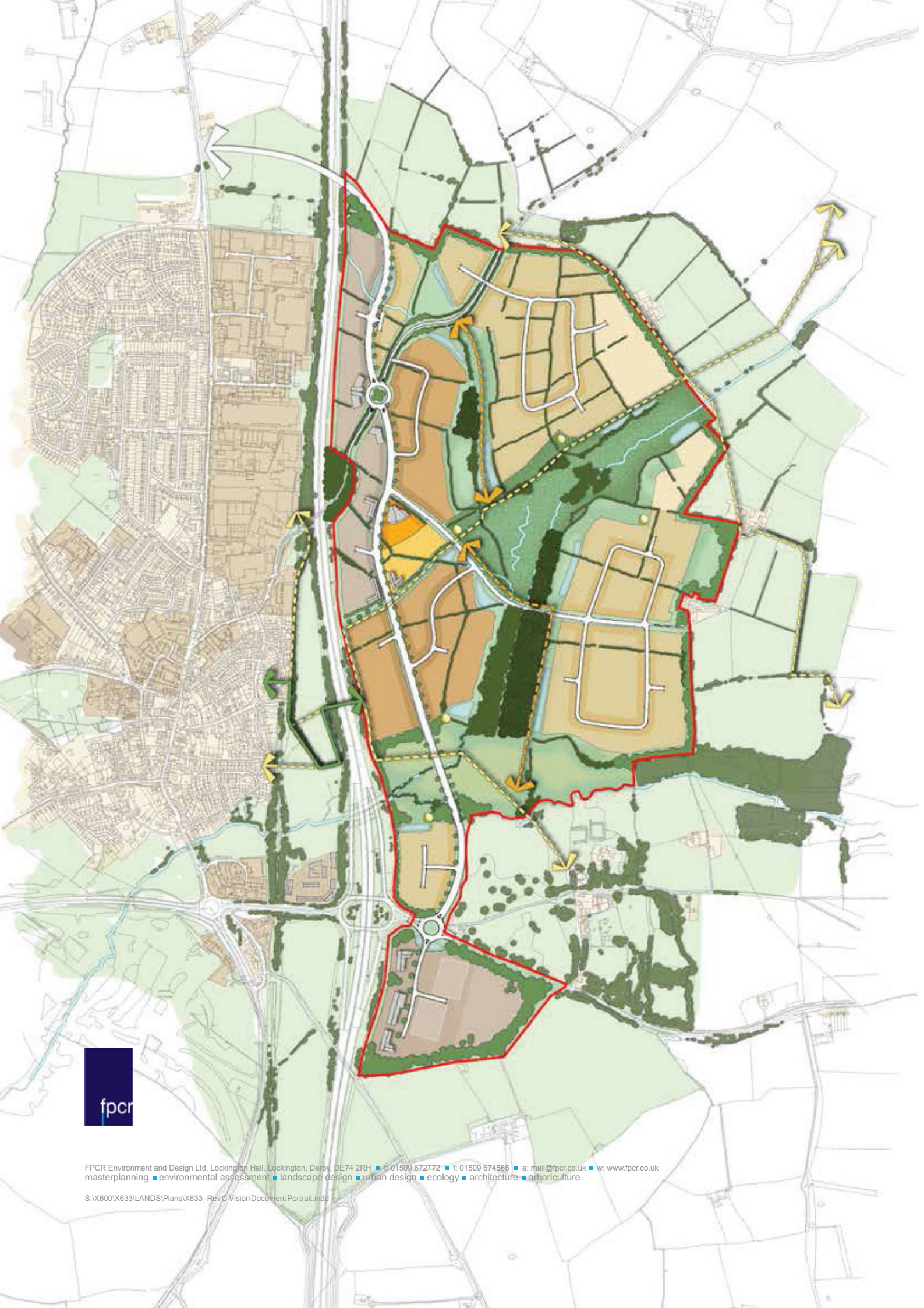


**APPENDIX A2**  
**Draft Strategic Transport Assessment, February 