used a user hierarchy for the network to develop and appraise the potential mitigation strategy. This is shown in Table 6.1, and is required in order to ensure full potential of multi-modal solutions are investigated, prior to the investigation of highway options.
- 6.1.7 The trip rates forecast by the LLITM model are based on the assumption that all future sustainable urban extensions will be sustainable, and will inherently contain smarter choices, walking and cycling facilities, as they assume that the sites are developed in a way to ensure that they are well connected to the wider 'slow modes' networks and that travel planning is

at the core of all developments. As a result the Smarter Choices level of mitigation is included within the no mitigation strategy scenario detailed earlier.

- 6.1.8 This is also reflected in the relatively lower levels of trip generations for the development options.

Table 6.1 Proposed User Hierarchies for the Transport Assessments

	Mode	Possible Schemes
Consider first	Smarter Choices Pedestrians and Cyclists	New walk routes Enhanced integration Incentives, Built-in-Design Improved Information
	Public transport use	New services, Revised planning Subsidy, Incentives P&R Enhanced Integration Improved Information
Consider last	Other motor traffic	Car-Sharing Network Optimisation Junction Modifications New Lanes, New Roads

- 6.1.9 An iterative process utilising this user hierarchy has been undertaken in order to assess the impact of the mitigation option. We have therefore assessed the impact of the Public Transport mitigation first before applying the Highway mitigation measures.

6.2 Public Transport Mitigation

- 6.2.1 In general the Public transport mitigation measures ensure that all the development sites within the Emerging Development Strategy are accessed by a bus based public transport service with a frequency of at least 4 buses per hour. These services provide access to the main local centres and interchange facilities (Loughborough for the northern sites, Leicester and other local centres for the North Leicester sites).
- 6.2.2 This has been achieved by either the extension of an existing service to penetrate the site, with associated frequency increases where required, or through the provision of new services.

6.2.3 Figure 6.1 shows the public transport mitigation schemes for the emerging development strategy. This figure does not show the extensions and diversions to existing routes.

6.2.4 The public transport mitigation measures for the Emerging Development Strategy are as follows:

- Diversion and extension of existing ARRIVA bus service No. 6 to 10 minutes frequency (as existing) to link North East Leicester SUE to Syston, Thurmaston and Leicester;
- Dedicated, express service linking western area of the North East Leicester SUE to Leicester City via A607 corridor, 15 minute frequency;
- Dedicated, express bus service linking eastern area of North East Leicester SUE to Leicester City via Victoria Road East, Overton Road and A47 corridor, 15 minutes frequency;
- Frequency enhancement for Thorpe-Acre to Shelthorpe circular bus, with improved walk links to access the bus stop from West Loughborough development;
- Provision of a new service linking West Loughborough SUE with Loughborough Town Centre via Dishley Road development, Bishop Meadow Industrial Estate and Railway Station. Clockwise and anticlockwise services running at 15 minutes frequency;
- Extension of existing Shepshed to Loughborough bus route 4 to serve the proposed Shepshed development;
- Improved walking routes from Watermead development to bus services in Syston; and
- Diversion and extension of existing service 126 between Leicester and Loughborough at 15 minutes frequency through the North Birstall.
- Provision of bus lanes on:
 - A607 between Humberstone Lane and Troon Way junctions; and
 - A47 between Overton Road and Hastings Road.
- Bus Priority at:
 - A607 inbound north of Gypsy Lane junction;
 - Hamilton Way / Victoria Road East junction;
 - Victoria Road East/Gypsy Lane and Victoria Road East / Portway/Hastings Road junctions; and
 - Overton Road / Humberstone Road junction.

6.2.5 Bus priority has been modelled by reducing the journey time for buses using those routes.

6.3 Highway Mitigation

6.3.1 The highway mitigation strategy aims to address the impact of the emerging development strategy by providing benefits to the overall area of impact of the developments rather than concentrating on localised upgrades to individual junctions. It is likely that some localised junction improvements may still be required which should be identified as part of the detailed application for the sites.

- 6.3.2 The highway mitigation measures for the emerging development strategy are shown graphically in Figure 6.2. The graphical representation of the measures is for illustrative purposes only and in no way is intended to set out the exact configuration of mitigation measures.
- 6.3.3 The highway mitigation measures identified for the Emerging Development Strategy are as follows;

West Loughborough and Shepshed

- Western Distributor Road from A512 to A6 North;
- Dualling of A512 between Snell's Nook Lane and M1 J23;
- Capacity enhancements at Epinal Way / Ashby Road junction;
- Re-configuration of Epinal Way / Alan Moss Road junction;
- Capacity improvements at A6/Alan Moss Road/Belton Road;
- Capacity enhancements at Belton Road / Belton Road West junction;
- Dualling of Ashby Road (A512) at eastern end (linking to Epinal Way roundabout);
- Traffic Calming through old Ashby Road, Garendon Road, Alan Moss Road, Tennyson Road, Windsor Road and Sandringham Drive; and
- A direct link from West Shepshed site to A512 via new junction.

South Charnwood and North Leicester

- Capacity enhancements at A607/Barkby Thorpe Lane and Troon Way/Barkby Road roundabouts;
- Improved capacity on the link from Anstey Lane to A46 junction;
- Capacity enhancement at Anstey Lane / Krefeld Way roundabout;
- Improvements of M1 J22 and J23;
- New Spine Road via East Thurmaston from Barkby Thorpe Lane to King Street/Hamilton Lane and additional link to Sandhills Avenue (Spine Road required to also provide access to the site);
- New Link Road from the site westward to link Melton Road and A607 north of the A607/Barkby Thorpe Lane junction;
- Severing of all vehicular traffic of route linking from North East Leicester SUE eastwards / southwards to Scraptoft;
- Widening of A607 (N) approach to the A46 (Hobby Horse)roundabout to provide an additional lane over 300 metres;
- Capacity enhancements at Humberstone Lane junction with A607;
- Capacity enhancements at A607/Troon Way/Watermead Way junction;
- Dualling of Troon Way between A607 and Nicklaus Road junctions;
- Dualling of Troon Way between Nicklaus Road and Barkby Road junctions;

- Improvements at Troon Way/Nicklaus Road junction;
 - Signalisation of Barkby Road / Humberstone Lane junction;
 - Measures along Catherine Street;
 - A new signalised roundabout on the A6 north of the A46 interchange near the North Birstall. A new link road from the new roundabout on the A6 north of A46 interchange to the Wanlip junction to the South East and a Wanlip bypass to Rectory Road;
 - A new roundabout to the west of the A6 connected to the A6 and North Birstall development site by a dual carriageway. Also connected to a realigned old A6 route with two-directional traffic;
 - At A46 interchange, a bus bridge over the junction carrying buses from the A6 South to the North Birstall development site, and vice versa;
 - Junction improvements at A6 / Redhill Way, Abbey Hill / Beaumont Leys and Abbey Lane / Abbey Park Road junctions; and
 - Improvements at access junction for Watermead development.
- 6.3.4 It should be noted that the mitigation measures developed as part of this study aim to address the strategic impacts of the development strategy as a whole. These measures will need to be refined as and when the development proposals progress.

