Harborough District Local Plan

Preliminary Traffic Impact Assessment

Leicestershire County Council / Harborough District Council

Final Report

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Harborough District Local Plan - Preliminary Traffic Impact Assessment

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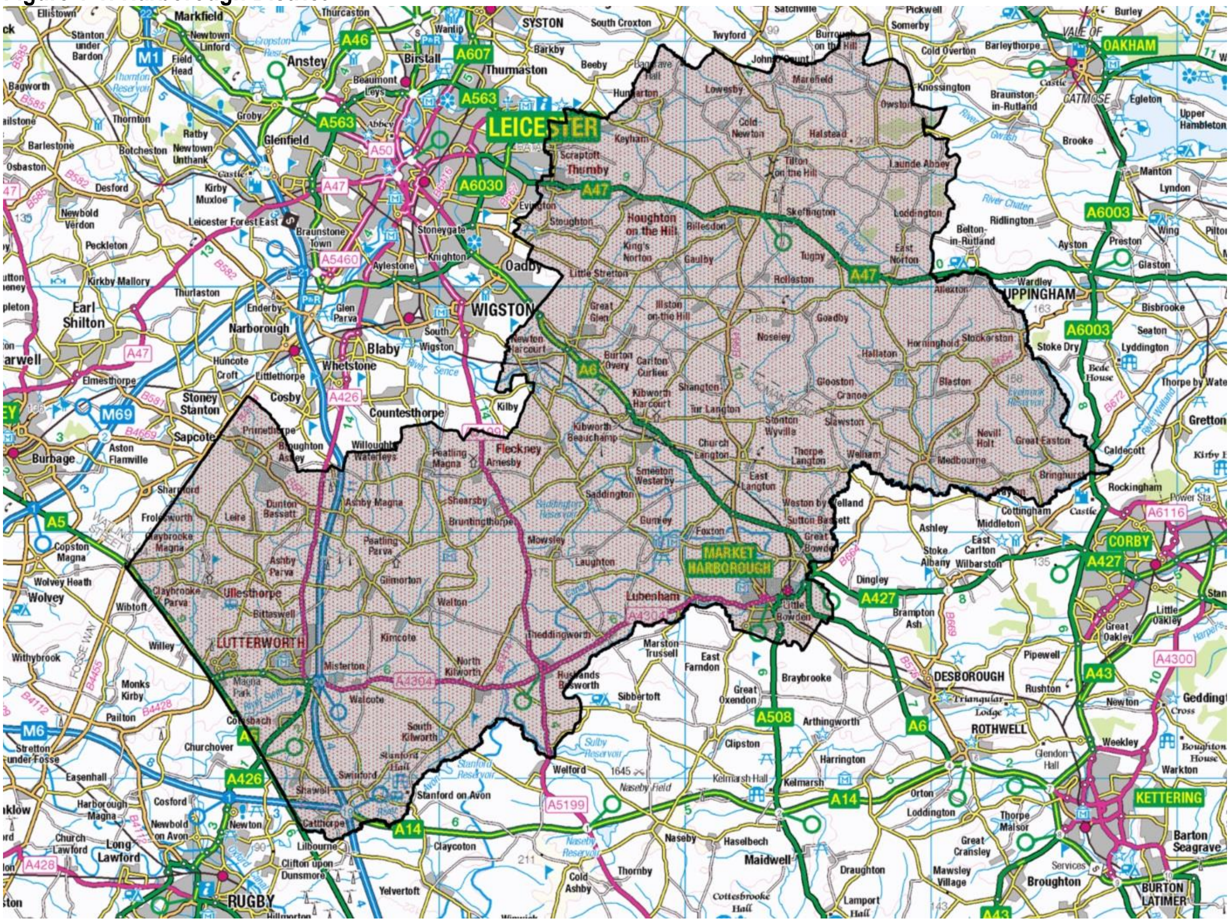
Contents

1. Introduction

1.1 Background

1.1.1 Jacobs was commissioned by Harborough District Council (HDC) and Leicestershire County Council (LCC) to undertake a preliminary Traffic Impact Assessment (TIA) of short-listed Harborough District Local Plan development options, to inform the selection of a preferred option. The Harborough District study area is shown in Figure 1-1.

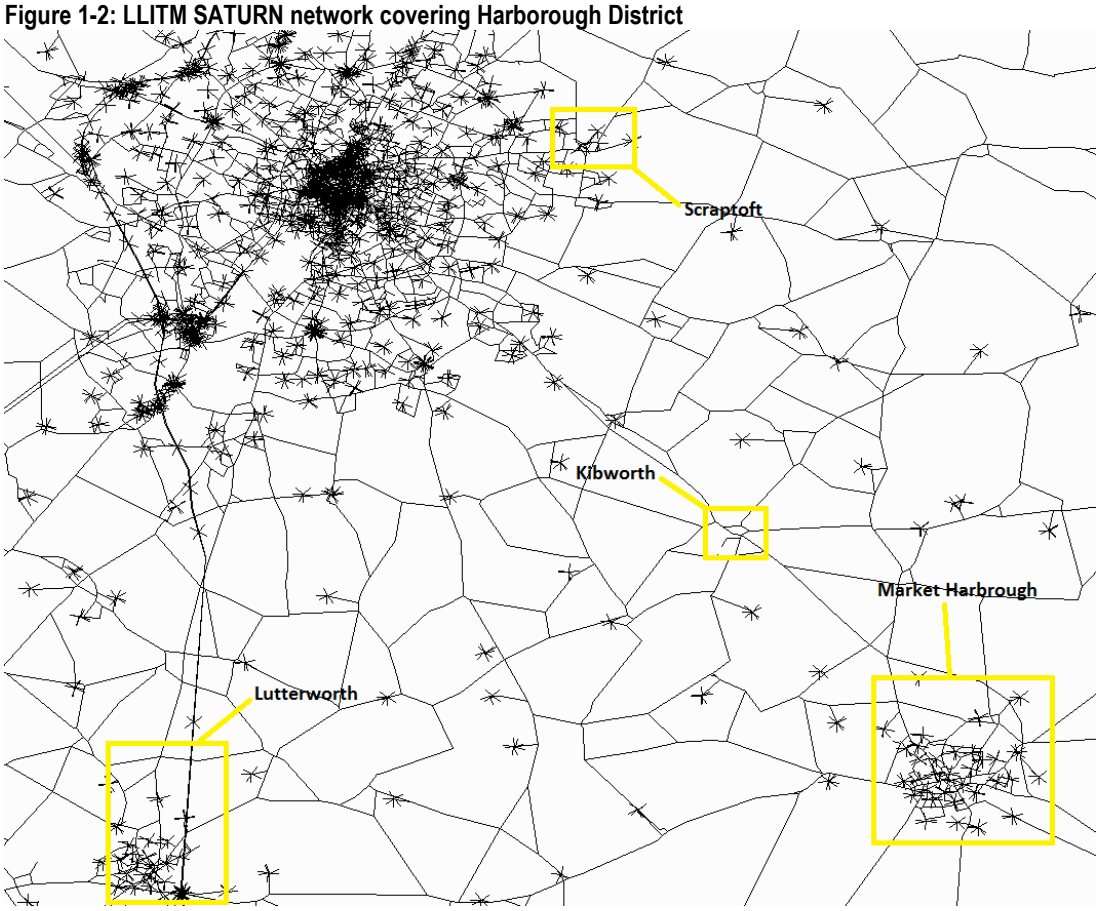
Figure 1-1: Harborough District



1.1.2 The methodology for this study involved using the highway component of the Leicester & Leicestershire Integrated Transport Model (LLITM) to test the trip generation impacts of the four short-listed options on the road network in Harborough District. The highway component is a strategic model coded in industry standard SATURN software that includes all major roads and many minor roads in the County within its simulation area (denoting the area where all junctions are fully coded, included signal timings and staging). The model network is illustrated in Figure 1-2.

1.1.3 The 2031 LLITM Reference Case (ref: SP) was used as the ‘do minimum’ baseline against which the Local Plan options were assessed. All scenarios were tested using AM (0800-0900) and PM (1700-1800) peak hour model runs.

Figure 1-2: LLITM SATURN network covering Harborough District



1.1.4 Trip generation and distribution forecasts for the options were developed in spreadsheets with reference to HDC planning assumptions, previous studies (notably the Strategic Transport Assessment undertaken in 2015), the TRICS database, and LLITM highway model demand matrices.

1.2 Report structure

1.2.1 The remainder of this report is structured as follows:

- Chapter 2 summarises the short-listed Local Plan options that have been tested as part of this study;
- Chapter 3 details the approach to estimating the trip generation and distribution of the short-listed development options, listing the data sources and the assumptions that were used in the calculations;
- Chapter 4 covers the modelling of options using the highway component of the LLITM;
- Chapter 5 draws out the key conclusions from the study and recommends next steps.

2. Local Plan development options

2.1 Overview

2.1.1 HDC identified nine separate options for accommodating future development needs in the district up to 2031 in their Local Plan Options Consultation Paper[1]. Member workshops were created in order to assist the process of sifting this long-list of options under three headers:

- Consultation – assessing the key issues raised during the Options Consultation;
- Deliverability – comprising evidence on land availability (from the latest Strategic Housing Land Availability Assessment and housing trajectories); infrastructure (from infrastructure providers' consultation responses, the Strategic Flood Risk Assessment and the Strategic Transport Assessment); and Viability (from the Viability Assessment);
- Planning Principles – comprising an assessment against sustainability (using evidence from the September 2015 Sustainability Appraisal Interim Report); NPPF Core Planning Principles; and Local Plan Objectives.

2.1.2 Based on this assessment, the nine long-list options were reduced to a short-list of four options put forward for further assessment. These short-listed options were:

- Option 2: Core Strategy Distribution;
- Option 4: Scraptoft / Thurnby Strategic Development Area (SDA);
- Option 5: Kibworth SDA (North East proposal only);
- Option 6: Lutterworth East SDA.

2.1.3 These four short-listed were the subject of the TIA undertaken as part of this study, and further details of the development assumptions included within each option are provided later in this Chapter. Before options could be tested, a suitable future year 'do minimum' baseline (referred to as the Reference Case) needed to be established, against which option traffic impacts would be compared. The following section of this chapter describes the Reference Case used for the purpose of this comparison.

2.2 Reference Case planning growth

2.2.1 The traffic model used for option testing was the highway component of the LLITM model (base year 2014) version 5, coded in industry-standard SATURN software. The 2031 Reference Case (SP scenario), supplied by LCC, provided the starting point for the assessment, and included the committed development assumptions set out in Table 2-1.

Table 2-1: LLITM v5 Reference Case (scenario SP) committed development assumptions for Harborough District

Harborough District	2009-2011	2012-2016	2017-2022	2022-2026	2027-2031	Total
Residential - dwellings	1,011	1,945	1,919	1,758	265	**6,897**
- floorspace	122,006	236,476	218,921	135,052	31,084	**743,539**
Retail (m^2)	0	3,000	6,400	4,400	0	**13,800**
Office (m^2)	10,425	83,525	40,950	6,250	0	**141,150**
Industrial (m^2)	6,350	87,000	6,250	6,250	0	**105,850**
Warehouse (m^2)	17,575	56,375	-	-	-	**73,950**

[1] HDC (September 2015), 'A New Local Plan for Harborough: Options Consultation Paper'

2.2.2 These committed development assumptions contributed to an overall forecast of growth in occupied households (summarised in Figure 2-1) and jobs (summarised in Figure 2-2) in the District by 2031. In addition to the committed development assumptions, these forecasts also account for a wide range of other future trend assumptions, including national and regional economic growth by sector, productivity, the demographic and socio-economic characteristics of the resident population and labour market, and property and transport costs. Further details on the process of developing land-use assumptions for the LLITM are provided in the Model Description Report[2].

2.2.3 The graphs indicate that between 2016 and 2031, there is an assumed growth of 1,900 occupied households in the District, with 330 located in Market Harborough, an increase of 5.1%. In this same time period, there is an assumed increase of 1,800 jobs, a 4.5% increase.

Figure 2-1: Forecast growth in households in Harborough District (2011-2031)

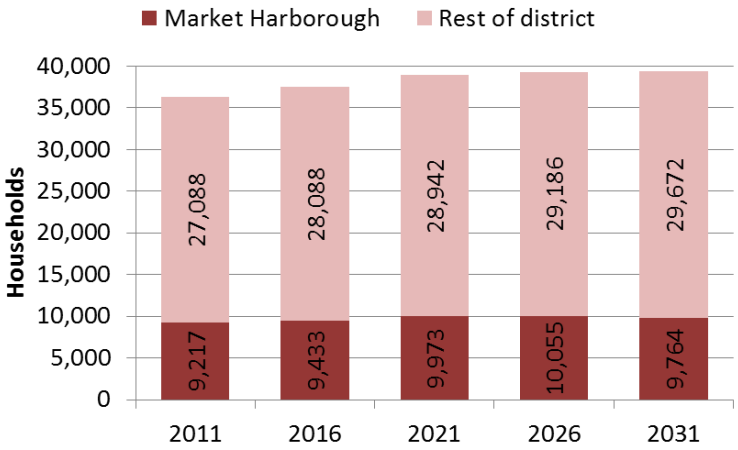
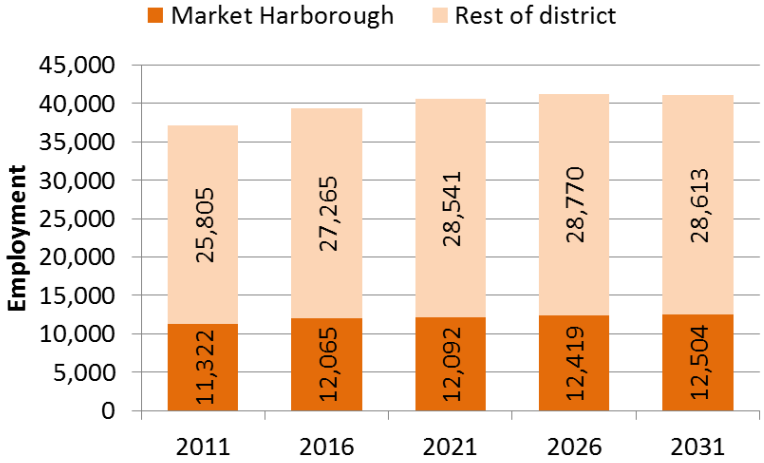


Figure 2-2: Forecast growth in employment in Harborough District (2011-2031)

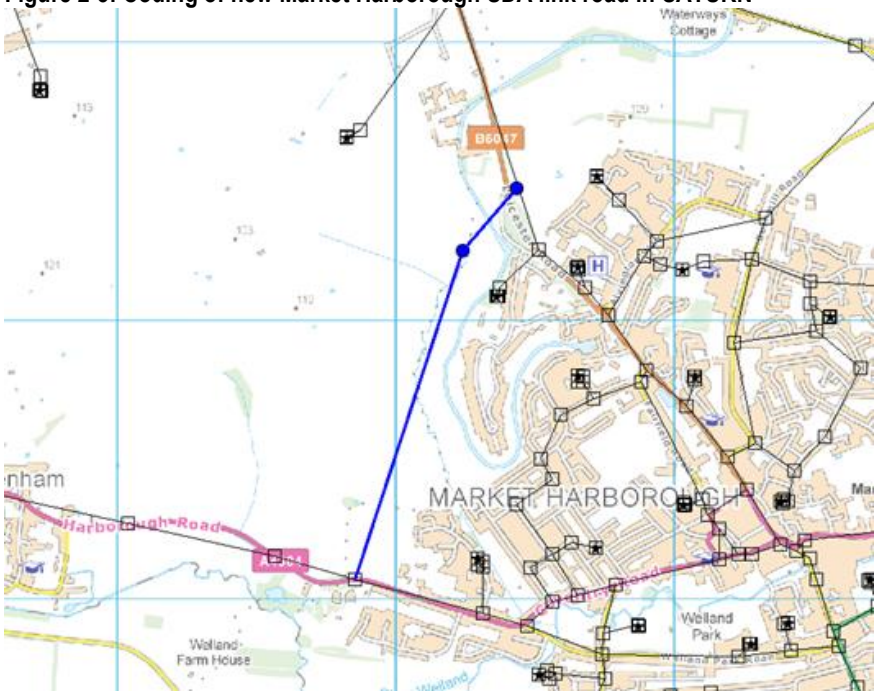


2.2.4 A review of the Reference Case growth assumptions with HDC officers indicated that the forecasts described above were in line with HDC expectations for the future year baseline with one exception: the absence of the full development of the Market Harborough SDA, a development of some 1,500 dwellings located on greenfield land immediately to the west of The Woodlands and the Market Harborough Arm of the Grand Union Canal, and connected to the existing road network via a new link road between the B6047 Leicester Road and the A4304 Harborough Road. Although an assumption of a partial build-out of 1,000 households on the site was included in the version 5 Reference Case for 2031, the SDA site in its most up-to-date form (including the provision of the new link road) was approved by HDC following the development of the version 5 model.

[2] David Simmonds Consultancy, on behalf of LCC (October 2013), 'LLITM, Project Report 106, Model Description Report'.

2.2.5 To account for this, the Reference Case model demand matrices were adjusted to account for expected trip generation associated with a full build-out of the site to 1,500 dwellings by multiplying the demand assumptions for the model zone in question by a factor of 1.5. The model network was also amended to incorporate the new link connecting the B6047 and the A4304 as a single-carriageway local distributor road with a speed limit of 30mph, on the alignment shown in Figure 2-3.

Figure 2-3: Coding of new Market Harborough SDA link road in SATURN



2.2.6 The Reference Case traffic implications of these amendments are summarised in the following chapter of this report. The remainder of this chapter describes the planning assumptions associated with the four short-listed options, which were assumed to be additional to the growth assumptions included in the amended Reference Case as described above.

2.2.7 Across all the short-listed options a total of 10 employments sites were identified by HDC, and all were incorporated in the analysis described in this report. In contrast, housing targets were identified for a total of 27 settlements across the district. Due to the time constraints on the study, all settlements with a total housing allocation of 100 new dwellings or more were included in the assessment, while any settlements with a total allocation of less than 100 dwellings were excluded. In practice this meant that the assessment considered all sites identified in each option in six settlements: Market Harborough, Kibworth/Kibworth Harcourt, Fleckney, Scraptoft/Thurnby, Houghton-on-the-Hill, and Lutterworth.

2.2.8 Road network arrangements for each of the options were defined in LLITM with reference to the following sources – for Option 2, the Core Strategy Distribution, no new roads were included in the assessment:

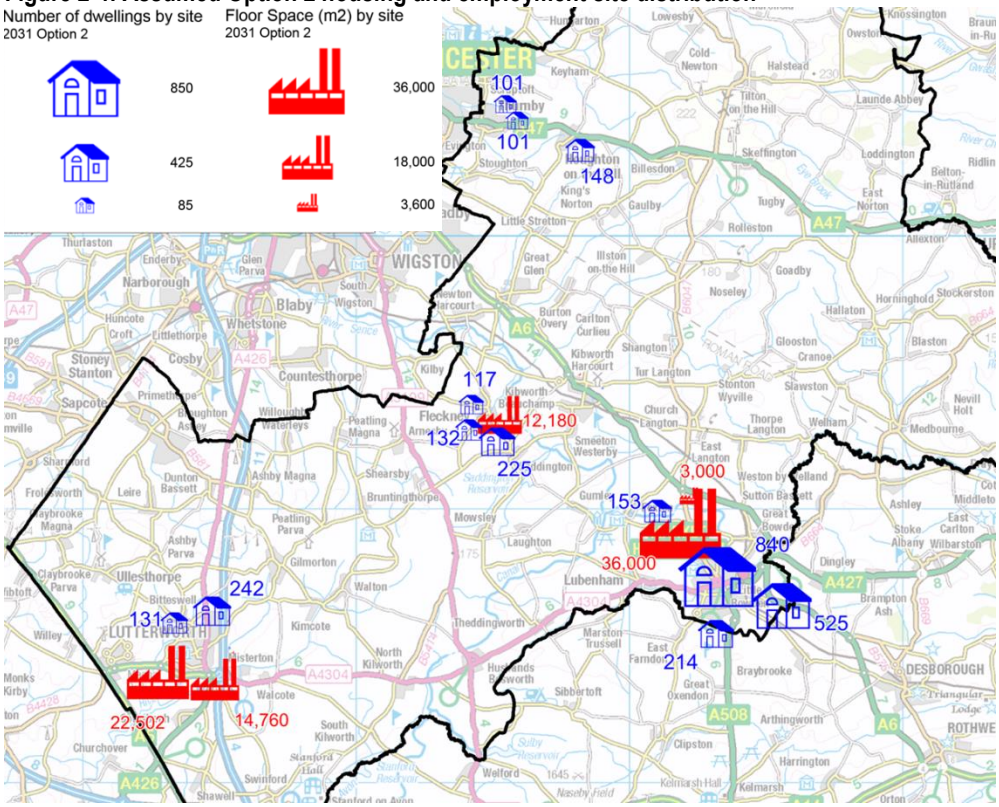
- Option 4: Parkers of Leicester Ltd (January 2016), 'Scraptoft North – Proposals for a Sustainable New Neighbourhood – Submission to Harborough District Council';
- Option 5: Merton College Oxford/Diocese of Leicester (October 2015), 'Kibworth Harcourt Proposed Strategic Development Area';
- Option 6: Hallam Land Management Ltd/FPCR Environment/Design Ltd (March 2015), 'Lutterworth East Vision' – LLITM road network coding for key junctions was also provided by the developers for testing during this study.