2016**

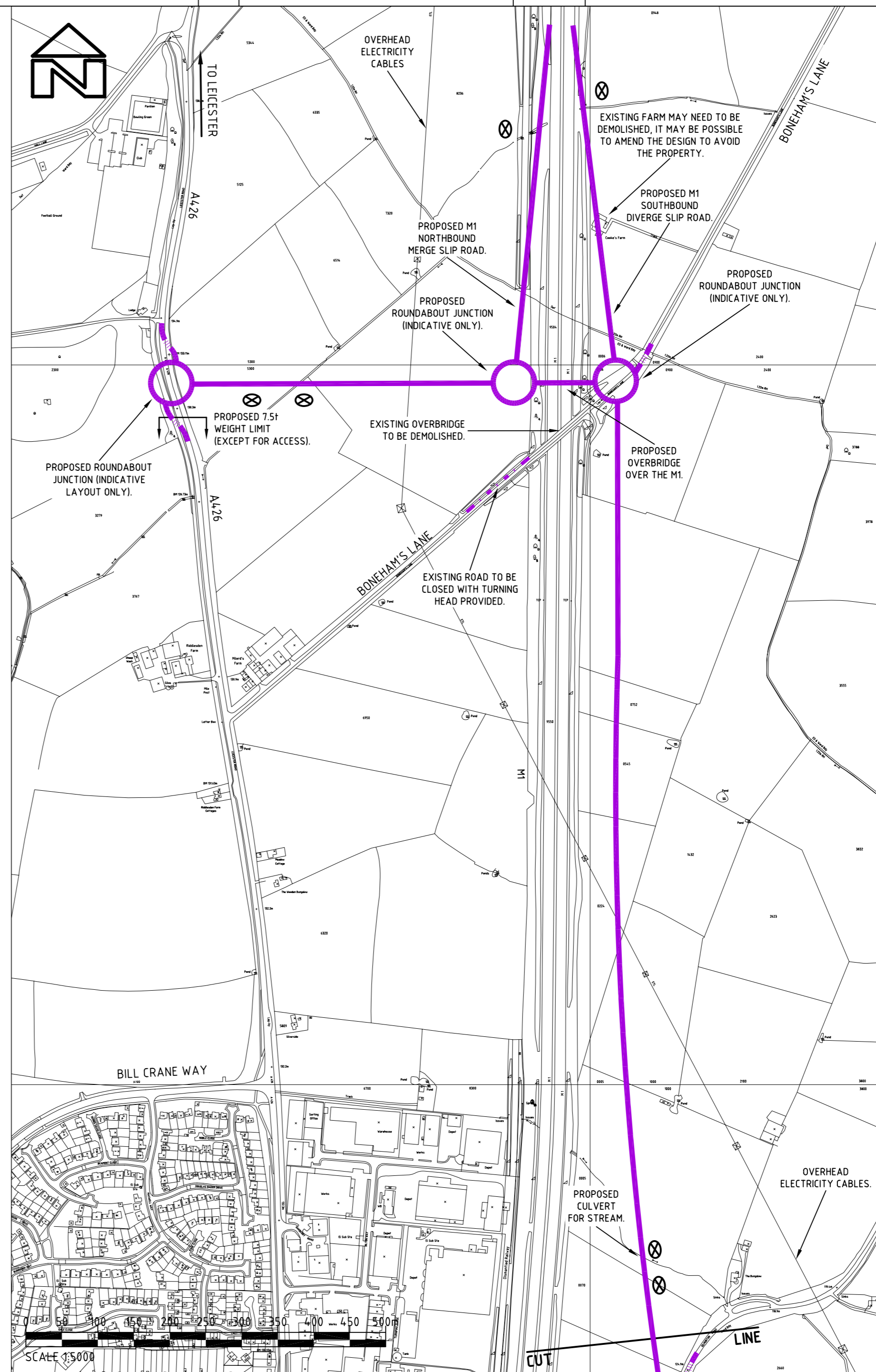
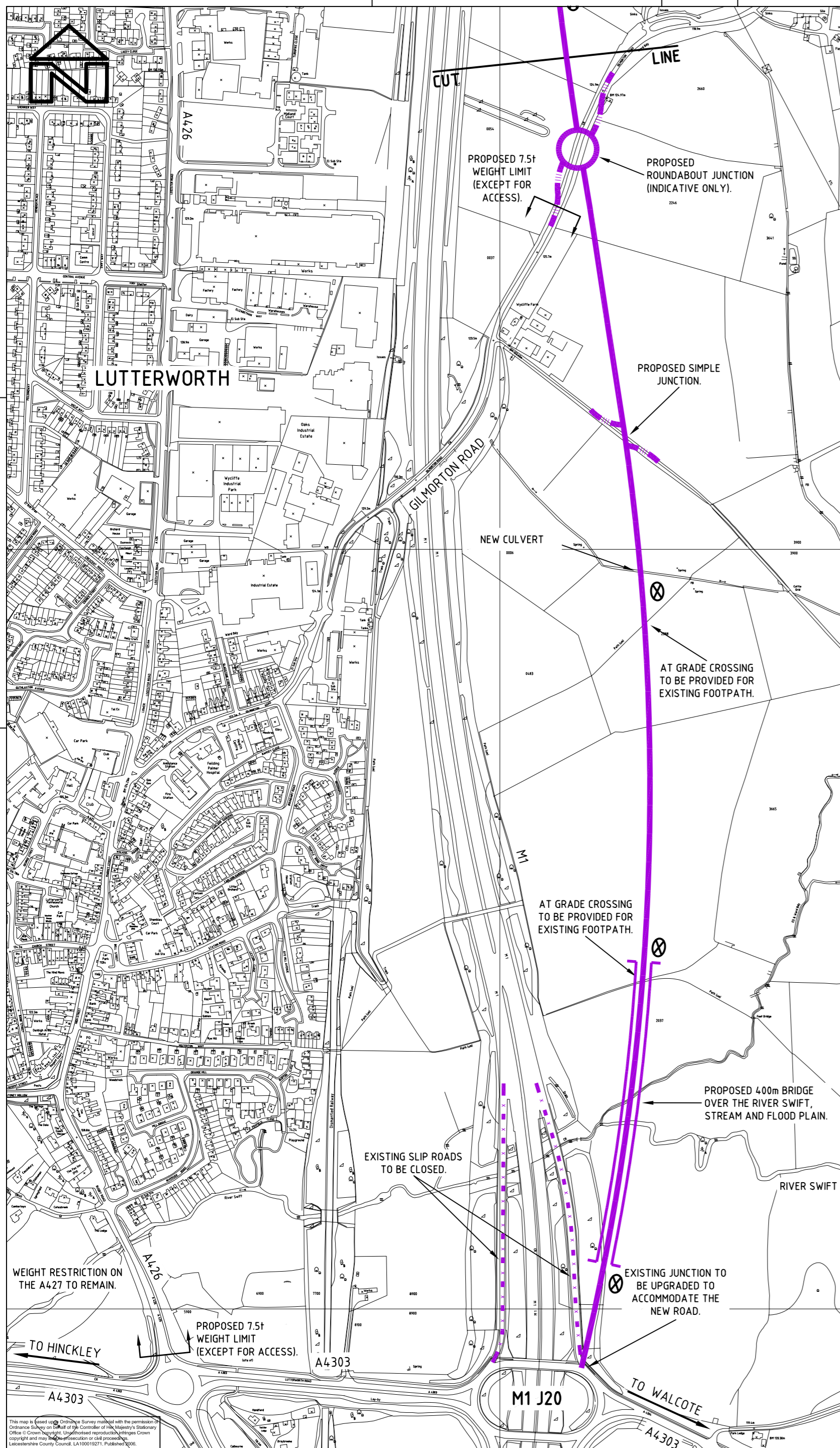
# *INITIAL MASTERPLAN*

