Edwards & Edwards Consultancy Ltd

4 Ascot Drive

Coalville

Leicestershire

LE67 4DF

Blaby Local Plan Delivery DPD

Site Allocations assessment

DOCUMENT CONTROL

Project: **Blaby Local Plan. Transport Implications of site allocations**

Title: **Assessment of Highways and Transport Implications of Site Allocations (Phase 2 Transport Assessment)**

Client: Blaby District Council

Quality Checking

Primary Author: Duncan Forbes / Mark Wills Date: October 2017

Review by: Neal Edwards / Mark Wills Date: October 2017

Version	Date	Author	Review	Approve	Comments
1.0	31 10 2017	DF/MW	NE/MW	DF	Issued

0 Contents

1 Introduction

1.1 To address the predicted shortfall in housing delivery at New Lubbesthorpe, Blaby District Council (BDC) plan to allocate some 1,000 dwellings adjacent to the urban area of Leicester to be delivered between 2021 and 2035. In addition, BDC plan to allocate approximately 30ha of employment land at Enderby, near to junction 21 on the M1

1.2 A phase 1 study looked at the high-level impacts on the highway network of different housing and employment options.

1.3 For the preferred housing allocation, the phase 1 work showed that in principle the delivery of the housing was possible, however, there should be further work to look at whether:

- Further measures should be introduced to reduce movements through Kirby Muxloe from the A47 to Ratby Lane
- Further improvements should be made at the A47/Braunstone Lane junction
- Further improvements should be made from the A47/Braunstone Lane junction to the A46.

1.4 For the employment land allocation the results showed that a site consisting of exclusively B8 land-use would produce a fairly localised impact, however, with part of the land allocated to B1 and B2 uses the higher density of workers could lead to significant transport impacts which could possibly lead to substantial displacements of traffic in an already congested part of the network.

1.5 BDC plan to allocate 750 dwellings to a site north of the A47 in the Kirby Muxloe / Leicester Forest East area, with a further 250 dwellings on sites to the north of the district within the Principal Urban Area (PUA) and to allocate the employment site for B8 land use.

1.6 The employment site at Enderby is now actively being promoted. It was agreed with Leicestershire County Council Highway Authority (LHA) that the transport assessment that will be developed for this application will take account of the strategic impact of the proposed development and therefore there is not a requirement to undertake a further study of that site now. In addition, a note was produced by EAE[1] to demonstrate that there should be a minimal cumulative transport impact from the delivery of a B8 employment site at Enderby and the housing to the north of the district. Consequently, this study has only considered the transport implications of the 1,000 new dwellings planned for the north of the district.

1.7 This phase 2 study has been commissioned to assess the transport implications of the housing developments and to identify the ‘in-principle’ transport mitigation measures required as part of a proportionate approach for local plan preparation.

1.8 Consultation has been undertaken with the Local Highway Authorities Leicestershire County Council and Leicester City Council and Highways England. None of the authorities have any *specific* concerns relating the planned scale or location of the development. However, they all wish to ensure that transport impacts are identified and material impacts mitigated. Their opinion will only be finalised once a planning application with an accompanying transport assessment is received.

1.9 This report presents our findings relating to the proposed housing development and contains sections relating to:

- Consultation with the Highway Authorities
- Background to the study and general assumptions
- In Principle Access Arrangements to the proposed site on the A47
- Estimation of Car Trip-volumes and Demand Management
- The Impact of the A47N site on Railway Level Crossings
- Modelling of the Highways Impact of the additional 1,000 dwellings
- Identification of possible Public Transport, bus lane and Park and Ride measures
- Identification of possible highways Improvements
- In principle transport mitigation measures

2 Consultations with the Highways Authorities

2.1 There are three highways authorities that have been consulted as part of this study. Each have responded on the basis that this is a strategic assessment, and that their final opinion will rest upon specific application(s) received and the accompanying transport assessment.

[1] Blaby Local Plan: Justification for not including the employment site in the assessment. 202 Employment Land Justification - v2.pdf

2.2 The three authorities are:

- Leicestershire County Council Highway Authority. It is the Local Highway Authority (LHA) responsible for the transport infrastructure within the district of Blaby.
- Leicester City Council Highway Authority is responsible for the transport infrastructure within the City Council area
- Highways England is responsible for the Strategic Road Network (SRN) which includes the A46 and M1

2.3 The LHA has been involved in the development of the methodology used to assess the highways impacts. In addition, it has advised that the principles of the 6C's guide should be used when determining the access requirements for the site.

2.4 Leicester City Council Highway Authority has been advised of this proposal. At present it has no specific concerns, although it would wish to minimise any impact on the highway network that impacts access to the city centre, the Outer Ring Road and the Fosse Park area and to ensure that it is attractive to access the city via public transport.

2.5 Highways England(HE), in a letter dated 11th May 2017, advised that it had conducted a high-level review of the 750 dwellings originally proposed and had concluded that it considered that the sites would have limited impact on the operation of the Strategic Road Network (SRN) due to the small scale of development and the distance from the junctions. HE has been sent the phase 1 study which in general concurred with their conclusions regarding the impact on the SRN. HE has asked for sight of this report once complete.

3 Background and Assumptions

3.1 It was agreed with Leicestershire County Council Highway Authority (LHA) that the most appropriate way to assess the impact of the new dwellings was to consider the impact from a fully built out 'New Lubbesthorpe' development together with the additional allocation of 1000 houses, effectively assessing the impact in 2035. Although this goes beyond the end of the plan period, this approach ensures a robust approach to the assessment and ensures that the full scale of the impact is considered.

3.2 The LHA, however, was concerned about the potential phasing of the Lubbesthorpe and possible North of A47 development and were looking for reassurance that there would not be a gap between when mitigation associated with the Lubbesthorpe development is delivered and when it would be required by the proposed new housing. EAE have produced a note[2] that demonstrated that, based upon the planned level of growth and the proposed trigger points in the Lubbesthorpe S106 agreement, that all the mitigation measure should be delivered.

4 Access Arrangements

4.1 It is proposed that the site be accessed from two points on the A47. Figure 4-1 indicates the initial locations for the access points. Initial contact has been made with the LHA who confirmed that they would require the access to comply with the 6C's guidance and that it would expect a comprehensive transport assessment and travel plan as part of a formal planning application.

4.2 The access points are proposed to be priority T junctions with right turning lanes into the site. The actual design of the access will need to be prepared and agreed with the LHA as part of the application. Drawing 3031/001 included in Appendix A indicates that access to the site can be provided in accordance with the 6C's guidance. Proposed bus laybys have also been shown on Drawing 3031/002 to demonstrate that it will be possible to construct laybys adjacent to the site. Bus service options will need to be investigated during the transport assessment as part of the planning application to determine whether it is viable to divert services into the site, to serve the development, or if services will stop adjacent to the site using the bus laybys.

4.3 It is proposed that the speed limit along the frontage of the site be reduced to 40 mph (it is currently national speed limit) and suitable signage and entry treatment be provided, again detail to be agreed with the LHA.

4.4 A review of accident data concludes that there have been no serious accidents in the vicinity of the site accesses between 2012 and 2017.

4.5 It was noted during a site visit that there are services in the southern verge adjacent to the A47, namely Telecom, which may need alteration. There is likely to be other services along the frontage of the site.

---

[2] Transport Mitigation: Modelling Assumptions for the North of A47 site.
01 LubbInfrastrucutreDelivery.docx

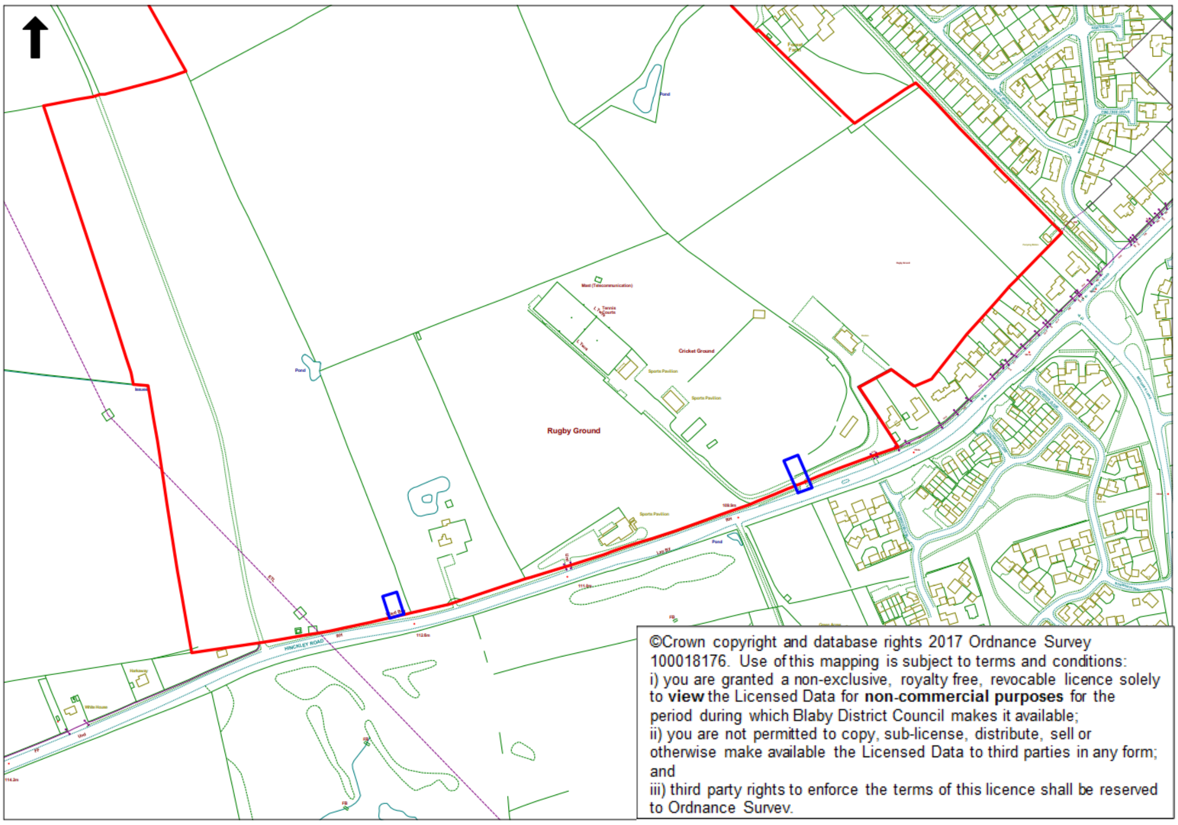


Figure 4-1: Map showing site boundary and potential points of access

5 Car Trips and Demand Management

5.1 This is a local plan assessment, not a detailed planning application. Consequently, it is not possible to take into account the specific details of the type of houses to be built, nor the specific transport mitigation and demand management measures that will be proposed as part of a formal planning application.

5.2 BDC Core Strategy Policy CS10 seeks to achieve a modal shift away from private car use and so it will be expected that any application would include provision of a Travel Plan for new residents which includes measures to encourage the use of public transport and provision of new walking & cycling routes within the site and connections into the cycle lanes on the A47.

5.3 The likely number of car trips has been estimated using TRICS, based upon survey data at a number of sites between 2008 and 2015. It should be noted that the 6C's guide recommends the use of the 85th percentile car trip-rates when undertaking a planning application. These would be used to determine the baseline trip-volumes to and from the site, and these would then be discounted to account for local factors that would impact the travel choices that would be made.

5.4 For this study, however, the housing mix is unknown and the specific travel planning measures will only be developed as part of the planning application. However, it is note that:

- The LLITM distributions show that a large proportion of car trips make use of the A47 corridor.
- the site sits adjacent to the A47, at the edge of the PUA with fast and frequent bus services on the Coventry – Nuneaton - Hinckley - Leicester City corridor.
- The Meynell's Gorse Park and Ride site is located approximately 2.5km from the site providing a direct link to the City.
- The S106 Agreement for the Lubbesthorpe development included the addition and extension of bus lanes along the length of the A47.

5.5 Therefore, it is likely that Public Transport could provide an important role in providing access to the site. To reflect this in this study the trip rates from an average development have been used rather than the 85th percentile. This is approximately 20% reduction and is in-line with trip-rate reductions that have been agreed previously with Leicestershire County Council Highway Authority when undertaking strategic assessments in the PUA.

5.6 Table 5-1 shows the number of vehicles that are estimated to access the additional 1,000 houses. This consists of the Allocated dwellings at the North of A47 site and a number of smaller sites. An additional 107 dwellings on top of those identified as allocations have been added **for modelling purposes only** to account for windfall/unknown sites that may come forward.

Table 5-1: Estimated additional vehicles based upon 1,000 extra dwellings

Vehicles per Hour				AM: 0800 to 0900			PM: 1700 to 1800		
	Allocated Dwellings	Additional	Total	Arr	Dep	total	Arr	Dep	total
Trip-Rate (veh per hour)				0.131	0.367	0.498	0.309	0.184	0.493
Land North of the A47	750		750	98	275	374	232	138	370
Grange Farm and Mill Close	74	55	129	17	47	64	40	24	64
RatbyLane/Desford Road	52	39	91	12	33	45	28	17	45
Land off Braunstone Lane	17	13	30	4	11	15	9	5	15
Total	893	107	1,000	131	367	498	309	184	493

6 Railway Level Crossings

6.1 There is only one railway level crossing located in the vicinity of the proposed site on land North of the A47. The railway is a single-track freight only line with a very limited number of train movements per day.

6.2 This crossing on Station Drive (off Station Road / Kirby Road) provides vehicular access to the Kirby Muxloe Golf Course and a number of properties south of the railway as well as providing pedestrian access to Footpath V82 which provides a route between Station Drive and Barry Drive.

6.3 The proposed development does not extend to, nor intersect with, either Station Drive or the Station Drive to Barry Drive footpath. In addition, there is no Public Right of Way to connect between the boundary of the proposed development and the footpath.

6.4 Therefore, it is not anticipated that the proposed development would materially impact the number of vehicular or pedestrian movements on the crossing.

7 Modelling of Highways Impact

7.1 Introduction

7.2 The LLITM model was commissioned to determine the transport impacts of 1,000 additional dwellings.

7.3 In consultation with the LHA it was agreed that the assessment would be in addition to the delivery of the houses in Lubbesthorpe. It was also agreed that the modelling would assume that the transport mitigation measures agreed as part of the Lubbesthorpe S106 Agreement would be included in the model run as committed improvements (see Appendix B). In addition, transport measures associated with the Optimus Point development are also included in the model run.

7.4 With regard to the mitigation proposed for the Lubbesthorpe development the LHA was concerned that:

- Firstly, there is a possibility of a ‘gap’ between when mitigation associated with the Lubbesthorpe development is delivered and when mitigation is required due to the additional traffic associated with the residential development on land North of the A47.
- Secondly that the A47 development could delay the triggering of mitigation measures from Lubbesthorpe, and may also lead to developers slowing down, or stopping, the delivery of houses at Lubbesthorpe as building progresses on the land North of the A47
- Thirdly, whether it would be considered reasonable, in the circumstances, to place planning conditions on the A47 development to deliver measures that were expected to be delivered by the Lubbesthorpe development, but which may not now be delivered in the time period previously considered acceptable.

7.5 Delivery of the Lubbesthorpe S106 Agreement mitigation is dependent on the trigger points and a ‘Highways Delivery Schedule’ which is agreed between the developers and the LHA. This schedule details the delivery of infrastructure dependant on the build-out of the site and the highways network conditions. EAE have produced a technical note[3] that demonstrates that it is reasonable to assume the mitigation measures will be delivered and that it is appropriate to assess the impact of the development with the measures in place.

7.6 LLITM assessment

7.7 The model run was undertaken by the Leicestershire County Council LLITM modelling team using the Highways (SATURN) component of the LLITM model using the 2031 AM and PM model. In addition, the results were compared against the 2016 model run.

7.8 The model is being run assuming that the full allocation of Lubbesthorpe and the additional 1,000 dwellings have been delivered by 2031 in order to determine a worst-case assessment. Thus, this report details the cumulative impact of the 1,000 dwellings and does not specifically address an individual site.

7.9 The 2031 model year is the closest to the Local Plan year and the model already assumes that Lubbesthorpe is fully built-out and the S106 Agreement mitigation delivered.

7.10 The full report is attached as Appendix E. A validation check demonstrated that the model was fit-for-purpose for undertaking this study. The validation did note that the inbound travel time on the A47 was slow in the model compared to the observed with the largest difference around the Braunstone Crossroads and that some recalibration along this stretch could have tightened up the model fit, but that the nature of the study and the fact that the general flow and journey time fit is good around this stretch means the model is fit for use in this study.

7.11 The model provided a comparison between a do-minimum scenario and a do-something scenario in which the only difference was the addition of 1,000 additional homes. In addition, it provides a comparison to the modelled conditions in 2016.

7.12 The 1,000 dwellings were made up of 750 dwellings on the site North of the A47 a further 250 dwellings were assumed to be delivered within the PUA. It is expected

[3] Transport Mitigation: Modelling assumptions for North of A47 site. Technical Note 9-8-17. 201 Lubb Infrastructure Delivery - v2.pdf

that these would be delivered on specific sites, but also occur at 'windfall' locations. For modelling purposes only, the planned development at the smaller sites was 'grossed' up to 250 dwellings in order that the impact from a total of 1,000 dwellings is modelled.

7.13 Figure 7-1 shows the distribution of traffic and potential volumes accessing the site in the morning peak period obtained from the phase 1 study. This distribution shows how traffic might route if congestion levels didn't change when more houses are added. It highlights the significant draw of traffic to the A47; the attractiveness of the route across the new Lubbesthorpe M1 bridge, and routing through Kirby Lane to access the northern side of Leicester.

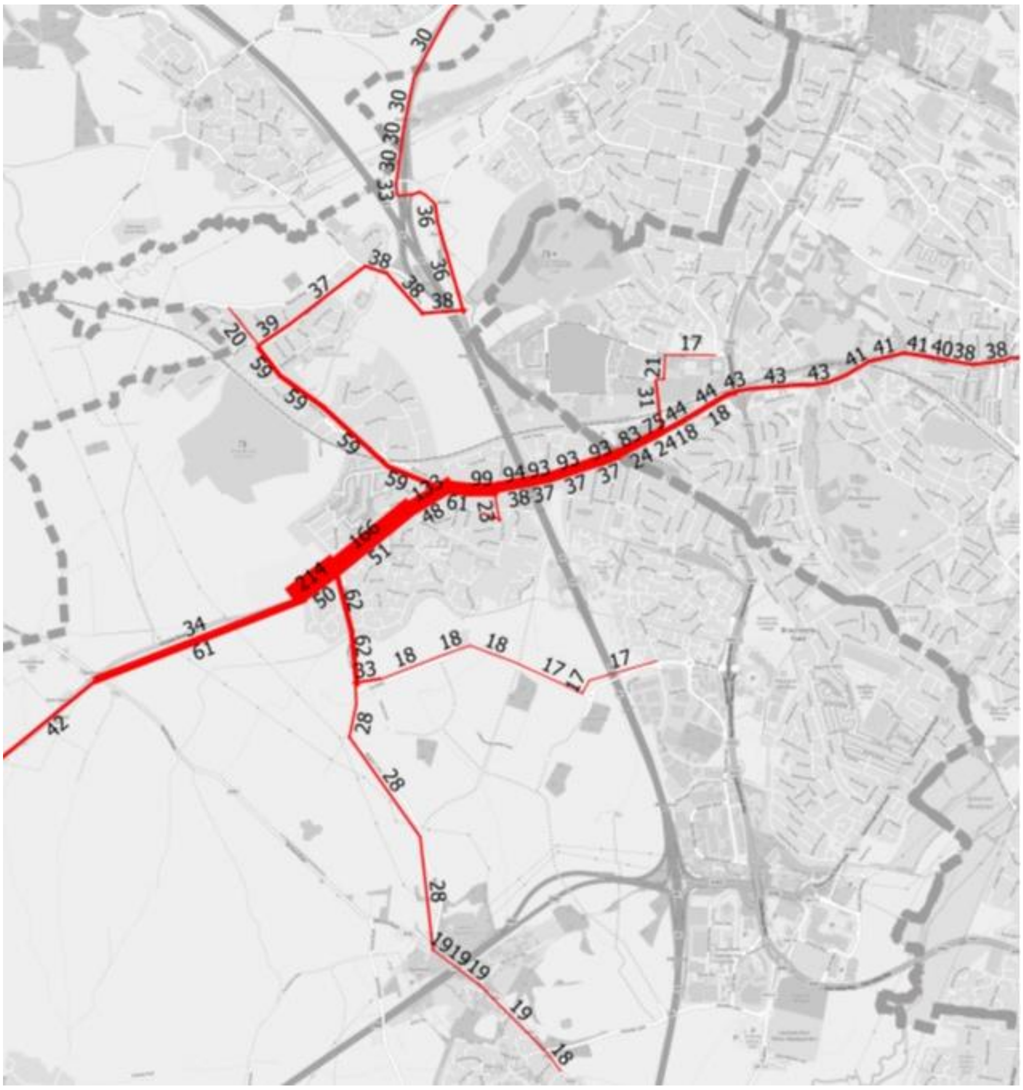


Figure 7-1: AM Peak Distribution of traffic from phase 1 (vehicle volumes based of TRICS mean trip-rate)

7.14 The modelled flow volume differences for the cases with and without the additional houses are presented below in Figure 7-2 and Figure 7-3 for the AM and PM peak period. To aid visibility, and to remove ‘clutter’ from links that are not materially impacted, only links with a change of 20 or more movements (where this represents greater than 5% of the total traffic flow) are shown.

7.15 This shows that generally on the A47 (due to traffic redistribution) the traffic levels are not significantly different between the two cases. In fact, traffic levels potentially fall inbound approaching the Braunstone Lane junction in the morning peak due to traffic moving to less congested routes. The plots do show that traffic on Kirby Lane could increase due to traffic accessing Desford, Kirby Muxloe and Ratby. Also, the route through Lubbesthorpe could prove more attractive to access the Southern parts of Leicester. Generally, the changes in flow volume are modest, and the total flow level over the M1 bridge (which is less than 900 vehicles per hour in each time period) is well within the expected DMRB design limits for a single carriageway road.

7.16 It should also be noted that there are no material changes on the routes towards or on the A46 or M1

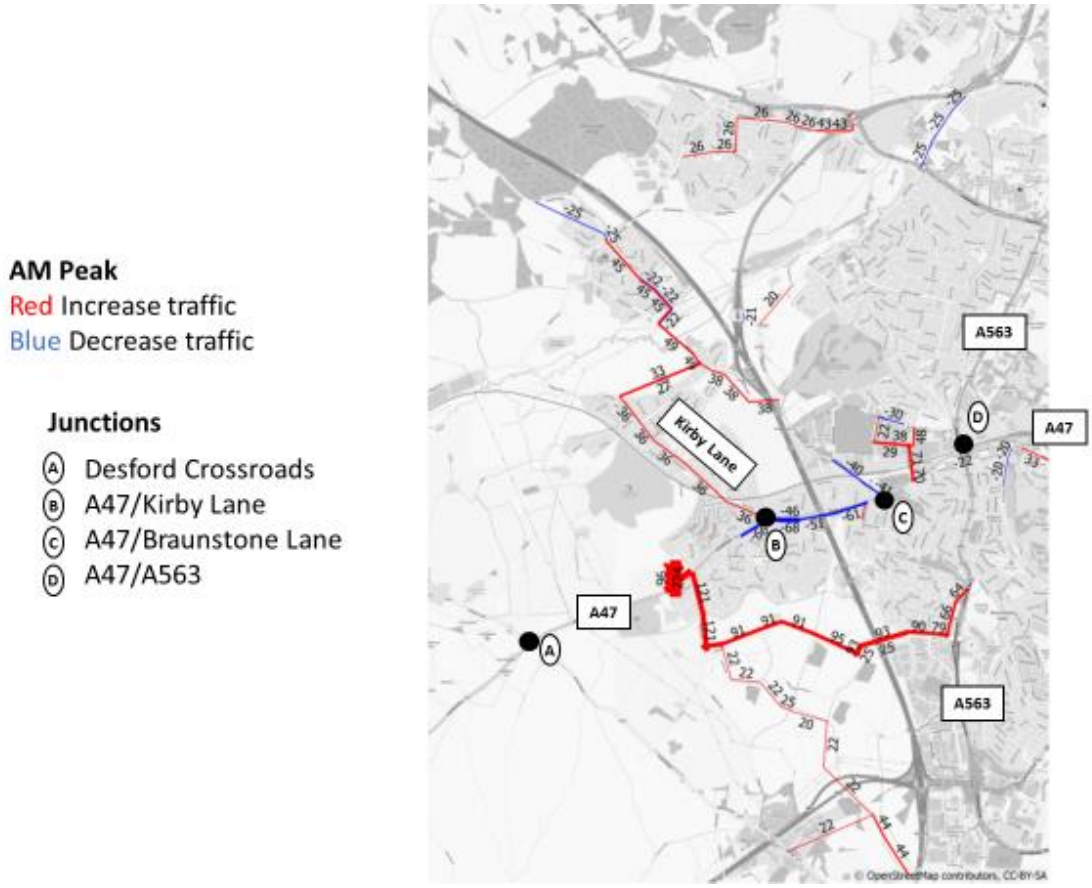


Figure 7-2: 2031 AM Peak: Difference in Traffic volume with 1,000 extra houses

Figure 7-3 2031 PM Peak: Difference in Traffic volume with 1,000 extra houses

7.17 The report shows that traffic levels increase within the immediate area of Kirby Muxloe, Braunstone (West of the A563), Lubbesthorpe and Leicester Forest East (see fig 5-6 in LLITM report). The additional 500 movements to/from the developments in each peak hour cause traffic levels (vehicle-km) in the immediate area to increase by around 3%. This could lead to an overall fall of speed of 0.2kph (0.7%) in the AM Peak hour (28kph to 27.8kph) and 0.8kph (2.7%) in the PM Peak hour (29.8kph to 29 kph).

7.18 The report shows that journey times on most of the key routes in the area are largely unaffected by the addition of 1,000 houses. Figure 7-4 (below) shows the 8 routes selected for analysis.

7.19 The exception is route 2 between the proposed North of A47 site and the A47/Braunstone Lane junction. This showed significant increases (up to 40 seconds) in delay in both the morning and evening peak hour. Further analysis showed that the delay was due to delays at the A47/Kirby Lane junction and the A47/Braunstone Lane junction.

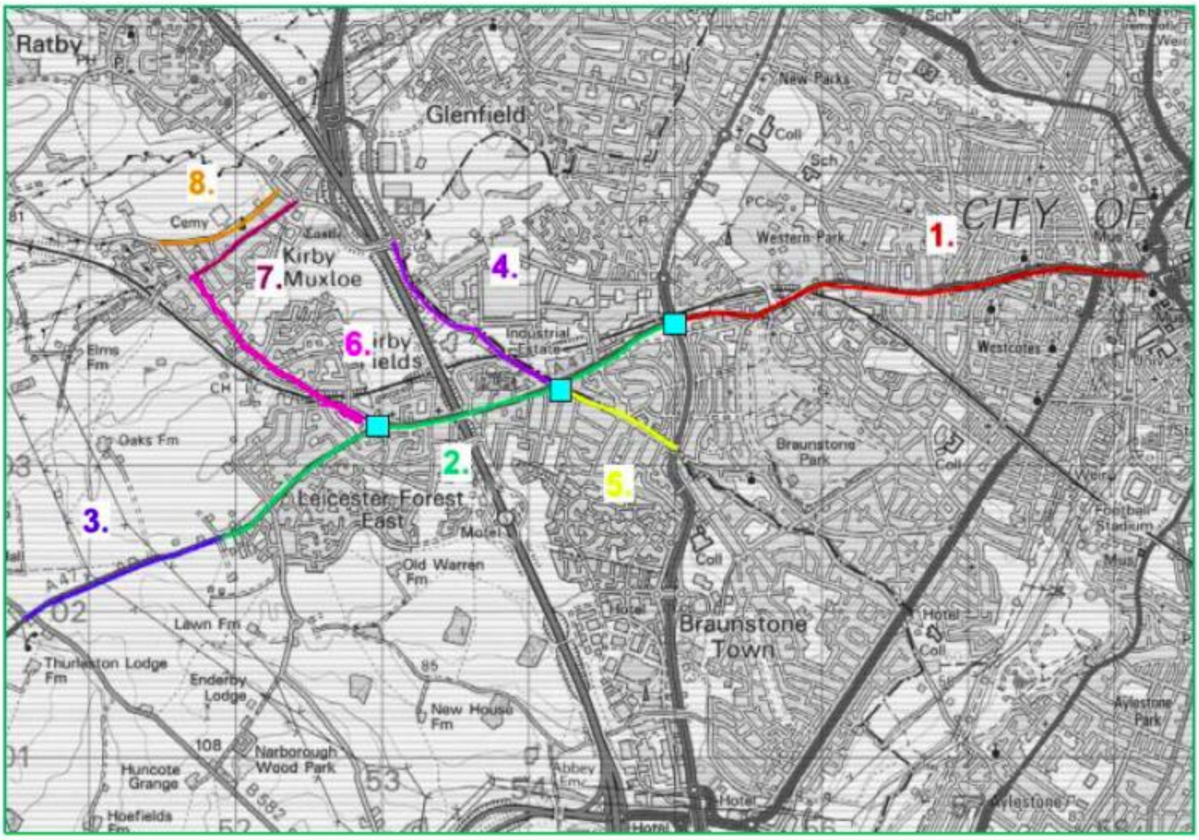


Figure 5-9: Route Locations for client specified output

Figure 7-4: Routes for undertaking journey time comparisons.

7.20 An analysis of junction performance was also undertaken on several junctions on the A47 which again highlighted the delays on the A47/Kirby Lane junction, the A47/Braunstone Lane junction and also the A47/A563 junction.

7.21 The LLITM report in particular noted that delays at the A47/A563 junction are primarily from the A563 (New Parks Way) entry where the proposed new design has only a limited right turn flared lane, rather than a dedicated high-capacity right turn lane.

7.22 In Summary the LLITM report showed:

- that traffic could be re-routing away from the A47 as the overall traffic levels are similar to the situation without the additional 1,000 dwellings. Journey times on the 8 routes analysed saw little change with the exception of the stretch between the proposed development site and the A47/Braunstone Lane junction where the A47/Kirby Lane and the A47/Braunstone Lane have seen a deterioration in performance – even with the Lubbesthorpe mitigation measures included.
- There is a potential for greater volume of traffic to use the M1 bridge through Lubbesthorpe. However, the total volumes are well within the design limits of the bridge.
- The A47/A563 junction sees a deterioration in performance on the New Parks Way entry
- traffic has increased on Kirby Lane, however it is not clear that this is undesirable given the possible range of destinations in the Kirby-Desford-Ratby directions.
- There has been no material increases in traffic or delays on the access to the A46 or the M1.

8 Possible Mitigation: Public Transport, P&R and Bus Lanes

8.1 The North of Hinckley Road site is located directly adjacent to the A47 which is an important route for accessing the City of Leicester as well as for providing a route to Hinckley, Nuneaton and Warwickshire to the west.

8.2 BDC policy seeks to achieve a modal shift away from private car use and so it will be expected that any application would include provision of a Travel Plan for new residents which includes measures to encourage the use of public transport; and provision of new walking, cycling routes within the site and connections into the cycle lanes on the A47.