Figure 6.1 Public Transport Mitigation Package – Emerging Development Strategy

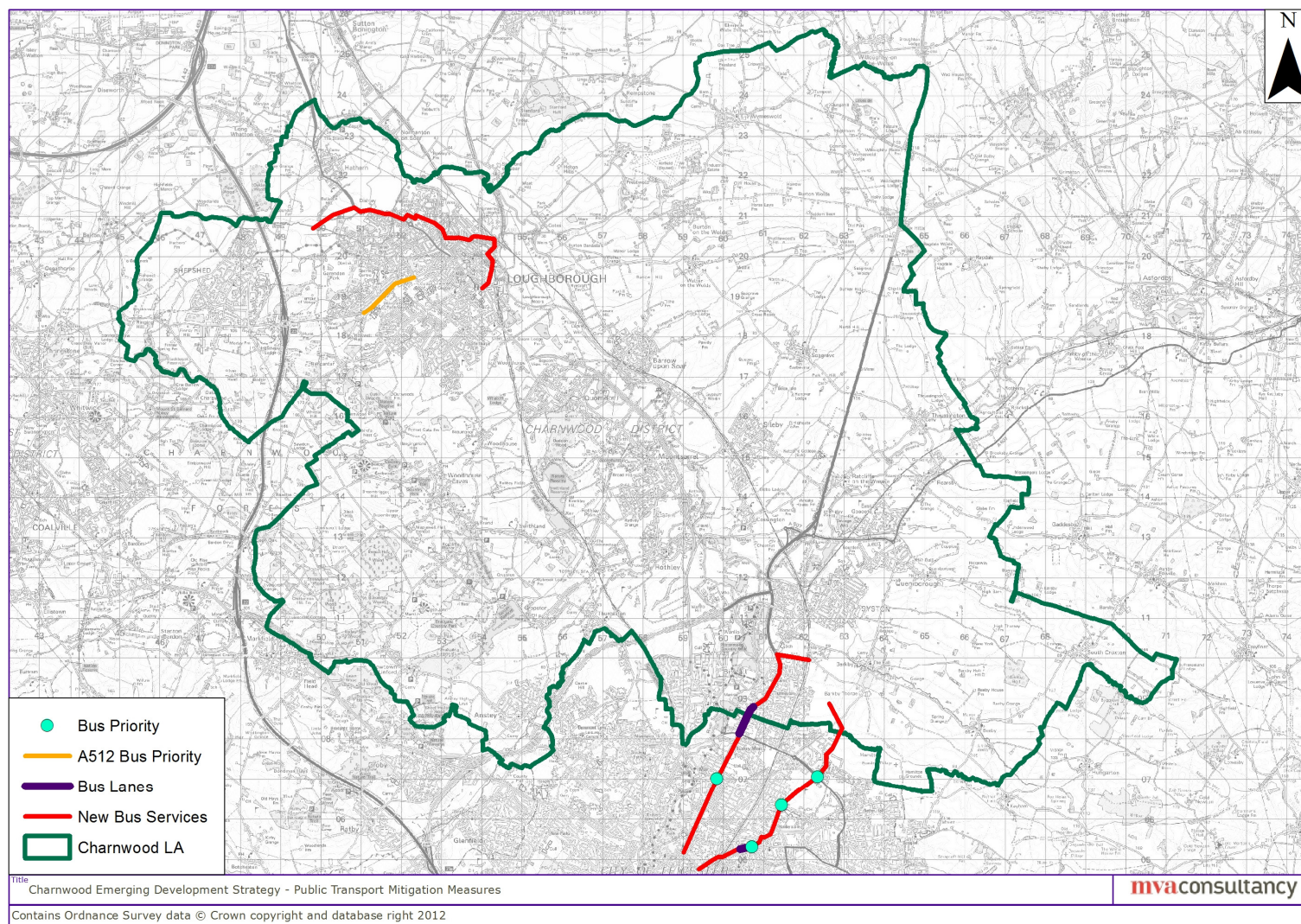
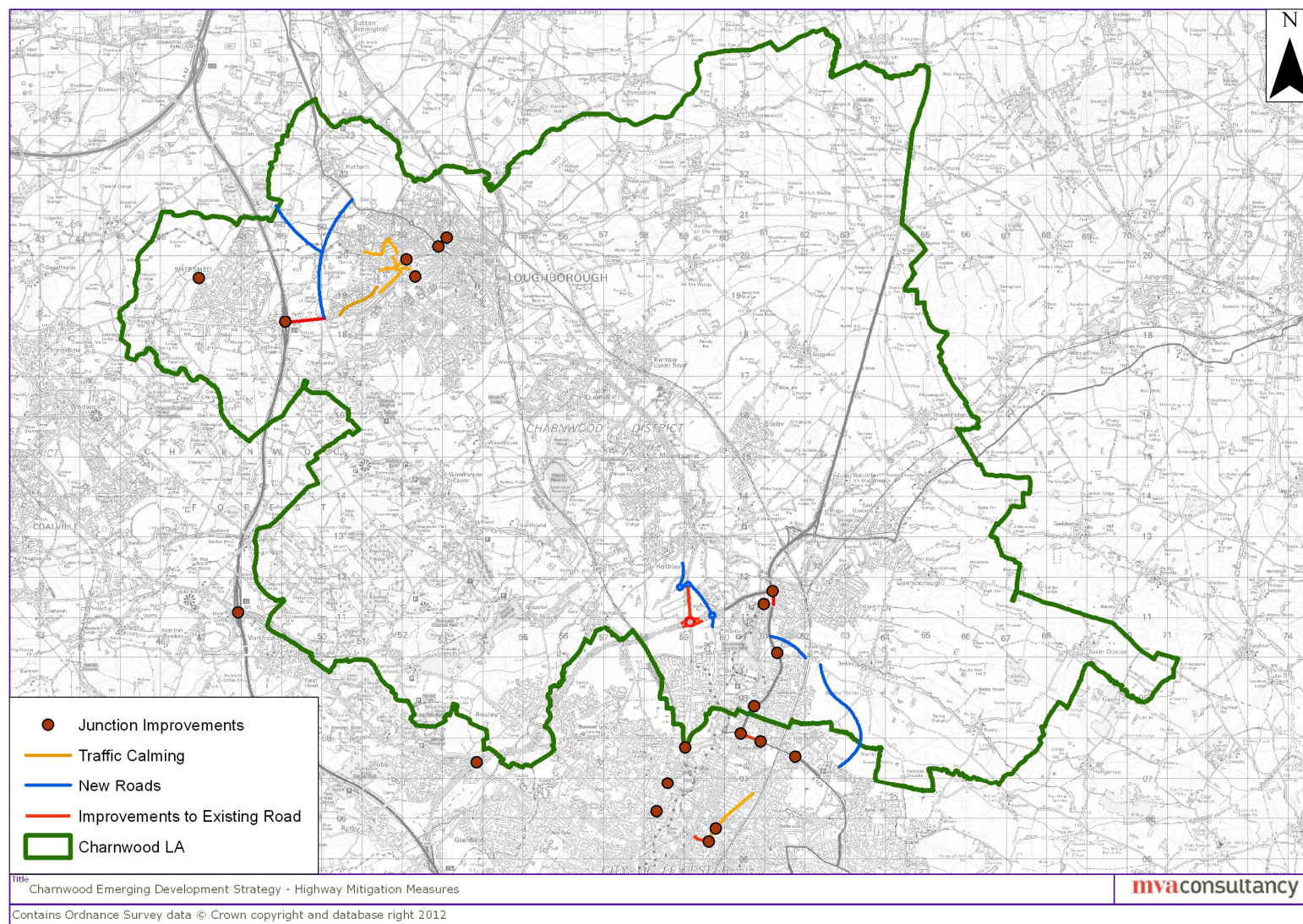