2.3 Option 2 – Core Strategy Distribution

Overview

2.3.1 In this option, the housing distribution would continue in a broadly similar fashion to the existing adopted core strategy. The majority of the employment and housing provision would fall within Market Harborough with smaller additional housing and employment sites provided in Lutterworth and Fleckney. There would also be some additional housing around Scraptoft and Houghton. Approximately 70% of the future new housing would be planned for urban settlements, with the other 30% situated on more rural sites. The site locations assumed for the Option 2 test are shown on the plan in Figure 2-4, with further detail on the site locations and characteristics provided in Appendix A.

Figure 2-4: Assumed Option 2 housing and employment site distribution



Development assumptions

2.3.2 The sites indicated on the plan above amount to a total of 3,053 new dwellings and 88,442 square metres of employment floor space (assumed to be office and light industrial). The majority of the new dwellings (1,732) would be located in and around Market Harborough, with 474 in Fleckney and 373 in Lutterworth. For employment, Market Harborough again provides the bulk of the development with 39,000 square metres of floor space, with a further 36,000 at two separate sites in Lutterworth.

Road network changes

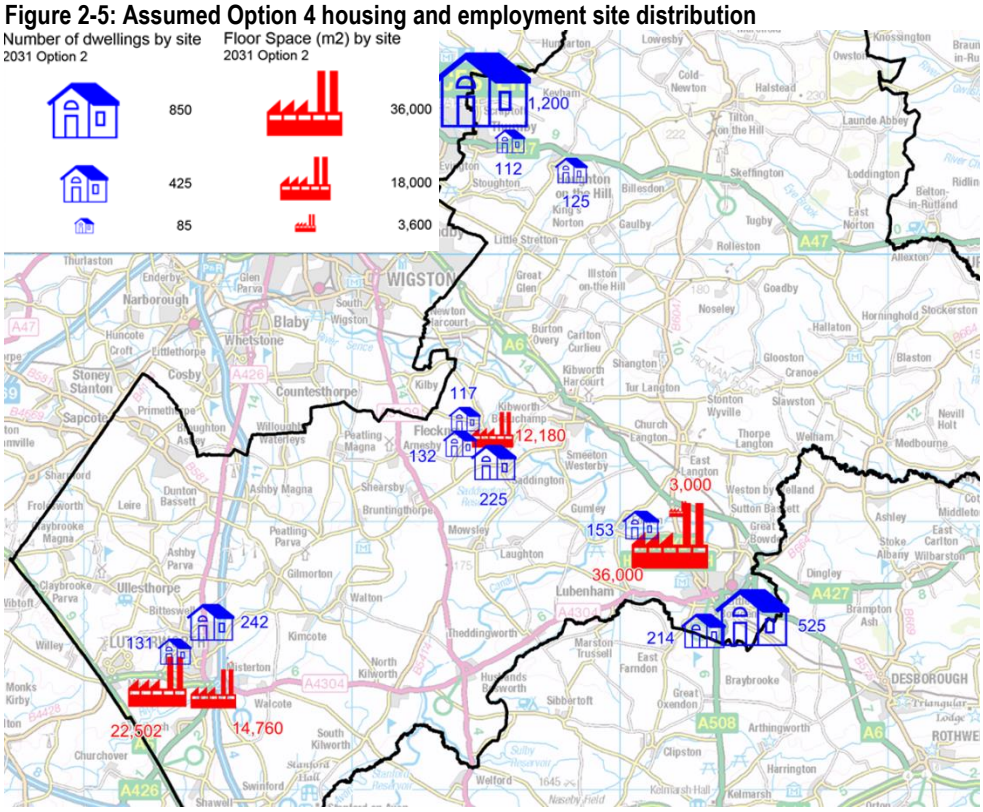
2.3.3 For the purpose of testing this option, no road network changes beyond those described earlier for the amended Reference Case were assumed.

2.4 Option 4 – Scraptoft/Thurnby Strategic Development Area

Overview

Option 4 proposes significant development in an SDA to the north and east of the village of Scraptoft, with further lower-level residential development in Houghton-on-the-Hill, Lutterworth and Market Harborough. The Scraptoft North SDA does not include proposals to deliver employment land, meaning that the majority of employment would be provided in Market Harborough with 10 hectares of land dedicated, and a further four hectares of land in Lutterworth. The site locations assumed for the Option 4 test are shown on the plan in Figure 2-5, with further detail provided in Appendix A.

Figure 2-5: Assumed Option 4 housing and employment site distribution



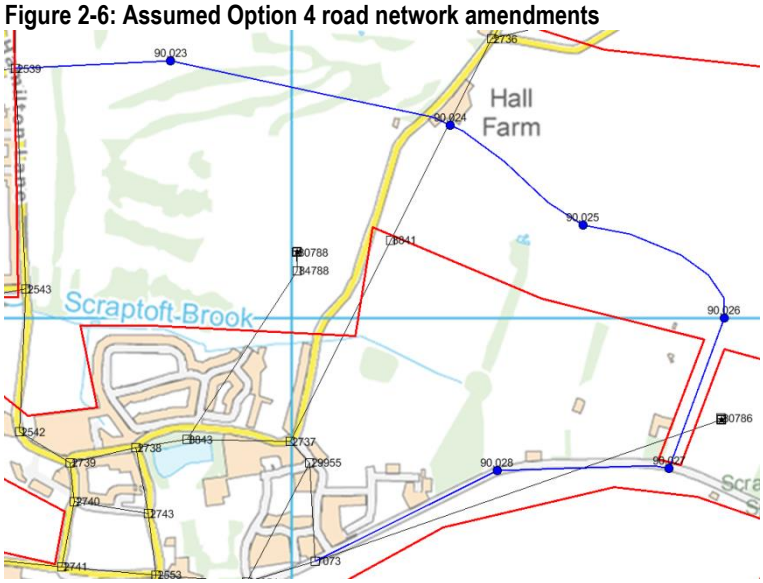
Development assumptions

2.4.1 An additional 1,312 dwellings are provided in Scraptoft and Thurnby in this option with 1,200 of those assumed to be delivered through the Scraptoft North SDA site. A further 892 dwellings are provided in Market Harborough and 474 in Fleckney. For employment, Market Harborough provides the bulk of the development with 39,000 square metres of floor space, with a further 36,000 at two separate sites in Lutterworth.

Road network changes

2.4.2 A new two-way single-carriageway link road with a 30mph speed limit was coded through the SDA to the north and east of Scraptoft village, connecting to Hamilton Lane (via a mini-roundabout), Beeby Road (via a mini-roundabout) and the existing Covert Lane/Malsbury Avenue priority junction, as shown in blue on the plan in Figure 2-6. The existing single lane section of Covert Lane to the east of the latter junction is not coded in the LLITM Reference Case, and so this section of Covert Lane effectively appears as a new two-way single carriageway road used exclusively by development traffic in the Option 4 test.

Figure 2-6: Assumed Option 4 road network amendments

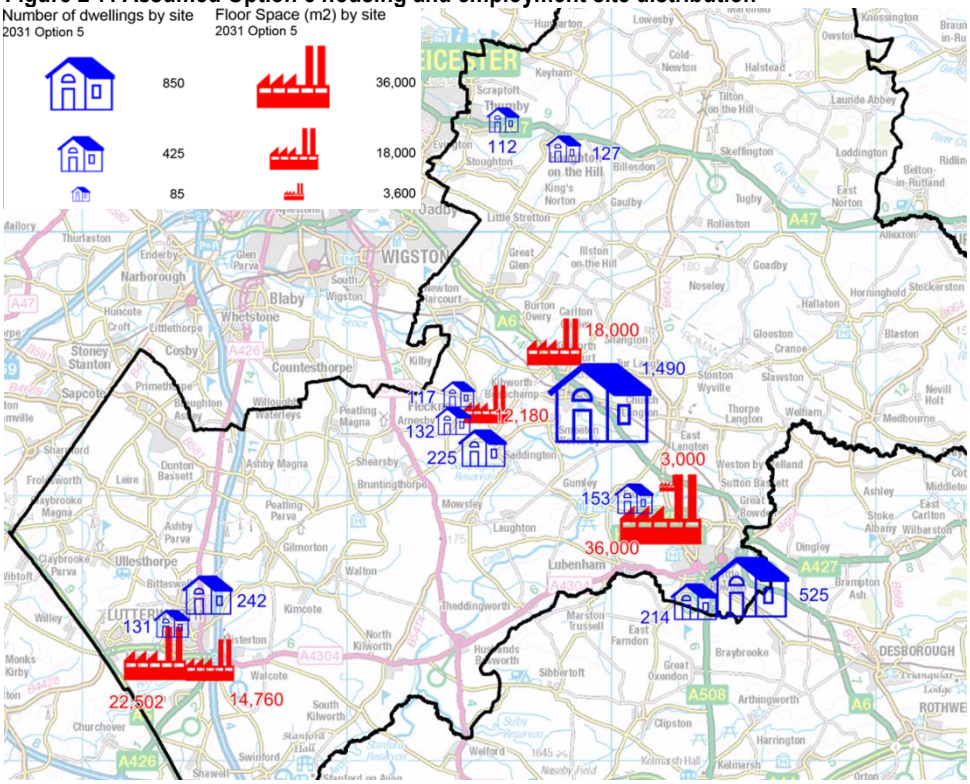


2.5 Option 5 – Kibworth Strategic Development Area

Overview

2.5.1 Option 5 includes new road infrastructure and residential/employment development to the north and east of Kibworth Harcourt. Some 1,490 additional houses would be delivered on the Kibworth SDA site, bisected by a new bypass road connecting to two new junctions on the A6 to the north and south of the existing settlement. Approximately 5 hectares of employment land would be delivered as part of the Kibworth SDA, with a further 10 hectares delivered in and around Market Harborough. Additionally, 4 hectares of employment land would be provided in Lutterworth on two separate sites, as well as a further 3 hectares around Fleckney. The site locations assumed for the Option 5 test are shown on the plan in Figure 2-7, with further detail provided in Appendix A.

Figure 2-7: Assumed Option 5 housing and employment site distribution



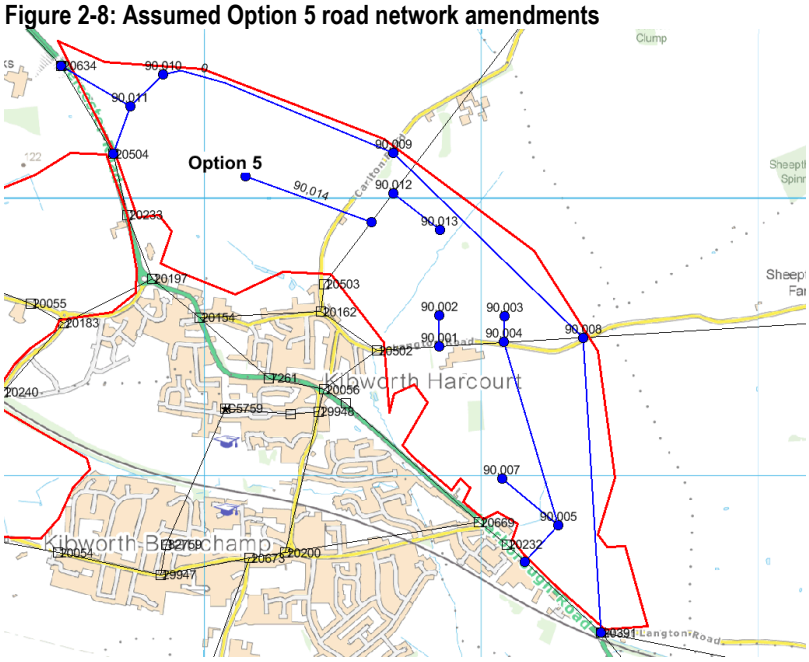
Development assumptions

2.5.2 In Option 5 an additional 1,490 houses would be added to the north and east of Kibworth Harcourt, with a further 892 houses provided in Market Harborough and 474 in Fleckney. An additional 18,000 square metres of office and light industrial floor space would also be provided as part of the Kibworth SDA in addition to new sites provided in Market Harborough (39,000 square metres), Lutterworth (37,000 square metres) and Fleckney (12,000 square metres). The employment land provision in these three locations is the same as that assumed in Options 2 and 4.

Road network changes

2.5.3 Option 5 includes the provision of a new two-way single carriageway bypass road for the A6 through Kibworth, with a 30mph speed limit and new junctions provided on the A6 north and south of the existing settlements (both coded as uncontrolled roundabouts) as well as Carlton Road and Langton Road (both coded as mini-roundabouts). The new link road and junctions are shown on the plan in Figure 2-8 along with new road accesses for the SDA site onto Carlton Road, Langton Road, and the A6 just to the south of its junction with New Road.

Figure 2-8: Assumed Option 5 road network amendments

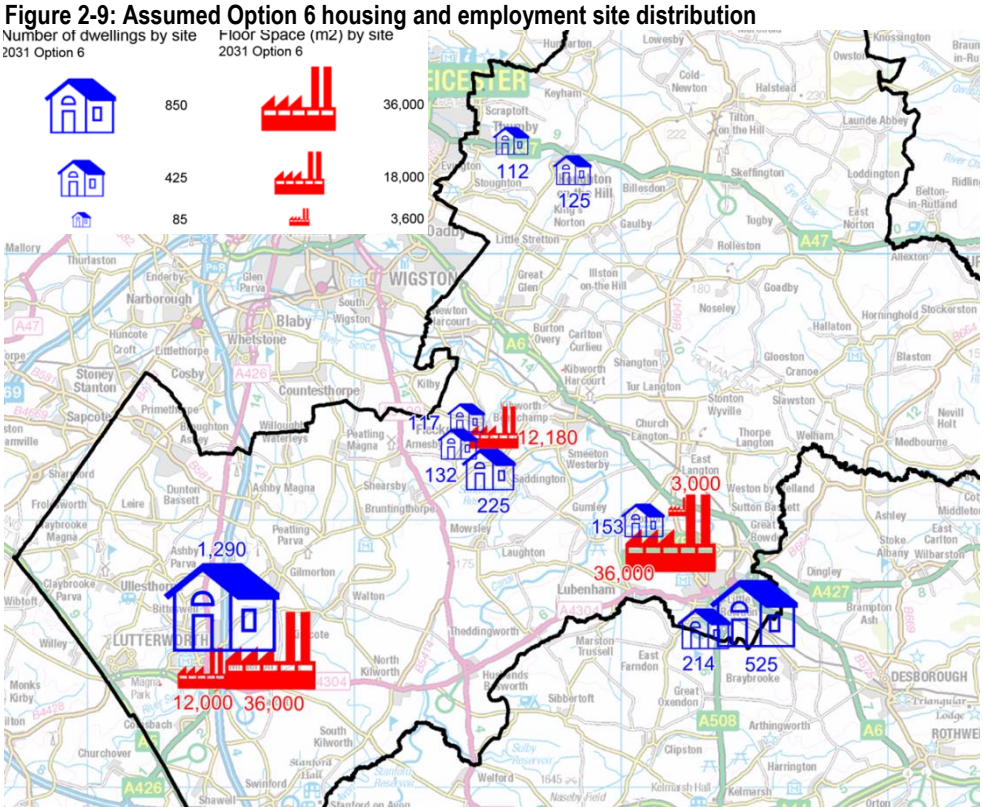


2.6 Option 6 – Lutterworth Strategic Development Area

Overview

2.6.1 Option 6 is focussed on a proposal to provide approximately 1,300 additional dwellings on land to the east of Lutterworth. A new link road would be provided through the SDA site connecting the A4304 (to the east of its junction with the M1) with the A426 to the north of the existing settlement to provide congestion relief for the existing town centre. It is also proposed that there would be an additional 10 hectares of employment land to the south of Lutterworth, as well as approximately 3 hectares in Fleckney. The site locations assumed for the Option 6 test are shown on the plan in Figure 2-9, with further detail provided in Appendix A.

Figure 2-9: Assumed Option 6 housing and employment site distribution



Development assumptions

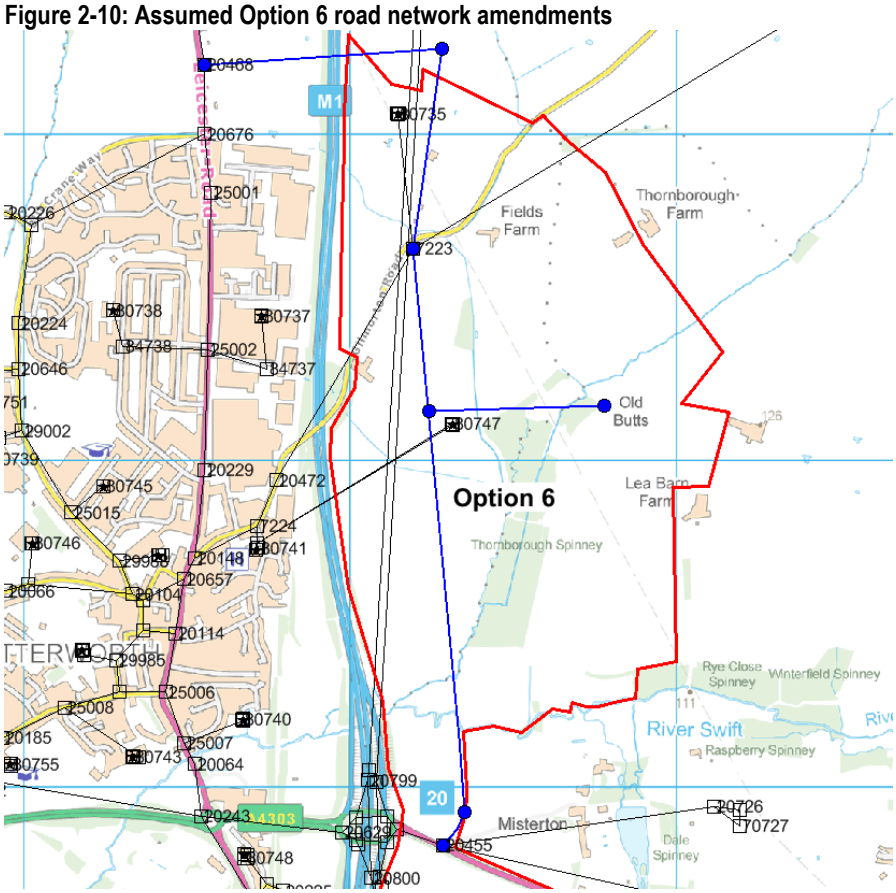
2.6.2 An additional 1,290 dwellings are proposed in the SDA to the east of Lutterworth, with 892 in Market Harborough, 472 in Fleckney, and smaller sites provided in Kibworth and Scraptoft. An additional 48,000 square metres of employment floor space would also be provided to the south of Lutterworth, as well as similar additional employment seen in options 2, 4 and 5 for other areas of the district (39,000 square metres in Market Harborough and 12,000 square metres in Fleckney).