8.3 The estimated cost for the basic components of a travel plan are shown in Table 8-1.

Table 8-1: Components of a travel plan

Element	breakdown of cost	Total cost
Travel Plan	£3000	£3,000
Travel Pack	£75 each x 750 dwellings (excludes complementary vouchers/tickets)	£56,000
Monitoring	£3,000 per year for 5 years	£15,000
		£74,000

8.4 The A47 is used by two existing bus services providing a fast, frequent services on the corridor linking Leicester, Hinckley, Nuneaton and Coventry.

8.5 The 48 (operated by Stagecoach) connects Leicester with Hinckley, Nuneaton and Coventry and the 158 (operated by Arriva) which connects Leicester to Hinckley and Nuneaton.

8.6 The 48 service operates with 3 services per hour in each direction with approximate travel times to/from the nearby 'The Red Cow' stop near Kirby Lane

- Leicester (Haymarket): 24 mins
- Hinckley (Bus station): 38mins
- Nuneaton (Bus Station): 53 mins
- Coventry (trinity Street): 102 mins

8.7 The 158 service operates with 3 services per hour in each direction with approximate travel times to/from Braunstone Crossroads of:

- Leicester (St Margaret's): 22 mins
- Hinckley (Bus station): 37mins

- Nuneaton (Bus Station): 54 mins

8.8 Drawing 2 in Appendix A show that it is possible to provide a bus layby on the A47. However, the size of the proposed site means that houses at the far end of the site will be greater than 400m from the bus stop. It is estimated that the cost of adding the laybys would be £50k excluding any utility diversion costs.

8.9 During the planning application process it will be important for the promoter to engage with the two bus companies and the local highway authorities in order to assess whether buses could be diverted through the development using one of the access points as an entry and the other as an exit in order to create a route through the site that would ensure all the houses are within 400m of a bus stop. The bus companies would be looking at the benefits of extra patronage and offsetting this against the increased journey time of the diversion. The bus company may look to contributions to offset any net loses. This could be in the range £150k to £250k per annum

8.10 In addition, it would also be important to determine whether an additional service should be provided linking the development site with Leicester city centre. The benefits of this would be dependent on the timing of the existing buses and the level of overcrowding. The promoter of the development may wish to fund an all-day, peak period or off-period bus service linking to the site. This is likely to cost in the range £200k to £400k per annum, or may wish to consider the benefits of extending the new bus services linking Lubbesthorpe to Leicester onto the new development (for instance through Beggars Lane). This is estimated as £150k to £250k per annum

8.11 As well as the service buses, the Meynell's Gorse Park and Ride (P&R) site is located around 2.5km (~1.5mile) from the proposed development. It is possible that residents of the proposed development could be encouraged to use the P&R site. It is however noted that the P&R service is one of the most successful in Leicester and is close to capacity at peak times.

8.12 There are a number of potential options for improving P&R that could be provided through S106 agreements:

- Funding the revenue costs of providing an additional bus to allow an increase in frequency on the route between the P&R site and Leicester (~£100k pa for 5 years)
- Provide funding to provide more car parking spaces. The limited land available means that this would be provided by the addition of a second deck, in part of the

car park. This is estimated as £300k - £500k but would depend on ground conditions and specification of the structure.

8.13 There are further options that could be considered by the site promoter during the planning application, for instance providing a shuttle bus service linking the proposed site on the A47 to the Meynell's Gorse P&R site allowing residents to access the P&R buses without using a car.

8.14 The A47 has recently seen significant investment in bus priority measures and the Lubbesthorpe S106 agreement will add additional measures on the A47 between Baines Lane and Braunstone Lane and at the A47/Braunstone Lane junction and the A47/A563 junction as part of the agreed junction improvements.

8.15 As part of this study the following additional opportunities for bus lanes on the A47 were identified and are detailed in Appendix C.

- Beggars Lane to Baines Lane noting that this section includes the M1 bridge which may limit opportunities due to weight and/or safety issues. The cost is estimated at around £1.5m to £2.5m. The public utility diversion costs could be very high and not included in this estimate
- Avery Hill Inbound. It is noted that an outbound bus lane in proposed in the Lubbesthorpe S106. Including an inbound lane would require widening the carriageway which is estimated at £500k to £600k It is recommended that bus journey time improvements analysis is carried out and assessed alongside the detailed cost estimate to determine whether this improvement would be value for money.
- Winstanley Drive to Oswin Road outbound. This involves carriageway widening. The indicative estimated cost of this new length of bus lane is £400k to £500kexcluding any necessary public utility diversion works. It is recommended that bus journey time improvements analysis is carried out and assessed alongside the detailed cost estimate to determine whether this improvement would be value for money.
- Frampton Avenue to Western Park Road (including a bus gate on the approach to the railway bridge). This involves widening the carriageway and the removal of trees. Cost £400k to £500k. Previously this has been considered by the City Highways Authority, but rejected due to poor value for money and severance issues, particularly outside Dovelands school

8.16 In Summary, there are a number of measures that have been identified that would enhance the public transport accessibility of the proposed development site. In section 0 the opportunities are considered alongside the modelling results and the potential for highways improvements to provide an 'in-principle' list of possible mitigation options.

8.17 When a planning application is prepared the site promoter will need to engage with the bus companies and the local authorities to determine which are most likely measures that could be considered. Initial thoughts on possible options are summarised in Table 8-2. In section 10 these options are considered alongside the LLITM modelling results and the potential for highways improvements to provide an ‘in-principle’ list of possible mitigation options.

8.18 The costs are budgetary estimates and would need revision following discussion/agreement between the various parties during the planning application. The estimates don’t include any land or public utility diversion works costs. The bus service costs are very indicative only as the costs will depend on existing service operations and wider bus company considerations

Table 8-2: Summary of public transport measures

Type	Intervention	Estimated Cost
Travel Plan	Comprehensive travel plan	£74,000
Bus Services	Providing two Laybys for existing bus services on the A47. Excluding service costs	£50,000
Bus Services	Diverting existing bus services into the development	£150k to £250k per annum
Bus Services	Additional Service between Development site and Leicester	£200k-£400k per annum
Bus Services	Extending the proposed Leicester to Lubbesthorpe services on to the new development	£150k to £250k per annum
Park and Ride	Additional Bus service	£100k pa for 5 years
Park and Ride	Additional deck in part of the car park	£300k to £500k
Bus Lanes	Beggars Lane to Baines Lane	£1.5m to £2.5m
Bus Lanes	Avery Hill Inbound	£500k to £600k
Bus Lanes	Winstanley Drive to Oswin Road outbound	£400k to £500k
Bus Lanes	Frampton Avenue to Western Park Road	£400k to £500k

9 Possible Mitigation: Highways Improvements

9.1 Following the outcome of the stage 1 transport report and the LLITM modelling results commissioned as part of phase 2, EAE have focussed on looking at opportunities for infrastructure improvement on the A47 between Desford Crossroads and the Inner Ring Road, and on routes through Kirby Muxloe.

9.2 This has involved looking at the improvements proposed for the Lubbesthorpe S106 Agreement, looking at traffic level increases forecast through LLITM, discussions with City Council and County Council Highways Officers and visits to site.

9.3 As well as physical improvements to the links we have also discussed the operation of the junctions with Area Traffic Control (ATC). ATC actively manage the road network through the use of variable message signs and through the control of the traffic signals. The control of the traffic signals allows the operation of the network to be optimised in order to meet defined objectives.

9.4 In particular we have discussed the options for adding SCOOT[4] to signals along the A47 and MOVA[5] to the larger junctions. The cost of adding this optimisation is due to the cost of vehicle detection sensors, communication channels between the sensors and signal controller, communication channels between the controller and the ATC control centre as well as the software license.

9.5 Table 9-1shows how each set of signals is currently operated. This highlights that SCOOT is already providing benefits on the A47 whilst the junctions in yellow are where MOVA is already installed, or where it could be installed to provide an additional benefit.

---

[4] Split Cycle and Offset Optimisation Technique (SCOOT): Traffic signal control software that allows for the coordination or adjacent traffic signals using data from vehicle detectors to control the signals in order to minimise queues and delays along a route

[5] Microprocessor Optimised Vehicle Actuation (MOVA): Traffic control software for isolated junctions that optimises the operation of the junction based upon the detection of approaching vehicles.

Table 9-1: Traffic signal operation of junctions on the A47

ID	Junction	Operation
11111/2	West Bridge/St Nicholas Circle	UTC Timed plans AM Peak and off peak. Scoot PM Peak
11141	West Bridge/Duns Ln	Scoot
11151	KRR/Tudor Rd	Scoot
11413/4	KRR/Kate Street	Scoot (currently off comms)
11441	KRR/Glenfield Rd East (and OB Cross)	Scoot
11461	KRR/Fosse Rd	Scoot
11531/2	KRR/Hinckley Rd	Scoot
11543/4	Hinckley Rd/Carlisle St	local detection (crossing)
11561	Hinckley Rd/Wyngate Dr	Scoot
11573	Hinckley Rd/Kingswood Ave	local detection off peak, Scoot peak
11583	Hinckley Rd/Western Park	local detection off peak, Scoot peak
11655	Hinckley Rd/Leisure Centre	Scoot
11652/3	Hinckley Rd/Cort Crescent pel	local detection 24/7
11651	Hinckley Rd/Cort Crescent	local detection 24/7
11661/2/3/4	Hinckley Rd/New Parks Way Rbt	TC Timed plans
40131	Hinckley Rd/Braunstone Ln/Ratby Ln	Scoot
40123	A47/Holmfield Rd West	local detection (crossing)
40193	A47/Packer Ave	local detection (crossing)
40143	A47/Kings Dr	Scoot
40173	A47/Kathleen Rutland Home	Scoot
40111	A47/Kirby Ln	Scoot
40161	A47/Warren Ln	Scoot
40171	A47/Beggars Ln	Scoot
40181	Desford Crossroads	MOVA

9.6 Appendix D contains details on the opportunities and constraints to improve the highways network along the A47 corridor and through Kirby Muxloe

9.7 Initial thoughts on deliverable mitigation options are shown below. In section 0 the opportunities are considered alongside the LLITM modelling results and the potential for Public Transport improvements to provide an ‘in-principle’ list of possible mitigation options.

9.8 The costs are budgetary estimates and would need revision following discussion/agreement between the various parties during the planning application. The estimates don’t include any land or public utility diversion works costs.

Table 9-2: Summary of potential junction improvements

Scheme	Description	Contribution
A47/Desford Crossroads	This scheme to significantly increase the capacity of the junction is actively being promoted by Leicestershire County Council. The Lubbesthorpe SUE is required to make a contribution of £806,000. It is proposed that the contribution from the North of A47 site of 750 dwellings compared to 4250 at Lubbesthorpe should contribute pro-rata	750/4250 = 18% £142,000

A47 Kirby Lane junction	Adding an additional lane inbound in order to increase the volume of flow across the junction during the traffic signals ‘green’ period.	£750,000 to £1,000,000
A47 / Braunstone Lane	Significant improvements are proposed for this location funded through the Lubbesthorpe S106. However, the junction is very constrained and whilst an inbound left turn filter lane on the A47 would be desirable the carriageway is already abutting the highways boundary. As a consequence, there no further infrastructure improvements that could be made without acquiring the adjacent land. However, the operation of the junction could be improved with the installation of MOVA.	£300,000
A47/A563 Junctions	Significant improvements are proposed as part of the Lubbesthorpe S106 agreement. However, it was noted from the modelling that the Eastern entry from New Parks Way was under stress in the evening peak. This could be improved by extending the right turn entry flare to a longer dedicated right turn lane. In addition, the junction is not MOVA enabled. Adding MOVA would improve the operation of the junction.	Dedicated Right turn lane £250,000 to £350,000 MOVA - £300,000
A47 /Oswin Road/Cort Crescent junction	The junction is forecast to be stressed in 2031. There is highways land that would enable the provision of a separate left turn lane into and out of Cort Crescent.	£300k to £500k
Station Road (Kirby Muxloe)	Kirby Lane leading to Station Road provides a route between the A47 and Kirby Muxloe. There is already speed reduction measures on this stretch of road, and there are opportunities to add one or two additional features between Wentworth Green and Linden Lane. The adoption of these measures would need to be balanced against hindering ‘legitimate’ trips using this route to travel between the A47 and Ratby, Kirby Muxloe and Desford.	£15,000

10 In-Principle Transport Measures

10.1 The approach adopted in this study has been to consider the LLITM modelling results, the broad objectives of the highways authorities and the potential measures that could be delivered to support public transport and the highways network.

10.2 However, it should be noted that it will only be possible to assess the detailed impact and required mitigation once the precise nature of any development is known and the impact of the development assessed with the appropriate demand measures.

10.3 In particular the transport authorities are only able to formally respond to a formal planning application. Consequently, the opinions expressed in this report reflect their 'best advise' on the most likely requirements for measures to support non-car travel and measures to mitigate the impact on the highways network. The opinions expressed as part of this study will not prejudice their response to a formal planning application.

10.4 The modelling work has demonstrated that the Strategic Road Network (SRN) is unlikely to be materially impacted by the development of 1,000 houses in and around the PUA to the north of Blaby. Consequently, there are not any additional measures proposed to support the A46 or M1 or junctions that access the SRN.

10.5 For the LHA it was noted that they wished to ensure that there is safe access onto the A47 and that delays and congestion is minimised. They welcome measures that support road traffic as well as measures that encourage the uptake of public transport. The City Highways Authority wish to ensure that access to the City and the Fosse Park area is maintained and that they will support measures that encourage the use of public transport.

10.6 Consequently, at this stage it is only possible to 'propose' possible mitigation measures. These have been split into three categories: most-likely measures which are highly likely to be requested, lower priority measures from which only a selection would be considered, and less likely measures where the schemes are unlikely to be selected due to the distance from the site and their expected impact.

10.7 The most likely measures are likely to include a large proportion of the following schemes which provide a direct benefit to the immediate vicinity of the proposed development and A47. It should be noted that the costs provided exclude estimates for the diversion of services (gas, water, telecom etc) which may be present.

Table 10-1: Most likely schemes to be requested by the highways authorities

Scheme	Description	Contribution
A47/Desford Crossroads	This scheme to significantly increase the capacity of the junction is actively being promoted by Leicestershire County Council. The Lubbesthorpe SUE is required to make a contribution of £806,000. It is proposed that the contribution from the North of A47 site of 750 dwellings compared to 4250 at Lubbesthorpe should contribute pro-rate	750/4250 = 18% £145,000
A47 Kirby Lane junction	Adding an additional lane inbound in order to increase the volume of flow across the junction during green period and thus reduce inbound delays	£750,000 to £1,000,000
A47 / Braunstone Lane	Significant improvements are proposed for this location funded through the Lubbesthorpe S106. However, the junction is very constrained and whilst an inbound left turn filter lane on the A47 would be desirable the carriageway is already abutting the highways boundary. As a consequence there no further infrastructure improvments that could be made without acquiring the adjacent land. However the operation of the junction could be improved with the installation of MOVA	£300,000
Station Road (Kirby Muxloe)	Kirby Lane leading to Station Road provides a route between the A47 and Kirby Muxloe. There a already speed reduction measures on this stretch of road, and there are opportunities to add one or two additional features between Wentworth Green and Linden Lane. The adoption of these measures would need to be balanced against the desire to hinder ‘legitimate’ trips using this route to travel between the A47 and Ratby, Kirby Muxloe and Desford.	£15,000
Travel Plan	Comprehensive travel plan	£74,000
Bus Services	Providing two Laybys for existing bus services on the A47	£50,000
Bus Lanes	Beggars Lane to Baines Lane	£1.5m to £2.5m
TOTAL		£2.834M to £4.08M

10.8 In addition there are likely to be one or more 'lower priority' options from the list in Table 10-2 which may be requested by the highways authority. Each of these individually has merit, however any measures required will be determined by the priorities agreed in discussion between the site promoter and the highways authorities.

Table 10-2: Lower priority schemes that m

Type	Intervention	Cost
A47/A563 Junctions	Significant improvements are proposed as part of the Lubbesthorpe S106 agreement. However, it was noted from the modelling that the Eastern entry from New Parks Way was under stress in the evening peak. This could be improved by extending the right turn entry flare to a longer dedicated right turn lane. In addition the junction is not MOVA enabled. Adding MOVA would improve the operation of the junction	Dedicated Right turn lane £250,000 to £350,000 MOVA - £300,000
Bus Services	Diverting existing bus services into the development	£150k to £250k pa
Bus Services	Additional Service between Development site and Leicester	£200k to £400k pa
Bus Services	Extending the proposed Leicester to Lubbesthorpe services on to the new development	£100k to £200k pa
P&R	Additional Bus service	£100k pa for 5 years
P&R	Additional deck in part of car park	£300k to £500k
Bus Lanes	Avery Hill Inbound	£500k to 600k.
Bus Lanes	Winstanley Drive to Oswin Road outbound	£400k to £500k
Bus Lanes	Frampton Avenue to Western Park Road	£400k to £500k

10.9 The following are less likely to be required due to their location and the results of the transport modelling which showed that journey times on the A47 were not significantly impacted by the development.

Table 10-3Less likely measures

Scheme	Description	Contribution
A47 /Oswin Road/Cort Crescent junction	The junction is forecast to be stressed in 2031. There is highways land that would enable the provision of a separate left turn lane into and out of Cort Crescent.	£300k to £500k

11 Conclusions/Findings

11.1 This, phase 2, study has been commissioned to assess the transport implications of proposed housing allocations on the edge of the PUA and to identify the likely ‘in-principle’ transport mitigation measures required as part of a proportionate approach for the preparation of the Blaby Local Plan Delivery DPD.

11.2 Three highways authorities (Leicestershire County Council Highway Authority, Leicester City Council Highway Authority and Highways England) have been consulted as part of this study. Each has responded on the basis that this is a strategic assessment, and that their final opinion will rest upon specific planning application(s) received and the accompanying transport assessment.

11.3 The findings of this study are summarised as follows:

11.4 **Access Arrangements to the North of A47 site**: It has been shown that it is possible in-principle to provide access to the site which complies with the requirements of the 6C’s guide.

11.5 **Level Crossings**: There is only one railway level crossing located in the vicinity of the proposed site on land North of the A47. The railway is a single-track freight only line with a very limited number of train movements per day. The proposed development does not extend to, nor intersect with any footpath leading to the crossing. Consequently, it is not anticipated that the proposed development would materially impact the number of pedestrian or vehicular movements on the crossing.

11.6 **Transport Modelling**: The LLITM[6] report notes that the greatest impact is likely to be on the A47 with the greatest impact at the Kirby Lane, Braunstone Lane and A563 junctions.

11.7 **Possible Mitigation: public transport measures, services and bus lanes**: When a planning application is being prepared the site-promoter will need to engage with the bus companies and the local authorities to determine which are most likely measures that could be considered. The study has considered numerous options which are summarised in Table 8-2 Those options considered most likely to be required are included in the ‘in-principle’ mitigation measures reported in paragraph 11.9.

[6] Leicester and Leicestershire Integrated Transport Model

11.8 **Possible Mitigation: Highways Improvements.** This study has looked at measures involved in improving the control of traffic through improved optimisation of traffic signals as well as looking at opportunities for making improvements to the highways infrastructure. Table 9-2 summarises the opportunities identified. Those options considered most likely to be required are included in the ‘in-principle’ mitigation measures presented later in paragraph 11.9.

11.9 **In-principle Transport Measures**: The approach adopted in this study has been to consider the LLITM modelling results, the broad objectives of the highways authorities and the potential measures that could be delivered to support public transport and the highways network.

11.10 However, it should be noted that it will only be possible to assess the detailed impact and required mitigation once the precise nature of any development is known and the impact of the development assessed with the appropriate demand management measures.

11.11 However, it is possible to highlight measures that are considered likely to be agreed by the applicant and the LHA. These could include a large proportion of the following schemes (Table 11-1) which provide a direct benefit to the immediate vicinity of the proposed development and A47. The main report also highlights schemes deemed ‘lower priority’ that may also be considered.

Table 11-1: Most likely schemes to be requested by the highways authorities

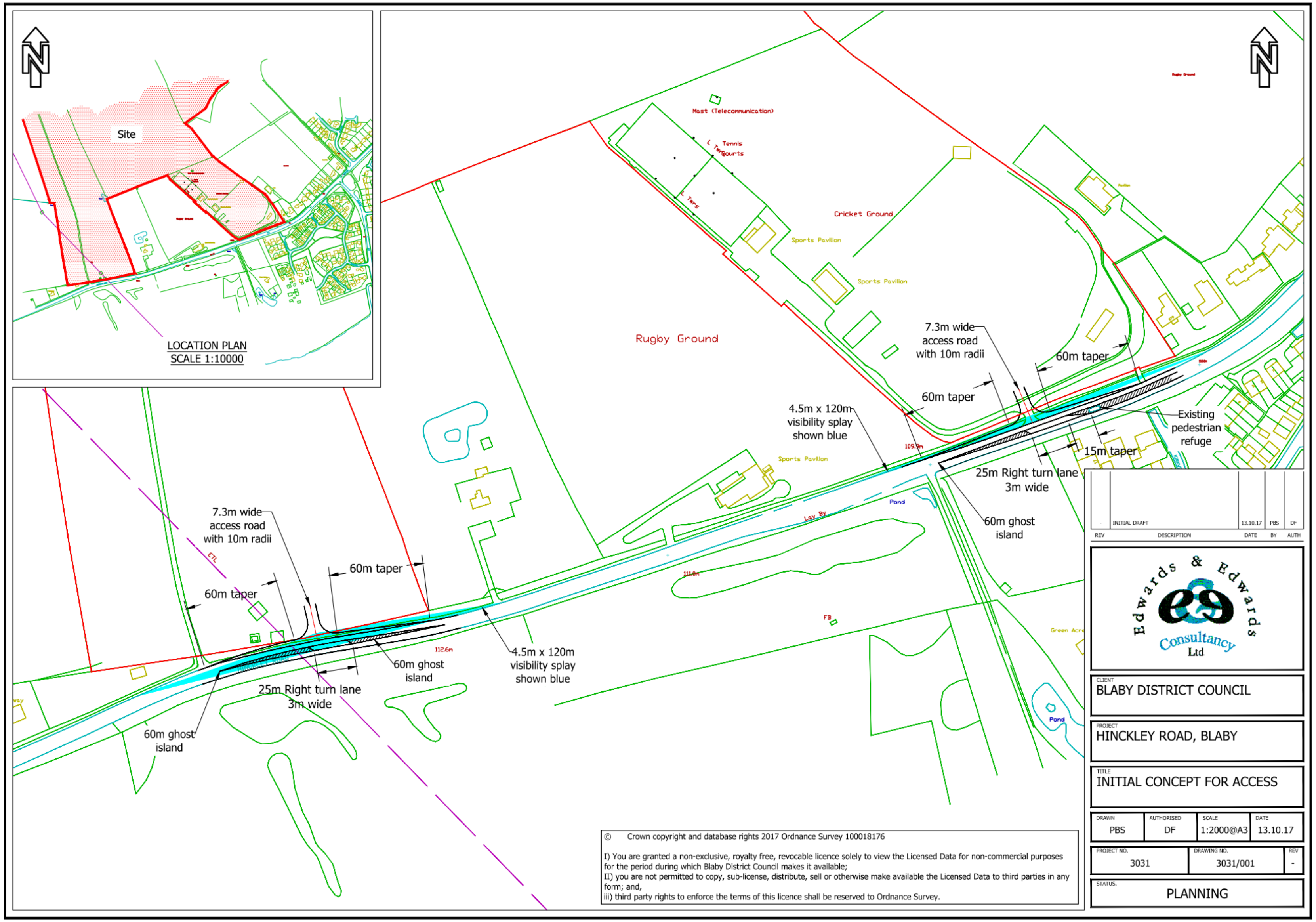
Scheme	Description	Contribution[7]
A47/Desford Crossroads	This scheme to significantly increase the capacity of the junction is actively being promoted by Leicestershire County Council. The Lubbesthorpe SUE is required to make a contribution of £806,000. It is proposed that the contribution from the North of A47 site of 750 dwellings compared to 4250 at Lubbesthorpe should contribute pro-rate	750/4250 = 18% £145,000
A47 Kirby Lane junction	Adding an additional lane inbound in order to increase the volume of flow across the junction during green period and thus reduce inbound delays	£750,000 to £1,000,000
A47 / Braunstone Lane	Significant improvements are proposed for this location funded through the Lubbesthorpe S106. However, the junction is very constrained and whilst an inbound left turn filter lane on the A47 would be desirable the carriageway is already abutting the highways boundary. As a consequence there no further infrastructure improvments that could be made without acquiring the adjacent land. However the operation of the junction could be improved with the installation of MOVA	£300,000
Station Road (Kirby Muxloe)	Kirby Lane leading to Station Road provides a route between the A47 and Kirby Muxloe. There a already speed reduction measures on this stretch of road, and there are opportunities to add one or two additional features between Wentworth Green and Linden Lane. The adoption of these measures would need to be balanced against the desire to hinder 'legitimate' trips using this route to travel between the A47 and Ratby, Kirby Muxloe and Desford.	£15,000
Travel Plan	Comprehensive travel plan	£74,000
Bus Services	Providing two Laybys for existing bus services on the A47	£50,000
Bus Lanes	Beggars Lane to Baines Lane	£1.5m to £2.5m
TOTAL		£2.834M to £4.08M

[7] It should be noted that the costs provided exclude estimates for the diversion of services (gas, water, telecom etc) which may be present

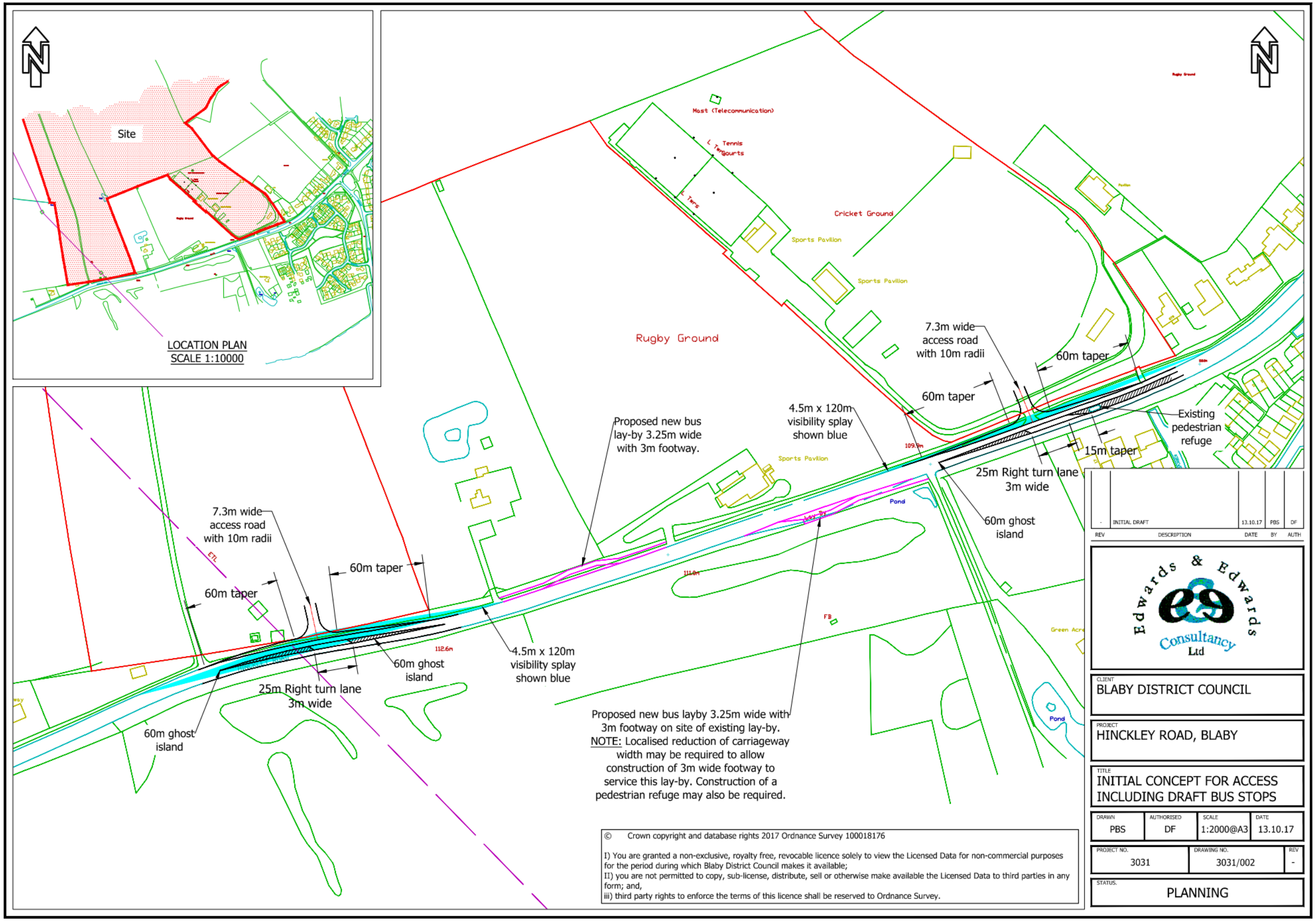
Appendix A. Access Arrangements – Land north of the A47

The drawings show a concept drawing of the possible access arrangements.

Drawing 3030/001 shows a possible access arrangement from both potential locations
Drawing 3030/002 shows a possible access arrangement and demonstrates the feasibility of adding bus-stops



Drawing 1: Demonstrating the possibility of access to the A47



Drawing 2: Demonstrating the possibility of access to the A47 and the possibility of adding bus laybys

Appendix B. Lubbesthorpe Mitigation Measures

11.12 Annex1 to the Lubbesthorpe S106 agreement summarised the highways works agreed within the S106 together with the trigger points.

- **Part 1 of the annex** details mitigation required at an early stage (for instance to provide access to the site and for the M1 bridge) are triggered by **maximum** build-out levels that will be allowed before the mitigation is delivered.
- **Part 2 of the annex** details mitigation required later is triggered by a **minimum** build out level and a Highways Delivery Schedule. This Highways Delivery Schedule is to be agreed with County Highways following the delivery of the 300th dwelling. This schedule is then reviewed and updated on the delivery of the 1,000th dwelling and then after every 500 dwellings.

11.13 In addition, contributions towards the cost of improvements are set out in seventh and ninth schedule within the S106 agreement. These are:

- Foxhunter roundabout which is triggered at 3,000 dwellings;
- Desford Crossroads (£806k) which is triggered at 3,500 dwellings;
- Leicester Bus station which is triggered at 50, 2600 and 3750 dwellings

11.14 WSP have produced a draft Highways Delivery Schedule dated 10/7/2015 in which they provide predicted trigger levels based upon expected increases in traffic. These, together with the minimum trigger level are summarised in Table 11-2. This highways Delivery Schedule will be reviewed by County Highways on a regular basis during the delivery of the housing.