Figure 6.2 Highway Mitigation Package – Emerging Development Strategy



7 Public Transport Mitigation Modelling Results

7.1 Introduction

- 7.1.1 The public transport mitigation has been applied to the emerging development strategy within the LLITM model. For each site the bus based public transport has been improved to a level that provides at least four buses per hour passing through the site serving the local commercial centre and associated interchange facilities.

7.2 Impact on Public Transport Usage

- 7.2.1 Table 7.1 provides details of the levels of public transport usage for each of the site with and without the public transport mitigation. Some of the sites are already well served by public transport and therefore the level of mitigation over and above the base scenario is limited.
- 7.2.2 Majority of the public transport trips are to/from the local commercial centres (i.e., Loughborough for the northern development sites and Leicester for the southern sites) as these are the areas primarily served by the public transport services.
- 7.2.3 The North East Leicester, West Loughborough and North Birstall sites have the greatest levels of peak hour public transport usage in the no mitigation scenario as they are already served by frequent public transport routes. A small increase in public transport usage can be gained by upgrading these services, with the North East Leicester site predicted to receive the greatest increase in usage of all the sites. This site also incurs the greatest improvements to bus service provision.

Table 7.1 Impact of PT Mitigation on Emerging Development Strategy – PT Patronage (persons)

Emerging Development Strategy	No Mitigation				PT Mitigation				% Change			
	AM		PM		AM		PM		AM		PM	
	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN
West of Loughborough	206	34	41	124	212	40	48	129	3%	18%	17%	4%
West Shepshed	26	6	5	19	35	8	17	32	35%	33%	240%	68%
Science Park	6	125	137	6	7	134	150	8	17%	7%	9%	33%
North of Birstall	69	19	20	42	80	22	22	48	16%	16%	10%	14%
Watermead	7	23	15	1	8	28	23	2	14%	22%	53%	100%
North East of Leicester	234	20	25	134	325	29	36	183	39%	45%	44%	37%
Total	548	227	243	326	667	261	296	402	22%	15%	22%	23%

Overall Conclusion

- 7.2.4 Table 7.2 provides a summary of the overall peak hour public transport generations for the emerging development strategy.

Table 7.2: Overall Development Strategy Public Transport Usage

	No Mitigation		PT Mitigation	
	AM	PM	AM	PM
Emerging Development Strategy	775	569	928	698

- 7.2.5 The public transport measures result in 20% increase in public transport usage in the AM peak. This percentage is 23% in the PM peak.
- 7.2.6 Table 7.3 provides highway/PT modal share for the emerging development strategy sites with and without the public transport mitigation.
- 7.2.7 It can be seen that the public transport mitigation strategy improves the PT modal share by 2% for the emerging development strategy sites. This level of modal shift is unlikely to provide enough relief to fully mitigate the traffic impacts of the emerging development strategy.
- 7.2.8 West Loughborough and Science Park have limited impact in terms of change in public transport modal share. This is because the sites are already served with good public transport access.
- 7.2.9 The public transport share for West Shepshed is forecast to increase by 7%. This is due to the extension and frequency enhancement of the existing bus service connecting the site with Loughborough. It should also be noted that West Shepshed is a relatively smaller site and a small change in public transport usage can result in significant change in modal share.
- 7.2.10 The two new express bus services to Leicester City improve the PT modal share for North East of Leicester SUE by 4%; whereas North Birstall PT share is likely to increase by 1%.
- 7.2.11 Overall PT modal share for the emerging development strategy is forecast to increase by 2%.

Table 7.3 Highway - PT Modal Share

Emerging Development Strategy	Modal Share			
	No Mitigation		PT Mitigation	
	Highway	PT	Highway	PT
West of Loughborough	90%	10%	89%	11%
West Shepshed	87%	13%	80%	20%
Science Park	91%	9%	90%	10%
North of Birstall	93%	7%	92%	8%
North East of Leicester	89%	11%	8%	15%
Overall	90%	10%	88%	12%

- 7.2.12 This shows that the public transport mitigation measures are forecast to bring some benefits and are important to support and complement smarter choice measures; however, these measures alone are not sufficient to offset the negative impact of population growth in Charnwood on the highway network.
- 7.2.13 As a result no further assessment of the impact of public transport mitigation package on the local highway network has been undertaken.

8 Highway Mitigation Modelling Results

8.1 Overview

- 8.1.1 The predicted impacts of the highway mitigation measures as outlined in Chapter 6 for the Emerging Development Strategy are provided in the following chapter of the report.

8.2 Flow Difference

- 8.2.1 Figures 8.1 and 8.2 provide the impact of the highway mitigation package in the AM and PM peaks by comparing traffic flows in the highway mitigation scenario with the no mitigation scenario.

South Charnwood and North Leicester

- 8.2.2 Provision of the spine road through North East Leicester SUE (required to also provide access to the site), along with the western link with A607 and southern link to Sandhills Avenue, provides an alternative route into Leicester City Centre via A6030 Victoria Road E. This results in significant increase in traffic along this route and significant relief to local areas of Thurmaston, Barkby and Barkby Thorpe.
- 8.2.3 The new junction at the A607 makes Melton Road corridor more attractive than the Queniborough Road corridor for Syston traffic.
- 8.2.4 The mitigation package associated with North Birstall development site provides a bypass to the A6/A46 junction and results in congestion relief along the A6. However, it also causes an increase in traffic along Wanlip Lane.
- 8.2.5 Improvements at the Hobby Horse junction and the A6/A46 bypass results in a reduction in delays along the A46. This subsequently results into increase in traffic along the A46 and provides relief to parallel routes within Rothley and Mountsorrel.
- 8.2.6 Improvements along the Ring Road junctions result in increase in traffic along Troon Way and Watermead Way.

