AECOM DAVID SIMMONDS CONSULTANCY URBAN, REGIONAL AND TRANSPORT PLANNING

Blaby District Core Strategy:

Project Report

Blaby District Core Strategy:

Project Report

Prepared by: Ian Stanness (AECOM) Senior Consultant
Emma Richmond (DSC) Consultant

Checked by: Mark Dazeley (AECOM) Associate Director
Andy Dobson (DSC) Director

Approved by: Paul Hanson (AECOM) Regional Director

Rev No.	Comments	Checked by	Approved by	Date
1	Draft for comments	MJD	PAH	29/03/2012
2	Revised draft following comments	MJD	MJD	03/05/2012

AECOM House, 63-77 Victoria Street, St Albans, Hertfordshire, AL1 3ER

Telephone: 01727 535000 Website: http://www.aecom.com

Job No: 60221408 Reference: M001.050 Date Created: 17th Feb 2012

Whilst the modelling work outlined in this report has been carried out using the Leicester and Leicestershire Integrated Transport Model (LLITM), its findings and any conclusions do not necessarily represent the views of Leicestershire County Council as the Highway Authority.

Table of Contents

List of Tables

List of Figures

Executive Summary

Objectives and Scope

This study has looked at developing a package of mitigation measures in response to the preferred distribution of housing development contained within the proposed Blaby District Core Strategy. These mitigation measures aim to reduce the need for car travel within the District and to address the impacts of forecast growth on the highway network.

The Blaby District Core Strategy has been informed by a number of previous studies including the transportation assessment of development dispersal using ODYSSEUS study (URS, December 2011) which looked at the likely traffic generation from the proposed levels of growth and their distribution, identifying where hotspots were likely to occur. This formed the foundation of this more detailed LLITM study.

The package of proposed mitigation measures includes a number of schemes affecting both the highway network and public transport provision in and around Blaby District. These include schemes such as junction capacity improvements, increased bus service frequencies and improved bus journey times along the A426 corridor with the recent Better Bus Area Fund bid.

In addition to this, this study has also assessed the likely impact of proposed investment in Smarter Choice measures within Blaby District. These are schemes such as workplace and school travel plans, and general targeted marketing. The likely effect of these schemes has been assessed based on the proposed level of funding for each of these Smarter Choice measures and DfT guidance on the likely effects.

This study has drawn on the work undertaken using LLITM for the assessment of the Lubbesthorpe development. The modelling work undertaken as part of this study has drawn on this scenario, testing mitigation measures from this baseline. Within this, there have been two iterations of mitigation measures, with the second round of testing responding to the results of the first, initial round of testing.

The modelling work undertaken as part of this study is intended to inform strategy in terms of the mitigation measures that might be required. Additional work will be required to support detailed design in implementing the strategies.

This report seeks to provide an evidence base which can be used to inform the decision-making process. Commentary is provided to explain the modelling effects underpinning these forecasts, aiding the assessment of the proposed Core Strategy and mitigation measures. The report does not seek to determine whether the proposed Core Strategy and mitigation measures should be adopted, as the transport impacts are only a part of the decision making process; other local considerations aside from transport issues will need to be considered.

Future Context

Due to the growth assumed in the Core Strategy between 2008 and 2031, population within Blaby District is forecast to increase by around 16,000, or 17%. This increase in population is coupled with a forecast increase in households of around 11,000, or 29%, and an increase in employment of nearly 2,000 jobs, or 4%.

The growth of around 11,000 households between 2008 and 2031 is above that assumed in the Core Strategy over the same period of around 9,200 dwellings. This apparent discrepancy is due to the way the land-use model forecasts residential development. This is discussed in more detail in Section 4 of the main report, but is primarily due to the different representations of dwellings and households in the model.

It is worth noting that the Blaby Core Strategy is proposed to run to 2029. Modelling work within LLITM has been undertaken for the forecast year of 2031 as this captures all the proposed growth resulting from the Core Strategy.

This increase in population and employment results in an increase in travel demand produced by people and businesses located within Blaby District. Total travel demand produced by these people and businesses is forecast to increase by around 21%, in line with population growth, with similar levels of growth in car, public transport and active mode (walking and cycling) demand.

Comparing this with the growth forecast for Leicestershire (including Leicester City), across the county car demand is forecast to increase between 2008 and 2031 by almost 28%, therefore growth within Blaby District is forecast to be below that average. Blaby District has above average forecast growth in public transport demand compared to around 7% to 8% for Leicestershire, and comparable levels of growth in active mode demand.

As the growth in demand is broadly similar between car, public transport and active modes, mode shares are not forecast to change overall between 2008 and 2031. Nevertheless, there is a forecast decrease in car mode share adjacent to Leicester City[1], with a forecast increase in car mode share in the rural areas to the south of the District.

This forecast increase in highway demand within Blaby District, and growth in the remainder of Leicestershire and the surrounding areas, results in an increase in traffic within Blaby District. Traffic is forecast to increase by around 24% between 2008 and 2031 within Blaby District in the AM Peak and PM Peak hours. This increase in traffic increases delays and reduces average speeds on this area of the highway network. Average speeds are forecast to reduce by between 12% and 14% as a result of this increase in traffic, with higher reductions in average speeds within the PUA.

Comparing this with the corresponding growth forecast across Leicestershire, the traffic growth for the county is forecast to be between 27% and 29% in the two peak hours. This is above the growth forecast for Blaby District. However the average speed reductions across the county are forecast to be less than those experienced within Blaby District at around 10% to 13%.

These forecast increases in flows and delays, and resultant decreases in average speeds, result in increases in journey times on the main routes through and adjacent to Blaby District. Journey times have been assessed along the A47, A426, A563, B582 and B4114 / A5460, and although there is variation by route and modelled hour, the journey times along these routes are generally forecast to increase by around 20% from 2008 to 2031.

Despite these forecast increases in traffic and reductions in speeds, air quality emissions within Blaby District are forecast to fall significantly between 2008 and 2031. This is due to DEFRA guidance on the forecast improvements to the efficiency of vehicle engines over time. Due to this, the emissions of hydrocarbons are forecast to fall by 56% across the District, with nitrogen oxides forecast to fall by 77% and particulate matter by 36%. These forecast reductions are consistent with those forecast for Leicestershire as a whole.

In terms of carbon emissions, there is not the same level of efficiency savings assumed over time. This results in a forecast 6.2% increase in carbon emissions between 2008 and 2031 across Leicestershire, with a 3.9% increase in those emissions from links within Blaby District.

Impact of Mitigation Measures

The proposed mitigation measures have been modelled in two stages: firstly assessing the impacts of the 'hard' measures such as junction improvements and bus frequency changes; and then incrementally adding

[1] Within the Principal Urban Area (PUA)

'soft' Smarter Choice measures. This allows for the impact of the Smarter Choice investment to be isolated, and the impact of proposed 'hard' and 'soft' measures to be individually assessed.

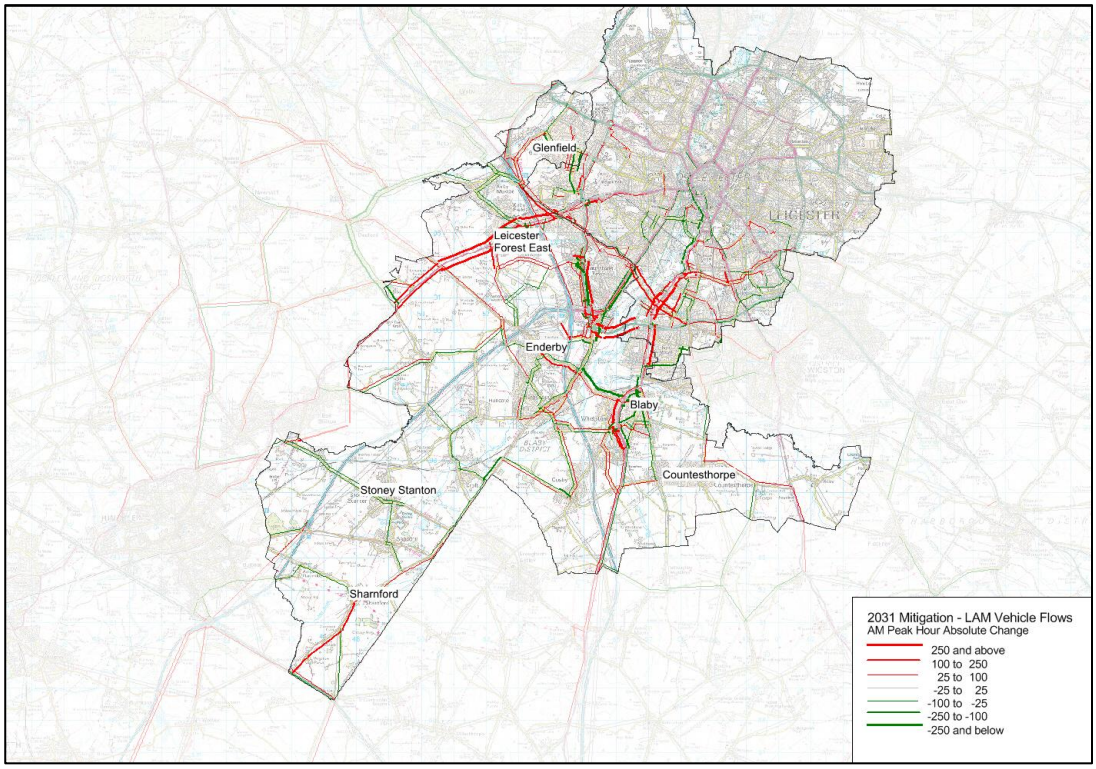
In terms of the demand forecast, the 'hard' measures through the increased bus service frequencies and the A426 Better Bus Area Fund bid schemes are forecast to increase public transport demand by around 2% across the district. The 'soft' Smarter Choice measures are forecast to reduce car demand by around 0.5% within 2031. This is a relatively small reduction in car demand compared to the almost 17% growth forecast between 2008 and 2031.

In terms of the performance and results from the highway model, there is little difference between the mitigation scenario with only the 'hard' measures and that including the Smarter Choices measures. There are forecast to be incremental improvements with the investment in Smarter Choice measures, but these are relatively small in comparison with the forecast impact of the proposed 'hard' measures.

The forecast highway model flows in the AM Peak and PM Peak hours show an increase along the A47, A426 and A563 corridors. This is in response to the increased capacities along these routes improving journey times and attracting more traffic. There are also forecast reductions in flow along the routes where traffic calming is proposed (within Enderby and Narborough, within Kirby Muxloe, and within Glenfield), and within Blaby as traffic switches to the A426 bypass route.

Figure ES.1 shows the forecast change in highway vehicle flows in 2031 with the introduction of the proposed package of mitigation measures. This shows the locations where flow increases are forecast, shown in red, and where flow decreases are forecasts, shown in green.

Figure ES.1: AM Peak Hour Absolute Vehicle Flow Changes in 2031 with Mitigation



As already mentioned, the improvements in capacity along some routes improve the forecast journey times compared to the 2031 forecast without the proposed mitigation measures. This is particularly evident along

the A47, A426 and A563 which see forecast improvements in their journey times of up to around 10% with the proposed mitigation measures. There are more significant individual savings at some of the junctions where capacity improvements are proposed, but these are countered by increases in delay at other junctions along the route where improvements are not proposed. These increases in delay are due to additional vehicle flows along these corridors as a result of the capacity improvements proposed.

It is worth noting in relation to the journey time forecasts that, with the introduction of the proposed mitigation measures, there is only one route whose journey time is at or below that contained within the 2008 Base Year model. This suggests that despite mitigation for some of the increases in journey times, the proposed mitigation does not compensate for all the increases in journey times forecast from the base year.

Overall, the proposed mitigation measures are not forecast to counter all the increases in traffic and delays forecast due to the Core Strategy and other growth in the area. The mitigation measures are forecast to reduce future year car demand, whist increasing public transport and active modes travel, but this is small in comparison to the growth from 2008.

This study has not looked at alternative distribution patterns for development within Blaby District; however previous studies have determined the distribution assessed here as the preferred option. The performance of the highway network is only one factor, albeit an important one, in the development of a Core Strategy for Blaby District.

The mitigation measures are forecast to improve the journey times along the A47, A426 and A563, which are core routes in the area, although not back to 2008-levels, and this would improve access between Blaby District and Leicester City. In terms of the highway network performance as a whole, there is not forecast to be a significant change in the level of traffic on the network with the mitigation measures in 2031. Traffic within Blaby District is forecast to grow by 24% from 2008 to 2031, and the mitigation measures are forecast to change the future year level of traffic by less than 0.5%.

There is little forecast incremental change in the highway network performance, in terms of traffic, average speeds and journey times, with the inclusion of Smarter Choice measures. The level of funding proposed for these measures is relatively low compared to the benchmark funding levels assumed in the DfT's Demonstration Town case studies. The funding for workplace and school travel plans is 27% of the benchmark funding, with funding for targeted marketing less than 1% of the benchmark. Increased and sustained funding for these measures would increase the likely impact of these measures, and hence mitigation of the traffic growth forecast for Blaby District.

Section 1 – Overview

1.1 Introduction

This report has been commissioned by Leicestershire County Council on behalf of Blaby District Council for use as part of the development of its Local Development Framework Core Strategy. Leicestershire County Council, as the Highway Authority, and Leicester City Council, as the adjoining Highway Authority, have been fully consulted.

Blaby District contains the significant development site of Lubbesthorpe. This is a sustainable urban extension containing some 4,500 dwellings and 21 hectares of employment land. The remainder of the allocation of housing growth for Blaby District from 2006 is approximately 2,900 dwellings to 2029, of which 700 dwellings is in the Principal Urban Area (PUA) adjoining Leicester City, and 2,200 is in the non-PUA. The housing completions up to 2009 / 2010 are included in the model forecasts, with the remainder of the forecast growth based on the proposed Core Strategy projections.

The driver for the quantity of development in the Core Strategy has been determined by the following:

- The Housing Requirements Project, a study commissioned by all Leicestershire Districts, Leicester City Council and Leicestershire County Council which seeks to identify the appropriate level of housing required across Leicester and Leicestershire Housing Market Area (HMA) between 2006 and 2031. This updates the requirements of the East Midlands Regional Plan (EMRP) which itself was based on evidence, including national household projections.
- The Blaby Employment Land and Premises Study, and Leicester and Leicestershire Employment Land Study which identified the quantity of employment land required in order to meet identified needs.
- The Blaby Retail Study which sought to identify the likely capacity for additional retail growth within the District.

These three studies combined have helped to inform the likely levels of growth in the three key areas of retail, employment and housing.

A number of Leicestershire District Councils commissioned a study which looked at the impacts of different development options on climate change. This study showed that, amongst other things, a policy of 'urban concentration' resulted in reduced levels of CO2 emissions per dwelling than a more dispersed pattern of development.

The Blaby District Core Strategy has also been informed by three previous transportation studies:

- The *'Assessment of Transportation Implications'* (Scott Wilson 2009) primarily considering the transportation implications of the various options for sustainable urban extensions and, to a lesser extent, development in other 'better served settlements' of the District.
- The *'PTOLEMY: Impact of housing growth on the Leicester PUA'* (WSP / Leicester City Council, April 2009) study which considered the impact of housing growth on the PUA, including all corridors into Leicester City within Blaby District.
- The Transportation Assessment of development dispersal using ODYSSEUS (URS, December 2011) study looked at the likely traffic generation from the proposed levels of growth and their distribution, identifying where hotspots were likely to occur. This formed the foundation of this more detailed LLITM study.

This work on the Core Strategy takes the preferred distribution of housing development, derived from previous studies, and looks to develop a package of mitigation measures to address the impacts of forecast highway traffic growth. These mitigation measures consist of highway infrastructure, changes to public transport provision, and Smarter Choice initiatives.

The forecast year for this modelling work is 2031, with mitigation measures being tested in this forecast year. This modelling builds on the work undertaken to assess the Lubbesthorpe development within LLITM, taking the existing 2031 forecast including this development as the starting point.

Whilst the modelling work outlined in this report has been carried out using the Leicester and Leicestershire Integrated Transport Model (LLITM), its findings and any conclusions do not necessarily represent the views of Leicestershire County Council or Leicester City Council as the relevant Highway Authorities.

The LLITM model is a robust, WebTAG[2] compliant integrated model, which is based on assumptions including economic forecasts and predictions regarding travel behaviour. These assumptions are based on observed base year data, recent trends and DfT WebTAG forecasting assumptions. These assumptions should be taken into account when considering the forecasts contained in this report.

LLITM is a powerful tool which represents all modes of travel, and through the tour-based demand setup, links the outbound and return legs of an individual's journey. It also includes an environmental assessment tool, which uses current DfT and DEFRA guidance and processes to forecast emissions based on the model results. That said, as with any model, there are strengths and weakness associated with LLITM. These include the data sources used in constructing the model, along with the data stored and calculated within the model. Any limitations that apply to the LLITM forecasts are discussed during the course of this report.

1.2 Model Overview

More details on the structure and use of the model can be found in the demand model report (*PR05 - Demand Model*) and the user guide for LLITM (*PR08 - LLITM User Guide*). However, in summary the Leicester and Leicestershire Integrated Transport Model (LLITM) consists of four main components:

- a highway supply model (LLITM-HW), developed in SATURN by Scott Wilson;
- a public transport supply model (LLITM-PT), developed in CUBE Voyager by Scott Wilson;
- a variable demand model (LLITM-DM), built in EMME by AECOM; and
- a land-use model (LLITM-LUM), built in bespoke DELTA software by David Simmonds Consultancy.

In addition to this LLITM also includes a reporting tool called EASE which calculates and graphically represents results from the model. These results include information on flows from the highway and public transport models, delays from the highway model, the results of the land-use model, and calculated emissions and noise levels.

Further details on these elements of the integrated model can be found in the following documents:

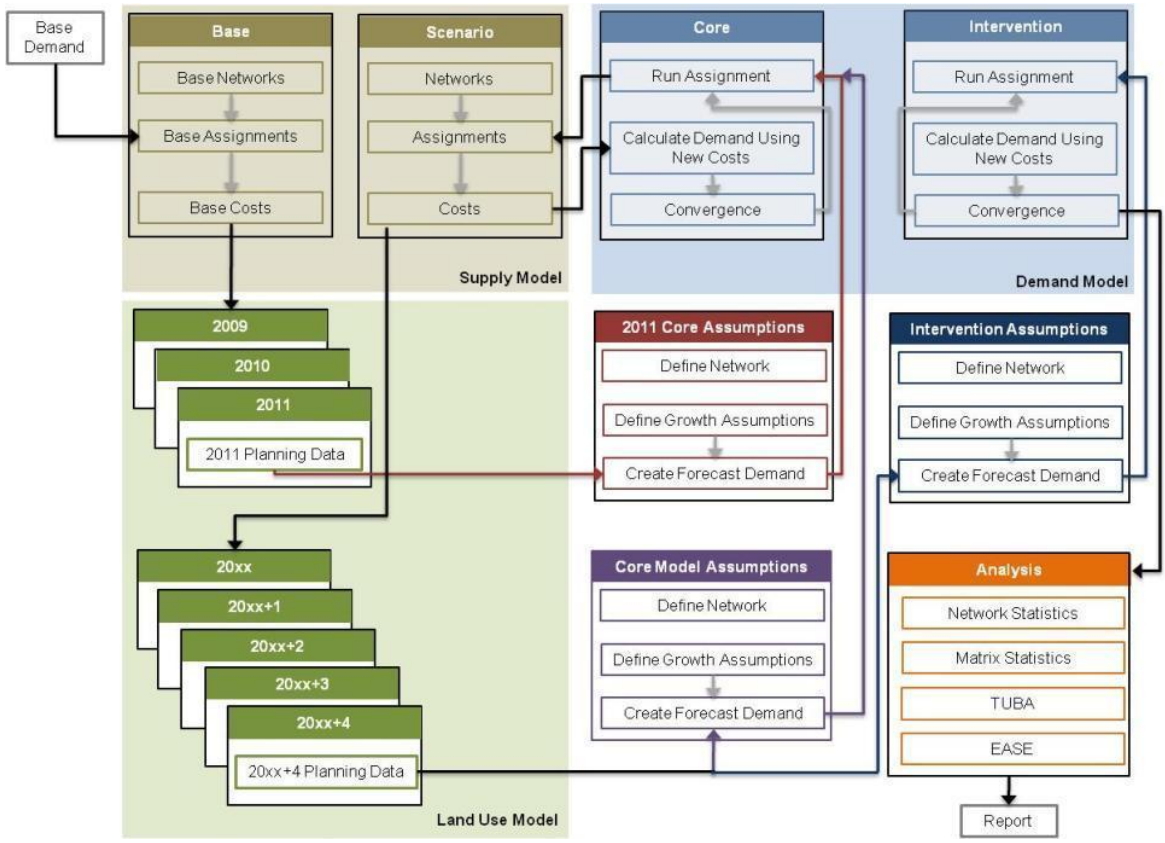
- PR01: Data Collection Report;
- PR02: Highway Local Model Validation Report;
- PR03: Public Transport Local Model Validation Report;
- PR04: Land Use Model Development Report;
- PR05: Demand Model Development Report;

[2] WebTAG is the DfT's transport analysis guidance on the methods and assumptions that should be used in the course of transport studies.

- PR06: Forecasting Report;
- PR07: Demonstration Testing Report; and
- PR08: LLITM User Guide.

Within the integrated model there is a flow of information between all of these four components. Figure 1.1 gives an overview of this flow of information between the various process and components of LLITM.

Figure 1.1: Overview of Flow of Data and Processes within LLITM



This shows the flow of information required in building up a core scenario, with costs from previous years being used in the land-use model, which in turn then allocates growth in the subsequent years. Trip growth is calculated by applying a customised version of the DfT's trip-end model to the planning data generated in LLITM-LUM. This means that the core scenario years need to be run in sequential order, with the output from one forecast year forming some of the inputs for the next.

1.3 Terminology

This section details the terminology used in this report that is specific to this study. This includes the model scenarios that are included in this study, and some of the assumptions adopted for the reporting of these model scenarios. Further information on the generic terms used in relation to LLITM is discussed within this report, and can also be found in Appendix A.

1.3.1 Model Scenarios

Within this report there are a number of modelling scenarios referenced, and the following is a list of these scenarios and how they are referred to:

- **2008 Base Year**: this is the validated base year model including the recalibration work undertaken in the vicinity of the proposed Lubbesthorpe development in November 2011.
- **2031 LAM**: this is the 2031 Lubbesthorpe Application Model, i.e. the 2031 forecast from the existing Lubbesthorpe assessment. The forecast assumptions relating to the Lubbesthorpe development that are included in this scenario are detailed in Section 2.2 in terms of the highway and public transport network and Smarter Choice measures, with the land-use assumptions discussed in Section 4.2.
- **2031 'Hard' Only**: this is the 2031 LAM with the introduction of the 'hard' measures included in the mitigation. 'Hard' measures are those that can be directly represented in the highway and / or public transport assignment networks. This includes such mitigation measures as junction improvements and bus service frequency increases. These 'hard' measures are detailed in Section 2.3.
- **2031 Mitigation**: this is the 2031 LAM with both 'hard' and 'soft' mitigation measures. 'Soft' measures are those that cannot be directly represented within LLITM. These are measures such as workplace travel plans and targeted marketing initiatives. The derivation of the effects calibrated to represent these 'soft' measures is contained within Appendix B with the results of the calibration process detailed in Section 2.3.3.

Using these scenarios, various comparisons will be made between model forecasts. Differences between 2008 Base Year and 2031 LAM shows the forecast changes due to the Blaby District Core Strategy without any of the mitigation measures proposed in this study. Incremental changes between 2031 LAM and the two mitigation scenarios will show the impact of the proposed package of mitigation measures, with the 2031 'Hard' Only used to identify the effect attributable to the 'hard' mitigation measures.

1.3.2 Reporting

Within the reporting, changes to results have been colour coded as to their perceived benefit or disbenefit. Changes that are seen as an improvement are shown in green, whereas changes that are a worsening of conditions are shown in red. This is irrespective of the direction of change. For example, an increase in delay will be shown in red as this is not desirable, whereas an increase in average speeds will be shown in green.

Within the reporting of forecasts for Blaby District, the district has been split into three subsets. These subsets divide Blaby District into those areas within the PUA (Principal Urban Area), those that are outside the PUA but urban in nature, and the remaining rural areas. The following details these subsets:

- **Blaby – PUA***:* includes Glenfield, Kirby Muxloe, Glen Parva, Leicester Forest East, Braunstone Town and the future proposed location of the Lubbesthorpe development.
- **Blaby – Urban***:* includes the larger central villages of Enderby, Narborough, Blaby, Countesthorpe and Whetstone.
- **Blaby – Rural***:* this includes the remainder of the district not covered by the above two definitions.

These areas are shown in Figure 1.2, with Blaby – PUA shown in red, Blaby – Urban shown in blue, and Blaby – Rural shown in green. In a similar manner, highway network statistics for Blaby District have been reported using these three area definitions. Each link in the highway model has been allocated to one of these reporting areas based on the location of the mid-point of the link. Figure 1.3 shows the result of this allocation process for the 2031 LAM highway network.

Figure 1.2: Blaby District Reporting Areas

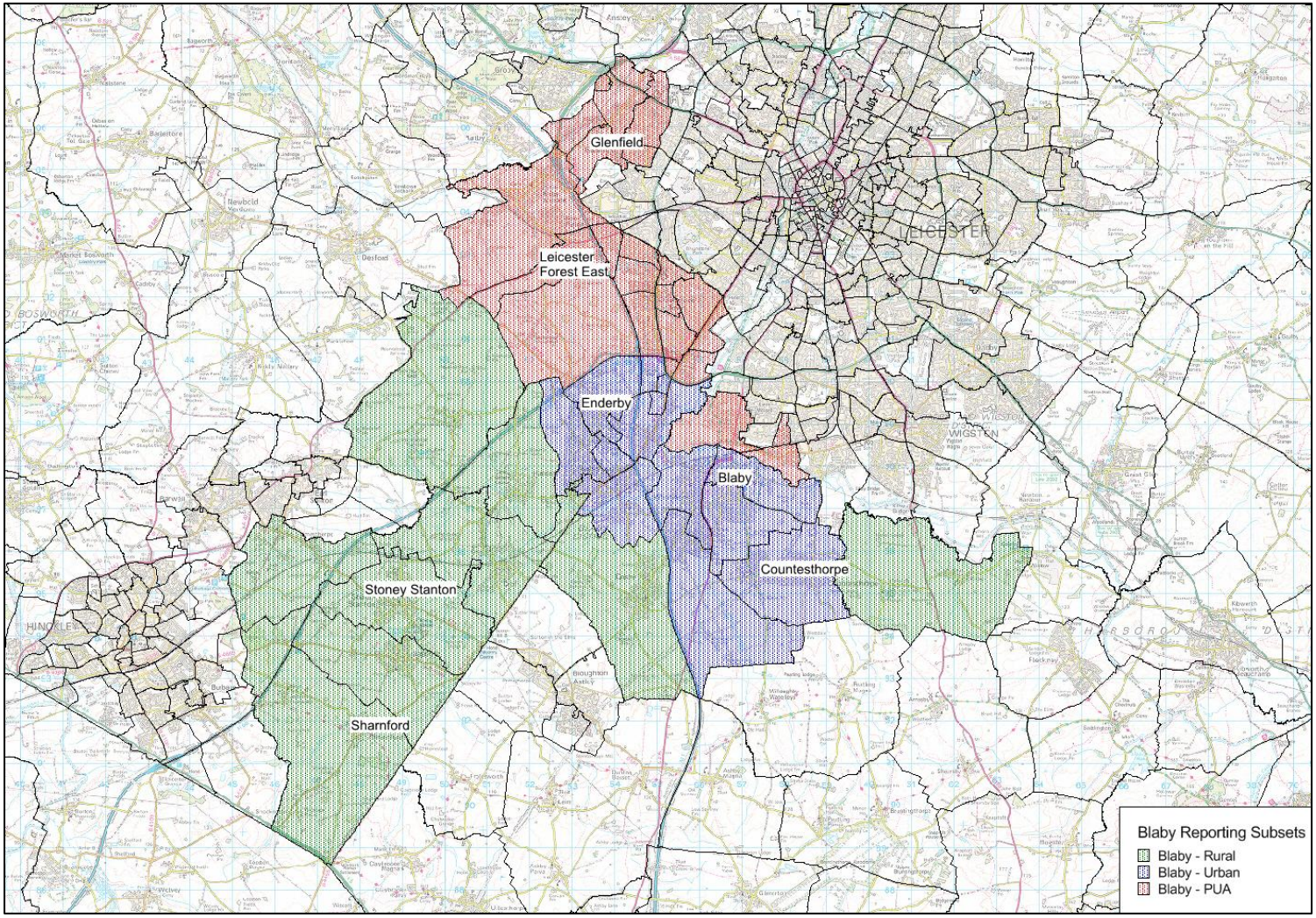
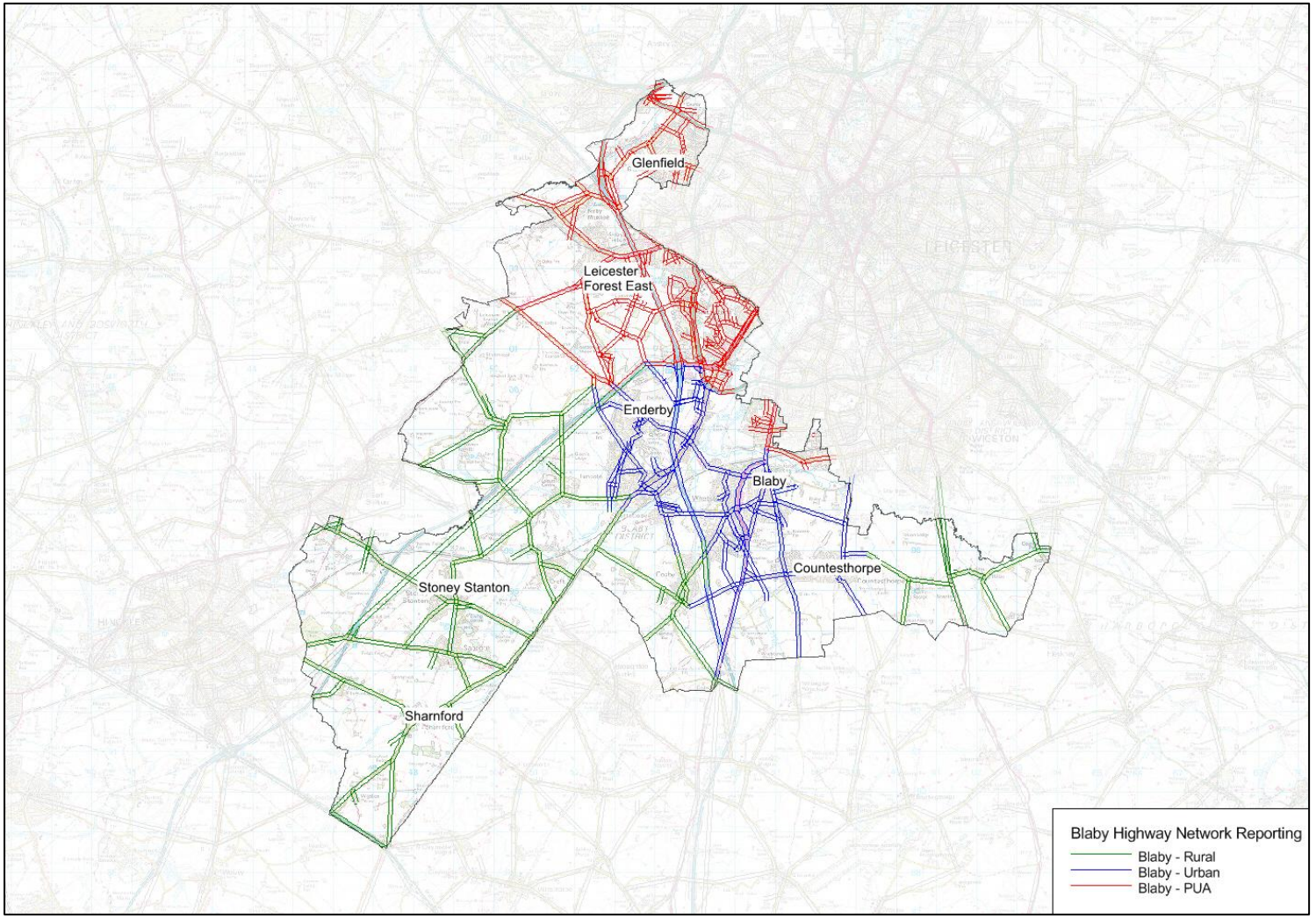


Figure 1.3: Blaby District Reporting Highway Links



1.4 Report Structure

This report contains the following sections and appendices:

- Section 2 – Forecasting Methodology and Assumptions. This section contains the assumptions used within the model in forecasting. This includes the application of government guidance (WebTAG) and other assumptions, as well as the forecast assumptions contained within the 2031 LAM and the mitigation measures tested as part of this study.
- Section 3 – Model Performance Review. This section summarises the result of a high-level review of the base year highway model.
- Section 4 – Land-Use Forecasts. In this section, the results of the land-use forecasts contained within the 2031 LAM are reported. This section also includes a comparison of the land-use model inputs contained within these forecasts against the Blaby District Core Strategy.
- Section 5 – LLITM Forecasts. This section details the forecasts from the 2031 LAM Scenario, showing the changes from the 2008 Base Year to the 2031 situation without any of the proposed mitigation measures implemented. Also included in this section is the forecast change in 2031 conditions as a result of the mitigation measures proposed, with results given for the 'hard' and 'soft' elements of the proposed package.
- Section 6 – Summary and Conclusions. This section summarises the results of this study, based on the results detailed in Section 5.
- Appendix A: Glossary of Terms. This appendix contains a glossary of terms used in relation to LLITM applications.
- Appendix B: Smarter Choice Benchmarking. This appendix details the derivation of the targets used in the calibration of the effect of the proposed Smarter Choice initiatives.

Section 2 – Forecasting Methodology and Assumptions

2.1 Core Scenario Assumptions

There are a number of assumptions, i.e. model inputs, which are required when running the integrated model for forecasting. These include network inputs for highway and public transport, assumptions on the supply and cost of parking in Leicester and Loughborough, economic assumptions on such items as values of time and fuel costs, and planning policy assumptions for the land-use model.

Table 2.1 lists the assumptions used within this version of LLITM and these forecasts, excluding the network assumptions for the highway and public transport models, and the assumptions specifically relating to the Lubbesthorpe development or proposed mitigation measures for the Blaby District Core Strategy.

Table 2.1: Forecast Assumptions

Input	Assumptions / Source
Economic growth (GDP growth, value of time)	Information on changes in GDP and thus values of time are taken from DfT advice (WebTAG 3.5.6, April 2011). Values of time are assumed to be constant across modes of travel, time periods and geographical areas. Values of time vary only by trip purpose, income level and length of trip.
Public transport fares	Bus - 1.5% per annum until 2015; and 0.75% per annum thereafter. Rail - 2008 to 2010 based on observed data (with regulated and unregulated components based on published information). Growth from 2010 to 2011 is based on the observed growth between 2008 and 2010, and has been assumed to be 3.1%. Growth from 2011 to 2015 has been assumed to be 3% per annum; and 1% thereafter. These assumptions reflect our interpretation of current Government policies and an assumption that the current imperative to reduce subsidies (increase fare revenues) will then reduce.
Car operating costs	Changes in fuel prices, vehicle fuel efficiency, and non-fuel operating costs have been taken from WebTAG 3.5.6, April 2011.
Parking charges	Parking charges assumed to grow 2% per annum over inflation, in approximate line with historic salary increases. For new park and ride sites included in the model, the charges have been taken from the existing Meynell's Gorse park and ride site.
Parking capacities	The zone capacities of private / non-residential parking (PNR) increase in relation to the changes in employment within each zone. In terms of the new park and ride sites, where no specific information is available, the same capacity as Meynell's Gorse in 2008, of 520 spaces, has been assumed. This applies to all new park and ride sites except Birstall which has a known capacity of 1,000 spaces. Aside from new park and ride sites and PNR, the only parking capacity change from the base year is an increase in the capacity at

Input	Assumptions / Source
	Meynell's Gorse of 500 spaces.
Land use: population and employment forecasts	Population and employment growth across the East Midlands sub-region have been constrained to government TEMPRO (version 6.2) forecasts. This means that at a sub-regional level, the LLITM forecasts match those contained within government guidance. However, the allocation of land-use within this sub-region may differ from TEMPRO forecasts. Detailed information on planning policy (land allocated by development type) has been collated from individual districts during 2009 and has been used in LLITM-LUM.
Car ownership	Car ownership is forecast within LLITM-LUM.
Car occupancy	Changes in car occupancy (i.e. the average number of passengers in a vehicle) over time have been taken from WebTAG 3.5.6, April 2011.
Trip rates	These are the number of trips of different modes and purposes generated by a given level of population or employment within a zone. These are assumed to be constant over time. Demand growth from the base year is applied at a 24-hour level. The splits of this 24-hour demand to time periods are also assumed to be fixed for 'reference demand' over time. The resultant allocations to time periods from the demand model may vary from the reference case due to time-period choice within the demand model.
Highway congestion changes (for external buffer network).	The external, or buffer, network is coded with fixed link speeds that do not respond to changes in forecast highway flows. The buffer network area is used to represent the network outside of Leicestershire. In order to represent the likely decrease in these speeds over time in this area, speed changes have been derived from average changes in congestion in the internal simulation network (Leicestershire) for two forecast years: 2021 and 2031; other forecast years are interpolated based on these. National Transport Model (NTM) was initially considered as a source for these speed changes, but these congestion changes were found incompatibly low compared with other model assumptions, unless considerable, and unlikely, infrastructure improvement in external areas was assumed.
Active mode costs	No changes to active mode costs relating to specific infrastructure (cycle lanes for example) have been included. The active mode network is a copy of the base year highway network, with all one-way links converted to two-way.
Smarter Choice Measures	Based on investment levels into Smarter Choice measures of £200,000 p.a. for both Leicester City and the remainder of Leicestershire, target mode shifts have been derived from existing

Input	Assumptions / Source

	research and demonstration towns (as discussed in *'PR07: Demonstration Testing Report'*). These targets come into effect in 2016, and the calibrated parameters are constant thereafter, assuming that investment continues at the same rate.
	
	The mode shift calibrated in 2016 are:
	
	• Workplace travel plans:
	  ○ 5% reduction in commuting car drivers to Leicester City
	  ○ 6% reduction in commuting car drivers to Leicestershire market towns
	• School travel plans:
	  ○ 3% reduction in education car drivers to Leicester City
	  ○ 6% reduction in education car drivers to the rest of Leicestershire
	• Targeted marketing:
	  ○ 0.4% reduction in car drivers from Leicester City
	  ○ 0.1% reduction in car drivers from the rest of Leicestershire
	
	There are also calibrated changes in average car occupancy as a result of these Smarter Choice measures for workplace and school travel plans.

Freight growth	Freight growth is not forecast by the land-use model, so growth is taken from the 2009 version of NTM. This provides growth forecasts for vehicle-kms for freight, with these growth rates being applied separately to LGV and OGV base year matrices.

There are also a number of infrastructure schemes relating to the highway and public transport networks that are included in the forecast models in the core scenario. The core scenario schemes have been identified by Leicestershire County Council, the Highway Authority, as being either 'committed' or 'highly likely' going forward. These schemes have been included in the network models over time based on their assumed completion dates.

2.2 2031 LAM Assumptions

The 2031 Lubbesthorpe Application Model (LAM) was selected for the purposes of this project by the client group because:

- it was available to fit within the timescale of the project;
- the Blaby District housing distribution that it assumes provides a good fit with the submission Core Strategy proposals; and
- it extends to cover the Core Strategy period to 2029.

As the 2031 LAM has been adopted from another study, there are a number of assumptions that have been used during the creation of this forecast. This section looks at the highway and public transport network assumptions, and the Smarter Choice assumptions contained within the 2031 LAM. The land-use forecasts

contained within this scenario are discussed in Section 4.2.2. The assumptions detailed below are those that are additional to the core scenario assumptions detailed in Section 2.1.