Table 11-2: Proposed S106 mitigation measures

Mitigation Measure	Minimum Trigger	WSP proposed trigger
A47 Baines Lane Junction	301	1700
A47 Bus Lane (Baines Lane to Braunstone Lane)	351	1500
A47/Braunstone Lane Junction	750	1500
A47/A563 Junction	501	1500
A47/Kirby lane	Not specified	1500
Vaughan Way/Causeway Ln Junction	1000	2500
M69 Bridge link	2000	2500
Leicester Lane / St Johns Junction	Not specified	2500 or occupation of 50,000sqm of employment land
Meridian South / A563 Roundabout signalisation	Not specified	2500
A5460/A563 link improvements	Not specified	3500
Withers Way / A563 improvements	Not specified	2500

Appendix C. Possible Bus Priority measures on the A47

11.15 This appendix provides a review of current, proposed and possible additional Bus Priority Measures on the A47 corridor

11.16 There are currently significant lengths of bus lane, both inbound and outbound on the A47, between the A47/Avery Hill junction (between the A47/Ratby Lane junction and the A47/A563 Outer Ring Road junction). A new length of bus lane is proposed between Baines Lane and the Braunstone Crossroads inbound in the Lubbesthorpe S106 Agreement and from Avery Hill to the Braunstone Crossroads outbound.

11.17 From Beggars Lane to Baines Lane the highway corridor is generally wide enough (between 17m to 19.5m) to accommodate a new bus lane (inbound likely to be preferable). This section would include crossing over the M1 bridge and hence this would need checking as to the suitability or otherwise of an additional lane of carriageway over the bridge. Creation of a bus lane would require kerbline alterations to both sides of the carriageway for the majority of this length and hence this would be an expensive scheme that is estimated to be between £1.5m to £2.5m. Public utility diversion costs could be very high and not included in this estimate

11.18 New lengths of bus lane in each direction could be provided from the existing bus lanes on the A47 near Avery Hill to the Braunstone Crossroads. Carriageway widening would be required. The indicative estimated cost of this new length of bus lane is £500,000 to £600,000 excluding any necessary public utility diversion works. Noting that an outbound bus lane is proposed as part of the Lubbesthorpe S106 it is recommended that bus journey time improvements analysis is carried out and assessed alongside the detailed cost estimate to determine whether this improvement would provide value for money.

11.19 A new length of bus lane would be possible from near Winstanley Drive to the existing bus lane outbound after the A47/Oswin Road junction assuming the junction improvements at Oswin Road were progressed. Provision of a bus lane would require carriageway widening. The indicative estimated cost of this new length of bus lane is £400,000 to £500,000 excluding any necessary public utility diversion works. It is recommended that bus journey time improvements analysis is carried out and assessed alongside the detailed cost estimate to determine whether this improvement would provide value for money.

11.20 A new length of outbound bus lane from Frampton Avenue to Western Park Road including a bus gate on the approach to the railway bridge (city council bus pinch points list) could be provided at an estimated cost of £400k to £500k. However, this was considered as part of the Enderby Park and Ride service route scheme and it was concluded at that time (2009) that the journey time benefit was quite small (verses the cost of widening the carriageway and removal of trees) and there would be a severance issue here particularly outside the Dovelands School.

Appendix D. Possible Highways Improvements

11.21 The A47 Corridor (excluding Bus lanes)

11.22 This is a key radial route into and out of Leicester from the west. The route is two-way single carriageway, over the M1 on an overbridge, from the development site to the approach to the A563 Outer Ring Road junction. From the A563 Outer Ring Road the route has lengths of two lane (one being a bus lane) two-way carriageway, two way in bound/one lane outbound carriageway and two way single carriageway with the crossing of the railway line, at the “Shoulder of Mutton” bridge being a restriction. The Meynell’s Gorse Park and Ride service uses the A47 from Ratby Lane into the city centre. The Enderby Park and Ride service has used the A47 from the A563 Outer Ring Road in the past and uses this route if the Soar Valley Way/A426 corridor is affected by disruption.

11.23 *A47 Desford Crossroads*. Leicestershire County Council highways have undertaken some early feasibility work on a scheme to address the congestion issues experienced by road users at the crossroads – The draft plan of the likely scheme is shown in Figure 11-1. Should funding be awarded for the scheme under the National Productivity Investment Fund, then more detailed designs will be progressed to allow full consultation to take place with local businesses, residents and wider stakeholders. If approved the scheme could be delivered in the financial year 2019/20.

11.24 Through their S106 agreement the promoters of Lubbesthorpe are required to contribute £806,000 to the improvements. Given that developments on the A47 are likely to have a similar proportion of trips travelling west on the A47 then it is proposed that the contribution could be pro-rate to the number of houses:
750/4250 * £806,000 ≈ £142,000

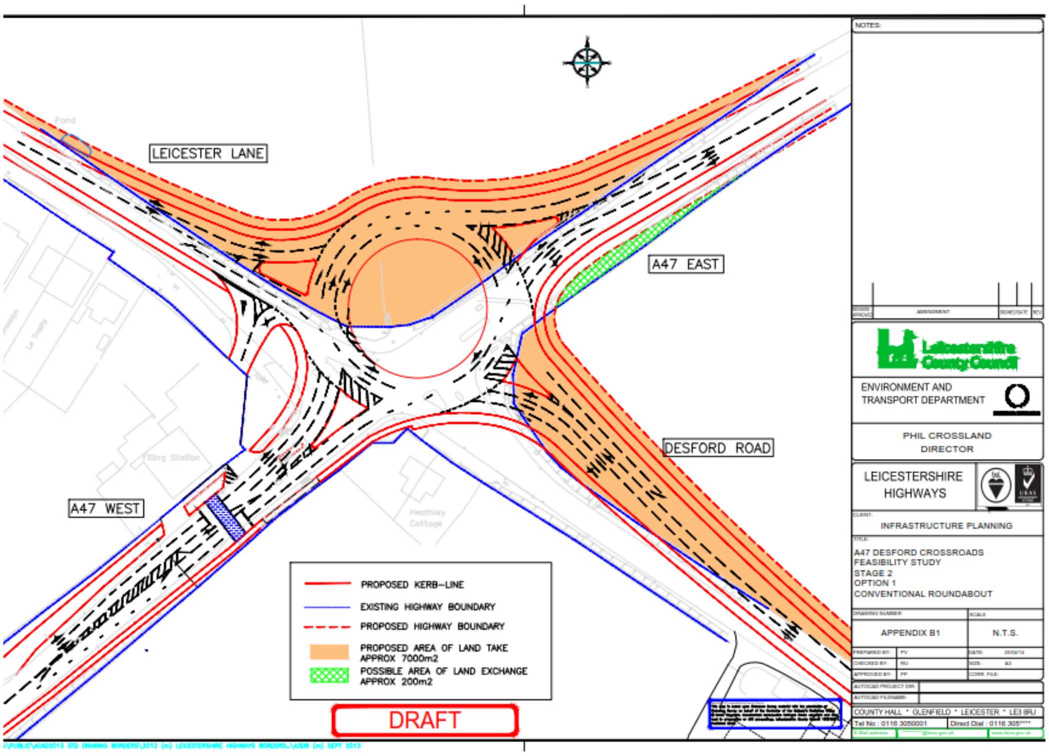


Figure 11-1: Draft scheme for Desford Road / A47 Junciton

11.25 The *A47/Kirby Lane junction* is a signalised T junction on a bend on the A47 The junction is predicted to be severely stressed. Mitigation is proposed for the junction in the Lubbesthorpe S106 Agreement Figure 11-2. The mitigation includes removal of a refuge and provision of a pelican crossing on the A47 on the inbound (to the city) approach to the junction. Kirby Lane carriageway is to be widened to allow two lanes approaching the A47 for a left and a right turn lane.

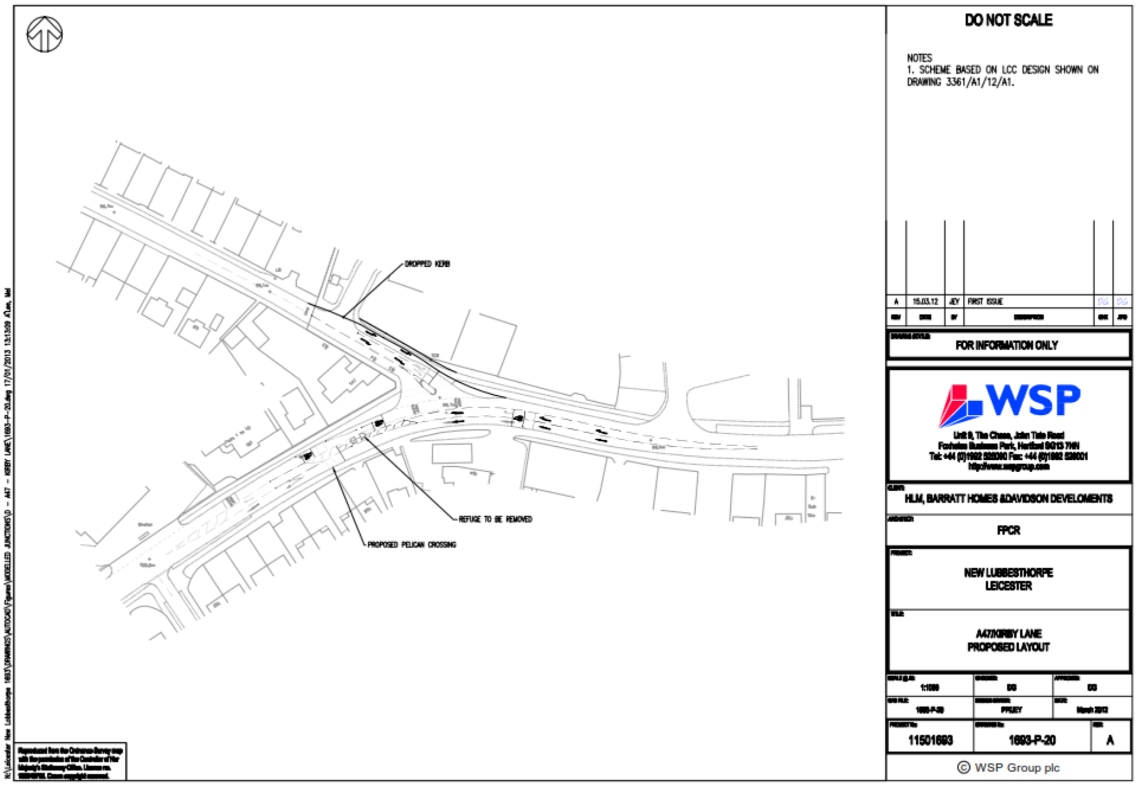


Figure 11-2: Kirby Lane Junction, proposed Lubbesthorpe S106 improvements

11.26 Modelling suggests that inbound delays on the A47 start at this junction. The stop lines are located a considerable distance from the junction to facilitate turning movements into and out of Kirby Lane, this results in longer delays.

11.27 As the highway corridor varies between approximately 17.5m and 19.5m wide near the junction, and there is garden land and a former petrol station site adjacent to the highway, if additional land was required/justified, there is scope to re-design the junction (see Figure 11-3 for an indicative layout) and provide an additional traffic lane either inbound or outbound at the junction, with appropriate tapers and merge lengths to help improve junction capacity. The design of the junction should be such that capacity is improved for traffic on the A47 and that traffic should be discouraged from rat running through Kirby Muxloe. The indicative estimated cost (not including any public utility diversions necessary and any not including any land costs (unlikely to be required)) is £750,000 to £1M.

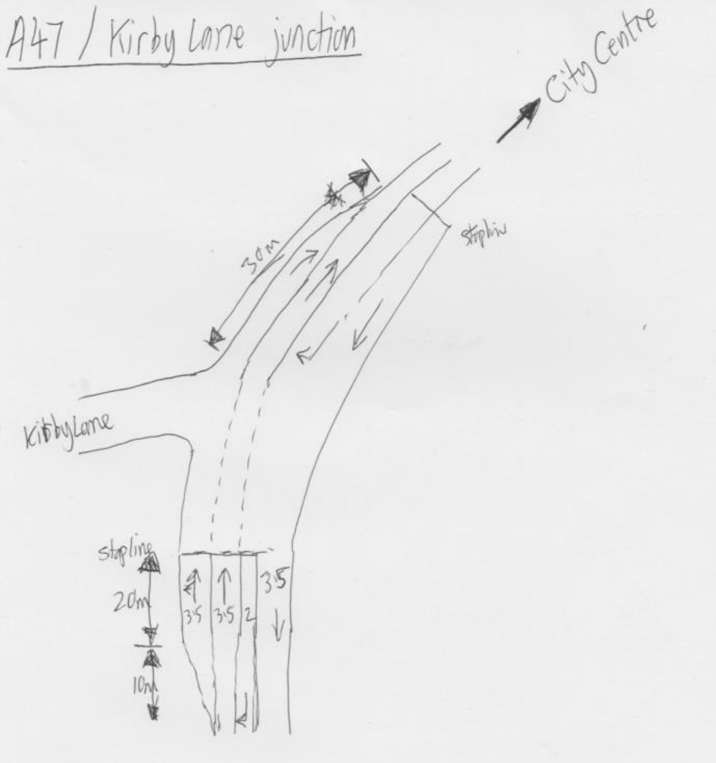


Figure 11-3: Sketch of possible improvements to add an additional in bound lane

11.28 The *A47/Ratby Lane/Braunstone Lane junction* is a signalised four arm junction (see Figure 11-4) with the Meynell's Gorse Park and Ride site adjacent off Ratby Lane. The site has a separate bus-only access joining the A47 immediately to the North-East of the junction. The junction is predicted to be severely stressed.

11.29 Extensive mitigation improvements are proposed at the junction as part of the Lubbesthorpe Section 106 Agreement. (Figure 11-5) The improvements include widening on each of the approaches to the junction to allow an additional running lane on each approach. The exit merge lane on Ratby Lane is also planned to be extended. A new length of bus lane is proposed on the inbound approach to the junction, from Baines Lane, and a signalised bus gate is planned at the end of the bus lane on the inbound approach to the junction. A new length of bus lane is also proposed on the outbound approach to the junction, from Avery Hill, and a signalised bus gate is planned at the end of the bus lane on the outbound approach to the junction.

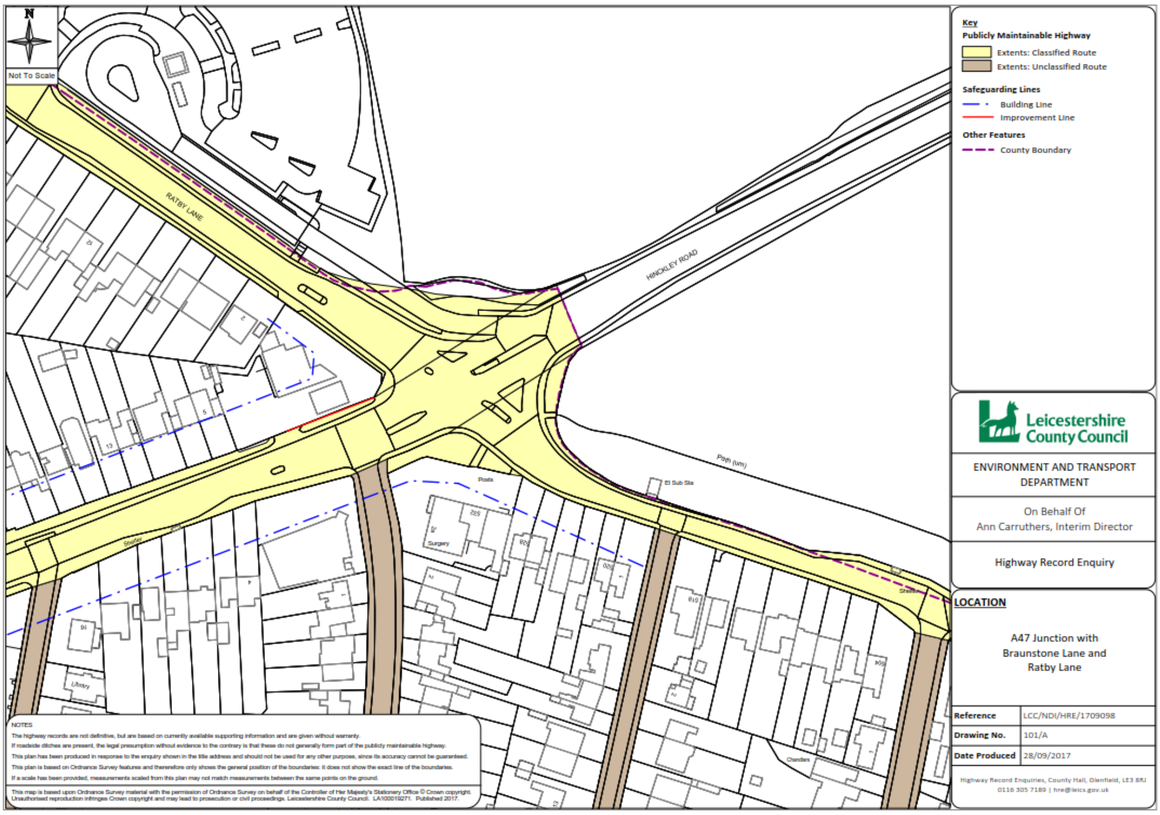


Figure 11-4: Highways Extents at A47/Braunstone Lane junction

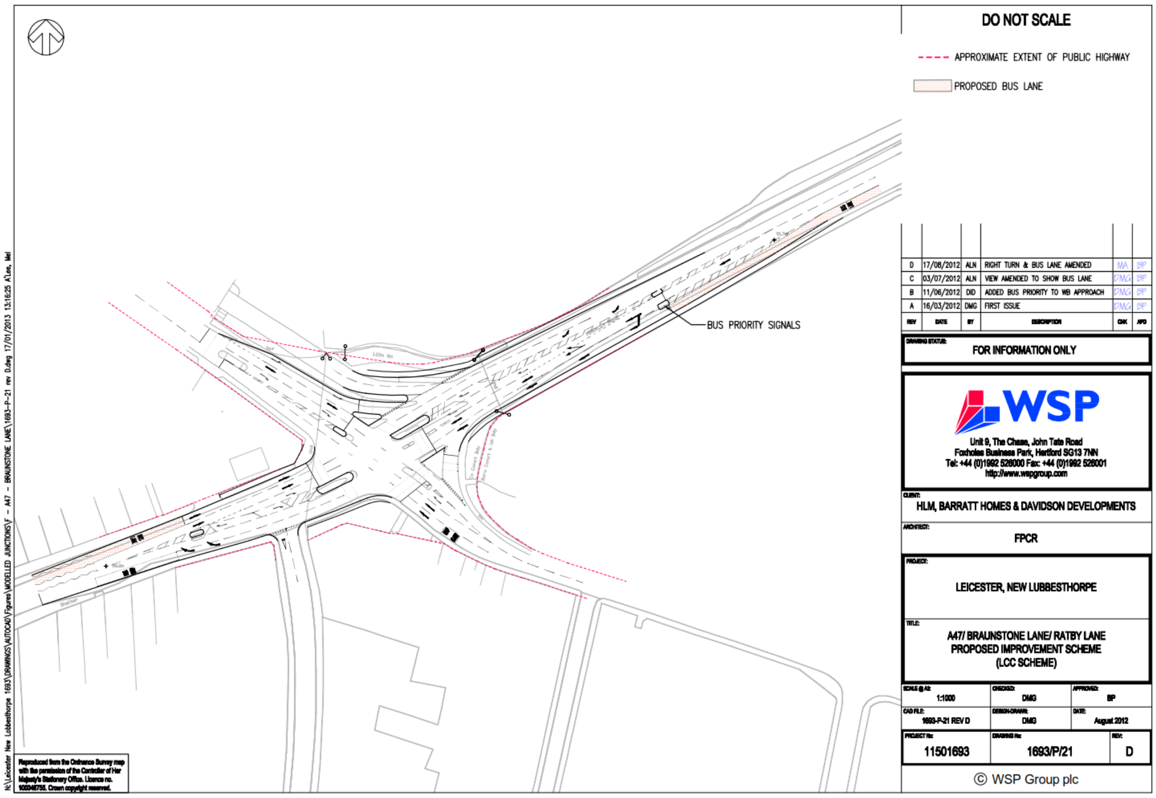


Figure 11-5: Improvements proposed within the Lubbesthorpe S106 agreement

11.30 There is an improvement line prescribed on Hinckley Road, however the works to improve/widen this part of Hinckley Road were carried out in the late 1930's. The building lines were established to ensure that any new buildings were located sufficiently far back to protect the amenity of the residents.

11.31 There is land available, currently a car sales forecourt, which could be used to create a separate left turn lane into Ratby Lane. If this were progressed it may mean the car sales business being relocated as the land remaining may be insufficient for the business. Providing this left turn lane may help make the A47/Ratby Lane route more attractive to drivers accessing the A46 and hence reduce additional traffic through Kirby Muxloe village. The potentially high costs involved in delivering the turning lane make the delivery of this option unlikely.

11.32 The junction is currently operated within the SCOOT. ATC can use this to optimise the traffic flow on the A47. However at this junction it may not optimise flows for the P&R bus or traffic on Ratby Lane or Braunstone Lane. Further discussion is necessary during any planning application related to the adoption of MOVA operation at this junction. This is estimated at £300,000, but would depend on the additional traffic sensors and communication channels required.

11.33 The *A47/Meadwell Road junction* is a priority T junction. There is currently space at the junction for both left and right turners to exit Meadwell Road at the same time. The junction is predicted to be severely stressed although it is a "loading point" for traffic in the LLITM model (so the flows into this junction could be overestimated in the LLITM model). Mitigation is not proposed for the junction in the Lubbesthorpe S106 Agreement. Meadwell Road is a link between Braunstone Lane and the A47 and can be a rat run to avoid the A47/Braunstone Lane/Ratby Lane junction.

11.34 Whilst there is space to improve the junction including signalising this would increase delay to traffic on the A47, including local bus services and the park and ride service and could encourage rat running along Meadwell Road. The close proximity of the Golf Course Lane junction with the A47 would also need to be taken into account. Hence mitigation is not recommended for this junction.

11.35 The *A47/Golf Course Lane junction* is a priority T junction providing one of three accesses to the Scudamore Road industrial estate from the classified road network. The junction is predicted to be severely stressed. Mitigation is not proposed for the junction in the Lubbesthorpe S106 Agreement.

11.36 The junction could be improved by local widening to improve/provide a separate left turn out of Golf Course Lane, a left turn lane into Golf Course Lane and/or signalisation. The close proximity of the Meadwell Road junction with the A47 would also need to be taken into account. Whilst there is space to improve the junction including signalising this would increase delay to traffic on the A47, including local bus services and the park and ride service. In addition, the industrial estate accesses onto Ratby Lane (which is currently being improved) and the A563 Outer Ring Road are more appropriate accesses. Hence mitigation is not recommended for this junction.

11.37 The *A47/A563 Outer Ring Road junction* is a four-arm signalised roundabout with multiple lane approaches including bus lanes, both inbound and outbound on entrances to and exits from the junction. The junction is predicted to be severely stressed. Extensive mitigation improvements are proposed at the junction as part of the Lubbesthorpe Section 106 Agreement. The improvements include removing the signalised roundabout and providing a signalised crossroads junction with additional lanes at the approach to stop lines and separate bus lanes on the approaches to and through the junction on the A47.

11.38 The proposed mitigation has been reviewed and considered extensive. Improving the capacity of the right-turn movement from the A563 (Braunstone Way) Outer Ring Road into the A47 city bound could be desirable but the topography (and the A563 is elevated on a bridge over Hockley Farm Road on the approach to the junction) is such a constraint that no further mitigation is recommended on this approach.

11.39 The LLITM modelling did however note that the New Parks Way (A563) approach to the junction was constrained by having a limited capacity flare rather than a longer dedicated right turn lane. The indicative estimated cost of extending right turn lane from New Parks Way is £250,000 to £350,000 excluding any public utility diversion works deemed necessary. In addition the junction is currently operated on fixed timing plans. The Lubbesthorpe S106 agreement related to the physical improvements at the junction. Further enhancements could be made by the adoption of MOVA at this junction estimated to cost £300,000

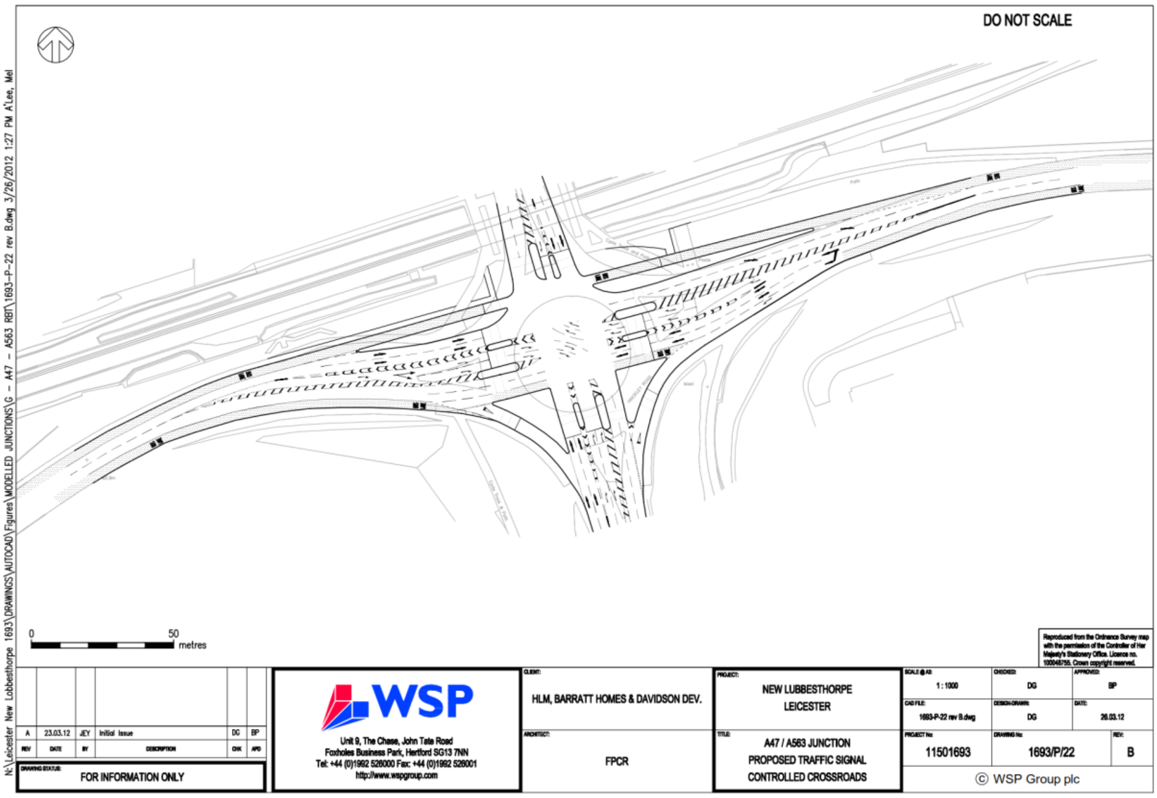


Figure 11-6: Proposed improvements at the A47/A563 junction

11.40 The *A47/Oswin Road/Cort Crescent junction* is a four-arm signalised junction with two lanes on all approaches. The junction is predicted to be severely stressed. Mitigation is not proposed for the junction in the Lubbesthorpe S106 Agreement.

11.41 There is land available to provide a separate left turn into and out of Oswin Road and similarly there is land available to provide a separate left turn lane into and out of Cort Cresent. Figure 11-7 below shows an indicative layout for an improved junction. The indicative estimated cost of these junction improvements is £300,000 to £500,000 excluding any necessary public utility diversions.

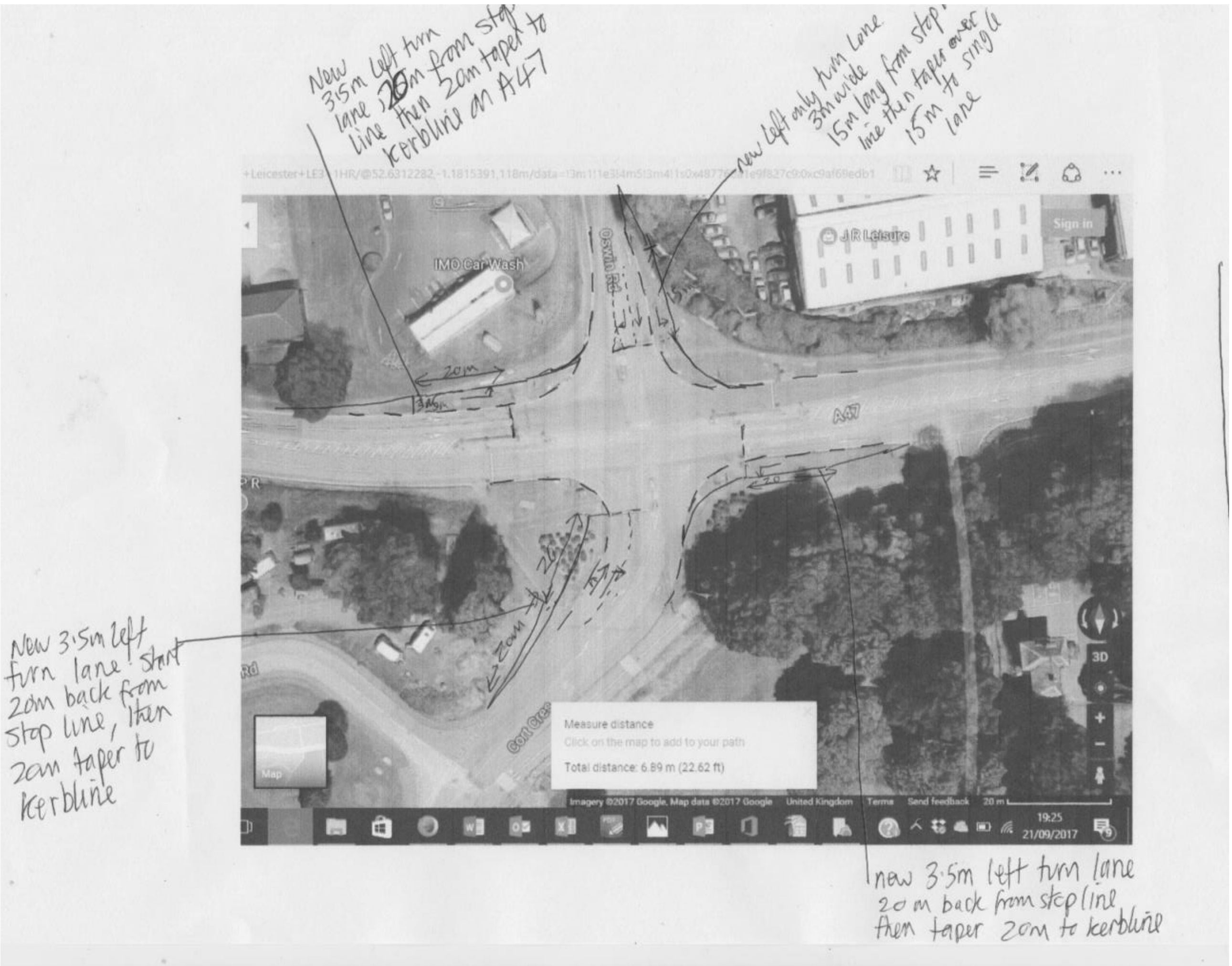


Figure 11-7: Indicative layout of additional lanes at the A47/Oswin Road/Cort Cresent junction

11.42 The junctions of A47/Western Park Road, A47/Westfield Road and the A47/Meadhurst Road junctions are predicted to be stressed or severely stressed. These predictions are partly a function of how traffic is “loaded” to the network in the LLITM. Mitigation is not proposed for the junction in the Lubbesthorpe S106 Agreement.