A



***SCOTT WILSON  
'EASTERN' BYPASS  
OPTION***

**B**



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED AND ONLY WRITTEN DIMENSIONS SHALL BE USED

**NOTES**

1. PROPOSED CENTRE LINE SHOWN IS ONLY A PRELIMINARY ALIGNMENT AND WOULD BE SUBJECT TO CHANGE, IF SCHEME IS DEVELOPED FURTHER.
2. CENTRE LINE DESIGNED IN ACCORDANCE WITH TD 19/93 FOR A DESIGN SPEED OF 60 kph.
3. PROPOSED JUNCTIONS SHOWN ARE ONLY INDICATIVE AND HAVE NOT BEEN DESIGNED.

**KEY**

- PROPOSED SINGLE CARRIAGEWAY ROAD (7.3m WIDE WITH 1m HARD STRIPS) AND 3m FOOTWAY/CYCLEWAY.
- - - EXISTING CARRIAGEWAY TO BE RE-ALIGNING.
- - - EXISTING ROAD TO BE CLOSED.
- ⊗ INDICATIVE LOCATION FOR POSSIBLE BALANCING POND.

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Revision Details	By	Date	Suffix
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Job Title  
**LEICESTERSHIRE COUNTY COUNCIL**

Drawing Title  
**LUTTERWORTH TRAFFIC PLAN  
FEASIBILITY STUDY  
OPTION C**

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***MODELLING  
TECHNICAL NOTE***