As part of the inclusion of the Lubbesthorpe development, additional highway network has been included for the development site. Figure 2.1 shows the additional highway network that has been assumed with the inclusion of the Lubbesthorpe development within LLITM. The additional highway network is represented as red links within the plot, and includes:

- the internal links within the development;
- two access points onto Beggar's Lane;
- a single access point onto Leicester Lane, including a new bridge over the M69;
- an access onto Meridian Way, including a new bridge over the M1; and
- a bus-only route to the north of the development onto the A47.

In terms of public transport provision, two new bus services have been included within the public transport network with the inclusion of the Lubbesthorpe development. These are:

- an express service from the development to the city centre; and
- a hopper service between the development and local employment areas.

The express service to the city centre has a 10-minute frequency in the AM Peak and PM Peak hours, and a 15-minute frequency in the interpeak. The local circular hopper service has a 30-minute frequency in all time periods in each direction, clockwise and anti-clockwise. Figure 2.2 shows the routes of these services within the LLITM public transport model.

Figure 2.1: Lubbesthorpe Highway Network Assumptions

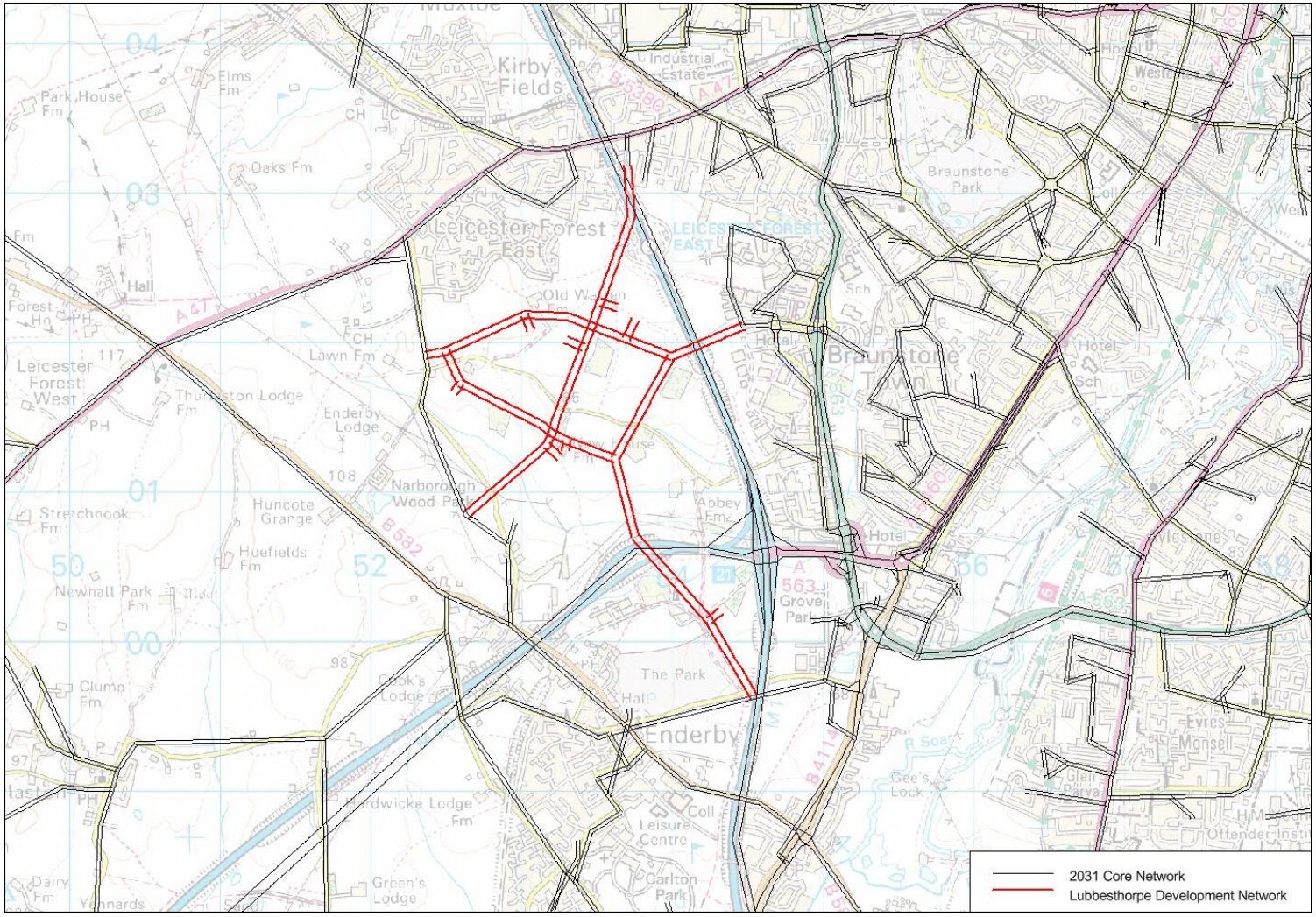
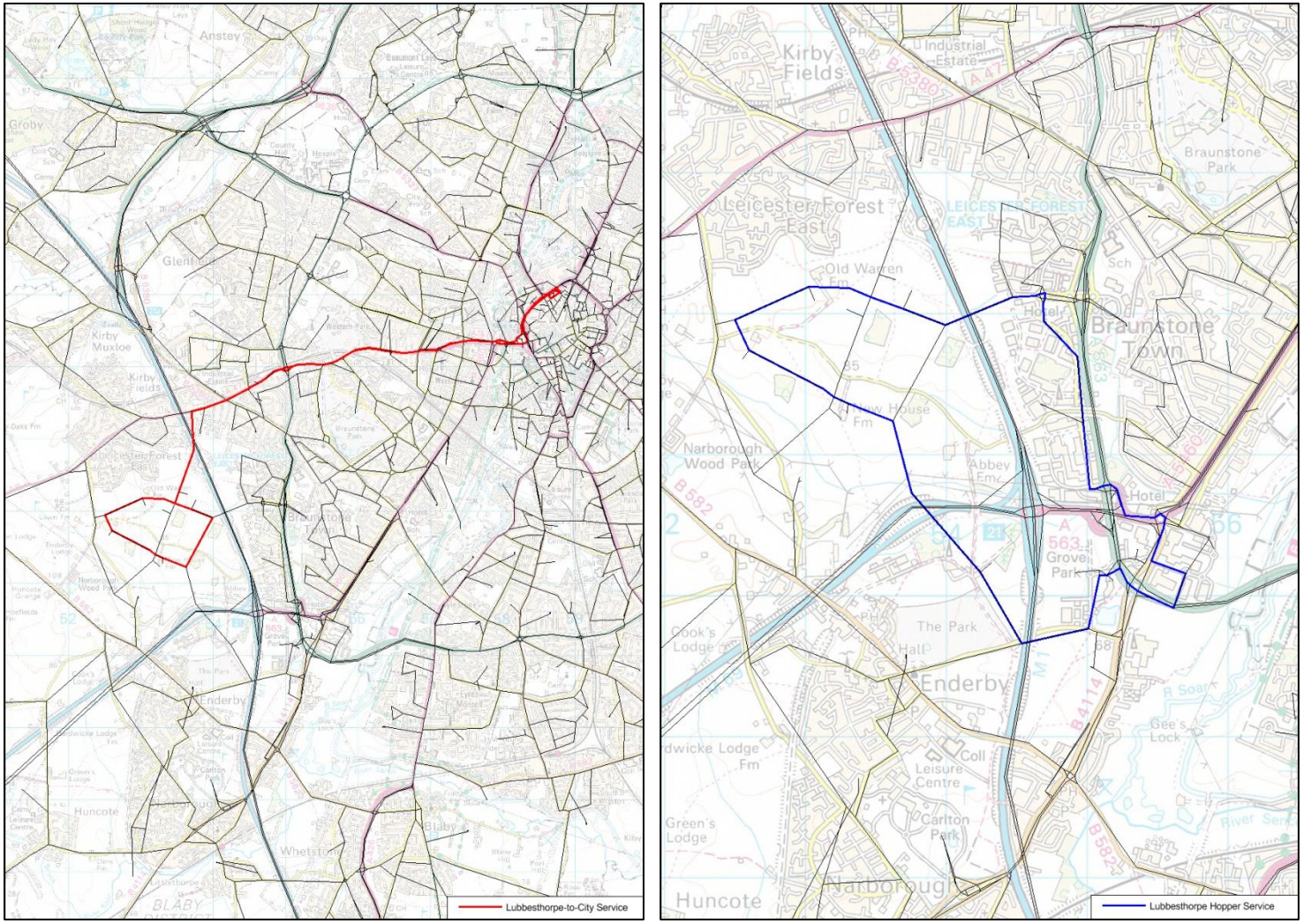


Figure 2.2: Lubbesthorpe Public Transport Service Assumptions



In addition to the highway and public transport assumptions for the Lubbesthorpe development, additional Smarter Choice initiatives are included for trips to / from the development itself. These Smarter Choice initiatives have been assumed to be implemented in 2026, and in this forecast year the following mode shifts have been calibrated:

- a 8% reduction in commuting car drivers to the Lubbesthorpe development due to workplace travel plans;
- a 4% reduction in education car drivers to the Lubbesthorpe development due to school travel plans; and
- a 2% reduction in car drivers from the Lubbesthorpe development due to targeted marketing initiatives.

As with the core scenario Smarter Choice assumptions, there are corresponding changes in car occupancies as a result of the workplace and school travel plans, and the targeted marketing initiatives proposed.

This calibration of Smarter Choice measures for the Lubbesthorpe development is additional to the Smarter Choice assumptions detailed in Table 2.1. This means that the effect of the county-wide Smarter Choice investment from 2016 onwards is retained in the 2031 LAM, and these measures are seen as additional to those. For trips that are subjected to both county-wide and Lubbesthorpe Smarter Choice measures, these trips experience the effect of both initiatives. This means that these trips see the effect of a reduction in car mode share due to the county-wide funding, and then a subsequent, further reduction in car mode share due to the Lubbesthorpe development funding.

The inclusion of these aforementioned assumptions for the Lubbesthorpe development were considered acceptable by the client and the County and City highway authorities as they are considered to be prerequisites for a development of this scale. The highway network assumptions and public transport provision provide access to the development site, rather than being mitigating measures for the development itself.

2.3 2031 Mitigation Measures and Assumptions

This section details the mitigation measures that have been tested as part of this study. These mitigation measures have been drawn up by County and City highway officers based on the outcomes of:

- An initial piece of work undertaken for the Core Strategy work that made use of the URS 'ODYSSEUS' model. This work provided a broad indication of the proposed housing growth's extent of impact on the highway network.
- Other, and separate, modelling work undertaken to assess the planning application of the proposed Lubbesthorpe development.

The mitigation measures detailed in Section 2.3.1 and 2.3.2 constitute those classed as 'hard' measures, and are therefore included in the 2031 'Hard' Only scenario. The Smarter Choice initiatives detailed in Section 2.3.3 are those that are incrementally added to the 2031 'Hard' Only scenario to create the 2031 Mitigation scenario.

During this study there were two rounds of mitigation testing, the second of which included a refinement of the proposed 'hard' mitigation measures in response to the results of an initial test using LLITM.

It is worth noting at this point that the 2031 'Hard' Only and Mitigation scenarios have been run within LLITM as 'with intervention' tests. This means that there is no interaction with the land-use model, and therefore the planning forecasts underpinning the 2031 LAM are the same as those in the two mitigation scenarios. The

timescale and methodology adopted in this study does not allow for land-use to respond to the mitigation measures proposed.

2.3.1 Highway Network Mitigation

A number of highway mitigation measures have been proposed to be tested as part of this study. The following details the highway mitigation measures included in both the 2031 'Hard' Only and 2031 Mitigation scenarios. Those schemes highlighted in blue are those that were added to the package of measures in the second round of testing in response to the results of an initial test.

Table 2.2: Highway Network Mitigation Measures

Location	Mitigation Measure
Southern side of the PUA	
A5 / B4114 Smockington Hollow Junction	• Introduce signal control • Additional ahead lane for A5 approach from the south-east • Additional ahead lane for A5 approach from the north-west
B4114 / Cosby Road Junction	• Introduce signal control • Additional ahead lane for B4114 approach from the south-west • Additional ahead lane for B4114 approach from the north-east • Additional lane for Cosby Road approach to allow for separate lane for left and right turners.[3]
Capacity, safety and other improvements at A5460 / B4114 Roundabout	• Introduce signal control on Fosse Park Avenue approach, and widening of approach • Additional lane on Narborough Road (North) and A5460 approaches • Additional lane on Narborough Road (North) exit • Exit lanes on A5460 and Narborough Road (South) reduced from 3 to 2 lanes • Alterations to circulating lanes
A563 / Meridian South Roundabout	• Introduce signal control on all approaches except Meridian South arm
Warren Park Way	• New link road between Warren Park Way and Lubbesthorpe development network north of Leicester Lane[4] • Single (7.3m) carriageway, with 30mph design speed • Improved and signalised junction between B582 and Warren Park Way • Roundabout junction between link road and Lubbesthorpe development network

[3] Due to the coding methodology adopted in the development of LLITM, this approach is coded with two-lanes at the stop-line in the 2008 Base Year and 2031 LAM models. To represent an increase in capacity at this junction, the saturation flows for this approach have been increased by 50%.

[4] Warren Park Way is not represented in the 2031 LAM; therefore this mitigation measure has introduced both the link road and Warren Park Way. This requires the introduction of a new signalised junction on the B582 at the junction with Warren Park Lane.

Location	Mitigation Measure
B4114 / Leicester Lane Junction	• Allow right-turn from Leicester Lane
B582 / Leicester Lane, Enderby	• Dedicated lane for left and ahead movements for B582 approach from the north
B4114 / B582 Foxhunter Junction	• Introduce signal control on B582 approach from the north-west
Traffic calming through Enderby and Narborough	• 20mph speed limit imposed on route between B4114 and B582 along Cross Street, Mill Lane, Stewart Avenue and Forest Road
A426 / A563 Junction	• Change of lane configuration for A563 approach from the west • Addition ahead lane for A426 approach from the north • This is in additional to junction improvements contained within the 2031 LAM at this junction • New link road between A563 west and A426 north, with signal control at each end • A563 west to / from A426 north movements are removed from the main junction and forced to use the link road

A426 Corridor (based on Better Bus Area Fund bid)	• New bus lanes, some additional to existing infrastructure and some reallocating lanes from general traffic:
	  ○ Hillsborough to Woodbank southbound (additional)
	  ○ Hall Close to A563 northbound (additional)
	  ○ Around Marsden Lane northbound (reallocation)
	  ○ Paige Road to Wigston Lane southbound (additional)
	  ○ North of Boundary Road to Saffron Lane northbound (reallocation)
	  ○ Infirmary Square to Bonner's Lane northbound (reallocation)

A426 / Middleton Street / Wigston lane Junction (based on Better Bus Area Fund bid)	• Changes to signal timings and staging
A426 / B582 Junction	• Signalise existing roundabout • Additional approach lane for A426 north and south approaches
Western side of the PUA	
A47 / B582 Desford Crossroads	• Additional ahead lane for A47 approach from the west • Additional ahead lane for A47 approach from the east
A47 / Beggar's Lane Junction	• Additional ahead lane for A47 approach from the west • Additional ahead lane for A47 approach from the east • 2 left lanes and one right lane for Beggar's Lane approach[5]
A47 / Kirby Lane Junction	• Additional ahead lane for A47 approach from the west • Increased flare on Kirby Lane approach to 60m
A47 / Ratby Lane / Braunstone Lane Junction	• Additional ahead lane for A47 approach from the east • Additional right turn lane for the Ratby Lane approach

[5] Due to the coding methodology adopted in the development of LLITM, this approach is coded with two-lanes at the stop-line in the 2008 Base Year and 2031 LAM models. Therefore the mitigation scenario may understate the increase in capacity at this location.

Location	Mitigation Measure
	• Ban right turn for Braunstone Lane approach
A47 / A563 Junction	• Addition of free-flow left turn lane for A47 approach from the east. Results in 2 ahead and 1 right turn lane for this approach. • Additional right turn lane on A563 approach from the south
A47 Bus Lane	• Addition of bus lane on A47 eastbound between Baines Lane and A47 / Ratby Lane / Braunstone Lane Junction
Traffic calming in Kirby Muxloe	• 20mph speed limit imposed on Station Road and Main Street
Traffic calming in Glenfield	• 20mph speed limit imposed on Liberty Road and Dominion Road

Within the proposed mitigation measures there are a number of junctions where signal control is being introduced. It is outside the scope of this study to develop 'optimal' signal timings and staging for these junctions. Signal timings and staging have been defined based on the arrival flows in the 2031 LAM scenario, with no optimisation for the flow changes resulting from the mitigation measures. These may not represent the optimal performance of these junctions, and therefore may underestimate the potential capacity improvements.

2.3.2 Public Transport Provision Mitigation

With the exception of the introduction of the bus lane on the A47 eastbound to the east of Baines Lane, the only public transport service change from the 2031 LAM in the first round of mitigation testing was the increase in frequency of the Arriva services 84, 84A and 85. These bus services are shown in Figure 2.3, and their frequencies have been increased to every 15 minutes in all time periods.

In the second round of mitigation testing, the Better Bus Area Fund bid bus improvements to the A426 corridor have also been included. As part of the bid, journey time improvements for the services along this corridor were assumed. These have been adopted for this study, with journey times inbound to Leicester reduced by 6 minutes in the AM Peak, 3 minutes in the interpeak and 5 minutes in the PM Peak. Those services outbound from Leicester along this corridor have had their journey times reduced by 2 minutes in the AM Peak, and one minute in the interpeak and PM Peak.

In addition to this journey time improvements in the second round of mitigation testing, alterations to service frequencies have been made for services 50 and 50a. These services have had their frequencies increased to every 10 minutes in all time periods. Service 50a has two variants: those that originate / terminate at Fosse Park; and those that originate / terminate at Croft. Together these are assumed to have a 10 minute service, with the variant to / from Fosse Park running every 15 minutes and the service to / from Croft running every half hour. These routes are shown in Figure 2.4.

Figure 2.3: Arriva Services 84, 84A and 85

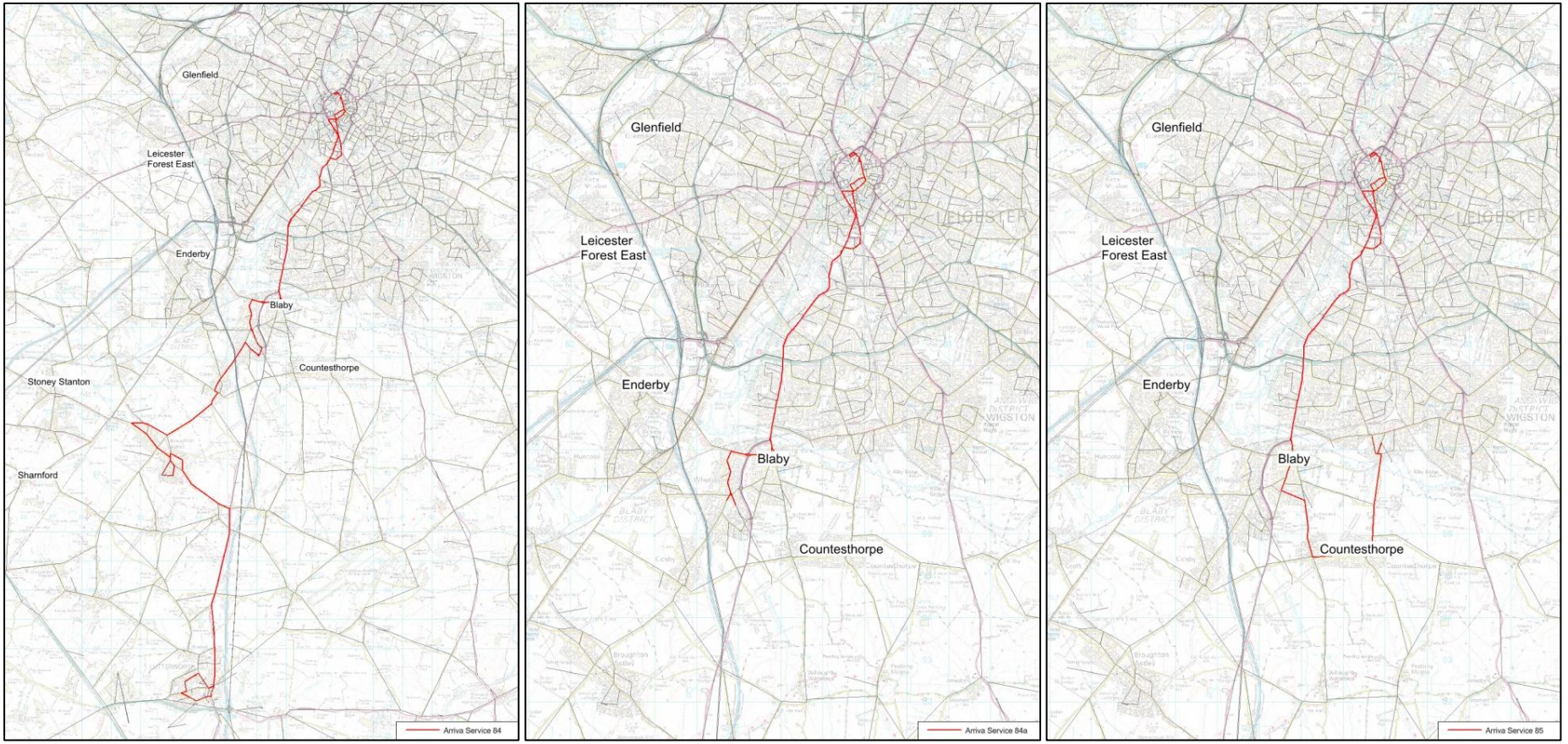
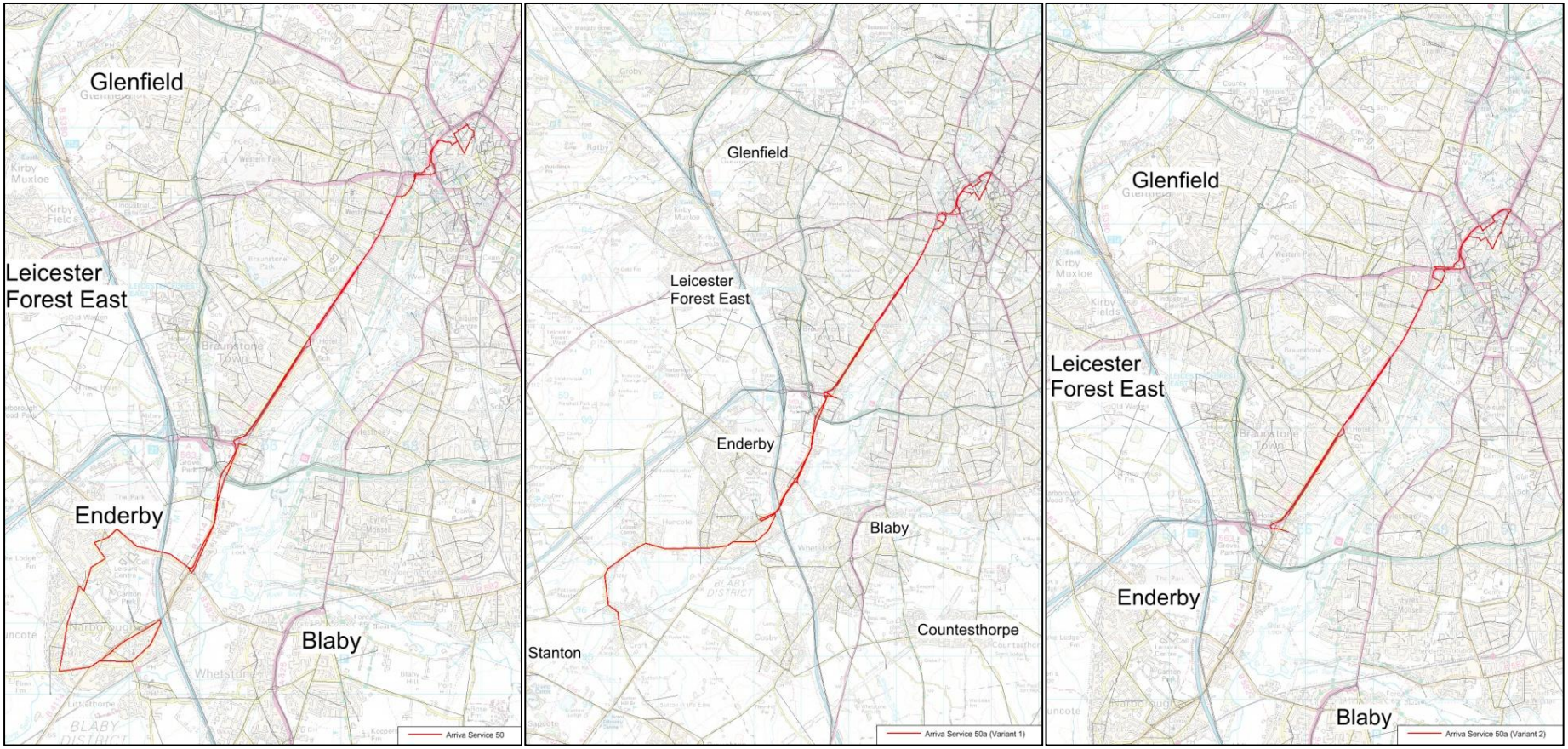


Figure 2.4: Arriva Services 50 and 50a



According to the published timetable on the Arriva website at the time of this study, each of the three services 84, 84a and 85 runs every half-hour throughout the day. The exception to this is service 84a, which does not run during the PM Peak. Similarly, for services 50 and 50a, according to the timetable these have 20 minute frequencies in both directions and all time periods. For the two variants of service 50a, the service which originates / terminates at Fosse Park runs every 30 minutes, with the service which continues to /from Croft running hourly.

In the 2008 Base Year and 2031 LAM scenarios the coded frequencies are identical, therefore indicating that there is no scheme included in the core scenario to change the frequency of these services from the base year. However, the coded frequencies in the public transport supply model do not match those obtained via the Arriva website.

Table 2.3 shows the headways that are coded in the public transport model in the 2008 Base Year and 2031 LAM models. Headway is the amount of time between services, so headway of 30 minutes indicates that this service runs twice an hour in a given period. Those headways given in bold are those that agree with the currently published timetable.

Table 2.3: Coded Headways (minutes) for Arriva Service 84, 84a and 85

	AM Peak		Interpeak		PM Peak	
	From Leicester	**To Leicester**	**From Leicester**	**To Leicester**	**From Leicester**	**To Leicester**
Published timetable suggests headways of 30 minutes						
Service 84	**30**	20	**30**	**30**	**30**	20
Service 84a	60	60	60	60	60	60
Service 85	20	15	20	15	20	15
Service 50a (Fosse Park)	20	20	20	20	20	20
Published timetable suggests headways of 20 minutes						
Service 50	**20**	15	**20**	15	**20**	15
Published timetable suggests headways of 60 minutes						
Service 50a (Croft)	**60**	**60**	**60**	**60**	**60**	**60**

For the first proposed set of bus service frequency changes, with the exception of service 84 from Leicester, none of the services run with half-hourly service in the public transport model in all time periods. Given that all three of these services have 15-minute headways in all time periods and directions in the 2031 mitigation scenarios, this will over- and understate the change on these services. For example, service 84a runs once an hour in the AM Peak, which will increase to four times an hour with the mitigation. This is four times as many services, whereas according to the timetable this should be a doubling of the service frequency.

Similarly for the Arriva services 50 and 50a, the service 50a to / from Croft has the correct frequency coded, as does service 50 from Leicester. For service 50 to Leicester and the service 50a variant to / from Fosse Park, the coded frequencies are greater than those contained in the timetable. This will understate the impact of the frequency increases in the mitigation scenarios.

In the mitigation scenarios, these services have been coded with the service frequencies as defined for the proposed mitigation by the client group. These assumptions will therefore over- and understate the changes in public service provision along the corridors served by these bus services. At a strategic level, the impact of these coding errors is likely to be minimal in the context of the growth forecast to 2031. However, there may

be local impacts on junctions and corridors due to over- and understatements of the likely shift to public transport with the proposed mitigation measures.

2.3.3 Smarter Choice Initiatives

Calibration Process and Benchmarks

The core scenario already contains a calibrated effect of Smarter Choice initiatives in 2016 across the county, and the 2031 LAM contains additional Smarter Choice measures for demand to / from the Lubbesthorpe development. In addition to these initiatives, further Smarter Choice funding is to be allocated to Blaby District. As with the Lubbesthorpe development Smarter Choice measures, these Smarter Choice initiatives are additional to those already calibrated in the 2031 LAM. This means that the reductions in car mode share due to this proposed investment will be additional to those contained within the core scenario and 2031 LAM assumptions.

For example, Blaby District will be subject to the core scenario Smarter Choice measures from 2016 onwards, with a calibrated effect due to this investment. The mode share changes calibrated for this proposed mitigation measures are additional to that resulting from the core scenario assumptions. Any mode share changes resulting from this calibration are additional to those calibrated in the 2031 LAM.

The calibration area over which this investment of Smarter Choice measures is assumed to act is Blaby District. The Smarter Choice calibration has not been focused on individual initiatives that may be implemented for development sites that are proposed as part of the Core Strategy. However, since the Lubbesthorpe development also has Smarter Choice measures calibrated as part of the 2031 LAM, the zones representing this development have been excluded from Blaby District for the purposes of calibration.

The process of calibrating Smarter Choice measures in this study follows emerging guidance on this from WebTAG contained within the consultation document WebTAG 3.10.6C, November 2011. This process has also been adopted in a number of other LLITM applications.

The benchmarking of the likely effect of the proposed Smarter Choice initiatives is based on the level of funding per head for workplace and school travel plans, and for targeted marketing. This proposed funding is compared with the investment in a number of demonstration towns, with the proportion of funding proposed to be spent compared to these demonstration towns defining the likely impact of the initiatives.

The funding for these Smarter Choice initiatives that has been assumed for this study is of a similar level, per head, that was assumed for Leicester City in the core scenario Smarter Choice measures. These funding levels are given below, in 2005 prices, along with the proportion of the benchmark funding:

- £0.82 per employee for workplace travel planning (27% of the benchmark level);
- £1.34 per head for school travel planning (27% of the benchmark level); and
- £0.09 per head for targeted marketing (0.4% of the benchmark level).

The funding for Smarter Choice measures is assumed to be spent in 2031, the year in which the initiatives are being assessed. The mode share changes calibrated to are therefore those for the year of investment in Smarter Choice measures. In order to retain these mode share changes in the medium-term, continued investment would be required. Without this investment, the likely effect of these schemes will decrease over time. This is in part due to the natural churn of households, with new households to the area not being aware of the Smarter Choice measures. An assumption used in another LLITM application was that the effect is likely to reduce by 8% per year if investment was not continued.

Further details on the derivation of the target mode shifts can be found in Appendix B, however the targets that have been calibrated to are:

- a 5% reduction in commuting car drivers to Blaby District, including a 1.5% reduction in car passengers, due to workplace travel plans;
- a 3% reduction in education car drivers to Blaby District, including a 0.9% reduction in car passengers, due to school travel plans; and
- a 0.4% reduction in total car drivers from Blaby District as a result of targeted marketing.

The calibration of Smarter Choice measures was undertaken based on the first round of mitigation testing. The timescales of this assessment did not allow for the recalibration of the effect with the additional schemes in the second round of testing. The process of calibrating these mode share change effects is as follows:

- Assess the impact of the 'hard' measures that promote public transport use, assumed to be the bus service frequency changes detailed in Section 2.3.2 in this case, in a converged model. This effect is then subtracted from the targets, with the remainder being represented by 'soft' measures.
- Alternative specific constants (ASCs) are added to the highway costs, making highway a less attractive option, to achieve the remainder of the mode shift targets. This is done through a one iteration run of the model, as the evidence for these effects does not include the impact of induced traffic (i.e. people switching back to highway once observing the relief in congestion).

LLITM is then run to convergence with the calibrated ASCs, with the results from the 2031 Mitigation scenario being extracted from the converged model. The converged model contains the impact of induced demand and the effect of rerouting of traffic in the assignment. It is likely that the mode share changes in the converged model will be less than the calibrated targets.

Calibration Results

The benchmark mode shifts include both the effect of 'hard' and 'soft' measures, hence the above methodology when calibrating the effect. There is no information on the relative level of impact from the 'hard' and 'soft' elements of the initiatives in the demonstration towns used as evidence for the likely effect. However, work on the Local Sustainable Transport Fund bid for Leicestershire assumed that around 10% of the effect came from 'hard' measures, with the remaining 90% was attributable to 'soft' measures. This assumption is based on other implementations of Smarter Choice funding, and the relative effects of 'hard' and 'soft' measures in these applications. This assumption has been adopted in this study.

When looking at the change in car drivers as a result of the increase bus services proposed within Blaby District in the first round of testing, there is little forecast reduction in car drivers. Depending on the purposes considered, at most the reduction in car drivers is forecast to be 0.1% across Blaby District from the 'hard measures'. This is below the level we would expect, assuming that approximately 10% of the effect results from 'hard' measures.

Therefore, in order to not over-represent the likely effect of travel planning and marketing measures, the calibrated effect of the 'soft' measures contained within the proposed mitigation measures has been to 90% of the benchmark targets. Table 2.4 shows target car driver reductions, both derived from the benchmarking exercise and the adjusted target used in the calibration, and the result of the calibration within Blaby District. This table also includes the ASCs in generalised minutes added to highway costs in order to achieve the reductions in mode share.

These ASCs are added to highway generalised costs for the required subset of movements in the matrices. For example, workplace travel plans are targeted at commuting trips attracted to Blaby District, and therefore the ASC is added to commuting generalised costs for all movements with an attraction in Blaby District.

Table 2.4: Smarter Choice Car Driver Reduction Targets and Modelled Effect

	Benchmark Effect	Adjusted Benchmark	ASC	Calibrated Effect
Workplace travel plans	5%	4.5%	9.96	4.5%
School travel plans	3%	2.7%	0.92	2.6%
Targeted marketing	0.4%	0.4%	0	0.8%

Within this study there were two rounds of mitigation tested, allowing for the opportunity to refine the definition of the 'hard' highway and public transport mitigation measures as a result of the outputs from the first round of testing. The changes to the 'hard' schemes between the two rounds were:

- further modifications to the A426 / A563 junction;
- bus priority measures along the A426 corridor;
- improvements to the A426 / Middleton Street / Wigston Lane junction;
- signalisation of the A426 / B582 junction; and
- increased frequency for Arriva services 50 and 50a.

The programme did not allow for the recalibration of Smarter Choice measures with the second round of 'hard' measures, so the calibration is based on the definition of schemes in the first round of testing. The additional measures in relation to the Better Bus Area Fund bid, i.e. bus priority schemes along the A426 corridor, may have resulted in more significant reductions in car driver trips as a result of the 'hard' measures.

If this effect was close to 10% of the total target car driver trip reductions assumed to be attributable to 'hard' measures, it may not have been necessary to amend the target trip reductions as detailed above. If these 'hard' measures resulted in car trip reductions greater than 10% of the targets, then the calibration of the 'soft' measures will overstate the likely effects of this investment. On balance, any potential overstatement of the effect of 'soft' measures is likely to be minimal.

Section 3 – Model Performance Review

The base year highway flow calibration and validation results, the journey time validation, and the network capacities were reviewed for the major links inside and in the vicinity of Blaby District. The aim of this task is to identify any deficiencies in the base year highway model that would materially affect its use for this strategy study. It is recognised that additional validation work may be required to inform the detailed design as part of the business case of any potential mitigation measures.

This task is not a model audit of the base year highway model. This piece of work has looked at the main routes and most significant discrepancies between the model and the available observed data. No review of the public transport model has been undertaken as part of this study.

3.1 2008 Base Year Model Review

3.1.1 Modelled Highway Flows

There are a number of screenlines and cordons used in the calibration and validation of the base year highway model. In addition to the counts that were used during the first calibration of the base year model, in this version of the base year highway model additional counts were added in around the proposed development sites at Lubbesthorpe.

Screenlines and cordons are groups of counts on the highway network that form watertight barriers that pick up certain movements in the highway model. A screenline is a collection of counts that picks up, for example, north-south movements within an area. Cordons are 'rings' of counts, generally around an urban area, that capture all the trips going into, out of and through the cordon.

In the development of the highway model an initial matrix, called the prior matrix, is developed based on survey data, planning data and other data sources. This is then adjusted to correspond with counts through a process of matrix estimation. Matrix estimation uses a set of counts, usually formed into screenlines and cordons, which are classified as calibration counts. A separate set of counts, known as validation, are not used in this process, and provide an independent check on the modelled flows.

In the calibration of the LLITM base year highway model, all counts, both those defined as calibration and validation, were used in matrix estimation. This means that there is no real distinction between the two datasets.

Figure 3.1 shows the location of the links where observed data is available from the calibration and validation of the base year highway model. Black links show where there is calibration data, with red links showing where validation data is located.

Using the subset of calibration / validation counts of interest to this study gives a total of 87 locations, with each location containing a count in both directions. This results in a total of 174 observed counts. Of these 174 counts, 90% meet DMRB acceptability guidelines in the AM Peak hour, with 85% meeting these guidelines in the PM Peak hour. Both these modelled hours meet the DMRB guidelines of 85% of counts meeting the acceptability criteria so no remedial action in terms of highway flows was required for this strategic study.

Figure 3.1: Location of Observed Link Flow Data

3.1.2 Modelled Journey Times

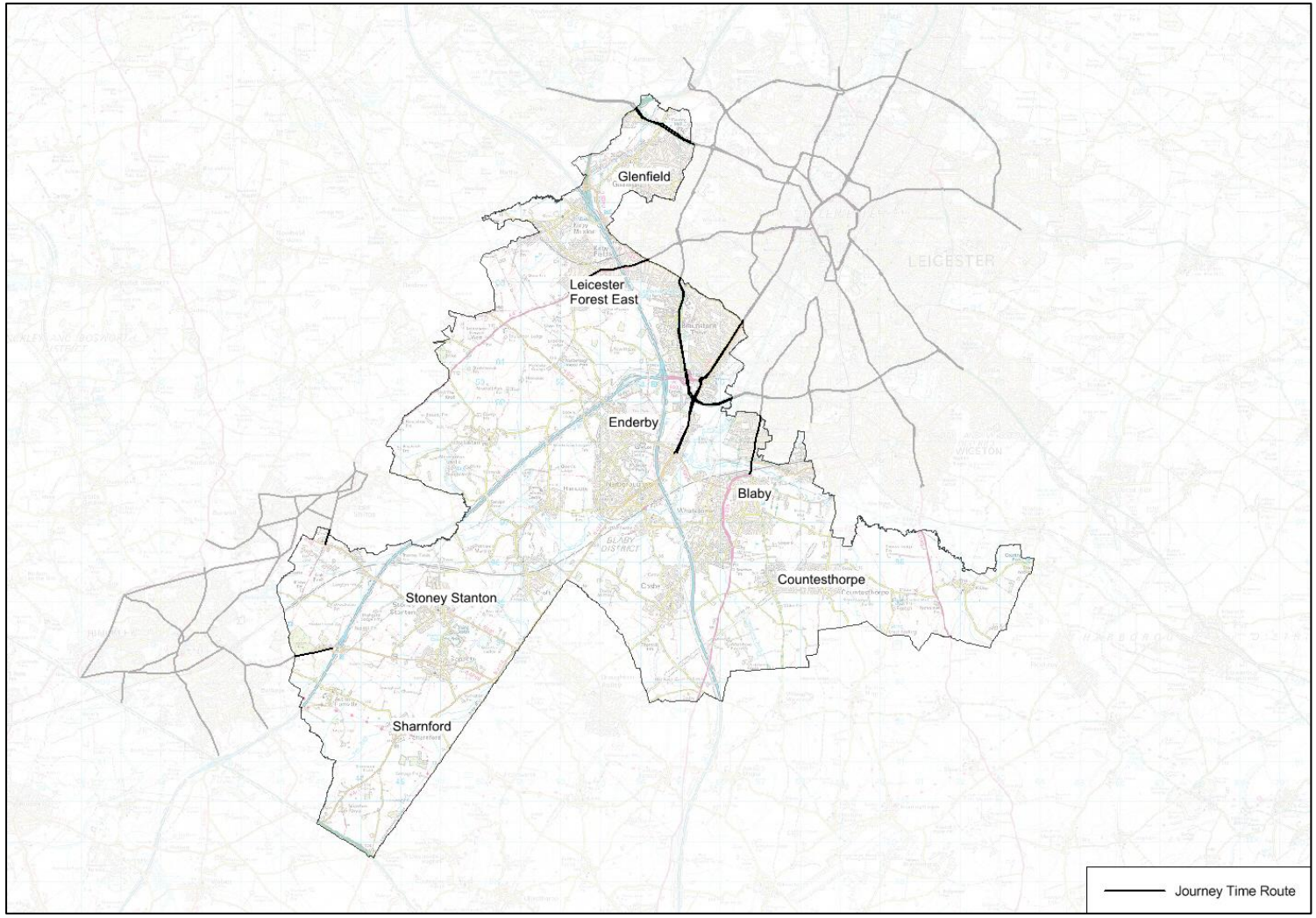
Figure 3.2 shows the location of the journey time routes used in the validation of the base year highway model. This shows that there is very little observed journey time data within Blaby District. There is however observed data on some of the radial routes into Leicester City and along the A563 which is of interest to this study.