Road network changes

2.6.3 The assumed road network changes associated with Option 6 are summarised on the plan in Figure 2-10 and include the provision of a new two-way single carriageway link road with a 30mph speed limit connecting the A4304 at its junction with Chapel Lane to a new uncontrolled roundabout on the A426 north of its existing junction with Bill Crane Way. The new link road runs to the east of the M1 and Lutterworth through the new SDA site for much of its length, crossing the M1 via a new bridge to the north of the existing settlement.

2.6.4 In addition, the A4303/Rugby Road roundabout would be converted to a signalised four-arm junction, while a new signalised junction would be provided replacing the existing A4304/Chapel Lane junction. The M1 Junction 20 roundabout would also be signalised. Signal cycle times and junction geometry assumptions were sourced from the traffic team working for the SDA developers and were incorporated in the SATURN model.

Figure 2-10: Assumed Option 6 road network amendments



External development impacts

2.6.5 In addition to testing the impacts of the Lutterworth SDA option described above, HDC also requested that a sensitivity test was carried out to determine the cumulative impact of proposed developments around Magna Park to the west. This would include 278,709 square metres of employment floor space for warehousing and distribution with ancillary offices, located on two sites immediately to the west of the existing development and south of the A4303 to the west of its junction with Brookfield Way.

2.6.6 Some minor network changes were made to allocate trips to and from these sites on to the road network, as shown in Figure 2-11. A new junction was coded to allocate expected demand from the sites on to the A5 and Mere Lane, with the latter providing a new connection to Hunter Boulevard.

Figure 2-11: Assumed 'Option 6 + Magna Park cumulative impact' road network amendments

3. Trip generation and distribution estimates

3.1 Introduction

3.1.1 In order to assess the impacts on the road network of the proposed development options described in the previous chapter, it was necessary to estimate both their anticipated vehicular trip generation and how those trips would distribute across the network. The methodology adopted for this process is summarised in this chapter.

3.1.2 All trip generation figures were estimated for the AM peak hour (0800-0900) and the PM peak hour (1700-1800) to match the time periods for the subsequent assessment of options using the highway component of the LLITM.

3.2 Traffic generation

Residential

3.2.1 In order to estimate the likely vehicular traffic generation for the residential element of each development option, reference was made to the 'Harborough District Potential Development Scenarios Strategic Transport Assessment' (STA). Residential trip rates included in the STA were compared with a variety of rates for different residential categories from the TRICS 7.3.2 database[3], and Jacobs subsequently concluded that the STA rates were higher than average when compared with TRICS but within an acceptable range. Their use therefore ensured a conservative assessment of the traffic impacts of residential development associated with each Local Plan option.

3.2.2 AM peak hour residential trip rates were sourced directly from the 'edge of town' residential category in the STA. PM peak hour trip rates were then estimated by transposing the AM peak hour inbound and outbound figures, based on the assumption that AM peak hour trip patterns would broadly reverse in the PM peak hour. The resultant AM and PM peak hour trip rates per dwelling are shown in Table 3-1. This indicates for example that every 100 new dwellings are assumed to generate 64 new outbound vehicle trips and 17 new inbound vehicle trips during the AM peak hour, with the figures reversed during the PM peak hour.

Table 3-1 : Residential vehicular trip rates per dwelling

Location	AM Peak Hour		PM Peak Hour	
	Inbound	Outbound	Inbound	Outbound
Edge of town	0.17	0.64	0.64	0.17

3.2.3 The proposed residential trips were assigned to existing zones in the highway component of the LLTIM. A 2% reduction was applied to the residential trip rates outlined in Table 3-1 to account for a small number of trips that would travel internally within a zone and would therefore not impact on the road network in the model. The resultant total residential traffic generation (number of vehicle trips) for each of the development options outlined in Chapter 2 is summarised in Table 3-2.

[3] TRICS is a database of over 7,150 directional transport surveys at over 110 types of development in the UK and Ireland, allowing the user to estimate the traffic and trip generation of a development site based on its characteristics, including development type and quantum – further information is available on the TRICS website: http://www.trics.org/

Table 3-2 : Residential trip generation

Development Option	AM Peak Hour		PM Peak Hour	
	Inbound	Outbound	Inbound	Outbound
2	509	1,915	1,915	509
4	529	1,992	1,992	529
5	578	2,175	2,175	578
6	482	1,814	1,814	482

Employment – B1 office use

3.2.4 The STA did not include detailed trip rate information for the different employment land-uses identified by HDC for each development option. As a result, the TRICS 7.3.2 database was the source for employment land trip rates used in this study. The forecast traffic generation of the proposed B1 office use for each development option was calculated using the 'employment office' category from TRICS. All sites located in England with the exception of Greater London were selected and all weekend surveys were deselected. The resultant TRICS outputs are summarised in Table 3-3.

Table 3-3 : B1 office vehicular trip rates per 100 square metres of floor space

AM Peak		PM Peak	
Inbound	Outbound	Inbound	Outbound
1.233	0.202	0.146	1.106

3.2.5 As with residential trips, a 2% reduction was applied to the office trip rates outlined in Table 3-3 to account for a small number of intra-zonal trips that would not impact on the external road network. The resultant B1 office traffic generation for each of the development options outlined in Chapter 2 is summarised in Table 3-4.

Table 3-4 : B1a office trip generation

Development Option	AM Peak Hour		PM Peak Hour	
	Inbound	Outbound	Inbound	Outbound
2	404	66	48	363
4	404	66	48	363
5	495	81	59	444
6	399	65	47	358

Employment – B1c industrial use

3.2.6 The forecast traffic generation (both vehicles and heavy goods vehicles) of the proposed B1c industrial use for each development option was calculated using the 'employment industrial unit' category from the TRICS 7.3.2 database. All sites located in England with the excpetion of Greater London were selected and all weekend surveys were deselected. The resultant TRICS outputs are summarised in Table 3-5.

Table 3-5 : B1c industrial vehicular trip rates per 100 square metres of floor space

Vehicle type	AM Peak Hour		PM Peak Hour	
	Inbound	Outbound	Inbound	Outbound
Vehicles	0.698	0.093	0.065	0.545
Heavy goods vehicles	0.022	0.020	0.003	0.003

3.2.7 As with other trip rates used in this study, a 2% reduction was applied to the rates outlined in Table 3-5 to account for a small number of intra-zonal trips that would not impact on the external road network. The resultant B1c industrial traffic generation for each of the development options outlined in Chapter 2 is summarised in Table 3-6.

Table 3-6 : B1c industrial trip generation

Development Option	AM Peak Hour		PM Peak Hour	
	Inbound	Outbound	Inbound	Outbound
2	403	75	33	297
4	403	75	33	297
5	480	89	39	354
6	397	74	32	293

Employment – B8 industrial use

The forecast traffic generation (both vehicle and heavy good vehicles) of the proposed B8 industrial use for each development option was calculated using the 'employment warehousing (commercial)' category from the TRICS 7.3.2 database. All sites located in England with the excpetion of Greater London were selected and all weekend surveys were deselected. The resultant TRICS outputs are summarised in Table 3-7.

Table 3-7 : B8 warehousing vehicular trip rates per 100 square metres floor space

Vehicle type	AM Peak Hour		PM Peak Hour	
	Inbound	Outbound	Inbound	Outbound
Vehicles	0.064	0.042	0.029	0.076
Heavy goods vehicles	0.014	0.012	0.010	0.016

3.2.8 As with the other trip rates used in this study, a 2% reduction was applied to the B8 warehousing trip rates outlined in Table 3-7 to account for a small number of intra-zonal trips that would not impact on the external road network. The resultant B8 warehousing traffic generation for each of the development options outlined in Chapter 2 is summarised in Table 3-8.

Table 3-8 : B8 distribution trip generation

Development Option	AM Peak Hour		PM Peak Hour	
	Inbound	Outbound	Inbound	Outbound
2	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	11	8	6	13

3.3 Traffic distribution

3.3.1 Following the development of trip generation estimates for each development component for the four short-listed options as described above, traffic was then distributed to the road network based on the distribution for similar adjacent zones already included in the Reference Case model. For example, residential trips associated with the Kibworth SDA were assumed to distribute across the road network in a similar way to trips from existing residential areas in the Kibworths, while employment trips associated with the Lutterworth East SDA were assumed to distribute in a similar way to trips from existing employment areas in Lutterworth.

3.3.2 It should be noted that the distributions used to assess traffic impacts in this study have not therefore been developed through a full run of the land-use and demand model components of the LLITM, and therefore may not fully account for the potential interaction between new developments and existing settlements.

3.3.3 It is therefore a recommendation of this study that a full LLITM run is conducted of the four short-listed options subsequent to the publication of the draft Local Plan to ensure that reported traffic impacts are broadly consistent with those reported as part of this preliminary assessment.

4. Highway modelling analysis

4.1 Overview

4.1.1 This chapter summarises the analysis undertaken using the highway component of the LLITM to assess the traffic impact of the four short-listed options described in Chapter 2, based on the trip generation and distribution assumptions described in Chapter 3.

4.1.2 The highway component of LLITM version 5 (base year 2014), coded in industry-standard SATURN software, was used to undertake the assessment of each of the four options against the Amended Reference Case, which is also described in Chapter 2, for the forecast 2031 AM and PM peak hours (0800-0900 and 1700-1800). Following discussions with LCC and HDC, for the purposes of this study, we have reported the following SATURN outputs for each option, as follows:

- Volume/Capacity Ratio (VCR) – the ratio of the actual flow of traffic as a % of theoretical link capacity on every link in the model network (accounting for capacity constraints associated with junctions) – in general terms, congestion and delay start to become significant as links reach 80% of capacity, with severe issues occurring wherever the 100% threshold is exceeded – it should be noted that the VCRs quoted in this report are averages for the full modelled hours and therefore may hide shorter-duration issues that occur during peak flow periods within the hour in certain locations – we have highlighted links where overall VCR exceeds 60% as a proxy for this issue;

- Delay at junctions – measured in seconds per PCU[4], this metric represents the average excess time taken for individual vehicles to clear a junction during the peak modelled hours when compared with the time that would be taken during uncongested conditions (i.e. accounting for the speed limit of the roads in question and natural stoppages associated with the phasing of traffic signals);

- Carbon Dioxide emissions – measured in kilos per hour by link, this metric is a function of the volume of traffic forecast to use the link in question during the peak hour, and the extent of delay that is forecast to occur on that link (since emissions vary according to vehicle speed) – it should be noted that outputs direct from SATURN have been included in this assessment as a rough proxy for potential traffic-related air quality issues that may arise as a result of each option, but that results should be interpreted bearing in mind the following extract from the SATURN user manual[5]: "*SATURN contains some fairly simple-minded internal procedures for the estimation and display of five standard pollutants: carbon monoxide, carbon dioxide, hydrocarbons, nitrogen oxides and lead. The estimation procedures are similar to those used to estimate fuel consumption, i.e. a linear model with explanatory variables of time, distance, primary and secondary stops. It needs to be emphasised that this is an extremely crude model. If it gets to within an order magnitude of the "true" answer it will be doing well*".

4.1.3 In each of the options, the network changes are described and assessed, with particular attention given to strategic routes and routes that are already heavily congested in the Amended Reference Case.

[4] Traffic is composed of various types of vehicles, which have varying impacts on road network capacity and performance as a consequence of certain characteristics (for example, vehicle size, average speed, rate of acceleration etc). As a result, a common unit known as the Passenger Car Unit (PCU) is often utilised in traffic assessments to account for the impact of vehicle composition: common vehicle types are assigned a conversion factor to work out an equivalent PCU value (for example, a Bus or Coach is typically assigned a value of 2 PCUs, an articulated lorry is equivalent to 2.3 PCUs, and a motorcycle is equivalent to 0.4 PCUs). Using PCUs ensures that traffic impacts are not underestimated in situations where a high proportion of traffic is composed of larger vehicles (such as buses, coaches and lorries) or overestimated where a high proportion of traffic is composed of smaller vehicles (such as motorcycles).

[5] SATURN Version 11.3 Manual (April 2015), Section 15.33 (https://www.saturnsoftware.co.uk/saturnmanual/pdfs/SATURN%20v11.3.12%20Manual%20(Main).pdf).

4.2 2031 Amended Reference Case model runs

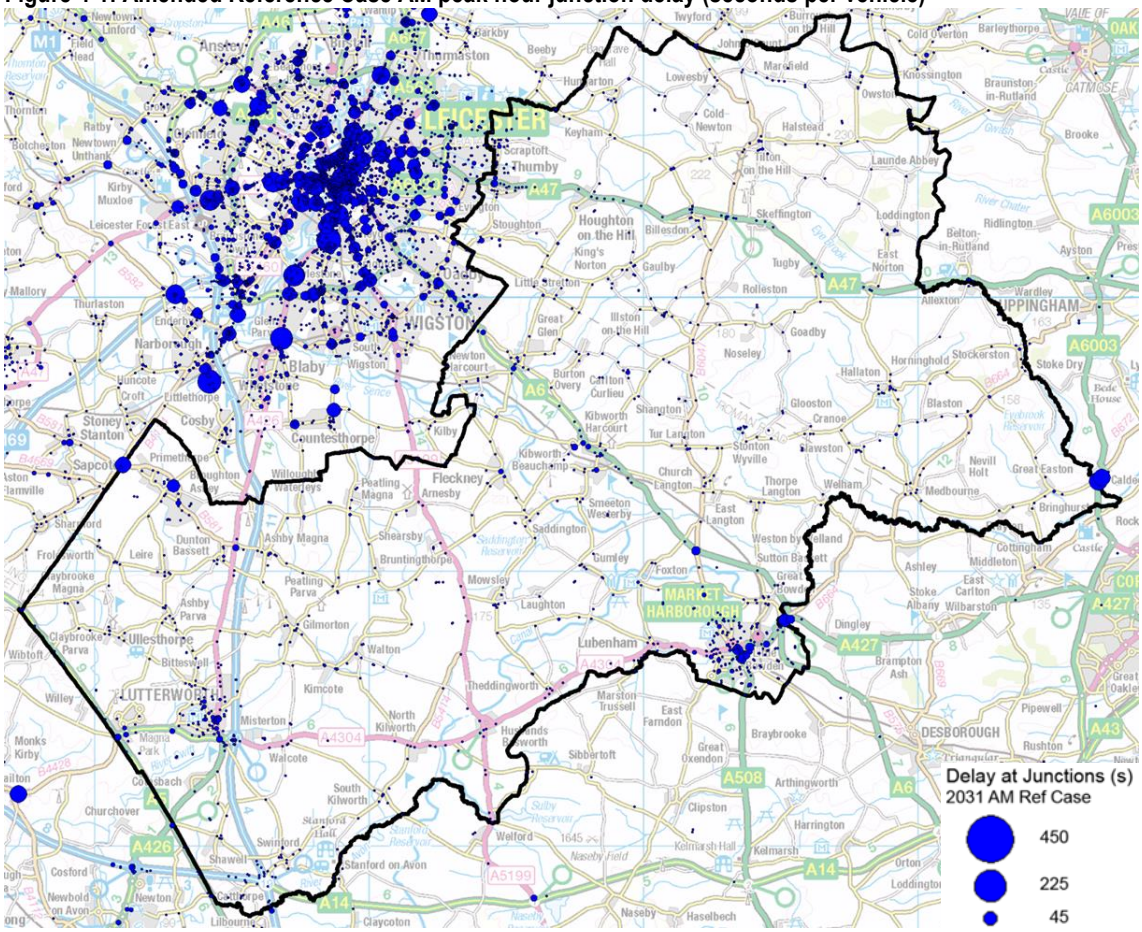
4.2.1 As mentioned in Chapter 2, the LLITM 2031 Reference Case model was amended during the course of this study to accommodate growth associated with a full build-out of the Market Harborough SDA to 1,500 dwellings and the delivery of the associated new western road link connecting the B6047 and the A3404.

4.2.2 Figure 4-1 shows the average delay at junctions (measured in seconds per PCU) forecast during the 2031 AM peak hour in the Amended Reference Case. In general, the major junctions in Harborough District perform reasonably well with relatively little delay, particularly when compared with junctions in Leicester.

4.2.3 The highest level of delay is forecast on the junctions in and around Market Harborough itself, notably the Northampton Road junctions with Coventry Road, St. Mary's Road and Springfield Street; the St. Mary's Road/Kettering Road junction; and the A6 junctions with the A4304 Rockingham Road/Harborough Road and Melton Road/Harborough Road.

4.2.4 Lower levels of delay are forecast on clusters of junctions in and around the Kibworths and Lutterworth, particularly along the A426. Notable pinch points are also evident at two junctions on the A6003 in Caldecott on the eastern edge of the district, and at two junctions on the B581 Coventry Road in the vicinity of Primethorpe.

Figure 4-1: Amended Reference Case AM peak hour junction delay (seconds per vehicle)

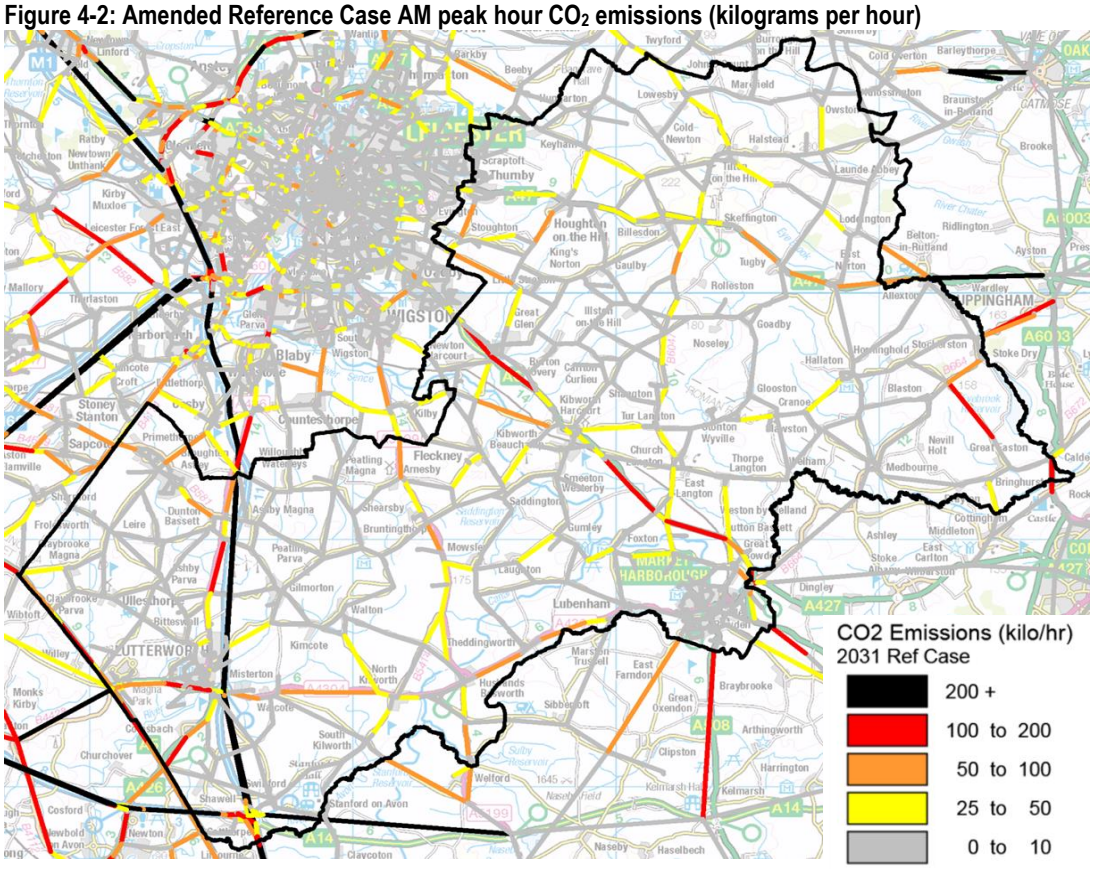


4.2.5 Forecast AM peak hour Amended Reference Case CO_2 emissions (measured in kilograms per hour) are shown on the plan in Figure 4-2. Within Harborough District, the highest levels of emissions are forecast on the M1 and the A14 corridors in the south-west. In addition, relatively high levels of

emissions are also evident on the A6 between Market Harborough and Leicester and, to a lesser extent, on the A47, the A4304 and the A5199 Welford Road towards Wigston.

4.2.6 Outside the district, relatively high levels of emissions are also forecast on the southern approach roads in Market Harborough, notably the A508, and the A47 around Uppingham. Away from the main roads, low levels of emissions are forecast, meaning that traffic and congestion in general are relatively light.