11.43 Given that there is little scope for widening improvements at these residential side road junctions and that signalising any of these junctions would lead to delays to traffic on the A47 mitigation is not recommended for these junctions.

11.44 Kirby Muxloe village – Kirby Lane, Forest Rise, Station Rd, Main Street

11.45 From Kirby Lane to Main Street / Station Road there are several bends, particularly at the railway bridge, and small “hills” along its length and there are full width flat top road humps along part of Station Road, from Wentworth Green to Barwell Road. The bends and changes in topography do act as traffic calming features to some extent.

11.46 Forest Rise, which runs parallel to Kirby Lane could be used as a short cut. However, the entrance to Forest Rise, which is an unadopted road, is quite secluded and Forest Rise has significant size pot holes which will be acting as a deterrent to drivers wishing to rat run through Kirby Muxloe village.

11.47 Main Street is heavily parked up on one side for most of its length and hence this is acting as “natural” traffic calming.

11.48 Extensive traffic calming, mainly full width flat top road humps, are proposed as part of the Lubbesthorpe S106 Agreement for Leicester Forest East on each side of the A47 (ie Warren Lane Area and Marydene Drive Area) and on Kirby Lane to help discourage “rat running” through these areas and through Kirby Muxloe village.

11.49 Further possible traffic calming measures have been considered and our conclusion is that the traffic calming scheme on Station Road could be reviewed and enhanced, for example one or two additional features (estimated as £15,000) added between Wentworth Green and Linden Lane. However, this intervention should be balanced with the needs of the residents as the route provides an important link to/from Kirby Muxloe and Desford Lane.

Appendix E. LLITM Modelling Report

Leicester & Leicestershire Integrated Transport Model

LLITM External Application

Blaby Local Plan
Site Allocation Options

Project Reference Number:	3851.077
Date:	16 October 2017
Authors:	Matt Parker, Richard Best
Manager:	Alex Gray

Leicestershire County Council
County Hall
Glenfield
Leicester
LE3 8RA

01163 057 323
llitm@leics.gov.uk
http://www.leics.gov.uk

Contents

1. Document Sign-off

1.1. Control Details

Document Location:	X:\TMODELLING\05. 3851 (External)\MF3851.77.SRT. Local Transport Plan (Blaby) - September 2017\06. Deliverables\3851.77_BlabyLocalPlan_v2.docx
Production Software:	Microsoft Word 2010
Authors:	Matt Parker, Richard Best
Owner:	Alex Gray, Network Data and Intelligence Team

1.2. Document history and status

Revision	Date	Description	By	Review	Approved
0.1	06/10/17	Draft for internal review	MP	RB	RB
1.0	11/10/17	Draft for client approval	MP	RB	RB
2.0	16/10/17	Final version	MP	RB	RB

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

2. Overview

2.1. Introduction

2.1.1. This report has been commissioned from Leicestershire County Council (LCC) by consultants Edwards & Edwards for Blaby District Council to provide evidence for a study to assess the impact of additional housing, together with associated transport mitigation measures, in the vicinity of Leicester Forest East, Kirby Muxloe and the Leicester Principal Urban Area (PUA).

2.1.2. The Leicester and Leicestershire Integrated Transport Model (LLITM v5.1) is being used to provide traffic forecasts to quantify the likely impact of 4 prospective developments.

2.1.3. The location of the prospective developments and their relationship to LLITM5.1 zones is shown in Figure 2-1 below.

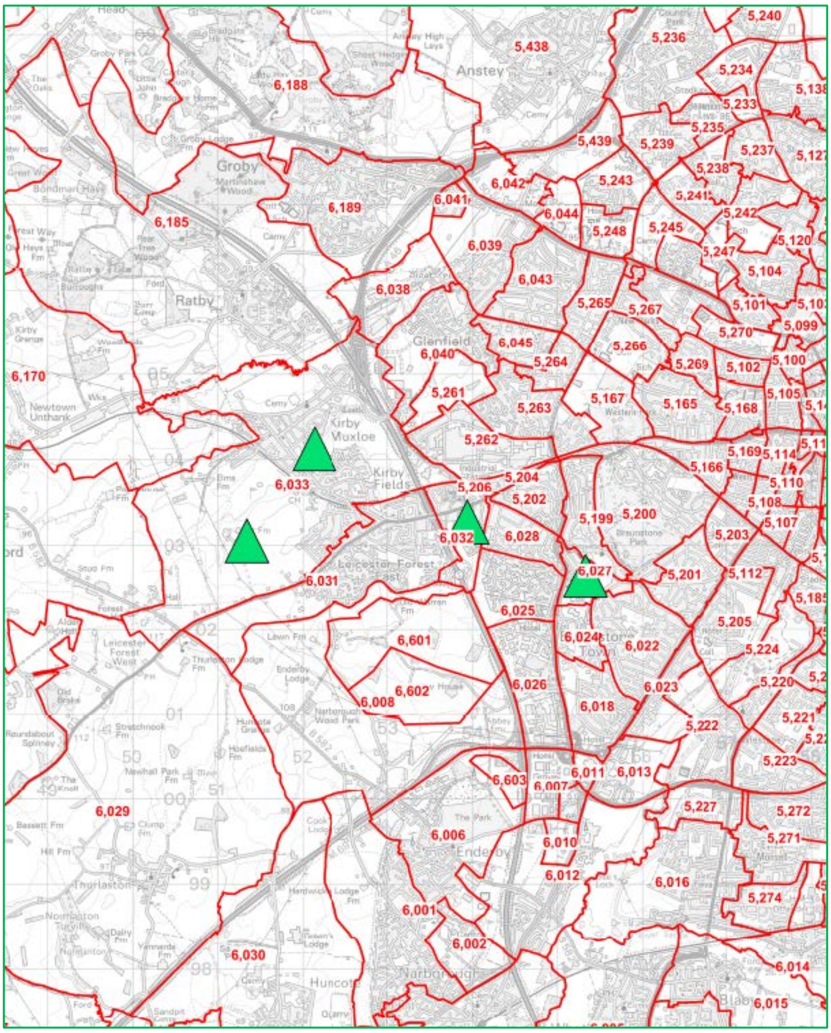


Figure 2-1: Location of prospective additional Blaby housing to be assessed

2.1.4. A total of 1000 new dwellings are to be tested in the 4 model zones identified above:

- New zone (west of existing zone 6033) (+750 dwellings)
- Existing zone 6032 (+129 dwellings)
- Existing zone 6033 (+91 dwellings)
- Existing zone 6027 (+30 dwellings)

2.1.5. For the purpose of this assessment it has been agreed that only the LLITM highway model needs to be used. The following is an outline summary of the modelling work to be undertaken:

- Check core scenario network coding and update where necessary (to include any updated infrastructure or new model zones);
- Build new trip matrices to account for additional trips generated by new housing developments;
- Run and analyse assignment outputs for 2016 (Core) and 2031 (Core, Development Only) AM and PM Peak scenarios.

2.1.6. The specific detail of this approach is contained in the 'methodology' section 4 below.

2.2. Model Overview

2.2.1. The Leicester and Leicestershire Integrated Transport Model (LLITM) consists of four principal components:

- Highway supply model developed in SATURN;
- Public transport supply model, developed in EMME;
- Variable demand model, built in EMME;
- Land-use model, built in bespoke DELTA software.

2.2.2. The base year of the model is 2008 with full forecasts being available for years 2011, 2016, 2021, 2026, and 2031.

2.3. Report Structure

2.3.1. Section 3 details the validation of the network in the vicinity of the proposed developments.

2.3.2. Section 4 details the outline methodology undertaken in extracting the 2016 and 2031 forecast information from LLITM.

2.3.3. Section 5 details an overview of the results supplied to the client.

2.4. File References

2016_Core_AM_blp.UFS
2016_Core_PM_blp.UFS
2031_Core_AM_blp.UFS
2031_Core_PM_blp.UFS
2031_Dev_AM_blp.UFS
2031_Dev_PM_blp.UFS

2016_sp_Core_AM.ufm
2016_sp_Core_PM.ufm
2031_sp_Core_AM_blp.ufm
2031_sp_Core_PM_blp.ufm
2031_sp_DEV_AM_blp_v4_FINAL.ufm
2031_sp_DEV_PM_blp_v4_FINAL.ufm

Modelling working folder:
Y:\LCC\Project\Modelling_Project_Folders\Blaby_Local_Plan-September_2017

3. Model Validation

3.1. LLITM Validation

3.1.1. The LLITM is LCC's principal transportation forecasting tool for the County and Leicester City. Within the county boundary travel decisions are modelled in detail, whilst beyond, a less detailed approach is adopted to account for 'external' trips using the county's network.

3.1.2. LLITM has been built and validated to be compliant with the Department for Transport's WebTAG guidance. Whilst at the wider area LLITM meets WebTAG

3.1.3. Guidance it is necessary to review model suitability in the area of influence of any scheme/development being assessed. This has been done by considering the 2008 base year fit of observed and assigned traffic flows and journey times in line with WebTAG acceptability guidelines (unit M3.1).

3.2. Observed vs Modelled Flows

3.2.1. WebTAG compliance for traffic flows is governed by meeting the following acceptability rules in at least 85% of cases:

- Individual flows within 100 veh/hour of counts for flows less than 700 veh/hour
- Individual flows within 15% of counts for flows from 700 to 2,700 veh/hour; or
- Individual flows within 400 veh/hour of counts for flows more than 2,700 veh/hour; and
- GEH values of <5 for individual flows.

3.2.2. A local area review of the 2008 base year highway model for AM and PM peak hours is shown in Figures 3.1 and 3.2 respectively where,

- Green links signify modelled flows compliant with WebTAG;
- Red links signify a WebTAG non-compliance where modelled flows are excessively larger than observed counts; and
- Blue links signify WebTAG non-compliance where modelled flows are excessively less than observed counts.

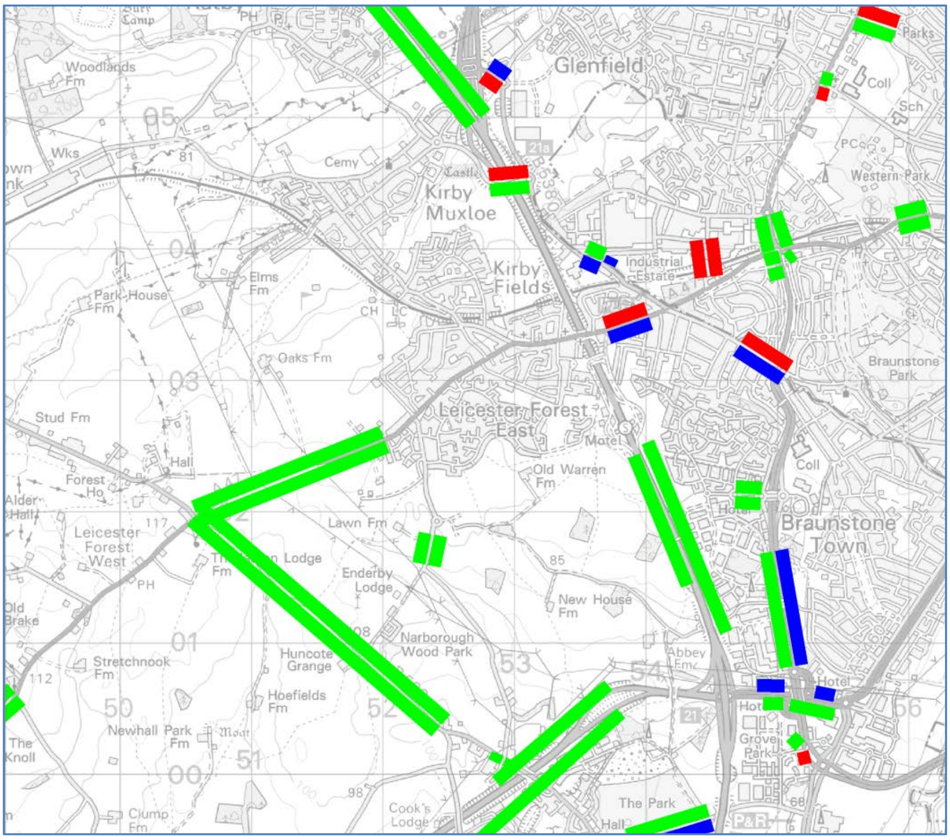


Figure 3-1: 2008 Base Modelled Flows and Count Data, AM Peak

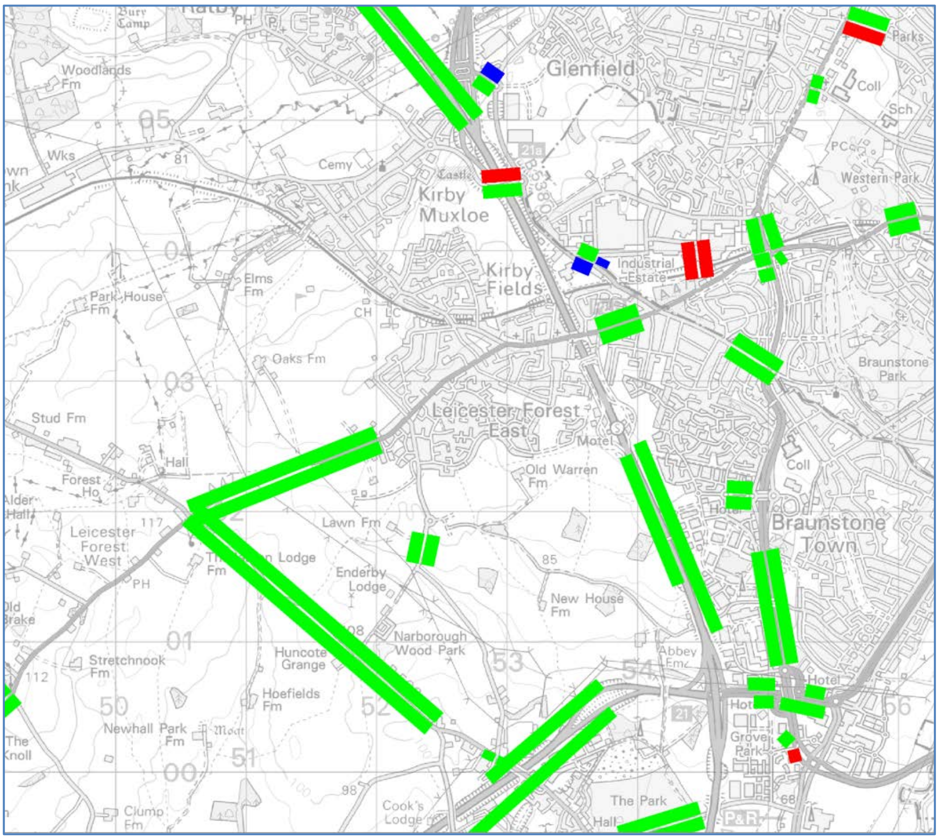


Figure 3-2: 2008 Base Modelled Flows and Count Data, PM Peak

3.2.3. These results demonstrate that the count sites in the immediate vicinity of the study area show a reasonable fit against modelled flows.

3.2.4. In the AM Peak, there are some minor issues evident in the vicinity of the Wembley Road industrial estate (located to the north of the A47 to the east of the M1) whilst the western approach to Braunstone cross roads is over assigning inbound and under-assigning outbound. In part, this is due to the close proximity of a LLITM zone loading point. However, at other key junctions such as Desford Crossroads and A47/Outer District Distributor (ODDR), a good validation fit is evident.

3.2.5. In the PM Peak, model fit is generally good although there is a recurrence, albeit to a lesser degree, of the Wembley Road industrial estate issue.

3.3. Observed vs Modelled Journey Times

3.3.1. For journey time validation WebTAG acceptability guidance requires for 85% of routes:

- Modelled times along routes should be within 15% of surveyed times (or 1 minute, if higher than 15%).

3.3.2. In the LLITM v5 Highway Model Local Model Validation Report (LMVR)[1], journey time analysis on a number of key routes is undertaken to compare modelled times in the 2008 Base against observed times.

3.3.3. There are two routes which traverse the study area for this project; A47 Leicester Forest East – Leicester City Centre, and A563 (ODDR) between Beaumont Leys Lane and Fosse Park. Figure 3-3 (below) shows the location of these routes.

[1] LLITM Model Maintenance : Highway Assignment Local Model Validation Report v1.1, 12-11-2013

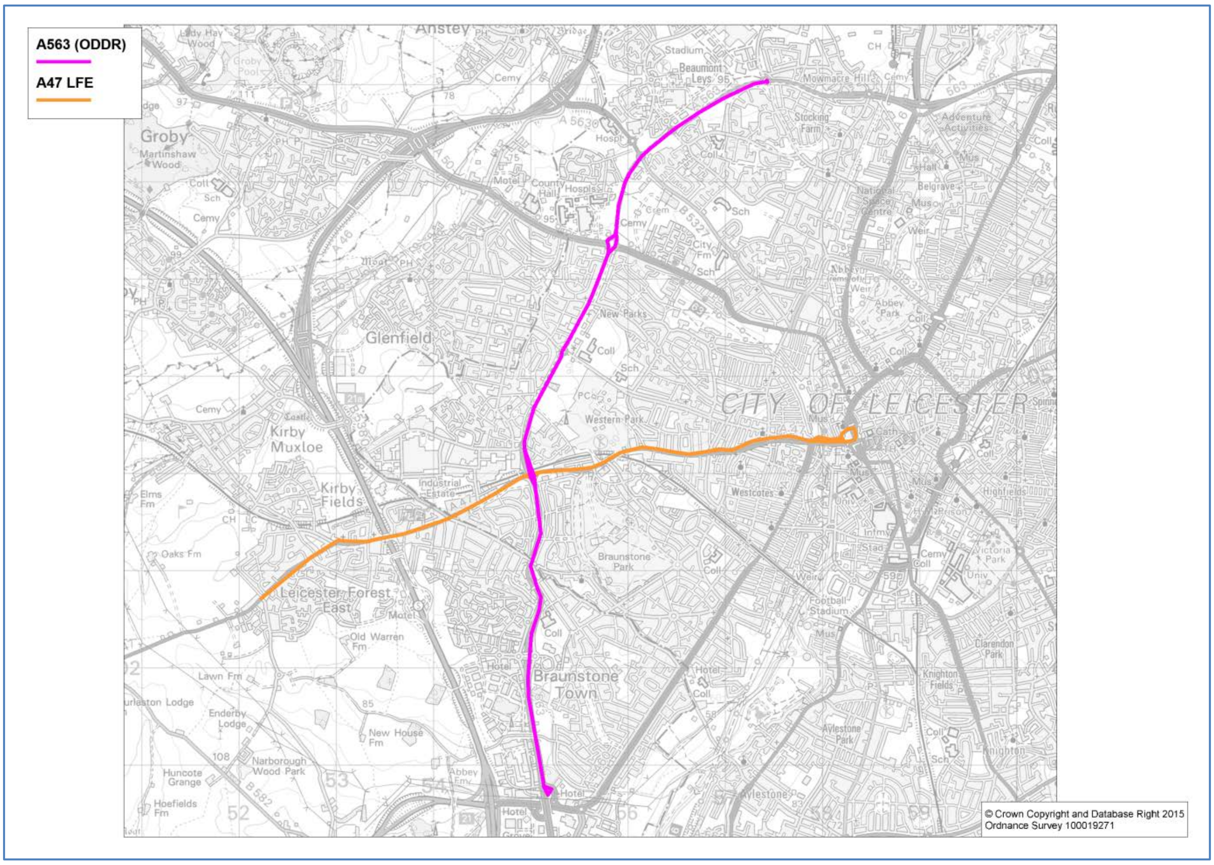


Figure 3-3: Journey time validation routes

3.3.4. The Highway Model LMVR provides tables showing the absolute and percentage difference in journey times between the 2008 Base modelled times and observed times. These differences are presented in Table 3-1.

Route	AM Peak			PM Peak		
	Abs.	%	Pass	Abs.	%	Pass
A47 LFE Inbound	03:43	21.5%	No	00:46	5.7%	Yes
A47 LFE Outbound	01:08	9.0%	Yes	01:17	8.1%	Yes
A563 ODDR2 Clockwise	00:42	5.3%	Yes	-00:44	-4.8%	Yes
A563 ODDR2 Anti-Clockwise	-00:24	-2.7%	Yes	01:22	10.1%	Yes

Table 3-1: Journey time validation statistics, LLITM v5 Highway Model LMVR

3.3.5. The A47 LFE inbound route in the AM Peak is over 3.5 minutes slower in LLITM than observed and is the only route to fail the WebTAG criteria. Figure 3-4 shows the time/distance plot for this route and indicates the main deviation occurs around the Braunstone Lane crossroads.

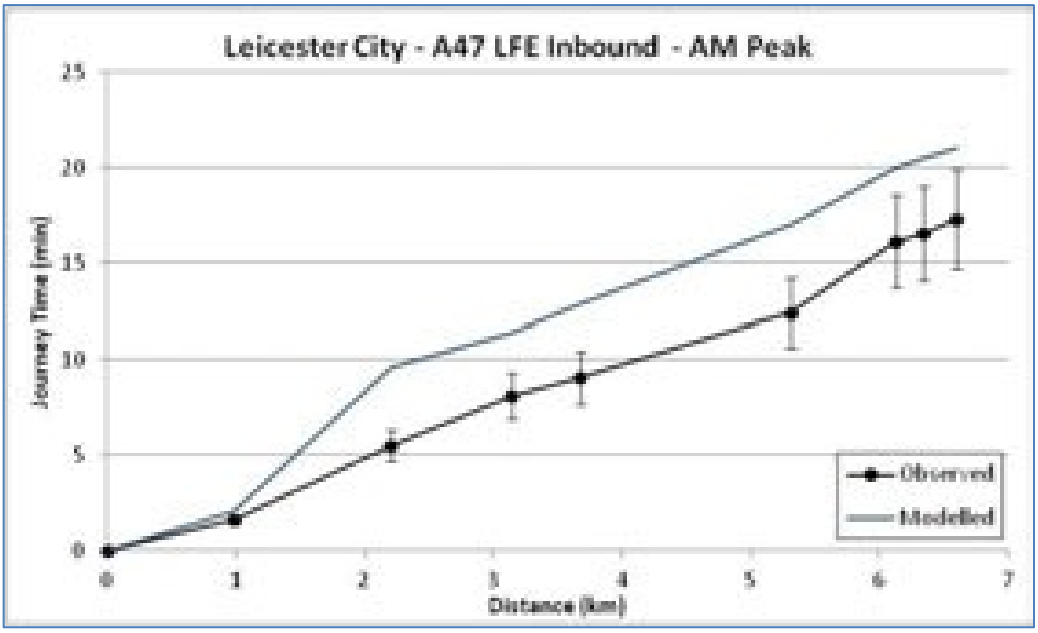


Figure 3-4: A47 LFE inbound route time/distance plot, LLITM v5 Highway Model LMVR

3.3.6. The inbound A47 stretch from Kirby Lane through Braunstone crossroads towards the Outer District Distributor Road (ODDR) is a notorious congestion hotspot during the AM peak hour where journey time variation can be high.

3.3.7. Ideally, some re-calibration along this stretch would have tightened the model fit but the nature of the study and the fact that the general flow and journey time fit is good around this stretch should not be prohibitive.

3.3.8. The general level of 2008 Base year validation is good implying that the LLITM5.1 highway model is fit for the purposes of this commission.

4. Methodology

4.1. Specified Outputs from Brief

4.1.1. It has been agreed with the client consultants Edwards & Edwards that the following output be supplied from the LLITM:

- SATURN bandwidth plots showing 2016/2031 (AM & PM peak hour) directional flow changes on each link for:
  - 2031–2016 Core (background growth)
  - 2031 Development Only–2031 Core (development impact)

- Cordon area statistics, including total vehicle distance (pcu.Kms), total vehicle travel time (pcu.hrs), over-capacity queues (pcu.hrs) and average speed (Kph), for the following:
  - 5% flow difference area of influence
  - Inner cordon defined by the client

- Local traffic impact, including volume/capacity ratios, turning delays and volumes on key junctions (see fluorescent blue squares on Figure 4-1for location):
  - Beggars Lane/A47, Hinckley Road
  - Kirby Lane/A47, Hinckley Road
  - Braunstone Lane/A47, Hinckley Road
  - A563, ODDR/A47, Hinckley Road

- Identification of junctions within a 2% flow difference area of interest having V/C ratios between 85-100% and >100% in the core

- Identification of additional junctions pushed into V/C ratio ranges between scenarios:
  - Development Only and Core

- Local traffic impact, including travel time, average speed, and traffic (pcu.Km) for the following areas (see coloured routes on Figure 4-1 for location):

  1. A47 between the Inner Ring Road and ODDR
  2. A47 between the ODDR and the A47 development site
  3. A47 between the A47 development site and Desford Crossroads
  4. B5380, Ratby Lane between the A47 and the roundabout to Kirby Muxloe
  5. Braunstone Lane between the A47 and bridge over the A563, Lubbesthorpe Way
  6. Kirby Muxloe on Kirby Lane near to the A47
  7. Kirby Muxloe on Main Street
  8. Kirby Muxloe on Desford Road

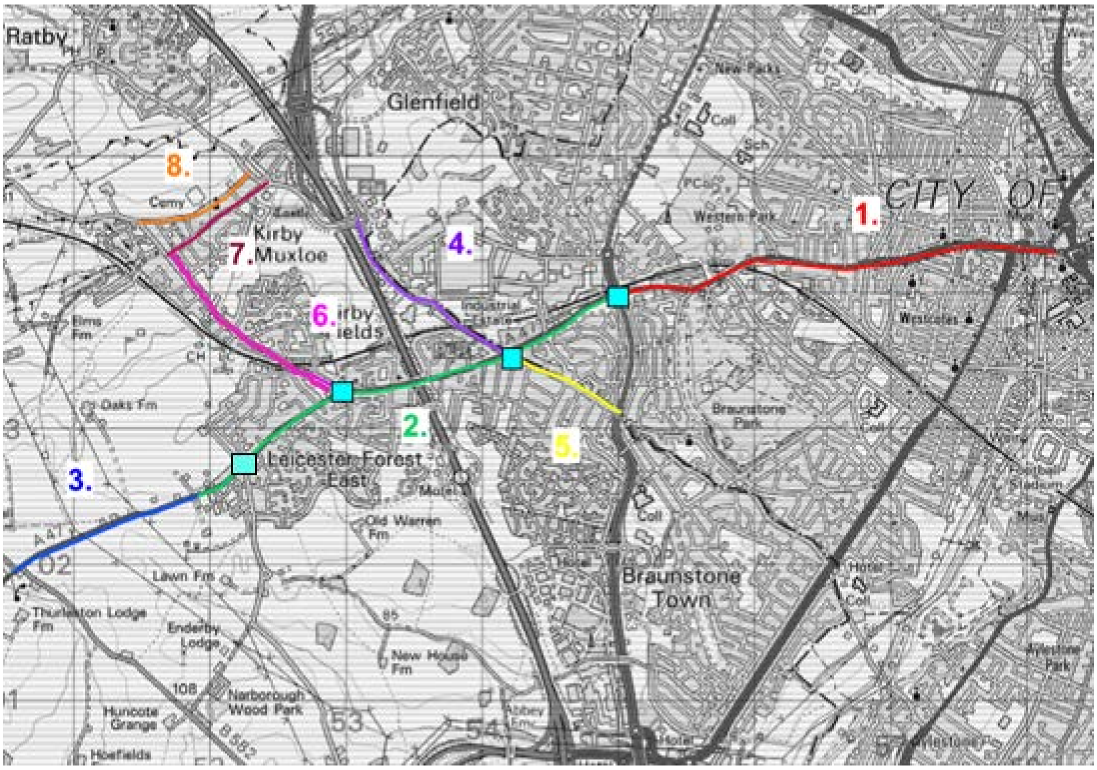


Figure 4-1: Route and junction locations for client specified output

4.1.2. The following methodology was undertaken to produce the above outputs.

4.2. Network Coding:

4.2.1. Created a new zone centroid connector, for the 750 residential units development, to the north of the A47 (new zone 6620).

4.2.2. Included new zone and associated coding in core network (to allow comparable network comparisons between core and development scenarios).

4.2.3. Updated Desford Crossroads scheme coding in 2031 core (previously coded as one-lane plus flare but now two-lane plus flare entry points) (see Figure 4-2).

4.2.4. Removed unrealistic “rat-run” routeing option that would have allowed trips to bypass A47/Kirby Lane junction (Kings Drive/Rushmere Walk/Stafford Leys).

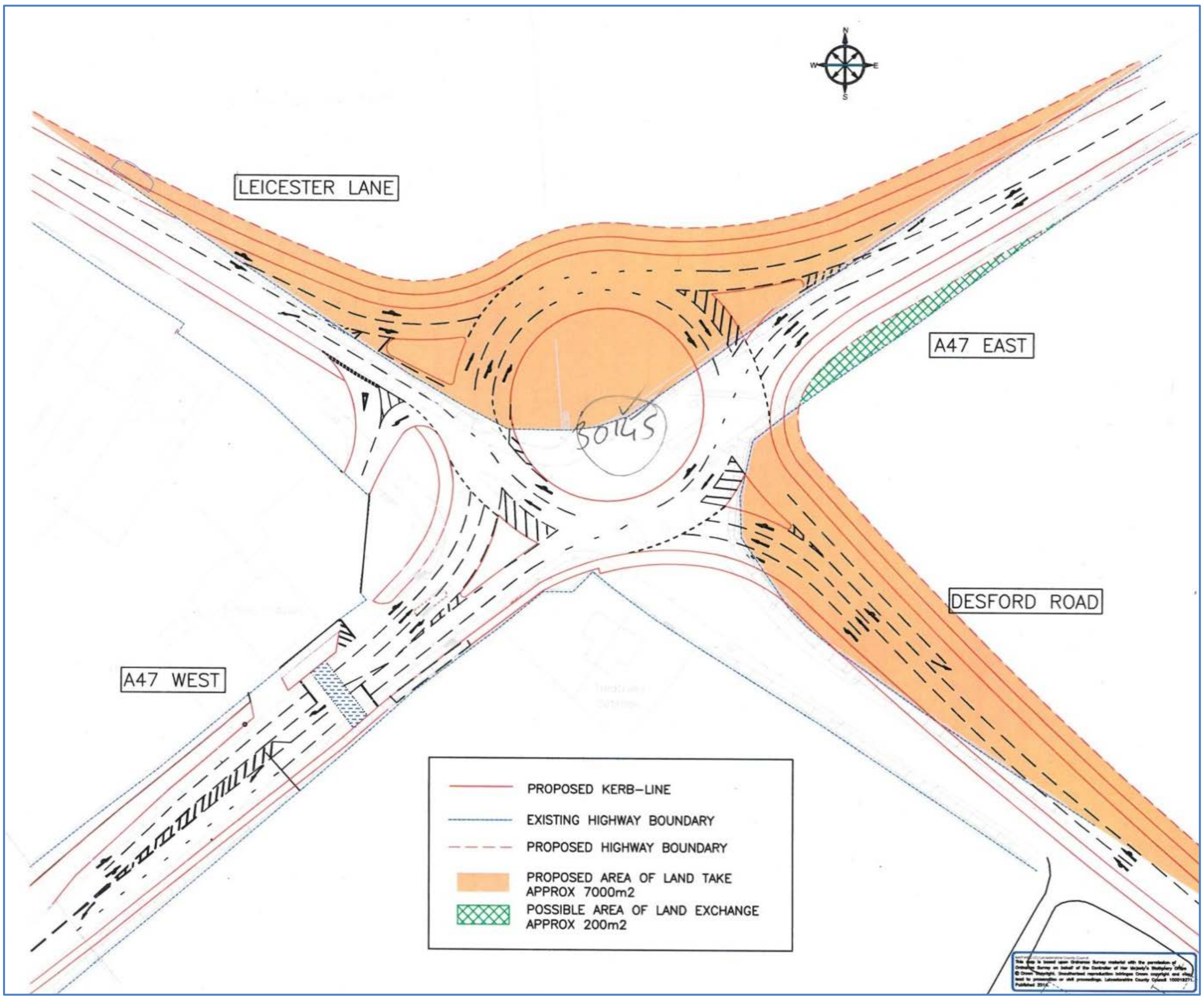


Figure 4-2: Desford Crossroad scheme coding design

4.3. Matrix Building:

4.3.1. For 2031 'development' matrices, a new zone was allocated (6620) to existing matrices for the larger development of 750 dwellings to the north of the A47.