The review of the performance of the 2008 Base Year model against observed journey times has therefore focused on radial links into Leicester passing through Blaby (i.e. A426, A5460, and A47) and on the A563. Of these 10 routes (5 routes in two directions, with the A563 divided into two individual routes), 70% are within DMRB guidelines of being within ±15% of the observed journey times in the AM Peak hour, with 50% within ±15% in the PM Peak hour.

DMRB guidelines states that 85% of journey times should be within ±15% in each modelled hour. The AM Peak hour is slightly outside this guideline with 7 out of 10 journey time routes within ±15%. The PM Peak is further away from this guideline; however there are a number of journey time routes that are close to ±15% of the observed journey time. In the PM Peak, all the 10 journey time routes are within ±20% of the observed journey times, suggesting that there are no significant failures.

Given this journey time validation performance no remedial action in terms of journey times was required for this strategic study.

Figure 3.2: Location of Journey Time Validation Routes



3.1.3 Highway Capacities

Within the highway model, junction capacities are not coded directly. They are instead calculated based on the forecast flows at the junction and the coded saturation flows. These saturation flows are the number of PCUs[6] that can theoretically make a given movement if there is no opposing traffic. Therefore the junction capacities reviewed as part of this study are the result of the base year assignment.

As part of the methodology to calculate volume-to-capacity ratios, the capacity of a link is derived from the minimum value of either the coded link capacity or the sum of the calculated turning capacities at the end of the link from the assignment. This is to represent the limiting capacity for a link that will contribute to 'stress' on the network: is the link and / or the junction under stress?

Figure 3.3 highlights the links in the highway model with a capacity below 2,500 PCUs per hour. This broadly corresponds to the links with a capacity around that expected of a single-carriageway road. Figure 3.4 shows the links with a capacity between 2,500 and 5,000 PCUs per hour, which broadly relates to a dual-carriageway. Figure 3.5 shows the links with capacities above 5,000 PCUs per hour, and therefore relating to links with three or more lanes.

On the whole, these three figures give a good correspondence between modelled capacity and road type. For example, the two-lane section of the Blaby bypass is shown in Figure 3.4, whereas the remainder of the A426 is shown in Figure 3.3 indicating that it has a capacity corresponding to approximately one-lane of traffic.

[6] This stands for Passenger Car Unit, which is the unit in which the highway model works. Rather than considering vehicles directly, these are converted into a common unit representing the size of the vehicle in question. Therefore, a car or LGV is one PCU, whereas an OGV or a bus is assumed to be two PCUs.

Figure 3.3: Links with Capacity below 2,500 PCUs per hour

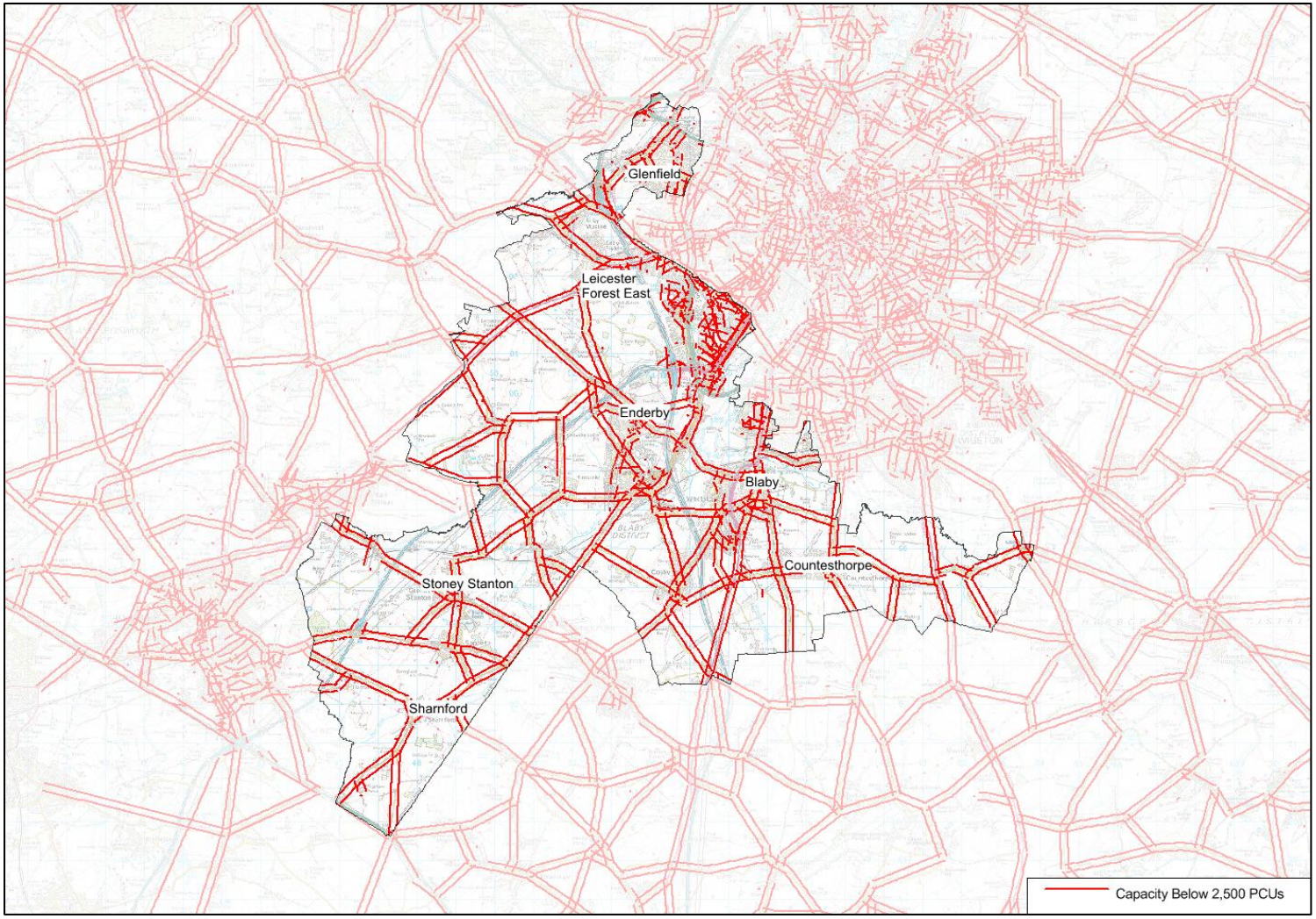


Figure 3.4: Links with Capacity between 2,500 and 5,000 PCUs per hour

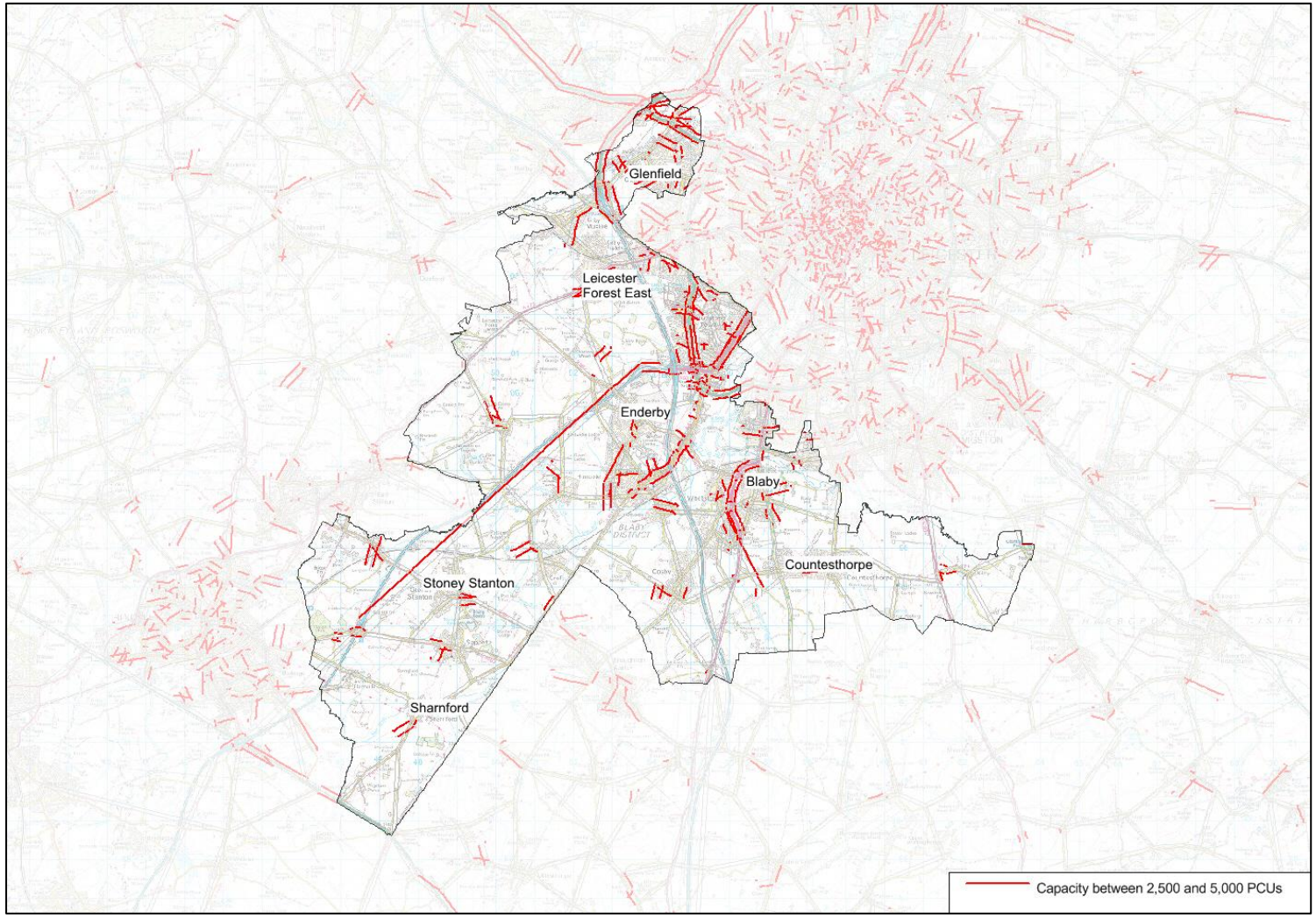
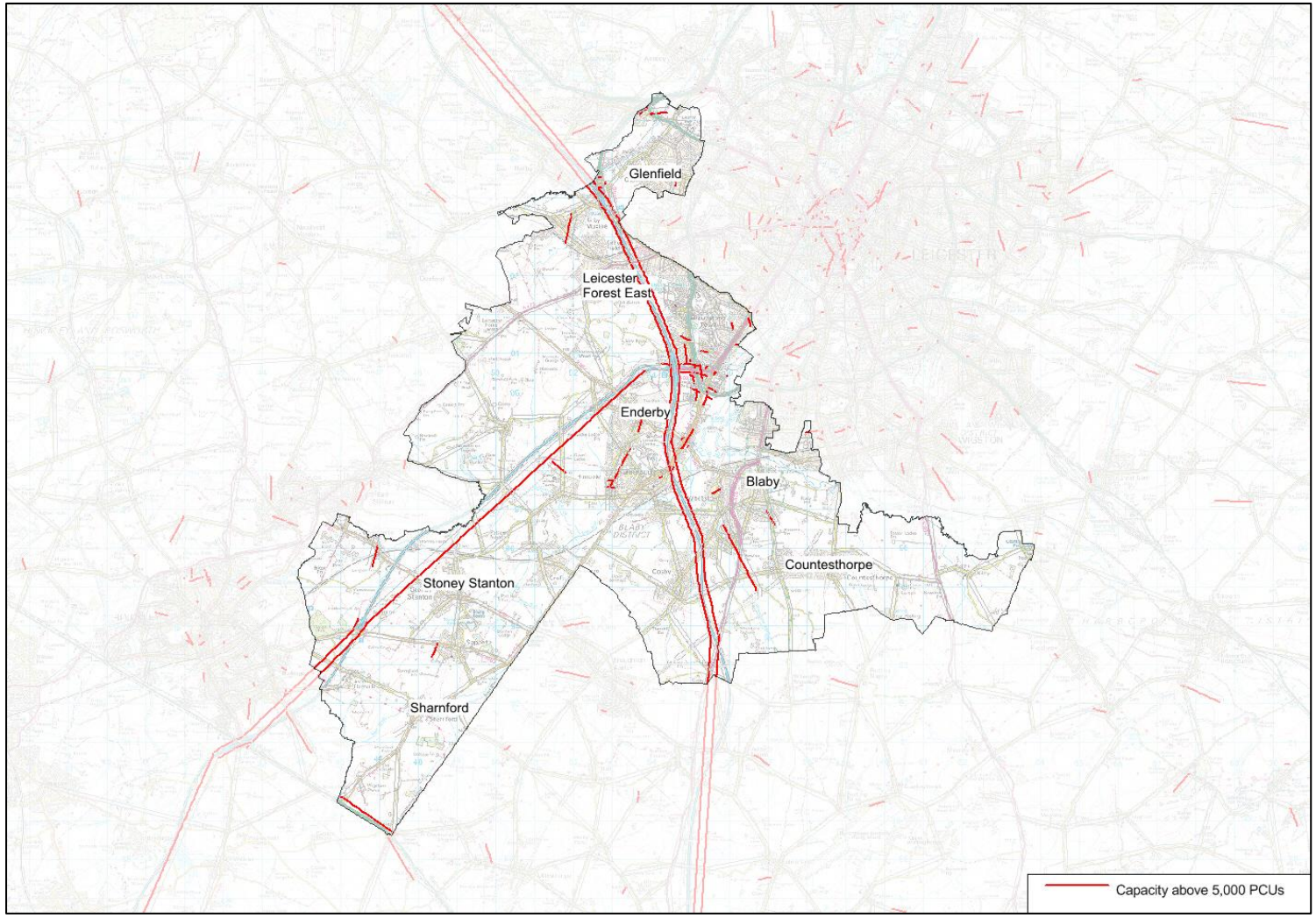


Figure 3.5: Links with Capacity above 5,000 PCUs per hour



3.2 Conclusions

Overall the modelled flows perform well against DMRB guidelines, with 90% and 85% of link flows passing DMRB criteria in the AM Peak and PM Peak hours respectively. In terms of journey time validation, 70% of journey time routes in or around Blaby District meet DMRB guidelines in the AM Peak hour, with 50% meeting these guidelines in the PM Peak hour. Considering a slightly relaxed criteria, all journey time routes in the PM Peak hour are within ±20% of the observed times suggesting that the failures are not significant at a strategic level.

A review of the calculated capacities within Blaby District has also been undertaken as part of this review. This has shows that there is a general good level of consistency between the capacities calculated as part of the assignment procedures and the expected capacities of the main routes within Blaby District.

This performance review is not a thorough model audit, and so further issues with the highway model may exist. The public transport model has also not been reviewed as part of this study. However, given the observations on the performance of the base year model, conclusions and recommendations from this modelled work can be made whilst bearing these discrepancies in mind.

Given these observations on the performance of the base year model, conclusions and recommendations from this modelled work can be made for the purposes of this strategic study.

Section 4 – Land-Use Forecasts

4.1 The Land-Use Model

4.1.1 Model Overview

This sub-section contains a description of the processes that are modelled within the land-use model. This should assist in understanding the results described in the rest of this section.

The model forecasts land-use changes incrementally. Applications typically start in the base year (2008) and forecast the change in the number of households, employment and floorspace over the ensuing twelve months. These forecasts are then used as the starting point for forecasting change over the next year. This process continues throughout the forecast period, in this case through to 2031.

The model forecasts changes in land use in terms of square metres of floorspace. For residential land-use the information on dwellings planned has been converted into m^2 of residential floorspace.

In addition to this forecasting (of the overall levels of households, population, employment etc.) the model makes forecasts of their changing distribution. In each twelve month forecast there will be households and employment that move to new accommodation. These will include new households that have formed (and employment that has been created) in that period and a proportion of the existing stock of households and employment that seek to move or relocate in any one year.

Key determinants of where households and employment move to include the availability of floorspace (i.e. dwellings, retail, office, industrial floorspace etc), rent levels, residential quality, environmental factors and accessibility. The rent levels relate to the supply and demand for floorspace and are calculated within the model.

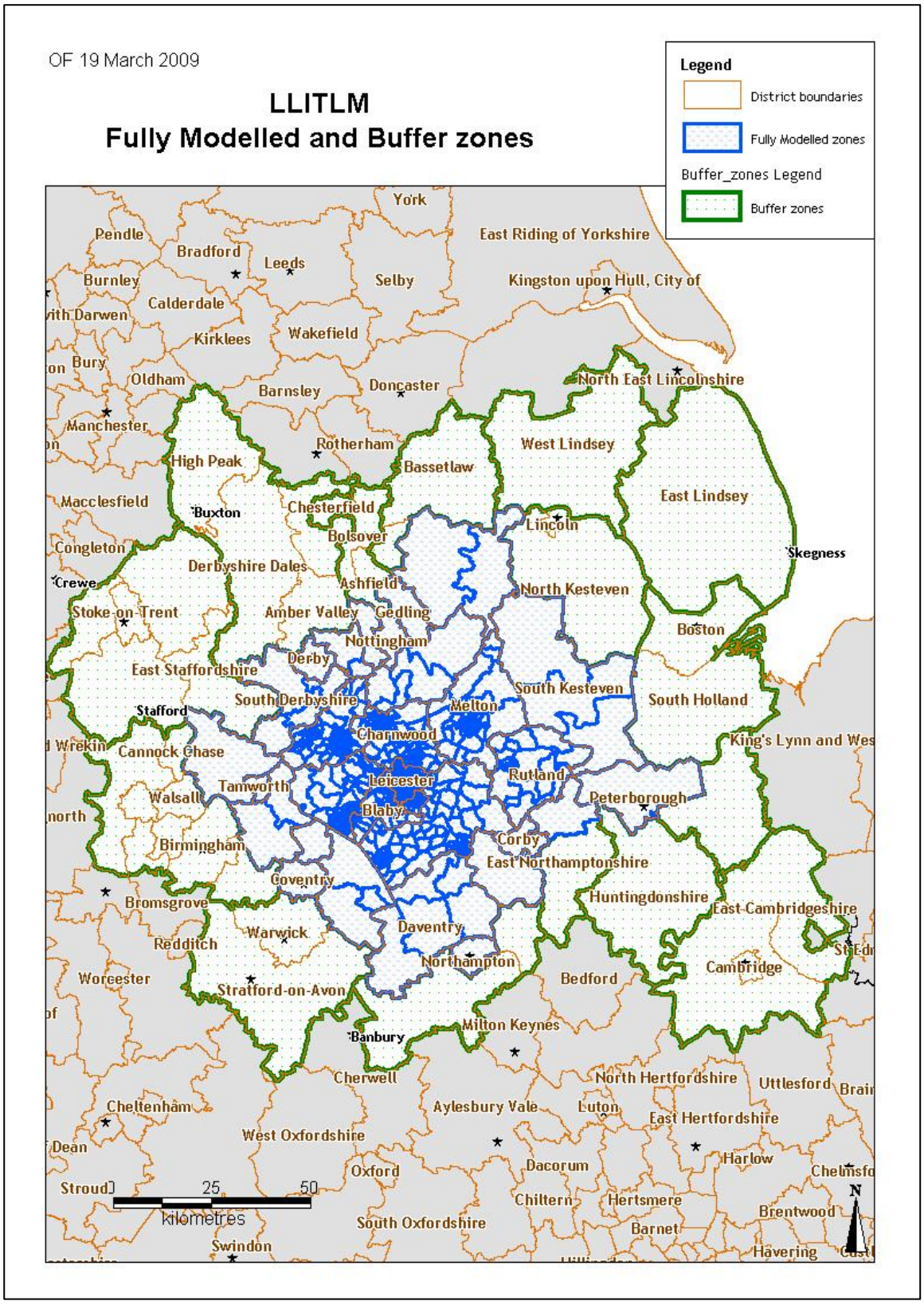
The model is constrained to be consistent with the levels of change forecast in the DfT's TEMPRO v6.2 demographic and economic forecasts. For population, this constraint is applied at the Modelled Area level. The Modelled Area represents the total area modelled by the land use model. This is shown in Figure 4.1, and includes all of Leicester and Leicestershire and parts of adjacent counties.

The growth at zone or district level is determined by the model and will be influenced by the pattern of new development, which in turn is dependent upon the planning policy inputs which are based upon information on the scale and distribution of future development provided by the local planning authorities.

For employment the growth is initially constrained to be consistent with TEMPRO v6.2 at the Modelled Area level (broadly similar to travel-to-work area). However the land-use model has a variable economic scenario that allows overall levels of growth to 'pivot' around this in response to land use or transport policy interventions.

Key output from the land-use model includes the population, number of households, employment and levels of development at zone level. Within Blaby District there are 49 zones, these provide a relatively fine level of disaggregation of district forecasts.

Figure 4.1: Fully Modelled Area



4.1.2 The Blaby Application

This application uses an identical set of inputs to the land-use model as was used in the application of the model to appraise the transport impacts of the Lubbesthorpe development. This approach was agreed with the client at the outset, and ensures a degree of consistency between the two applications. This land-use scenario is referred to within this section as 'Test LR'.

This land-use model run includes five new development zones to represent the Lubbesthorpe SUE development. These represent the zones on the Lubbesthorpe Masterplan.

4.2 The Land Use Model Inputs

4.2.1 The Planning Inputs

The location and scale of future planned development are input into the LLITM land-use model as 'planning policy inputs'. In this application the inputs are those that were used in the Lubbesthorpe Application Model. These were based upon information received from the local planning authorities and include:

- information on planning commitments and allocations / potential growth by settlement provided by Blaby District Council in 2010;
- information on the proposed Lubbesthorpe development provided by the developer in 2011; and
- information on planning commitments and allocations across the other Leicestershire authorities (and parts of adjacent counties) provided by the various planning authorities, also in 2010.

As part of the preliminary work on defining the approach to modelling that was to be undertaken for the appraisal of the Blaby Core Strategy, the District Council has provided an update to their 2010 data. This update reflects new permissions and a re-assessment of the likely phasing of some sites. The difference between the new profile of future residential development and that provided in 2010 is summarised in the following section. Subsequent sections describe the employment planning inputs.

4.2.2 LAM Residential Inputs vs. Blaby Core Strategy

The zone-level differences between the 2010 residential data (the original planning policy inputs) and the updated residential data are shown in Table 4.1. The same comparison at a sector level is shown in Table 4.2**Error! Reference source not found.**.

A comparison of the two sources shows that by 2031:

- the updated strategy provides for an additional 22 dwellings;
- there are planned increases in the number of permitted developments in the Blaby PUA and Rural sectors in the updated strategy compared to the 2010 strategy; and
- the number of permissions within the Blaby Urban areas declines compared to the previous inputs.

The scale of these differences was not felt by the client to be of a scale that would significantly impact upon transport flows and hence require a re-running of the model with updated inputs. These residential planning inputs are displayed, at zone level for Blaby District, in Figure 4.2.

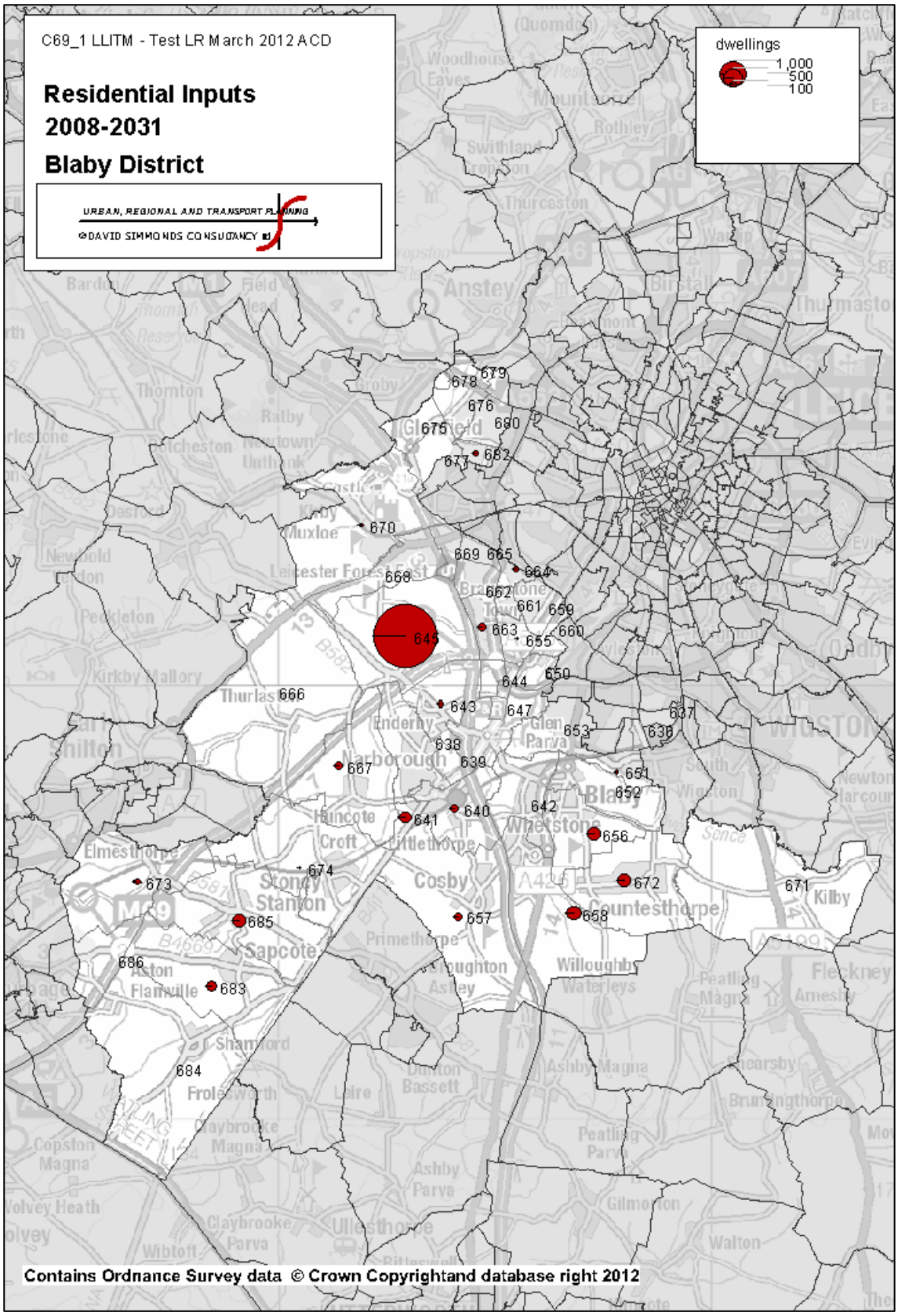
Table 4.1: Residential Inputs Blaby District by Zone in Dwellings (2031)

Zone	Original	Revised	Difference
640 Narborough & Littlethorpe	136	136	0
641 Narborough	316	216	-100
645 LFE / Lubbesthorpe (including Lubbesthorpe development zones)	4,956	4,956	0
643 Enderby (including Lubbesthorpe development zones)	197	200	3
651 Glen Parva	52	101	49
656 Blaby	532	532	0
655 Braunstone	27	27	0
657 Cosby	83	125	42
658 (Whetstone)	579	500	-79
661 Braunstone Town	0	0	0
663 Thorpe Astley	121	81	-40
664 Braunstone Town	56	56	0
665	0	0	0
666 Thurlaston	0	15	15
667 Huncote	110	131	21
668 LFE	0	180	180
670 Kirby Muxloe	491	350	-141
671	0	0	0
672 Countesthorpe	385	414	29
673 Elmesthorpe (ES)	100	105	0
674 Croft	20	50	30
682 Glenfield	496	500	-4
683 Sapcote South	160	180	20
684 (Sharnford)	10	24	14
685 Stoney Stanton	347	330	-17
Total	***9,174***	***9,209***	***22***

Table 4.2: Residential Inputs Blaby District by Sector in Dwellings (2031)

Sector	Revised	Original	Revised
PUA	6,199	6,251	44
Urban	1,829	1,782	-47
Rural	1,146	1,176	25
Total	***9,174***	***9,209***	***22***

Figure 4.2: Residential Planning Inputs



4.2.3 Employment-related Planning Policy Inputs

The planning policy inputs include provision for a limited amount of retail development. This includes 10,125m^2 in the Blaby PUA sector and 3,500m^2 in the Blaby Urban sector (see Table 4.3). Of the Blaby PUA development, 8,125m^2 is associated with the Lubbesthorpe development. This development represents a 7.4% increase in the quantity of retail development within Blaby District.

There is provision for 59,000m^2 of new office floorspace within the planning policy inputs. This represents a potential 14.3% increase in the quantity of office floorspace within the District. 12,000m^2 of this additional floorspace is planned within the Lubbesthorpe development; part of this is in zone 643 (Enderby) and lies within the Blaby Urban sector, the remainder is within the Blaby PUA sector. There is also a large development located in zone 641 (Narborough) within the Blaby Rural sector.

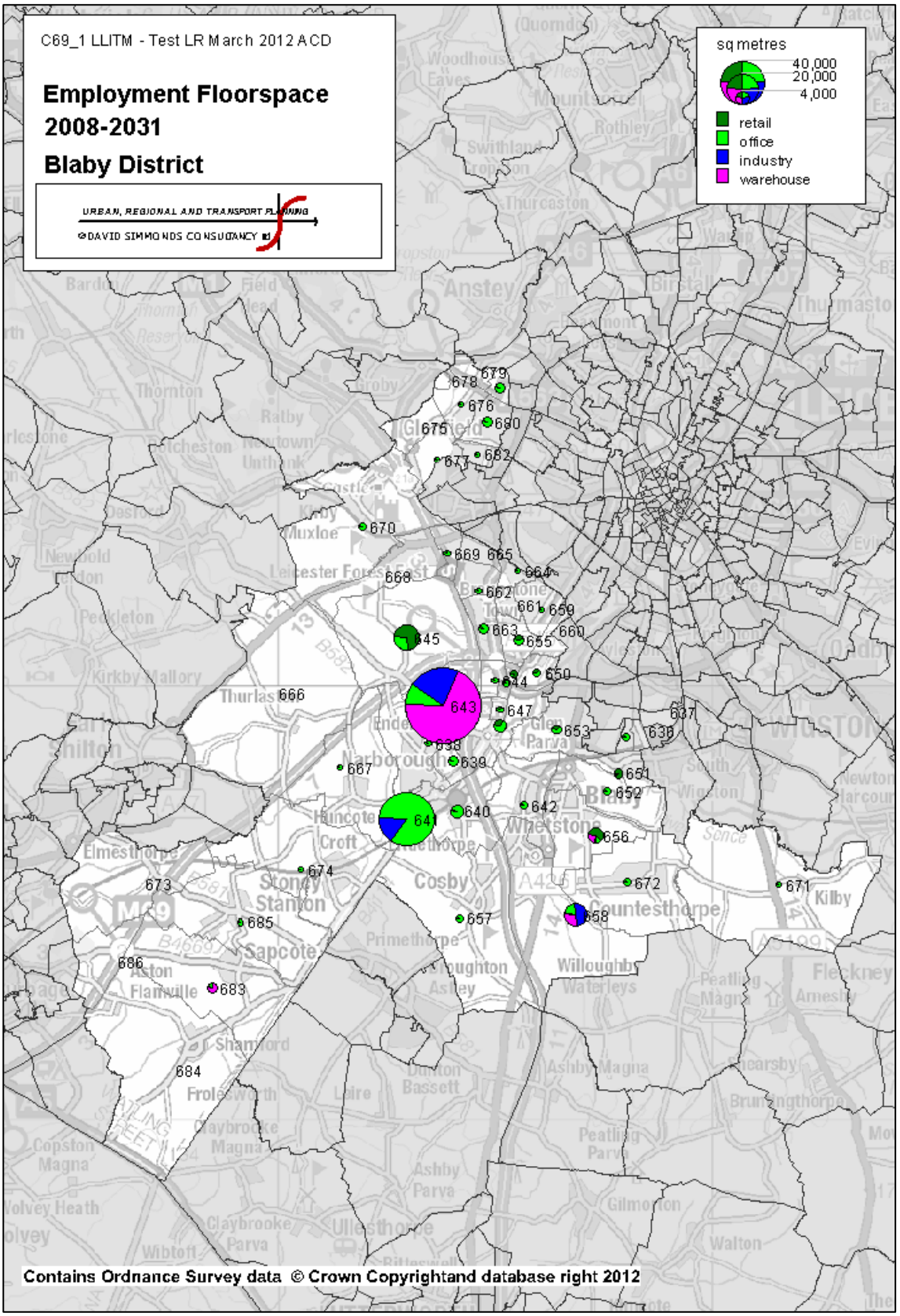
There is provision for 37,040m^2 of new industrial floorspace within the planning policy inputs. This represents a potential 5.6% increase in the quantity of industrial floorspace within the District. 22,749m^2 of this additional floorspace is planned within the Lubbesthorpe development within zone 643 (Enderby). Within the Blaby Rural sector a large development is located in zone 641 (Narborough).

There is provision for 73,950m^2 of new warehouse floorspace within the planning policy inputs. This represents a potential 31.1% increase in the quantity of warehouse floorspace within the District. 68,250m^2 of this additional floorspace is planned within the Lubbesthorpe development within zone 643 (Enderby). The remainder is planned for Blaby and Whetstone (zones 656 and 658 respectively), within the Blaby Urban sector and Sapcote (zone 683) in the Blaby Rural area.

Table 4.3: Employment-related Growth Inputs for 2008 to 2031 by Blaby Sector (m^2)

Sector	Retail	Office	Industrial	Warehouse
PUA	10,125	3,000	0	0
Urban	3,500	9,000	27,749	72,950
Rural	0	47,500	9,291	1,000
Total	***13,625***	***59,000***	***37,040***	***73,950***

Figure 4.3: Employment-related Inputs



4.2.4 Topping Up of Planning Policy Inputs

The original exercise to create a database of employment planning policy inputs identified the following three shortcomings, in relation to the data that was provided:

- a shortfall in the information on future development associated with some of the land uses modelled;
- inconsistencies in coverage across the Fully Modelled Area, with seemingly comprehensive information in some areas but gaps in the information elsewhere; and
- inconsistencies in coverage over time, with information being limited to only part of the forecast period (i.e. 2009-2031).

To address these issues, additional synthetic information was introduced so as to ensure that the scale and distribution of proposed development in each area and over time was consistent with the overall levels of growth in the economic scenario. This ensured that where the economic scenario was forecasting, for example, a 3% increase in employment, then the planning policy inputs would be topped up (where necessary) to ensure that there was a 3% increase in the land-use associated with that employment growth.

Table 4.4 describes the additional planning policy inputs that were input, for Blaby District, as part of this process.

Table 4.4: Topping Up of Planning Policy Inputs for Blaby District by Sector, 2009-31 (m^2)

	2009 to 2031			
Sector	**Retail**	**Office**	**Industry**	**Warehouse**
PUA	4,486	19,461	123	0
Urban	3,473	21,633	98	0
Rural	425	4,827	37	0
Total	***7,504***	***33,841***	***258***	***0***

4.3 The Land-Use Forecasts

4.3.1 Why these forecasts may differ to other sources?

The following three sub-sections describe the LLITM forecasts of population, households and employment for Blaby District. It is important to recognise that these forecasts are not constrained at the district level to be consistent with other forecasts (for example the NTEM forecasts, ONS population and household projections or locally-commissioned forecasts).

The results may differ from these other sources. This reflects the differing methodologies underpinning the forecasts. In LLITM the forecasts take account of policy (the inputs described above), the levels of accessibility and the intervening opportunities that may arise in Blaby District's neighbouring authorities. If accessibility improves in neighbouring areas relative to Blaby District or neighbouring authorities allocate residential and / or employment sites close to Blaby District, then this is likely to make those areas more attractive relative to Blaby District for both households and businesses looking to relocate.

4.3.2 Possible Impact of Proposed Mitigation Measures

The transport model has been used to test the impacts of various mitigation measures. That testing has been undertaken using the transport model as a standalone model, rather than as part of a land-use and transport interactive model. This approach was agreed with the client at the outset of this project, as this was consistent with the timescales required for this study.

This approach means that the possible land-use impacts of the mitigation measures have not been forecast. These might include changes in the take up of proposed development, impacts upon property (through higher or lower rents), and changes to the numbers of households residing or workers working in particular locations.

It is possible to speculate as to what those impacts might have been. If the mitigation measures improved the accessibility of a specific zone to others then that zone would have been relatively more attractive for mobile households and employment and there may have been small increases in the numbers of residents and workers. The scale of these increases would relate to the change in accessibility modelled. Mitigation in one zone might make other zones slightly less attractive locations. In this case levels of households or employment might decline slightly.

4.4 Population Forecasts

The population of Blaby District is forecast to increase by 16,068 over the period from 2008 to 2031. The breakdown, by sector, is shown in Table 4.5. Over 60% of the additional population is forecast to reside within the Blaby PUA sector, which includes the Lubbesthorpe development.

Table 4.5: Increase in Population between 2008 and 2031 (LLITM Forecasts)

Sector	2008	2031	Absolute Growth	Percentage Growth
PUA	43,094	53,072	9,978	23%
Urban	32,403	35,203	2,899	9%
Rural	16,567	19,758	3,191	19%
Total	***92,064***	***108,132***	***16,068***	***17%***

Figure 4.4 shows the changing composition of population over the period between 2008 and 2031. The number of children increases by around 1,702 (9%), the number of working-age adults by around 1,161 (2%) and the number of retirees by over 13,200 (83%).