Figure 4-2: Amended Reference Case AM peak hour CO_2 emissions (kilograms per hour)

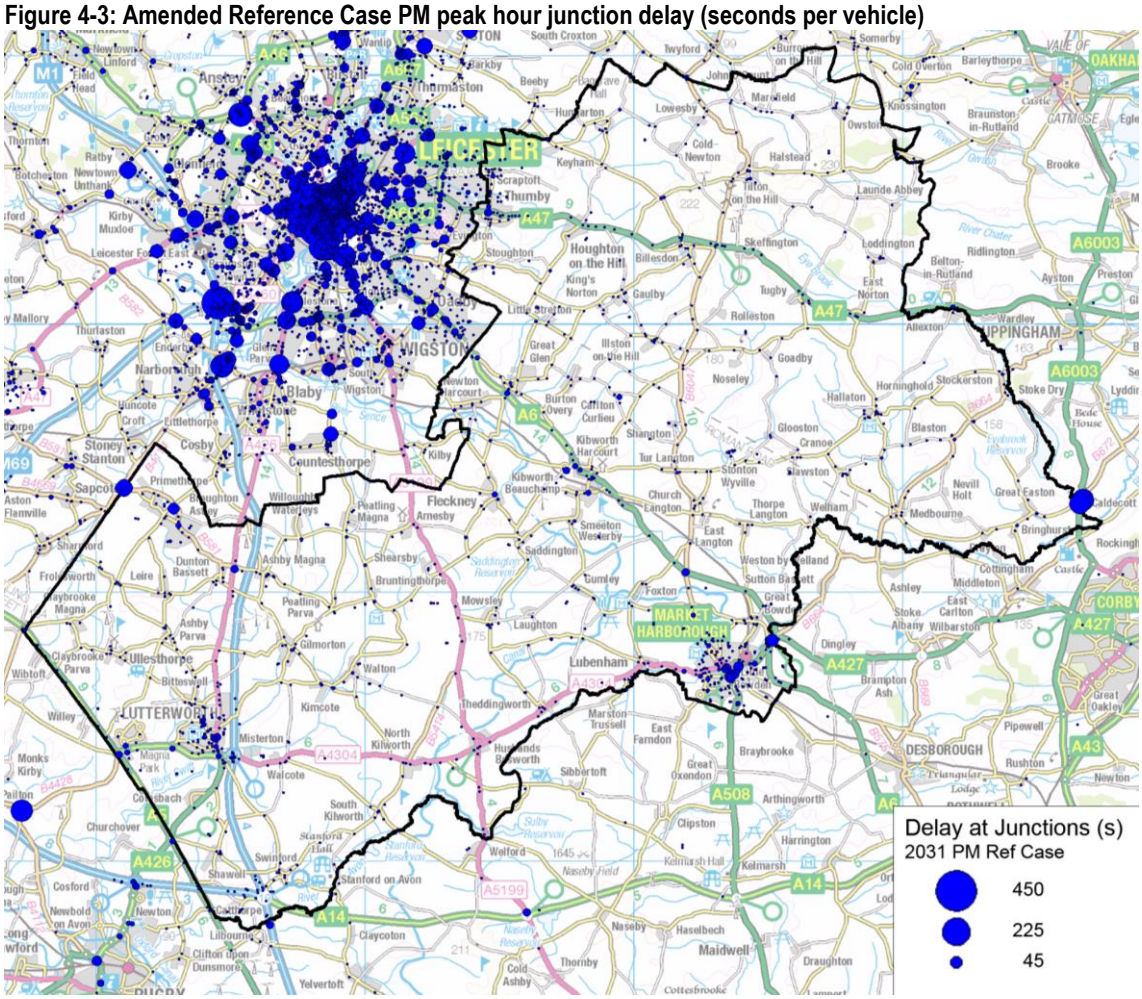


4.2.7 Figure 4-3 shows the average delay at junctions (measured in seconds per PCU) forecast during the 2031 PM peak hour in the Amended Reference Case.

4.2.8 The plan indicates similar issues in this time period to those in the AM peak hour described above, with the highest level of delay within the District occurring at junctions in and around Market Harborough, and lower levels at clusters of junctions in and around the Kibworths and Lutterworth. Other key pinch points evident in the AM peak hour (the junctions on the A6003 in Caldecott and the B581 Coventry Road in the vicinity of Primethorpe) are also evident in the PM peak hour.

4.2.9 However, as with the AM peak hour, delays on the network in the PM peak hour within Harborough District are significantly lower than those forecast at junctions in Leicester in the 2031 Amended Reference Case.

Figure 4-3: Amended Reference Case PM peak hour junction delay (seconds per vehicle)



4.3 Summary of option analysis

4.3.1 The Amended Reference Case road network performance, summarised in the previous section, provides the baseline against which the four short-listed options have been assessed. Link and junction-based analysis for each option is provided later in this chapter, and should be read in the context of the headline outputs from each model test described below.

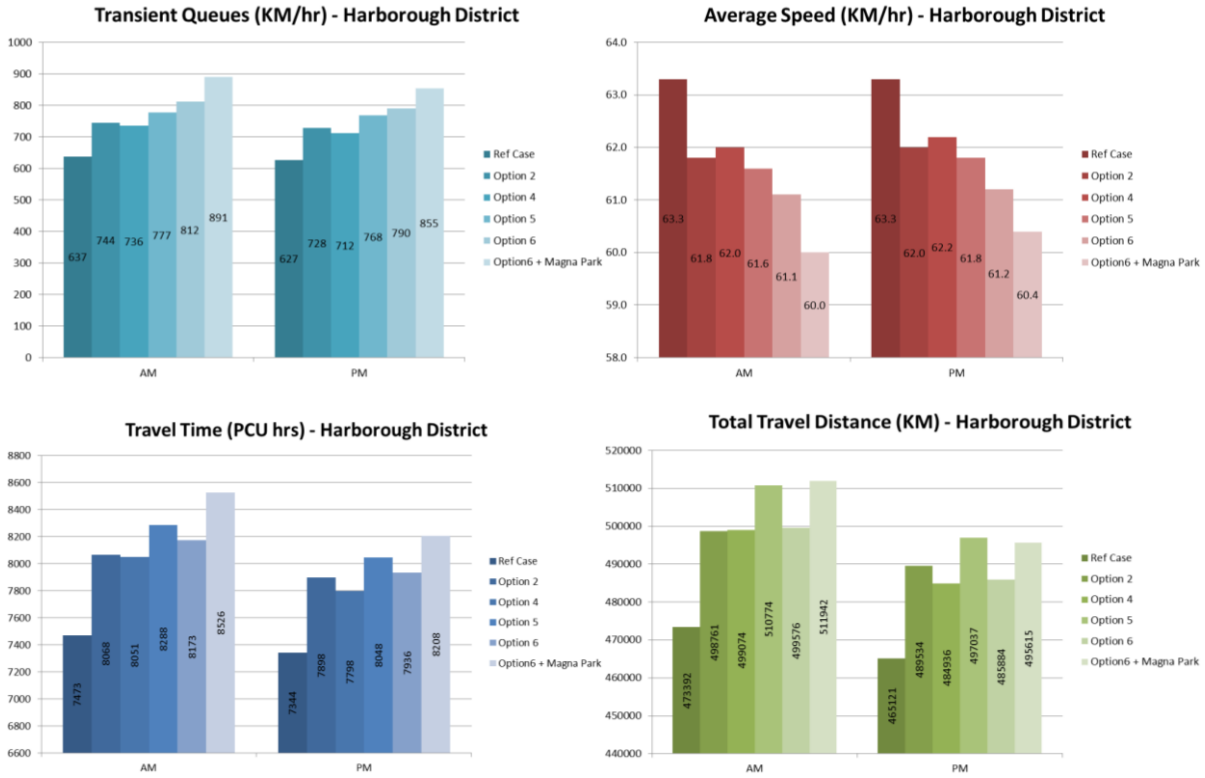
4.3.2 Figure 4-4 summarises option impacts on the road network purely within Harborough District in both peak hours in 2031, reported in terms of overall travel time (measured in PCU-hours), overall travel distance (PCU-kms), average speed (kph), and transient queues (measured in PCUs). The latter metric represents the forecast number of vehicles left in queues on the road network at the end of the modelled hour due to network congestion, which would consequently have to complete their journeys in the subsequent hour.

4.3.3 The graphs indicate that for roads in Harborough District, Option 4 (the Scraptoft North SDA) results in the lowest level of traffic impact of all the four options, including the lowest level of transient queueing, the highest average speeds, and the lowest overall travel time in both peak hours.

4.3.4 In contrast, Option 6 (the Lutterworth East SDA) results in the highest level of transient queuing and the lowest average speeds, primarily due to congestion forecast at the 'Frank Whittle' A4303/Rugby Road junction and the new A4304/eastern SDA link road junction. The graphs also show that road network performance deteriorates further when Option 6 is assessed together with the cumulative impact of new development at Magna Park.

4.3.5 In addition, Option 5 (the Kibworth SDA) results in the highest forecast travel time and travel distance, primarily as a result of the assumed traffic distribution from the site. Relative to the settlements where development is focussed in the other options, the Kibworths are generally either smaller in size or are more isolated from significant external trip generators or attractors (for example Leicester), resulting in Kibworth SDA-related traffic travelling further on average to reach its destinations.

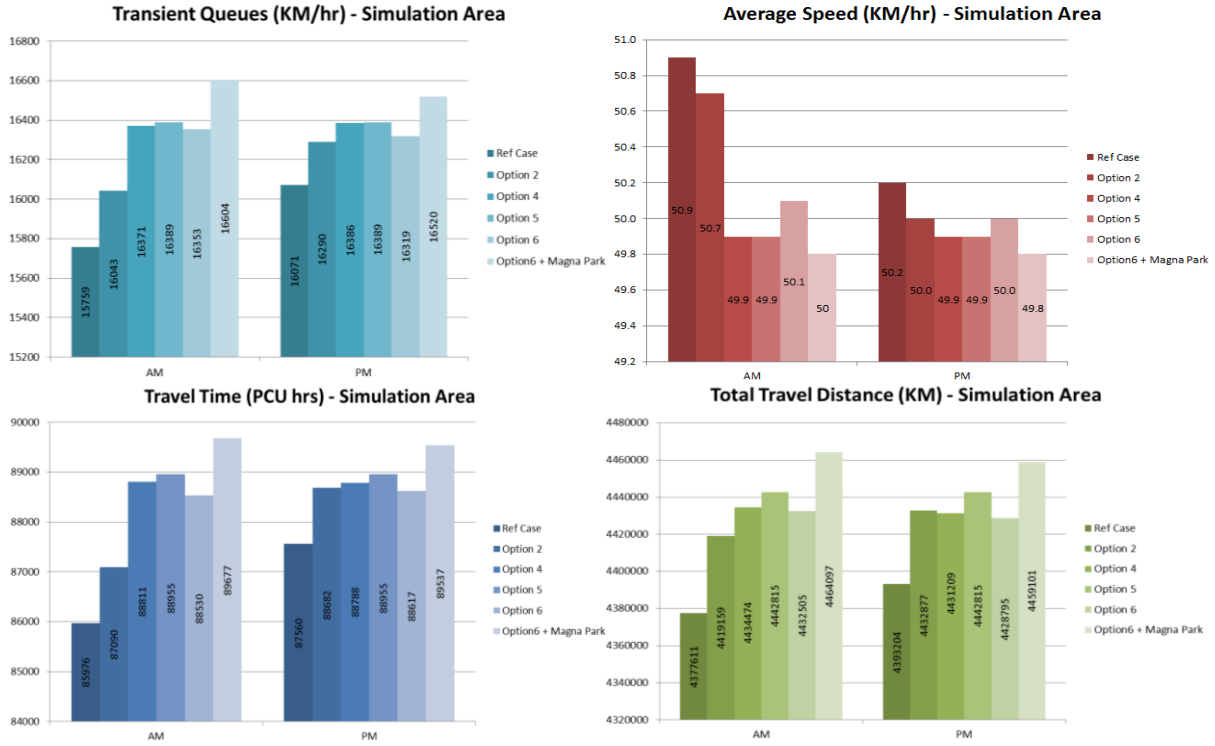
Figure 4-4: Summary of option impacts on road network in Harborough District



4.3.6 Building on the analysis described above, Figure 4-5 summarises option impacts on the road network across the entire model simulation area, which as described in Chapter 1 is broadly similar to the area covered by Leicestershire County. The graphs indicate that based on this geographic definition, Option 2 (the Core Strategy Distribution) generally results in the lowest level of traffic impact, including all four metrics in the AM peak and transient queuing in the PM peak. It is also notable that Option 6, when assessed without the cumulative impact of development at Magna Park, outperforms Options 4 and 5 for all metrics in all time periods when impacts are assessed across the County.

4.3.7 Option 2 largely performs well when impacts are considered at a County-level as the focus of development is on Market Harborough, which is located on the southern boundary of the County. As a result, when compared with the other options, traffic from development in this area is more likely to distribute to the road network in Northamptonshire to the south, which is not included in the model simulation area. This displacement effect is similar to that observed for Option 4 when impacts are assessed at a district level: much of the traffic generated by the Scraptoft North SDA distributes to the road network in Leicester and although this reduces impacts within the district itself, the impact at County-level is influenced as a result of development traffic increasing delay at already congested junctions within Leicester.

Figure 4-5: Summary of option impacts on road network in model simulation area (County)



4.3.8 It should be noted that none of the tests undertaken results in a definite critical traffic issue either within Harborough District or the County itself, and the differences between the options described above are relatively minor in terms of scale. Development-related traffic generally forms a small proportion of total forecast flow on major roads and consequently results in small incremental increases in delay at specific junctions. The exception to this may be the impact of development traffic on junctions on the A4303 and A4304 in Option 6, although further more detailed assessment is required to determine this definitively. Further discussion of these impacts is described later in this chapter.

4.3.9 It should also be noted that, as described in Chapter 3, fixed vehicle trip rates have been used to assess traffic impacts in all four short-listed options and as a result, no account has been taken of the varying potential for mode shift away from private vehicular transport to more sustainable modes (i.e. walking, cycling and public transport) in each option. A full run of the land-use and transport components of the LLITM would be required for a robust assessment of this potential for mode shift, but it may be surmised that Options 2 and 4 are likely to present a greater potential when compared with Options 5 and 6.

4.3.10 In Option 2, development is concentrated in Market Harborough, where the existing settlement is significantly larger than either the Kibworths or Lutterworth and is consequently likely to support more local jobs, services and facilities for people living in new residential developments, which is in turn likely to result in a higher proportion of development-related journeys being made on foot or by bicycle. In addition, the existing settlement has a rail station providing a frequent direct service to Leicester, London St. Pancras and other stations on the Midland Main Line, and its relative size supports a more comprehensive bus network. Both these factors increase the likelihood of development-related trips in Market Harborough using public transport when compared with development in the Kibworths or Lutterworth.

4.3.11 In Option 4, development is concentrated in Scraptoft, which is on the fringe of the Leicester urban area. While the development itself is unlikely to support a significant quantum of local jobs, services and facilities, its proximity to Leicester increases the potential for providing high frequency bus services to the SDA site and consequently encouraging a higher proportion of development-related trips onto public transport.

4.3.12 The remainder of this chapter describes the detailed traffic impacts of each of the four short-listed options in turn.

4.4 Option 2 (Core Strategy Distribution) model results

4.4.1 Option 2 included no road network changes, and development is concentrated primarily in Market Harborough, with smaller sites in Fleckney, Houghton, Lutterworth and Scraptoft.

4.4.2 The two delay plots below in Figure 4-6 and Figure 4-7, for the AM and PM peak hours respectively, show that there is a general increase in delay at junctions in Market Harborough, including the A6/A226 roundabout and the A508/A4304 junction. An increase in delay is also evident at junctions in the centre of Lutterworth and Fleckney, although smaller in scale than that reported in Market Harborough. There are only very minor changes evident across the rest of the network within the District.

Figure 4-6: Change in AM peak hour junction delay (seconds per vehicle, Option 2 v Amended Reference Case)

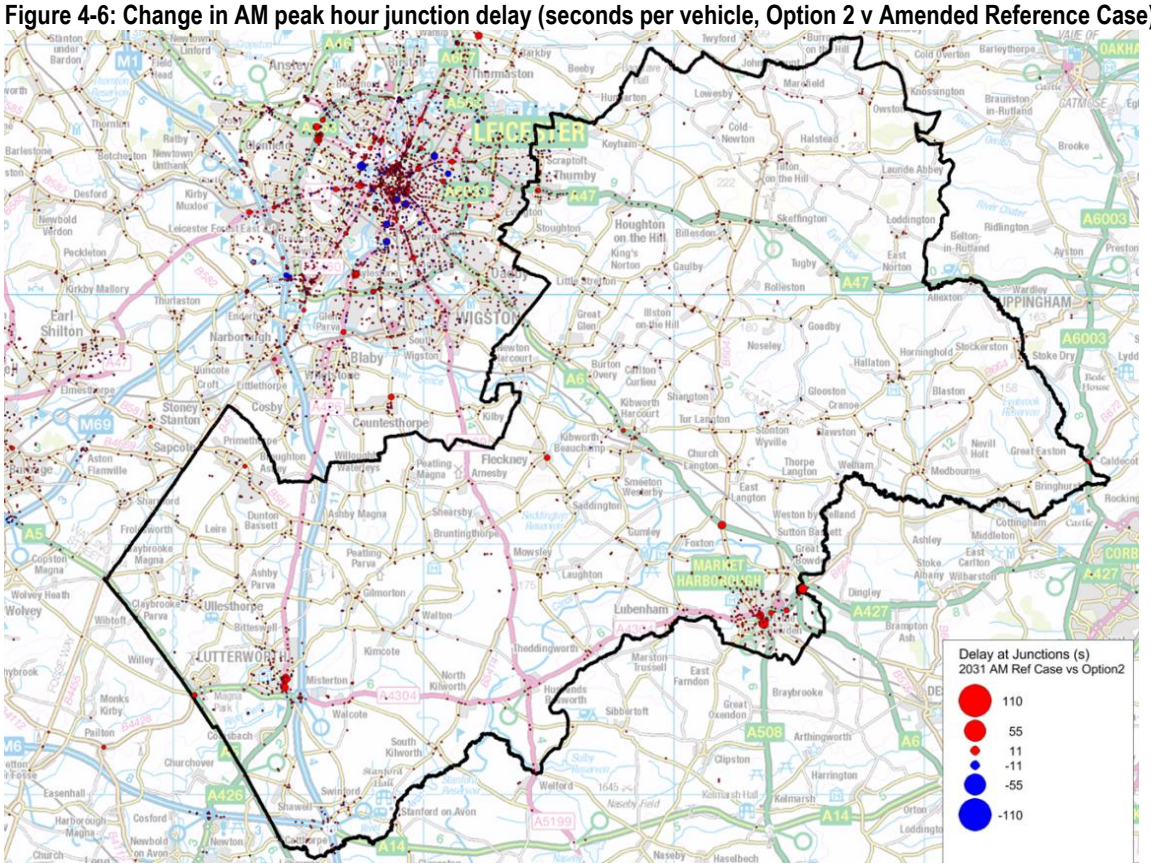
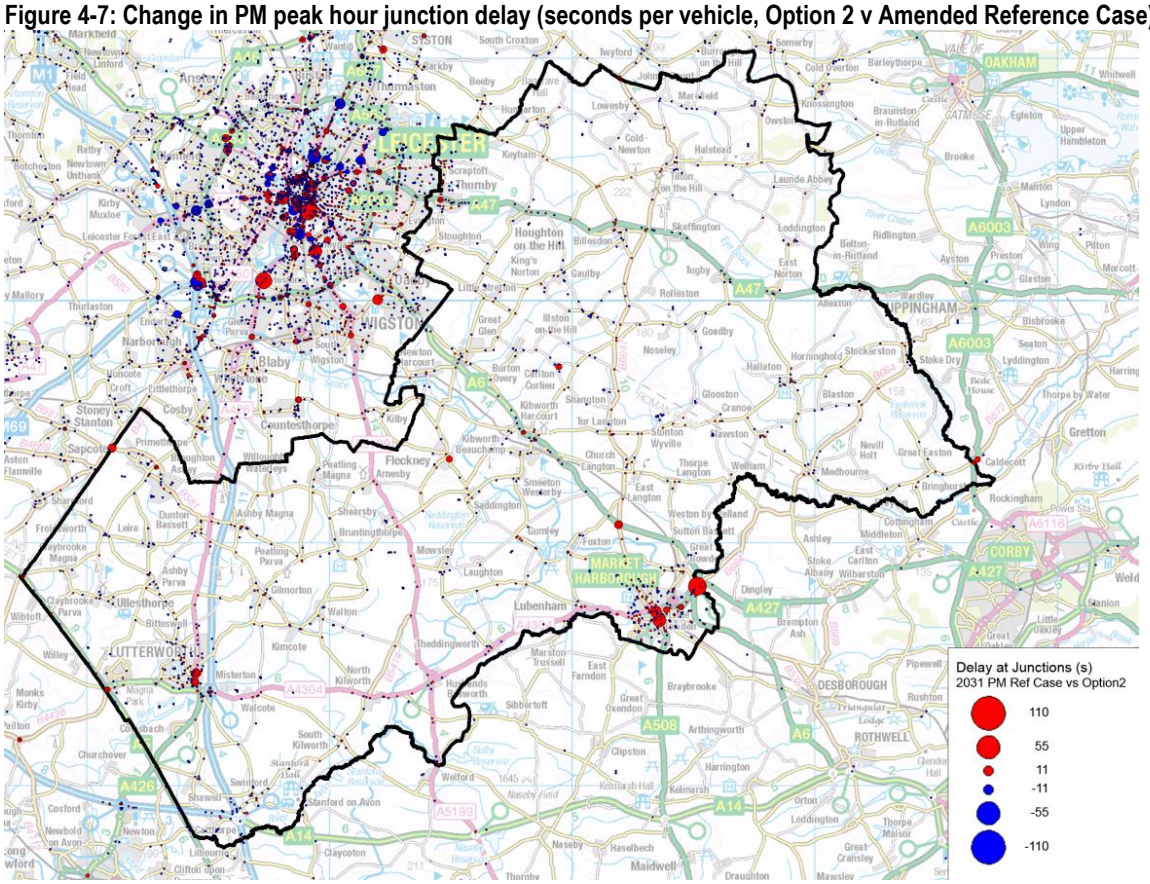


Figure 4-7: Change in PM peak hour junction delay (seconds per vehicle, Option 2 v Amended Reference Case)



4.4.3 The plots above also indicate that the delay changes in Option 2 are similar in both the AM and PM peak hours and therefore, in the interests of brevity, additional analysis is provided below for the AM peak hour only.