4.3.2. The trip distribution from zone 6031 was copied to zone 6620, and row and column totals factored to the trip end totals for 750 dwellings.

4.3.3. The remaining three development zones (6027 +30 dwellings, 6032 +129 dwellings, and 6033 +91 dwellings) were furnessed to match the updated trip end totals reflecting the additional trips generated by developments.

4.3.4. The generation of trip ends from the supplied trip rates is displayed in the below tables. An expected total (i.e. existing trip ends + additional generated trip ends), and a final total (i.e. the assigned total after matrix balancing has taken place) is presented.

Zone	New Units		Trip Rate	Additional Trip Ends	Existing Trip Ends	Expected Trip Ends	Final Matrix Trip Ends
6620	750	O	0.367	275	0	275	274
		D	0.131	98	0	98	98
6032	129	O	0.367	47	706	753	756
		D	0.131	17	450	467	466
6033	91	O	0.367	34	466	500	477
		D	0.131	12	1077	1089	1109
6027	30	O	0.367	11	153	164	164
		D	0.131	4	134	138	138

Table 4-1: Trip generation for development zones, AM Peak

Zone	New Units		Trip Rate	Additional Trip Ends	Existing Trip Ends	Control Trip Ends	Final Matrix Trip Ends
6620	750	O	0.184	138	0	138	139
		D	0.309	232	0	232	235
6032	129	O	0.184	24	429	453	453
		D	0.309	40	455	495	494
6033	91	O	0.184	17	576	593	596
		D	0.309	28	883	911	916
6027	30	O	0.184	6	197	203	203
		D	0.309	9	236	245	245

Table 4-2: Trip generation for development zones, PM Peak

4.3.5. The differences between expected and final trip ends for the development zones are negligible in most cases. However, for zone 6033 (AM peak), the matrix has approximately 20 trips too few for origin trips, and 20 trips too many for destination trips. The matrix balancing which is undertaken during the furnessing process is likely to have caused this issue. However, due to the relatively small magnitude of the error, it would be disproportionate to attempt to further investigate the disparity in values.

4.4. Highway Assignments:

4.4.1. Peak hour assignments were run for the following scenarios:

- 2016 Core
- 2031 Core
- 2031 Development (i.e. Core + 1000 dwellings)

4.5. Area of Influence:

4.5.1. Area of influence defined by considering flow differences (AM & PM combined) between 2031 Core and 2031 Development scenarios in excess of +/- 5%.

4.5.2. To minimise highlighting 5% link increase with small absolute link flow values, links were only considered which had a flow of >200 PCUs in either the Core or Development scenario.

4.5.3. Figure 4-3 shows the 5% area of influence, where green links show 5% flow increases, and blue links show 5% flow decreases.

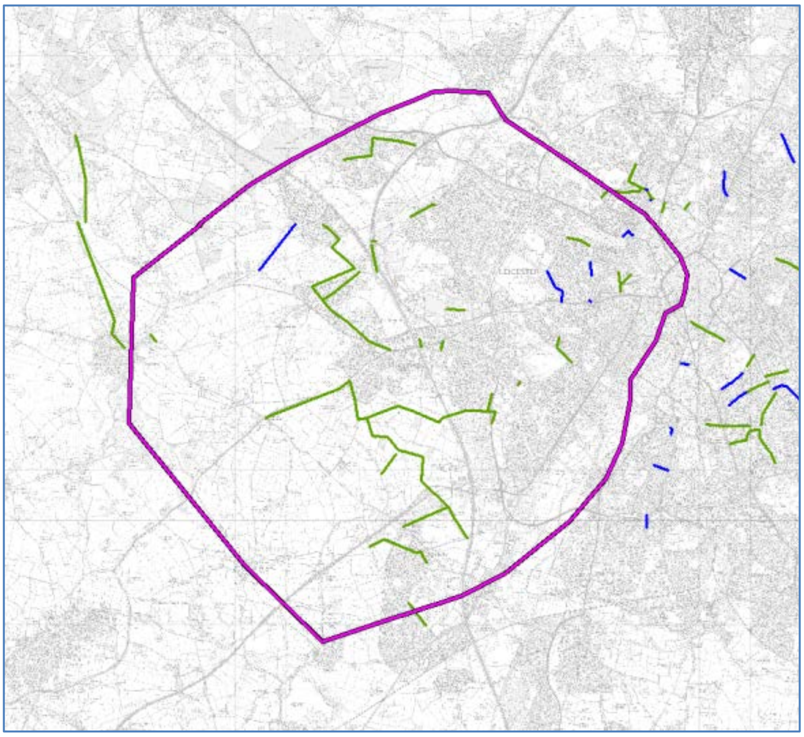


Figure 4-3: 5% Area of Influence

5. Results

5.1. Unit Definitions

5.1.1. In the work undertaken here the unit of traffic flow is expressed in passenger car units per hour (pcus/hr). The concept of the pcu is used to convert different vehicle types to a standard passenger car unit for ease and accuracy of assessment. It is particularly relevant when modelling junction capacity where the type and proportion of specific vehicle types is a critical determinant to the design process. In LLITM the following relationships are used to convert vehicles to pcu's:

- OGV1/OGV2 2pcu's
- PSV 2pcu's
- Car 1pcu
- LGV 1pcu

5.1.2. The results are supplied to the client in a zipped file in either MapInfo or Excel format, for the 5% area of influence (apart from volume/capacity plots which are supplied to 2% area of influence).

5.2. Bandwidth Plots

5.2.1. LLITM peak hour (AM and PM) forecast directional flow difference plots (PCUs) within the 5% area of influence have been reported for the following scenarios:

- 2031–2016 Core (background growth)
- 2031 Development Only–2031 Core (development impact)

5.2.2. Please note that, for each bandwidth plot presented in this report, any motorway link output has been omitted to avoid masking any changes on minor roads close to the M1 and M69.

<u>Impact of background growth (2031 – 2016 Core)</u>

5.2.3. Figure 5-1 and Figure 5-2 show the forecast impact of 2016 to 2031 background growth for AM and PM peak hours respectively.

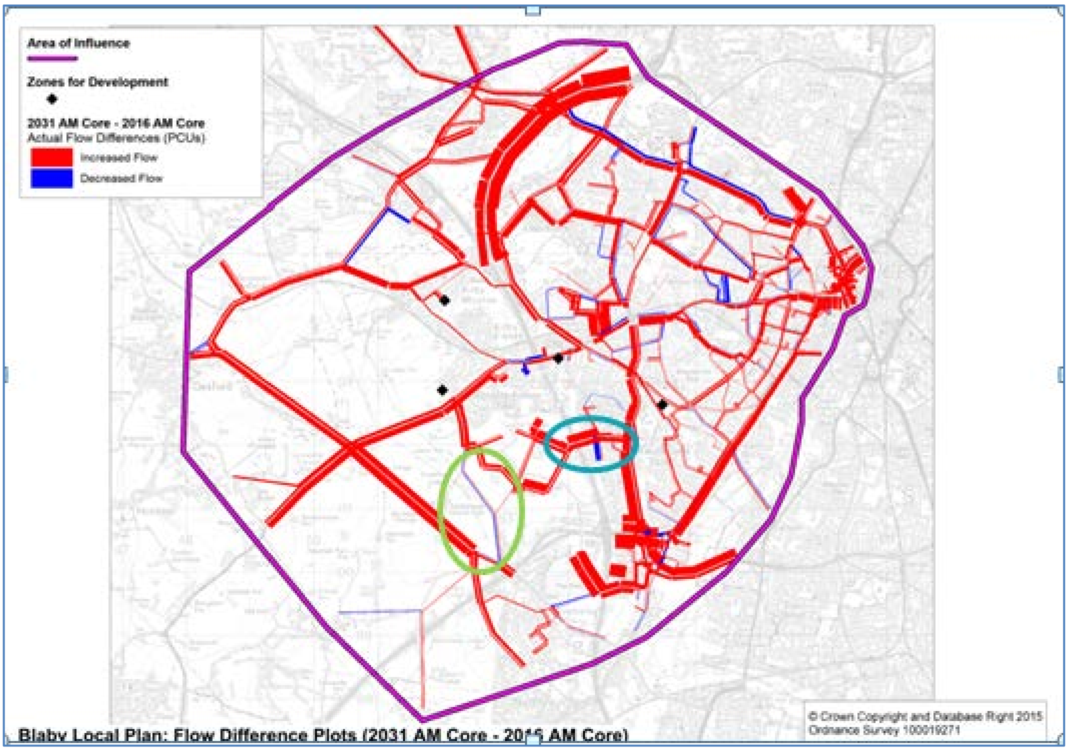


Figure 5-1: Actual flow difference plots within 5% AoI, 2031 AM Core - 2016 AM Core

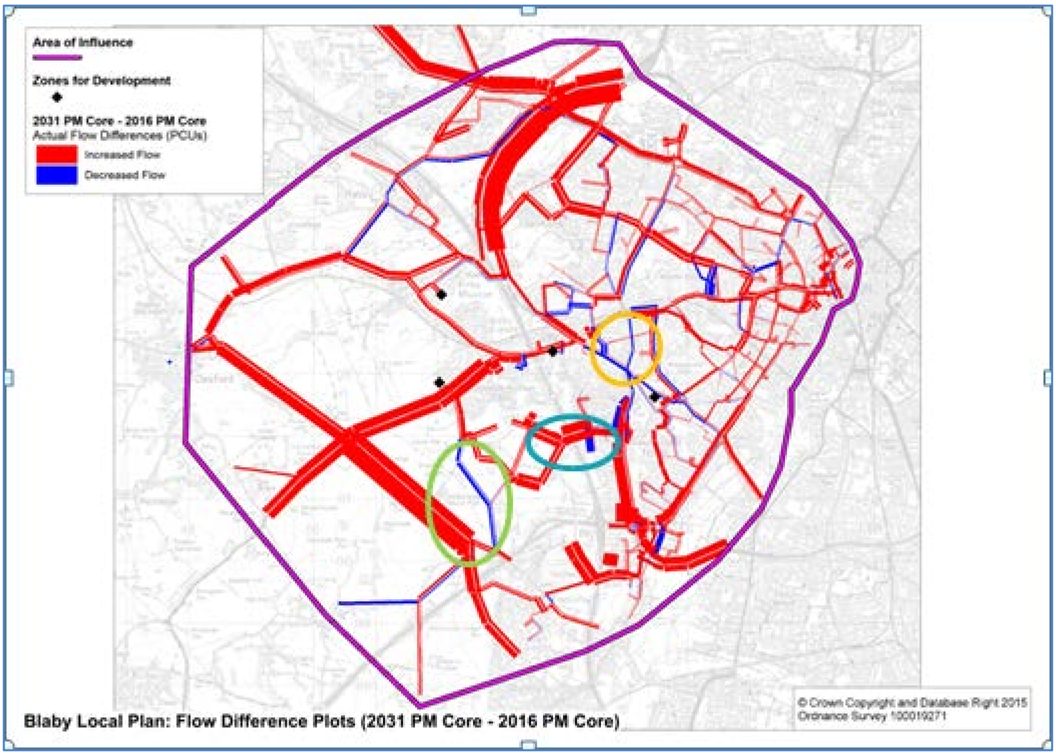


Figure 5-2: Actual flow difference plots within 5% AoI, 2031 PM Core - 2016 PM Core

5.2.4. It can be seen that the majority of links see an increase in flow commensurate with increased future population and car ownership projections. There are, however, three notable exceptions where link flows are forecast to fall:

- Beggars Lane south of the Lubbesthorpe Strategic Urban Extension (SUE) access.(AM and PM peak hours)
- Braunstone Lane between the A47, Hinckley Road and Narborough Road. (PM peak hour)
- Lubbesthorpe Way (ODDR) between Hinckley Rd, A47 & Meridian (PM peak hour)

5.2.5. In all cases, the impact of the new bridge crossing the M1 and linking the Lubbesthorpe SUE with Lubbesthorpe Way is forecast to offer an attractive alternative to the Principal Urban Area (PUA) from the heavily congested A47 radial route.

<u>Impact of Development (2031with development – 2031 Core)</u>

5.2.6. Figure 5-3 and Figure 5-4 display the corresponding 2031 flow difference plots showing the forecast impact of the proposed developments.

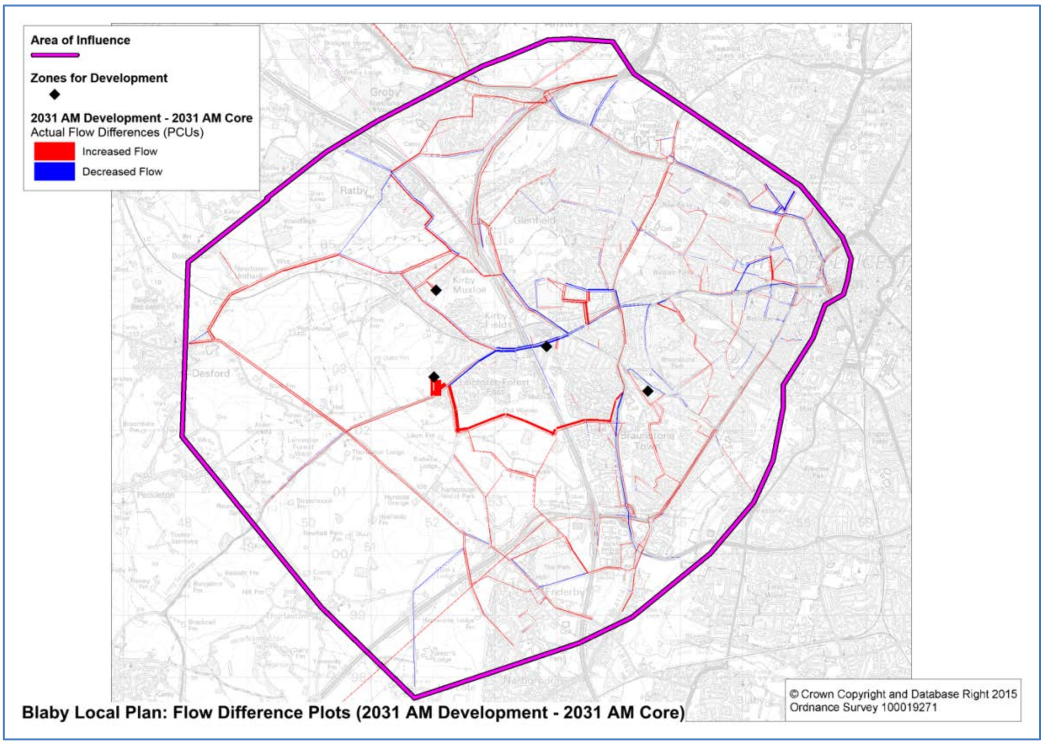


Figure 5-3: Actual flow difference plots within 5% AoI, 2031 AM Development - 2031 AM Core

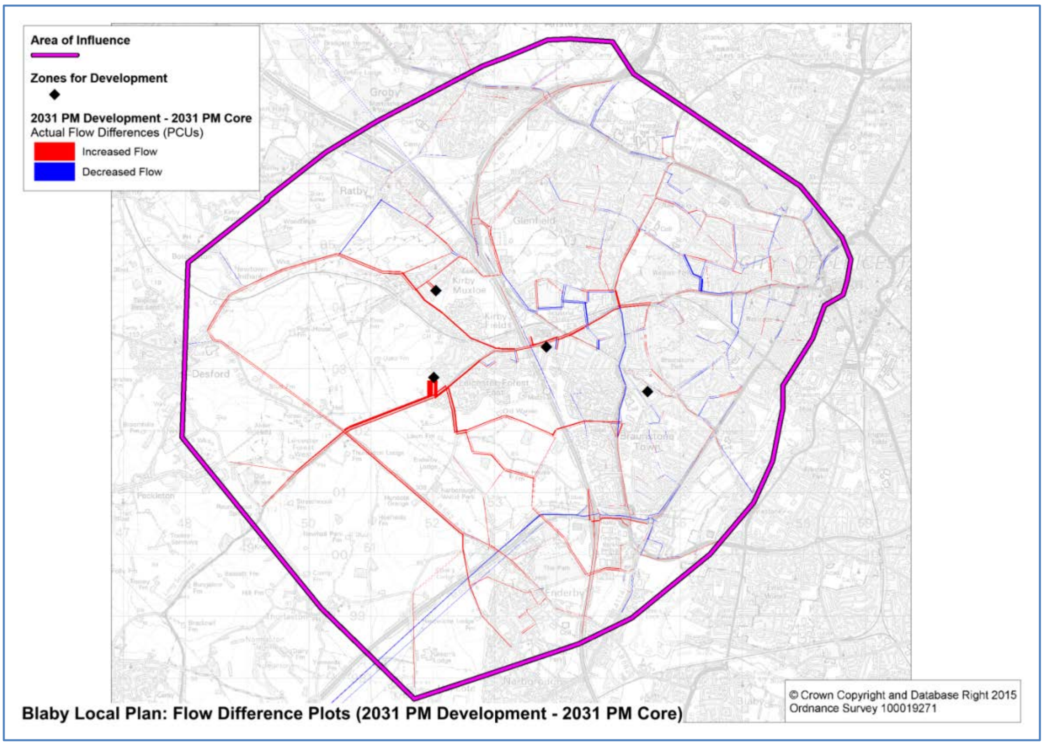


Figure 5-4: Actual flow difference plots within 5% AoI, 2031 PM Development - 2031 PM Core

5.2.7. In the AM Peak hour, the flow difference plot shows a decrease in trips using the A47 between Kirby Lane and the Braunstone Lane/Ratby Lane crossroads and is an indication of worsening congestion along this radial. This is corroborated later in the report when considering junction and journey time performance metrics.

5.2.8. Given that the main junctions on this route are already either at, or nearing, capacity in the AM peak hour it is no surprise the network struggles to accommodate the additional development traffic which heads towards the Leicester PUA.

5.2.9. The Kirby Lane/A47 junction epitomises the demand pressures exerted on this part of the network and is characterised by volume/capacity figures in excess of 100% for all turning movements in 2031 (see Table 8-3).

5.2.10. The addition of the development trips contributes to increasing delay per PCU figures at the Kirby Lane/A47 junction by approximately 10 seconds (see Table 5-5). The close proximity of the largest development to this radial means that longer distance trips are displaced by this congestion as can be seen from the difference plots.

5.2.11. The most popular alternative inbound route utilises the Lubbesthorpe Bridge over the M1 with an increase of approximately 90 PCUs in the AM Peak hour. Other routes inbound to the PUA such as Desford Road, Leicester Lane, Narborough Road and Ratby Road also show increases but on a reduced scale.

5.2.12. In the PM Peak hour, the A47 between Kirby Lane and the Braunstone Lane/Ratby Lane crossroads is forecast to increase flow due to there being some spare capacity (see Table 5-6).

5.2.13. The route using the Lubbesthorpe Bridge over the M1 remains attractive in the PM peak hour but on a smaller scale than in the morning.

5.3. Area of Influence Summary Statistics

5.3.1. When looking at the highway impact of a development and/or scheme it is useful to gauge the performance over the wider area. This is usually done by identifying an area of influence/interest, in which benefits/dis-benefits accrue, in order to provide relevant time, distance and congestion statistics.

5.3.2. The client has specifically requested area wide statistics within 2 cordons:

- An area of influence (aoi) defined by consideration of percentage link flow changes beyond ±5%.
- An inner cordon specified by the client.

- <u>±5%.Area of Influence</u>

5.3.3. Figure 5-5 shows the extent of the previously defined area of influence (Section 4.4) together with the component links of the SATURN highway network contained within this area.

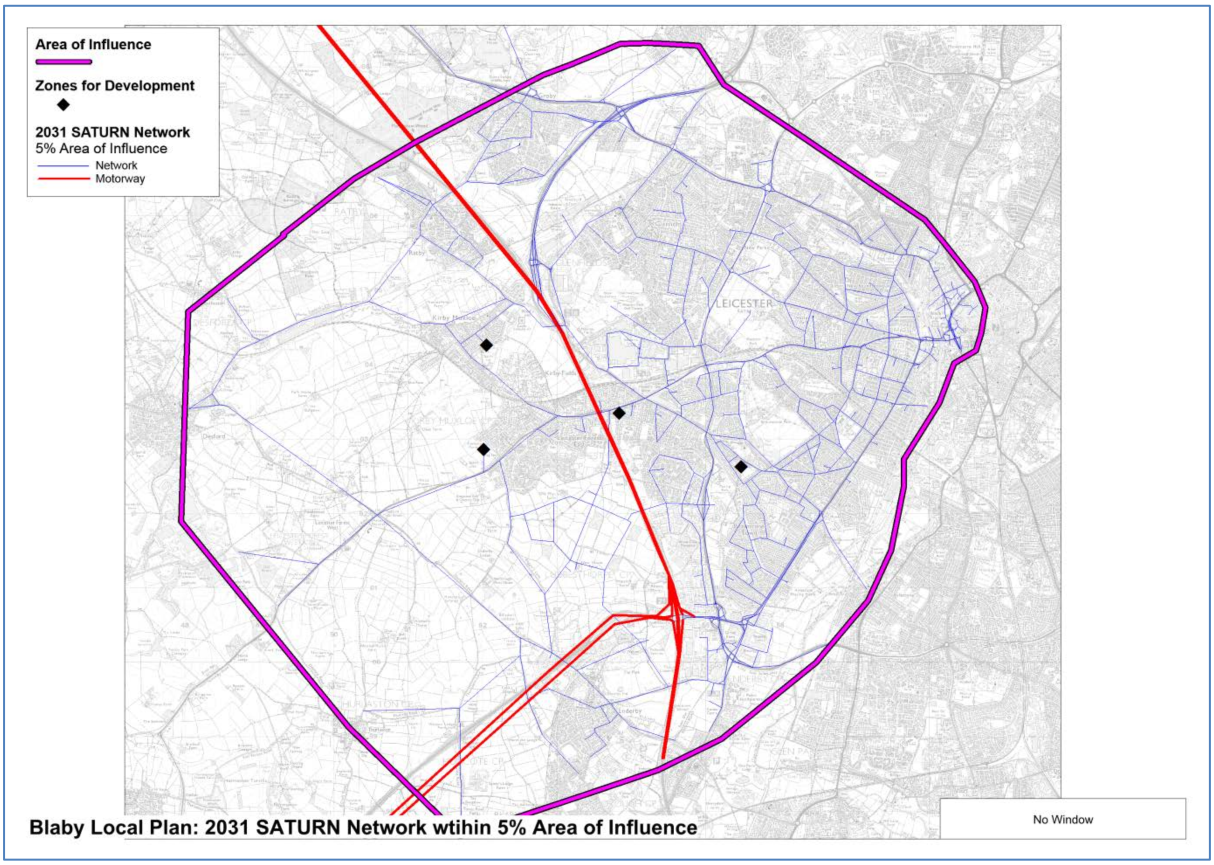


Figure 5-5: 5% Area of Influence, 2031 SATURN Network

5.3.4. Peak hour Area of Influence summary statistics are presented in Table 5-1 and Table 5-2 for each of the 3 scenarios; 2016 & 2031 core and 2031 with development. In order to provide more local clarity it is worthy of note that the figures associated with the motorway links (marked red in Figure 5-5) have been removed to avoid them overwhelming these statistics.

AM Peak	**2016 Core**	**2031 Core**	***Diff (31 Core - 16 Core)***	**2031 Development**	***Diff (31 Dev - 31 Core)***
Over-Capacity Queues (pcu.hrs)	290.4	472.8	182.4 (62.8%)	498.3	25.5 (5.4%)
Total Travel Time (pcu.hrs)	6,232.8	7,830.8	1,598.0 (25.6%)	7,927.7	96.9 (1.2%)
Total Travel Distance (pcu.kms)	203,285.1	232,477.1	29,192.0 (14.4%)	234,630.9	2,153.8 (0.9%)
Average Speed (kph)	32.6	29.7	-2.9 (-8.9%)	29.6	-0.1 (-0.3%)

Table 5-1: AM Peak summary statistics, 5% AoI

PM Peak	**2016 Core**	**2031 Core**	***Diff (31 Core - 16 Core)***	**2031 Development**	***Diff (31 Dev - 31 Core)***
Over-Capacity Queues (pcu.hrs)	222.1	676.2	454.1 (204.5%)	699.3	23.1 (3.4%
Total Travel Time (pcu.hrs)	6,108.2	7,840.2	1,732.0 (28.4%)	7,952.8	112.6 (1.4%)
Total Travel Distance (pcu.kms)	197,678.5	230,397.3	32,718.8 (16.6%)	232,310.9	1,913.6 (0.8%)
Average Speed (kph)	32.4	29.4	-3.0 (-9.3%)	29.2	-0.2 (-0.7%)

Table 5-2: PM Peak summary statistics, 5% AoI

Background Growth: 2016 vs 2031 Core

5.3.5. It can be seen that there has been an increase in congestion and a reduction in network performance as the demand for travel has increased between 2016 and 2031. In both peak hours there has been a circa 9% reduction in average network speed from approximately 32.5Kph to 29.5Kph. This is a legacy of increases in over capacity queues, total travel times and distances.[2]

[2] Over-capacity queues = the extra time spent in queues at over-capacity junctions waiting for the cycle in which the vehicle exits (subdivided into queues on the links and, if there are any, queues on centroid connectors due to blocking back)). *SATURN Manual,* 17-17.

Impact of Proposed Development: 2031 with vs 2031 without

5.3.6. Not surprisingly, the inclusion of an additional 1,000 dwellings has resulted in a further deterioration in network performance characterised by speed reductions of 0.3% and 0.7% for AM and PM peak hours respectively.

- Inner Cordon

5.3.7. Figure 5-6 shows the extent of the client defined 'Inner Cordon', itself focussed on the local roads in the immediate vicinity of the developments, together with the component links of the SATURN highway network contained within this area.

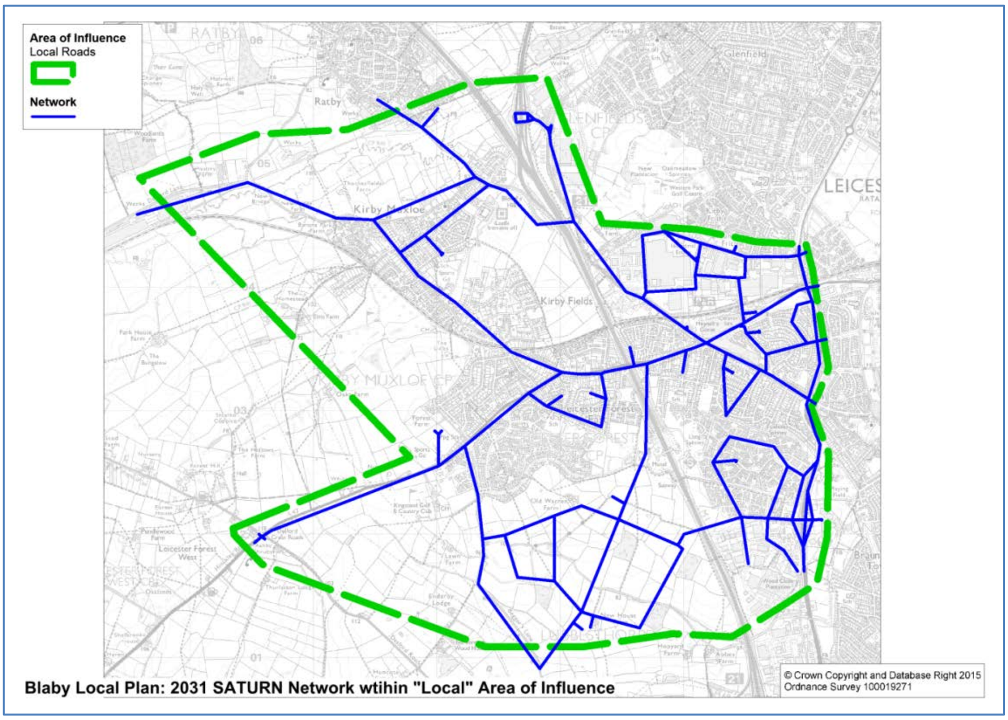


Figure 5-6: "Local" Area of Influence, 2031 SATURN network

5.3.8. Peak hour summary statistics for this "local" area of influence are presented in Table 5-3 and Table 5-4 for each of the 3 scenarios; 2016 & 2031 core and 2031 with development. Once again any figures associated with the motorway links have been excluded. In addition, those relating to the A46-Leicester Western Bypass have also been omitted too.

AM Peak	2016 Core	2031 Core	*Diff (31 Core - 16 Core)*	2031 Development	*Diff (31 Dev - 31 Core)*
Over-Capacity Queues (pcu.hrs)	73.2	131.6	58.4 (79.8%)	157.5	25.9 (19.7%)
Total Travel Time (pcu.hrs)	1,216.5	1,509.7	293.2 (24.1%)	1,555.0	45.3 (3.0%)
Total Travel Distance (pcu.kms)	38,759.8	42,278.5	3,518.7 (9.1%)	43,187.7	909.2 (2.2%)
Average Speed (kph)	31.9	28.0	-3.9 (-12.2%)	27.8	-0.2 (-0.7%)

Table 5-3: AM Peak summary statistics, "Local" AoI

PM Peak	2016 Core	2031 Core	*Diff (31 Core - 16 Core)*	2031 Development	*Diff (31 Dev - 31 Core)*
Over-Capacity Queues (pcu.hrs)	62.4	87.9	25.5 (40.9%)	111.5	23.6 (26.8%)
Total Travel Time (pcu.hrs)	1,221.6	1,407.7	186.1 (15.2%)	1,486.2	78.5 (5.6%)
Total Travel Distance (pcu.kms)	40,698.2	41,966.1	1,267.9 (3.1%)	43,055.9	1,089.8 (2.6%)
Average Speed (kph)	33.3	29.8	-3.5 (-10.5%)	29.0	-0.8 (-2.7%)

Table 5-4: PM Peak summary statistics, "Local" AoI

Background Growth: 2016 vs 2031 Core

5.3.9. The inner cordon is more congested than the wider '±5% area', due to the exclusion of less congested links, but exhibits similar attributes to those discussed earlier.