Figure 4.4: Population Profile 2008 to 2031 for Blaby District

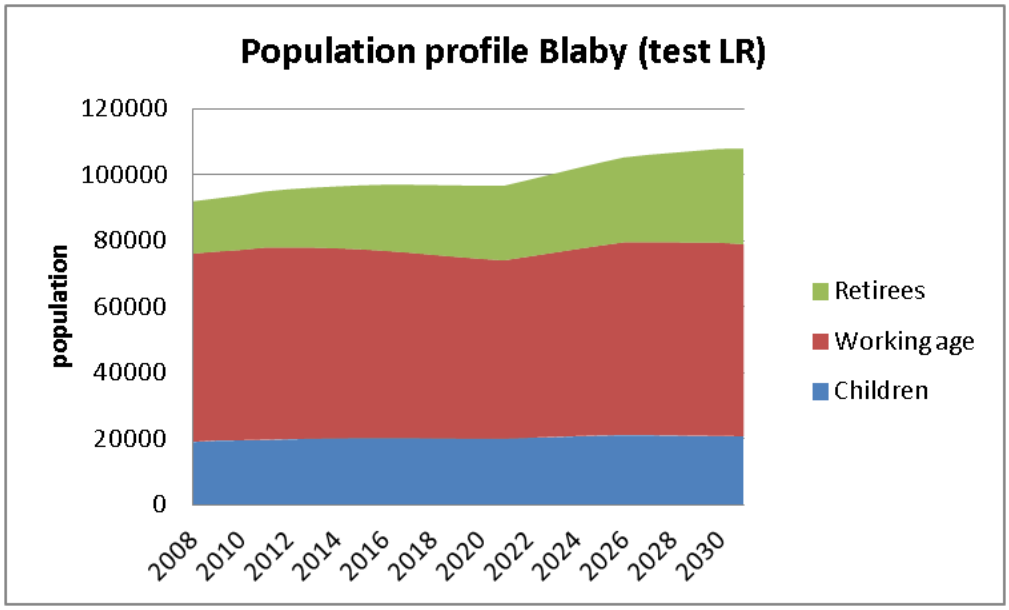


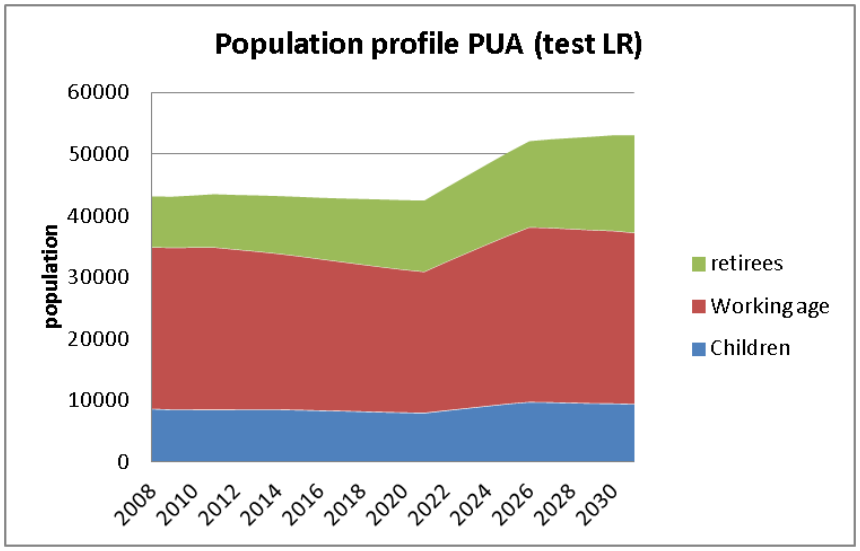
Figure 4.5 shows the changing population profile for the Blaby PUA, Urban and Rural sectors. Most of the growth is concentrated within the Blaby PUA sector where the numbers of children and working age adults are forecast to increase by 9% and 6% respectively. The number of retirees is forecast to increase by over 90%. The faster growth in population forecast for the period between 2021 and 2026 relates to the phasing of the Lubbesthorpe SUE development, when 4,250 additional dwellings are made available for occupation.

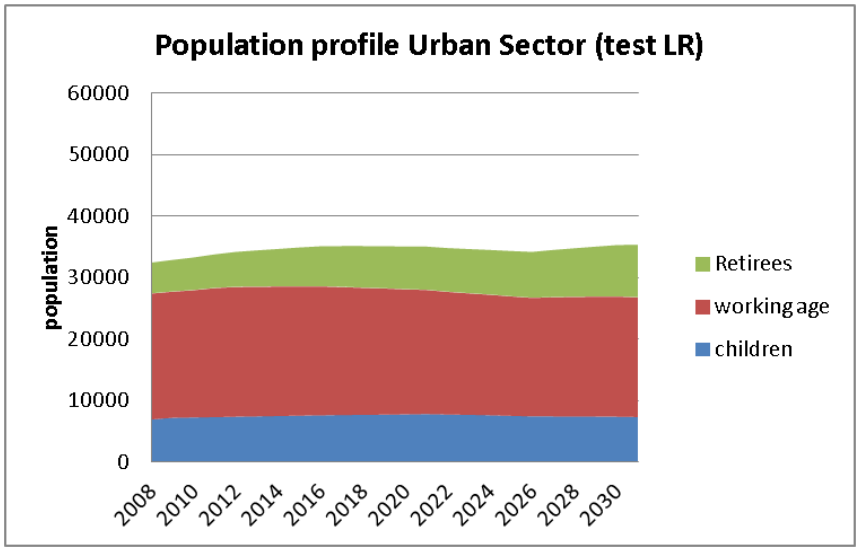
Within the Blaby Urban and Rural sectors there are increases of 16% and 14% respectively in the forecast increase in numbers of children. Whereas the numbers of working-age adults are forecast to decline in the Blaby Urban sector (by 5%) and increase by 6% in the Blaby Rural sector. The numbers of retirees are forecast to increase within these two sectors, though with percentage increases of 71% in the Blaby Urban sector and 76% in the Blaby Rural sector, the rate of increase is not as great as within the PUA sector.

Figure 4.6 shows the absolute change in population by LLITM zone. To summarise:

- the major growth is within zone 645 where the population increases by 9,972, which relates to the Lubbesthorpe development;
- there are increases of 500 or more persons in zone 641 (Narborough), 656 (Blaby), 658 (Whetstone), 670 (Kirby Muxloe), 672 (Countesthorpe), 682(Glenfield) and 685 (Stoney Stanton); and
- there are decreases in population in 24 of the Blaby District zones. This occurs largely in zones where there is no planned residential development or there are only small amounts of additional dwellings planned. The additional residential provision is insufficient to compensate for a declining household size in these areas.

Figure 4.5: Forecast Population Profile for Blaby Sectors





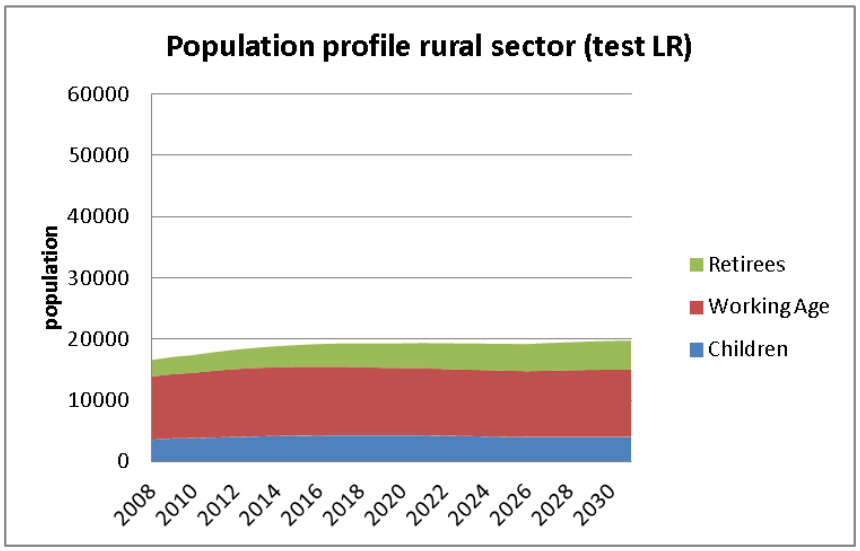
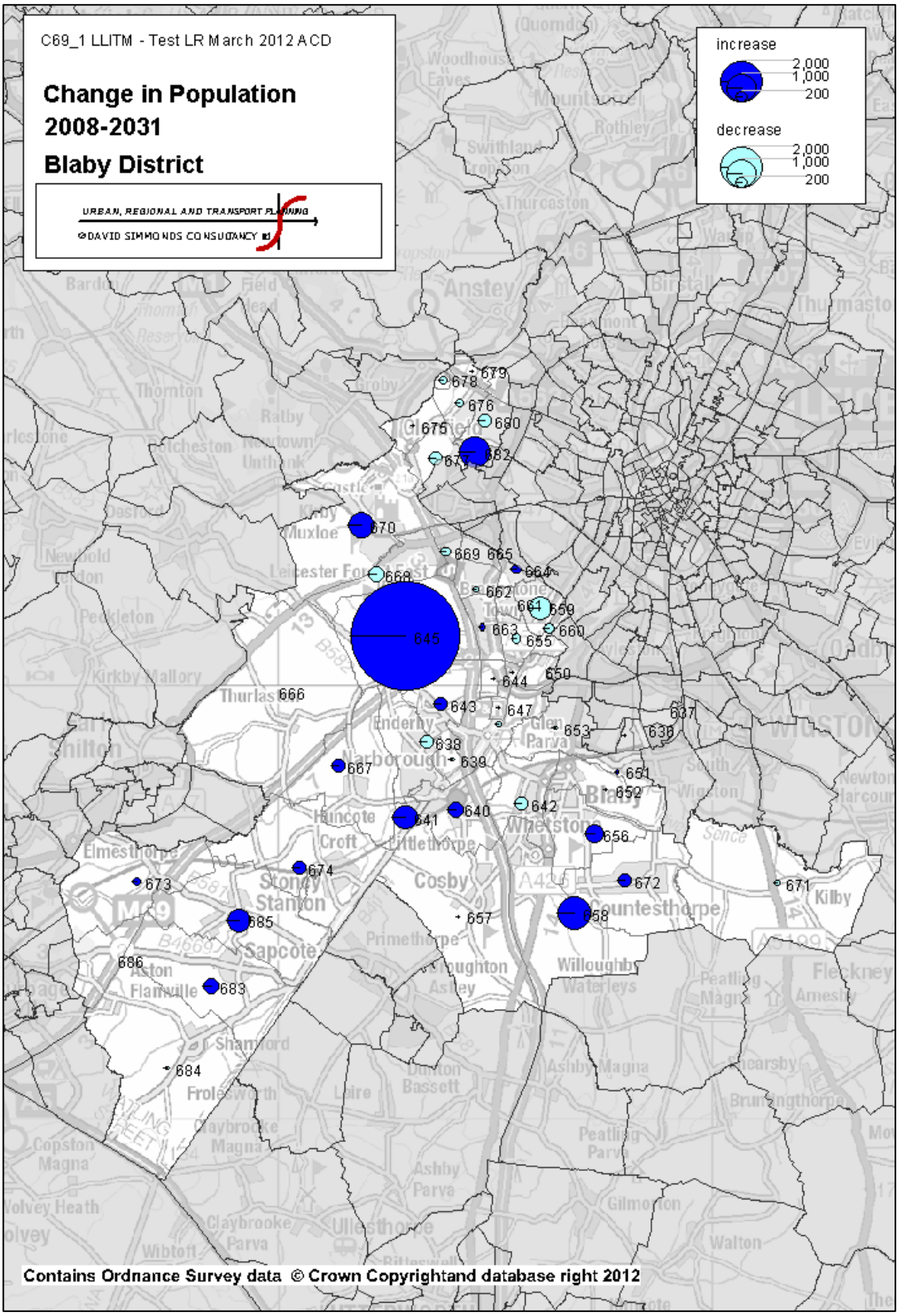


Figure 4.6: Population Forecast by Zone for Blaby District



4.5 Household Forecasts

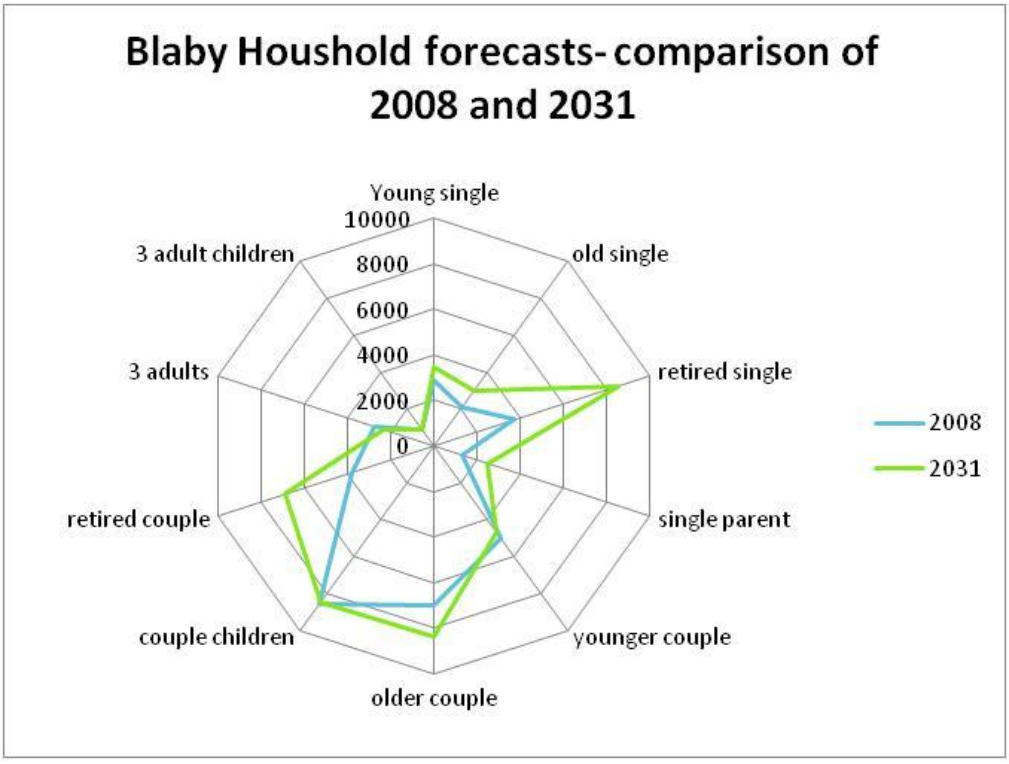
The number of households resident within Blaby District is forecast to increase by 11,136 over the period from 2008 to 2031. The breakdown, by sector, is shown in Table 4.6. Over 60% of the additional households are forecast to reside within the Blaby PUA, which includes the Lubbesthorpe development.

Table 4.6: Increase in Households between 2008 and 2031

Sector	2008	2031	Absolute Growth	Percentage Growth
PUA	17,818	24,844	7,027	39%
Urban	13,258	15,508	2,250	16%
Rural	6,844	8,703	1,859	26%
Total	***37,919***	***49,055***	***11,136***	***29%***

Figure 4.7 shows the composition of households forecast in Blaby in 2008 and 2031. This suggests a large increase in both retired single households and retired couple households. There are declines in the numbers of young couple and couples with children households.

Figure 4.7: Forecast Blaby Household Profile



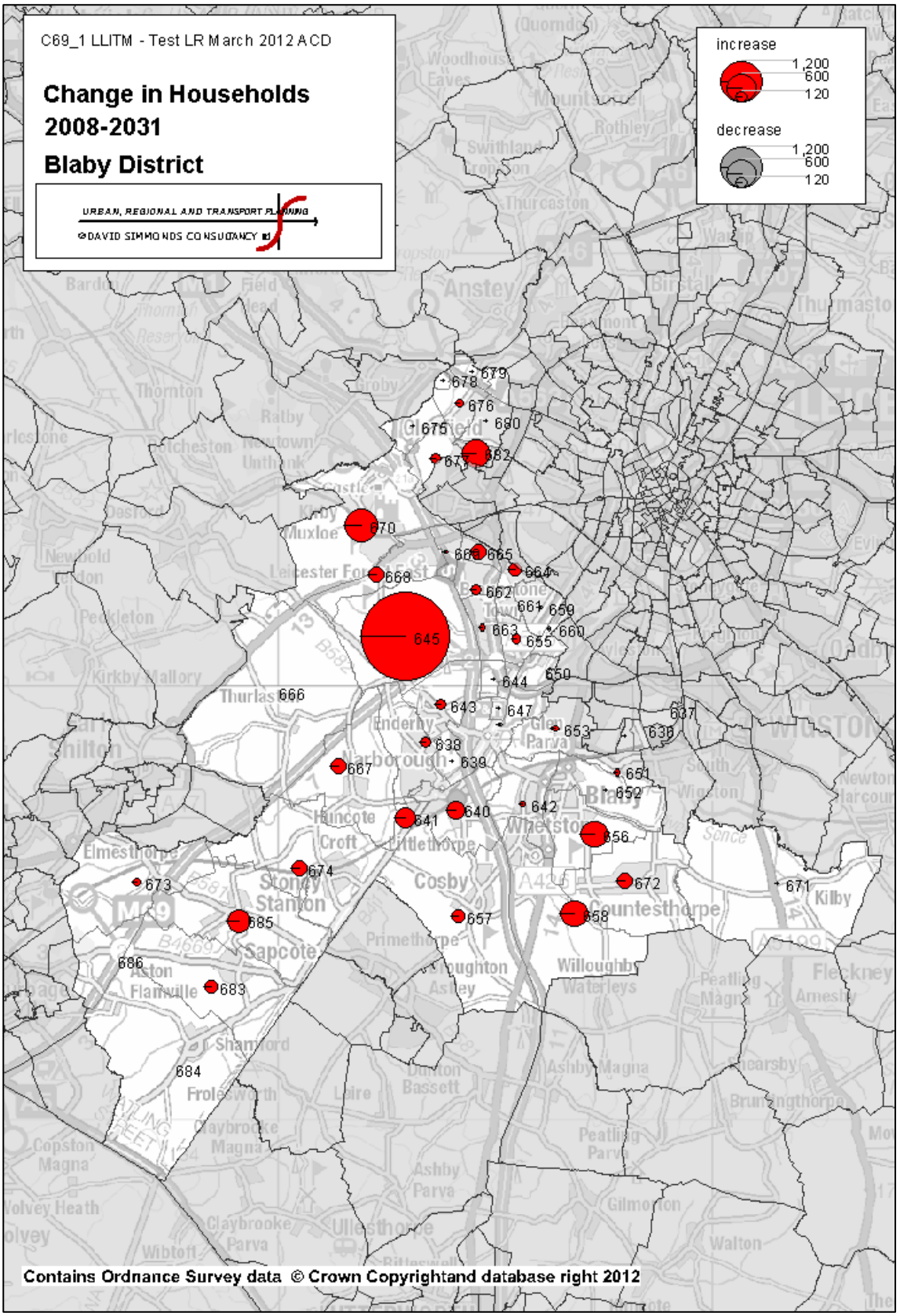
The previous analysis of the Lubbesthorpe development identified that the largest household groups forecast to move into the new development were young couples, couples with children, young singles and single parents. This reflected the mix of dwellings planned at Lubbesthorpe and the assumptions on expected occupiers of each dwelling type in that development. The growth in retired singles and retired couples is

forecast to take place amongst those residing within the existing housing stock and the other new developments within Blaby District.

Figure 4.8 shows the absolute change in households by LLITM zone. To summarise:

- the major growth is within zone 645 where there are 4,263 additional households; this relates to the Lubbesthorpe development;
- there are increases of 250 or more households in zone 641 (Narborough), 658 (Whetstone),682(Glenfield) and 685 (Stoney Stanton); and
- there are small decreases, of 16 households or less, in the number of households in five zones. Again this occurs largely in zones where there is no planned residential development or there are only small amounts of additional dwellings planned; the additional residential provision is insufficient to compensate for a declining household size in these areas.

Figure 4.8: Household Forecast by Zone for Blaby District



4.5.1 The Match of Households and Dwellings

The previous sections have described the residential planning inputs and the number of additional households. The planning policy inputs provide for an additional 9,209 dwellings, yet the number of households is forecast to increase by 11,136. At first glance these figures do not appear to match.

The reason for the mismatch is, in part, a result of the way in which LLITM models residential development and the definition of households used. LLITM models square metres of floorspace rather than dwellings. So there is no mechanism by which one household is assigned to one dwelling. Households are assigned to square metres of residential floorspace, the precise amount being dependent upon the demand for floorspace (as reflected in the rent) and the household's ability to pay (as reflected in income). This can mean that in areas of demand, a residential floorspace that originally related to 100 dwellings may be occupied by 110 households. This is perhaps not unreasonable; there are many examples in real life of more than one household occupying a dwelling. For example:

- two or more young single person households may 'share' a dwelling;
- a couple or family household may take in a lodger (single person household) to help pay the mortgage; or
- an elderly relative or grown-up son / daughter may live with a couple or family household.

The definition of households used does not assume that a household equals a dwelling space. Rather it is a similar definition to that used in the Census and other government statistics where more than one household may occupy a dwelling space. The advantage or appropriateness of this approach is more obvious when considering trip generation (as is the case in this exercise). It seems unreasonable to treat two or more single persons sharing the same dwelling as one household for trip generation as they are likely to have distinctly different levels of car ownership and trip patterns to a 'family unit'.

It is also worth considering the forecast population growth for Blaby District. Table 4.7 compares LLITM with some of the other published population forecasts. The percentage increase in population in LLITM is broadly consistent with the ONS 2008-based population projections. The difference may reflect the differing methodologies described in paragraph 4.3.1. Growth in NTEM is forecast to be significantly lower.

Table 4.8 compares the LLITM household projections with NTEM and the DCLG household projections (based upon the ONS population projections). Here LLITM has a higher rate of growth than the DCLG forecasts, despite the population growth being similar. This reflects the mix of households used within LLITM. NTEM household projections again appear very low in comparison.

Given that the population growth that is being modelled within LLITM appears broadly consistent with ONS forecasts, David Simmonds Consultancy believe that the forecasts represent a good basis for understanding future growth and trip generation across Blaby District.

Table 4.7: Comparison of LLITM and Other Population Projections

Source	2008	2031	Abs Growth	% Growth
LLITM Forecasts	92,064	108,132	16,068	17%
ONS 2008-based Projection	93,500	108,900	15,400	16%
NTEM v6.2	92,474	97,623	5,149	6%

(Note: ONS Forecasts rounded to the nearest 100)

Table 4.8: Comparison of LLITM and Other Household Projections

Source	2008	2031	Abs Growth	% Growth
LLITM Forecasts	37,919	49,055	11,136	29%
DCLG 2008-based Projection	38,000	46,600	8,600	23%
NTEM v6.2	37,842	40,367	2,525	7%

(Note: DCLG Forecasts for 2031 extrapolated from 2028 and 2033 published forecast, and rounded to nearest 100.)

4.6 Employment Forecasts

The number of jobs located within Blaby District is forecast to increase by 1,949 over the period from 2008 to 2031. This represents a 4% increase in employment. Employment declines over the three years to 2011; thereafter there is a 6% increase.

The breakdown by sector is shown in Table 4.9. Around two-thirds of the additional employment is forecast to be within the Blaby Urban sector; this includes the employment development associated with Lubbesthorpe at Enderby.

Table 4.9: Increase in Employment between 2008 and 2031

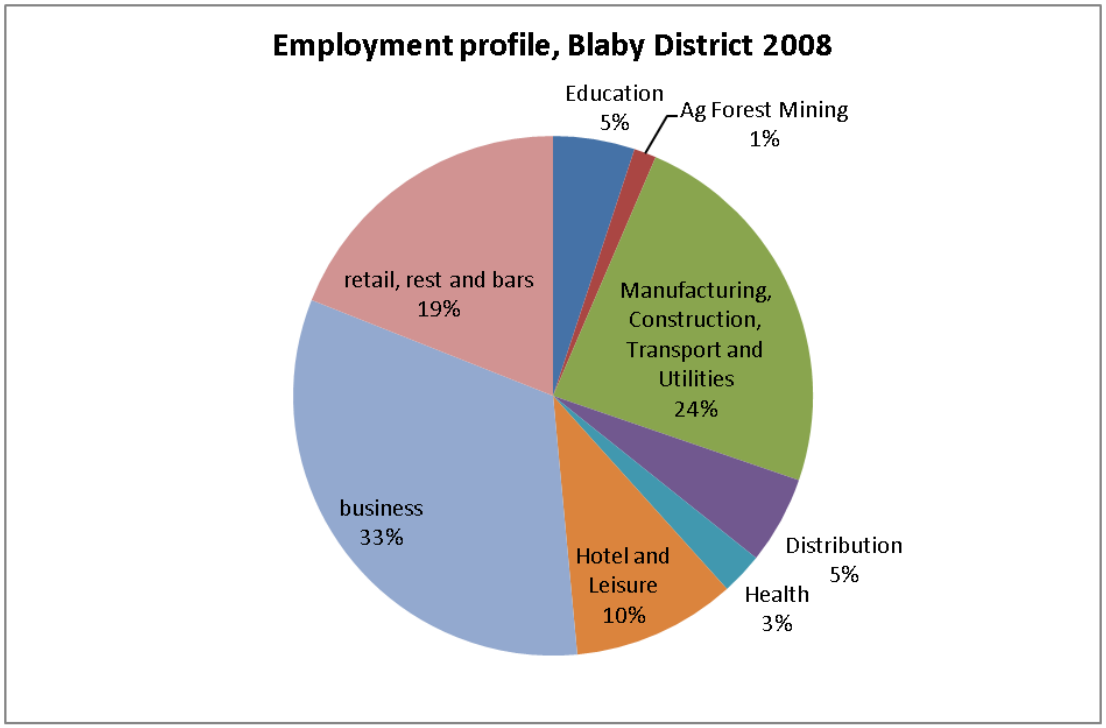
Sector	2008	2031	Absolute Growth	Percentage Growth
PUA	22,771	22,968	198	1%
Urban	19,674	21,333	1,660	8%
Rural	5,646	5,738	92	2%
Total	***48,090***	***50,039***	***1,949***	***4%***

Figure 4.9 shows the composition of employment in 2008 and 2031. The proportion of jobs in health, education, business and the hotel and leisure sectors increases, whilst the proportion of jobs in manufacturing, construction, transport and utilities and distribution declines.

Figure 4.10 shows the forecast absolute change in employment by LLITM zone. To summarise:

- the major growth is within zones 643 and 645 where the number of jobs is forecast to increase by 1,262, this relates to the Lubbesthorpe development;
- there are increases of 100 or more jobs in zone 639 (Narborough (part)), 640 (Narborough and Littlethorpe), 649 (Enderby, east of the M1), 650 (Fosse Park) and 652 (North Blaby); and
- there are decreases in employment in 20 of the Blaby District zones. The largest decreases are forecast in zone 662 (Foxholes Spinney) and 663 (Thorpe Astley) where the decline in employment over the period from 2008 to 2031 is forecast to be 162 and 545 respectively. This decline is a result of the mix of employment within the zones (and the proportion of employment in sectors that are forecast to decline) and the relocation of employment to more attractive locations.

Figure 4.9: Forecast Employment Profile for Blaby District



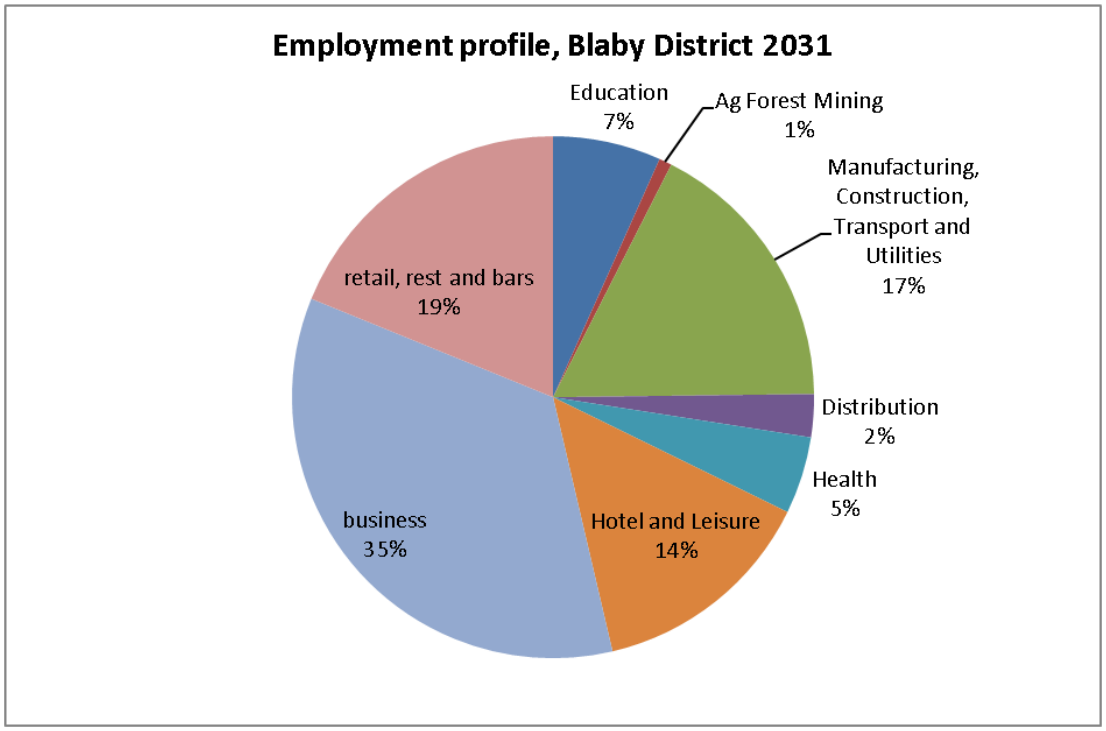
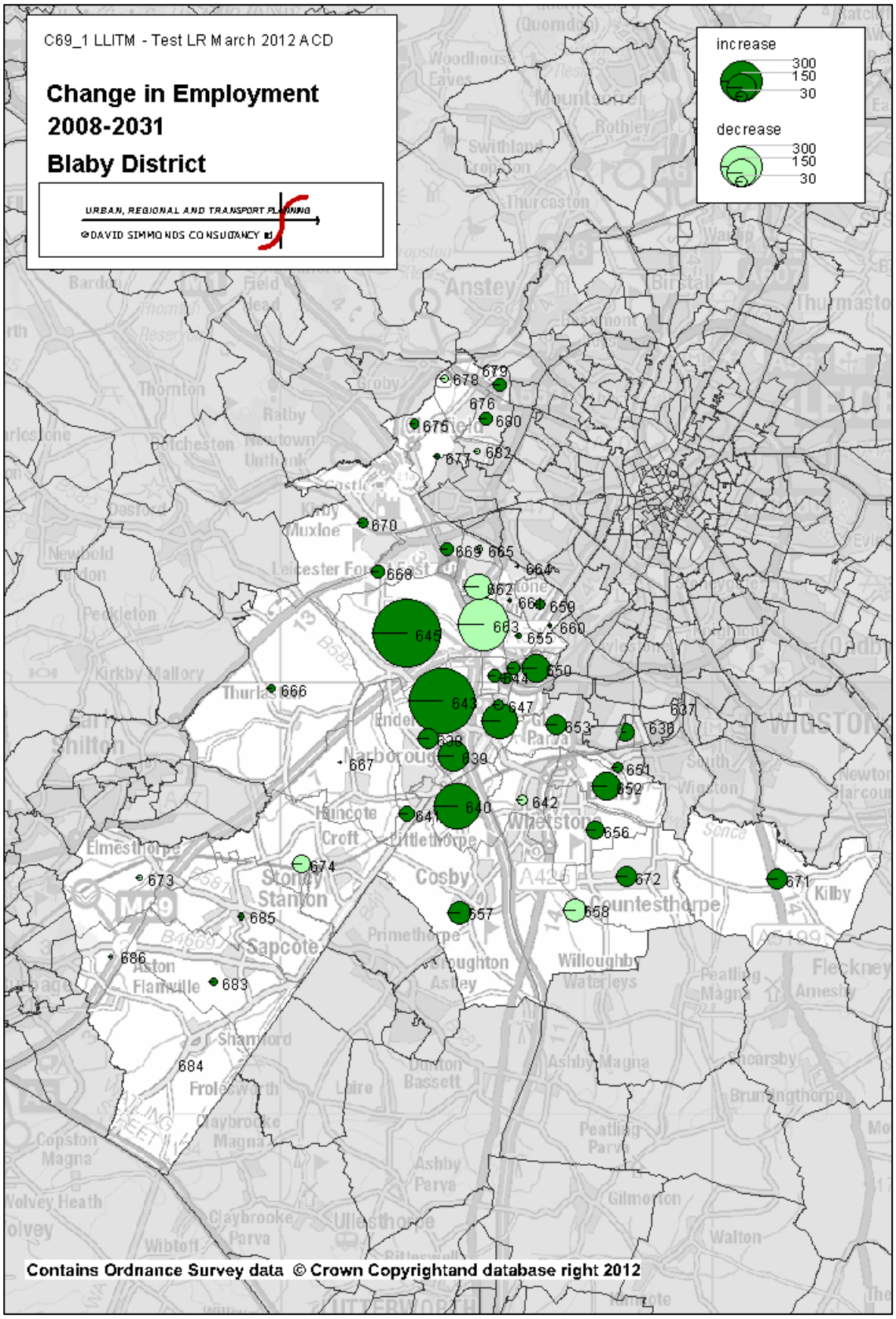


Figure 4.10: Employment Forecast by Zone for Blaby District



Section 5 – LLITM Forecasts

This section details the forecasts from LLITM for the four scenarios considered by this study: the 2008 Base Year; 2031 LAM; 2031 'Hard' Only; and 2031 Mitigation scenarios. The results detailed in this section relate to the second, and final, round of mitigation testing.

The reporting of the model scenarios has been split into three subsections:

- **Demand forecasts**: this looks at the forecast trips produced by land-use within Blaby District in the different scenarios;
- **Highway network performance**: this considers some of the key results from the assignment of highway demand onto the network, including flows and journey times; and
- **Environmental forecasts**: this considers the outputs from EASE, the environmental assessment tool within LLITM which forecasts carbon and air quality emissions.

On the request of the client group, this reporting of the model forecasts focuses on the AM Peak and PM Peak, although some analysis is taken at a daily level, and this will be discussed further in the following sections.

5.1 Demand Forecasts

The section looks at the forecasts for demand produced within Blaby District. There is a distinction here between demand produced within Blaby District and trips with an origin within Blaby. The model is built using tour-based demand matrices, as opposed to trips-based matrices. This means, that for home-based purposes such as commuting, the outbound and return legs of the journey are linked into a single tour.

Considering commuting, if a person drives to work in the AM Peak and returns in the PM Peak, this is two highway trips but only a single tour. The tour has two legs, the outbound and return trips, and contains information of the time periods of these two individual legs. In this example the production of the tour is the person's home, with the attraction being the place of work. In the case, of the two trips that constitute this tour, the outbound trip has an origin at home and a destination at work, with the return trip having an origin at work and a destination at home.

Given this definition, the demand forecasts in this section are based on the tours produced, not originating, within Blaby District. This gives a measure of the demand resulting from the land-use assumptions and forecasts within this area.

The demand forecasts also consider person demand, not vehicular demand. This means that car passengers are also included in the forecasts, and are classified as choosing highway as their mode of transport. This is a fairer comparison with public transport and active mode demand forecasts which are intrinsically person demand.

The choice of considering person tours rather than trips is partly due to the fact that this is the unit in which LLITM operates, but also due to the available matrices within the model as it is currently set up. Demand forecasts, and in particular mode shares, require the consideration of person demand as opposed to vehicle demand. These data are only available for production / attraction tour matrices, as the origin / destination matrices within the model have been converted to vehicle demand for highway demand.

All the reporting on the demand forecasts makes reference to the three subsets of Blaby District defined for reporting. These are the sections of Blaby District that are within the PUA, those consider urban in nature, and more rural areas. The definitions of these areas can be found in Section 1.3.2 and in Figure 1.2.

5.1.1 Total Demand Productions

The first forecasts regarding future year demand consider the total person demand produced within a neutral weekday within the Blaby District. Table 5.1 gives the forecasts for four scenarios considered as part of this study. The demand forecasts are given separately for the three sub-areas of Blaby District, as well as for Blaby District as a whole. The corresponding data has also been extracted for Leicestershire, including Leicester City, to allow for comparison of Blaby District to the county average.

The data for each geographical area are detailed by mode of travel. Highway demand is split between freight and non-freight purposes, along with a total for all highway demand. Public transport and active mode forecast demand totals are also given for each area.

Included in this table are the percentage changes between the different scenarios. The percentage change included with the 2031 LAM forecasts shows the change in demand from the 2008 Base Year to the 2031 LAM. The percentage differences included with the two mitigation scenarios show the change between the 2031 LAM and each of the two mitigation scenarios. No percentage change between the 2031 'Hard' Only and Mitigation scenarios is included.

Within LLITM, the allocation of public transport demand between rail and bus is performed during the assignment of demand onto the network. This means that separate matrices for bus and rail demand are not available within the model setup, and so a total for all public transport is given in these forecasts.

In addition to this there is also not a separate matrix of park and ride demand. During the application of the parking model, demand that chooses to use a park and ride service is added to both the highway and public transport assignment matrices for the two legs of the journey: the highway element of the journey and the public transport element. In this reporting, demand that chooses to use a park and ride service is included in the highway demand forecast totals. However, LLITM does produce forecasts for the usage of the car parks at the park and ride sites, and these forecasts are discussed in Section 5.1.2.

Table 5.1: 24-hour Neutral Weekday Person Production Tour Totals

		2008 Base	2031 LAM		2031 'Hard' Only		2031 Mitigation	
Blaby - PUA	Highway (ex Freight)	62,833	74,468	18.5%	74,495	0.0%	74,226	-0.3%
	Highway (Freight)	12,996	19,551	50.4%	19,551	0.0%	19,551	0.0%
	Highway	*75,828*	*94,019*	*24.0%*	94,045	0.0%	93,776	-0.3%
	PT	4,251	5,305	24.8%	5,354	0.9%	5,360	1.0%
	Active	19,871	24,906	25.3%	24,831	-0.3%	25,095	0.8%
	All Modes	***99,951***	***124,230***	***24.3%***	***124,230***	***0.0%***	***124,230***	***0.0%***
Blaby - Urban	Highway (ex Freight)	41,906	47,104	12.4%	47,006	-0.2%	46,660	-0.9%
	Highway (Freight)	9,781	13,949	42.6%	13,949	0.0%	13,949	0.0%
	Highway	*51,687*	*61,053*	*18.1%*	60,955	-0.2%	60,609	-0.7%
	PT	3,845	4,217	9.7%	4,343	3.0%	4,344	3.0%
	Active	15,671	17,801	13.6%	17,774	-0.2%	18,119	1.8%
	All Modes	***71,203***	***83,072***	***16.7%***	***83,072***	***0.0%***	***83,072***	***0.0%***
Blaby - Rural	Highway (ex Freight)	21,016	25,062	19.2%	25,031	-0.1%	24,810	-1.0%
	Highway (Freight)	3,789	5,386	42.1%	5,386	0.0%	5,386	0.0%
	Highway	*24,806*	*30,448*	*22.7%*	30,417	-0.1%	30,196	-0.8%
	PT	691	844	22.0%	864	2.4%	862	2.2%
	Active	6,828	7,589	11.2%	7,600	0.1%	7,823	3.1%
	All Modes	***32,325***	***38,881***	***20.3%***	***38,881***	***0.0%***	***38,881***	***0.0%***
Blaby District	Highway (ex Freight)	125,755	146,634	16.6%	146,531	-0.1%	145,696	-0.6%
	Highway (Freight)	26,566	38,886	46.4%	38,886	0.0%	38,886	0.0%
	Highway	*152,321*	*185,520*	*21.8%*	185,417	-0.1%	184,581	-0.5%
	PT	8,788	10,366	18.0%	10,561	1.9%	10,565	1.9%
	Active	42,369	50,297	18.7%	50,205	-0.2%	51,036	1.5%
	All Modes	***203,478***	***246,183***	***21.0%***	***246,183***	***0.0%***	***246,183***	***0.0%***
Leicestershire	Highway (ex Freight)	1,144,396	1,461,693	27.7%	1,461,865	0.0%	1,461,007	0.0%
	Highway (Freight)	222,688	322,258	44.7%	322,258	0.0%	322,258	0.0%
	Highway	*1,367,084*	*1,783,950*	*30.5%*	1,784,123	0.0%	1,783,265	0.0%
	PT	87,421	93,979	7.5%	94,389	0.4%	94,471	0.5%
	Active	476,991	556,940	16.8%	556,356	-0.1%	557,135	0.0%
	All Modes	***1,931,496***	***2,434,870***	***26.1%***	***2,434,868***	***0.0%***	***2,434,872***	***0.0%***

Changes from Base Year to 2031 LAM

Firstly considering the growth in demand from the 2008 Base Year to the 2031 LAM for Blaby District as a whole, there is forecast to be growth of 21% in 24-hour person productions for all modes, with a 16.6% growth in highway demand (excluding freight), an 18% growth in public transport and an 18.7% increase in

active mode demand. This is broadly consistent with a forecast growth of population of 17% within Blaby District across the same period.