West Loughborough and Shepshed

- 8.2.7 Traffic calming through western parts of Loughborough provides traffic relief to the local roads. Provision of additional capacity at Epinal Way / Alan Moss Road junction results in traffic increase along Alan Moss Road.
- 8.2.8 Ashby Road / Epinal Way junction improvements cause increase in traffic along the A512 and sections of Epinal Way, reducing traffic along Forest Road and Nanpantan Road corridor.
- 8.2.9 Provision of Western Distributor Road provides relief to western areas of Loughborough and Loughborough Town Centre.

- 8.2.10 Overall, the mitigation package helps better utilise the road hierarchy, by diverting traffic from small, rural roads to more appropriate, strategic roads. This results in reduction in rat-running and advantage to suburban and rural locations.

8.3 Congestion

- 8.3.1 Figures 8.3 and 8.4 identify the junctions, in the AM and PM peaks respectively, which were congested (v/c <85%) in the No Mitigation Scenario but are relieved of congestion with the mitigation package in place. These junctions have been identified by red circles.
- 8.3.2 The new junctions becoming over capacity due to the mitigation package have been identified by blue circles.
- 8.3.3 There are a number of junctions where the highway mitigation strategy has reduced the level of congestion below the 85% threshold, these include;

Loughborough and Shepshed

- A6 / Warwick Way;
- The Epinal way junctions with A512 and Park Road;
- Nanpantan Road / Snell's Nook Lane;

Soar Valley

- A607 / Fosse Way;
- Main Street / Syston Road;

South Charnwood and North Leicester

- A607 / Barkby Thorpe Lane;
- Junctions within Barkby village;
- A607 / Humberstone Lane;
- A563 Troon Way / Barkby Road;
- St Ives Road / Barkby Road;
- Melton Road / Marfitt Street and
- Anstey Lane / Krefeld Way.

- 8.3.4 The creation of a new junction on A607 north of the ASDA roundabout causes delays to the existing traffic, pushing the new junction congestion level beyond 85% threshold.

8.4 Noise

- 8.4.1 Figure 8.5 compares the noise levels for the emerging development strategy (with highway mitigation in place) against the noise levels in the Reference Case.
- 8.4.2 The provision of the highway mitigation package is forecast to significantly reduce noise levels within Shepshed, parts of Loughborough and Barkby village. However, the provision of the western link for North East Leicester SUE, along with the spine road, provides an alternative route into Leicester City, hence attracting significant traffic and resulting in increase in noise levels along that route.

Figure 8.1 Impact of Highway Mitigation on Emerging Development Strategy – AM Peak Flow Difference profile

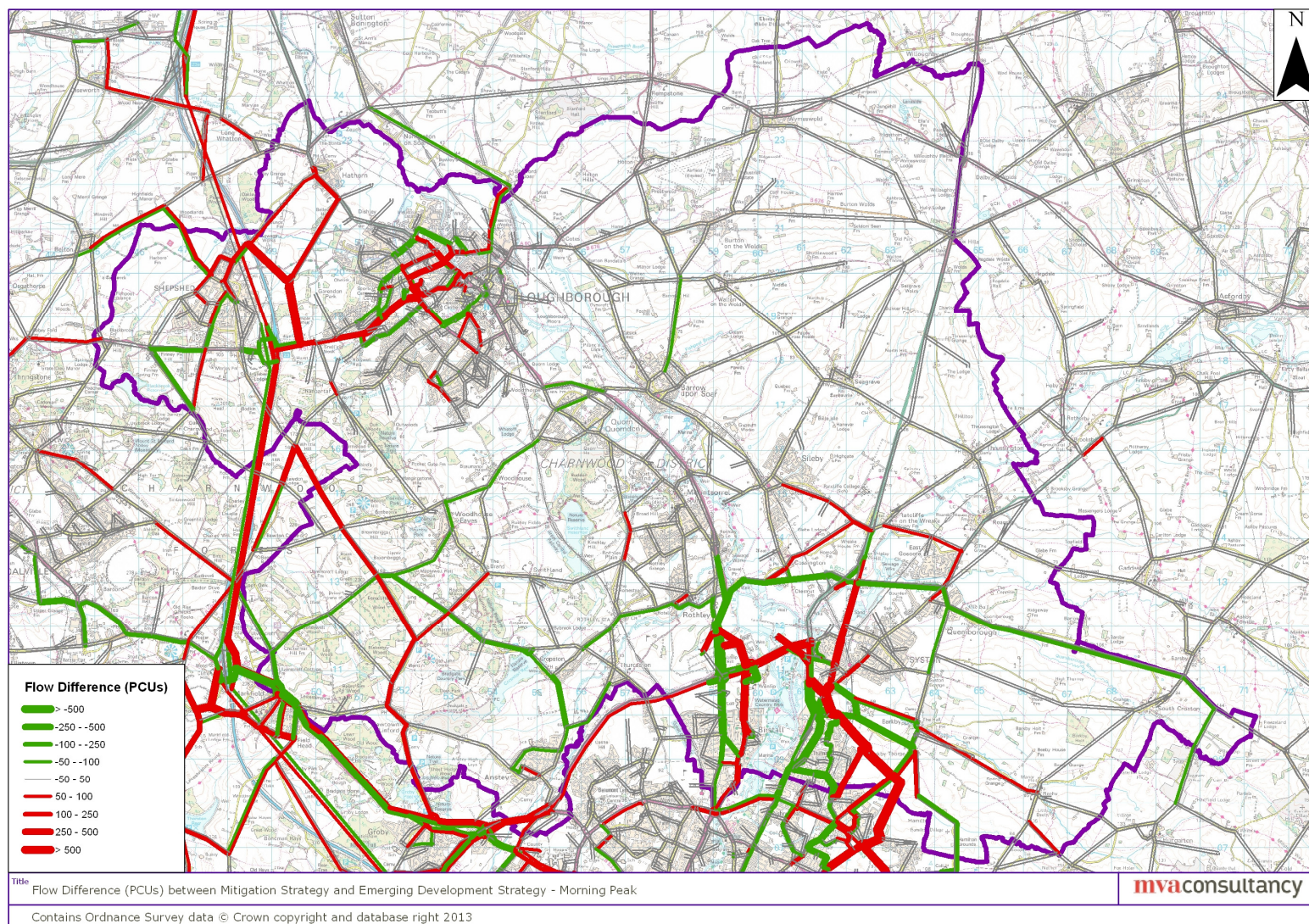


Figure 8.2 Impact of Highway Mitigation on Emerging Development Strategy – PM Peak Flow Difference Profile