**C**

# LLITM | Lutterworth East Development:

## TN2: LLITM Modelling



# LLITM | Lutterworth East Development:

## TN2: LLITM Modelling

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## Section 1 – Introduction

### 1.1 Lutterworth East Modelling

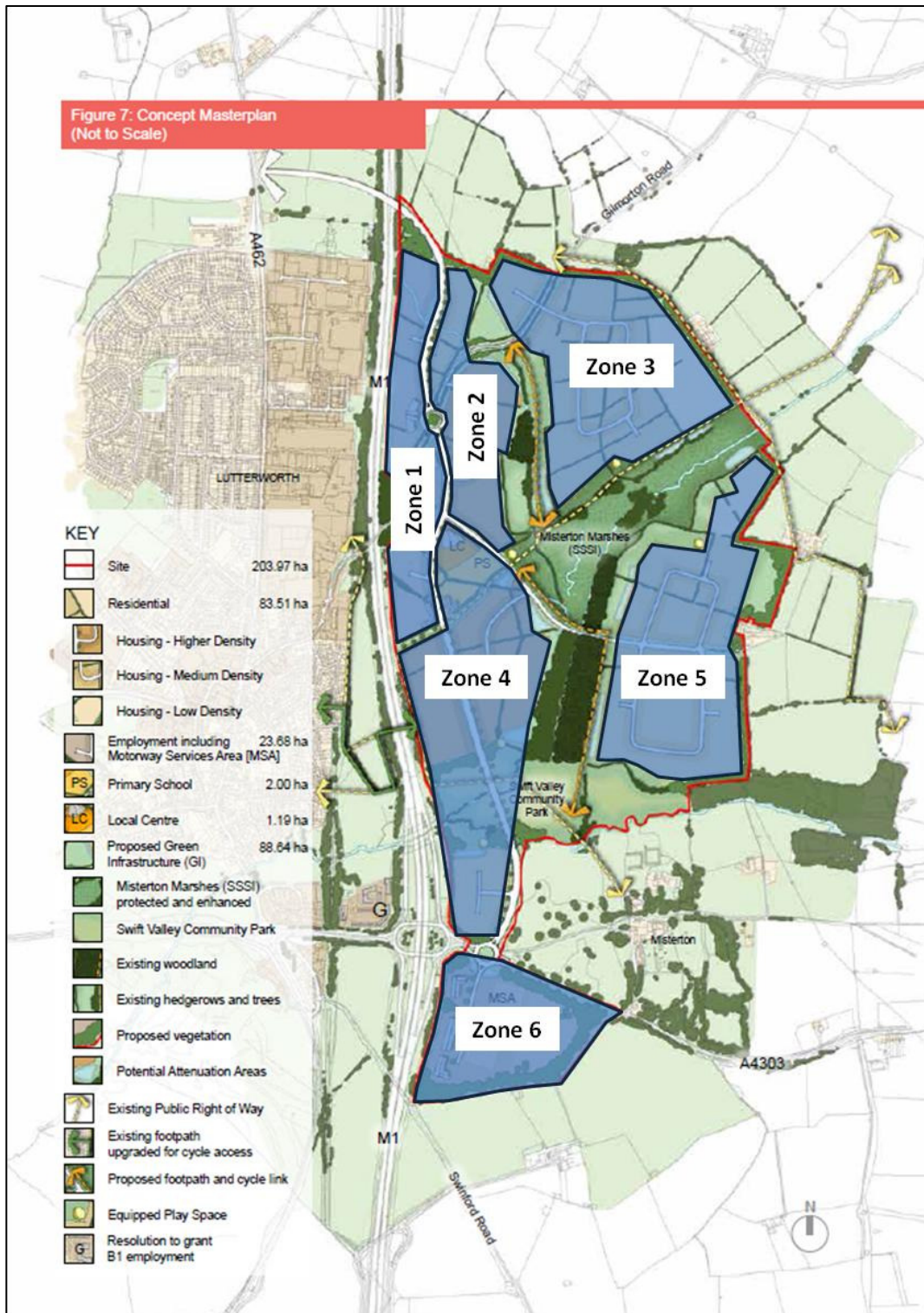
- 1.1.1 As part of the assessment of the proposed Lutterworth East development, a number of model runs using the Leicester and Leicestershire Integrated Transport Model (LLITM) were requested. These looked at forecasting the impact of the proposed development and of the proposed link road between the development and the A426 to the north of Lutterworth.
- 1.1.2 The proposed Lutterworth East development is to contain around 2,500 dwellings and around 20 hectares of employment land, plus a primary school and local retail and community facilities. It is to be located to the east of the M1, with the majority of the development located to the north of the A4303.
- 1.1.3 The modelling within LLITM has represented the following four scenarios:
- the calibrated and validated 2008 base year;
  - a 2031 forecast using the existing ‘core scenario’ without the proposed development; and
  - a 2031 forecast based on the ‘core scenario’ and including the proposed development both:
    - without the link road between Gilmorton Road and the A426 north of Lutterworth; and
    - with the link road between Gilmorton Road and the A426 north of Lutterworth.
- 1.1.4 All modelling within LLITM has been based on LLITM v5.2, which uses the 2008 base year models calibrated and validated in September 2013.
- 1.1.5 This Technical Note discusses the modelled assumptions adopted in representing this proposed development within LLITM. This builds on the assumptions set out in ‘*TN1 - Lutterworth East Modelling Assumptions*’, and also includes some high-level analysis of the model forecasts.
- 1.1.6 This Technical Note contains the following Sections:
- Section 2 – Base Year Model Updates: details the updates to the base year models required to use development zones to represent the proposed development.
  - Section 3 – Land-Use Assumptions: details the processing of the assumption regarding the development into the format required for use within LLITM.
  - Section 4 – Network Assumptions: details the network assumptions (both highway and public transport), primarily focussing on the changes made in relation to the proposed development.
  - Section 5 – Model Forecasts: provides some high-level analysis of the model forecasts from LLITM.

## Section 2 – Base Year Model Updates

### 2.1 Development Zones

- 2.1.1 In order to represent the proposed Lutterworth East development, it was agreed that a number of development zones would be used for this assessment. These development zones are empty zones within the base year model, and can be located throughout Leicester and Leicestershire to represent future year developments.
- 2.1.2 As the demand model contained within the LLITM suite is an incremental model, looking at changes in cost from the base year to a given future year scenario, the development zones to be used within the Lutterworth East assessment need to be moved to the location of the proposed development in the base year model. The base year model is then re-run with the development zones in place to generate representative costs of travel to / from these zones in the base year.
- 2.1.3 It is important when including these zones in the base year model that they have a limited impact on the base year highway and public transport assignment models. This has been achieved by removing the possibility of through traffic using the proposed Lutterworth East development network, and by using 'dummy' nodes within the highway assignment model. These 'dummy' nodes do not generate delay, and therefore have a limited impact on the base year assignment models.
- 2.1.4 As discussed in '*TN1 - Lutterworth East Modelling Assumptions*', it was agreed that a total of six development zones would be used to represent the proposed development. These have been defined so as to distinguish different types of land-use (residential and employment) and also areas of the development which load onto the network at different locations.
- 2.1.5 Figure 2.1 shows the definition of the six development zones used as part of the LLITM assessment of the proposed Lutterworth East development.