Comparing this with the forecast growth in demand for Leicestershire over the same period there is 26.1% growth in all modes, with a 27.7% growth in highway demand (excluding freight), a 7.5% growth in public transport and a 16.8% increase in active mode demand. This shows that the overall growth and growth in non-freight highway demand within demand within Blaby District is forecast to be lower than that across the county as a whole. Public transport growth is forecast to be higher within Blaby District compared to the county average, with active mode growth forecast to be of broadly the same order.

Looking at the three reporting areas within Blaby District, there is forecast to be different levels of demand growth in these three areas. The PUA reporting area is forecast to see growth in all demand by 24.3%, with growth in the Blaby Urban area forecast to be 16.7% and in the Blaby Rural area the growth is forecast to be 20.3%. These broadly correspond with the relative levels of population growth forecast in the three areas. The forecast population growth is 23%, 9% and 19% within the Blaby PUA, Urban and Rural reporting areas respectively.

This pattern of growth, with the highest growth in Blaby PUA, followed by Blaby Rural, and the lowest growth in the Blaby Urban area is generally replicated for the forecast growth in demand by mode. There are some exceptions to this pattern:

- Blaby PUA non-freight highway demand growth is marginally below that in the Blaby Rural area; and
- active mode growth within the Rural area is the lowest forecast active mode growth of the three regions.

Changes due to Proposed Mitigation Measures

Considering the impact of the proposed mitigation measures over and above the 2031 LAM forecasts, it is worth noting that there is no forecast change in total demand. This is due to WebTAG advice on the structuring of demand models when all modes of travel are represented (i.e. for a model that includes active modes). LLITM falls into this category, and the advice is that in a 'with intervention' scenario there should be no change in the total 24-hour demand. The demand can choose to change mode, time period, destination and parking option, but the total demand remains unaffected.

For Blaby District as a whole, the 'hard' mitigation measures are forecast to reduce non-freight highway demand by 0.1% and active mode demand by 0.2%, but increase public transport demand by 1.9%. This shift to public transport will be, primarily, as result of the increases in bus service frequencies within Blaby District and the bus corridor improvements along the A426.

With the introduction of Smarter Choice measures there is forecast to be little incremental change in public transport demand over 24-hours. However, there is a further reduction in non-freight highway demand from 0.1% to 0.6% within Blaby District. This is countered by a forecast increase in active mode demand within Blaby District.

Within each of the Blaby District reporting areas, the pattern of change between the 2031 LAM and the two mitigation scenarios is broadly similar to that forecast for the District as a whole. The 'hard' measures generally marginally reduce non-freight highway demand compared to the 2031 LAM, with public transport demand forecast to increase. With the introduction of Smarter Choice measures there are further forecast reductions in highway demand, little change in public transport compared to the 'Hard' Only scenario, and increases in active mode.

One area of note is the incremental change with the introduction of Smarter Choice measures. Across Blaby District the incremental change compared to the 'Hard' Only scenarios is a 0.5% to 0.6% reduction in non-freight highway demand produced within Blaby District. This is in line with the calibrated effect of the targeted marketing measures after one iteration of the demand model, as seen in Table 2.4. This shows that the

calibration has resulted in a 0.8% reduction in car drivers after one iteration. The effect of running the demand model to convergence, and including the effect of induced traffic, has reduced the reduction in car demand, as expected.

It is worth noting that the larger calibrated effects are those for workplace and school travel planning. These however only affect commuting and education demand respectively, and also act upon attractions to Blaby District. The data in this section has considered productions from Blaby District.

Another area of consideration is the relative impact of the mitigation measures compared to the forecast growth between the base year and the 2031 LAM. Considering non-freight highway demand produced within Blaby District, the growth from the 2008 Base Year to the 2031 LAM is 16.6%. The growth from the 2008 Base Year to the 2031 Mitigation scenario is 15.9%, which shows that the mitigation measures, including Smarter Choice measures, do not significantly reduce the forecast growth in highway demand due to the Blaby Core Strategy.

5.1.2 Park and Ride Usage

These forecasts are based on the best available assumptions, but are not the result of a detailed study into forecast park and ride usage in Leicestershire. The parking model is a sensitive element of LLITM, and the calibrated characteristics of the new park and ride sites have been inherited from Meynell's Gorse. This assumption may not be appropriate in some instances, so forecasts should be treated with particular caution.

Considering the forecasts for park and ride usage, in the base year of the model, the only park and ride site is that at Meynell's Gorse on the Leicester City / Blaby District boundary. Between the 2008 Base Year and the 2031 LAM, the core forecasting assumptions include the addition of five new park and ride sites. Of those that are in, or serve development in Blaby District, these include Enderby, which opened in 2009 and a possible site at Glenfield.

Table 5.2 shows the forecast car park occupancies for these park and ride sites in the 2008 Base Year and 2031 LAM forecasts. Table 5.3 shows the same data but for the three 2031 forecasts: LAM; 'Hard' Only; and Mitigation scenarios. The car park occupancies have been extracted for the park and ride sites that are in, or serve development in Blaby District.

The car park occupancies quoted in these tables are the number of vehicles in each of the car parks at the end of the modelled period. So for the AM Peak Period, the figure is the number of vehicles parked at 10:00. For the interpeak period this is the car park occupancy at 16:00, and in the PM Peak Period it is at 19:00.

Table 5.2: 2008 Base Year and 2031 LAM Forecast Park and Ride Car Park Occupancies

	2008 Base Year			2031 LAM		
	AM	**IP**	**PM**	**AM**	**IP**	**PM**
Meynell's Gorse	221	256	62	495	584	211
Enderby				195	246	51
Glenfield				249	292	95
Total Usage	*221*	*256*	*62*	*939*	*1,123*	*357*

Table 5.3: 2031 LAM, 'Hard' Only and Mitigation Forecast Park and Ride Car Park Occupancies

	2031 LAM			2031 'Hard' Only			2031 Mitigation		
	AM	IP	PM	AM	IP	PM	AM	IP	PM
Meynell's Gorse	495	584	211	495	585	208	508	599	209
Enderby	195	246	51	197	251	49	130	189	44
Glenfield	249	292	95	254	296	95	193	249	102
Total Usage	*939*	*1,123*	*357*	*946*	*1,132*	*352*	*831*	*1,037*	*355*

These tables show that there is significant forecast growth in park and ride usage from the 2008 Base Year to the 2031 LAM scenario. This in part due to the introduction of new park and ride sites at Enderby and Glenfield, but also due to increased forecast usage of the existing Meynell's Gorse site.

With the introduction of the 'hard' mitigation measures in the 2031 'Hard' Only scenario there is forecast to be little change in the usage of these three park and ride sites. There is however a more significant effect with the introduction of Smarter Choice measures, where there is a forecast reduction in usage at both Enderby and Glenfield.

The way Smarter Choice measures have been modelled in LLITM is to 'push' people away from choosing highway as their mode of travel by adding additional cost to highway trips, and encourage public transport, walking and cycling. In the parking model, the only trips that have the option to use a park and ride parking site are those that have chosen highway as their mode of travel, and then choose to use a park and ride service to complete their journey into Leicester City. Since Smarter Choice measures have the effect of reducing the number of people who choose highway as their mode, there is a smaller pool of demand that can opt to use a park and ride service.

The representation of Smarter Choice measures in LLITM is to reduce highway demand, but this has the knock-on impact of reducing the demand that may wish to use park and ride. This representation of Smarter Choice measures does not allow for a 'pro-park and ride' effect. Instead the modelled effect will be to encourage the use of public transport for the entire journey, rather than the use of a park and ride service to complete a highway trip, and walking and cycling as opposed to car travel.

5.1.3 Mode Shares

Using the data contained in Section 5.1.1, mode shares can be calculated for 24-hour neutral weekday person demand. As with the demand total forecasts, these figures are based on productions from within Blaby District, and have been segregated into the three Blaby District reporting areas along with a total for Blaby District and the corresponding information for Leicestershire, including Leicester City.

As with the demand forecasts, differences have been included for mode share. These again show the difference between the 2031 LAM and the 2008 Base Year, and then between the two mitigation scenarios and the 2031 LAM. In this case however, the differences are the absolute, not percentage, change in mode share between scenarios. A change of 2 percentage points in terms of a given mode share does not mean that this mode share has increased by 2%, rather that the difference in mode share is an additional 2%. For example, a change in mode share from 68.4% to 70.4% would be a change of 2 percentage points.

Freight demand has been excluded from the highway mode share calculation as this demand does not have a choice of mode, i.e. there is no freight demand using public transport or active mode.

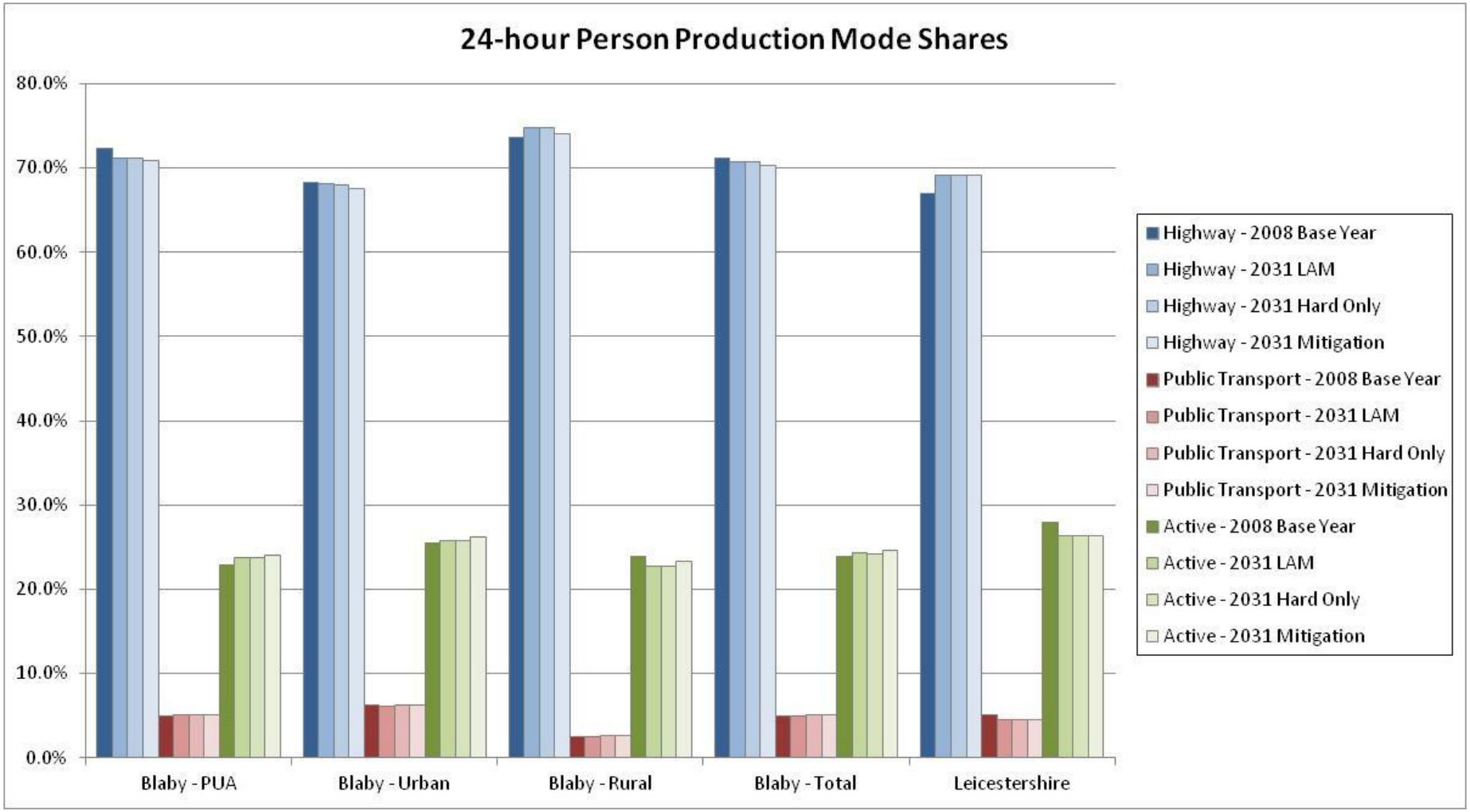
Figure 5.1 shows the same mode share information for the different geographical areas over a 24-hour neutral weekday, but graphically.

Table 5.4: 24-hour Neutral Weekday Person Mode Shares

		2008 Base	2031 LAM		2031 'Hard' Only		2031 Mitigation	
Blaby - PUA	Highway (ex Freight)	72.3%	71.1%	-1.1	71.2%	0.0	70.9%	-0.2
	PT	4.9%	5.1%	0.2	5.1%	0.0	5.1%	0.1
	Active	22.9%	23.8%	0.9	23.7%	-0.1	24.0%	0.2
Blaby - Urban	Highway (ex Freight)	68.2%	68.1%	-0.1	68.0%	-0.1	67.5%	-0.6
	PT	6.3%	6.1%	-0.2	6.3%	0.2	6.3%	0.2
	Active	25.5%	25.8%	0.2	25.7%	0.0	26.2%	0.5
Blaby - Rural	Highway (ex Freight)	73.7%	74.8%	1.2	74.7%	-0.1	74.1%	-0.8
	PT	2.4%	2.5%	0.1	2.6%	0.1	2.6%	0.1
	Active	23.9%	22.7%	-1.3	22.7%	0.0	23.4%	0.7
Blaby District	Highway (ex Freight)	71.1%	70.7%	-0.3	70.7%	0.0	70.3%	-0.5
	PT	5.0%	5.0%	0.0	5.1%	0.1	5.1%	0.1
	Active	23.9%	24.3%	0.3	24.2%	0.0	24.6%	0.4
Leicest-ershire	Highway (ex Freight)	67.0%	69.2%	2.2	69.2%	0.0	69.2%	0.0
	PT	5.1%	4.4%	-0.7	4.5%	0.0	4.5%	0.0
	Active	27.9%	26.4%	-1.6	26.3%	0.0	26.4%	0.0

(Note: Mode shares may not add to 100% due to rounding to one decimal place)

Figure 5.1: 24-hour Neutral Weekday Person Mode Shares



Changes from Base Year to 2031 LAM

Considering first the change in forecast mode share from the base year to the 2031 LAM, there is little change in mode share over time across Blaby District. There is a marginal reduction in highway mode share, with a corresponding marginal increase in active mode. Within the reporting areas for Blaby District, for Blaby PUA there is a forecast reduction of highway model share by 1.1 percentage points, with the majority of this switching to active mode. There is little change in forecast mode shares for the Blaby Urban reporting sector over time, with a forecast increase in highway mode share for Blaby Rural by 1.2 percentage points.

Comparing Blaby District with Leicestershire as a whole, Blaby District has a slightly higher highway and public transport mode share compared to the county average, with a lower active mode share. Leicestershire as a whole has a forecast increase in highway mode share of 2.2 percentage points, with reductions in public transport of 0.7 percentage points and in active model of 1.6 percentage points. This is in contrast to Blaby District which is forecast to see a marginal reduction in highway mode share between 2008 and 2031.

Changes due to Proposed Mitigation Measures

The 'hard' mitigation measures do not have a significant impact on the forecast mode shares in 2031. There is a slight increase in public transport mode share across the district, but no significant changes. With the introduction of the Smarter Choice measures there is forecast to be more significant changes in mode share. Across the district as a whole, the highway mode share reduces by 0.5 percentage points, with the majority of this reduction being countered by an increase in active mode share.

Overall the proposed mitigation measures are not forecast to have a material impact on the mode choice of travellers at a strategic level.

5.2 Highway Network Forecasts

Taking the highway element of the demand discussed in Section 5.1, the 24-hour person tour matrices are converted to individual hour assignment matrices for the AM Peak (08:00 – 09:00) and PM Peak (17:00 – 18:00) hours. This is a multi-stage process, which can be summarised as the following:

- 24-hour person demand is split into time-period-pairs based on the proportions calculated by the demand model. Time-period-pairs are an extension of the standard time periods represented in a transport model. They contain the information on both the outbound and return times of the two legs of a tour. For example, an AM-PM time-period-pair defines that a tour's outbound trip takes place during the AM Period, with the return trip taking place during the PM Period.
- Person demand is converted to vehicles using occupancy matrices. These are derived from the base year matrices, with changes to occupancy applied over time based on assumptions contained within WebTAG guidance.
- Time-period-pair matrices are production / attraction matrices at this stage. These are converted to origin / destination matrices by undertaking the following processes for each time-period-pair:
    - the matrix, as it is, is allocated to the outbound time period origin / destination matrix; then
    - the matrix transposed is allocated to the return time period origin / destination matrix.

  The process of transposing a matrix is to reflect the fact that for the return leg of a tour the origin is the attraction and the destination is the production. As the matrices are stored in production / attraction format, transposing the matrix swaps the production and attraction zones to create a return leg origin / destination matrix.

  This process produces origin / destination matrices for peak periods rather than individual hours.

- Peak hour factors and a delta matrix[7] are then applied to the period origin / destination matrices to convert these to peak hour assignment matrices. The peak hour factors are also derived from the base year matrix build.

This highway demand is then assigned onto the network. This network includes the 'committed' or 'highly likely' highway infrastructure projects, and, in the case of the two Blaby mitigation scenarios, the highway infrastructure schemes detailed in Table 2.2.

This section details the results of these assignments, reporting on some aggregate network statistics, the forecast links flows, the congestion resulting from these flows, and the forecast journey times along key routes in the area.

5.2.1 Highway Network Statistics

Forecast highway network statistics have been extracted from the model for links within Blaby District, which have been further allocated to one of the three subsets of Blaby District. This allocation process has been based on the mid-point of each modelled link, and the results of this allocation process can be seen in Figure 1.3. It is worth noting that all links within Blaby Distinct have been allocated to one of the reporting areas, including motorway links along the M1 and M69.

The highway network statistics that are reported on in this section are the following:

- **Vehicle-kilometres**: this is the sum of the vehicle flows on each link multiplied by the length of the link. This is an indicator of traffic on the network, and includes both any changes in the number of trips and the forecast changes in trip destinations, and therefore trip length.
- **Vehicle-delay**: this is result of the multiplication of vehicle flows and delay on each link in the model. This gives an indication of the level of delay experienced by traffic on the network, and includes both traffic growth and changes in delay. It should be noted that if individual delays on links and junctions do not increase, but traffic volumes do, vehicle-delay will increase.
- **Average speeds**: this is the average speed across all links experienced by vehicles using the selected subset of links.

In these network statistics, the vehicle flows used include both car and freight traffic, but excludes bus flows.

Table 5.5 and Table 5.6 show these network statistics for the AM Peak hour (08:00 – 09:00) and PM Peak hour (17:00 – 18:00). These tables show the forecast vehicle-kilometres, vehicle delays and average speeds for the three reporting areas of Blaby District, Blaby District as a whole, and for Leicestershire, including Leicester City. The Leicestershire network performance has been included to provide a comparison with the network performance within Blaby District.

In these tables, percentage changes are given between the 2008 Base Year and the 2031 LAM, and then between the two mitigation scenarios, 'Hard' Only and 'Mitigation', and the 2031 LAM. No comparison showing the incremental change between the 'Hard' Only and Mitigation scenarios, i.e. the effect of Smarter Choice measures, is included.

The percentage changes for network statistics are colour coded as to their positive or negative impact on the performance of the highway network. For example, increases in vehicle-kilometres and vehicle-delay are

[7] A delta matrix is one that converts assignment matrices produced by a demand model to those consistent with the base year assignment. Ideally this process would not be required; however it was not possible to reconstruct the tour-based matrices from the results of the highway matrix estimation process. A delta matrix was therefore required to provide consistency between the demand model and the assignment model.

negative impacts, whereas an increase in average speeds is a positive impact. Positive impacts have been shown in green, with negative impacts shown in red.

Table 5.5: AM Peak Hour Highway Network Statistics

		2008 Base	2031 LAM		2031 'Hard' Only		2031 Mitigation	
Blaby - PUA	Vehicle Distance (Veh-km)	122,250	152,509	24.8%	155,777	2.1%	155,551	2.0%
	Vehicle Delay (Veh-hrs)	649	1,363	110.2%	1,374	0.8%	1,368	0.3%
	Speed (kph)	55	45	-18.1%	45	-0.5%	45	-0.3%
Blaby - Urban	Vehicle Distance (Veh-km)	92,117	112,124	21.7%	111,746	-0.3%	111,460	-0.6%
	Vehicle Delay (Veh-hrs)	800	1,306	63.3%	1,295	-0.9%	1,282	-1.9%
	Speed (kph)	45	39	-12.1%	40	0.1%	40	0.5%
Blaby - Rural	Vehicle Distance (Veh-km)	105,465	132,404	25.5%	131,859	-0.4%	131,838	-0.4%
	Vehicle Delay (Veh-hrs)	248	528	112.6%	540	2.3%	541	2.5%
	Speed (kph)	69	61	-11.8%	60	-0.5%	60	-0.5%
Blaby District	Vehicle Distance (Veh-km)	319,832	397,037	24.1%	399,382	0.6%	398,849	0.5%
	Vehicle Delay (Veh-hrs)	1,697	3,197	88.4%	3,208	0.3%	3,190	-0.2%
	Speed (kph)	55	47	-14.3%	47	-0.3%	47	-0.1%
Leicest-ershire	Vehicle Distance (Veh-km)	2,303,210	2,960,247	28.5%	2,965,215	0.2%	2,966,332	0.2%
	Vehicle Delay (Veh-hrs)	13,660	25,888	89.5%	25,825	-0.2%	25,813	-0.3%
	Speed (kph)	49	43	-13.0%	43	0.1%	43	0.1%

Table 5.6: PM Peak Hour Highway Network Statistics

		2008 Base	2031 LAM		2031 'Hard' Only		2031 Mitigation	
Blaby - PUA	Vehicle Distance (Veh-km)	135,563	164,662	21.5%	166,835	1.3%	166,719	1.2%
	Vehicle Delay (Veh-hrs)	1,048	1,841	75.7%	1,986	7.9%	2,020	9.8%
	Speed (kph)	48	41	-15.5%	39	-3.7%	39	-4.4%
Blaby - Urban	Vehicle Distance (Veh-km)	98,560	124,076	25.9%	122,670	-1.1%	122,387	-1.4%
	Vehicle Delay (Veh-hrs)	1,128	1,688	49.6%	1,661	-1.6%	1,654	-2.0%
	Speed (kph)	40	36	-8.4%	37	0.3%	37	0.5%
Blaby - Rural	Vehicle Distance (Veh-km)	114,170	140,831	23.4%	137,958	-2.0%	137,977	-2.0%
	Vehicle Delay (Veh-hrs)	276	550	99.4%	553	0.6%	557	1.2%
	Speed (kph)	68	60	-10.8%	60	-0.5%	60	-0.6%
Blaby District	Vehicle Distance (Veh-km)	348,293	429,568	23.3%	427,463	-0.5%	427,082	-0.6%
	Vehicle Delay (Veh-hrs)	2,452	4,079	66.4%	4,200	3.0%	4,231	3.7%
	Speed (kph)	50	44	-12.0%	43	-1.7%	43	-2.0%
Leicest-ershire	Vehicle Distance (Veh-km)	2,446,100	3,110,908	27.2%	3,110,877	0.0%	3,113,190	0.1%
	Vehicle Delay (Veh-hrs)	16,492	27,841	68.8%	28,040	0.7%	28,120	1.0%
	Speed (kph)	47	43	-10.1%	42	-0.3%	42	-0.4%

Changes from Base Year to 2031 LAM

The highway network statistics aren't directly related to the demand growth given in Table 5.1, as the demand data only reports on productions from Blaby District whereas the network statistics consider all traffic within Blaby District, including through traffic, but a comparison of growth can be made. Across Blaby District, 24-hour highway person demand produced within the district is forecast to grow by around 22% from 2008 to the 2031 LAM. This compares with 24.1% and 23.3% growth in vehicle-kms on all links within Blaby District in the AM Peak and PM Peak hours respectively, which is broadly comparable.

Comparing the forecast growth in traffic in terms of vehicle-kms within Blaby District against that for Leicestershire as a whole, the growth within Blaby District is 24.1% and 23.3% in the AM Peak and PM Peak hours. This is lower than the corresponding growth for the county, which is forecast to see vehicle-km growth of 28.5% and 27.2% in the AM Peak and PM Peak hours.

This increase in traffic results in forecast decreases in average speeds across the network. Within Blaby District, average speeds are forecast to fall by 14.3% and 12% in the AM Peak and PM Peak hours between the 2008 Base Year and 2031 LAM. This is in comparison to the county averages of 13% in the AM Peak hour and 10.1% in the PM Peak hour. This suggests that despite the traffic growth being forecast to be lower within Blaby District compared to the county average, the forecast reductions in average speed are greater than the county average. This suggests that the highway network within Blaby District is operating closer to capacity compared to the county average, and that forecast increases in traffic on the network within Blaby District will have a more significant effect on delays and speeds than compared with the county average.

Considering the forecast increase in traffic in terms of vehicle-kms, and the subsequent reductions in average speeds, within the three Blaby District reporting areas, the following is a summary of the results:

- **Blaby – PUA**: forecast increase in traffic of 24.8% and 21.5% in the AM Peak and PM Peak hours, with forecast reductions in average speeds of 18.1% and 15.5% respectively.

- **Blaby – Urban**: forecast increase in traffic of 21.7% and 25.9% in the AM Peak and PM Peak hours, with forecast reductions in average speeds of 12.1% and 8.4% respectively.
- **Blaby – Rural**: forecast increase in traffic of 25.5% and 23.4% in the AM Peak and PM Peak hours, with forecast reductions in average speeds of 11.8% and 10.8% respectively.

These results suggest that the level of vehicle-kms growth within Blaby District is fairly consistent across the three reporting areas at around 25%. There are two exceptions to this in the AM Peak hour for Blaby Urban and the PM Peak for Blaby PUA, which see traffic growth forecast to be slightly lower at around 22%.

The forecast reductions in average speeds are largest for the Blaby PUA sector, at around 15% and 18% depending on the time period. The average speed reductions in both the Blaby Urban and Rural sectors are broadly similar, at between 8% and 12%.

It is worth noting that the average speeds within the Blaby PUA sector decrease the most of the three reporting sectors over time. This may suggest that this part of the network is most sensitive to increases in traffic in terms of average speeds.

Changes due to Proposed Mitigation Measures

Considering first the forecast effect of the 'hard' mitigation measures, these are forecast to increase vehicle-kms in the AM Peak hour by 0.6%, but decrease vehicle-kms in the PM Peak hour by 0.5%. Within the reporting areas there is a broadly consistent pattern between modelled hours of forecast vehicle-km changes. Within Blaby PUA there is a forecast increase in vehicle-kms, with decreases forecast in both Blaby Urban and Rural sectors. The reductions forecast in the PM Peak hour are larger in magnitude which results in an overall decrease in vehicle-kms in the PM Peak hour.

These results are again in broad agreement with the demand growth given in Table 5.1. This shows that there are forecast reductions in highway demand with the 'hard' mitigation measures in Blaby Urban and Rural sectors, but not in the Blaby PUA sector.

As with the forecast change in vehicle-kms, there again is a consistent pattern of forecast average speed changes across the three reporting areas. In Blaby PUA, the increased vehicle-kms results in average speeds reducing by 0.5% in the AM Peak hour and 3.7% in the PM Peak hour. In the Blaby Urban reporting sector the forecast reductions in traffic result in marginal improvements in average speeds of 0.1% and 0.3% in the AM Peak and PM Peak hours.

In the Blaby Rural sector the forecast reductions in vehicle-kms results forecast reductions in average speeds of 0.5% in both modelled hours. It would be expected that the forecast reductions in vehicle-kms within the Blaby Rural sector would result in increases in forecast average speeds; however this is not the case. Possible explanations for this effect are given below but include non-optimal signal timings and changes in pattern of demand at junction causing additional delays. Analysis of the highway assignment results suggests that modelled speeds are forecast to reduce on the approaches to the A5 / B4114 and B4114 / Cosby Road junctions, most likely due to non-optimal signal timings at these junctions.

On the face of it, the 'hard' mitigation measures do not appear to have made a significant improvement to the performance of the highway network within Blaby District. In fact, average speeds within the district are forecast to fall with the introduction of the 'hard' mitigation measures. Some reasons for this are that:

- some of the mitigation measures proposed are traffic calming schemes which reduce the modelled speeds at some locations (see Table 2.2);
- there are a number of proposed mitigation measures that signalise existing priority junctions, and the staging and timings for these new signalised junctions have not been optimised for the forecast flows; and

- that some of the mitigation measures improve the performance of a junction; however this results in increases in delay at junctions downstream (discussed in Section 5.2.4).

With the incremental inclusion of the 'soft' Smarter Choice measures in the 2031 Mitigation scenario, there is little forecast change in the performance of the highway network. Forecast vehicle-kms remain largely unchanged from the 2031 'Hard' Only scenario, as do forecast average speeds on the network. Generally, there are forecast to be marginally lower levels of vehicle-kms with the introduction of Smarter Choice measures compared to the 'Hard' Only scenario, and marginally higher average speeds.

The one significant exception to this is in the PM Peak hour within the Blaby PUA sector. Compared to the 2031 'Hard' Only scenario there is forecast to be a reduction in vehicle-kms but a decrease in average speeds. Within the constraints of this study, it has not been possible to examine the reasons why this reduction in traffic and results in an increase in delay and a decrease in average speeds.

Observations on Forecasts

As with the demand forecasts, it is worth putting the forecast changes due to the proposed mitigation measures in the context of the forecast changes between the base year and the 2031 LAM. Traffic is forecast to increase by around 25% in the two peak hours within Blaby District from the base year to the 2031 LAM, with average speeds reducing by 12% to 14%. Traffic is forecast to change by around ±0.5% with the mitigation measures, with average speeds reducing by up to a further 2%. These forecast impacts of the mitigation measures are therefore relatively small in comparison to the changes forecast from the base year to 2031.

5.2.2 Forecast Highway Network Flows

Plots of the forecast vehicle flow, including car and freight traffic, change between scenarios have been produced for all highway links. These show the forecast vehicle flow change in bandings for both increases and decreases in flow. In these plots, red bandwidths identify where vehicle flows are forecast to increase between two scenarios, with green showing where vehicle flows are forecast to decrease.

Figure 5.2 shows the change in AM Peak hour (08:00 – 09:00) forecast vehicle flows between the 2008 Base Year and the 2031 LAM., with Figure 5.3 and Figure 5.4 showing the forecast change in flow in 2031 between the LAM and the two mitigation scenarios: 'Hard' Only and Mitigation. In addition to this, Figure 5.5 shows the forecast change in flows between the 2031 'Hard' Only and Mitigation scenarios, i.e. showing the incremental impact of Smarter Choice measures on forecast highway flows.

The same comparisons for the PM Peak hour (17:00 – 18:00) are also provided. Figure 5.6 shows the forecast change in vehicle flows between the 2008 Base Year and the 2031 LAM, with Figure 5.7 and Figure 5.8 showing the forecast change between the 2031 LAM and the two mitigation scenarios. Figure 5.9 shows incremental effect on forecast vehicle flows with the inclusion of Smarter Choice measures.

These plots only show changes where the structure of the network is the same in the two scenarios being compared. For example, where a link is split or a new link is added, no change will be shown at these locations between two scenarios. This is of particular importance when looking at results in and around the proposed Warren Park Way and A563 / A426 junction link roads.

Figure 5.2: AM Peak Hour Absolute Vehicle Flow Changes: 2031 LAM – 2008 Base Year

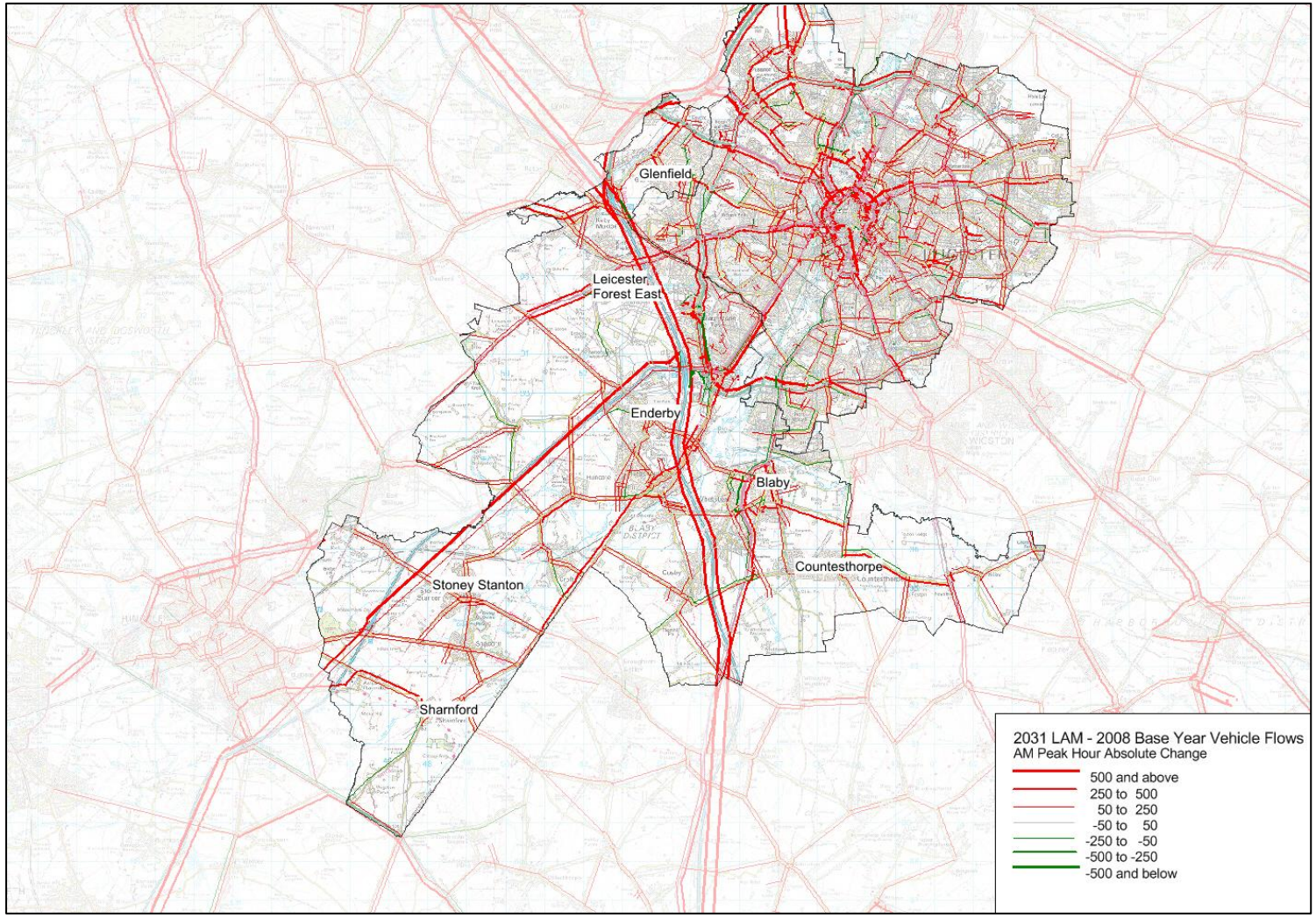


Figure 5.3: AM Peak Hour Absolute Vehicle Flow Changes: 2031 'Hard' Only – 2031 LAM

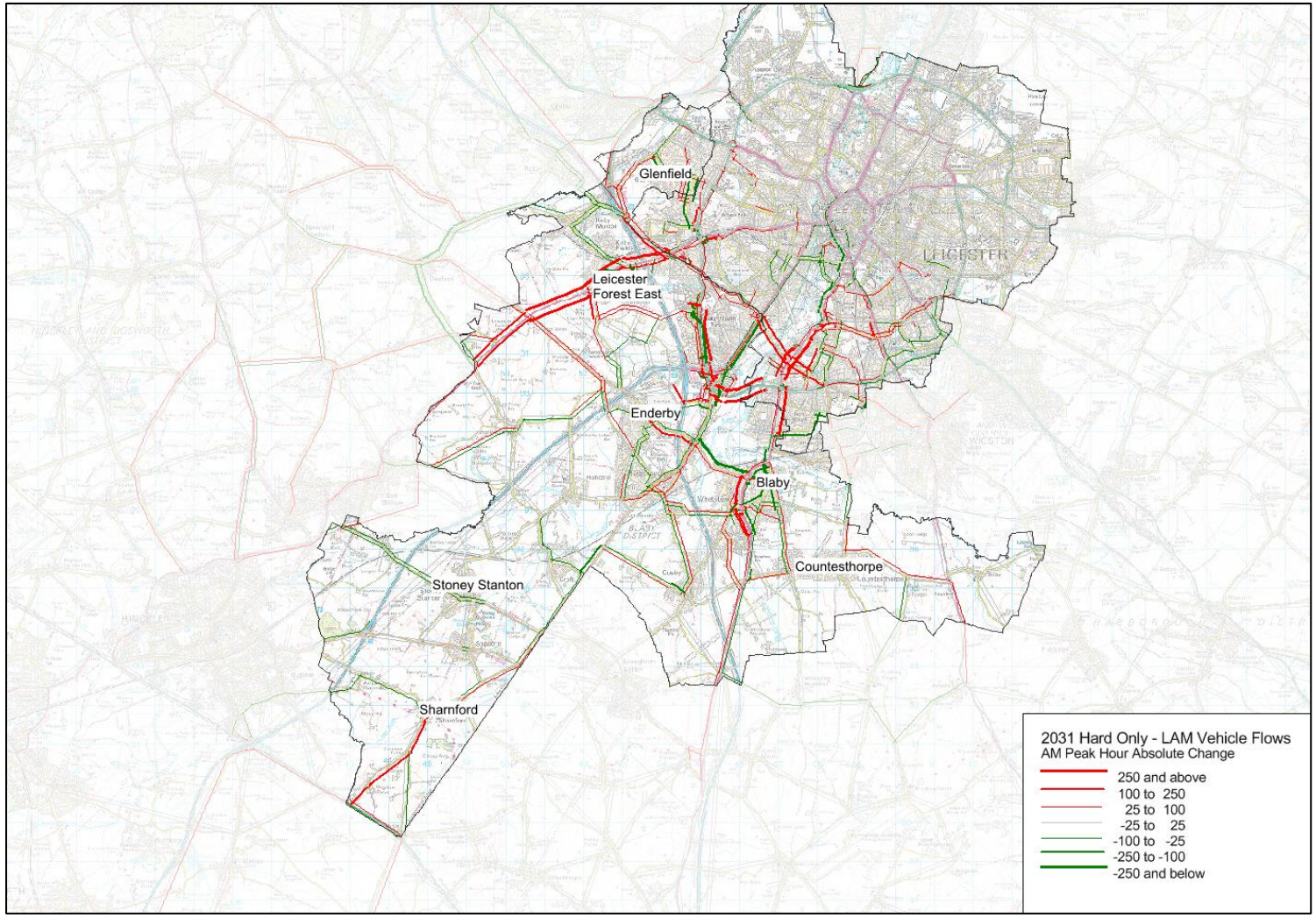


Figure 5.4: AM Peak Hour Absolute Vehicle Flow Changes: 2031 Mitigation – 2031 LAM