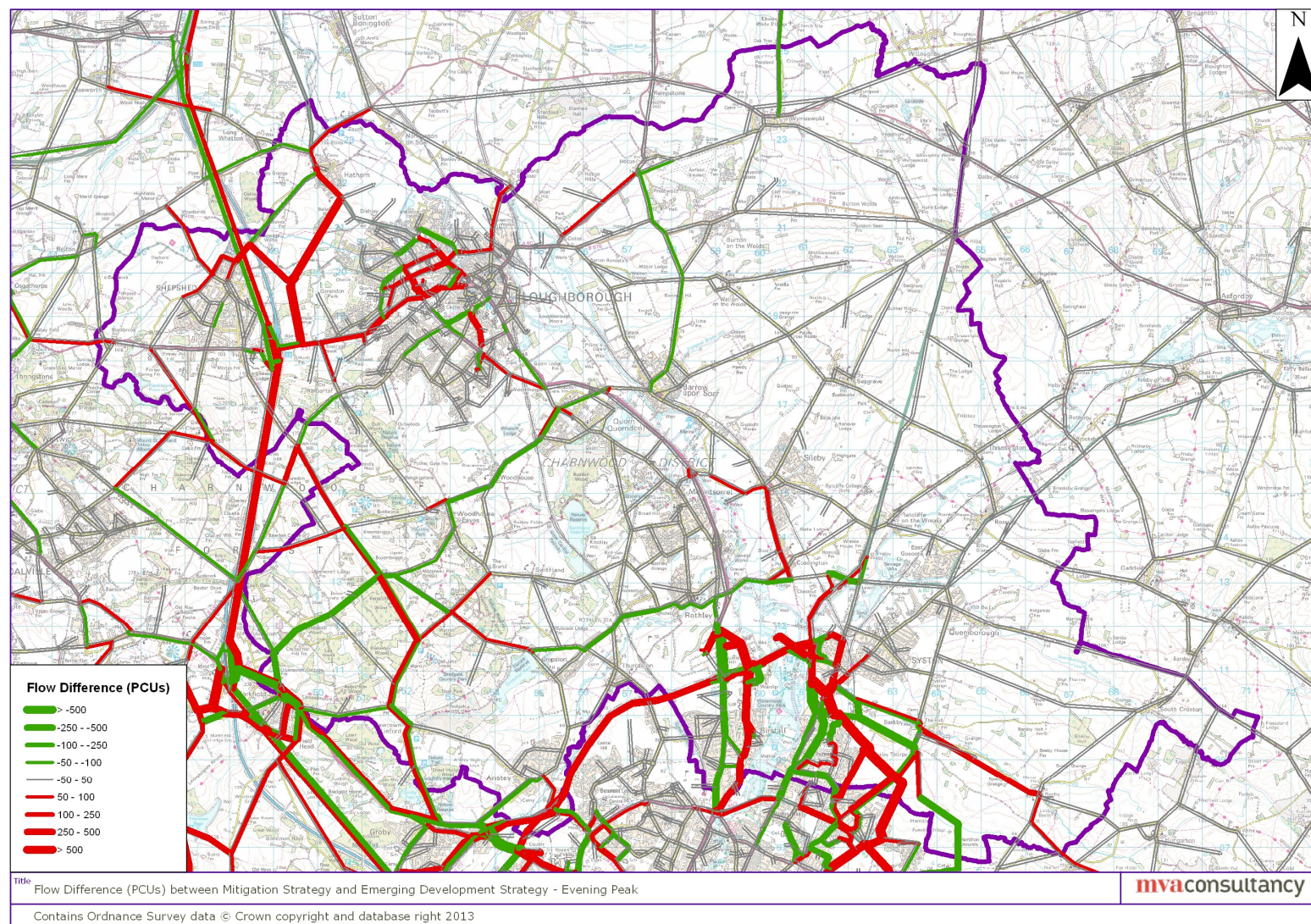


Figure 8.3 Emerging Development Strategy Congestion Profile – AM Peak

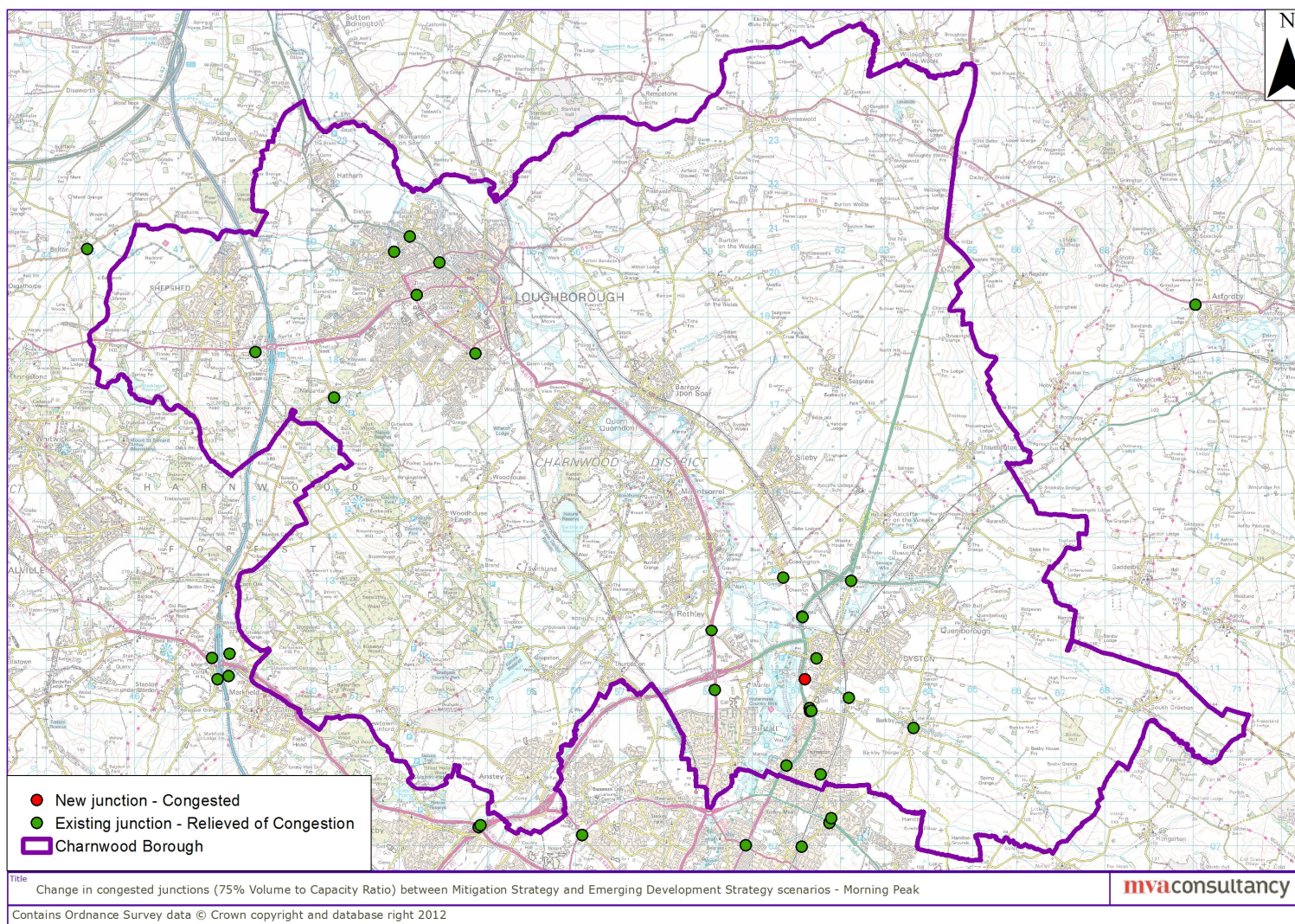