Impact of Proposed Development: 2031 with vs 2031 without

5.3.10. A similar pattern emerges when considering the impact of the development with statistics slightly worse for this more congested area.

5.4. Local Traffic Impact: Key Junctions

5.4.1. The client requested the local traffic impact (volume/capacity, turning delays, and turning volumes) be considered for 4 key junctions (Figure 5-7) in the vicinity of the proposed development.

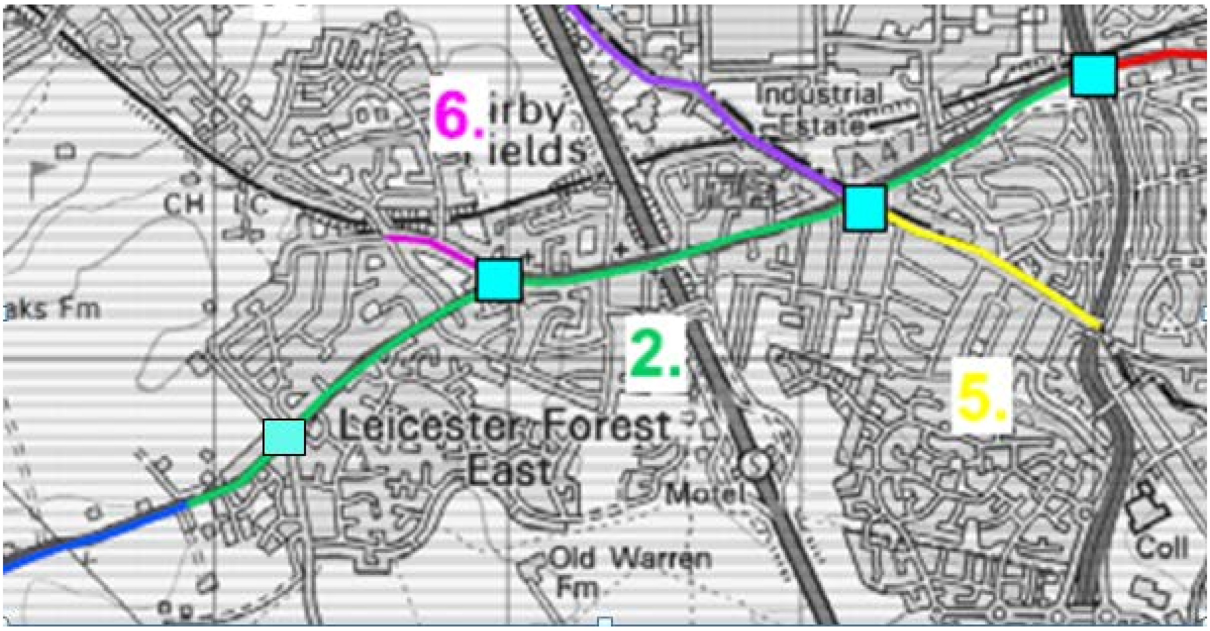


Figure 5-7: Junctions of local traffic impact analysis

5.4.2. Appendix A contains the tables detailing the requested traffic statistics by turning movement for the four junctions as follows:

- Beggars Lane/A47 (Table 8-1, Table 8-2)
- Kirby Lane/A47 (Table 8-3, Table 8-4)
- Braunstone Lane/A47 (Table 8-5, Table 8-6)
- A563/A47 (Table 8-7, Table 8-8)

5.4.3. A useful way of comparing and summarising the results of Appendix A is to calculate the delay per pcu of the traffic using each junction by scenario.

5.4.4. Table 5-5 and Table 5-6 show the delay per PCU figures, by scenario, for AM and PM peak hours respectively.

Delay per PCU (secs)	2016 AM Core	2031 AM Core	2031 AM Development
Beggars Lane/A47	11.8	14.9	15.9
Kirby Lane/A47	45.3	107.4	117.1
Braunstone Lane/A47	152.1	144.2	151.2
ODDR/A47	34.9	76.8	65.6

Table 5-5: Junction delay per PCU (seconds), AM Peak

Delay per PCU (secs	2016 PM Core	2031 PM Core	2031 PM Development
Beggars Lane/A47	56.8	47.2	51.5
Kirby Lane/A47	29.7	86.9	88.4
Braunstone Lane/A47	79.1	48.5	48.5
ODDR/A47	34.0	51.3	82.7

Table 5-6: Junction delay per PCU (seconds), PM Peak

Background Growth: 2016 vs 2031 Core

5.4.5. There has been deterioration in junction performance, between 2016 and 2031, for the Kirby Lane and ODDR junctions with the A47 in both peak hours. The forecast delay increase at the Kirby Lane junction is severe rising by about 1 minute per pcu whilst the ODDR, despite improvements, worsens by about 40s/pcu in the AM and 20s/pcu in the PM peak hour.

5.4.6. By contrast there has been an improvement in junction efficiency at Braunstone Crossroads of the order of 10s/pcu in the AM and 30s/pcu in the PM. A key component of this improvement is likely to be due to the increase in junction capacity as part of the Lubbesthorpe SUE mitigation strategy.

5.4.7. The Beggars Lane junction has seen a marginal fall in performance in the AM but a decent improvement in the PM peak hour.

Impact of Proposed Development: 2031 with vs 2031 without

5.4.8. In the AM Peak, the Kirby Lane/A47 and Braunstone Lane/A47 junctions see delay increases per PCU of 10 seconds and 7 seconds respectively. This contrasts with the PM Peak where delays remain fairly stable between the Core and Development scenarios.

5.4.9. This corroborates the narrative of section 5.1 which mentioned that the A47 at these two junctions in the AM Peak is over-capacity. In particular, a number of turning movements have volume/capacity (v/c) ratios exceeding 100% thus restricting the capability of the junction to absorb additional trips without significantly increasing vehicular delays. This contrasts with the PM core where there is some spare capacity and so additional demand can be adequately accommodated.

5.4.10. The ODDR/A47 junction displays more interesting results which warrant further analysis. The northern approach and turning movements, heading southbound down the ODDR (New Parks Way) experience significant delay relief in the AM Peak (approx. 60 seconds) but remain over-capacity. This explains why even though the delay figure is reduced, the flows on these turning movements remain similar. In the PM Peak however, significant delay increase are evident (approx. 150 seconds). This delay increase is coupled with a significant flow increase on the right-hand turn (approx. 90 PCUs), which is coded as a flared lane and not a dedicated high-capacity right-hand turn lane (Figure 5-8). This turning movement therefore seems to struggle with the increased quantity of right-turns in the 2031 PM Development scenario, unlike other right-turn movements on the junction which have both a flared right turn-lane and a dedicated standard right-turn lane (and therefore more capacity).

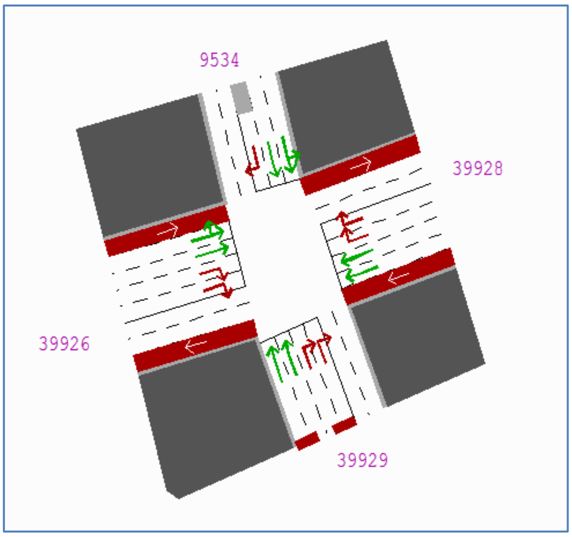


Figure 5-8: ODDR/A47 junction coding, 2031 Core

5.5. Local Traffic Impact: Key Routes

5.5.1. Figure 5-9 shows the eight client specified route locations for which travel times, speeds and flow weighted distance metrics have been extracted with the specific detail contained in Appendix B.

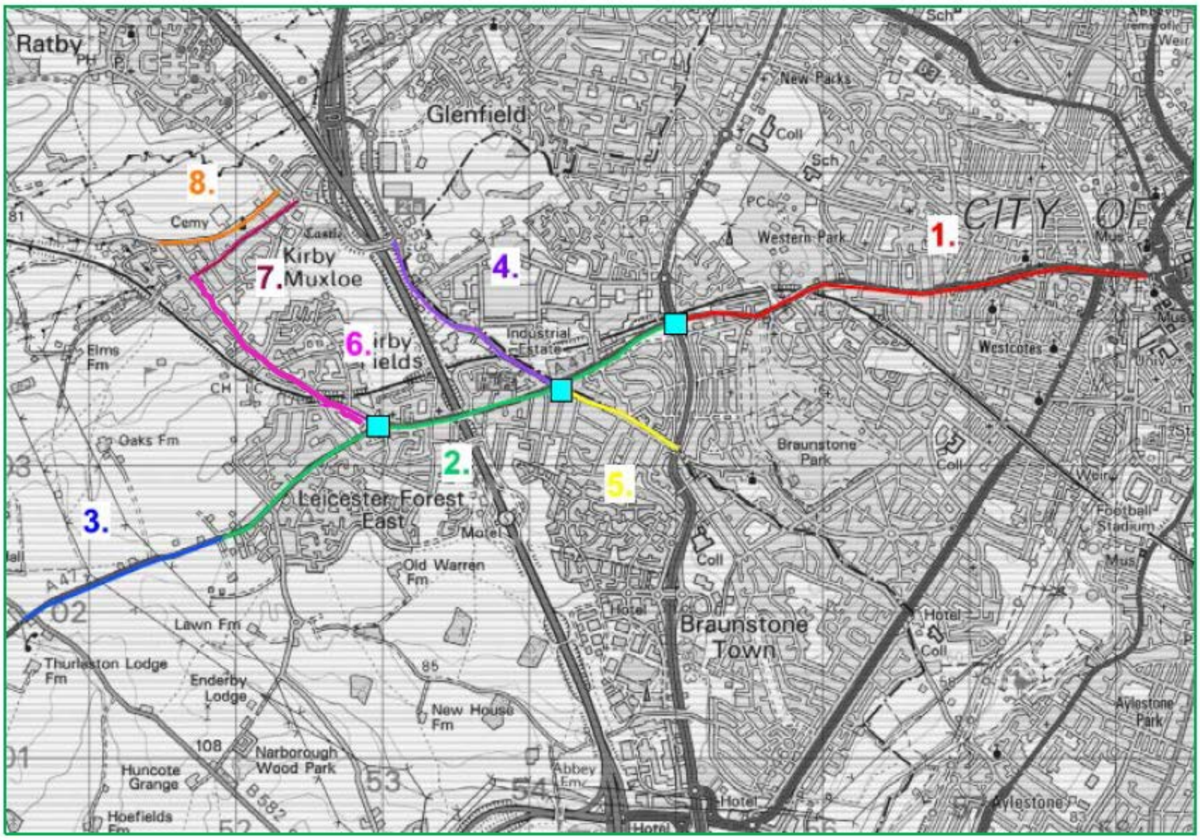


Figure 5-9: Route Locations for client specified output

5.5.2. Journey times are measured from the stop-line on the start junction. Along the route, link times and turning movement (straight ahead) times are calculated. This accounts for link traversal and any subsequent delay at the node. At the final junction, the route is deemed as having ended once the final turning movement has been made. This means that the final junction is always cleared.

5.5.3. With the exception of route 2 the other routes show relatively modest changes and so are left to the reader for review. However, the A47 route between the development and the ODDR is worthy of comment, in the context of the proposed development, and is discussed below.

5.5.4. Table 9-3 and Table 9-4 show the summary metrics for route 2 with the more significant development impact values highlighted in green.

5.5.5. It can be seen that in the AM peak hour there is over a 40s increase in journey time inbound (eastbound) to the PUA as a consequence of the development.

5.5.6. In the PM peak hour the LLITM forecasts a near 20s increase to both, the inbound (eastbound) and outbound (westbound) routes.

Route 2

Direction	Metric	2016 AM Core	2031 AM Core	2031 AM Development	2031 Dev-2031 Core
Eastbound	Travel Time (secs)	660.1	716.7	759.4	**42.70**
	Avg. Speed (kph)	18.8	17.2	16.2	-1.00
	Traffic (pcu.kms)	2949.8	2939.5	2959.6	20.10
Westbound	Travel Time (secs)	364.3	432.5	426.1	-6.40
	Avg. Speed (kph)	33.8	28.5	28.9	0.40
	Traffic (pcu.kms)	2522.8	3047.2	2906	-141.20

Table 5-7: Route 2 summary statistics, AM Peak

Direction	Metric	2016 PM Core	2031 PM Core	2031 PM Development	2031 Dev-2031 Core
Eastbound	Travel Time (secs)	418.4	572.1	591.9	**19.80**
	Avg. Speed (kph)	29.6	21.6	20.8	-0.80
	Traffic (pcu.kms)	2850.9	3254.7	3324.4	69.70
Westbound	Travel Time (secs)	446.9	392.3	410.1	**17.80**
	Avg. Speed (kph)	27.6	31.4	30.1	-1.30
	Traffic (pcu.kms)	2851.6	3561.7	3707	145.30

Table 5-8: Route 2 summary statistics, PM Peak

5.5.7. More detail of the junction performance along each section of route 2 is revealed by using LLITM output to derive corresponding distance-time graphs for each of the scenarios.

5.5.8. Figure 5-10 shows the AM inbound profile and highlights clearly where the impact of the development begins to ‘bite’; namely, from the Kirby Lane and Braunstone crossroads junctions.

5.5.9. The route starts having cleared the first junction (i.e. on the stopline). The subsequent points on the chart represent the times at which the junction is cleared.

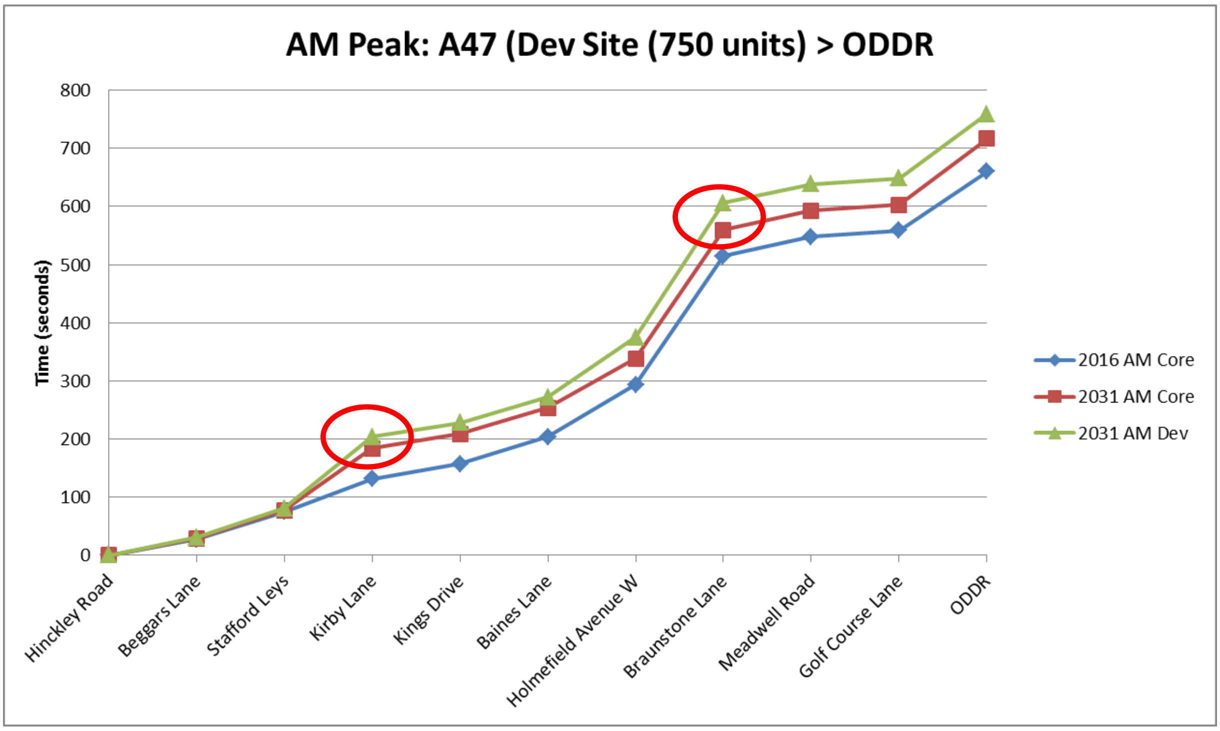


Figure 5-10: Route 2 Dev Site > ODDR time/junction plot, AM

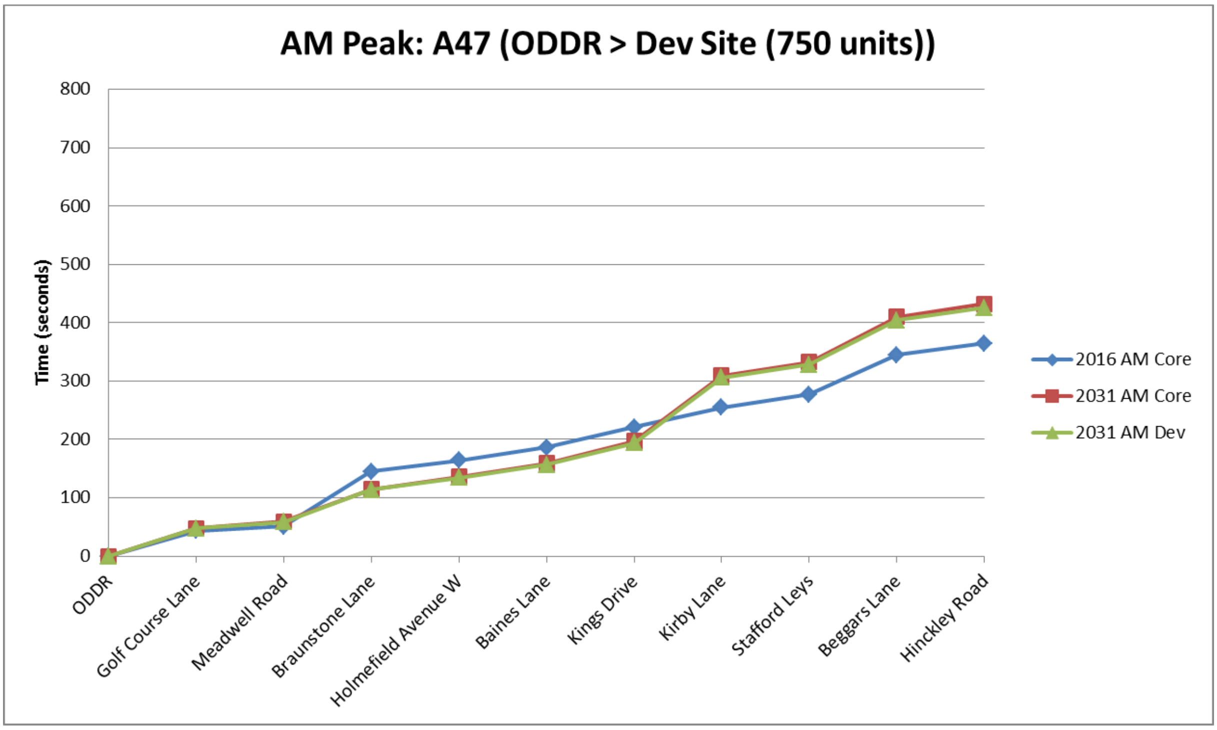


Figure 5-11: Route 2 ODDR > Dev Site time/junction plot, AM

5.5.10. The AM outbound profile is shown in Figure 5-11 and shows little difference between sectional journey times for 2031 with and without scenarios.

5.5.11. The corresponding PM peak hour profiles are shown in Figure 5-12 and Figure 5-13 below. The inbound direction follows a similar trajectory to the AM, albeit at a more reduced level. For outbound movements any changes are marginal but there is a slight worsening of congestion from Braunstone crossroads, Kirby Lane and Beggars Lane.

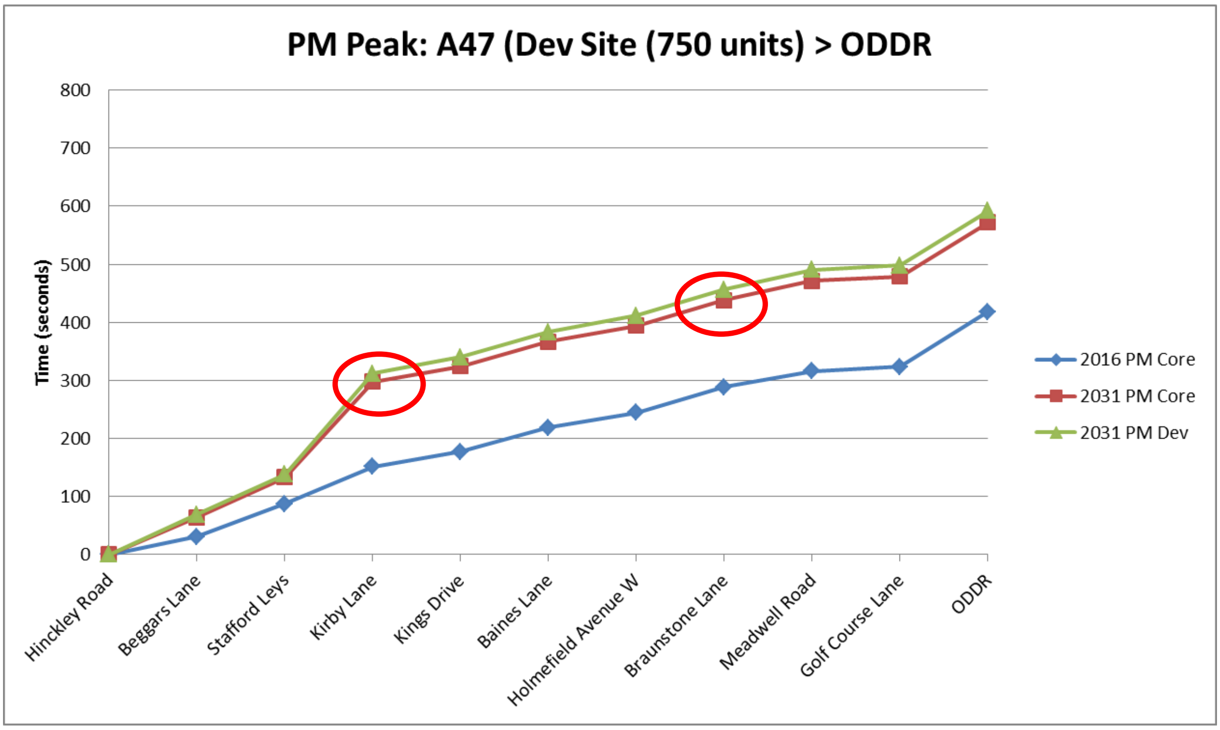


Figure 5-12: Route 2 Dev Site > ODDR time/junction plot, PM

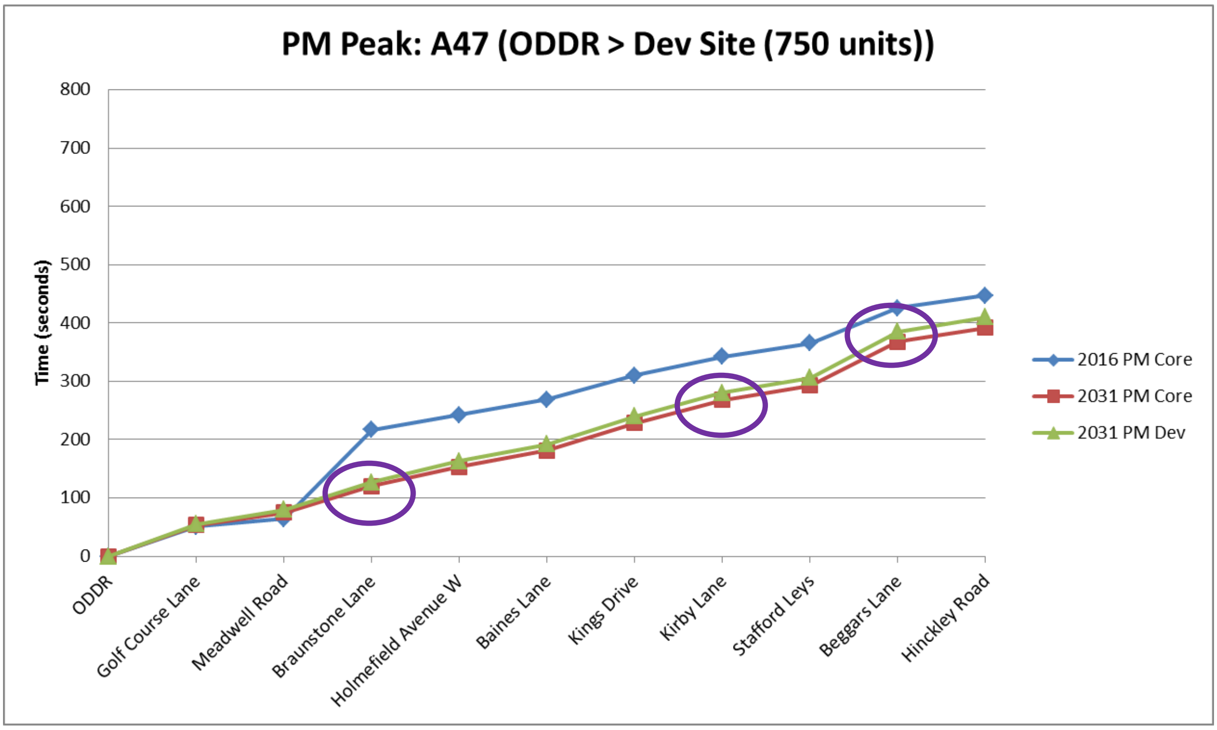


Figure 5-13: Route 2 ODDR > Dev Site time/junction plot, PM

5.6. Wider Area of Influence Volume/Capacity Ratios

5.6.1. Figure 5-14 and Figure 5-15 show those junctions having at least one turning movement approaching capacity in the respective 2016 AM and PM future forecasts. The measure of this performance is expressed by the volume over capacity (V/C) metric with two levels of congestion identified here:

- Early onset of junction breakdown V/C 85% to 100%
- Junction breakdown V/C >100%

5.6.2. Output has been shown at the ±5% aoi.

5.6.3. In a similar fashion to the above, Figure 5-16 and Figure 5-17 show the volume over capacity relationships for the 2031 AM and PM peak hour forecasts respectively.