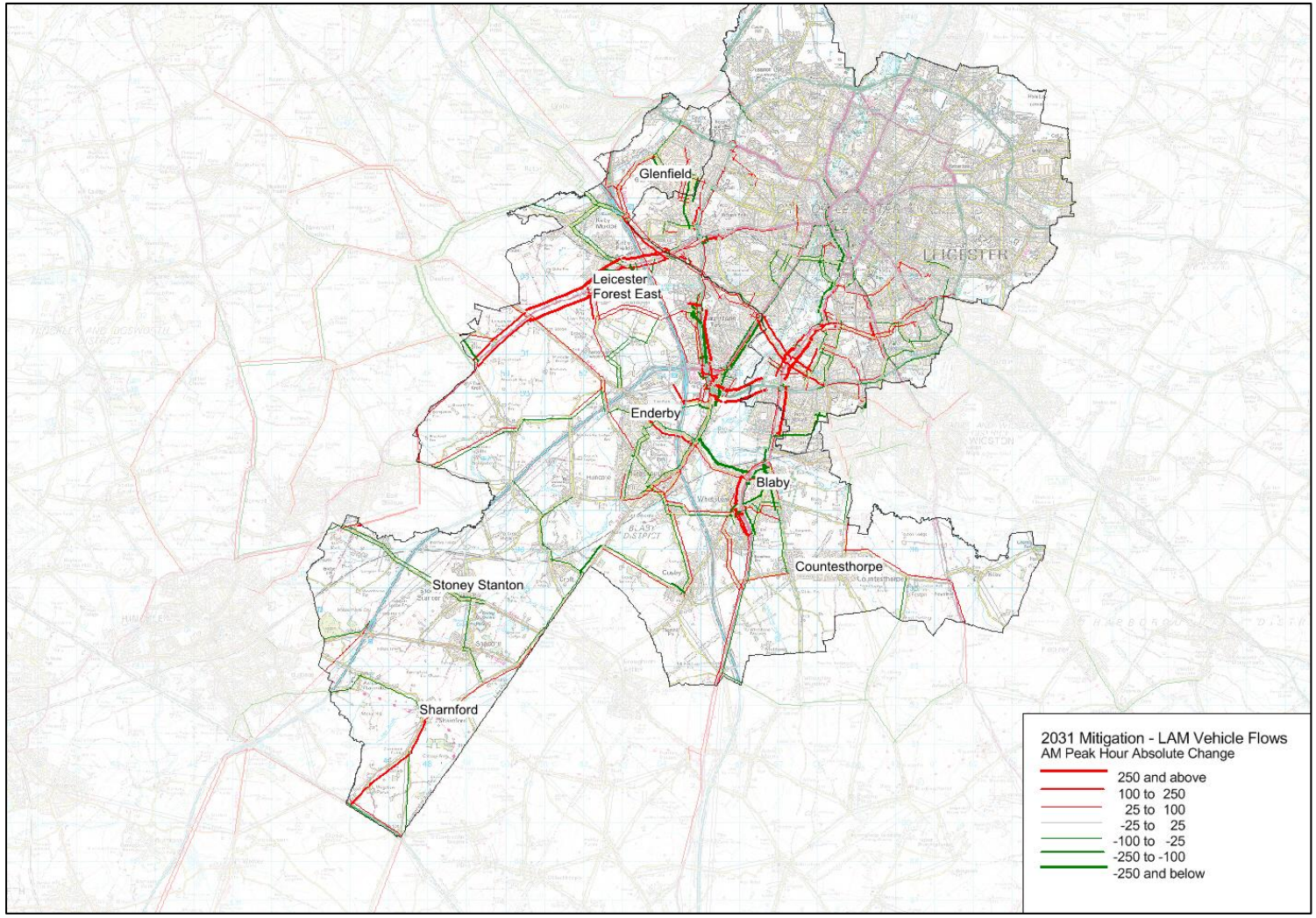


Figure 5.5: AM Peak Hour Absolute Vehicle Flow Changes: 2031 Mitigation – 2031 'Hard' Only

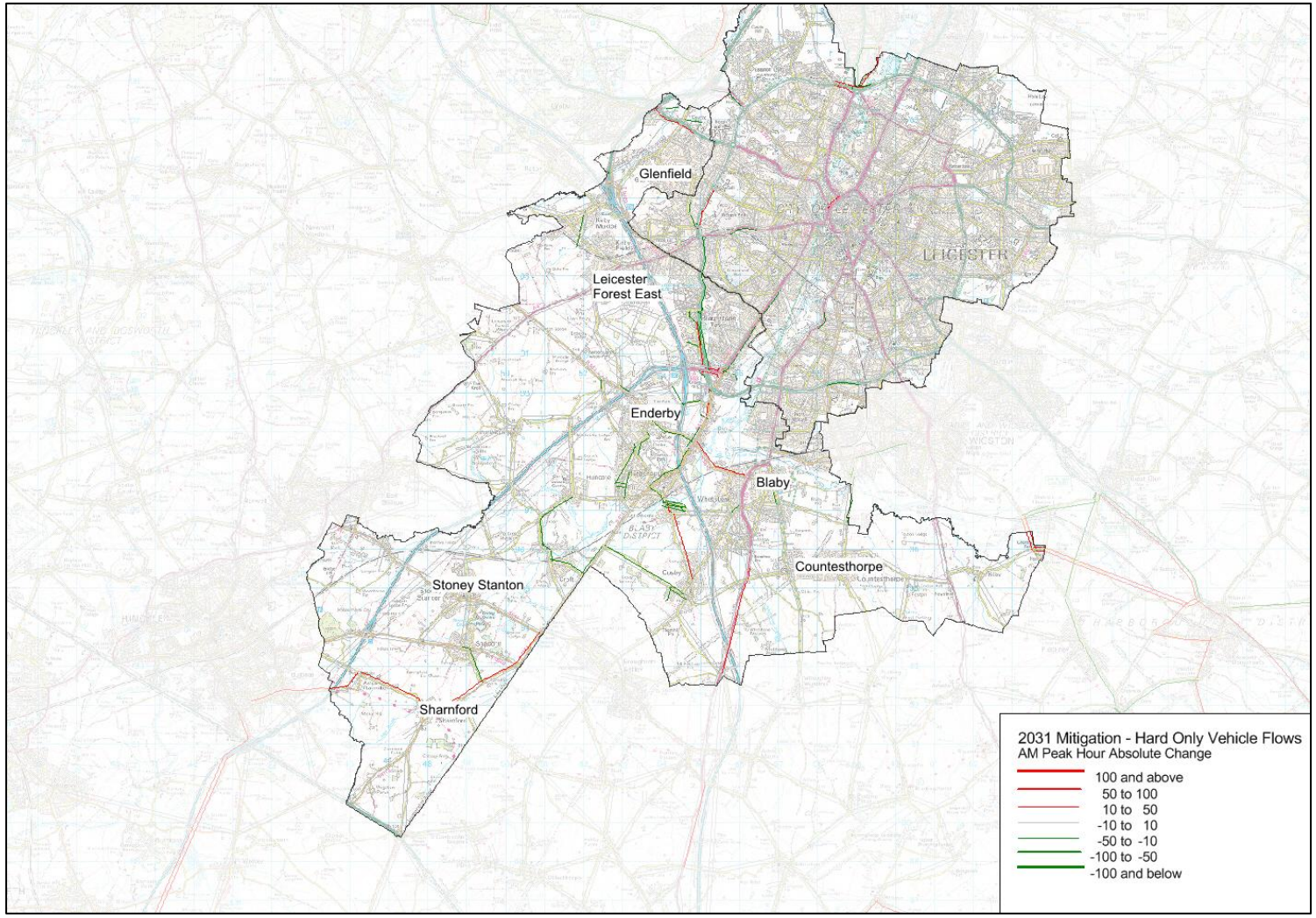


Figure 5.6: PM Peak Hour Absolute Vehicle Flow Changes: 2031 LAM – 2008 Base Year

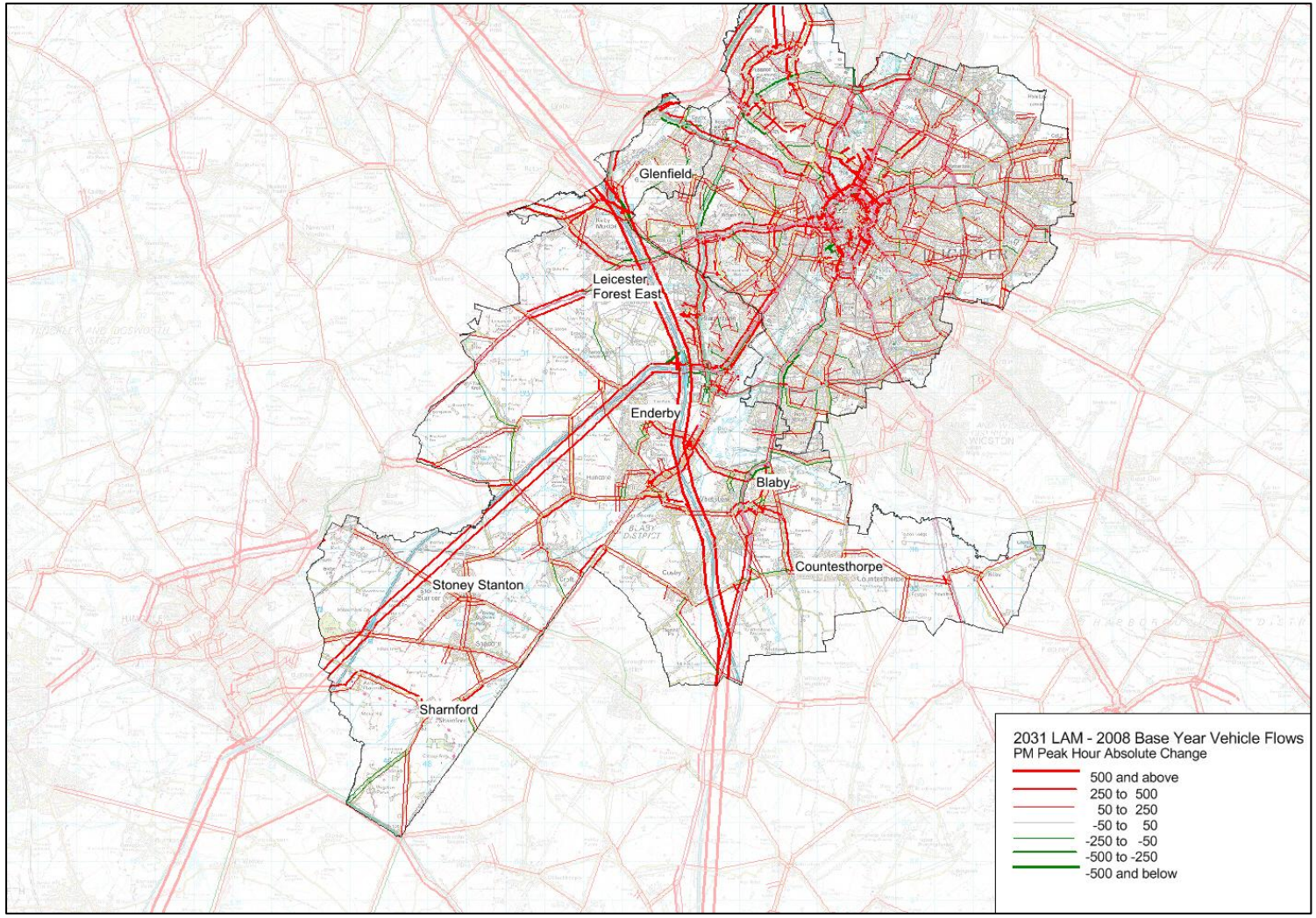


Figure 5.7: PM Peak Hour Absolute Vehicle Flow Changes: 2031 'Hard' Only – 2031 LAM

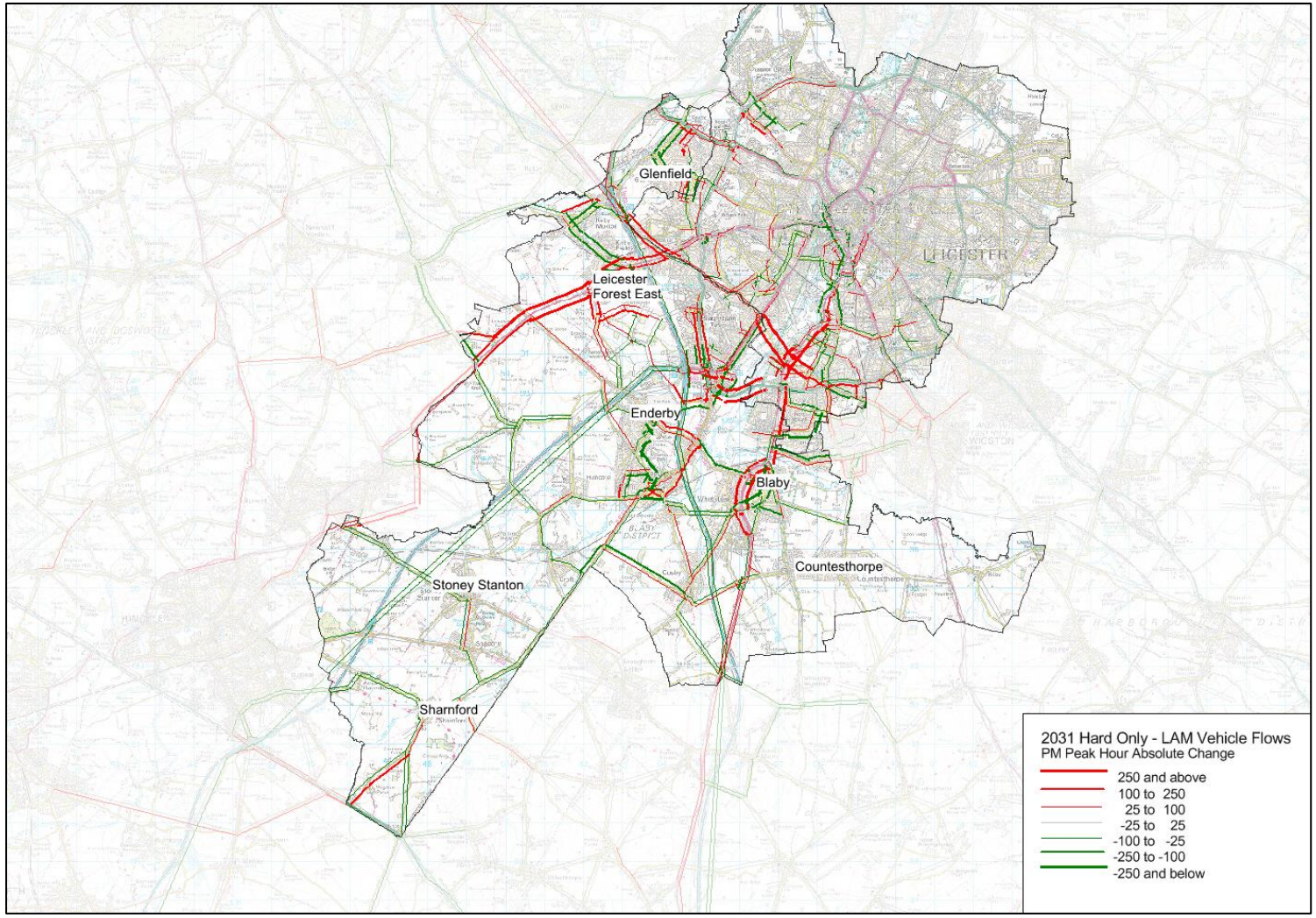


Figure 5.8: PM Peak Hour Absolute Vehicle Flow Changes: 2031 Mitigation – 2031 LAM

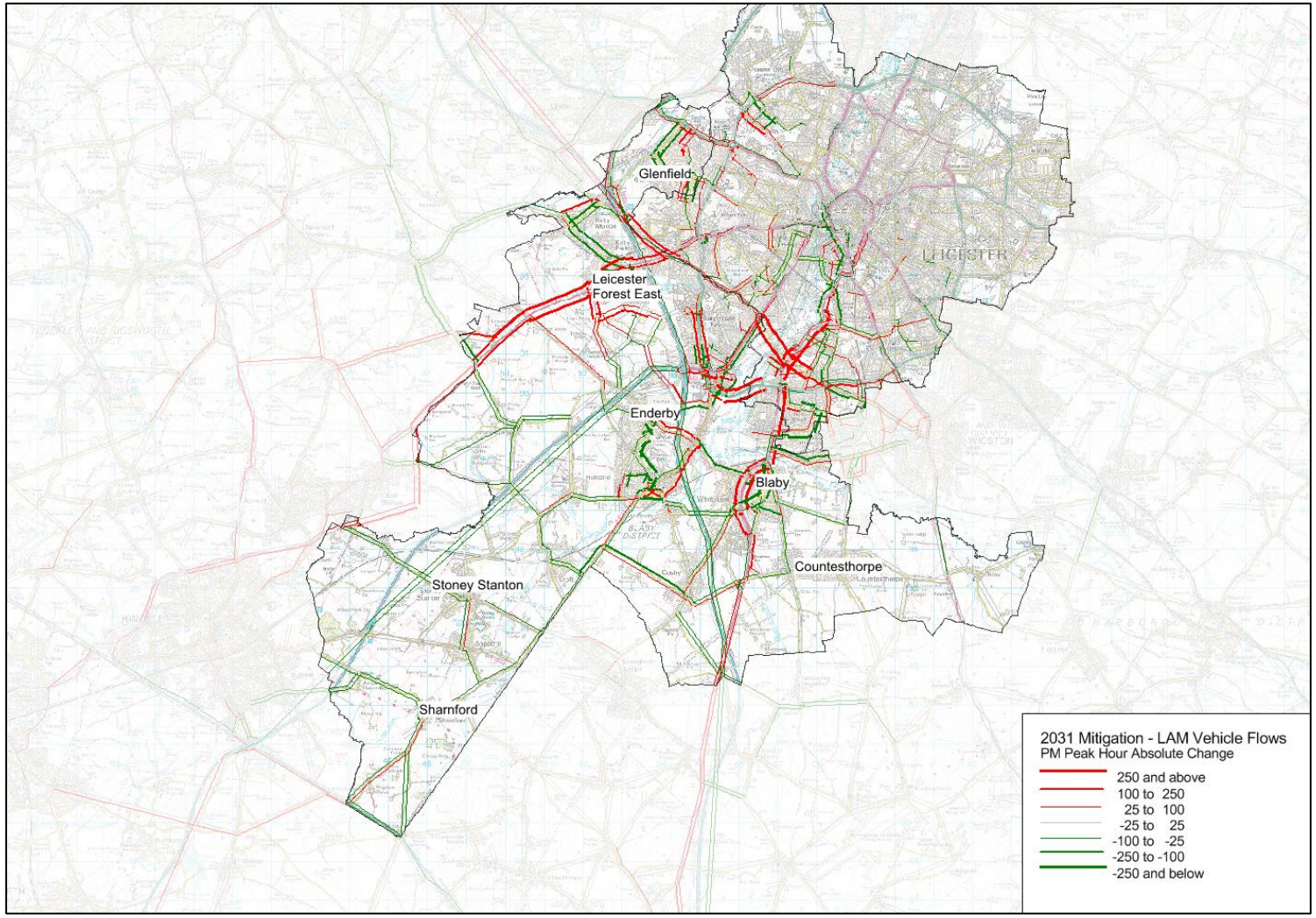
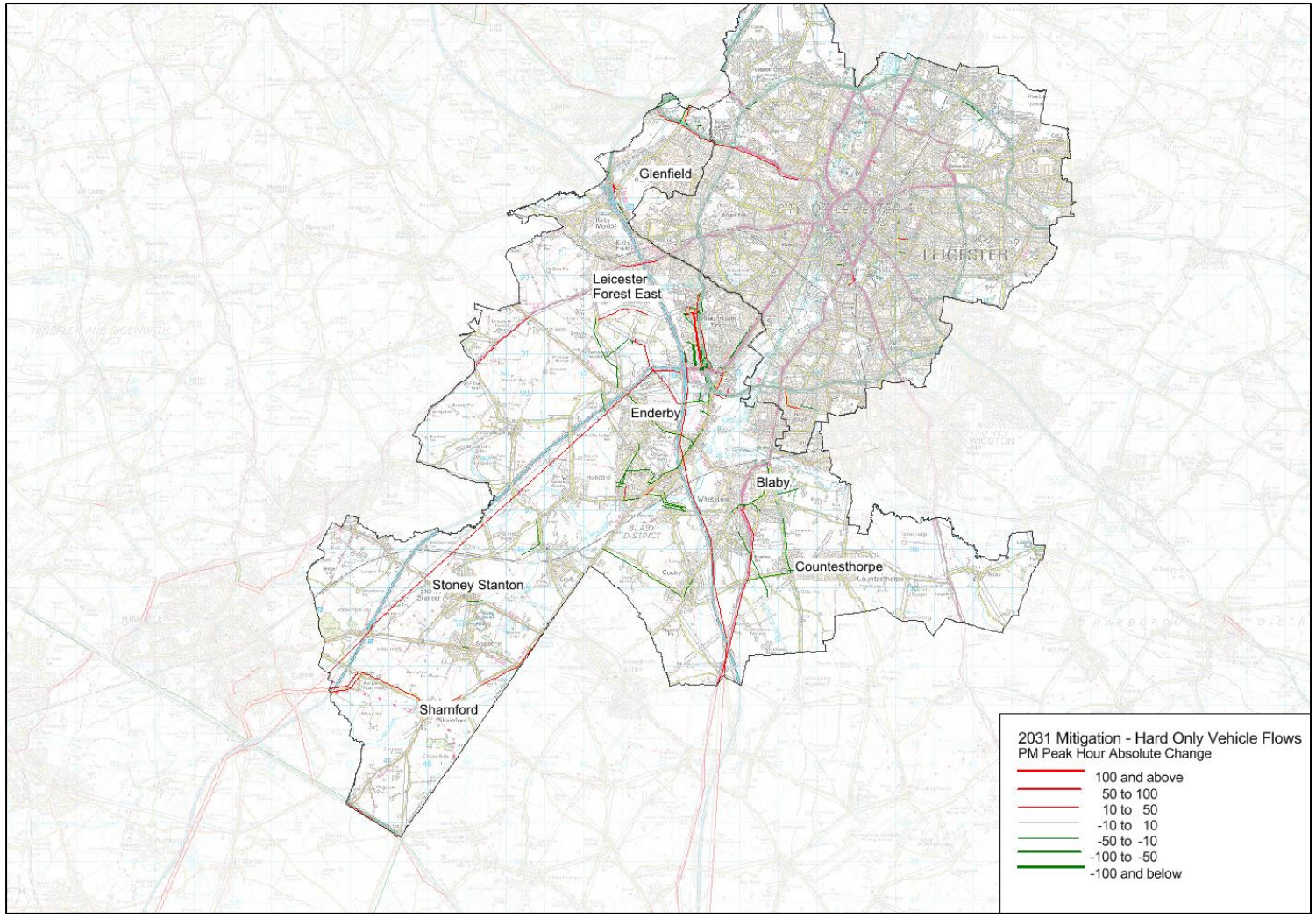


Figure 5.9: PM Peak Hour Absolute Vehicle Flow Changes: 2031 Mitigation – 2031 'Hard' Only



Changes from Base Year to 2031 LAM

The forecast vehicle flow changes between the base year and the 2031 LAM forecast, as show in Figure 5.2 and Figure 5.6, show that there are very few links which see a reduction in flow between these two scenarios. There are a number of local and rural roads that see little increase and in some cases a small decrease, but on the whole the pattern is of vehicle flow increases on all modelled links.

The largest forecast increases in vehicle flow in absolute terms in the AM Peak and PM Peak hours can be seen on the main trunk road routes through Blaby District: the M1 and M69; as well as the A47 and A563. The A563 anti-clockwise is forecast to see a significant increase in vehicle flows between the B4114 and the A426.

Changes due to Proposed Mitigation Measures

Considering the changes in forecast vehicle flows with the introduction of the 'hard' measures firstly, there are a number of corridors that see an increase in forecast volumes as a result of the mitigation measures. The mitigation measures along these routes have increased the capacity of the route and make the corridor more attractive to highway trips.

The main corridors that see an increase in vehicle flows compared to the 2031 LAM are the A47 corridor, the A426 corridor and the A563 Outer Ring Road for Leicester City, which form part of the Main Strategic Road Network in the area. The latter two of these corridors will have been influenced by the proposed improvements at the junction between these two roads. This will have increased the capacity at this junction, and along with other schemes along these routes will have attracted more traffic to the route. The increases seen on the A426 also relates to the improvements at the junction with Middleton Street and Wigston Lane, with forecast increases in flow along these two routes as well.

There are also areas of the highway network where flows are forecast to reduce as a result of the of proposed mitigation measures. There are forecast vehicle flow reductions along the routes where traffic calming is proposed. These are the routes through Enderby and Narborough, the residential routes between the A47 and Kirby Lane and some of the routes through Glenfield. These proposed traffic calming locations are detailed in Table 2.2.

There is also a forecast reductions on the local roads within Blaby as traffic is attracted to the A426 Blaby Bypass with the improvements proposed for the junction with the B582. However, there is also a forecast reduction in eastbound vehicle flows on the B582 to the west of the Blaby Bypass. This is as a result of lower capacities for movements from this arm at the junction with the A426 with the signalisation of this junction. In signalising this junction, priority has been given to A426 movements at the expense of the B582 approach. It may be possible that the signal staging and timings could be optimised at this junction to, at least, retain the capacity available for the B582 approach. If this was achieved, the forecast vehicle flows on the B582 at this location may not be forecast to reduce with the introduction of the 'hard' mitigation measures.

In terms of the incremental change in forecast vehicle flows with the inclusion of Smarter Choice measures, as shown in Figure 5.5 and Figure 5.9, there is little effect in strategic terms in vehicle flows with these proposed measures. Some flow reductions can be seen on the network, most notably in and around Enderby and Blaby, but on the whole the forecast flow changes are small in comparison to the growth over time or the impact of the proposed 'hard' measures.

5.2.3 Forecast Highway Congestion

Highway congestion plots have been produced for the AM Peak and PM Peak hours based on the forecast flows and capacities from the highway model. By dividing the forecast link volume by the capacity, this gives an indication of the 'stress' on the network via volume-to-capacity ratios. These have been reported via plots

of the highway network, with each link shaded based on the volume-to-capacity ratio calculated from the highway model.

The capacities from the highway model have been calculated based on the minimum of the link capacity and the sum of the turning capacities from the junction at the end of a given link. The aim of this process is to use the capacity which is the limiting capacity for flow at a given location, either the link itself or the junction. Using the minimum of the link and junction capacities picks out this limit.

The capacities at junctions within the highway model are calculated during the assignment based on the forecast flows at a junction. For example, if there is forecast to be a significant level of traffic opposing a given movement, this will reduce the capacity of the opposed movement. Therefore, given that the capacities respond to the forecast flows at a junction, these capacities may not be the same in the AM Peak and PM Peak hours.

In order to show the changes over time, and with the inclusion of the proposed mitigation measures, Figure 5.10 shows the change in volume-to-capacity ratios between the 2008 Base Year and the 2031 LAM, with Figure 5.11 and Figure 5.12 showing the incremental change between the 2031 LAM and the two mitigation scenarios respectively. All three of these figures are also showing the results of the AM Peak hour forecasts.

The corresponding plots for the PM Peak hour (17:00 – 18:00) have also been produced. Figure 5.13 shows the change in the PM Peak between the 2008 Base Year and the 2031 LAM, with Figure 5.14 and Figure 5.15 showing the incremental change between the 2031 LAM and the 'Hard' Only and Mitigation scenarios respectively.

When considering the plots of the change in volume-to-capacity ratios, as with the forecast vehicle flows, changes are only shown where the network structure is the same between the two scenarios being compared. For example, where a link is split or a new link is added, no change in volume-to-capacity will be shown at these locations.