Figure 8.4 Emerging Development Strategy Congestion Profile – PM peak

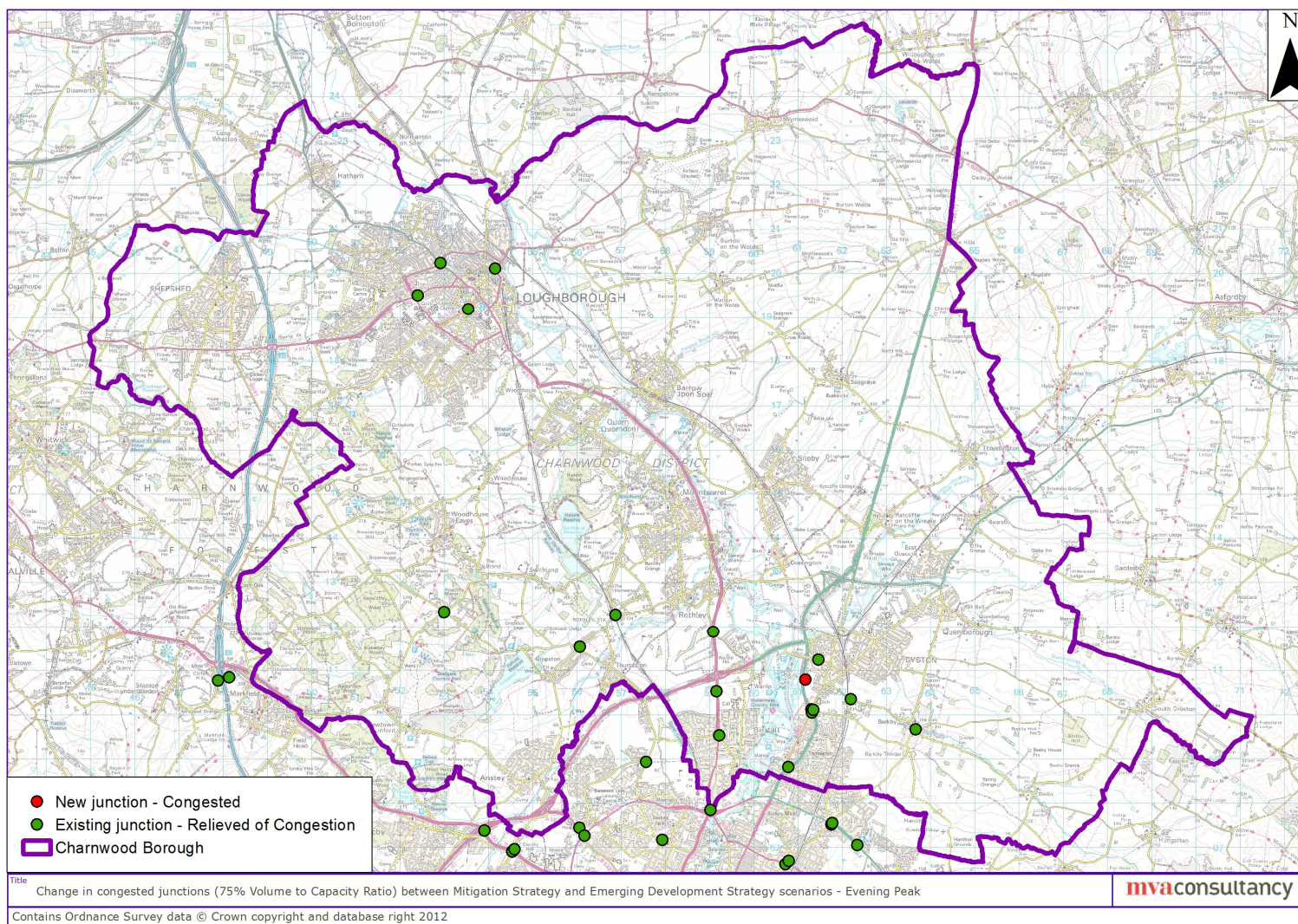
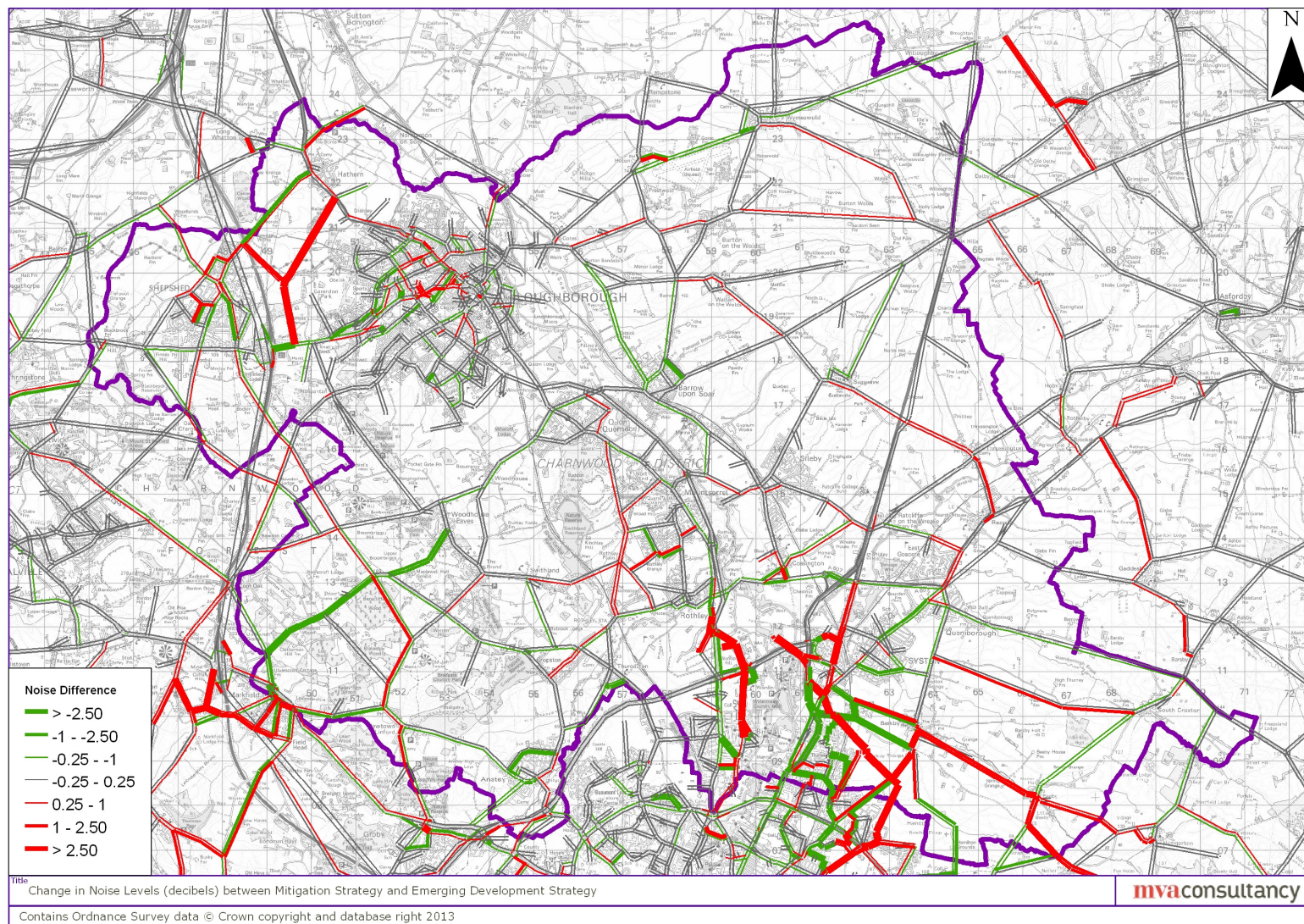