Figure 2.1: Lutterworth East Model Zones



## Section 3 – Land-Use Assumptions

### 3.1 ‘Core Scenario’

- 3.1.1 As part of the development of LLITM v5, a ‘core scenario’ was produced in late-2013 using the most up-to-date forecast assumptions at the time in terms of land-use development, highway network improvements, public transport service changes, investment in Smarter Choices initiatives and other model inputs. The land-use assumptions and forecasts which form part of this ‘core scenario’ is referred to as planning scenario ‘sp’.
- 3.1.2 This ‘sp’ land-use scenario has been forecast using the full land-use transport interaction (LUTI) model available within LLITM. This allows for iteration between the transport and land-use models whereby the forecast costs of travel influence the location of land-use, and the location of land-use changes influences the costs of travel.
- 3.1.3 The 2031 land-use forecasts from this ‘core scenario’ have been used as the input to the 2031 ‘without development’ scenario, and also as the basis for the ‘with development’ scenarios.
- 3.1.4 Further details on the assumptions underpinning the LLITM v5 ‘core scenario’ can be found in ‘PR104 - Revised Forecasting Report’.

### 3.2 Lutterworth East Land-Use Assumptions

- 3.2.1 Using the 2031 ‘sp’ forecasts, additional land-use has been added to the six defined development zones based on the proposed development contained within each zone. The definition of the amount of development located within each of the development zones is given in Table 3.1.

**Table 3.1: Assumed Dwelling and Employment by Zone**

Zone	Dwellings	Employment Land
1	0	10 ha
2	400	0
3	800	0
4	500	Primary school and local centre (~3 ha in total)
5	800	0
6	0	10 ha
<b>Total</b>	<b>2,500</b>	<b>20 ha plus primary school and local centre</b>

- 3.2.2 In order to use these inputs within LLITM, a number of assumptions are required to convert the inputs detailed in Table 3.1 into the format required for the model. Within LLITM, land-use forecasts are required for:
  - population by zone divided into 11 person types, and also divided into a number of car ownership classifications; and
  - employment by zone divided into 13 employment types.
- 3.2.3 In terms of population, the ‘core scenario’ forecasts for the model zones which constitute Lutterworth have been used to derive the required conversion factors. The first of these factors is the average occupancy of a dwelling to convert the input assumptions on the number of dwellings into an estimate of population. Using the forecasts for Lutterworth it has been assumed that there are, on average, 2.27 people per dwelling within

the proposed Lutterworth East development. This results in an estimated population for the Lutterworth East development of around 5,700.

- 3.2.4 This population is then required to be disaggregated into 11 person types based on age, gender and employment status. As with the average household size, the forecast demographics for Lutterworth have been used to define splits into these 11 person type. These disaggregation factors are given in Table 3.2,

**Table 3.2: Person Type Disaggregation Factors**

Person Type	Proportion
Children	20%
Male Full-time Employed	22%
Male Part-time Employed	2%
Male Student	0%
Male Unemployed	2%
Male Retired	11%
Female Full-time Employed	11%
Female Part-time Employed	9%
Female Student	0%
Female Unemployed	4%
Female Retired	18%

*Note: percentages have been rounded to the nearest whole value*

- 3.2.5 This forecast population is then required to be classified into a number of car ownership levels. This again uses the forecast car ownership levels for Lutterworth in the 2031 'core scenario', and applies these forecasts to the estimated population for the proposed Lutterworth East development. In summary, these car ownership levels are:
- 10% of households have no car;
  - 40% of households have one car; and
  - 50% of households have two or more cars.
- 3.2.6 In terms of employment forecasts, the first task is to understand the nature of the proposed employment land. For Zone 1 and Zone 6, the 10 hectares of employment land contained in each zone is assumed to be equally split between office (B1), warehousing / distribution (B8) and general (B2) land-uses.
- 3.2.7 These inputs on the area of employment land have been converted into an estimate of the number (and type) of jobs that will be generated by this development. The first assumption applied converts the total employment land into an approximation of the internal area of the buildings. Then, using employment densities from the Homes and Communities Agency<sup>1</sup>, these floorspace estimates have been converted to employment estimates.
- 3.2.8 Table 3.3 sets out the assumptions proposed to derive an estimate of the number of jobs generated by the employment in Zone 1 and Zone 6 of the proposed development. This methodology uses the following assumptions:
- the internal area of the employment buildings is 40% of the total land area; and
  - office buildings are on average two storeys high, general (B2) buildings being on average 1.5 storeys high, and warehouse buildings being one storey high.