4.4.4 The AM peak hour VCR plot in Figure 4-8 below indicates that the A6/A427/A4304 junction sees an increase in VCR on its major arms to over 80%, and to over 100% on the Dingley Road arm in Option 2. This is also the case on the northern Melton Road arm of its junction with the A6. The rest of the network shows very little change in VCR aside from minor issues in Fleckney, the Kibworths and Lutterworth.

4.4.5 The AM peak hour CO_2 emissions plot in Figure 4-9 below shows an increase in emissions on routes around Market Harborough, with the highest increase on the A508 south towards Northampton. The A6 experiences relatively little change in emissions but the increase in emissions on minor roads to the west including the A5199 suggests that some traffic is re-routing to avoid the A6 in this option. Some small increases in emissions are also evident on the A4304 south of Lutterworth.

Figure 4-8: Change in AM peak hour link Volume/Capacity Ratio (Option 2 v Amended Reference Case)

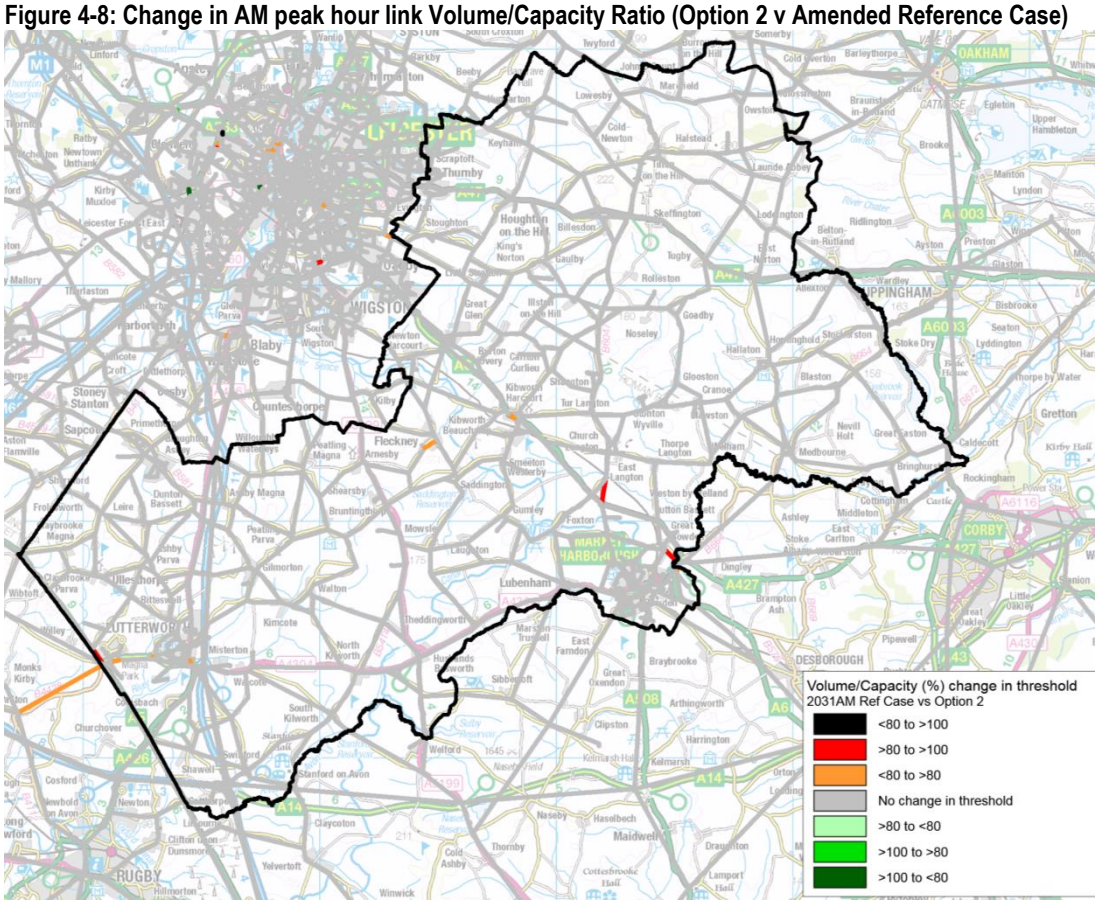
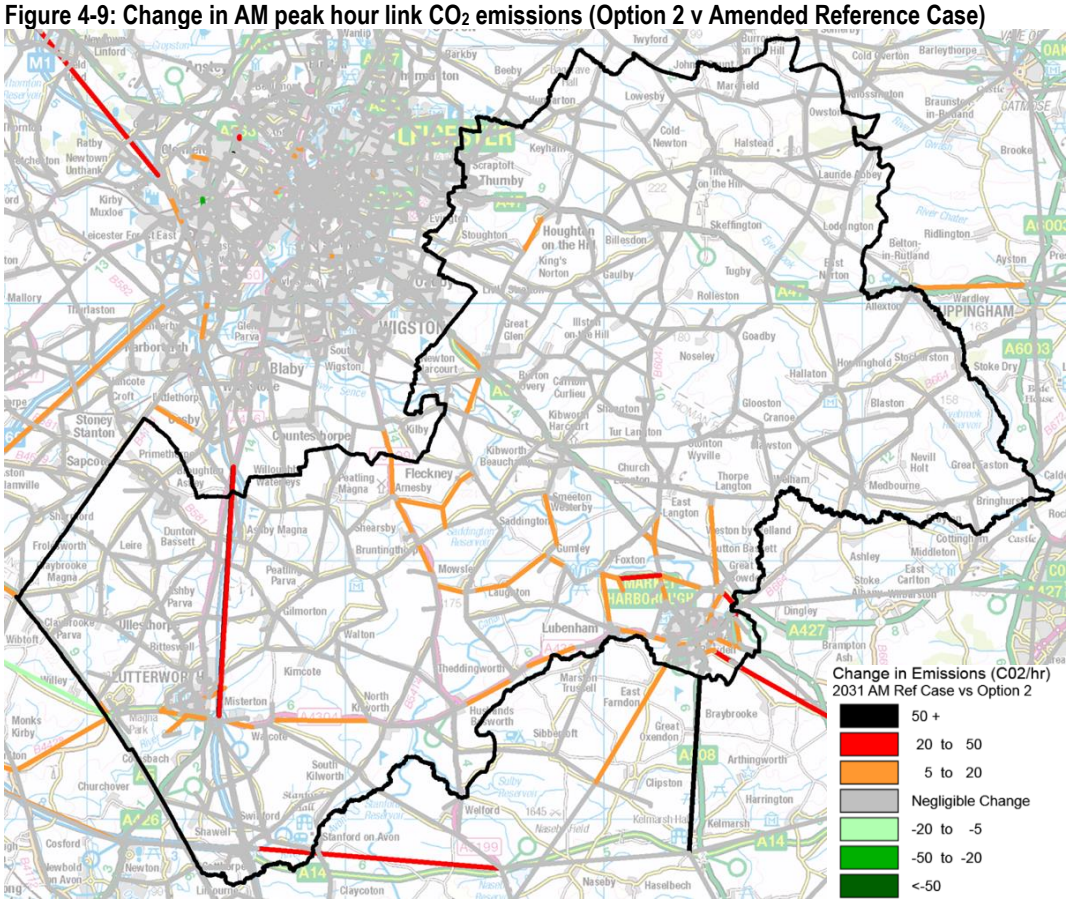


Figure 4-9: Change in AM peak hour link CO_2 emissions (Option 2 v Amended Reference Case)



4.5 Option 4 (Scraptoft/Thurnby SDA) model results

4.5.1 Option 4 includes a new link road connecting Hamilton Lane, Beeby Road and Covert Lane, passing through the proposed new Scraptoft North SDA where the bulk of residential development is focussed. Other development is concentrated in Market Harborough, Fleckney, Lutterworth and Houghton.

4.5.2 The AM and PM peak hour delay plots in Figure 4-10 and Figure 4-11 below show little increase in delay across Harborough District, although junctions around Scraptoft and along the A6 show some increase.

4.5.3 Increases in delay at busy junctions within Leicester itself are more evident in this option (particularly at the Church Road/Spencefield Lane and A6030/Hastings Road junctions), although the plot in Figure 4-12 (which shows the AM peak hour delay change in more detail in the vicinity of Scraptoft) indicates that these increases are still relatively minor.

Figure 4-10: Change in AM peak hour junction delay (seconds per vehicle, Option 4 v Amended Reference Case)

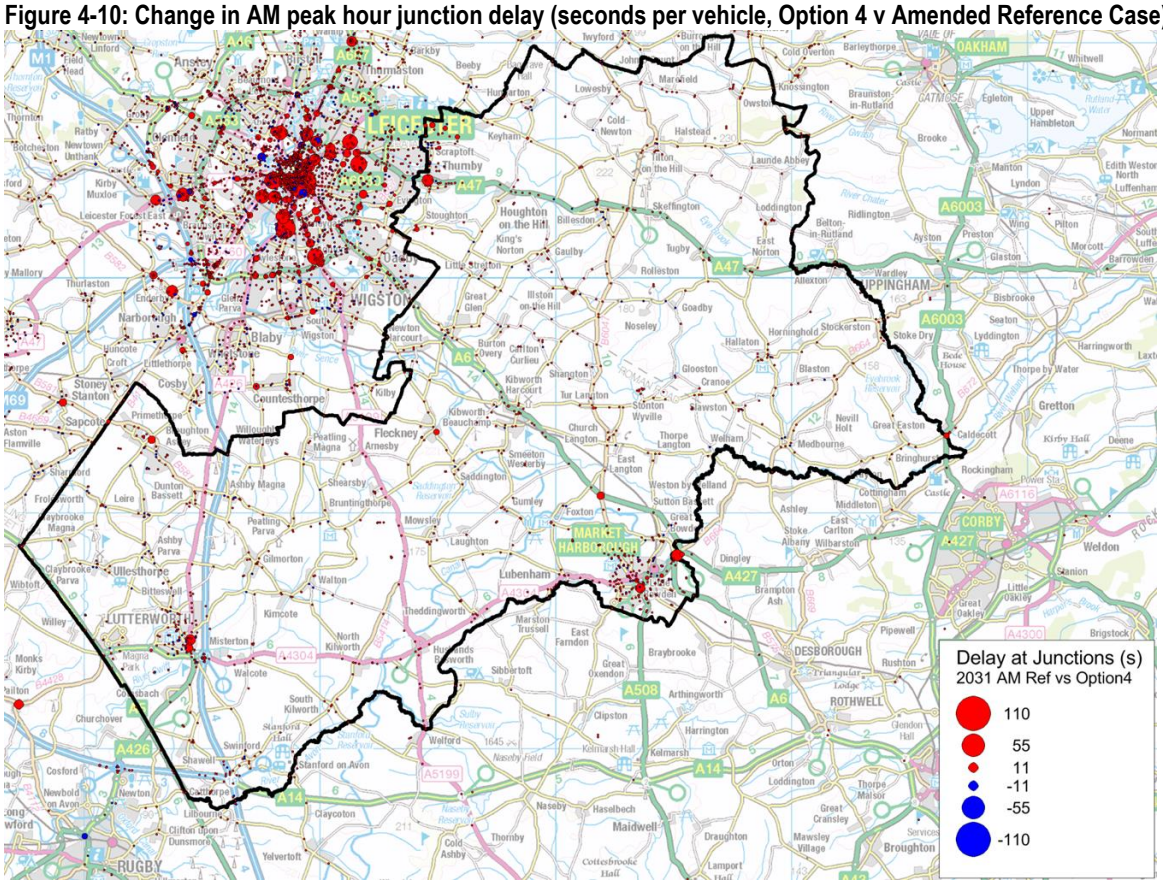


Figure 4-11: Change in PM peak hour junction delay (seconds per vehicle, Option 4 v Amended Reference Case)

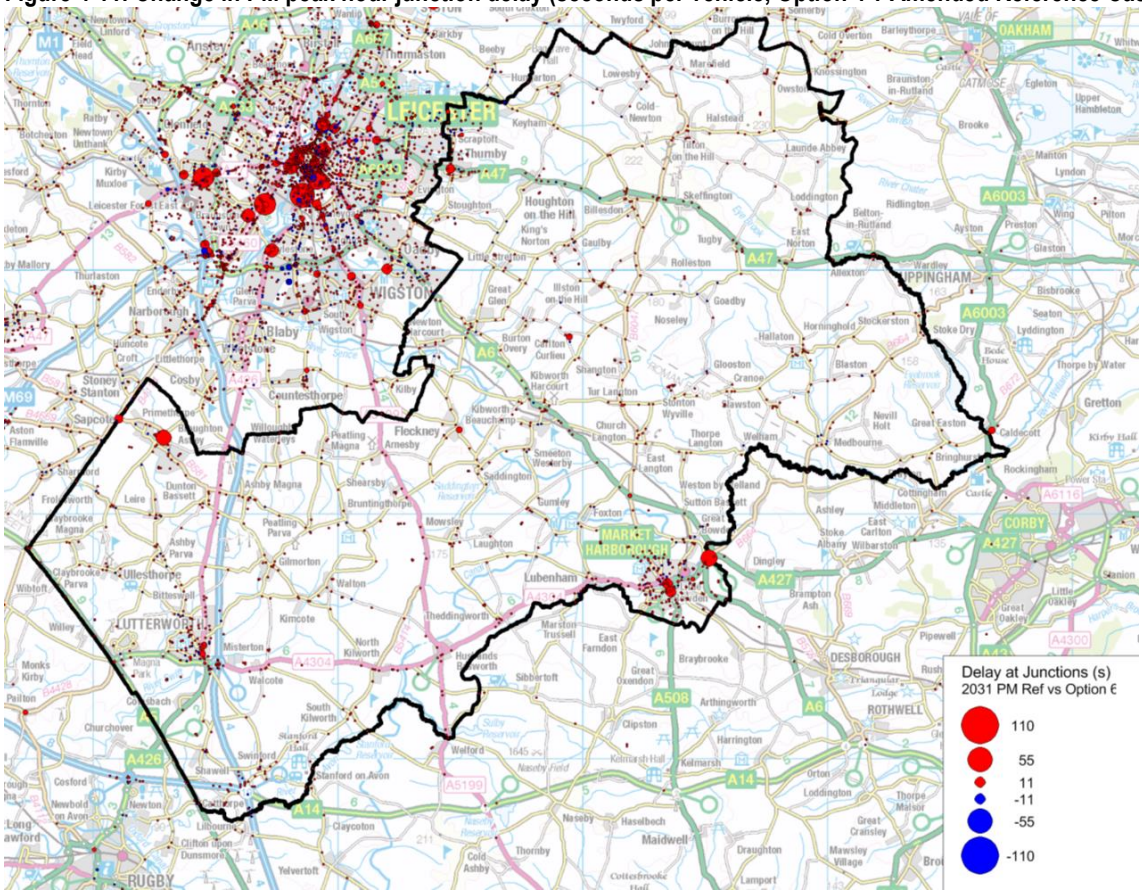
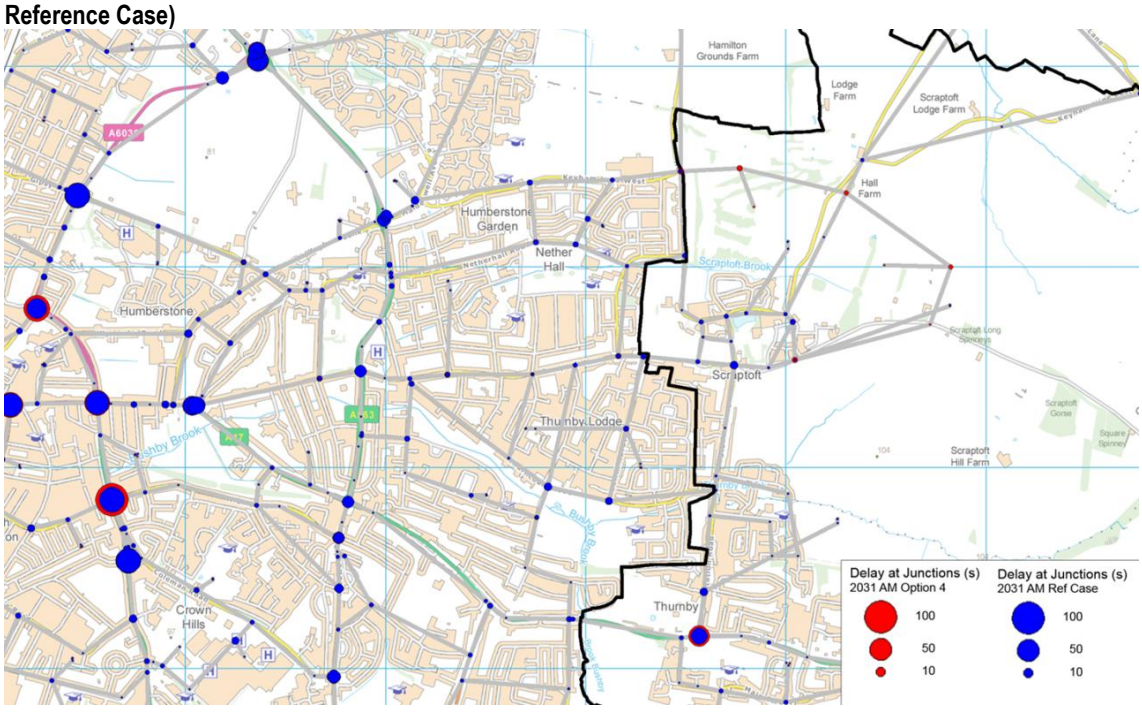
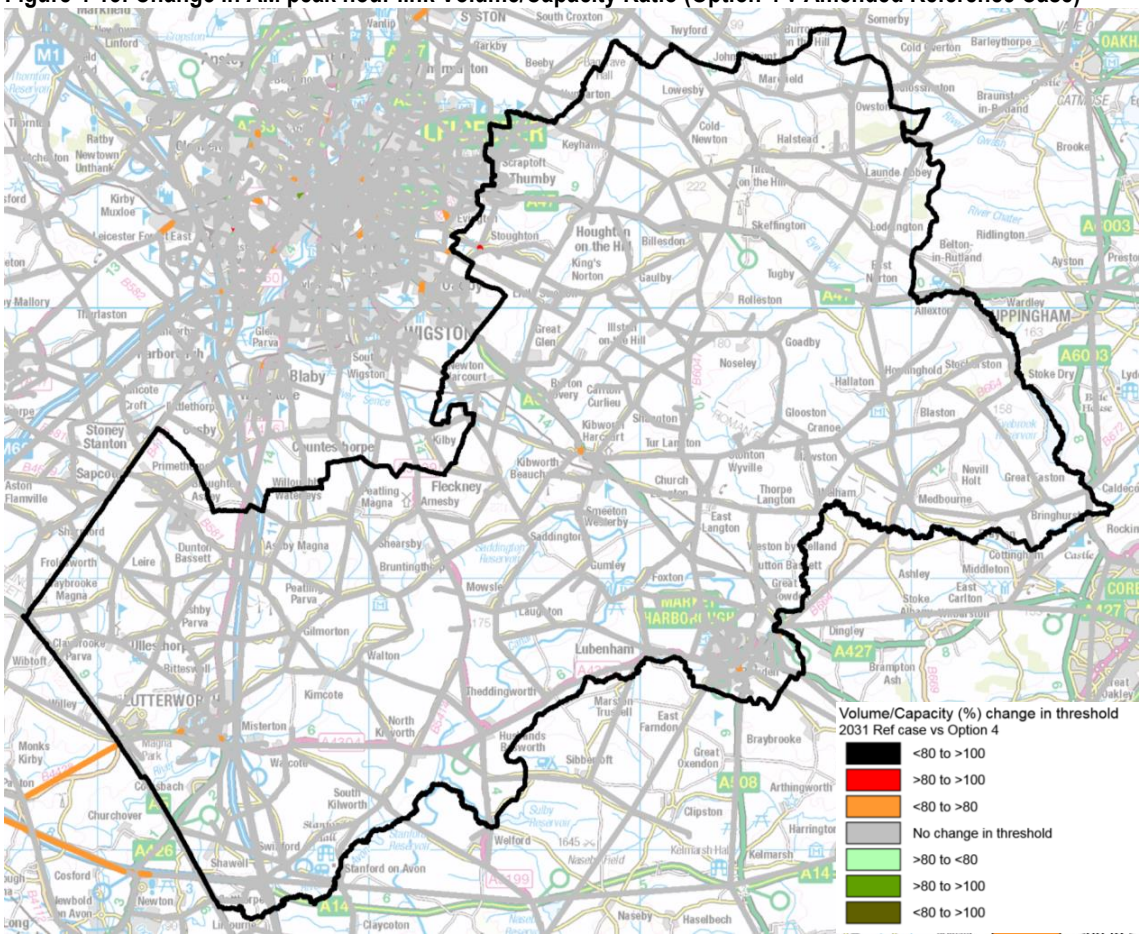