2016 Core

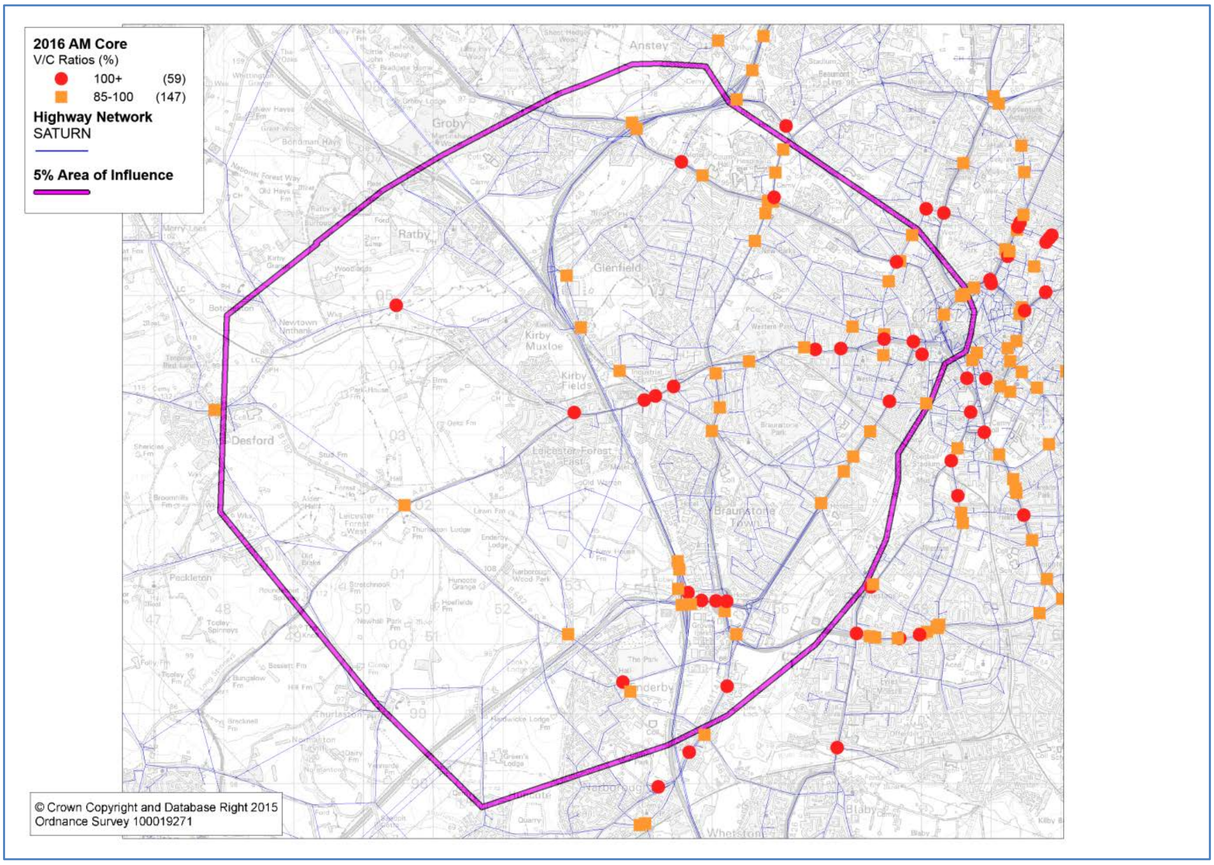


Figure 5-14: Over-capacity junctions within 5% AoI, 2016 AM Peak

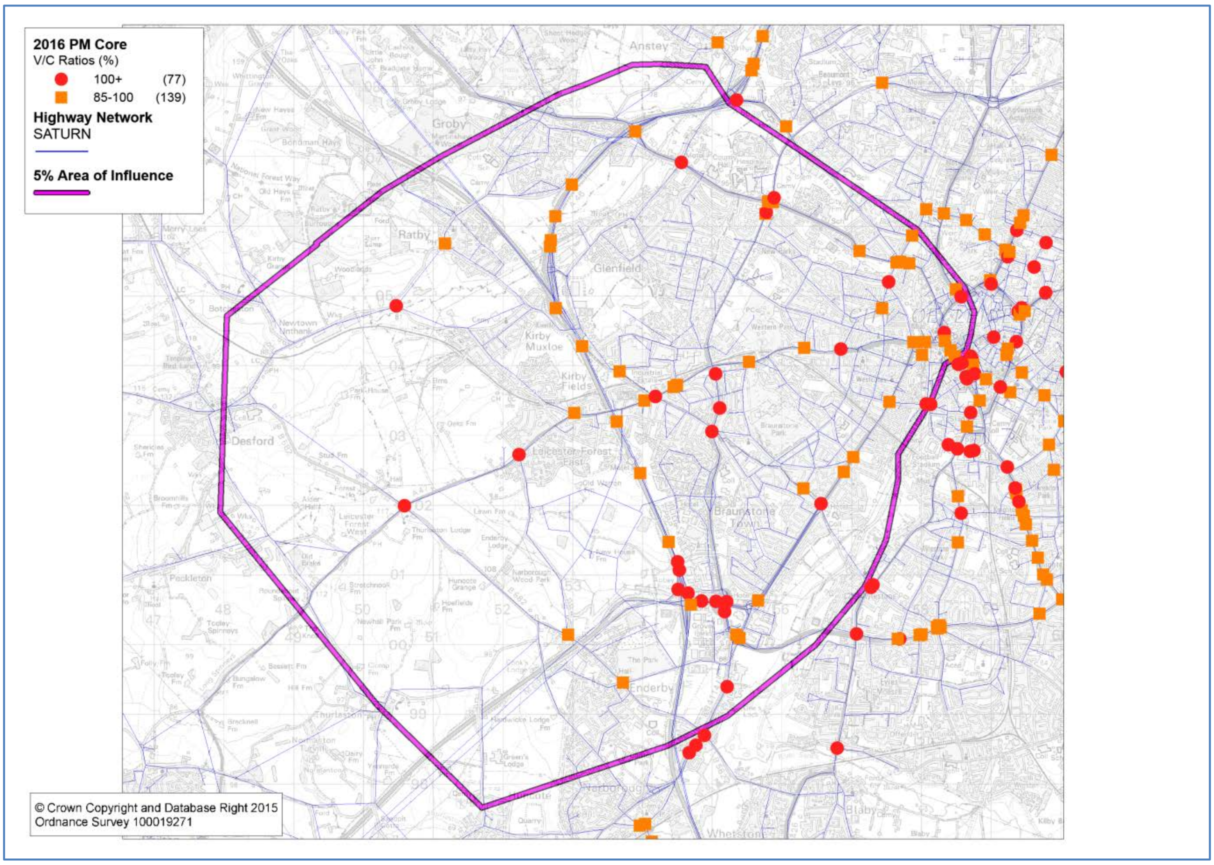


Figure 5-15: Over-capacity junctions within 5% AoI, 2016 PM Peak

2031 Core

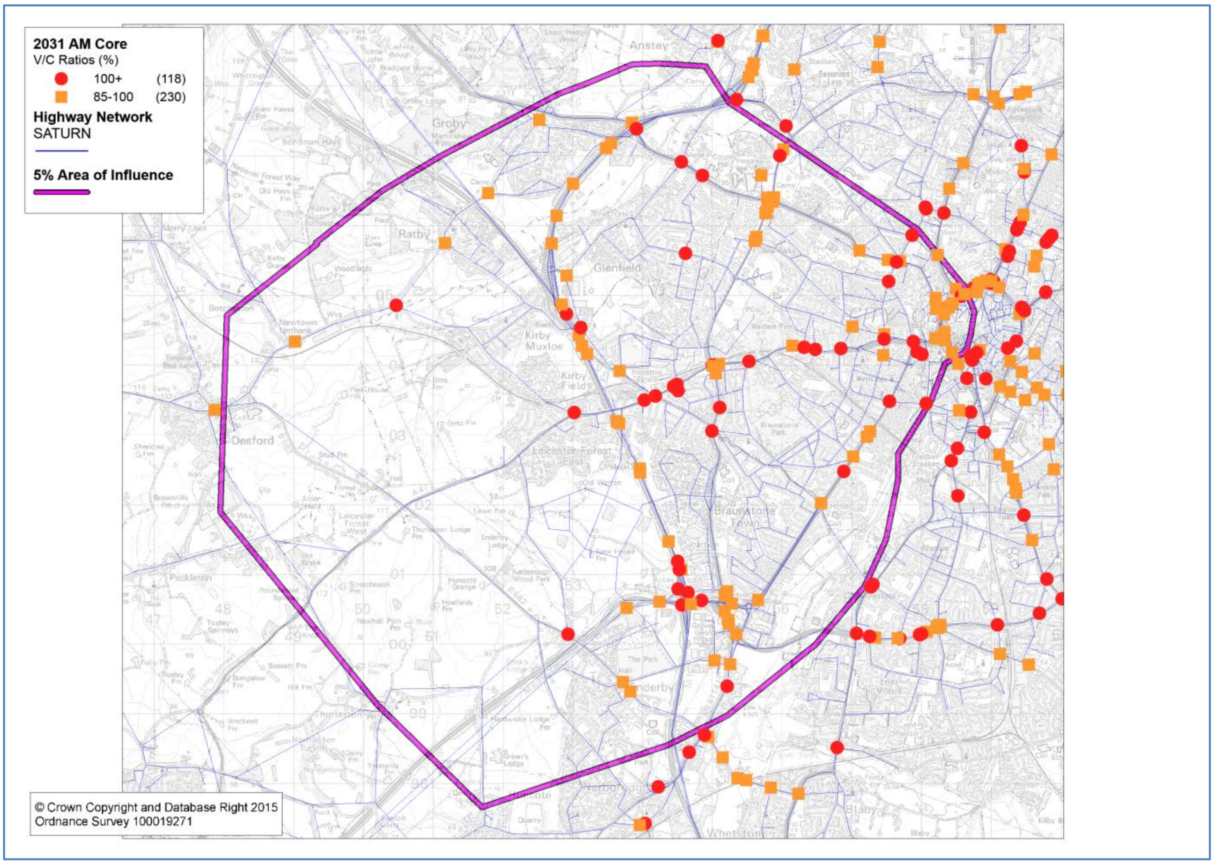


Figure 5-16: Over-capacity junctions within 2% AoI, 2031 AM Peak

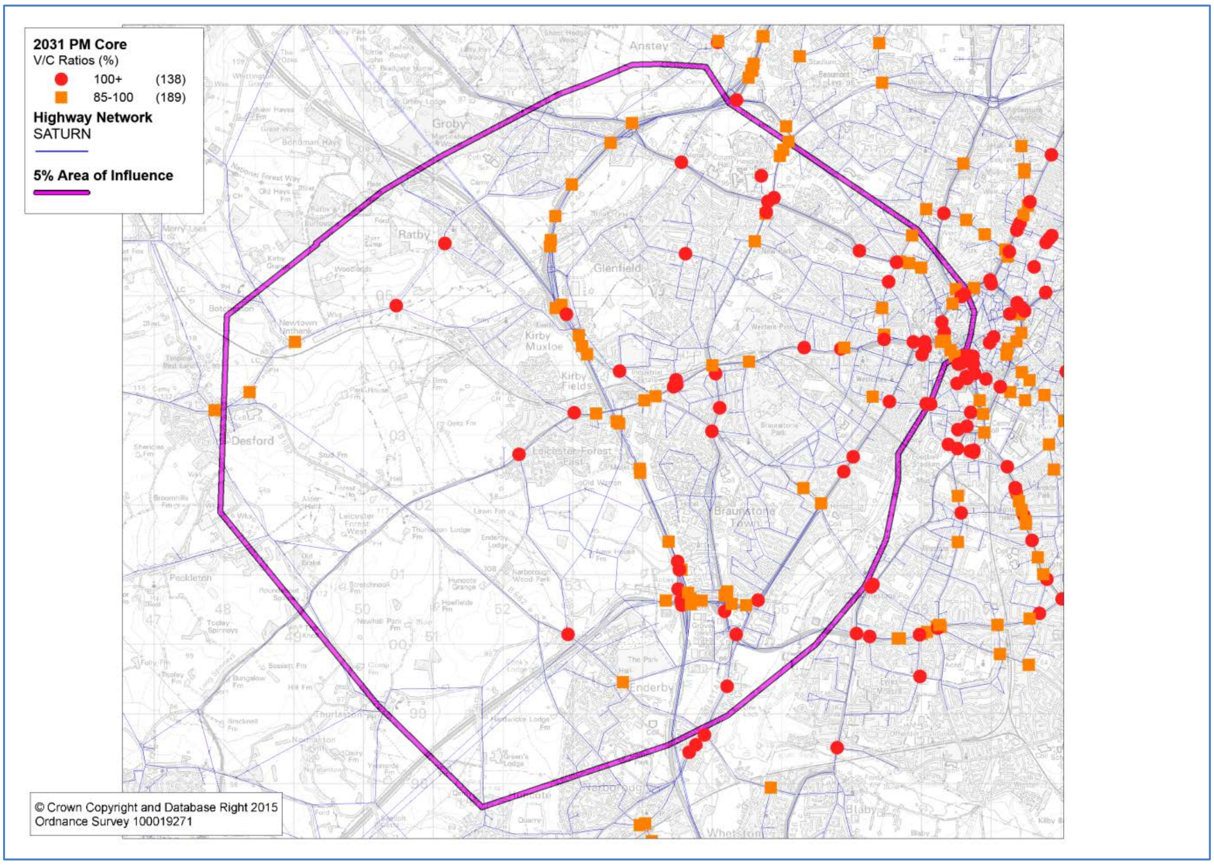


Figure 5-17: Over-capacity junctions within 5% AoI, 2031 PM Peak

2031 Development (Changes from 2031 Core)

5.6.4. The impact of the development in terms of the volume over capacity metric has been isolated for 2031 AM and PM peak hours in Figure 5-18 and Figure 5-19 respectively. This has been achieved by identifying only those junctions which are ‘flagged’ on our ‘85%-100%’ scale due to the development when compared with the standard 2031 core output.

5.6.5. Due to the fact that some junctions may move between classifications, emerge into or drop out of them, it is necessary to define the 5 levels shown in Table 5-9.

NO Development	WITH Development
< 85%	> 100%
85 to 100%	> 100%
< 85%	85 to 100%
85 to 100%	< 85%
> 100%	85 to 100%
>100%	<85%

Table 5-9: Revised V/C levels for comparing 2031 core with/without Development

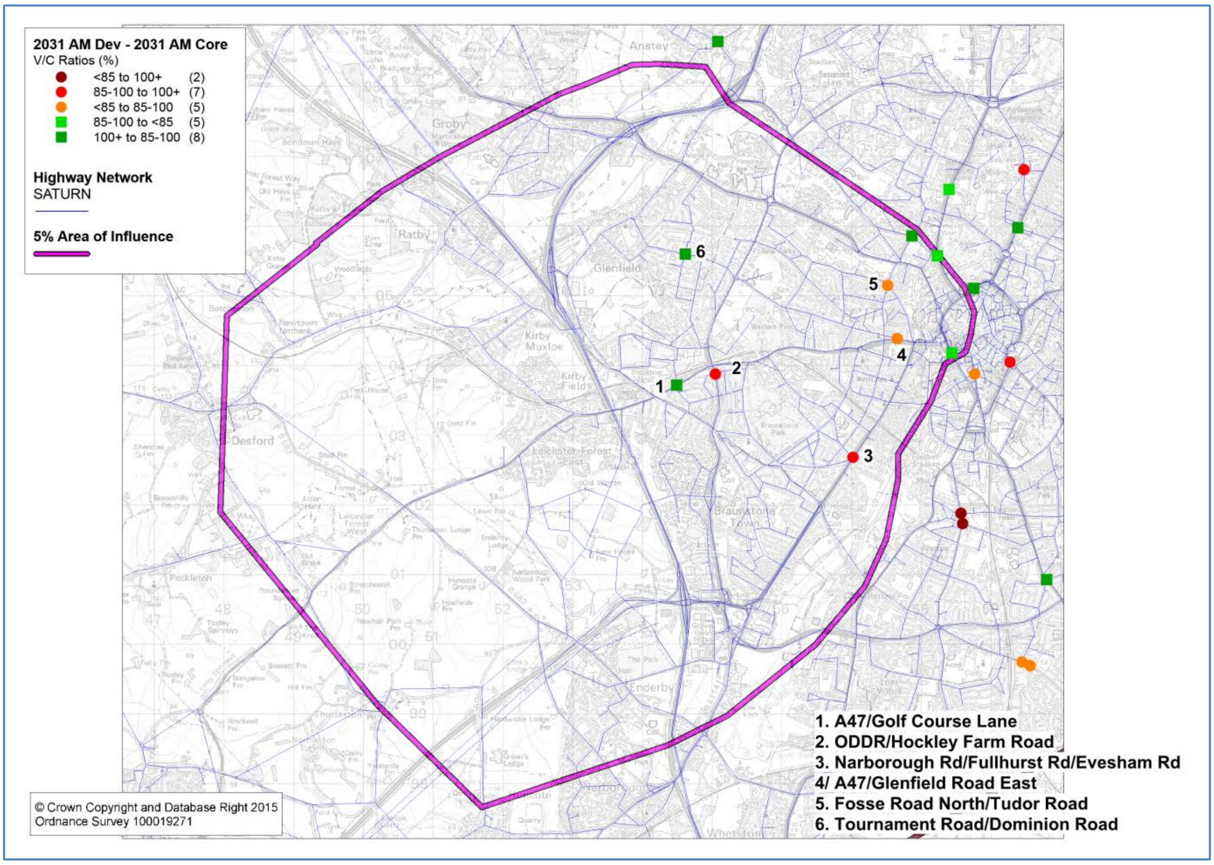


Figure 5-18: Over-capacity junctions within 5% AOI, differences from 2031 AM Core to 2031 AM Development

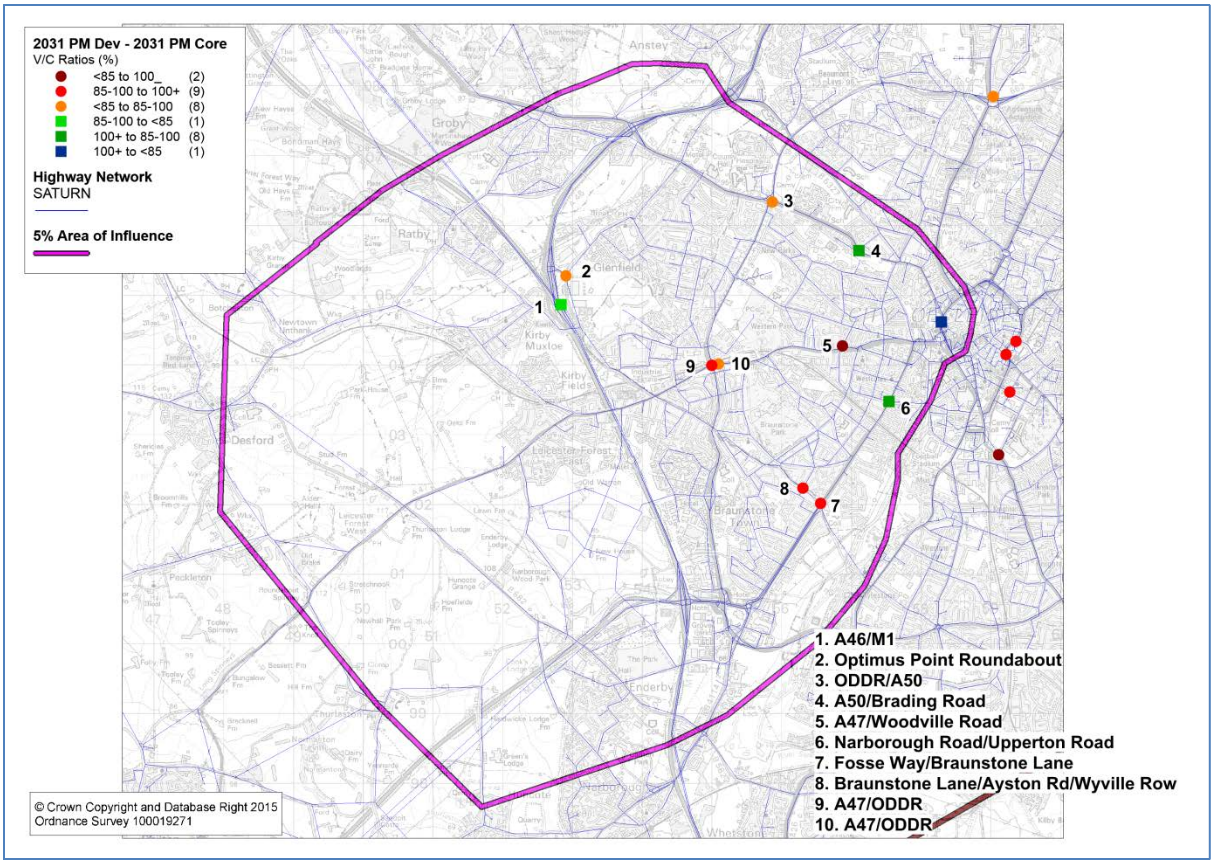


Figure 5-19: Over-capacity junctions within 5% AoI, differences from 2031 PM Core to 2031 PM Development

6. Summary

6.1.1. This report has used the LLITM5.1 highway model to test the impact of an additional 1,000 dwellings for Blaby District Council's consultants, E&E, in the vicinity of Leicester Forest East and Braunstone Town.

6.1.2. Having identified the area of influence (aoi) associated with the development, from knowledge of the displaced traffic caused by it, a review of model suitability was demonstrated prior to running the following peak hour highway scenario assignments:

- 2016 Core
- 2031 Core
- 2031 Core + development

6.1.3. A measure of the forecast background growth has been provided by comparing the 2016 and 2031 core scenarios whilst the impact of the development has involved comparison of 2031 forecast year, 'with' versus 'without', development scenarios

.

6.1.4. Most links within the aoi experience an increase in background flow between 2016 and 2031 with 3 notable exceptions:

- Beggars Lane to the south of the Lubbesthorpe SUE (AM & PM).
- Braunstone Lane to the east of the A47 (PM).
- Lubbesthorpe Way/ODDR between A47, Hinckley Rd and Meridian (PM)

6.1.5. The principal reason for relief on these links relates to improved connectivity with the PUA offered by the 'M1-bridge' crossing (SUE mitigation measure).

6.1.6. In general journey times increase on the measured routes between forecast years 2016 and 2031. However, there is some localised improvement for outbound A47 traffic using Braunstone Crossroads. This is a legacy of capacity improvements implemented as part of the Lubbesthorpe SUE mitigation strategy in 2026.

6.1.7. The effect of the additional housing is dominated by the 750 dwellings loaded onto the A47 west of Beggars Lane. This is not surprising, given the heavily congested nature of this radial towards the PUA.

6.1.8. Preliminary results suggest:

- Increased congestion on the A47 between Kirby Lane and the ODDR.

- An attractive alternative route through the Lubbesthorpe SUE and over the new M1-bridge towards Meridian.
- A dispersion of longer distance trips better able to divert around the additional congestion.
- Increased flows through Kirby Muxloe
- Increased flows on the B582

7. Contact Details

We trust that this report meets your requirements and we look forward to having the opportunity to work with you again in the future.

If you have any questions please do not hesitate to contact:

Tom Baker
ET-CF & LLITM Framework Manager
Network Data & Intelligence
Environment & Transport Department
Leicestershire County Council

Tel: 01163 057 323
Email: tom.baker@leics.gov.uk

8. Appendix A: Client Specified Junction Analysis

1. Beggars Lane/A47, Hinckley Rd

Beggars Lane /A47: AM Peak		Actual Flow (pcus)			Delay (seconds)			V/C Ratio		
Approach	Turn	2016 Core	2031 Core	2031 Dev	2016 Core	2031 Core	2031 Dev	2016 Core	2031 Core	2031 Dev
East (A47 WB)	Left	501	603	581	10	13	13	62	73	71
	Straight	579	705	682	11	14	13	65	81	78
South (Beggars Lane)	Left	31	139	159	24	26	26	9	41	47
	Right	136	147	146	25	26	26	40	43	43
West (A47 EB)	Straight	508	560	576	10	11	12	51	57	58
	Right	26	90	233	16	23	28	7	33	81

Table 8-1: Beggars Lane/A47 junction turning movement statistics, AM Peak

Beggars Lane /A47: PM Peak		Actual Flow (pcus)			Delay (seconds)			V/C Ratio		
Approach	Turn	2016 Core	2031 Core	2031 Dev	2016 Core	2031 Core	2031 Dev	2016 Core	2031 Core	2031 Dev
East (A47 WB)	Left	205	329	342	9	13	14	25	46	53
	Straight	598	817	861	11	17	19	66	90	95
South (Beggars Lane)	Left	25	82	121	195	123	130	105	101	102
	Right	442	426	428	195	123	130	105	101	102
West (A47 EB)	Straight	581	885	891	13	43	47	64	98	98
	Right	48	97	136	19	58	65	13	80	88

Table 8-2: Beggars Lane/A47 junction turning movement statistics, PM Peak

2. Kirby Lane/A47

Kirby Lane /A47: AM Peak		Actual Flow (pcus)			Delay (seconds)			V/C Ratio		
Approach	Turn	2016 Core	2031 Core	2031 Dev	2016 Core	2031 Core	2031 Dev	2016 Core	2031 Core	2031 Dev
East (A47 WB)	Left	402	490	423	7	85	86	40	100	100
	Straight	287	251	250	24	99	101	86	100	100
South-West (A47 EB)	Left	225	311	350	36	85	102	78	100	101
	Right	391	366	328	36	85	102	84	100	101
North-West (Kirby Lane)	Straight	90	83	78	132	197	205	100	104	104
	Right	210	218	219	138	203	211	100	104	104

Table 8-3: Kirby Lane/A47 junction turning movement statistics, AM Peak

Kirby Lane /A47: PM Peak		Actual Flow (pcus)			Delay (seconds)			V/C Ratio		
Approach	Turn	2016 Core	2031 Core	2031 Dev	2016 Core	2031 Core	2031 Dev	2016 Core	2031 Core	2031 Dev
East (A47 WB)	Left	456	625	654	7	10	11	46	63	65
	Straight	128	238	240	21	28	28	38	88	88
South-West (A47 EB)	Left	293	318	319	43	144	153	86	103	104
	Right	308	356	358	43	144	153	85	103	104
North-West (Kirby Lane)	Straight	155	193	248	34	142	132	65	102	102
	Right	199	208	207	44	149	139	96	102	102

Table 8-4: Kirby Lane/A47 junction turning movement statistics, PM Peak

3. Braunstone Lane/A47

Braunstone Lane/A47: AM Peak		Actual Flow (pcus)			Delay (seconds)			V/C Ratio		
Approach	Turn	2016 Core	2031 Core	2031 Dev	2016 Core	2031 Core	2031 Dev	2016 Core	2031 Core	2031 Dev
North (Ratby Lane)	Left	122	184	175	18	19	19	15	23	22
	Straight	241	291	283	29	31	30	35	43	42
	Right	213	235	211	43	45	43	48	53	47
East (A47 WB)	Left	77	101	104	66	30	30	77	24	25
	Straight	581	744	725	74	35	35	98	62	61
	Right	50	57	57	153	196	196	76	87	87
South (Braunstone Lane)	Left	43	19	14	339	452	455	109	115	116
	Straight	200	241	246	339	452	455	109	115	116
	Right	60	61	62	293	332	342	100	102	103
West (A47 EB)	Left	139	201	203	198	198	209	105	105	105
	Straight	1132	1063	1050	198	198	209	105	105	105
	Right	92	92	94	249	250	270	100	100	101

Table 8-5: Braunstone Lane/A47 junction turning movement statistics, AM Peak

Braunstone Lane/A47: PM Peak		Actual Flow (pcus)			Delay (seconds)			V/C Ratio		
Approach	Turn	2016 Core	2031 Core	2031 Dev	2016 Core	2031 Core	2031 Dev	2016 Core	2031 Core	2031 Dev
North (Ratby Lane)	Left	77	251	252	27	32	32	13	42	42
	Straight	290	349	352	62	88	91	76	91	92
	Right	44	46	46	205	219	219	84	87	87
East (A47 WB)	Left	8	102	117	129	18	18	102	20	23
	Straight	884	1093	1130	132	24	24	102	63	65
	Right	60	26	35	77	68	70	46	19	26
South (Braunstone Lane)	Left	224	141	143	124	113	113	102	99	99
	Straight	203	314	311	91	113	112	84	95	95
	Right	27	43	44	114	155	160	45	72	73
West (A47 EB)	Left	167	159	165	26	26	26	39	38	40
	Straight	910	917	931	26	26	26	61	61	62
	Right	53	60	65	80	84	87	45	51	55

Table 8-6: Braunstone Lane/A47 junction turning movement statistics, PM Peak

4. A563, ODDR/A47

(Note: For this junction in the 2016 core network the complexities in the coding means turning movements can only be revealed by running a select link analysis. Due to time restraints this was not done but can be on request).

A563 (ODDR)/A47: AM Peak		Actual Flow (pcus		Delay (seconds)		V/C Ratio	
Approach	Turn	2031 Core	2031 Dev	2031 Core	2031 Dev	2031 Core	2031 Dev
North (New Parks Way)	Left	126	129	191	124	105	101
	Straight	751	717	191	124	105	101
	Right	7	2	194	128	105	101
East (A47 WB)	Left	763	755	23	26	92	93
	Straight	415	399	51	50	61	59
	Right	374	378	63	63	75	76
South (Braunstone Way)	Left	378	377	7	7	31	31
	Straight	741	746	60	61	87	88
	Right	570	577	87	93	94	95
West (A47 EB)	Left	4	9	68	65	11	17
	Straight	598	576	68	65	89	86
	Right	239	280	53	55	48	56

Table 8-7: ODDR/A47 junction turning movement statistics, AM Peak

A563 (ODDR)/A47: PM Peak		Actual Flow (pcus)		Delay (seconds)		V/C Ratio	
Approach	Turn	2031 Core	2031 Dev	2031 Core	2031 Dev	2031 Core	2031 Dev
North (New Parks Way)	Left	159	183	50	200	92	105
	Straight	670	641	47	198	82	105
	Right	163	248	59	210	69	105
East (A47 WB)	Left	637	691	14	14	77	79
	Straight	579	559	56	54	79	76
	Right	219	221	63	63	59	60
South (Braunstone Way)	Left	309	306	9	9	32	33
	Straight	938	942	54	54	87	88
	Right	453	452	106	105	96	95
West (A47 EB)	Left	8	5	49	50	6	4
	Straight	452	473	49	50	62	65
	Right	295	270	75	69	80	73

Table 8-8: ODDR/A47 junction turning movement statistics, PM Peak

9. Appendix B: Client Specified Route Analysis

Route 1

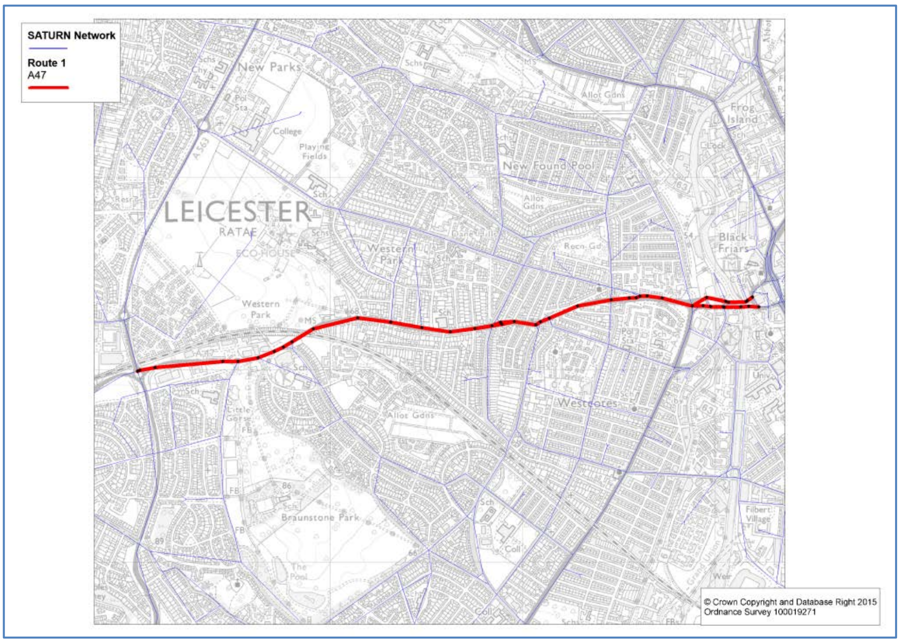


Figure 9-1: A47, between the Inner Ring Road and ODDR

Direction	Metric	2016 AM Core	2031 AM Core	2031 AM Development	2031 Dev-2031 Core
Eastbound	Travel Time (secs)	561.1	554.2	546.8	-7.40
	Avg. Speed (kph)	21.2	21.5	21.8	0.30
	Traffic (pcu.kms)	3987.8	4006.9	4012.9	6.00
Westbound	Travel Time (secs)	468.5	534.2	532.2	-2.00
	Avg. Speed (kph)	25.7	22.3	22.41	0.11
	Traffic (pcu.kms)	3007.5	3692.2	3645.7	-46.50

Table 9-1: Route 1 summary statistics, AM Peak

Direction	Metric	2016 PM Core	2031 PM Core	2031 PM Development	2031 Dev-2031 Core
Eastbound	Travel Time (secs)	444.8	490.9	492.7	1.80
	Avg. Speed (kph)	26.7	24.3	24.2	-0.10
	Traffic (pcu.kms)	2879.9	2992.7	3004.8	12.10
Westbound	Travel Time (secs)	507	565.3	570.8	5.50
	Avg. Speed (kph)	23.7	21.1	20.9	-0.20
	Traffic (pcu.kms)	3831	4275.6	4319.7	44.10