<sup>1</sup> <https://www.gov.uk/government/publications/employment-densities-guide>

This results in an estimated total employment for this site of around 3,400 jobs for each model zone.

**Table 3.3: Assumptions for Northern Employment Zone**

	Office (B1)	General (B2)	Warehouse / Distribution (B8)
Total employment land (ha)	3.33	3.33	3.33
Internal floorspace (%)	40%		
Internal floorspace (ha)	1.33	1.33	1.33
Building Storeys	2	1.5	1
Total Internal floorspace (ha)	2.67	2.00	1.33
Total Internal floorspace (m <sup>2</sup> )	26,667	20,000	13,333
Average employee density (m <sup>2</sup> per FTE)	10	36	75
Estimated Employees	2,667	556	178

3.2.9 A similar process has been adopted for the local centre contained within Zone 4 (as defined in Figure 2.1). This assumed a single storey retail centre (land-use A1), which equated to an estimated employment of around 265 for this element of the employment within Zone 4.

3.2.10 In addition to this there is proposed to be a primary school located within this zone. The estimated employment at the primary school has been based on the following assumptions:

- that there is one employee per 10 pupils attending the school;
- that all children of primary school age resident within the proposed development will attend the school, with children attending secondary schools and higher education travelling elsewhere; and
- that 35% of the children forecast to be resident within the proposed development are of primary school age.

This equates to around 400 primary school pupils, and therefore 40 jobs relating to the primary school.

3.2.11 Within LLITM employment is classified into thirteen categories defined by the DfT’s National Trip-End Model. Based on the employment estimates detailed above, the following correspondence to the required employment categories has been applied:

- B1 (office) employment has been classified as ‘*services (business, other, postal/courier) & equipment rental*’;
- B8 (warehouse / distribution) employment has been classified as ‘*industry, construction and transport*’;
- B2 (general) employment has been split equally between *services (business, other, postal/courier) & equipment rental*, ‘*industry, construction and transport*’ and ‘*business*’;
- employment relating to the primary school has been classified as ‘*primary & secondary schools*’; and
- employment relating to the local centre has been classified as ‘*retail trade*’.

### 3.3 Trip Rate and Distribution Assumptions

3.3.1 LLITM uses the DfT’s National Trip-End Model software (named CTripEnd) to forecast trip-ends based on the planning data inputs. It has therefore been assumed that the trip rates contained within the DfT’s National Trip-End Model are applicable to the proposed Lutterworth East development, and bespoke local trip rates are not required.

- 3.3.2 Similarly, LLITM requires a starting trip distribution for each development zone. For non-development zones the trip distribution in the base year model is used, but as for development zones there is no demand in the base year this is not possible. The in-built gravity model function within LLITM has been used to inform the forecast trip distribution to / from the proposed Lutterworth East development, and no adjustments to this process have been applied.



## Section 4 – Network Assumptions

### 4.1 Introduction

- 4.1.1 In addition to the assumptions on land-use data (detailed in Section 3) for the proposed development, the other main inputs into the model are the supply networks. These detail the assumed highway network infrastructure and the public transport service provision.
- 4.1.2 As with the land-use data, the existing 2031 'core scenario' has been used as the starting point for this application. The 2031 'core scenario' networks for highway and public transport have been used directly in the 'without development' scenario, with the necessary changes to the location of Lutterworth East development zones.
- 4.1.3 These 'core scenario' networks include a number of changes to highway infrastructure and public service provision. These are the schemes which are thought to be 'near certain' or 'more than likely', and a list of these schemes can be found in '*PR104 - Revised Forecasting Report*'.
- 4.1.4 For the 'with development' scenarios a number of changes to these 'core scenario' networks are required. These changes are detailed in this Section and are based on the interpretation of the current Masterplan document contained within '*TN1 - Lutterworth East Modelling Assumptions*'.