Figure 4-12: Change in AM peak hour junction delay in Scraptoft area (seconds per vehicle, Option 4 v Amended Reference Case)



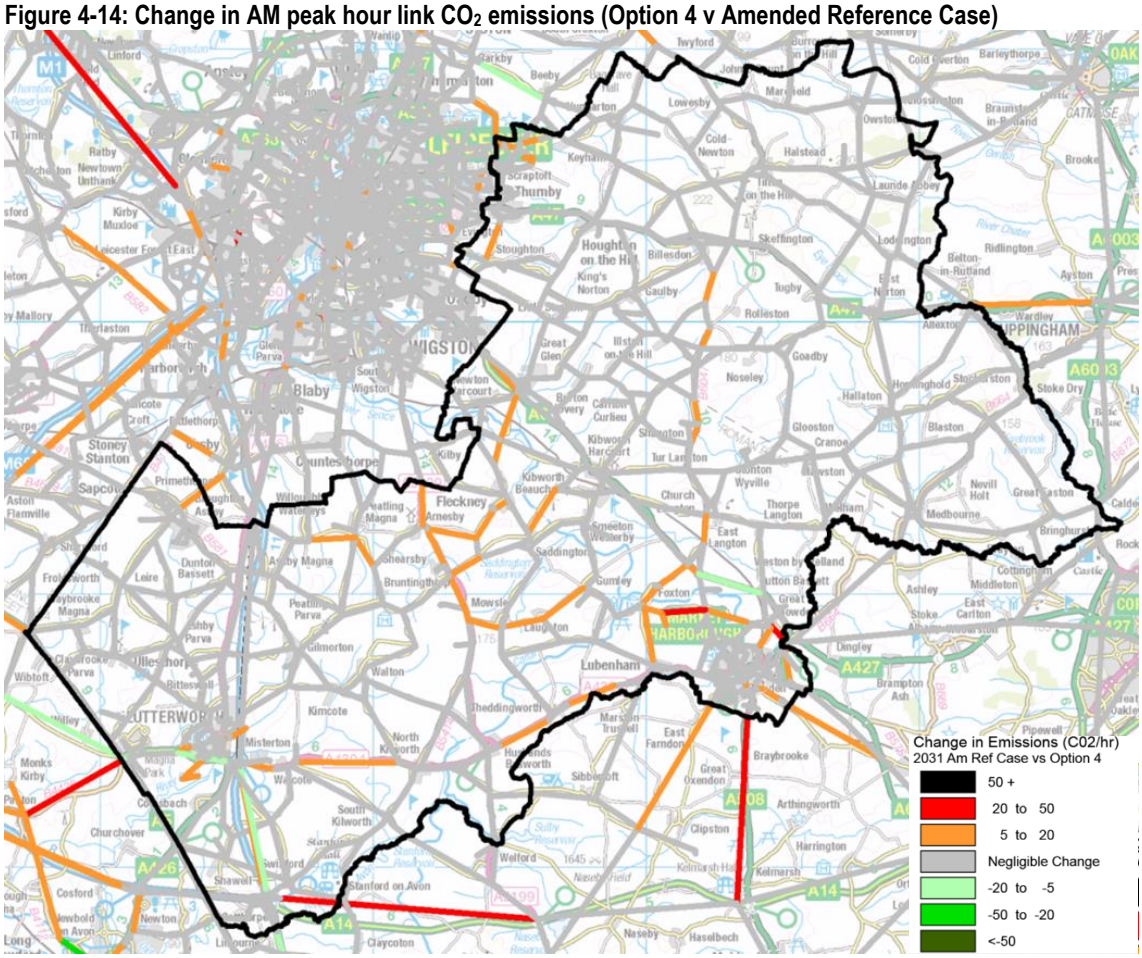
4.5.4 The AM peak hour VCR plot in Figure 4-13 below indicates that very few links cross the 80% or 100% thresholds as a result of Option 4 traffic. Some minor issues are evident, including an increase to over 100% capacity on one link in the village of Stoughton (most likely due to rat-running) as well as some increases on links to over 80% capacity, including the A6 in Kibworth and in Market Harborough town centre.

Figure 4-13: Change in AM peak hour link Volume/Capacity Ratio (Option 4 v Amended Reference Case)



4.5.5 The AM peak hour CO_2 emissions plot in Figure 4-14 also shows that there are only minor changes across the network in Option 4. The impact of avoidance of the A6 on minor roads to the west is also evident in this option, although to a lesser extent than that observed in Option 2 due to the lower level of development around Market Harborough.

Figure 4-14: Change in AM peak hour link CO_2 emissions (Option 4 v Amended Reference Case)



4.6 Option 5 (Kibworth SDA) model results

4.6.1 Option 5 includes the provision of a new bypass link for the A6 in Kibworth. Development is focussed on the associated Kibworth SDA site, with a lower level of development assumed in Market Harborough, Lutterworth, Houghton and Fleckney.

4.6.2 The AM and PM peak hour delay plots in Figure 4-15 and Figure 4-16 below show that the most significant increases in delay in this option occur on the A6 between Kibworth and Market Harborough, noticeably at the A6/Melton Road roundabout and the A6/A427/A4304 junction. There are also some increases at junctions in the centre of Lutterworth and Market Harborough.

Figure 4-15: Change in AM peak hour junction delay (seconds per vehicle, Option 5 v Amended Reference Case)

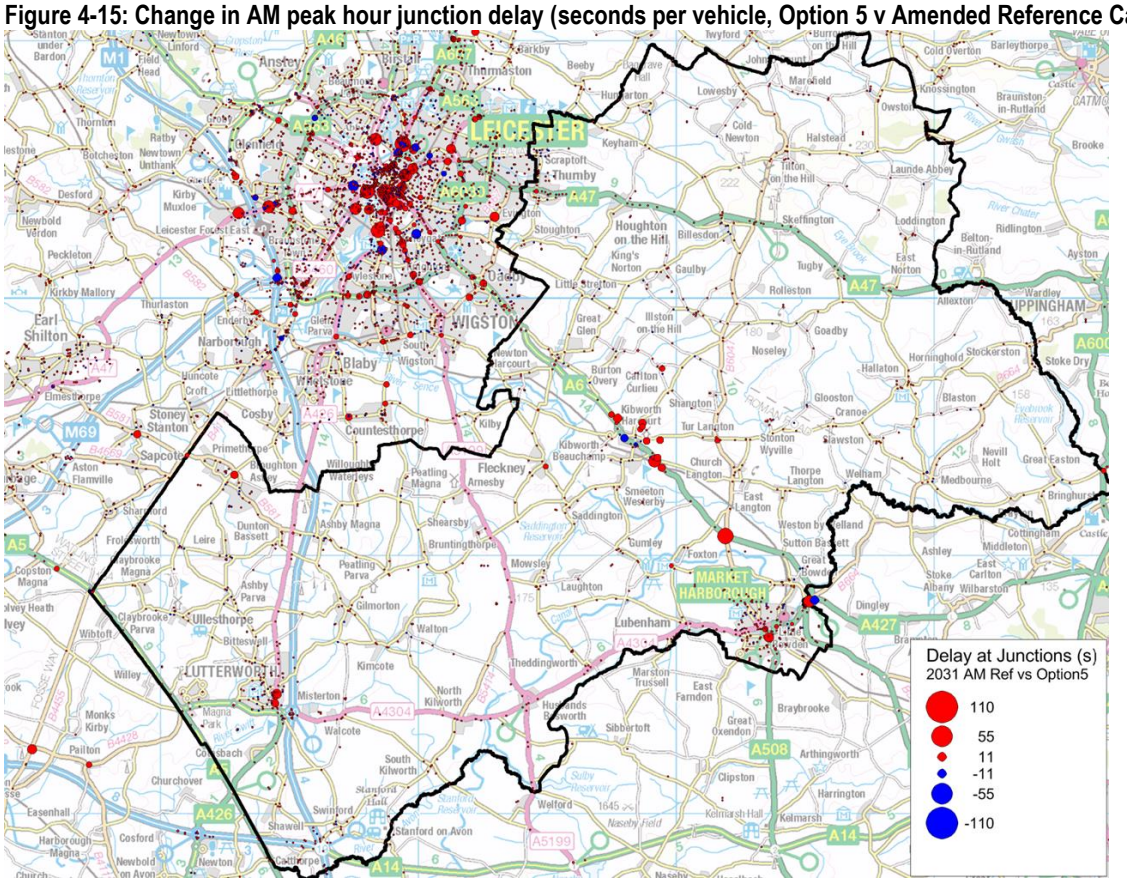
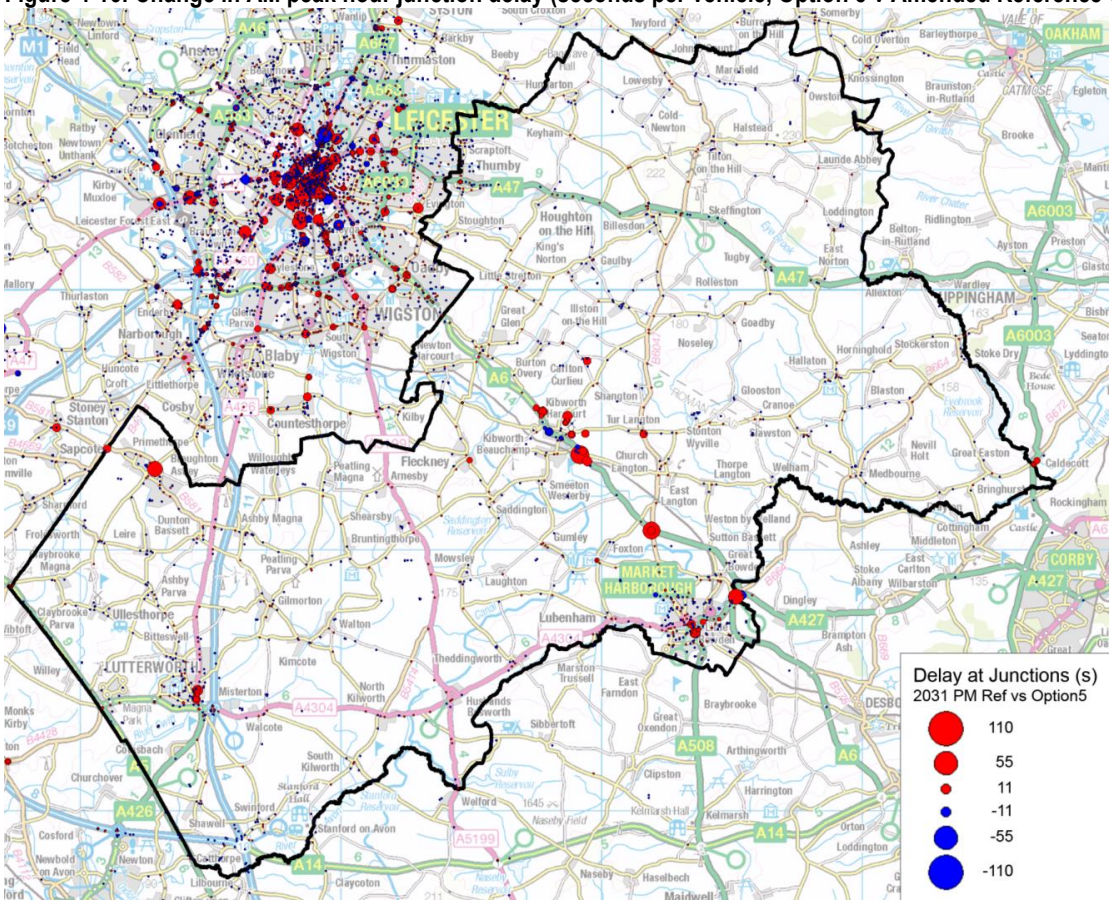
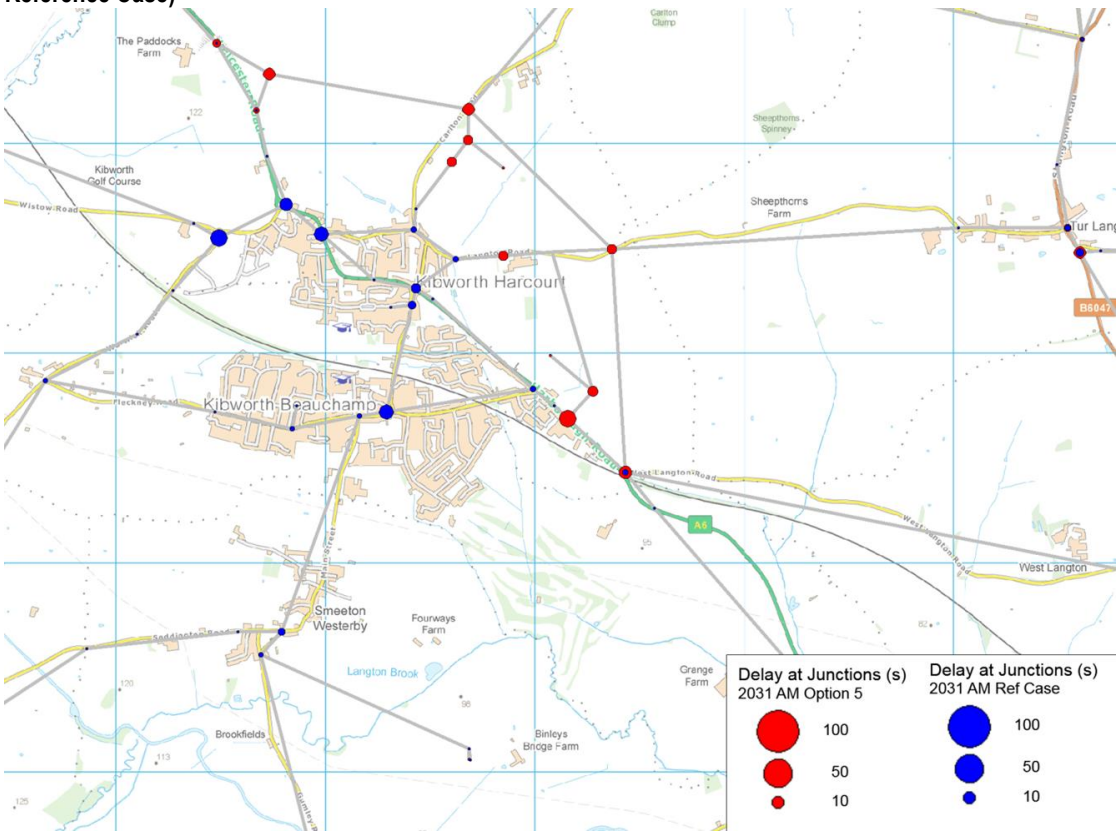


Figure 4-16: Change in AM peak hour junction delay (seconds per vehicle, Option 5 v Amended Reference Case)



4.6.3 The plots above also show some decrease in delay at junctions within Kibworth, as the bypass attracts a proportion of through traffic. This is more evident on the more detailed AM peak hour plot of delay changes in the Kibworth area, shown in Figure 4-17.

Figure 4-17: Change in AM peak hour junction delay in Kibworth area (seconds per vehicle, Option 5 v Amended Reference Case)



4.6.4 The AM peak hour VCR change plot in Figure 4-18 below shows little variance in threshold across the network, but the most notable changes occur on the A6, with increases above 80% on links either side of the existing settlement and a corresponding reduction below 80% within Kibworth itself due to the bypass road.

4.6.5 The change in AM peak hour CO_2 emissions plot in Figure 4-19 shows a more significant increase in emissions along the A6 between Kibworth and Wigston than is evident in any of the other options. In addition, the knock-on impact of increasing A6 congestion on traffic re-routing appears to be more evident in this option than in any of the others, with increases in emissions occurring on minor roads to the west of the A6 and also on the A4304 and the M1 into Leicester.