Figure 5.10: 2031 LAM - 2008 Base Year AM Peak Hour Volume-to-Capacity Ratios

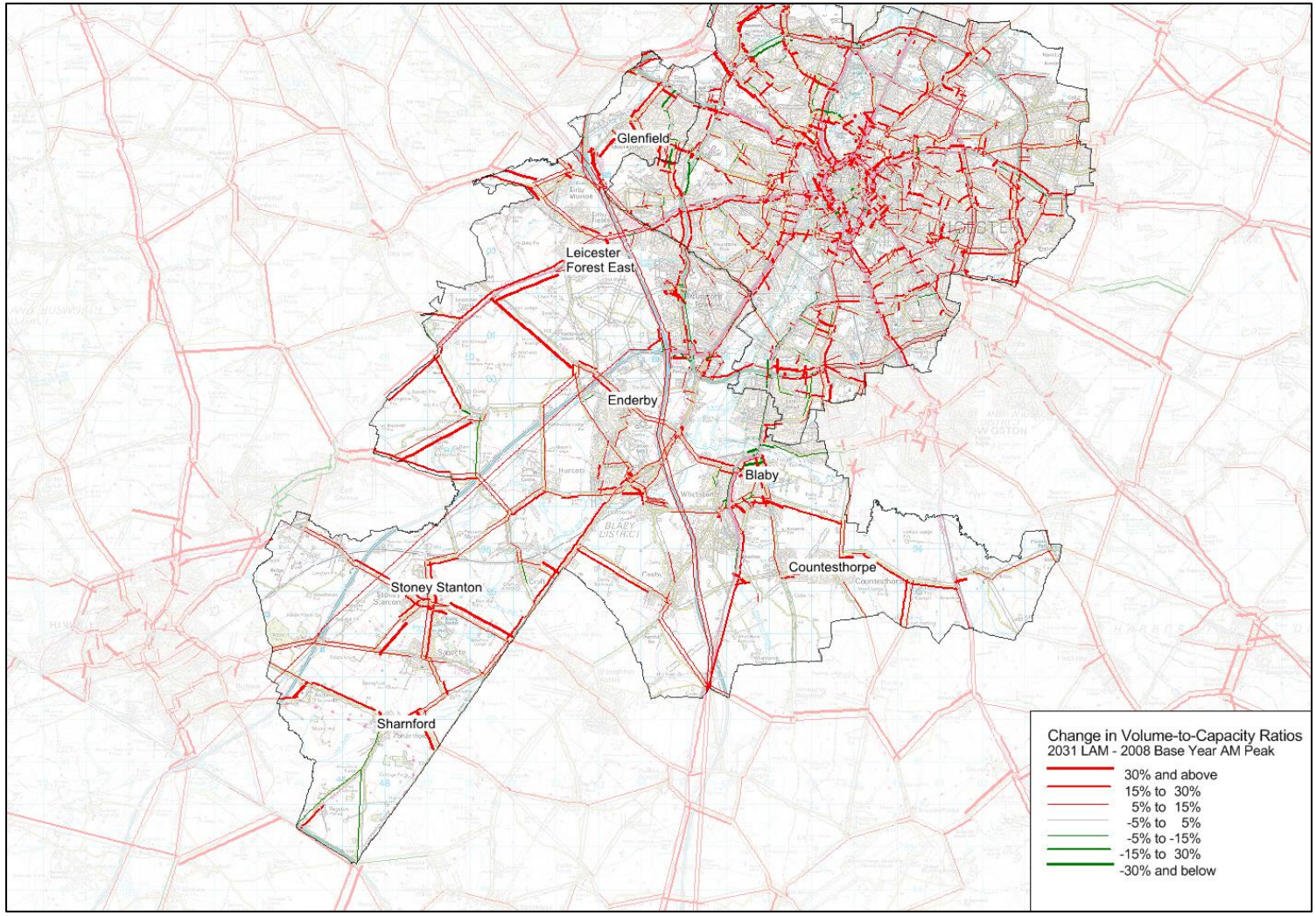


Figure 5.11: 2031 'Hard' Only - LAM AM Peak Hour Volume-to-Capacity Ratios

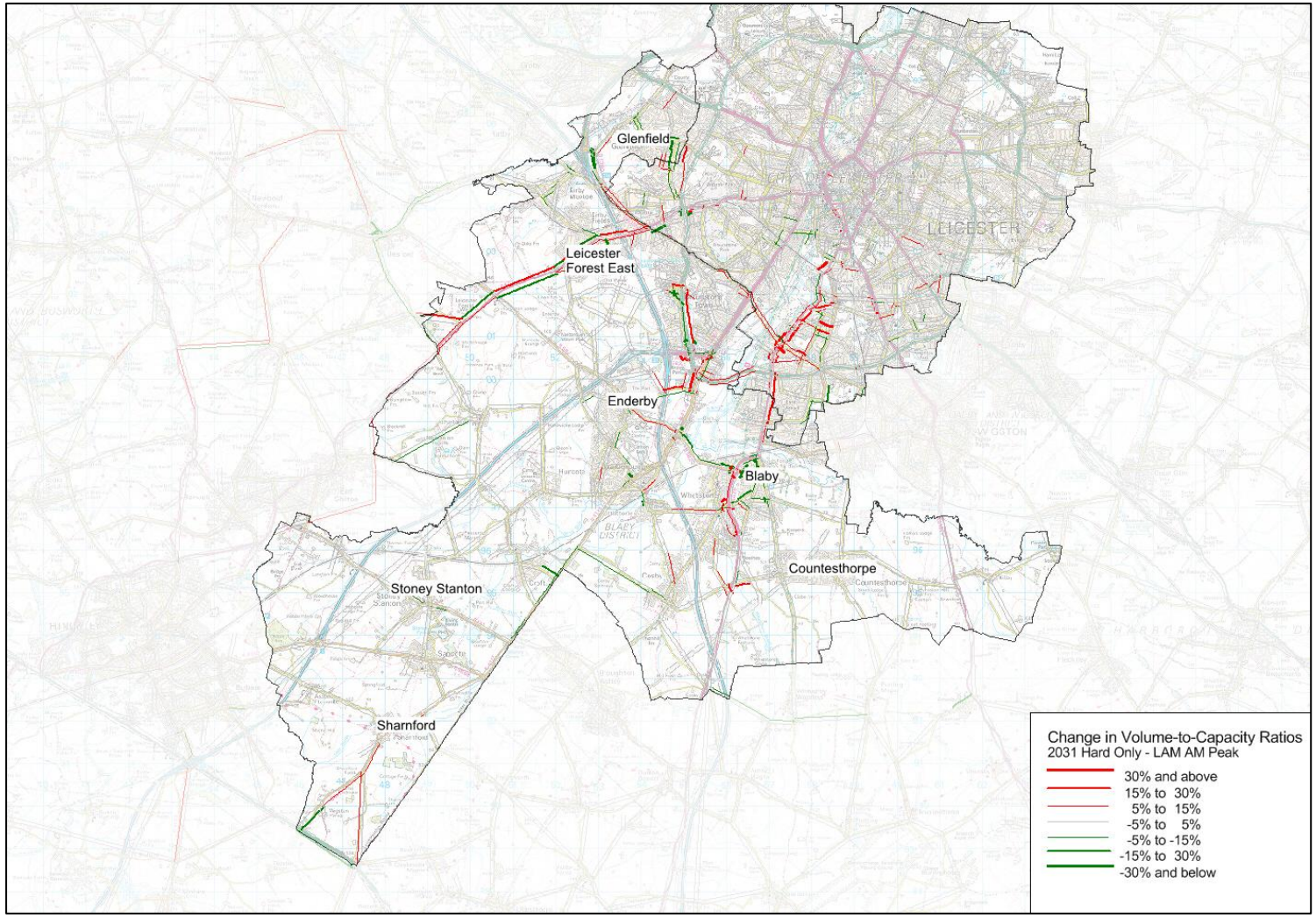


Figure 5.12: 2031 Mitigation - LAM AM Peak Hour Volume-to-Capacity Ratios

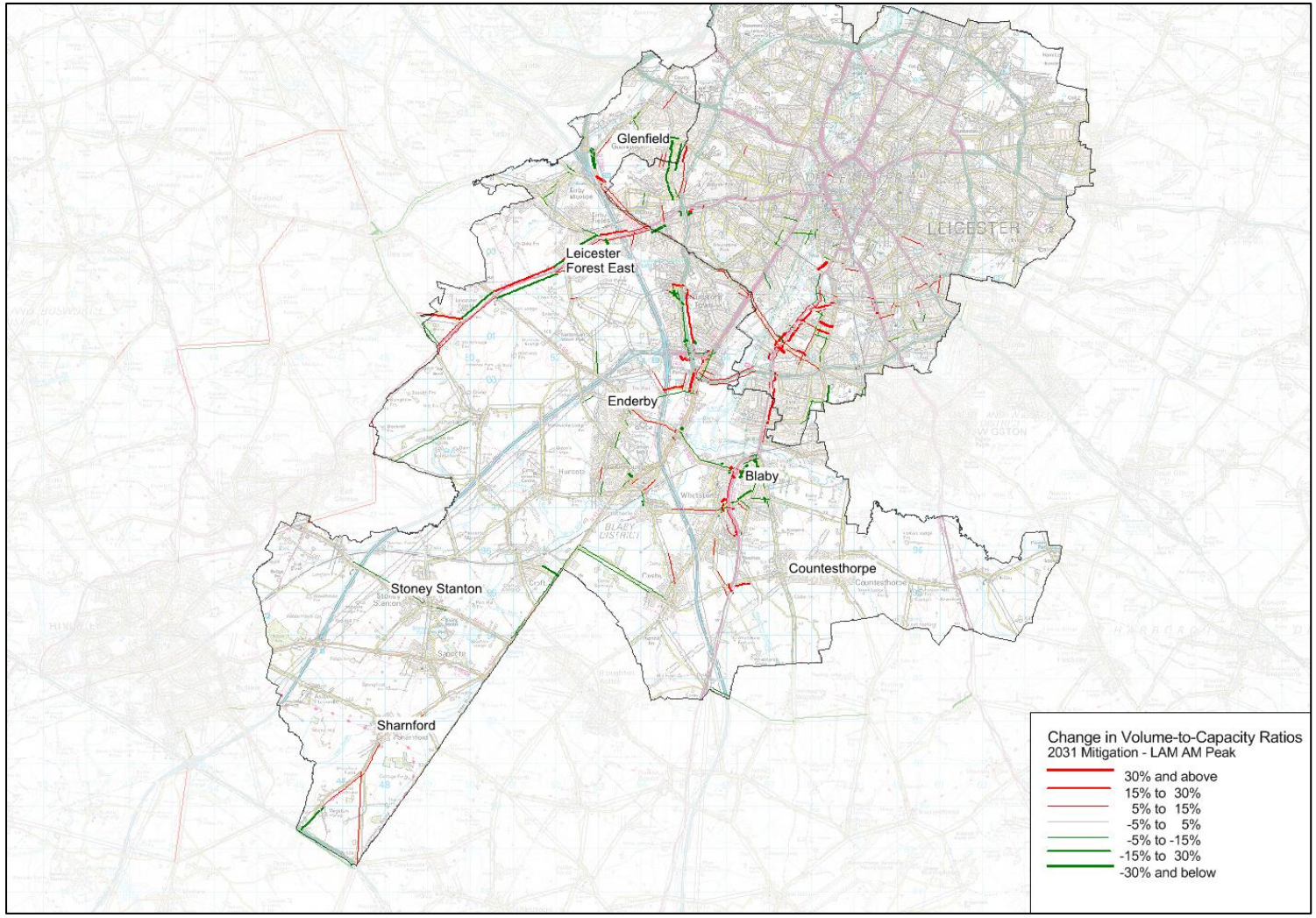


Figure 5.13: 2031 LAM - 2008 Base Year PM Peak Hour Volume-to-Capacity Ratios

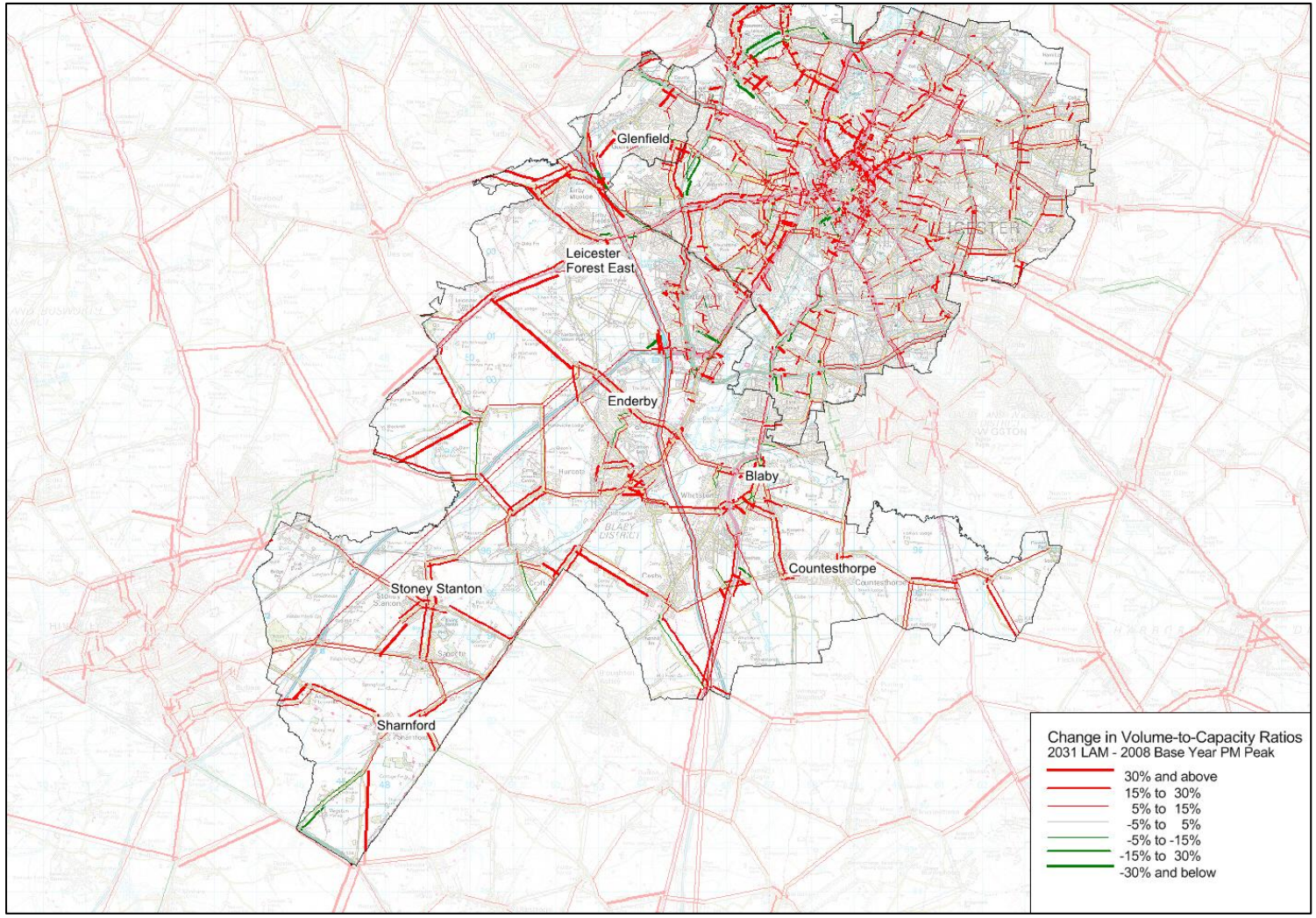


Figure 5.14: 2031 'Hard' Only - LAM PM Peak Hour Volume-to-Capacity Ratios

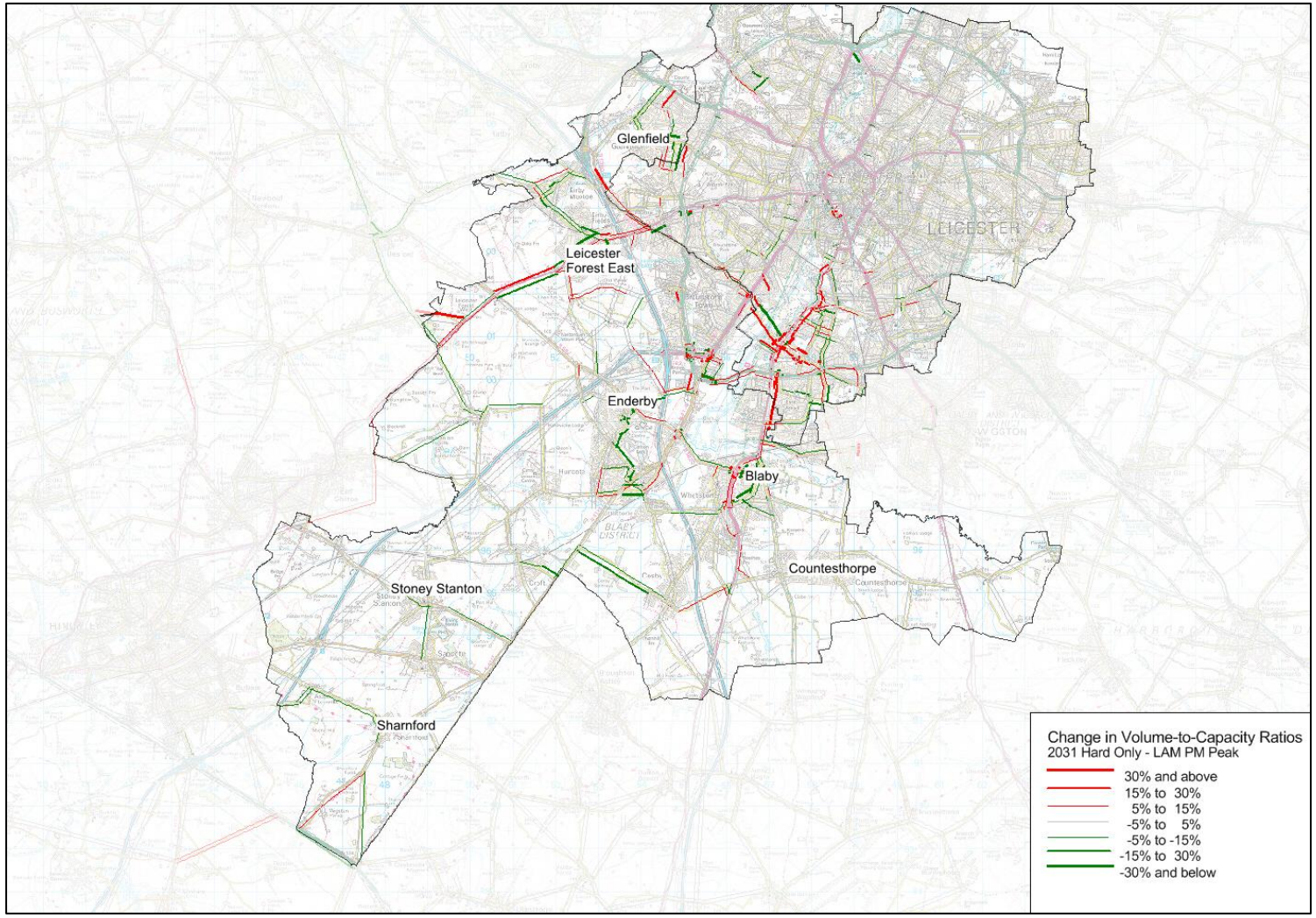
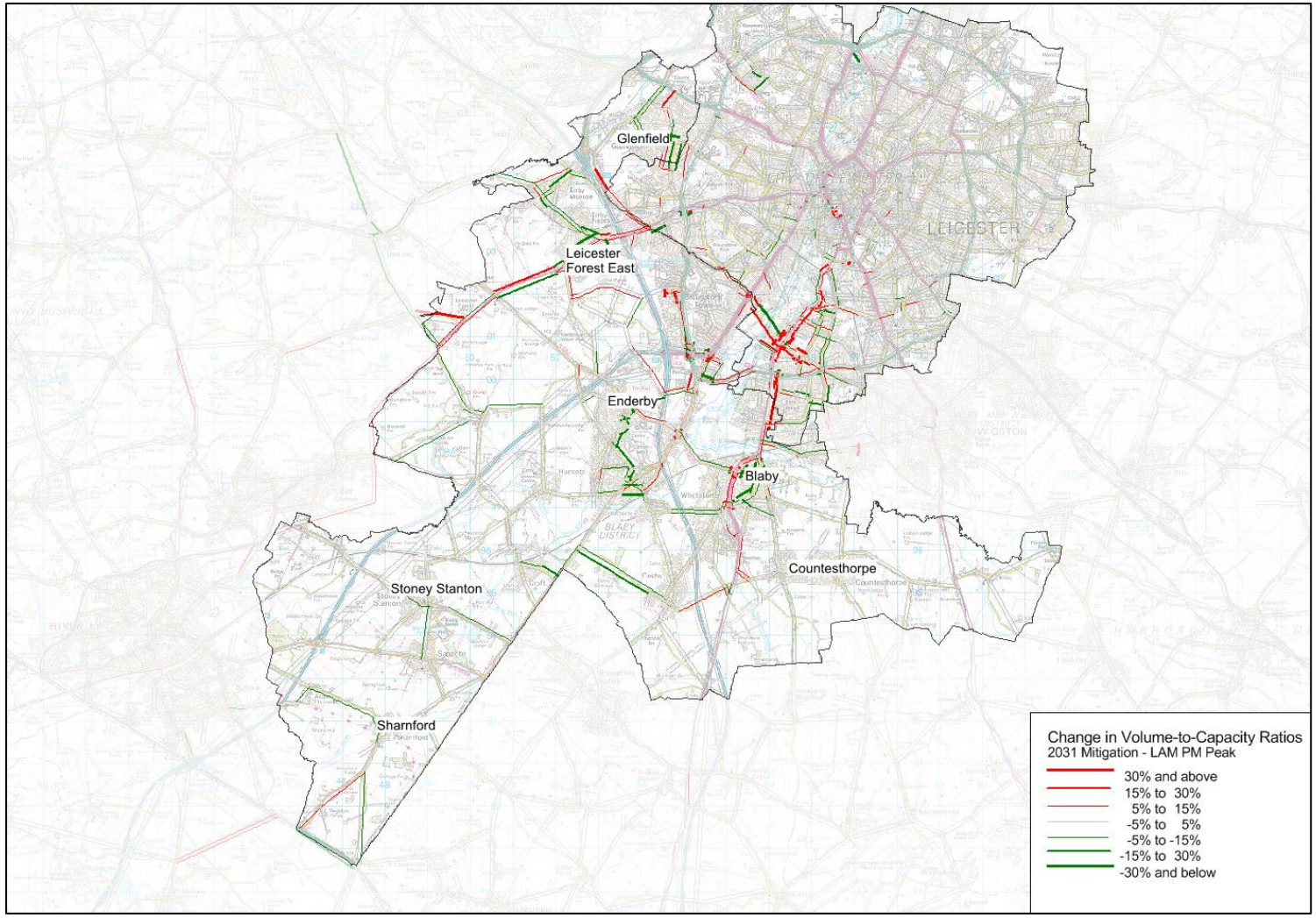


Figure 5.15: 2031 Mitigation - LAM PM Peak Hour Volume-to-Capacity Ratios



Changes from Base Year to 2031 LAM

In general, the forecast volume-to-capacity ratios increase from the 2008 Base Year to the 2031 LAM as a result of the increases in forecast vehicle flows over this period. There are some areas that see larger, in terms of absolute increase in the forecast volume-to-capacity ratio than others.

The A47 and the A563 are forecast to experience some of the larger increases in the volume-to-capacity ratios along sections of these routes. These are showing areas where congestion and 'stress' on the network are forecast to increase between the 2008 Base Year and the 2031 LAM.

Changes due to Proposed Mitigation Measures

There a number of isolated changes to the forecast volume-to-capacity ratios with the proposed mitigation measures. It is worth noting at this point that, due to the limited forecast vehicle flow changes with the incremental inclusion of the 'soft' Smarter Choice measures, there is no significant change in forecast volume-to-capacity ratios between the two mitigation scenarios.

There are forecast increases in volume-to-capacity ratios along some sections of the A47 between the junction with the B582 and Braunstone Lane. This is due to the increases forecast flows along this corridor which result from the increased capacity at junctions along this route. These increases in capacity can be seen through reductions in the volume-to-capacity ratios on the westbound approach to the junction with the B582, and the eastbound approach to the junction with Kirby Lane.

Another corridor that sees a forecast increase in volume-to-capacity ratios is the A426 corridor. This corridor is also forecast to see an increase in vehicle flows as a result of the proposed mitigation, most notably due to increases in capacity at the junction with the A563. This increase in flow results in higher forecast volume-to-capacity ratios. This corridor is also influenced by additional bus lanes along the route, which in some cases are a reallocation of lanes from general traffic to bus only. This will potentially reduce the capacity of the links for general highway traffic, and therefore increase the volume-to-capacity ratios at these locations.

It is worth noting that, due to the addition of the link road between the A563 and the A426 at the junction between these two routes, no change in volume-to-capacity ratios are shown on the A563 western and A426 northern approaches to this junction.

Due to the proposed traffic calming measures in the package of mitigation measures, there are forecast reductions in flow in the three areas where traffic calming has been tested: within Narborough and Enderby; within Kirby Muxloe; and within Glenfield. These forecast reductions in flow have the effect of reducing the forecast volume-to-capacity ratios at these locations, particularly in the PM Peak hour.

Another area of the model that sees a forecast reduction in volume-to-capacity ratios is within Blaby. This is as a result of highway flows being attracted to the Blaby Bypass from the town centre with the signalisation of the junction with the B582. This effect is most notable in the results from the PM Peak hour (17:00 – 18:00).

5.2.4 Forecast Journey Times

The forecast journey times for a number of key routes in and around Blaby District have been extracted from the model. These are the A47, A426, A563, B4114 / A5460 and B582, with Figure 5.16 showing these fives routes.

Figure 5.16: Highway Journey Time Routes Assessed

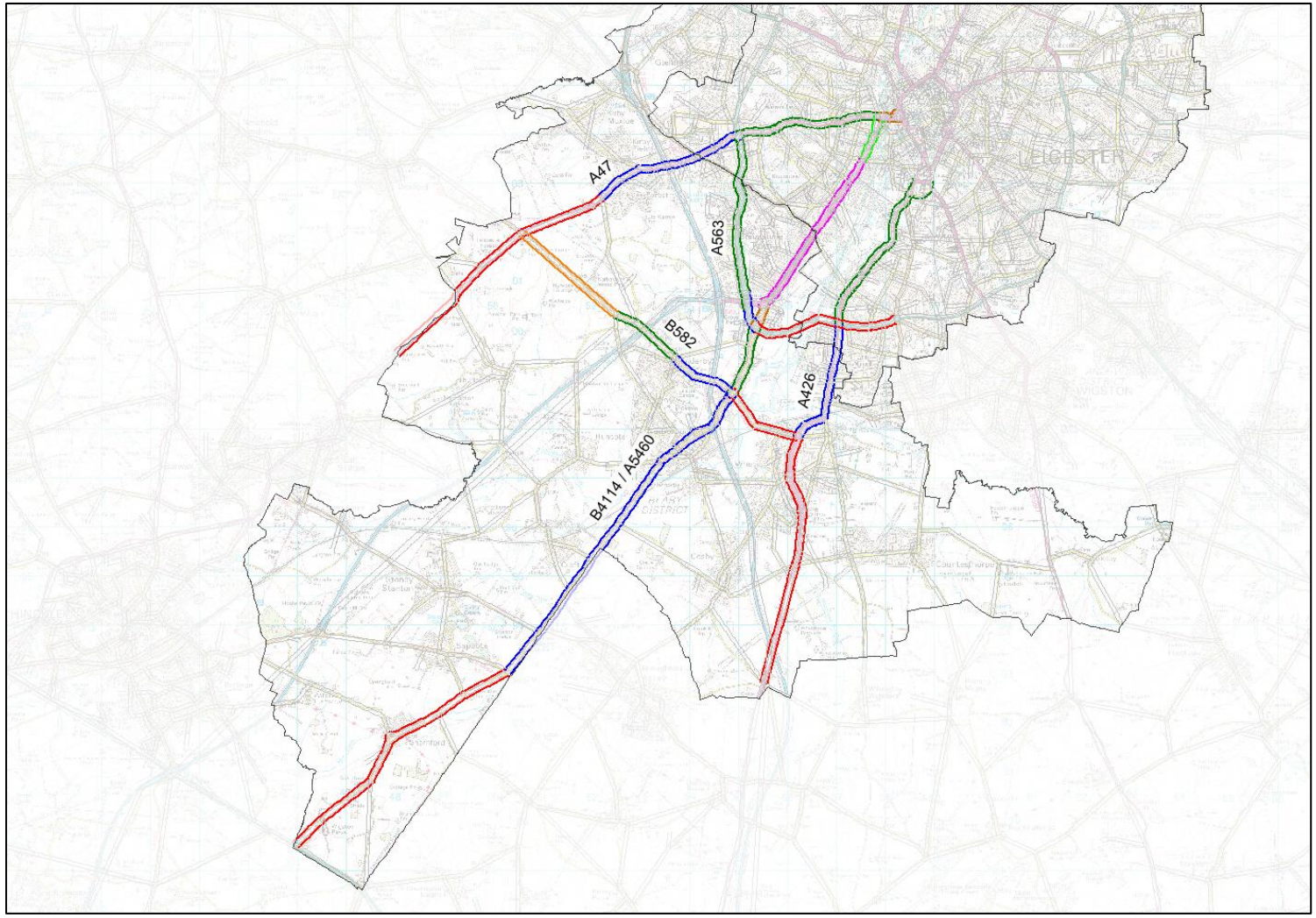


Table 5.7 and Table 5.8 give the percentage change in forecast modelled journey times for these five journey time routes selected in the AM Peak (08:00 – 09:00) and PM Peak (17:00 – 18:00) hours respectively. These differences are given between the 2031 LAM and the 2008 Base Year, and then between the two mitigation scenarios, 'Hard' Only and Mitigation, and the 2031 LAM. No differences are given between the 2031 Mitigation and 'Hard' Only scenarios, showing the incremental effect of Smarter Choice measures is included.

These changes in journey time are colour-coded based on their impact on the network performance. Reductions in forecast journey times are a positive impact on the network, and are therefore shown in green, whereas increases in journey times are a negative impact and therefore shown in red.

Table 5.7: Change in AM Peak Hour Forecast Journey Times

Location	Dist (km)	2031 LAM – 2008 Base	2031 'Hard' Only – LAM	2031 Mitigation – LAM
A47 Eastbound	12.31	17%	-7%	-7%
A47 Westbound	11.99	17%	-4%	-4%
B4114 / A5460 Northbound	19.81	8%	-1%	-2%
B4114 / A5460 Southbound	19.82	13%	0%	0%
A426 Northbound	11.57	21%	-1%	-2%
A426 Southbound	11.62	27%	-6%	-7%
B582 Eastbound	7.62	20%	-7%	-8%
B582 Westbound	7.60	3%	2%	2%
A563 Clockwise	7.05	18%	-5%	-6%
A563 Anti-clockwise	7.02	2%	-9%	-10%

Table 5.8: Change in PM Peak Hour Forecast Journey Times

Location	Dist (km)	2031 LAM – 2008 Base	2031 'Hard' Only – LAM	2031 Mitigation – LAM
A47 Eastbound	12.31	14%	-9%	-9%
A47 Westbound	11.99	26%	-5%	-5%
B4114 / A5460 Northbound	19.81	13%	0%	-1%
B4114 / A5460 Southbound	19.82	15%	-2%	-2%
A426 Northbound	11.57	24%	-4%	-4%
A426 Southbound	11.62	25%	-7%	-3%
B582 Eastbound	7.62	10%	0%	0%
B582 Westbound	7.60	3%	1%	1%
A563 Clockwise	7.05	26%	-6%	-6%
A563 Anti-clockwise	7.02	18%	-1%	-1%

Changes from Base Year to 2031 LAM

With the increase in vehicle flows forecast between the 2008 Base Year and the 2031 LAM, there are increases in all the total journey times for the five routes detailed in the section, in both directions and time

periods. Generally the increases in forecast journey times are around 20%, although there is variation around this by route, direction and time period.

The routes that experience the lowest forecast increase in journey times are the B582 westbound in both time periods, with a forecast increase of 3%, and the A562 anti-clockwise in the AM Peak hour with a forecast increase of 2%. The route that sees consistently higher than average increases in total forecast journey times is the A426. This journey times for this route are forecast to increase by between 21% and 27% depending on the time period and direction.

Changes due to Proposed Mitigation Measures

With the inclusion of the proposed 'hard' mitigation measures in the 2031 'Hard' Only scenario, the majority of the total journey times are forecast to reduce in comparison to the 2031 LAM. There are some routes that see an increase in forecast journey time, although these increases are relatively small.

The total journey time for the A47 route is forecast to decrease by between 4% and 9% depending on the time period and direction. The A563 route see forecast journey time reductions of between 1% and 9% depending on direction and time period, with the A426 forecast to see reductions in total journey times of between 1% and 7%.

There is little forecast change in total journey times for the B4114 / A5460 route with the proposed 'hard' measures. For the B582, there is a forecast decrease in total journey time of 7% in the eastbound direction, with a 2% increase in the westbound direction in the AM Peak hour. In the PM Peak hour there is little change in the eastbound or westbound direction for this route.

There is little incremental change in the forecast journey times between the 2031 'Hard' Only and Mitigation scenarios. Generally the forecast improvements in journey times along these five routes are greater with the inclusion of the Smarter Choice measures; however the differences are relatively small in magnitude.

5.3 Environmental Forecasts

Within LLITM is an environmental assessment tool, called EASE, which takes the results of the highway and public transport models and uses these to estimate air pollutants and carbon emissions based on these outputs. This is based on advice from DEFRA on the future emission rates for vehicles, and uses the DEFRA Emissions Factor Toolkit (EFT). This process is different from that adopted as part of the Blaby District's Local Air Quality Management.

Underpinning this process is the need, for the purposes of forecasting air pollutant and carbon emissions, to have an estimate of the highway volumes, including the proportion of HGVs, and their travel speeds on each link in the model for every hour within an average weekday, Saturday and Sunday. Since the highway and public transport models only represent three (AM Peak, average interpeak and PM Peak) of these 72 hours that are required, the remaining hours are estimated based on these three modelled hours. This involves the use of long-term traffic count data to map the three hours to the 72 hours that are required, and attributes from the highway model to estimate the speed on a link for a given volume of traffic.

Given this methodology, it should be noted that this process has not been calibrated to observed data at individual locations. Therefore, the 2008 Base Year emissions at a given location may not replicate observations on particular emissions at specific locations. The results of EASE therefore should be used to give forecasts of changes in emissions, and to give indications of where air quality issues may arise or be alleviated. These areas should then be subject to further detailed assessment.

Within these environmental forecasts there are two separate elements on emissions: local air quality pollutants; and area-wide carbon emissions. The forecasts for these two elements of emission are discussed in Section 5.3.1 and 5.3.2 respectively.

5.3.1 Air Quality Pollutant Emissions

In this assessment, the forecast levels of air quality pollutants has been assessed for hydrocarbon, nitrogen oxides and particulate matter for each of the four model scenarios.

DEFRA advice is that the rates at which these air quality pollutants are emitted from vehicles will fall significantly over the coming years. There are two factors that result in this predicted fall: the fuel consumption efficiency improvements over time (i.e. vehicles burning less fuel for a given distance travelled); and the fuel itself being burnt more efficiently over time (i.e. less of the fuel is released as un-burnt pollutants). This means that, even with the expected levels of traffic growth within the model, it is forecast that the levels of air quality pollutants with fall from 2008 levels.

Table 5.9 shows the forecast air quality emissions from the 2008 Base Year, 2031 LAM, 2031 'Hard' Only and 2031 Mitigation scenarios. This table gives the forecast levels of hydrocarbons, nitrogen oxides and particulate matter for links within the Blaby District reporting sectors based on the same mapping used in the highway network statistics (see Figure 1.3). Also included in this table are the forecasts for Leicestershire, including Leicester City, to provide context for the forecasts for Blaby District.

Percentage changes are given between the 2008 Base Year and the 2031 LAM, and then between the two mitigation scenarios and the 2031 LAM. No percentage differences have been given between the 2031 'Hard' Only and Mitigation scenarios.

In addition to this, emissions for this links that constitute the journey time routes (as shown in Figure 5.16) have also been extracted from the model. It is worth noting that some of these journey time routes extend out from Blaby District, most notably into Leicester City centre.

Table 5.9: Forecast Air Quality Pollutant Emissions

		2008 Base	2031 LAM		2031 'Hard' Only		2031 Mitigation	
HydroCarbons, g/km/day	Blaby - PUA	708,313	307,069	-56.6%	311,176	1.3%	310,427	1.1%
	Blaby - Urban	466,472	199,164	-57.3%	196,982	-1.1%	196,186	-1.5%
	Blaby - Rural	156,827	76,081	-51.5%	75,169	-1.2%	75,106	-1.3%
	Blaby District	*1,331,612*	*582,314*	*-56.3%*	583,328	0.2%	581,720	-0.1%
	Leicestershire	*10,739,716*	*4,538,980*	*-57.7%*	*4,543,384*	*0.1%*	*4,542,992*	*0.1%*
	A426	224,996	74,520	-66.9%	83,028	11.4%	82,986	11.4%
	A47	242,582	96,082	-60.4%	97,744	1.7%	97,759	1.7%
	A563	189,521	71,216	-62.4%	72,565	1.9%	72,511	1.8%
	B4114 / A5460	262,346	101,876	-61.2%	99,541	-2.3%	99,351	-2.5%
	B582	44,131	19,467	-55.9%	18,522	-4.9%	18,422	-5.4%
Nitrogen Oxides (NOx), g/km/day	Blaby - PUA	3,326,384	720,000	-78.4%	726,876	1.0%	725,650	0.8%
	Blaby - Urban	2,265,122	543,089	-76.0%	536,691	-1.2%	535,193	-1.5%
	Blaby - Rural	712,140	211,418	-70.3%	209,482	-0.9%	209,405	-1.0%
	Blaby District	*6,303,646*	*1,474,507*	*-76.6%*	1,473,049	-0.1%	1,470,248	-0.3%
	Leicestershire	*40,597,574*	*9,606,060*	*-76.3%*	*9,610,282*	*0.0%*	*9,610,371*	*0.0%*
	A426	786,449	147,401	-81.3%	161,541	9.6%	161,611	9.6%
	A47	758,785	164,147	-78.4%	169,300	3.1%	169,400	3.2%
	A563	790,311	138,667	-82.5%	145,195	4.7%	145,056	4.6%
	B4114 / A5460	958,929	208,871	-78.2%	203,762	-2.4%	203,433	-2.6%
	B582	190,173	46,680	-75.5%	44,143	-5.4%	43,965	-5.8%
Particulate Matter (smaller than ~10 micrometers), g/km/day	Blaby - PUA	193,393	132,549	-31.5%	133,707	0.9%	133,394	0.6%
	Blaby - Urban	125,228	71,169	-43.2%	70,278	-1.3%	70,053	-1.6%
	Blaby - Rural	42,748	26,760	-37.4%	26,490	-1.0%	26,474	-1.1%
	Blaby District	*361,369*	*230,478*	*-36.2%*	230,476	0.0%	229,922	-0.2%
	Leicestershire	*2,594,016*	*1,899,093*	*-26.8%*	*1,901,488*	*0.1%*	*1,901,574*	*0.1%*
	A426	53,289	35,244	-33.9%	39,572	12.3%	39,566	12.3%
	A47	54,416	45,344	-16.7%	46,177	1.8%	46,184	1.9%
	A563	50,889	39,048	-23.3%	41,001	5.0%	40,969	4.9%
	B4114 / A5460	62,480	45,073	-27.9%	43,627	-3.2%	43,543	-3.4%
	B582	10,484	6,859	-34.6%	6,500	-5.2%	6,472	-5.6%

In addition to providing tabular data, EASE also provides graphical results showing the forecast change in air quality pollutants. It should be noted that where new links have been created between scenarios, such as the Warren Park Way link road or the A563 / A426 link road, no change in emissions will be displayed within EASE as the graphical representation of the network has changed at these locations.

Figure 5.17, Figure 5.18 and Figure 5.19 show the forecast change in air quality emissions between the four modelled scenarios. Figure 5.17 shows the forecast change between the 2008 Base Year and the 2031 LAM, Figure 5.18 show the change between the 2031 LAM and 'Hard' Only scenarios, with Figure 5.19 showing the change between the 2031 LAM and Mitigation scenarios.

Figure 5.17: Forecast Change in Air Quality Emissions: 2008 Base Year to 2031 LAM

Figure 5.18: Forecast Change in Air Quality Emissions: 2031 LAM to 'Hard' Only

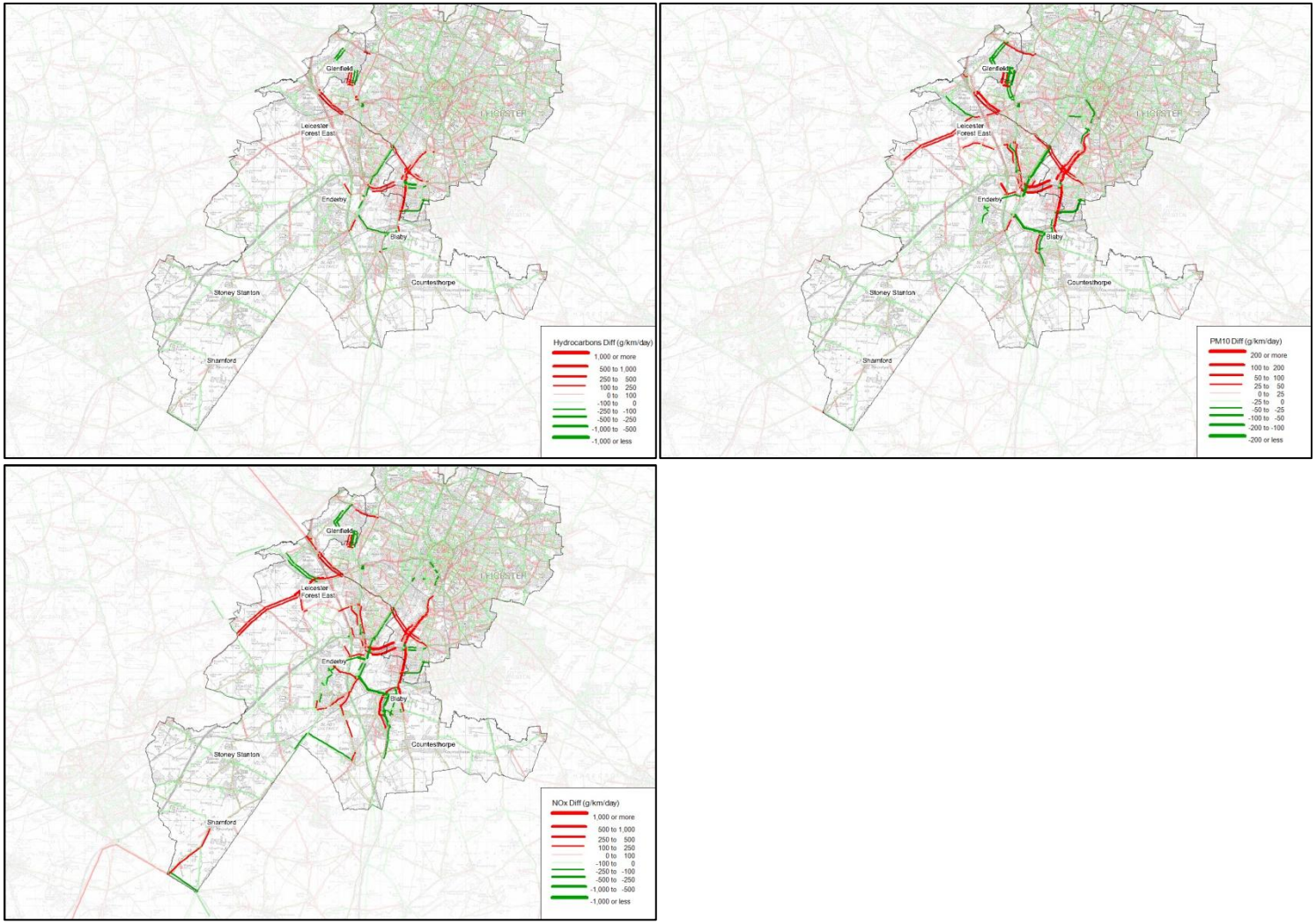
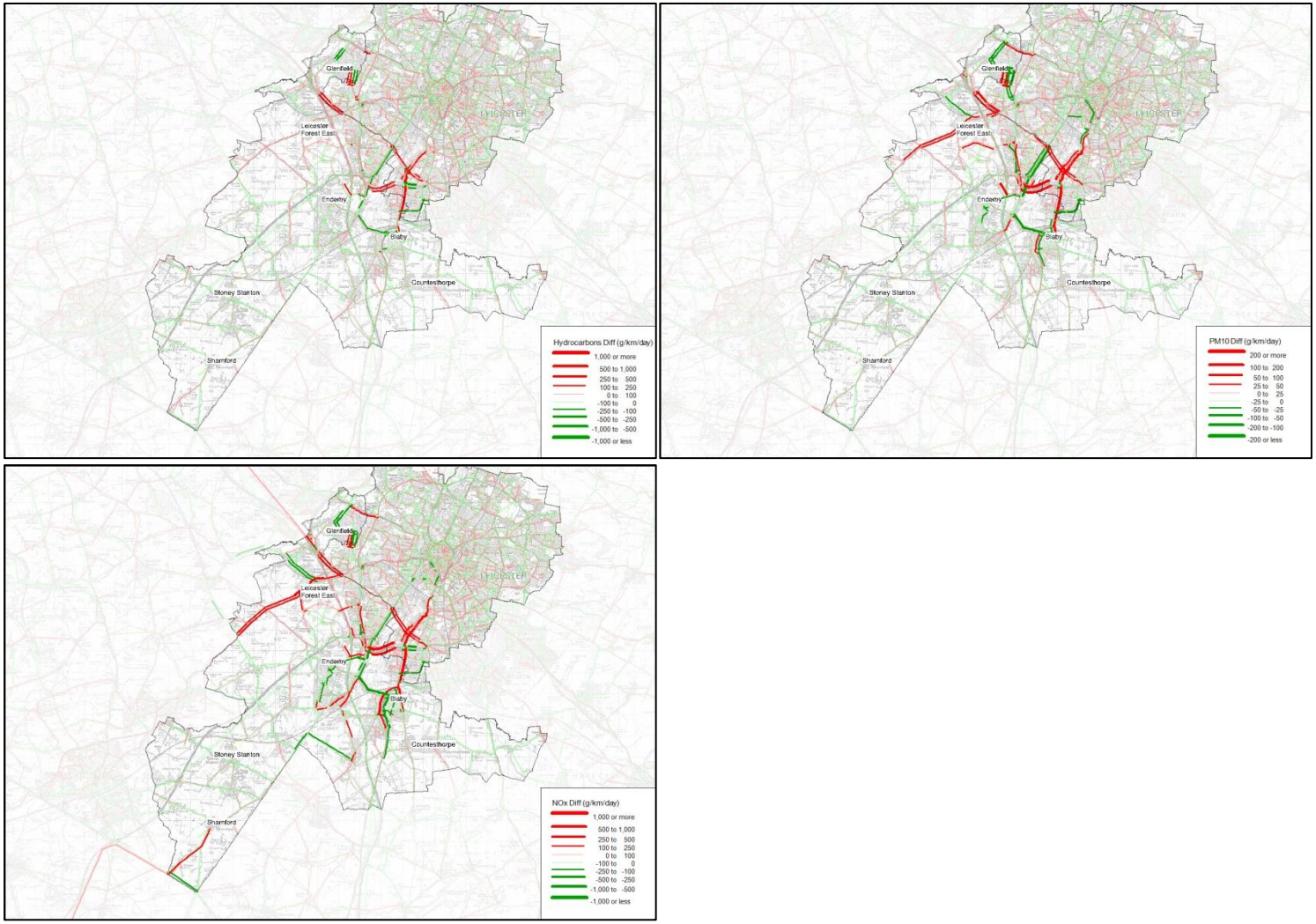


Figure 5.19: Forecast Change in Air Quality Emissions: 2031 LAM to Mitigation



Changes from Base Year to 2031 LAM

As previously mentioned, forecast levels of air quality pollutants are expected to fall over time despite expected increases in traffic, and this is the case in these forecasts. Across Leicestershire as a whole, the levels of hydrocarbon emissions are forecast to fall by almost 58% from the 2008 Base Year to the 2031 LAM, with forecast reductions of 76%, in nitrogen oxides, and of 27% in terms of particulate matter. A broadly similar pattern is replicated within Blaby District with forecast reductions of 56% for hydrocarbons, 77% for nitrogen oxides and 36% for particulate matter. The forecast reductions in particulate matter within Blaby District are higher than those for the county average.

In terms of the variation within the reporting areas, the general pattern is for higher, and comparable, levels of forecast reductions within Blaby PUA and Urban reporting areas in comparison to Blaby Rural. This is the case for both hydrocarbons and nitrogen oxides, but not for particulate matter which sees the lowest forecast reduction in Blaby PUA.

Considering the air quality pollutants forecast for the five journey time routes, generally the reductions along these routes are above the district average, although it is worth noting that these routes do extend outside Blaby District. This is the case of all routes for hydrocarbons and nitrogen oxides with the exception of the B582 which is below the district average. For particulate matter, the reductions along these five routes are all forecast to be below the district average, with the largest reductions forecast for the A426 and B582.

Changes due to Proposed Mitigation Measures

Within a given forecast year, the main determinant of the vehicle emissions is the forecast highway flow and the forecast speed. This means that there are no vehicle efficiency assumptions included in the changes forecast between the 2031 LAM and the two mitigation scenarios. It is also worth noting that there is an optimum speed for minimising vehicle emissions, and so an increase or decrease in forecast speeds does not immediately correspond with an increase or decrease in emissions.

Considering the forecast highway network statistics contained within Table 5.5 and Table 5.6, these show that there is forecast to be an increase in traffic (in terms of vehicle-kms) within Blaby PUA, with reductions in traffic in Blaby Urban and Rural reporting sectors in the 2031 mitigation scenarios compared to the 2031 LAM. This corresponds with the forecast changes in air quality pollutants within these areas, with increases in pollutants within Blaby PUA, and reductions in Blaby Urban and Rural sectors.

For Blaby District as a whole, in the two peak hours there is forecast to be an increase in traffic in the AM Peak hour, but a decrease in the PM Peak hour. From this it could be expected that there is an almost neutral change in total traffic when this is converted to the 72 hours that are required by the EFT. This is what the forecasts for Blaby District show, with little forecast change in the three pollutants from the 2031 LAM with the introduction of the proposed mitigation measures.

In terms of the assessed routes, there are forecast increases in pollutants with the mitigation measures along the A563, the A47 and in particular the A426, with forecast reductions along the B4114 and B582. Comparing the figures of the forecast changes in air pollutants with the introduction of the mitigation measures (Figure 5.18 and Figure 5.19) with the forecast changes in vehicle flows (Figure 5.2 to Figure 5.9) it can be seen that these show a similar pattern of change. Where there are increases in forecast vehicle flows with the mitigation measures, there are also forecast increases in emissions at these locations.

This suggests that the change in forecast volumes along these routes is the main driver of changes in emissions, although changes in forecast speeds will also impact on the forecasts. This is particularly relevant along the A426 where increases in capacity at the junction with the A426 have increased forecast volumes along this route, and therefore forecast emissions.

This correlation corresponds with assumption that emissions are related to the forecast highway flows. Along routes where the capacity has increased as a result of the proposed mitigation measures, resulting in more traffic being attracted to the corridor, there are corresponding increases in emissions along these corridors.

Considering the incremental change in emissions between the 2031 'Hard' Only and 2031 Mitigation scenarios, i.e. the impact of the proposed Smarter Choice measures, there is little difference between the forecasts for these two scenarios. In general the forecasts with Smarter Choice measures are for lower levels of emissions compared to the 'hard' measures only, but the differences are relatively small in comparison to the forecast changes over time, and those with the implementation of the 'hard' measures.

5.3.2 Carbon Emissions

Carbon emissions are an aggregated measure of emissions, and therefore have been reported for Leicestershire, including Leicester City, as a whole, with the contribution from links within Blaby District also reported. Table 5.10 shows the forecasts for carbon emissions, in tonnes per year, for Leicestershire and Blaby District. As with air quality emissions, percentage differences are given between the 2008 Base Year and 2031 LAM scenarios, and then between the 2031 LAM and the two mitigation scenarios. No differences are included between the 2031 'Hard' Only and Mitigation scenarios.

Table 5.10: Forecast Carbon Emissions (tonnes/year)

	2008 Base	2031 LAM		2031 'Hard' Only		2031 Mitigation	
Blaby District	84,626	87,902	3.9%	87,642	-0.3%	87,555	-0.4%
Leicestershire	548,963	582,926	6.2%	582,859	0.0%	583,057	0.0%

Changes from Base Year to 2031 LAM

As with air quality emissions, the level of carbon emissions is not forecast to change in line with traffic growth over time. Between the 2008 Base Year to the 2031 LAM, within Leicestershire the level of carbon emissions is forecast to increase by 6.2%, with an increase in Blaby District of 3.9%. This is in comparison to traffic growth of around 28% within Leicestershire and 24% within Blaby District.