### 4.2 Highway Network Assumptions

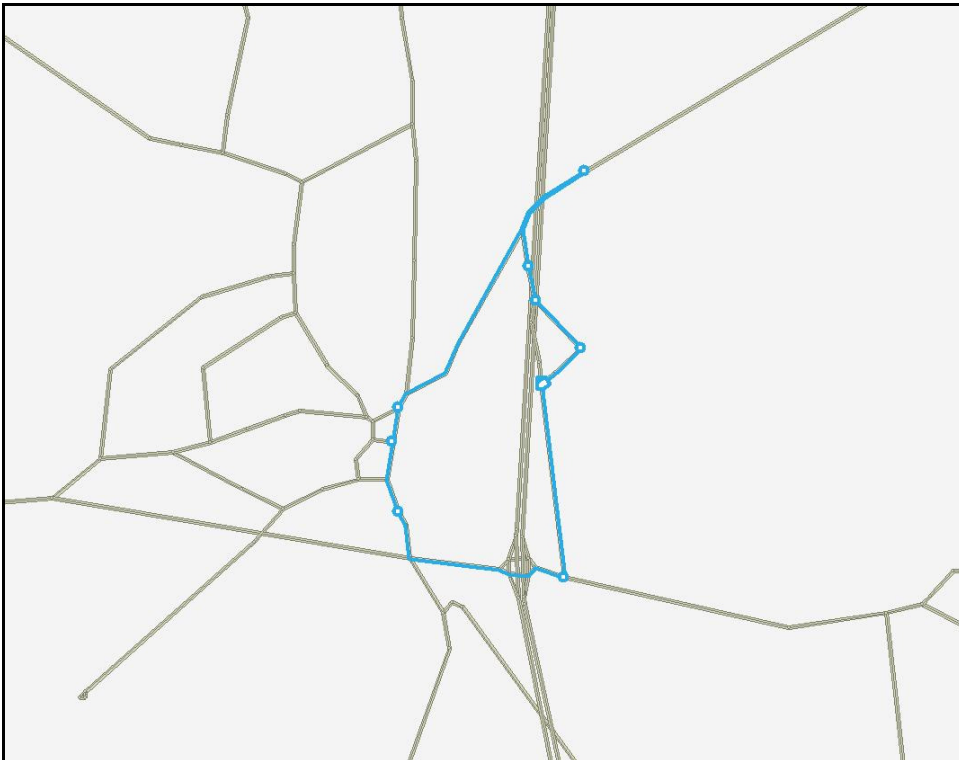
- 4.2.1 The changes to the highway networks from the 'core scenario' are related to the access points for the proposed Lutterworth East development and the internal network. The proposed Lutterworth East development will access the existing road network at a limited number of locations. These are:
- a four-arm roundabout junction on the A4303 to the east of M1 Junction 20;
  - a three-arm roundabout junction on Gilmorton Road (without the northern A426 connection);
  - a priority junction access to Gilmorton Road from Zone 2; and
  - a priority junction access to Gilmorton Road from Zone 3.
- 4.2.2 In the scenario with the addition of the link road between Gilmorton Road and the A426 to the north of Lutterworth, the junction access point on Gilmorton Road is converted from a three-arm to a four-arm roundabout. The connection with the A426 has been assumed to be a three-arm roundabout located around 200m to the north of the junction with Bill Crane Way.
- 4.2.3 All junctions introduced as part of the proposed development have been assumed to be of a good standard, with, for example, flared approaches to roundabouts and dedicated right-turn lanes at priority junctions where required.
- 4.2.4 The spine road through the proposed development has been assumed to be a single carriageway route with a 30mph speed limit within built-up areas, and a 40mph limit outside the proposed built-up areas. The local access roads to / from residential and employment developments are assumed to have 20mph speed limits in place.

### 4.3 Public Transport Service Assumptions

- 4.3.1 As part of the 'with development' scenario it has been assumed that a shuttle bus service will be in operation between the proposed development and Lutterworth town centre. This is a notional service at present to provide public transport access to / from the proposed development, and should not be seen as a committed scheme as part of the proposed development. The public transport provision for the proposed development is assumed to be developed further as part of the Transport Assessment process.

4.3.2 For the purposes of modelling this shuttle service within LLITM, a circular route has been defined calling at a number of locations within the proposed development and Lutterworth town centre. It is assumed to run every half hour throughout the day. This shuttle service is shown in Figure 4.1, with the circles along the route showing the location of the assumed bus stops for this service.

**Figure 4.1: Modelled Lutterworth East Shuttle Service**



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## Section 5 – Model Forecasts

### 5.1 Introduction

- 5.1.1 This Section details some high-level analysis which has been undertaken as part of the review and checking of the model forecasts. A more detailed assessment is to be undertaken as part of the local area modelling being undertaken, but this Section provides some information on the forecasts produced by LLITM.
- 5.1.2 This Section includes both forecast network performance statistics and forecast flow changes between scenarios from the highway model. Both these model forecasts report on the three time periods contained within the LLITM highway model. These are the AM Peak hour (08:00 to 09:00), an average interpeak hour (between 10:00 and 16:00) and the PM Peak hour (17:00 to 18:00).

### 5.2 Highway Network Statistics

- 5.2.1 Table 5.1 shows the highway network statistics in the three modelled hours and the four model scenarios for links within Harborough District. For each time period and scenario the table gives the forecast vehicle distance (a measure of total traffic on the network), assigned vehicle hours (a measure of total journey times), and average speeds.
- 5.2.2 In addition to the forecasts for these metrics, the changes between scenarios are also provided. These are incremental between scenarios, and therefore show:
- the change between the 2008 base year and the 2031 forecast without the proposed development;
  - the change between the 2031 forecast without and with the proposed development; and
  - the change between the 2031 forecasts without and with the connection from the development to the A426.
- 5.2.3 Firstly considering the change in network performance from the base year to a 2031 forecast scenario without the proposed Lutterworth East development, traffic on links within Harborough District is forecast to increase by between around 32% and 37% depending on the time period. This results in decreases in average speeds of between 2% and 2.6%.
- 5.2.4 When introducing the proposed Lutterworth East development, this increases traffic on the Harborough District network by between around 4% and 5%, which results in decreases in average speed of around 1.5% to 2%.
- 5.2.5 Introducing the link between the proposed development and the A426 to the north of Lutterworth does not significantly change the forecast traffic on the network. The total assigned travel time is however forecast to reduce, by between 0.1% and 0.5% depending on the modelled time period. Similarly, the forecast average speeds within Harborough District are forecast to increase by between 0.1% and 0.4% with the introduction of the link to the A426.