Figure 4-18: Change in AM peak hour link Volume/Capacity Ratio (Option 5 v Amended Reference Case)

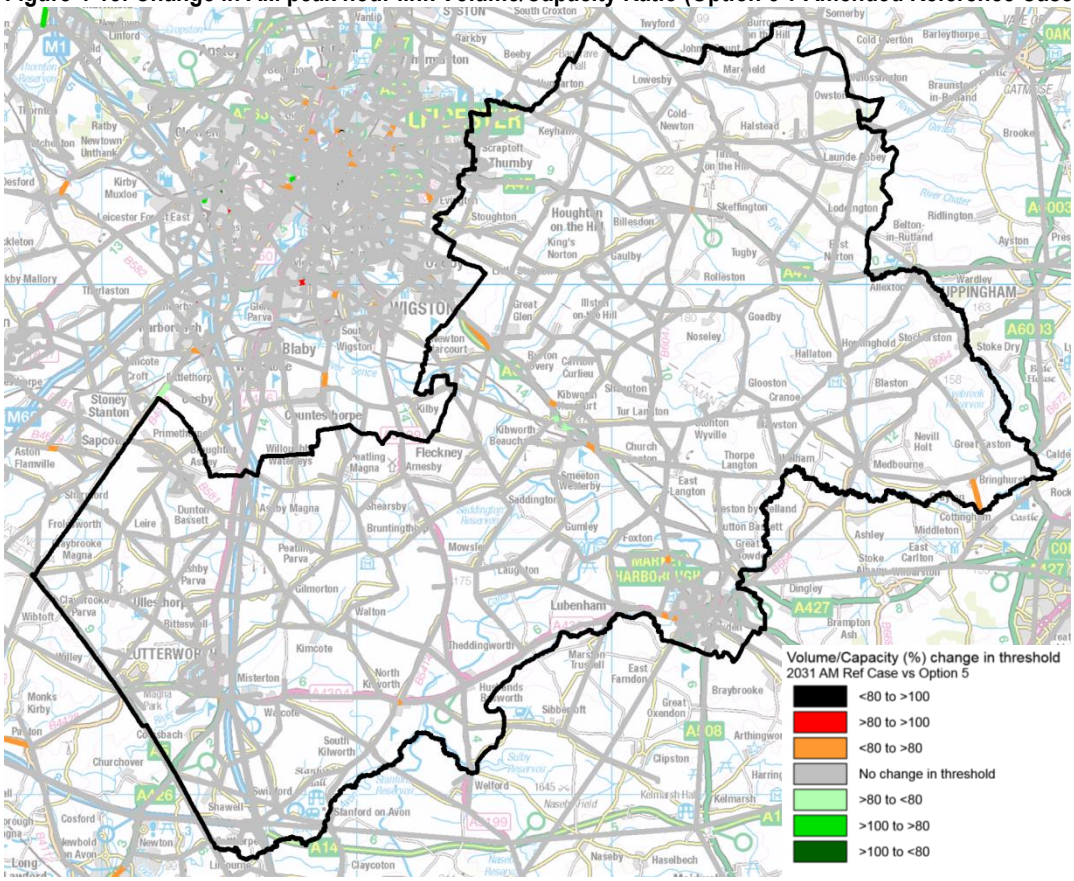
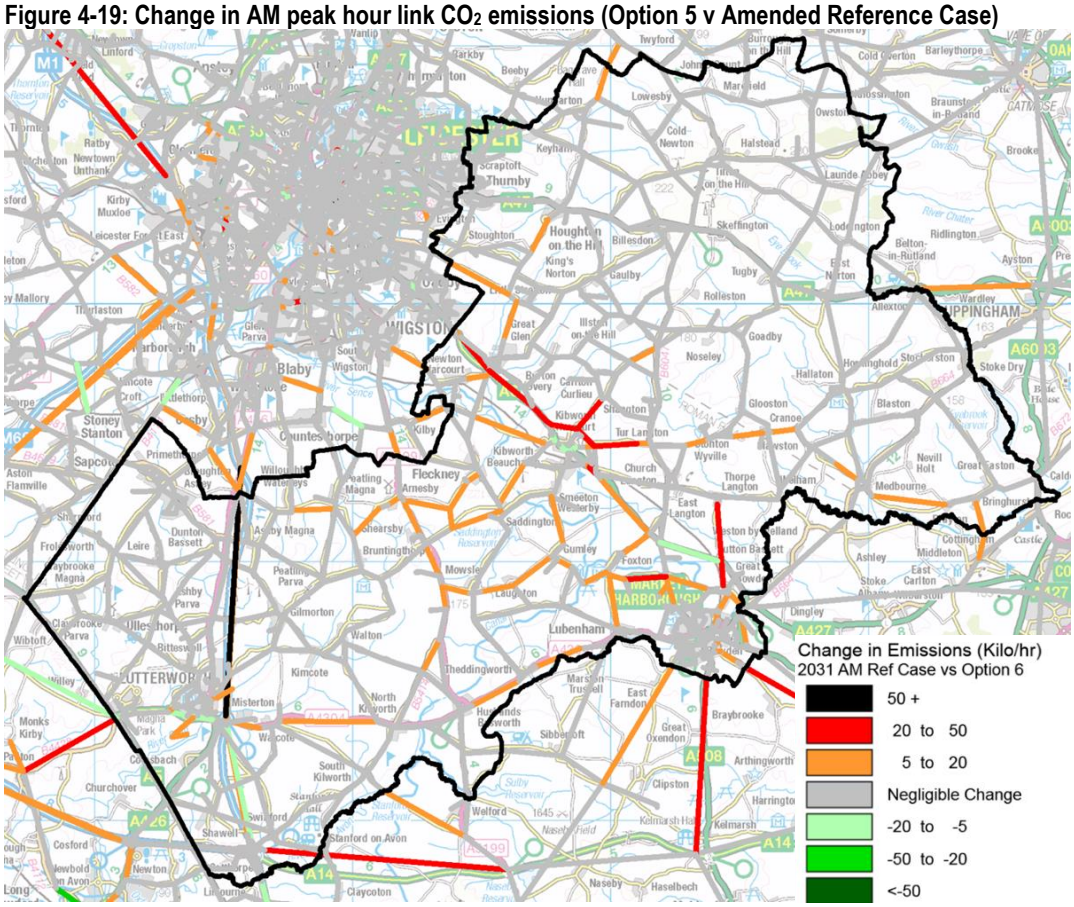


Figure 4-19: Change in AM peak hour link CO_2 emissions (Option 5 v Amended Reference Case)



4.7 Option 6 (Lutterworth SDA) model results

4.7.1 The focus of development in Option 6 is on the Lutterworth East SDA site, with supporting development in Market Harborough and Fleckney. A new link road is provided to the east of the M1 connecting the A4304 via a new signalised junction with a new roundabout on the A426. This option also includes the signalisation of the M1 Junction 20 and the 'Frank Whittle' A4303/Rugby Road junction. Junction and link road LLITM coding was provided for this option by the developers' traffic team.

4.7.2 The AM and PM peak hour delay plots in Figure 4-20 and Figure 4-21 below suggest that the signalisation of the M1 Junction 20 and the provision of two newly signalised junctions on the A4303 and A4304 either side generate a large increase in delay, which has a knock-on impact on the surrounding road network. Away from Lutterworth, there are also increases in delays around Market Harborough, particular increases at the A6/A4304/Dingley Road roundabout and the A6/B6047 roundabout.

Figure 4-20: Change in AM peak hour junction delay (seconds per vehicle, Option 6 v Amended Reference Case)

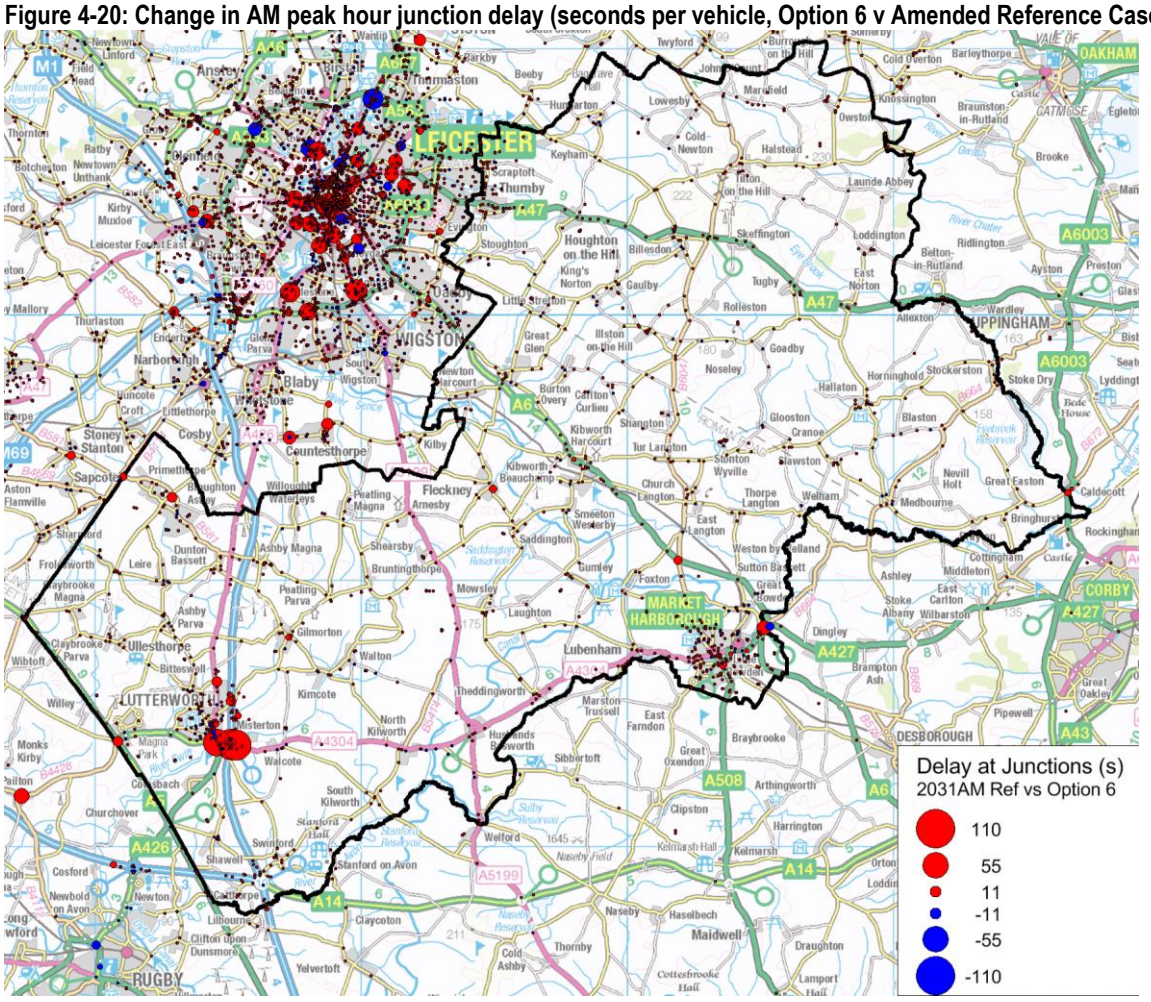
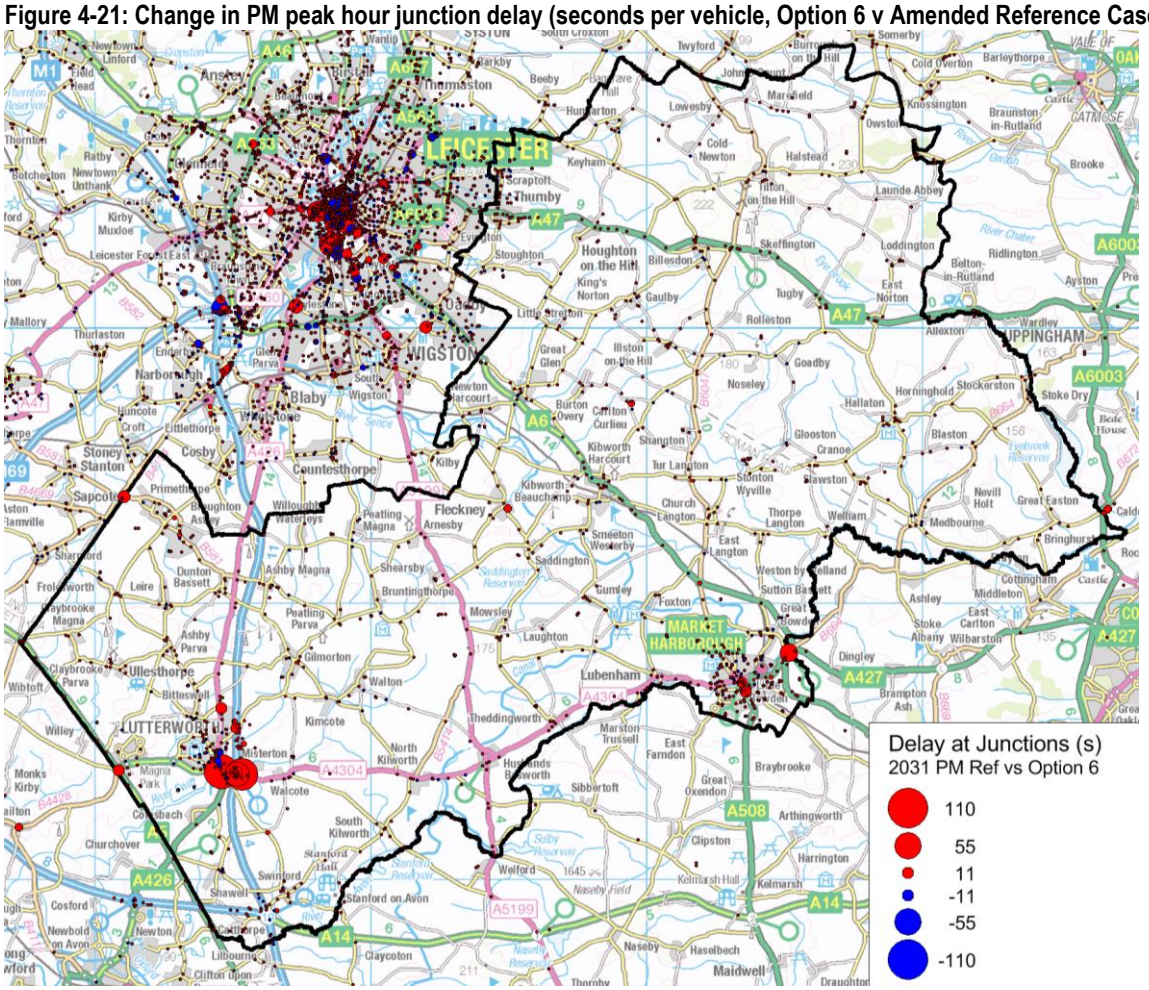


Figure 4-21: Change in PM peak hour junction delay (seconds per vehicle, Option 6 v Amended Reference Case)



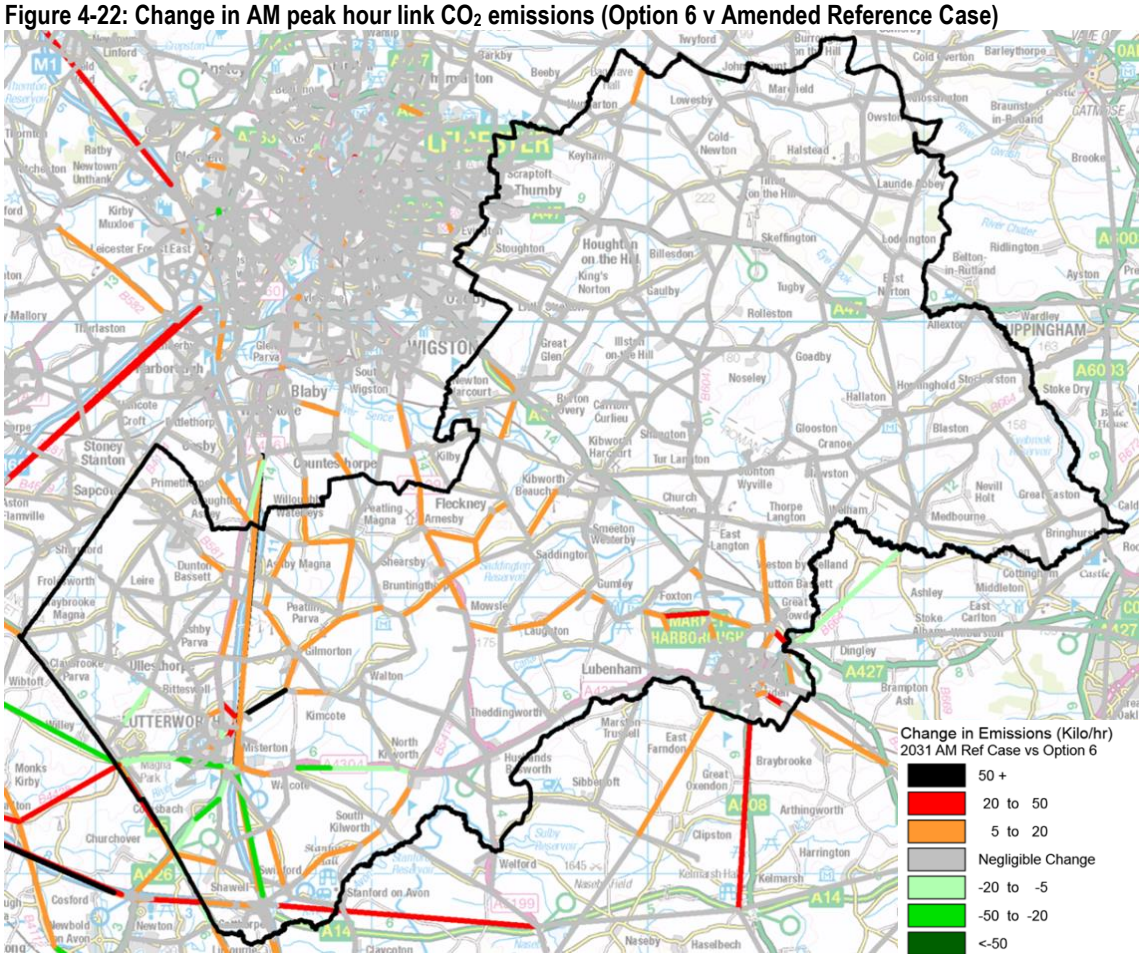
4.7.3 The AM peak hour emissions plot in Figure 4-22 below highlights some of the traffic issues caused in the Lutterworth area by delays at the aforementioned junctions.

4.7.4 Traffic is constrained along the A4303, A4304 and the Rugby Road to the south of Lutterworth, resulting in a reduction in emissions on these routes. However, partly as a result of the delays on the A4303 and A4304, a relatively high proportion of development traffic from the SDA routes on to Gilmorton Road, both to the north-east of the town and via the town centre itself.

4.7.5 In addition, delays at the new eastern link road junction with the A4304 limits the extent to which existing north-south traffic on the A426 diverts on to the new link road. This combined with the forecast increases on Gilmorton Road means that there is no evidence of a forecast reduction in town centre traffic associated with the option. There is also evidence of an increase in traffic, and consequently emissions, along the A14 to the south as traffic attempts to avoid the A4303/A4304 east-west corridor.

4.7.6 It should be noted that the junction signal timings developed for this option have not been optimised to match forecast traffic flows and as a result, it is possible that the issues described above could be mitigated through relatively minor works (signal optimisation and potentially some reconfiguration of proposed junction layouts). However, further more detailed assessment, including local junction modelling, would be required to determine this definitively.

Figure 4-22: Change in AM peak hour link CO_2 emissions (Option 6 v Amended Reference Case)



4.8 Option 6A (Lutterworth SDA + Magna Park development) model results

4.8.1 A further test of Option 6 was undertaken accounting for the additional traffic impact of committed development at Magna Park along the A4303 to the west of Lutterworth, as described in Chapter 2. This test is described in this report as Option 6A.

4.8.2 The two AM and PM peak hour plots in Figure 4-23 and Figure 4-24 below show the forecast change in delay at junctions in Option 6A when compared with the original Option 6 test described above.

4.8.3 The plots indicate that the cumulative impact of committed development at Magna Park further exacerbates the issues described above, by increasing demand and delay at the new signalised junctions on the A4303 and A4304. Magna Park development traffic also increases delay at junctions further to the west along the A5, the B4455 and around Wolvey.