Figure 8.5 Emerging Development Strategy - Changes in Noise Levels



8.5 Network Statistics within Charnwood Borough

- 8.5.1 Table 8.1 shows the congestion statistics within Charnwood for the Emerging Development Strategy, with and without the full mitigation package. The performance of the mitigation package in terms of percent mitigation is also reported.
- 8.5.2 This analysis indicates that a significant proportion of the delay and travel time impacts of the emerging development strategy are mitigated as a result of the package of proposals that have been assessed. During both peaks the travel distances have increased as a result of the mitigation, however, this is expected as the mitigation includes the provision of new routes which are faster but longer than the existing alternative routes for traffic.
- 8.5.3 Full mitigation is achieved in terms of average speed across the study area.

8.6 Congested Route Kilometres and Severity Index

- 8.6.1 Table 8.1 also shows the performance of the full mitigation package in terms of reducing the length of congested roads and severity index for the Emerging Development Strategy.
- 8.6.2 In terms of congested route kilometres, the mitigation package fully mitigates the impacts of the development strategy in both peaks.
- 8.6.3 In term of the severity index, the mitigation package fully mitigates the development impact in the PM peak, providing more than 100% mitigation. In the AM peak, however, only 42% mitigation is provided.
- 8.6.4 The mitigation package tested for the emerging development strategy includes numerous individual schemes which are spread across the network. It is therefore not possible to identify individual schemes having negative impact in the AM peak. This will be explored in more detail at planning application stage.
- 8.6.5 The reason for very high level of mitigation in the PM peak is that the impact of the emerging development strategy (in the absence of any mitigation package) is limited in the first place, and even a slight reduction in severity index results in significantly large levels of percentage mitigation.
- 8.6.6 Although severity index is a useful indicator, the overall mitigation needs to be assessed against a range of indicators (including average speed, delay, travel time and congested route kilometres). And full mitigation is achieved in both peak hours against most of these indicators.

Table 8.1 Network Statistics – Emerging Development Strategy

	AM				PM				Overall Mitigation
	Reference	No Mitigation	Full Mitigation	% Mitigation	Reference	No Mitigation	Full Mitigation	% Mitigation	
Delays (pcu-hrs)	714	845	525	244%	513	537	489	200%	222%
Total Travel Time (pcu-hrs)	19,831	20,337	20,017	63%	19,429	19,942	19,967	-5%	29%
Total Travel Distance (pcu-kms)	962,673	973,167	982,200	-86%	958,347	973,948	985,654	-75%	-81%
Average Speed (km/h)	48.5	47.9	49.1	200%	49.3	48.8	49.4	120%	160%
Congested Route Kms	60	66	57	133%	51	52	46	360%	247%
Severity Index	147	170	160	42%	119	121	106	550%	296%

- 8.6.7 There are a number of localised junction impacts as a result of the mitigation proposals that would need to be considered further as part of any detailed application for the individual development schemes and their associated mitigation packages.

8.7 Emissions Statistics

- 8.7.1 Table 8.3 shows the performance of the mitigation package in terms of reducing the environmental pollution for the emerging development strategy.

- 8.7.2 Key results are detailed below:

- the full mitigation package fully mitigates the environmental impacts of the development strategy relating to NO_x, PM₁₀ and PM₂₅ emissions.
- The level of mitigation achieved in terms of carbon emissions is 60%. The relatively lower level of mitigation for carbon emissions is attributed to the increase in average speed within the study area and also the distance travelled as a result of the new routes that are proposed.
- With full mitigation package in place, the emission levels are forecast to be lower than 2008 Base Year levels.

Table 8.2 Environmental Pollution – Highway Mitigation Impact

	Reference	No Mitigation	Full Mitigation	% Mitigation
Carbon (tonnes / year)	182,745	184,856	183,584	60%
NO _x (g/km/day)	2,835,605	2,879,267	2,807,080	165%
PM ₁₀ (g/km/day)	513,168	522,156	506,994	169%
PM ₂₅ (g/km/day)	298,514	303,781	295,150	164%

9 Cost Effectiveness

9.1 Introduction

- 9.1.1 This section provides a summary assessment of the emerging development strategy and the associated costs of the mitigation package. A further assessment has been undertaken in terms of cost of mitigation per dwelling to allow an assessment of the viability of the mitigation package.

9.2 Mitigation Costs

- 9.2.1 Table 9.1 details the costs associated with each of the mitigation measures identified and tested.
- 9.2.2 Where possible, the costs from the previous assessments have been used. These are based on standardised costs per km of highway based on distances taken from the model. No detailed designs are available at the present time and therefore these costs are indicative at this stage.
- 9.2.3 Due to the indicative nature of the proposals and their associated costs, a 15% risk and 40% optimism bias has been applied to all costs. The costs exclude any local works, works to underground services and land acquisitions..
- 9.2.4 The measures identified as part of this study are relatively strategic in nature and other works may be required / identified at a later stage through the standard development control process.
- 9.2.5 Similarly, the costs derived here are only indicative and will need to be refined at the individual planning application stage.