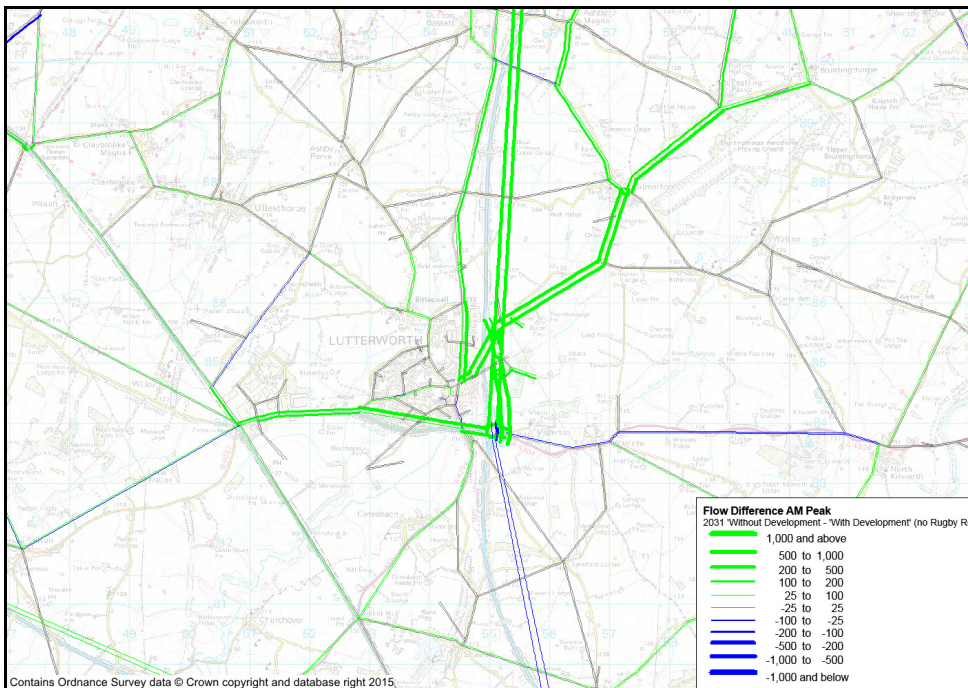
**Table 5.1: Highway Network Statistics: Harborough District**

		2008 Base Year	2031 'without development'	2031 'with development'	
				Without A426 Connection	With A426 Connection
AM Peak hour	Vehicle Distance (veh-km)	342,570	447,984	467,128	466,811
			30.8%	4.3%	-0.1%
	Assigned Vehicle-Time (veh-hours)	5,242	7,023	7,471	7,437
			34.0%	6.4%	-0.5%
Average Speed (kph)		65	64	63	63
			-2.4%	-2.0%	0.4%
Interpeak hour	Vehicle Distance (veh-km)	239,503	328,227	345,082	344,600
			37.0%	5.1%	-0.1%
	Assigned Vehicle-Time (veh-hours)	3,391	4,744	5,061	5,043
			39.9%	6.7%	-0.4%
Average Speed (kph)		71	69	68	68
			-2.0%	-1.4%	0.2%
PM Peak hour	Vehicle Distance (veh-km)	349,476	460,901	479,116	479,244
			31.9%	4.0%	0.0%
	Assigned Vehicle-Time (veh-hours)	5,322	7,210	7,607	7,598
			35.5%	5.5%	-0.1%
Average Speed (kph)		66	64	63	63
			-2.6%	-1.5%	0.1%

### 5.3 Highway Flow Change

- 5.3.1 Two sets of forecast flow change plots from the highway model have been produced. These show the forecast change in highway volumes with the introduction of the proposed Lutterworth East development, and then the forecast change in highway flows including the proposed development with the introduction of the link road to the A426.
- 5.3.2 Figure 5.1, Figure 5.2 and Figure 5.3 show the forecast change in highway volumes due to the introduction of the proposed Lutterworth East development in the AM Peak, interpeak and PM Peak hours. These three figures show a similar pattern of flow increases as a result of adding the proposed Lutterworth East development.
- 5.3.3 Figure 5.4, Figure 5.5 and Figure 5.6 show the forecast change in flows with the proposed Lutterworth East development due to the introduction of the link road from the proposed development to the A426 to the north of Lutterworth in the three modelled time periods. These again show a similar pattern of flow change between these two scenarios across time periods, with reductions in flow forecast within Lutterworth town centre.

**Figure 5.1: Forecast Highway Flow Change 2031 'without' and 'with' development (AM Peak hour)**



**Figure 5.2: Forecast Highway Flow Change 2031 'without' and 'with' development (Interpeak hour)**