Figure 4-23: Change in AM peak hour junction delay (seconds per vehicle, Option 6 + Magna Park v Option 6)

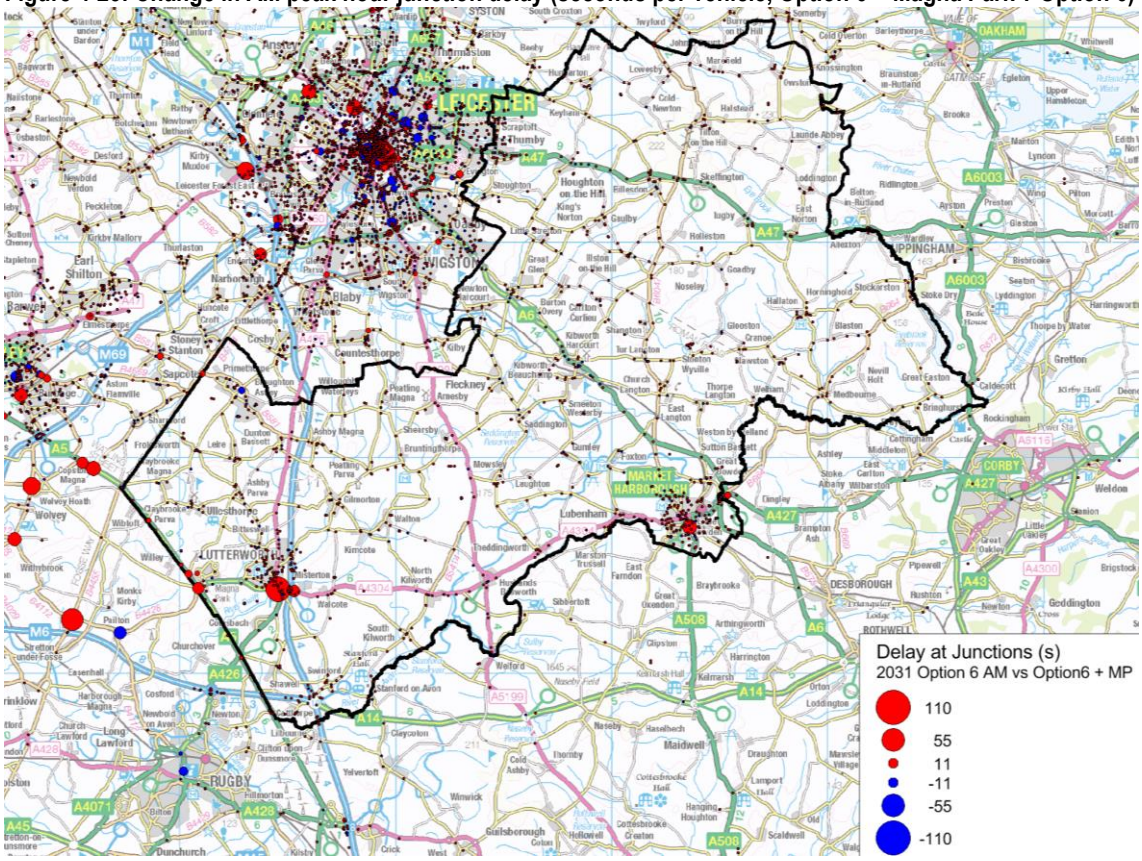
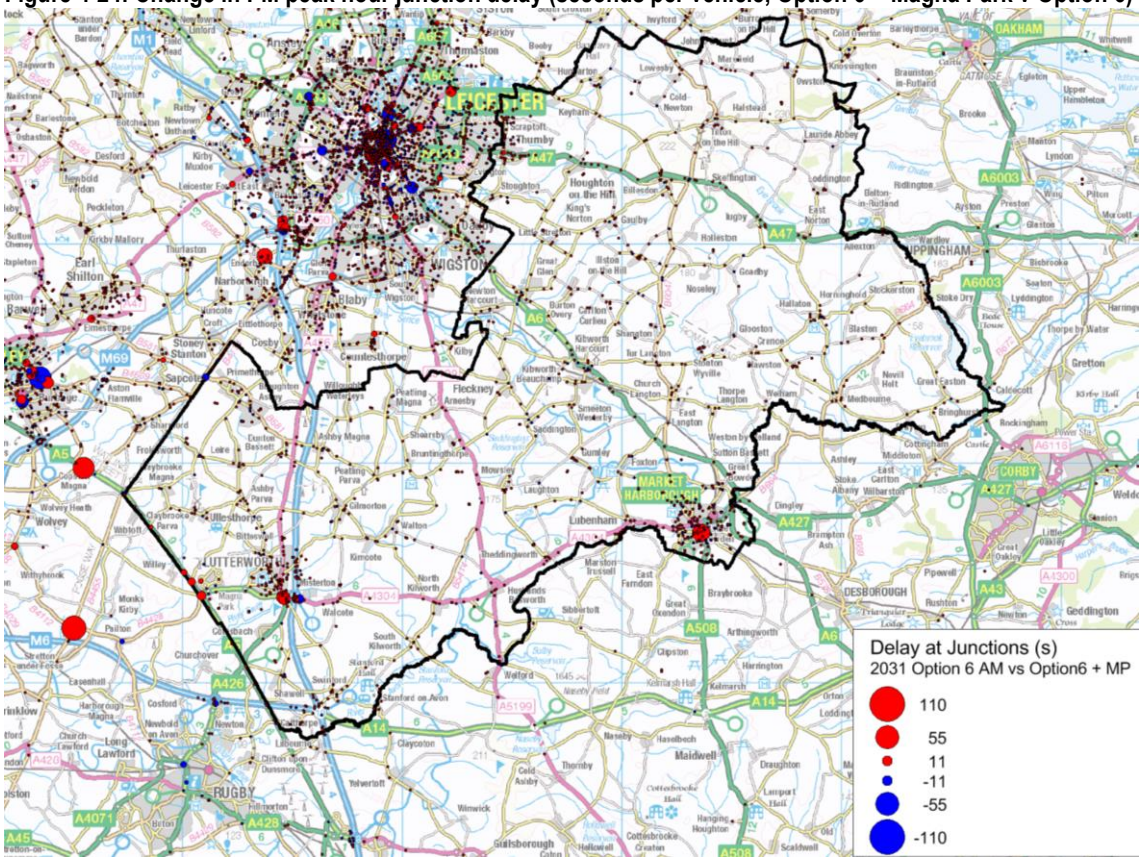


Figure 4-24: Change in PM peak hour junction delay (seconds per vehicle, Option 6 + Magna Park v Option 6)



5. Conclusions

5.1 Summary

5.1.1 The Local Plan development option assessment using the highway component of the 2031 LLITM results in the following headline conclusions with regard to the impact on the highway network in Harborough District and across Leicestershire:

- The Amended Reference Case LLITM runs indicate that some mitigation may be required at a number of junctions across the network regardless of the Local Plan option selected, although any required works would likely be limited to minor measures (for example, introducing or optimising traffic signals, reconfiguring junction geometry etc) – locations potentially requiring mitigation in the Reference Case include:
  - Key junctions in Market Harborough town centre, including the A4304 High Street/St. Mary's Road/Northampton Road junction; the Springfield Street/Northampton Road junction; and the Springfield Street/Kettering Road roundabout;
  - The A6 junctions with the A4304 Rockingham Road/A427 Harborough Road; and the B6047 Harborough Road/Melton Road;
  - The B581 junctions with Cosby Road and Coventry Road in the vicinity of Primethorpe;
  - The A6003 junctions with Lyddington Road and Great Easton Road in the vicinity of Caldecott;
- A number of other minor issues are also evident in the Amended Reference Case, including small delays at a number of junctions in the vicinity of the Kibworths, including the High Street/Station Street roundabout; and at a number of junctions in the vicinity of Lutterworth, including the A4303/Rugby Road junction and along the High Street;
- None of the options results in a critical traffic issue on the network, with the possible exception of the impact of Option 6 traffic on the M1 Junction 20 and new junctions on the A4303 (with Rugby Road) and A4304 – further more detailed investigation of the underlying causes and potential for mitigation at these locations is required;
- All the options result in minor or moderate issues at some junctions, as summarised in Table 5-1, although in general (with the possible exception of the aforementioned junctions in Lutterworth) the forecast increase in delay and congestion specifically as a result of option-related traffic is small in the context of forecast delays evident in the Amended Reference Case;
- For roads in Harborough District, Option 4 (Scraptoft North SDA) results in the lowest level of impact when compared with the other options – this option results in the lowest overall level of queuing across the network, the lowest overall travel time, and the highest average speeds in both the AM and the PM peak hours;
- However, due to its proximity to the city, Option 4 results in more noticeable impacts on the road network in Leicester, although in the context of forecast Amended Reference Case delays these additional impacts generally amount to minor increases in delay at already-congested junctions;
- Within Leicestershire (which is broadly equitable with the model simulation area), Option 2 results in the lowest impact, primarily because the concentration of development around Market Harborough on the County boundary leads to a higher proportion of trips allocating to the road network in Northamptonshire to the south;

- The concentration of development in Market Harborough in Option 2 does result in more significant option-related impacts on junctions identified as potential issues in the Amended Reference Case when compared with the other options, particularly the A6/A4304 Rockingham Road/A427 Harborough Road roundabout; the A6/B6047 Harborough Road/Melton Road roundabout; and the A4304 High Street/St. Mary's Road/Northampton Road junction – however, although more significant than the other options, the direct impact of option-related traffic on these junctions is still relatively minor.

5.1.2 As mentioned above, within the general conclusions arising from this study, each option results in impacts at specific locations on the road network. These traffic-related impacts are summarised in Table 5-1 alongside other wider transport-related considerations that we believe should be factored into the overall selection of a preferred option.

5.2 Next steps

5.2.1 The analysis summarised in this report provides a preliminary high-level assessment of the traffic impacts of each of the four short-listed development options for the Harborough Local Plan, based on a single end-of-Plan (2031) scenario for each option.

5.2.2 A number of subsequent steps should be taken to refine the resultant conclusions summarised in the previous section, as follows:

- A more detailed local assessment should be undertaken of the traffic impacts of Option 6, commensurate with the relatively more complex road network amendments envisaged as part of this option, including the provision of new signalised junctions and the proposed signalisation of the M1 Junction 20 – in particular, this assessment should address the extent to which junction timings and geometry can be optimised to improve network performance;

- Trip generation estimates should be expanded to include the cumulative impact of all housing sites, including those in settlements where less than 100 housing units are expected to be delivered;

- All sites should subsequently be included in a full run of the LLITM (including the land-use and demand model components), which would provide a more robust forecast of trip distribution to and from development sites, and the potential for mode shift to more sustainable modes.

Table 5-1: Summary of option transport impacts

Option	Impact	Strengths	Weaknesses
2 (Core Strategy Distribution)	Traffic-related	• Lowest overall impact of all options on road network in Leicestershire	• More significant (albeit minor) increase in delay at some relatively congested junctions in Market Harborough (A6/A4304 Rockingham Road/A427 Harborough Road; A6/B6047 Harborough Road/Melton Road; A4304 High Street/St. Mary's Road/Northampton Road) • Increased impact on road network in Northamptonshire when compared with other options
	Other transport considerations	• Market Harborough more likely to provide local jobs for residents of new housing, leading to a potential reduction in 'out-commuting' trips to other settlements and improved uptake of sustainable modes (particularly walking and cycling) when compared with the SDA sites • Concentration of development in settlement with mainline rail station, and a more comprehensive bus network when compared with the Kibworths and Lutterworth, is likely to result in improved public transport mode share	• Likely to lead to relatively high level of cross-boundary trips out of Harborough District, for example commuting into Northamptonshire and to Leicester/London via rail connection (with impacts for local economy)
4 (Scraptoft North SDA)	Traffic-related	• Lowest overall impact of all options on road network in Harborough District • A47 the least congested radial route into Leicester passing through District (compared with M1 and A6) in Amended Reference Case, so development is less likely to exacerbate baseline issues on key radial corridors	• Some evidence of increased rat-running to south-east of Leicester (i.e. through Stoughton), which would need to be controlled with local traffic management measures • Increase in delay at A47/Station Road junction in Thurnby • Some increases in delay evident at congested junctions within Leicester City (Church Road/Spencefield Lane; A6030 Tailby Avenue/Hastings Road; A6030 Coleman Road/Green Lane Road)
	Other transport considerations	• Focus on extension of Leicester urban area creates more potential for encouraging mode shift (i.e. through the extension of city bus services) compared with Options 5 and 6;	• Creation of urban extension likely to lead to increase 'out commuting' from District to Leicester City, particularly when compared with Option 2 • Likely to lead to highest level of cross-boundary trips out of Harborough District (with impacts for local economy)

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Option	Impact	Strengths	Weaknesses
5 (Kibworth SDA)	Traffic-related	• Provision of new bypass road results in reduction in traffic and delay on section of A6 passing through the Kibworths	• Results in biggest increase in travel time and distance in both Harborough District and Leicestershire when compared with other options • Results in biggest increases in traffic flow and emissions on key section of A6 between the Kibworths and Oadby/south-east Leicester
	Other transport considerations	• New bypass road increases potential for schemes to improve the urban realm and pedestrian/cycling facilities along the A6 in the Kibworths	• Likely to lead to highest level of 'out commuting' of all options (partly evidenced by increase in travel time/distance) • Likely to result in higher car mode share, particularly when compared with Options 2 and 4, due to relatively limited local public transport potential
6 (Lutterworth East SDA)	Traffic-related	• Relatively good County-wide network performance when compared with Options 4 and 5, particularly in the PM peak	• Biggest impact on road network performance in Harborough District (highest level of queuing, lowest average speeds) • Significant increase in delay at A4303/Rugby Road junction and new junction on A4304 to east of M1 junction, exacerbated by traffic associated with new development at Magna Park • As a result of delay, significant proportion of development traffic diverts to Gilmorton Road – traffic to/from west passes through town centre increasing delays at A426 junctions with Gilmorton Road, George Street and Church Street • Other traffic diverts from A4303/A4304 east-west route, increasing traffic volumes and emissions on alternative routes including A5, M6, and A14
	Other transport considerations	• When compared with Option 5, more potential for provision of local jobs within existing settlement	• Compared with Option 2, likely to lead to more 'out-commuting' trips, as existing settlement less likely to provide local jobs • Compared with Options 2 and 4, less potential for achieving mode shift to sustainable modes of transport

Appendix A. Option testing housing and employment site locations

A.1 Housing (all options)

Settlement	Housing site (>100 dwellings)	OPTION 2: CORE STRATEGY DISTRIBUTION	OPTION 4: SCRAPTOFT NORTH SDA	OPTION 5: KIBWORTH SDA	OPTION 6: LUTTERWORTH SDA
Fleckney	A/FK/HSG/12 - Land off Badcock Way	225	225	225	225
	A/FK/HSG/06 - Land to the north of Kilby Road	117	117	117	117
	A/FK/HSG/14 - Land off Arnsesby Road/Main Street	132	132	132	132
	SUB-TOTAL	**474**	**474**	**474**	**474**
Houghton	Not site specific	148	125	127	125
	SUB-TOTAL	**148**	**125**	**127**	**125**
Kibworth	A/KB/MXD/27 - Kibworth North and East SDA			1,490	
	SUB-TOTAL	**0**	**0**	**1,490**	**0**
Lutterworth	A/LT/HSG/15 - Land east of Leicester Road	242	242	242	
	A/LT/HSG/16 - Land off Brookfield Way	131	131	131	
	A/LT/MXD/03 - Lutterworth East				1,290
	SUB-TOTAL	**373**	**373**	**373**	**1,290**
Market Harborough	A/MH/HSG/35 - Overstone Park	525	525	525	525
	A/MH/HSG/34 - East of Blackberry Grange, Northampton Rd	214	214	214	214
	A/MH/HSG/61 - Land west of Airfield Farm	153	153	153	153
	Small sites/non-site specific	840			
	SUB-TOTAL	**1,732**	**892**	**892**	**892**
Scraptoft, Thurnby and Bushby	A/TH/HSG/25 - Land east of Charity Farm, plus A/TH/HSG/24 Charity Farm residual	101	112	112	112
	A/SC/HSG/14 - Land at Charles' Field, Scraptoft Hill Farm, plus A/SC/HSG/15 at Hayfield	101			
	A/TH/HSG/07 Coles Nursery site	124			
	A/SC/HSG/16 - Scraptoft North SDA		1,200		
	SUB-TOTAL	**326**	**1,312**	**112**	**112**
GRAND TOTAL		**3,053**	**3,176**	**3,468**	**2,893**

A.2 Employment (Option 2)

Settlement	Site location	OPTION 2 estimated floor space (square metres)		
		Office	Light Industrial	Strategic distribution
Fleckney	Land off Marlborough Way, Fleckney (E/001RC/11)		12,180	
	SUB-TOTAL	**0**	**12,180**	**0**
Kibworth	3 separate parcels within proposed SDA site E/013RC/15(A) (B) & C			
	SUB-TOTAL	**0**	**0**	**0**
Lutterworth	Land South of Lutterworth Road (E/005LT/11)	6,150	8,610	
	Land south of Lutterworth Rd / Coventry Rd (E/001LT/11)	9,300	13,202	
	Proposed SDA (Land to East of Lutterworth) - Land adjacent /E of M1 (E/006LT/15(A)			
	Proposed SDA (Land to East of Lutterworth) - Land south off A4303 (E/006LT/15(B)			
	SUB-TOTAL	**15,450**	**21,812**	**0**
Market Harborough	Airfield Farm (additional / SDA linked) (E/002M/11)	15,000	21,000	
	Land Adjacent to Bowden Business Village (E/001M/11)	3,000		
	SUB-TOTAL	**18,000**	**21,000**	**0**
GRAND TOTAL		**33,450**	**54,992**	**0**

A.3 Employment (Option 4)

Settlement	Site location	OPTION 4 (estimated floor space square metres)		
		Office	Light Industrial	Strategic distribution
Fleckney	Land off Marlborough Way, Fleckney (E/001RC/11)		12,180	
	SUB-TOTAL	**0**	**12,180**	**0**
Kibworth	3 separate parcels within proposed SDA site E/013RC/15(A) (B) & C			
	SUB-TOTAL	**0**	**0**	**0**
Lutterworth	Land South of Lutterworth Road (E/005LT/11)	6,150	8,610	
	Land south of Lutterworth Rd / Coventry Rd (E/001LT/11)	9,300	13,202	
	Proposed SDA (Land to East of Lutterworth) - Land adjacent /E of M1 (E/006LT/15(A)			
	Proposed SDA (Land to East of Lutterworth) - Land south off A4303 (E/006LT/15(B)			
	SUB-TOTAL	**15,450**	**21,812**	**0**
Market Harborough	Airfield Farm (additional / SDA linked) (E/002M/11)	15,000	21,000	
	Land Adjacent to Bowden Business Village (E/001M/11)	3,000		
	SUB-TOTAL	**18,000**	**21,000**	**0**
GRAND TOTAL		**33,450**	**54,992**	**0**

A.4 Employment (Option 5)

Settlement	Site location	OPTION 5 estimated floor space (square metres)		
		Office	Light Industrial	Strategic distribution
Fleckney	Land off Marlborough Way, Fleckney (E/001RC/11)		12,180	
	SUB-TOTAL	**0**	**12,180**	**0**
Kibworth	3 separate parcels within proposed SDA site E/013RC/15(A) (B) & C	7,500	10,500	
	SUB-TOTAL	**7,500**	**10,500**	**0**
Lutterworth	Land South of Lutterworth Road (E/005LT/11)	6,150	8,610	
	Land south of Lutterworth Rd / Coventry Rd (E/001LT/11)	9,300	13,202	
	Proposed SDA (Land to East of Lutterworth) - Land adjacent /E of M1 (E/006LT/15(A)			
	Proposed SDA (Land to East of Lutterworth) - Land south off A4303 (E/006LT/15(B)			
	SUB-TOTAL	**15,450**	**21,812**	**0**
Market Harborough	Airfield Farm (additional / SDA linked) (E/002M/11)	15,000	21,000	
	Land Adjacent to Bowden Business Village (E/001M/11)	3,000		
	SUB-TOTAL	**18,000**	**21,000**	**0**
GRAND TOTAL		**40,950**	**65,492**	**0**

A.5 Employment (Option 6)

Settlement	Site location	OPTION 6 estimated floor space (square metres)		
		Office	Light Industrial	Strategic distribution
Fleckney	Land off Marlborough Way, Fleckney (E/001RC/11)		12,180	
	SUB-TOTAL	**0**	**12,180**	**0**
Kibworth	3 separate parcels within proposed SDA site E/013RC/15(A) (B) & C			
	SUB-TOTAL	**0**	**0**	**0**
Lutterworth	Land South of Lutterworth Road (E/005LT/11)			
	Land south of Lutterworth Rd / Coventry Rd (E/001LT/11)			
	Proposed SDA (Land to East of Lutterworth) - Land adjacent /E of M1 (E/006LT/15(A)	15,000	21,000	
	Proposed SDA (Land to East of Lutterworth) - Land south off A4303 (E/006LT/15(B)			12,000
	SUB-TOTAL	**15,000**	**21,000**	**12,000**
Market Harborough	Airfield Farm (additional / SDA linked) (E/002M/11)	15,000	21,000	
	Land Adjacent to Bowden Business Village (E/001M/11)	3,000		
	SUB-TOTAL	**18,000**	**21,000**	**0**
GRAND TOTAL		**33,000**	**54,180**	**12,000**