Table 9.1 Indicative Cost of Mitigation Package

Mitigation Measure	Indicative Cost (£)	Cost including 15% Risk and 40% Optimism Bias (£)
M1 J23 improvements	£750,000	£1,162,500
Partial Western Distributor Road from A512 to A6 south of Hathern	£11,000,000	£17,050,000
Dualling of A512	£5,000,000	£7,750,000
Capacity Enhancements at Epinal Way / Ashby Road	£250,000	£387,500

Mitigation Measure	Indicative Cost (£)	Cost including 15% Risk and 40% Optimism Bias (£)
junction		
Re-configuration of Epinal Way / Alan Moss Road junction	£250,000	£387,500
Capacity enhancements at A6 / Alan Moss Road / Belton Road junction	£250,000	£387,500
Traffic Calming through old Ashby Road	£500,000	£775,000
Direct link from Shepshed residential development to A512 via a new junction.	£1,375,000	£2,131,250
Spine Road via East Thurmaston from Barkby Thorpe Lane to King St/Hamilton Lane.	£11,000,000	£17,050,000
Link to Sandhills Avenue	£2,500,000	£3,875,000
Severing of all vehicular traffic of route linking from North East Leicester SUE eastwards / southwards to Scraptoft.	£100,000	£155,000
Link road from North East Leicester SUE westward to link Melton Road and A607 north of the A607/Barkby Thorpe Lane junction.	£3,570,000	£5,533,500
Improvements at Hobby Horse roundabout	£825,000	£1,278,750
Capacity enhancements at A607 / Humberstone Lane junction	£400,000	£620,000
Capacity enhancements at A607 / Troon Way junction	£400,000	£620,000
Dualling of Troon Way	£2,000,000	£3,100,000
Improvements at Troon Way / Nicklaus Road junction	£200,000	£310,000
Signalisation of Humberstone Lane / Barkby Road junction	£200,000	£310,000
Measures along Catherine Street	£640,000	£992,000
A6 / Red hill Way junction improvements	£750,000	£1,162,500
Abbey Hill / Beaumont Leys junction improvements	£350,000	£542,500
Abbey Lane / Abbey Park Road junction improvements	£350,000	£542,500

Mitigation Measure	Indicative Cost (£)	Cost including 15% Risk and 40% Optimism Bias (£)
Mitigation associated with North of Birstall	£6,000,000	£9,300,000
Access junction improvement at Watermead	£250,000	£387,500
Public Transport Mitigation	£1,500,000	£2,325,000
Total Cost	£50,410,000	£78,135,500
Cost per residential property	£4,601	£7,132

10 Conclusion

10.1 Summary of Conclusions

- 10.1.1 This study has assessed the performance of a single emerging development strategy option against a range of indicators to inform the core strategy for Charnwood Borough Council. The emerging development strategy was informed by the stage 1 work undertaken in early 2012.
- 10.1.2 The focus of the study has been to assess the cumulative impact of the emerging development strategy and does not assess sites on an individual basis.

Reference Case Results

- 10.1.3 Like the stage 1 testing, the Emerging Development Strategy modelling results have been compared against a 2026 Reference Case, which was built on a 2008 Base Year model.
- 10.1.4 The Reference Case modelling results predict that, without the emerging development strategy, from 2008 to 2026:
- Traffic within Charnwood is forecast to increase by 16% in the peak hours.
 - Total number of households within Charnwood is forecast to increase by 13.7%, from 68,156 to 77,156.
 - The population of Charnwood is forecast to increase by 7.7%.
 - The total number of jobs within Charnwood is likely to increase by 0.6%

No Mitigation Results

- 10.1.5 Compared with the reference case, the emerging development strategy results in:
- 2.7% increase in traffic in Charnwood in the peak hours;
 - 12% increase in the number of households in Charnwood; and
 - 7,056 additional jobs in Charnwood.
- 10.1.6 In the absence of any mitigation package, the emerging development strategy is forecast to have significant impacts on the highway network. These impacts are in the form of increased traffic flows, delays and congestion. The impacts are more significant in the vicinity of the development sites.
- 10.1.7 The rerouting of existing traffic is more significant in the urban areas where base congestion is at its highest and there is limited spare capacity to accommodate the increase in traffic associated with the developments. As a result the additional development traffic forces existing traffic to reroute.

Mitigation Strategy Development

- 10.1.8 A two-staged mitigation strategy was developed for the emerging development strategy option – public transport mitigation and highway mitigation.

- 10.1.9 Soft measures such as smarter choices and walking and cycling improvements were not considered for the mitigation strategy because the trip rates forecast by the model already take account these elements into account and assume a level of sustainability in the development proposals.
- 10.1.10 Each development site has been assumed to have access to at least one bus service with at least four buses per hour.
- 10.1.11 A list of mitigation measures (the mitigation package) has been developed for the emerging development strategy based on the results of the 'without mitigation' model runs, information from previous studies and a series of discussions with Charnwood Borough Council, Leicestershire County Council, Leicester City Council, the Highways Agency and the developers.

PT Mitigation Results

- 10.1.12 The overall PT patronage for the emerging development strategy sites is forecast to increase by 20% in the AM peak and 23% in the PM peak.
- 10.1.13 The sites with the highest levels of patronage include West Loughborough, North East Leicester and North of Birstall.
- 10.1.14 Although there is a significant increase in the usage of public transport with the mitigation measures in place, it is unlikely that this will have a significant impact on the overall modal change from highway to public transport usage.

Highway Mitigation Results

- 10.1.15 The overall performance of the mitigation package needs to be assessed against a range of indicators (including delay, average speed, total travel time, congested route kilometres and severity index) rather than one single indicator. And against most of these indicators, full mitigation is achieved across both peak hours.
- 10.1.16 In terms of congested route kilometres, average speed and delay (caused by congestion), full mitigation is achieved across both peak hours.
- 10.1.17 In terms of severity index, the highway mitigation package provides full mitigation in the PM peak within the study area. However, during the AM peak, only 42% mitigation is achieved.
- 10.1.18 The mitigation package tested for the emerging development strategy includes numerous individual schemes (which include changing layout for junctions, signalisation of some existing roundabouts, dualling of sections of roads and traffic calming measures) which are spread across the network. It is therefore not possible to identify which individual schemes have a negative impact on the mitigation.
- 10.1.19 The reason for the PM peak having 550% mitigation (in terms of severity index) is that the impact of the development strategy (in the absence of any mitigation package) is limited in the first place. And even a slight reduction in severity index (by the mitigation package) results in significantly large levels of percentage mitigation.

- 10.1.20 The new roads modelled as part of the mitigation strategy provide congestion relief but increase travel distance in both peak hours.
- 10.1.21 The provision of western link from North East Leicester SUE, along with spine road and connection with Sandhills Avenue, provides an alternative route into Leicester, providing congestion relief to local areas of Thurmaston, Barkby and Barkby Thorpe, but significantly increasing traffic along Victoria Road East corridor.
- 10.1.22 There are a number of localised junction impacts as a result of the mitigation proposals that would need to be considered further as part of any detailed application for the individual development schemes and their associated mitigation packages.

Cost Effectiveness

- 10.1.23 The total estimated cost for the full mitigation package amounts to be slightly over £78M.
- 10.1.24 The cost per dwelling of the mitigation package is around £7,100.

Overall Conclusion

- 10.1.25 The objective of this study was to assess, on a strategic level, the impact of the emerging development strategy and the effectiveness of the mitigation measures to reduce those impacts. The analysis of the outputs from the LLITM model runs has shown that across the majority of indicators, the emerging development strategy can be accommodated and mitigated in transport terms.
- 10.1.26 However, in order to investigate the effectiveness of mitigation measures associated with individual development sites, further work will need to be undertaken at a later stage when detailed development schemes are prepared. It would be advantageous to explore in more detail the relative benefits of the individual mitigation measures to understand where some might be less effective than others in order to help refine the mitigation package and to possibly carry out some sensitivity testing.

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