The reason carbon emissions are not forecast to grow at a comparable rate to traffic is that vehicles are forecast to become more efficient. The amount of fuel required to travel a given distance is forecast to reduce over time. However, in contrast to air quality emissions, the efficiency by which that fuel is burnt does not affect the level of carbon emissions. Due to this, there are not the forecast reductions in carbon emissions that are given for air quality pollutants between the 2008 Base Year and the 2031 LAM (see Table 5.9).

The lower forecast growth in carbon emission from within Blaby District corresponds with the lower forecast growth in traffic within the district compared to the county as a whole. Leicestershire is forecast to see growth in traffic between the 2008 Base Year and the 2031 LAM of around 27% to 28% based the two peak hours, with the corresponding forecast growth within Blaby District of around 23% to 24%.

Changes due to Proposed Mitigation Measures

With both mitigation tests, with the 'hard' infrastructure schemes and with the addition of the Smarter Choice measures, the forecast level of carbon emissions across Leicestershire does not change significantly. The contribution to Leicestershire's total carbon emissions from within Blaby District falls marginally in the two mitigation scenarios.

With the ‘hard’ measures, carbon emissions for traffic within Blaby District are forecast to fall by 0.3% compared to the 2031 LAM, with a marginally larger forecast reduction of 0.4% with the complete set of mitigation measures, including Smarter Choice measures, compared to the 2031 LAM.

Section 6 – Summary and Conclusions

This section provides a summary of the results of the LLITM modelling work undertaken to assess the proposed Blaby District Core Strategy. The Blaby District Core Strategy has been informed by a number of previous studies including the transportation assessment of development dispersal using ODYSSEUS (URS, December 2011). This work has also drawn on the existing forecasting work undertaken to assess the proposed Lubbesthorpe development to the west of Leicester City, and has tested a number of proposed mitigation measures in order to offset the impacts of the growth associated to the Core Strategy.

The mitigation measures consist of both 'hard' infrastructure schemes, such as junction improvements and bus service frequency changes, and 'soft' Smarter Choice measures. These 'soft' measures are those that cannot be directly represented in the model, and reflect the likely impacts of travel planning and marketing measures aimed at reducing car travel.

This section also includes conclusions on the mitigation measures proposed based on the modelling work undertaken as part of this study.

6.1 Land-Use Forecasts

The land-use model uses the planning policy assumptions that were adopted as part of the Lubbesthorpe application, which differ from the current policies assumed for the Core Strategy. The differences between these two sets of planning policies are at a minimum in 2031, making this reporting robust, and were deemed by the client group to not be sufficient enough to warrant re-running the land-use model.

Within Blaby District, the land-use model is forecasting growth between 2008 and 2031 in population of 16,068 (or 17%), in households of 11,136 (or 29%) and in terms of employment of 1,949 jobs (or 4%). For population and employment, the highest forecast growth occurs within the Principal Urban Area (PUA) of Blaby District adjacent to Leicester City, mainly due to the proposed Lubbesthorpe development in this area.

It should be noted that the Core Strategy assumes growth of 9,209 dwellings over the same period. This appears to contradict the forecast for 11,136 additional households from the land-use model. The reason for this difference is that the land-use model forecasts using additional floorspace, rather than a specific number of dwellings. This allows for multiple-occupancy households to reside within a single dwelling.

It is also worth noting that the methodology adopted for this study does not allow for land-use to respond to the mitigation measures proposed. The likely effect of the mitigation measures on land-use would relate to the relative accessibility of certain areas. If the accessibility to an area was improved through highway network improvements or increased public transport provision, population and employment is more likely to reside at that location. Conversely, if the accessibility worsens due to, for example, increased highway delays, then population and employment are less likely to reside at that location.

6.2 Demand Forecasts

6.2.1 Demand Production Forecasts

These changes in land-use drive the demand forecasts within the model. Increases in population and employment result in increases in travel by car, public transport and active mode (walking or cycling).

The demand model's unit of demand is the tour, which are the linked outbound and return trips of a specific journey. For example, a commuting trip to and from work is two individual trips, but this is seen as a single tour in the demand model linking the two trips of this tour.

The demand model forecasts that, during a neutral 24-hour weekday, highway demand (excluding freight demand) produced within Blaby District will increase by 16.6% from 2008 to 2031 without any of the proposed mitigation measures. Similarly, public transport productions are forecast to grow by 18% over the same period, with active mode demand growing by 18.7%. These three growth figures are broadly in line with the forecast population growth of 17%.

Comparing this to the county averages, the forecast growth between 2008 and 2031 for Leicestershire, including Leicester City, for highway demand (excluding freight) is almost 28%, which is higher than that forecast for Blaby District. The forecast growth in public transport is almost 8%, which is below that forecast for Blaby District, with the growth in active mode broadly comparable at around 17%.

The proposed 'hard' mitigation measures mainly focus on junction improvements, bus service frequency increases and some traffic calming measures within urban areas. The impact on forecast demand produced within Blaby District of these proposed measures is an increase in public transport demand, with corresponding reductions in car demand and active mode demand. This increase in forecast public transport demand is primarily located outside the PUA, and is the result of the increased service frequencies and the Better Bus Area schemes. The Better Bus Area schemes provide a number of additional bus lanes along the A426 corridor into and out of Leicester City. These interventions are forecast to reduce the bus journey times along this corridor, making these services a more attractive option.

With the introduction of Smarter Choice measures there is a further forecast reduction in car demand. This reduction is around 0.5% of productions within Blaby District compared to the 2031 scenario with only the 'hard' mitigation measures. This decrease in car demand is countered by an increase in the forecast active mode demand, with little change in the forecast public transport demand.

It is worth noting the relative impact on car demand of the proposed mitigation measures in comparison to the growth over time due to the Core Strategy. Car demand over 24-hours is forecast to increase by 16.6% between 2008 and 2031 without any of the proposed mitigation. With the complete package of mitigation measures, 'hard' and 'soft' measures are forecast to reduce the 2031 car demand by 0.6%. This still leaves growth of 15.9% growth in car demand from 2008 to 2031 with the complete package of mitigation measures.

6.2.2 Mode Share Forecasts

In terms of forecast mode shares based on these demand forecasts, from 2008 to 2031 without any of the proposed mitigation, the forecast mode shares for the District do not change significantly. There is a marginally reduction in car mode share, with a corresponding increase in active mode. There is more variation within Blaby District, with a more significant reduction in car mode share within the PUA, and a forecast increase in car mode share within the rural areas of Blaby District.

The proposed 'hard' mitigation measures have a negligible effect on forecast mode shares in 2031, with only a marginal increase in the public transport mode share due to the forecast increases in demand for this mode.

With the introduction of the Smarter Choice measures there are forecast reductions in car mode share of 0.5 percentage points across Blaby District, a reduction from 70.7% to 70.3%. There is some variation around this average within Blaby District, with higher forecast reductions within the Blaby Urban and Rural areas, with a below average reduction within the PUA. These reductions in car mode share are primarily countered by corresponding increases in active mode.

6.3 Highway Performance Forecasts

As part of this study, a review of the base year highway model performance was undertaken. This performance review is not a thorough model audit, and the public transport model has also not been reviewed as part of this study. However, given the conclusions on the performance of the base year model (see Section 3.2) the base year highway model is suitable for this strategic study.

The above demand forecasts look at the demand produced by land-use within Blaby District. This section looks at the impact of this growth, and that within the model as a whole, on the network within Blaby District. This traffic reported using the Blaby District highway network includes demand to / from Blaby District and traffic passing through the District.

The vehicle information summarised in this section includes both car and freight demand, but excludes bus flows on links within the model, and is reported for the AM Peak (08:00 – 09:00) and PM Peak (17:00 – 18:00) hours.

6.3.1 Network Performance Forecasts

Considering the growth between 2008 and 2031 without any of the proposed mitigation measures, the level of traffic on the Blaby District network, measured in terms of vehicle-kilometres, is forecast to grow by around 24% in the AM Peak and PM Peak hours. There is not forecast to be any significant variations in forecast traffic growth between the three sub-areas of Blaby District.

This increase in traffic results in forecast average speeds to reduce by between 12% and 14% across the District as a whole. As opposed to the traffic growth, there is a variation in the forecast reductions of average speeds within Blaby District. The highest forecast reductions in average speeds are forecast within the PUA at between 15% and 18%, with lower forecast reductions in the urban and rural areas.

Comparing this against the county average, the forecast growth in traffic across Leicestershire is between 27% and 29%, which is above the growth forecast within Blaby District. However, this higher forecast growth in traffic across the county compared to Blaby District results in lower forecast reductions of average speed of between 10% and 13%.

The inclusion of the proposed package of mitigation measures, both ‘hard’ and ‘soft’, results in some increase in traffic in the AM Peak hour, with some reduction in traffic within the PM Peak hour. These changes are 0.5% increase in the AM Peak hour, with a forecast 0.6% reduction in the PM Peak hour. Irrespective of the direction of change in traffic, in both modelled hours, the forecast average speeds across the District reduce by 0.1% in the AM Peak hour and 2% in the PM Peak hour. The following are some potential sources of this general reduction in average speeds with the mitigation:

- Proposed is a number of traffic calming measures as part of the package of mitigation measures, and these by their nature will reduce speeds along these routes.
- There are a number of new signalised junctions proposed as part of the mitigation measures. The staging and timings of these new signalised junctions have not been optimised for the forecast future year flows, and so may not represent the optimal, or likely, performance of these junctions.
- Some of the junction improvements result in increases in capacity, and these result in higher forecast flows at other junctions on the network. Whilst delays may be reduced at the improved junctions, this may result in increases in delay at other junctions.

It is worth noting that the incremental change with the inclusion of the proposed Smarter Choice measures is marginally in comparison to the forecast change with the complete package of mitigation measures. The

highway network performance is marginally better with the inclusion of the Smarter Choice measures, but the changes are relatively small.

As with the demand forecasts, it is worth putting the forecast changes in network performance with the proposed mitigation measures in the context of the forecast changes between 2008 and 2031 without any of the proposed mitigation. Traffic is forecast to growth by around 24% within Blaby District between 2008 and 2031 without any mitigation, with the mitigation changing this forecast by around ±0.5%.

6.3.2 Highway Flow Forecasts

The 'hard' mitigation measures proposed increase the capacity of a number of junctions, and in so doing make these routes more attractive to car travel. This can be seen in forecast increases in vehicle flows in the AM Peak and PM Peak hours along the A47, A426 and A563 corridors with the introduction of the 'hard' mitigation measures.

In addition to these forecast increases along these three corridors, there are also a number of locations where flows are forecast to reduce with the introduction of the 'hard' mitigation measures. These are:

- the routes where traffic calming is proposed;
- within Blaby as traffic is attracted to the A426 Blaby Bypass; and
- eastbound on the B582 on the approach to the junction with the A426.

This forecast reduction in traffic on the B582 approaching the junction with the A426 is due to a forecast reduction in capacity for this approach with the signalisation of the junction between these two roads. In signalising this junction, priority was given to the A426 movement. However, different staging and signal times at this junction may optimise the performance and at least retain the capacity of each approach, if not increasing the capacity of some approaches.

In terms of the incremental change in forecast highway flows with the inclusion of Smarter Choice measures, there is little forecast change with the inclusion of these 'soft' measures.

6.3.3 Congestion Forecasts

As discussed in Section 5.2.3, volume-to-capacity ratios have been used as an indicator of network stress, and areas that risk congestion given the forecast flows in the highway model. This measure looks at the forecast highway flows against the forecast limiting capacity, either from the link or the junction.

Overall growth within Blaby District is forecast to increase the volume-to-capacity ratios from 2008 to 2031 without any of the proposed mitigation measures. The most significant increases in this volume-to-capacity ratio are located on the A47 around the junction with the B582, and on the A563 to the east of the A426.

Given the limited changes in flow with the incremental inclusion of the 'soft' mitigation measure proposed, the changes in congestion with the proposed mitigation are attributable to the 'hard' mitigation measures. The main areas of change in congestion relate to where flows are forecast the increase or decrease, and also where junction improvements are made. These locations are:

- Along the A47 there is a general increase in volume-to-capacity ratios as forecast flows increase; however there are reductions on the approaches to junctions where improvements have been proposed.
- Along the A426, particularly inside the A563, there are increases in volume-to-capacity ratios resulting from the increases in forecast flows. There are also increases as a result of reductions in

highway capacity at certain locations. These are where new bus lanes are proposed that reallocate lanes to bus-only traffic from general traffic.

- Reductions in volume-to-capacity ratios where traffic calming measures are proposed due to reductions in forecast volumes along these routes.
- A reduction in volume-to-capacity ratios within Blaby as traffic is attracted to the A426 with the improvements to the junction between the A426 and B582 along the Blaby Bypass.

6.3.4 Journey Time Forecasts

Due to the forecast growth in traffic between 2008 and 2031, the journey times assessed in this study along the key routes in and around Blaby District are forecast to increase by around 20% without any of the proposed mitigation measures. There is a variation around this growth in forecast increase in journey times by route and time period, but all total journey times increase from the base year.

With the inclusion of 'hard' mitigation measures there are general improvements in the journey times, particularly along the A47, A426 and A563, with little change forecast along the other routes assessed. Depending on the direction and time period, the following summarises the changes in forecast journey times with the introduction of the 'hard' measures:

- Along the A47 forecast journey times reduce by between 4% and 9%.
- Along the A426 journey times are forecast to reduce by between 1% and 7%.
- Along the A563 forecast journey times reduce by between 1% and 9%.
- Along the B582 there are forecast journey time reductions in the eastbound direction of 7%, with a small increase of 2% in the westbound direction in the AM Peak hour. There is little forecast change in the PM Peak hour.
- There is little or no change in forecast journey times along the B4114 / A5460 journey time route.

There are no significant improvements in forecast journey times with the incremental inclusion of Smarter Choice measures. Generally the forecast journey times are lower with the inclusion of Smarter Choice measures, but the changes are relatively small in comparison to the effect of the proposed 'hard' measures.

It is also worth putting the improvements in journey times forecast for the 'hard' measures in context of the forecast increases from the base year. There is only one journey time route whose forecast journey time in 2031 with the mitigation measures is lower than that forecast in the 2008 Base Year, which is the A563 anti-clockwise in the AM Peak hour. All other routes are forecast to have higher journey times in 2031 with the proposed mitigation compared to the base year.

6.4 Environmental Forecasts

6.4.1 Air Quality Emission Forecasts

Over time, the levels of air quality emissions are forecast to reduce significantly. This is due to the assumptions on emission rates contained within the DEFRA software used to forecast emissions. This takes account of forecast improvements in vehicle fuel consumptions (i.e. the amount of fuel required to travel a given distance) and the improvements in vehicle engine efficiency (i.e. cleaner engines producing lower emissions).

Given these assumptions, from the 2008 Base Year to the 2031 scenario excluding any of the proposed mitigation, the levels of hydrocarbon emissions within Blaby District are forecast to reduce by 56%, with

nitrogen oxide emissions forecast to fall by 77%, and particulate matter emissions forecast to fall by 36%. This is broadly in line with the averages for Leicestershire as a whole, including Leicester City.

With the proposed mitigation measures, the main driver of changes in emissions is the forecast vehicle flows. Where flows are forecast to increase, emissions are also typically forecast to increase, whereas in locations where flows are forecast to reduce, emissions also tend to reduce. The effects of variation in speeds and vehicle composition are comparatively small in the tests undertaken.

On this basis, there is little forecast difference between the emissions forecasts between the mitigation scenarios with only the 'hard' measures and with the complete set of mitigation measures. As the mitigation increases forecast flows along the A47, A426 and A563, there are also forecast increases in air quality emissions along these corridors. Conversely there are forecast reductions in emissions along the B4114 / A5460 and B582 routes as a result of the proposed mitigation measures.

Across Blaby District as a whole, there is little forecast change within 2031 in terms of air quality emissions with the introduction of the proposed mitigation measures; however there is a small forecast reduction.

6.4.2 Carbon Emission Forecasts

In terms of carbon emissions, these are not forecast to reduce as significantly as air quality emissions. This is due to the level of carbon emissions responding to the changes in fuel consumption over time, but not the efficiency by which the fuel is burnt within the engine. Therefore, carbon emissions are not forecast to grow in line with vehicle-kilometres, but also are not forecast to decrease at the same rates as for air quality emissions.

On this basis, carbon emissions across Leicestershire, including Leicester City, are forecast to increase by 6.2% from 2008 to 2031 without any of the proposed mitigation measures. The contribution to this county total from Blaby District is forecast to grow by smaller degree, with growth over this time period forecast to be 3.9%.

With the inclusion of the proposed mitigation measures, carbon emissions across the county do not change significantly. However, the contribution from within Blaby District is forecast to fall. This reduction is forecast to be 0.3% with only the 'hard' mitigation measures, and 0.4% with the complete proposed package.

6.5 Conclusions

With the planned growth contained within the Blaby District Core Strategy, travel demand, including car travel, is forecast to increase by around 17%. The proposed package of mitigation measures reduce this growth in car travel, increasing the growth in public transport and active mode travel, but the effect is marginally in comparison to the overall growth. Car demand is forecast to increase by 16.6% without the proposed mitigation, which is reduced to 15.9% with the mitigation measures, including Smarter Choice measures.

This increase in demand, and the forecast increases in demand for the remainder of Leicestershire and the surrounding areas, results in an increase in traffic on the Blaby District network of around 24%, without the proposed mitigation. This results in average speeds reducing by between 12% and 14%. The proposed package of mitigation measures is not forecast to significantly change the level of traffic or the average speeds experienced within Blaby District.

That said, the mitigation measures are forecast to reduce the delays at a number of key locations, and the reductions in these delays improves the journey times on some of the key routes to / from and around Leicester City. These improved journey times attract highway demand to these corridors, most notably the A47, A426 and A563, increasing forecast flows along these routes.

Overall the proposed mitigation measures are forecast to improve the access between Blaby District and Leicester City. However, they do not represent a step-change in highway network performance or forecast highway demand. These mitigation measures offset some of the impacts of forecast growth between 2008 and 2031, but are not forecast to return the highway network conditions to 2008-levels.

In terms of the incremental impact of Smarter Choice measures, these are forecast to reduce highway demand produced and attracted to Blaby District, but the impact is relatively small in comparison to the overall growth and forecast impact of the 'hard' measures. In order to achieve a more significant effect for Smarter Choice measures, more funding over a sustained period of time would be required.

Appendix A Glossary of Terms

LLITM

LLITM is Leicester and Leicestershire Integrated Transport Model which consists of four main components: a highway supply model, a public transport supply model, a variable demand model, and a land use model. In addition to this LLITM also includes an environmental reporting tool called EASE which calculates and graphically represents results from the model. LLITM can be used to assess the effects of various transport and land use schemes within Leicestershire.

Highway Supply Model

This is a representation of the highway network, onto which highway demand is assigned. This highway demand is split into car, LGV and OGV, with the car demand further split into employer's business and personal business (or 'other') trips with low, medium or high values of time (a proxy for income level).

Public Transport Supply Model

This is a representation of the public transport services in and around Leicestershire, and includes both bus and rail services. The network is a copy of the highway network, with the addition of rail links, with public transport services routing along this network.

Variable Demand Model

This is a WebTAG compliant demand model which alters forecast future year demand in response to change in cost from the various elements of the model: highway; public transport; and parking. These costs include travel time, operating costs such as fuel and charges such as parking charges. Responding to these costs, the demand model allows for changes between mode, time period and attraction.

The demand model also includes an active mode supply model and a parking model of parking within Leicester City and Loughborough.

Active Mode Supply Model

Active mode is non-motorised modes of travel, i.e. walking and cycling. This is assigned onto a copy of the base year highway network. The only alteration to the highway network for active modes is that all one-way links in the highway model are converted to two-ways links for active mode.

The active mode demand is based on limited observed data, and the network does not include footpaths or cycle ways, so care should be taken when considering demand and / or network results from the active mode model.

Parking Model

Within the demand model there is a representation of parking choices within Leicester City Centre and Loughborough. All demand to these two locations is required to find a parking space, be it on-street,

off-street or park and ride, and these choices are reflected in the demand assigned onto the highway and public transport models.

Land-use Model

This forecasts the number of households, population and jobs within each zone of the model. This is based on known committed developments and likely forecast developments within Leicestershire and the surrounding areas. These forecast assumptions are based on a consultation with the local authorities undertaken in 2009.

The land-use model takes account of costs of travel to / from a location, the forecast rents / house prices in an area, and other factors to determine a forecast future year land-use pattern.

EASE (Environmental Assessment Suite)

This takes results from the various elements of the model, and presents these in both tabular and graphical form. Included in this process is an environmental assessment tool which uses the DfT's Emission Factor Toolkit.

LLITM Core Scenario

A core scenario includes a number of land-use assumptions, economic assumptions and the infrastructure changes from the base year. These are applied, with interaction between the transport (demand / highway / public transport) model and the land-use model to build up this core scenario over time. This differs from a 'with intervention' scenario.

LLITM 'With Intervention' Scenario

A 'with intervention' scenario takes the Core Scenario is a given forecast year and introduced one or more changes to the highway infrastructure, public transport service provision, parking provision or Smarter Choice funding. There is no interaction with the land-use model in this scenario, and therefore the household, population and employment forecasts are the same in the two scenarios. This is required in order to perform an economic appraisal of a given set of interventions.

Demand Segmentation

Within the various elements of LLITM, the total travel demand is split into subsets that have similar travel and choice characteristics. This segmentation of demand is different in the different elements of LLITM, and these are detailed below.

Demand Model Segmentation

Within the demand model, the total travel demand is split based on the trip purpose, the trip mode and the car availability. In terms of mode, the travel demand is allocated to highway, public transport or active mode. Not all of these modes are available to all trips. Freight demand is all allocated to highway, with no public transport or active mode freight demand.

In terms of trip purpose, all non-freight travel demand is split based on the purpose of trip. Demand is allocated to commuting, education, shopping, home-based personal business (or 'other'), non-home-

based personal business, home-based employer's business and non-home-based employer's business. Further to this, all non-business demand is further split into three income levels: low; medium and high.

Further to this, travel demand is further split between car availability, or ownership, levels. There are three levels represented in the model: full-car, part-car and no-car. A household is "full" car-owning if it contains at least as many cars as licensed drivers; it is "part" car-owning if it contains more licensed drivers than cars but at least one car; and it is "no" car-owned if it contains no cars.

Highway Model Segmentation

Within the highway model the demand is aggregated into a smaller number of classifications which represent different relative weights attached to time and distance when choosing a route between two locations. Freight demand retained as OGV and LGV, with car demand aggregated to employer's business, and personal business (or 'other') trips with low, medium or high values of time (a proxy for income level).

Public Transport Segmentation

Within the public transport model all public transport demand is assignment with the same assumptions, and therefore demand is treated as a single demand segment. There is no distinction between trip purposes within the public transport model, i.e. between employer's business and personal business trips.

Tours

A 'tour' is a complete journey, starting and finishing at the same point. For example, leaving from home to travel to work and travelling home again in the evening is 1 tour. The tour is distinguished from the 'trip', because a trip is a single-leg of a tour- travel in order to get to a place to carry out some activity. The two-leg home-to-work tour above would therefore be two 'trips', a Home-Work trip followed by a later Work-Home trip.

Home-based trip purposes within the demand model are represented in terms of tours, whereas for non-home-based purposes this representation of travel is not applicable. Therefore, for non-home-based purposes the demand is represented as trips.

Time Periods

In addition to the allocation of demand to demand segments based on trip purpose and income level, travel demand is also allocated to a number of time periods. These are a sub-division of a neutral weekday over 24-hours, and the time periods that are represented differ in the different elements of LLITM.

Demand Model Time Periods

The demand model's unit of time is the modelled period. These are a sub-division of a 24-hour neutral weekday day such that the aggregation of these modelled periods gives 24-hour demand. In total there are five periods represented, although for some elements the two off-peak periods are combined into a single off-peak period:

- Off-peak Early: 00:00 – 07:00

- AM Period: 07:00 – 10:00
- Interpeak period: 10:00 – 16:00
- PM Period: 16:00 – 19:00
- Off-peak Late: 19:00 – 00:00

Within the demand model, home-based trips are represented in tours. Therefore the time period in which this demand is stored is based on both the outbound and return time of the two legs of the tour. These allocations are referred to as time-period-pairs. For example a AM-PM tour has an outbound trip in the AM Period and a return trip in the PM Period.

Highway and Public Transport Assignment Models

The two main assignment models represent three individual hours within a neutral weekday. These three hour are:

- AM Peak hour: 08:00 – 09:00
- Interpeak hour: an average hour within 10:00 – 16:00
- PM Peak hour: 17:00 – 18:00

Productions / Attractions and Origins / Destinations

The “production” of a tour or trip is the location of the traveller’s “base of operations”, usually their own house (possibly a hotel or the house of a friend). It is distinguished from the “origin” of a trip, which is simply the starting point. For example, in the case of a commuter returning home in the evening, their place of work is their origin, but their home is their production. When dealing with tours, the production is both the starting and ending point of the tour.

The “attraction” of a tour or trip is the other end of the tour from the production: the place the traveller is travelling to visit. Again, it is distinguished from the “destination”, which is simply the ending point. In the example above, the commuter’s home is the destination, but their workplace is the attraction.

The demand data within the demand model is stored in production / attractions. This is converted to origin / destination for assignment within the highway or public transport assignment models.

Person and Vehicle Demand

For highway demand there is a distinction required between person and vehicle demand. Person demand determines single-travellers who have chosen to travel by car, as opposed to the number of vehicles in which they travel. The difference between the two sets of demand is the occupancy of the vehicles.

The demand model works in person demand, as passengers within vehicles may choose to switch to public transport or active mode for their journey. For the assignment within the highway model, the matrices are converted into vehicles as their occupancy is irrelevant to this element of the model.

Reference Demand

Reference demand is the future year demand that is purely based on land-use and car ownership changes over time. This is the starting point for LLITM, which then adjusts this reference demand in response to the given scenario’s assumptions. This will (potentially) change the mode, time period and attraction of demand as a result of the costs calculated for a given scenario.

Generalised Cost

Generalised cost is the aggregation of all costs experienced for a given journey, converted into a common unit which is usually minutes.

For example, highway journeys experiences the journey time itself, the fuel expended for the given journey, the vehicle operating costs, and potentially any tolls or charges along the route. Similarly, for a public transport journey there is the journey time, including waiting and auxiliary transit stages, plus the fares for the given journey.

Alternative Specific Constants (ASCs)

ASCs are adjustments to the modelled generalised costs that reflect elements of choice that are not represented in the model. These ASCs are therefore introduced to account for these costs that are not represented in the highway, public transport or active mode assignments, or in the parking model to better replicate observed data.

These ASCs are present in the calibration of the parking model, and are therefore retained in forecasting work. ASCs are also used in the representation of Smarter Choice measures within LLITM.

Modelled Zones

Within LLITM, Great Britain is divided into a total of 953 zones. These zones represent different geographical areas, with greater detail contained within Leicestershire. These zones have been defined based on 2001 Census Output Areas, and are intended to capture areas with similar access to the highway and public transport infrastructure.

In addition to these 953 zones are 20 ‘development’ zones. These are empty in the base year of the model, but are available to represent land-use and demand that is required to be segregated from existing zones, i.e. a large-scale green-field development or a new park and ride site.

PCU

This stands for Passenger Car Unit, which is the unit in which the highway model works. Rather than considering vehicles directly, these are converted into a common unit representing the size of the vehicle in question. Therefore, a car or LGV is one PCU, whereas an OGV or a bus is assumed to be two PCUs.

Smarter Choice Measures

These include workplace and school travel plans and targeted marketing programmes. These interventions typically include a combination of ‘hard’ elements (e.g. improvements to public transport services or reduced fares) which can be directly represented within the LLITM supply models, and ‘soft’ elements, i.e. marketing campaigns and travel plans, whose effect is calibrated within the demand model.

There is limited evidence for the effect of Smarter Choice measures; however the effects calibrated are based on the proposed level of funding for Smarter Choice measures compared with a series of demonstration towns.

Vehicle-Kilometres

This is the result of the multiplication of vehicles by their length of journey, and is a common measure of traffic levels on the highway network. This is generally more informative than the number of vehicles since trips may be of variable length and changes in average lengths of trips over time are generally much larger than changes in total numbers of trips.

Passenger-Kilometres

Similarly to vehicle-kilometres, this is the total public transport passengers multiplied by length of journey. This is a common measure of public transport usage for similar reasons to the use of vehicle-kilometres for highway traffic.

Delay

This is the modelled highway travel time in excess of travel time under 'free-flow' or uncongested conditions. This includes time spent waiting a signals, even in the absence of any other traffic.

Volume-to-Capacity Ratio

This is a measure of congestion or stress on the highway network at individual locations. It looks at the capacity of a link and the forecast flow on that link and calculates the ratio of these two numbers. A value of 100% means that the forecast volume is equal to the link capacity, with values under 100% indicating that the flow is under the link's capacity and values over 100% indicating that they are above capacity.

For the capacity of a link, the constraining capacity from the link and the junction at the end of the link has been used. The capacities of all the turns at the junction at the end of the link are summed together, and the minimum of that value and the link capacity is used in the calculation of the volume-to-capacity ratio. This means that the limiting capacity from the link or the junction is used to calculate the stress on the highway network.

Public Transport Service Headway

The headway of a service in the public transport model is the time, usually expressed in minutes between services. For example, a headway of 30 minutes for a given service in a given period means that this service is run twice an hour in that time period.

Public Transport Generalised Time

The journey time with the public transport model is an aggregation of several different components on the total time from an origin to a destination. Some of these components of time also have a factor applied to them to represent the relative weights travellers attached to each component.

Total generalised time is the sum of in-vehicle time, i.e. the time on the bus or rail service, plus the average waiting time for the services and the auxiliary transit time, which is the journey time not on public transport to get to / from bus stops and within interchanges.

Within the public transport assignment the waiting time is factored by 2, with the auxiliary transit time factored by 1.8 to construct total generalised time.

WebTAG

This is the DfT's transport analysis guidance on the methods and assumptions that should be used in the course of transport studies. This guidance is sub-divided into 'units' which contain the advise on a given topic or area of transport modelling.

Appendix B Smarter Choice Benchmarking

Smarter Choice initiatives are measures such as workplace travel plans, school travel plans, and targeted marketing (i.e. personalised travel planning, travel awareness campaigns, public transport information and marketing), designed to change people's perceptions of travel to positively affect usage of the transport network towards reducing dependence on private cars and increasing physical activity.

This appendix outlines the methodology used to model the effects of Smarter Choices and details the assumptions adopted for the benchmarking of the likely effects of Smarter Choice measures within Blaby District. These assumptions and adopted methodology is based on the guidance contained within WebTAG Unit 3.10.6C, November 2011. At the time of writing, this WebTAG unit is consultation guidance.

B.1 General Modelling Approach

WebTAG Unit 3.10.6C states:

"There is currently no WebTAG guidance on the appraisal of certain Smarter Choice measures, in particular 'soft' measures which are intended to affect demand without affecting actual (as opposed to perceived) cost. However, this Unit does provide guidance on including the impacts of such measure as part of the modelling (and hence appraisal) of 'hard' measures."

WebTAG refers to 'hard' measures as measures that bear directly on the time and money components of generalised cost (e.g. improvements to public transport services or reduced fares) while 'soft' measures change travellers' response to differences or changes in generalised cost. Workplace travel plans and school travel plans potentially involve both 'hard' and 'soft' measures, while targeted marketing initiatives are all 'soft' measures.

It is important to distinguish between 'hard' and 'soft' measures within packages of Smarter Choices as they are modelled in different ways. Whilst 'hard' measures can be represented directly in LLITM, the effects of 'soft' measures, as WebTAG recommends, should be modelled indirectly through changes in model parameters.

WebTAG states that there is currently lack of information to inform the likely effect of Smarter Choice measures. Bearing this is mind, WebTAG suggests the following approach when modelling Smarter Choice measures, and it is this methodology that AECOM has adopted in this study:

1. **benchmark the expected impacts** of the Smarter Choice package based on the available evidence, taking account of the proposed intensity of application compared with the intensity of application to which the evidence relates;
2. **model the 'hard' components** of the Smarter Choice packages explicitly (where possible), and check that the impacts are less than the benchmark; and
3. **model the 'soft' components** of the Smarter Choice package by means of assumed adjustments to the model parameters; check that the impacts are plausible in comparison with the benchmark and the impacts of the 'hard' measures, and that the combined impacts of the 'hard' and 'soft' measures are consistent with the benchmark effect.

B.2 Benchmarking the Impacts of Proposed Measures

The following section details the assumptions used in benchmarking the effects of Smarter Choices measures within Blaby District in accordance with the assumptions provided by the client group on the application of Smarter Choice measures as part of the Core Strategy.

Prior to model the effects of Smarter Choices measures (steps 2 and 3 above), an appropriate benchmark or target car trip reduction should be established separately for each measure to be modelled. This means that a separate benchmark value is required to be derived for workplace travel plans, school travel plans and targeted marketing.

This requires two steps: first, the limited evidence on the observed impacts of Smarter Choices measures, when applied at a full intensity level, needs to be understood and interpreted. Then the impact should be related to the intensity level of the proposed package so that a benchmark of an appropriate scale can be derived. These are explained further in the following.

B.2.1 Evidence on Smarter Choice Measures

WebTAG provides the following statement on the lack of information to inform the likely effect of Smarter Choice measures:

"The evidence available from monitoring studies about the effect of Smarter Choice initiatives is currently limited. While there is some evidence about the effects of packages of measures in aggregate, evidence about the effects of individual 'soft' measures, in a form that informs the specification of how these may be modelled is scarce."

It refers to the following three UK-based studies on the effects of Smarter Choices measures whose results are published online:

- Smarter Choices: Changing the Way We Travel (Cairns et al., 2004);
- The Effects of Smarter Choice Programmes in the Sustainable Travel Towns": Full Report (Sloman et al., 2010); and
- The Smarter Travel Richmond and Smarter Travel Sutton Programmes: http://www.smartertravelrichmond.org, http://www.smartertravelsutton.org.

WebTAG advises that unless the package of Smarter Choices measures to be modelled matches the packages implemented and monitored in one of the subject towns in these studies, it will be difficult to make use of the results from these studies in determining a benchmark or target impact. However, despite its caveats, WebTAG identifies the meta-analysis carried out by Möser and Bamberg[8] (2008) as a more useful evidence for setting benchmark trip or traffic reductions. The results of this study, as summarised in WebTAG, is as follow:

- **Workplace travel plans**: the effects available are the combined effects of both 'soft' and associated 'hard' measures. The analysis suggests that workplace travel plans would increase the overall non-car mode share by 12 percentage points. Given the base mode share (35%), this implies an increase in the number of non-car trips by 34%, or a reduction in the number of car trips by 18% on the assumption that the total number of trips stays unchanged.
- **School travel plans**: the sample reviewed by Möser and Bamberg could be divided into a small group of six best-practice schools where a lot had been achieved, and the rest, where the impacts were marginal, perhaps due to the lack of intensity of application or coordination with the 'hard' measures involved (in those cases the 'hard' measures were 'Yellow' buses). This means that the average increase in the number of non-car trips of 7 percentage points, or the implied reduction in the number of car trips of 10% (from a base mode share of 60%). This would under-estimate the best-practice examples, but over-estimate the others in the school travel sample.

[8] Möser, G and S Bamberg (2008). The effectiveness of soft transport policy measures: a critical assessment and meta-analysis of empirical evidence. Journal of Environmental Psychology, Vol 28, pp10-26

- **Targeted marketing**: the analysis suggests that predominantly information and promotional campaigns would increase the overall non-car mode share by 5 percentage points. Given the base mode share (34%), this implies an increase in the number of non-car trips by 14%, or a reduction in the number of car trips by 8%.

B.2.2 Benchmarking

The following table shows a summary of Möser and Bamberg results.

Table B.1: Smarter Choices Impacts (Möser and Bamberg, 2008)

Measure	Reduction in Car Trips	Increase in Non-Car Trips
Workplace Travel Plan	18%	34%
School Travel Plan	10%	7%
Targeted Marketing	8%	14%

Given the nature of meta-analysis (tending to overstate the effects), these impacts are likely to be close to the upper limit in the possible range of impacts, especially as they take no account of induced traffic effects. Therefore, WebTAG recommendation is to take these reductions in car trips as **upper limits** and then to derive benchmarks as proportions of these upper limits. These proportions are derived by considering the proposed intensity of the application. For example, if it is proposed that school travel plans are to apply to 75% of school students in the study area, the benchmark would be 75% of that in the Möser and Bamberg results, i.e. a 7.5% reduction in car trips and a 5% increase in non-car trips.

In order to derive the intensity level of each application, knowledge on the proposed funding in relation to the funding associated with the benchmark car trip reductions for each measure are required. WebTAG does not specify the benchmark costs for different measures. In the absence of any specific benchmark cost, the evidence from the two UK-based studies on the effects of Smarter Choices (Cairns et al., 2004; Sloman et al., 2010) has been used. These suggest the following benchmark costs for different Smarter Choices measures:

- Workplace travel plans: £3.00 per employee per year
- School travel plans: £5.00 per pupil per year
- Targeted marketing: £25.00 per individual per year

Given the available annual funding allocated to ‘soft’ measures for each Smarter Choices measure and data on population, employment, and school pupils in the geographical area where the Smarter Choices measures are to be applied, annual funding per head can be calculated for each measure. The ratio of the proposed annual funding per head compared to the benchmark cost per head will give the intensity level for each measure. These intensity levels can then be used to derive the benchmark effects as explained earlier in this section.

It is worth noted that the benchmark effects derived in the above manner will exclude the effects of induced traffic and therefore the out-turn effects shown in fully converged runs are expected to be lower. Hence, the adjustment of the model to achieve the benchmark should be based on results from the demand model after one iteration, and not a fully converged model run.

A particular goal of Smarter Choice measures is to encourage car sharing. Therefore, along with the reductions in car trips, an increase in average car occupancy is also expected. WebTAG does not make any recommendation on the expected change in car passengers as a result of implementing Smarter Choices.

However, evidence from the DfT study on the effects of Smarter Choices in the demonstration towns (Sloman et al., 2010) suggested that while the main effects were a shift from car to public transport and active modes, there was a smaller reduction in car passenger mode share than car driver mode share. This implies that the average occupancy of vehicles increases.

On this basis, in modelling Smarter Choice measures in LLITM, it has been assumed that the reductions in car passengers are, on average, about 30% of the benchmark reductions in car vehicle trips. This assumption is used to adjust car passenger occupancies when the Smarter Choice measures are modelled.

B.2.3 Benchmark Effects for Blaby District Core Strategy

The funding for the Smarter Choice initiatives that has been assumed for this study is of a similar level, per head, that was assumed for Leicester City in the Core Scenario Smarter Choice measures. These funding levels are given below, in 2005 prices, along with the percentage of the benchmark funding:

- £0.82 per employee for workplace travel planning (27% of the benchmark level);
- £1.34 per head for school travel planning (27% of the benchmark level); and
- £0.09 per head for targeted marketing (0.4% of the benchmark level).

The funding for Smarter Choice measures is assumed to be spent in 2031, the year in which the initiatives are being assessed. The mode share changes calibrated to are therefore those for the year of investment into Smarter Choice measures. In order to retain these mode share changes in the medium-term, continued investment is required into these initiatives. Without this investment, the likely effect of these schemes will decrease over time. An assumption used in another LLITM application was that the effect is likely to reduce by 8% per year if investment wasn't continued.

Based on the above funding levels and the benchmark effects of Smarter Choice measures detailed in this appendix, the following are the target reductions in car drivers and car passengers assumed for this application:

- a 5% reduction in commuting car drivers to Blaby District, including a 1.5% reduction in car passengers, due to workplace travel plans;
- a 3% reduction in education car drivers to Blaby District, including a 0.9% reduction in car passengers, due to school travel plans; and
  a 0.4% reduction in total car drivers from Blaby District as a result of targeted marketing.