Table 9-2: Route 1 summary statistics, PM Peak

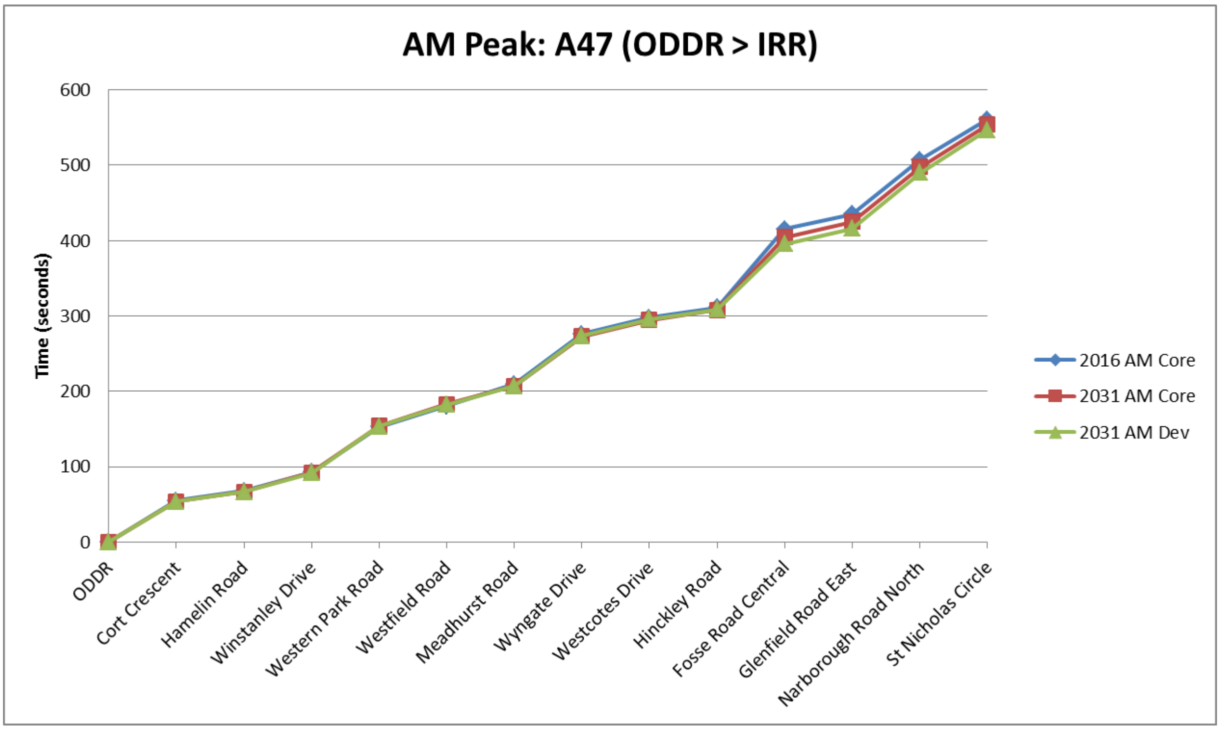


Figure 9-2: Route 1 ODDR > IRR junction/time plot, AM

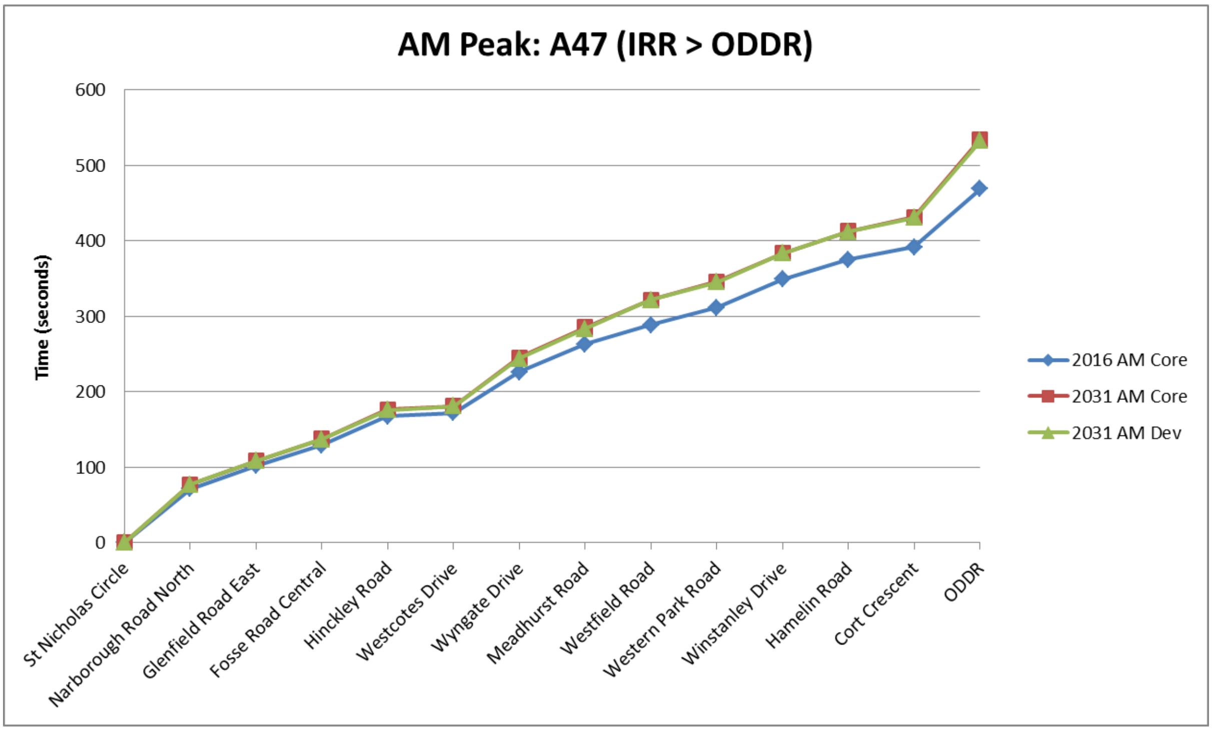


Figure 9-3: Route 1 IRR > ODDR junction/time plot, AM

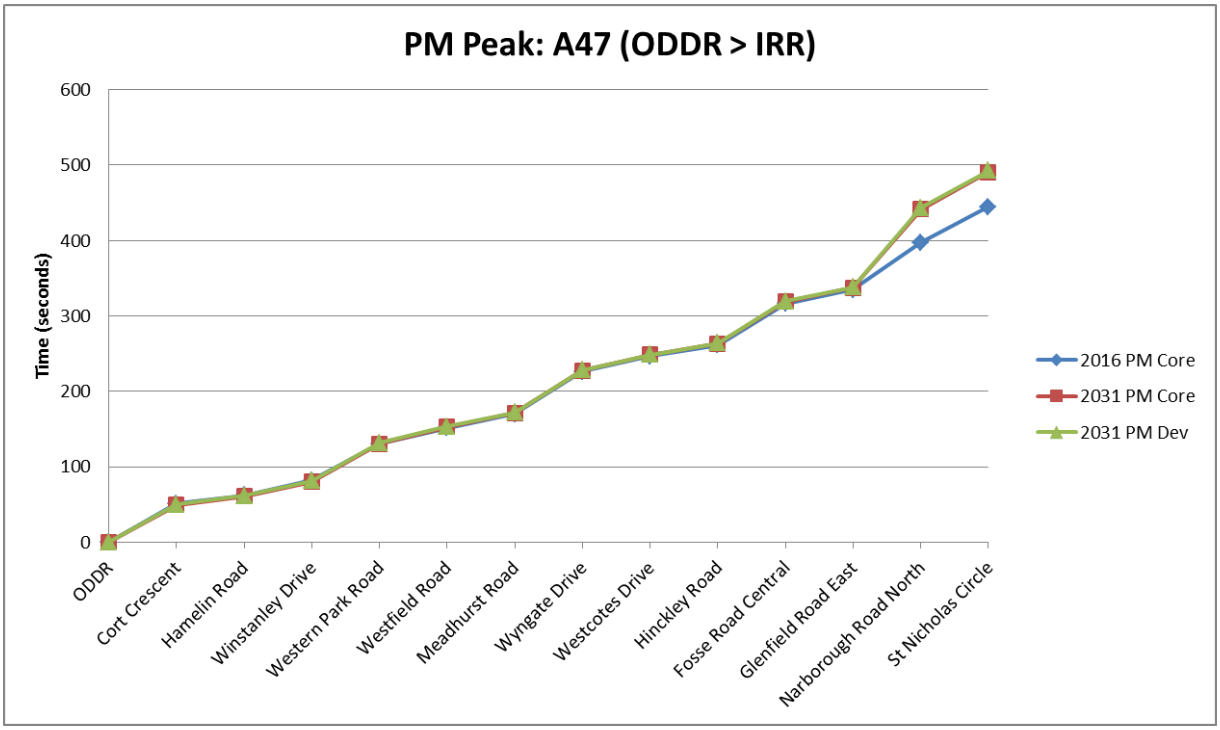


Figure 9-4: Route 1 ODDR > IRR time/junction plot, PM

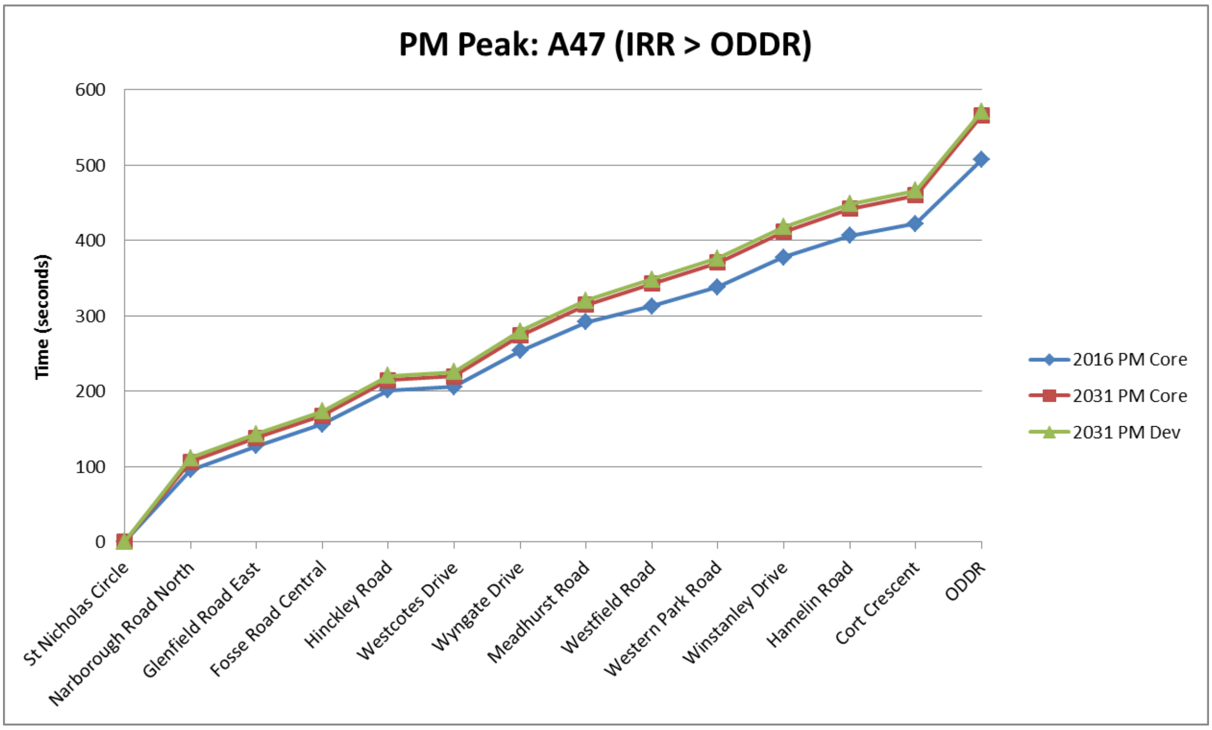


Figure 9-5: Route 1 IRR > ODDR time/junction plot, PM

Route 2

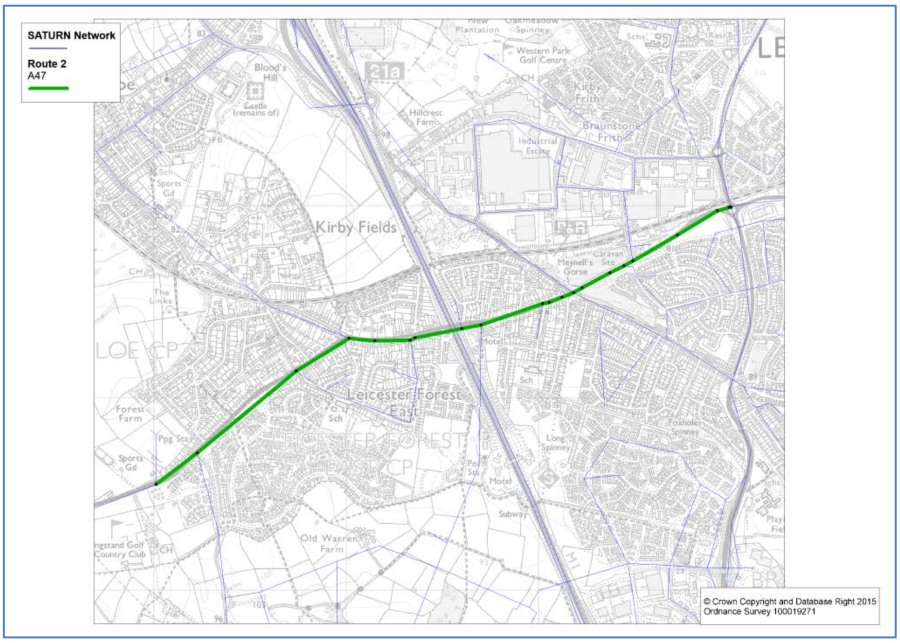


Figure 9-6: A47, between the ODDR and the 750 unit development site

Direction	Metric	2016 AM Core	2031 AM Core	2031 AM Development	2031 Dev-2031 Core
Eastbound	Travel Time (secs)	660.1	716.7	759.4	42.70
	Avg. Speed (kph)	18.8	17.2	16.2	-1.00
	Traffic (pcu.kms)	2949.8	2939.5	2959.6	20.10
Westbound	Travel Time (secs)	364.3	432.5	426.1	-6.40
	Avg. Speed (kph)	33.8	28.5	28.9	0.40
	Traffic (pcu.kms)	2522.8	3047.2	2906	-141.20

Table 9-3: Route 2 summary statistics, AM Peak

Direction	Metric	2016 PM Core	2031 PM Core	2031 PM Development	2031 Dev-2031 Core
Eastbound	Travel Time (secs)	418.4	572.1	591.9	19.80
	Avg. Speed (kph)	29.6	21.6	20.8	-0.80
	Traffic (pcu.kms)	2850.9	3254.7	3324.4	69.70
Westbound	Travel Time (secs)	446.9	392.3	410.1	17.80
	Avg. Speed (kph)	27.6	31.4	30.1	-1.30
	Traffic (pcu.kms)	2851.6	3561.7	3707	145.30

Table 9-4: Route 2 summary statistics, PM Peak

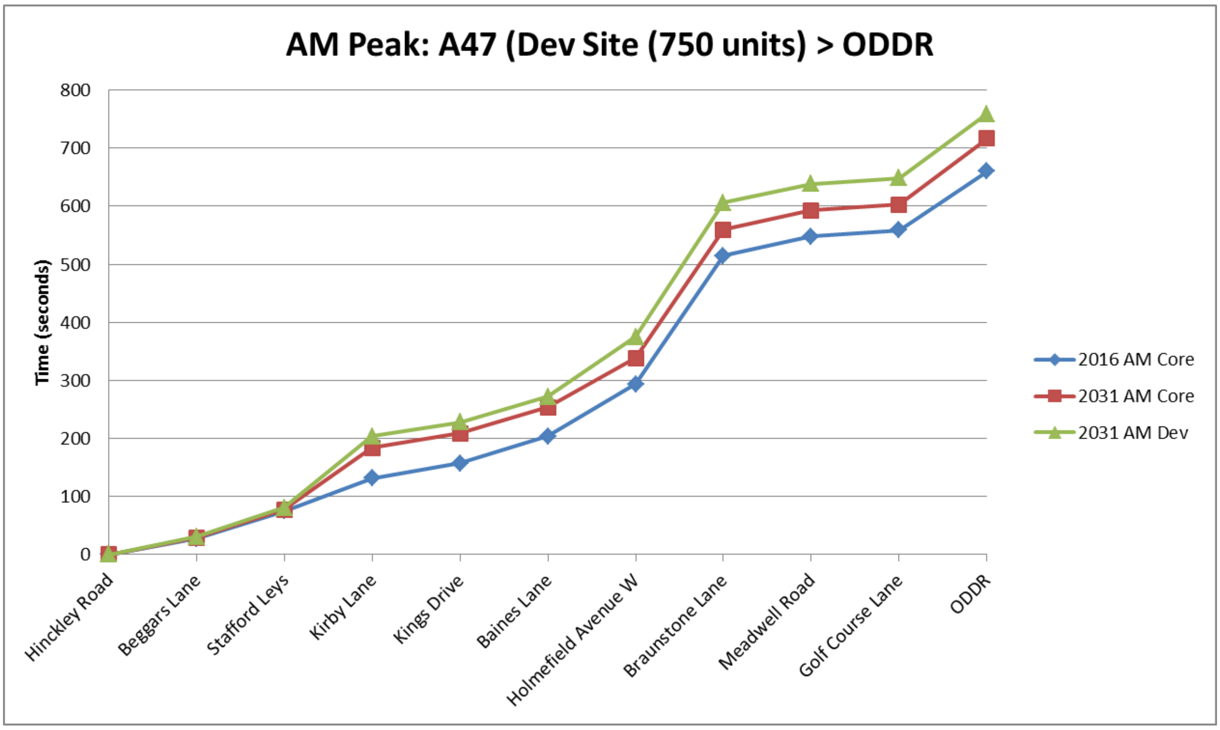


Figure 9-7: Route 2 Dev Site > ODDR time/junction plot, AM

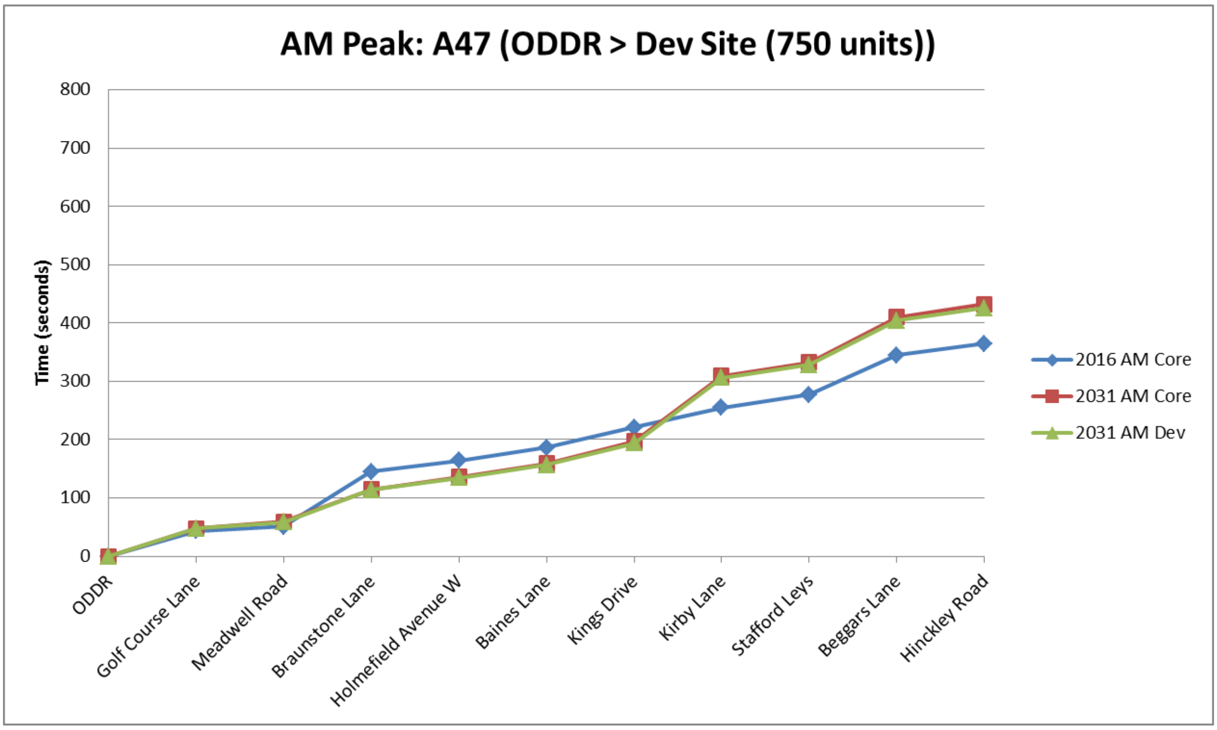


Figure 9-8: Route 2 ODDR > Dev Site time/junction plot, AM

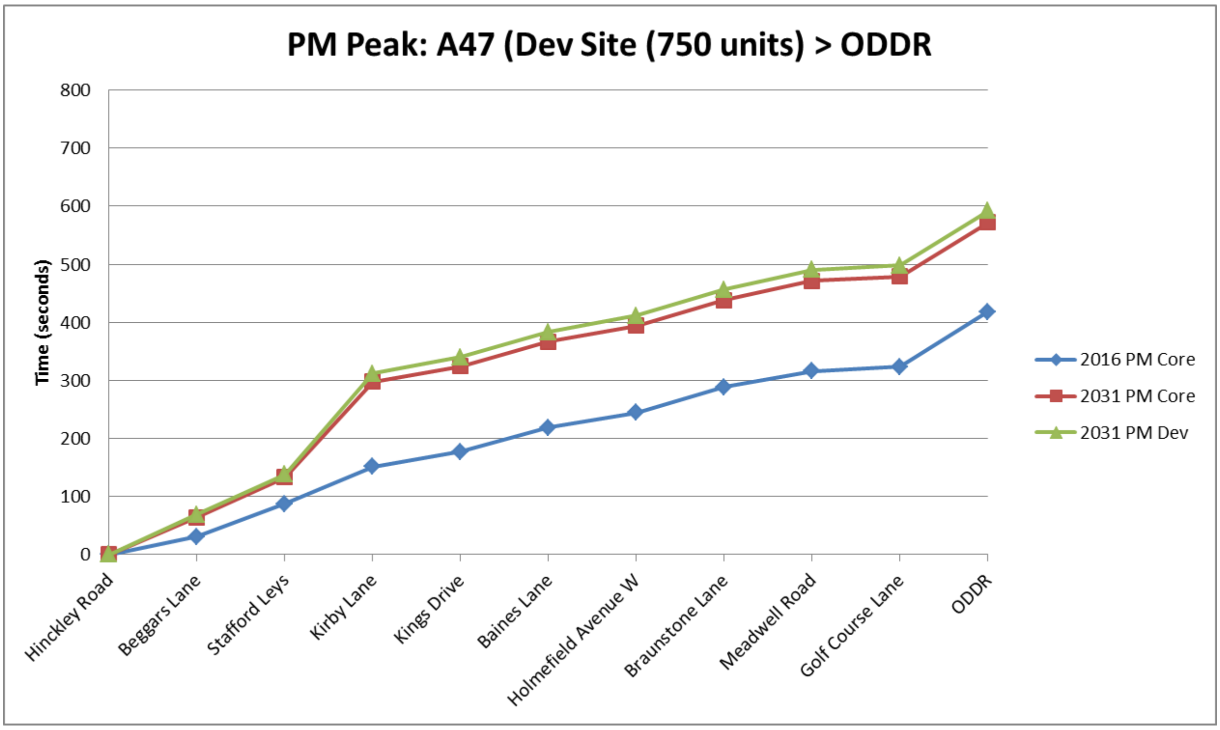


Figure 9-9: Route 2 Dev Site > ODDR time/junction plot, PM

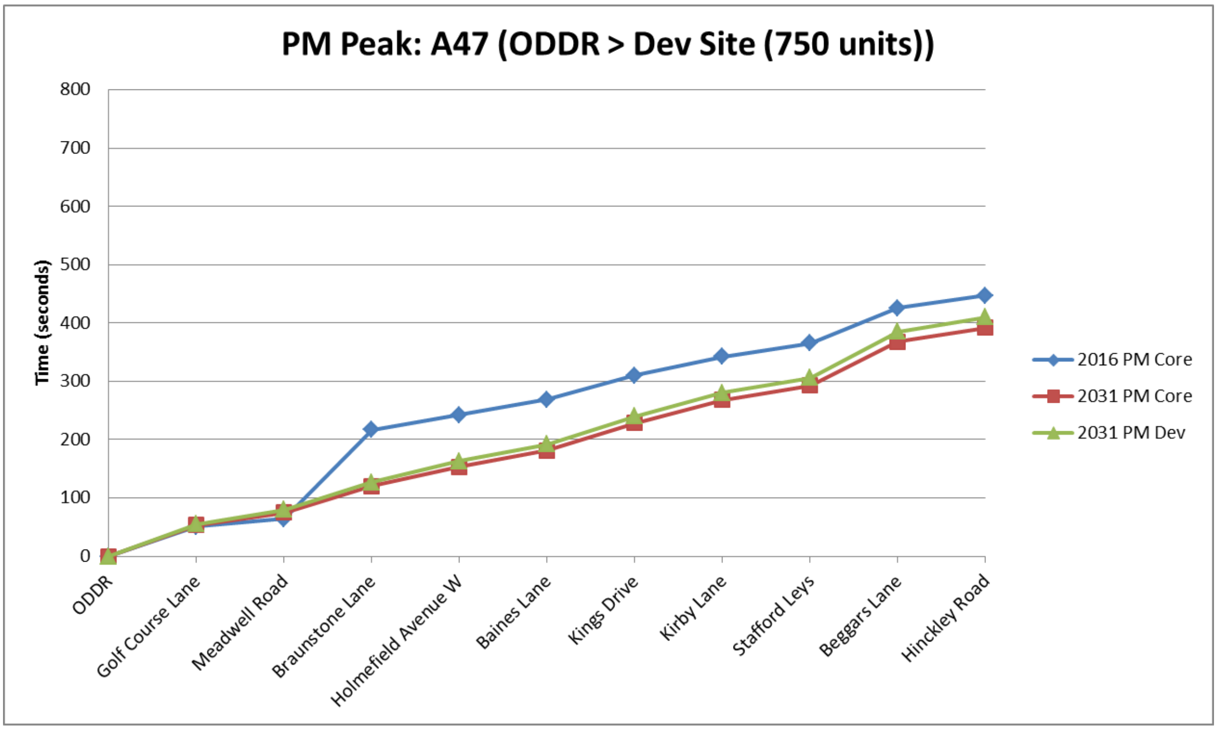


Figure 9-10: Route 2 ODDR > Dev Site time/junction plot, PM

Route 3

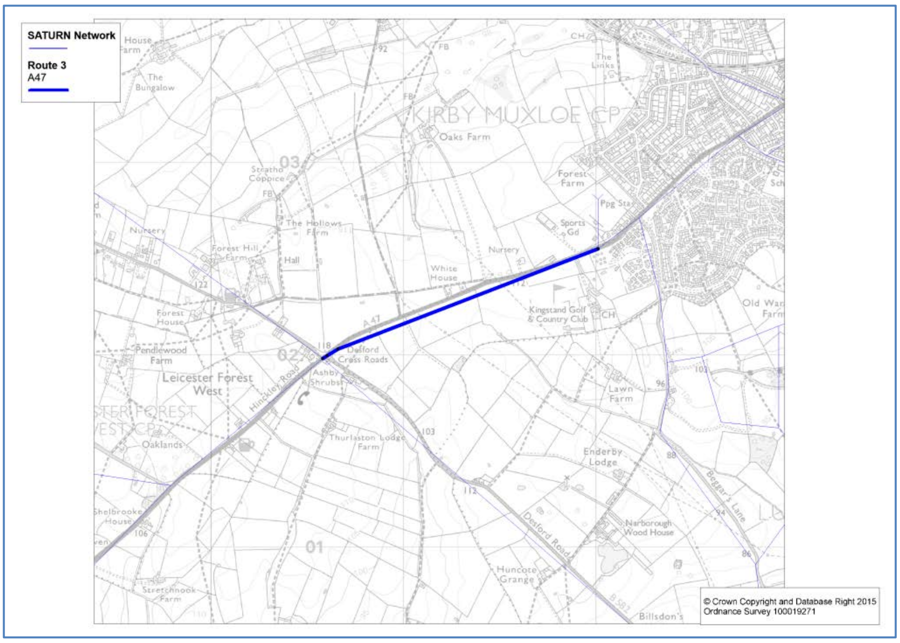


Figure 9-11: A47, between 750 unit development site (north of A47) and Desford Crossroads

Direction	Metric	2016 AM Core	2031 AM Core	2031 AM Development	2031 Dev-2031 Core
Eastbound	Travel Time (secs)	65.7	73	73.4	0.40
	Avg. Speed (kph)	79	75.5	75.1	-0.40
	Traffic (pcu.kms)	768.8	995.3	1013.3	18.00
Westbound	Travel Time (secs)	120.6	92.3	93.6	1.30
	Avg. Speed (kph)	45.7	59.7	58.9	-0.80
	Traffic (pcu.kms)	932.5	1292.1	1334.7	42.60

Table 9-5: Route 3 summary statistics, AM Peak

Direction	Metric	2016 PM Core	2031 PM Core	2031 PM Development	2031 Dev-2031 Core
Eastbound	Travel Time (secs)	68.1	87.4	92.7	5.30
	Avg. Speed (kph)	76.1	63	59.4	-3.60
	Traffic (pcu.kms)	905.9	1504.2	1639.8	135.60
Westbound	Travel Time (secs)	199.2	94.5	96.3	1.80
	Avg. Speed (kph)	27.6	58.3	57.2	-1.10
	Traffic (pcu.kms)	951.6	1374.8	1429.6	54.80

Table 9-6: Route 3 summary statistics, PM Peak

Route 4

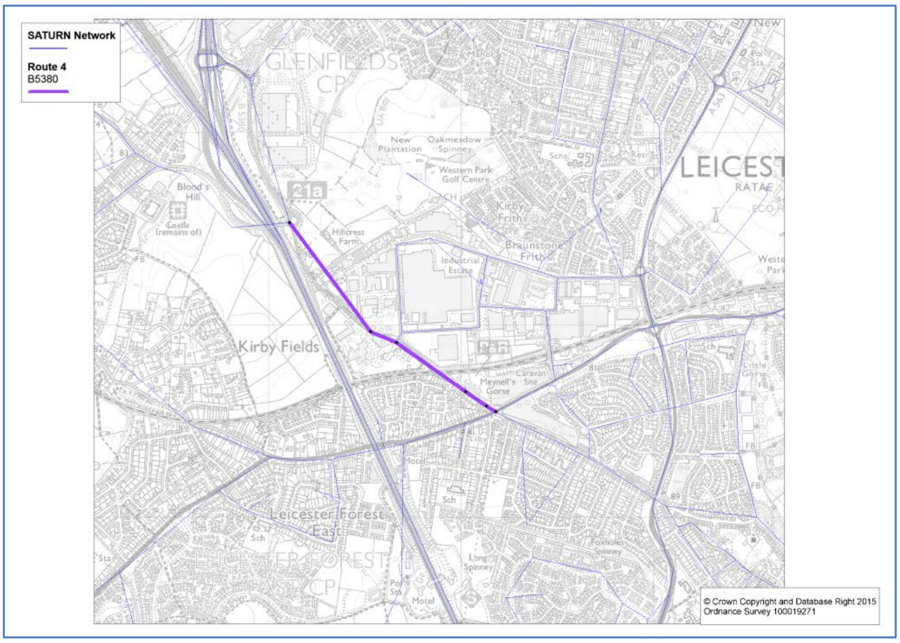


Figure 9-12: B5380, Ratby Lane between the A47 and the roundabout to Kirby Muxloe

Direction	Metric	2016 AM Core	2031 AM Core	2031 AM Development	2031 Dev-2031 Core
Northbound	Travel Time (secs)	135.1	140.3	141.1	0.80
	Avg. Speed (kph)	40.6	39.1	38.9	-0.20
	Traffic (pcu.kms)	568.4	752.7	775.3	22.60
Southbound	Travel Time (secs)	186	208.8	195.8	-13.00
	Avg. Speed (kph)	29.5	26.3	28	1.70
	Traffic (pcu.kms)	1414.8	1591.4	1537	-54.40

Table 9-7: Route 4 summary statistics, AM Peak

Direction	Metric	2016 PM Core	2031 PM Core	2031 PM Development	2031 Dev-2031 Core
Northbound	Travel Time (secs)	177.2	198.8	195.5	-3.30
	Avg. Speed (kph)	31	27.6	28.1	0.50
	Traffic (pcu.kms)	982.8	1014.9	1015.1	0.20
Southbound	Travel Time (secs)	216	332.9	326.9	-6.00
	Avg. Speed (kph)	25.4	16.5	16.8	0.30
	Traffic (pcu.kms)	801.2	1064.5	1049.7	-14.80

Table 9-8: Route 4 summary statistics, PM Peak

Route 5

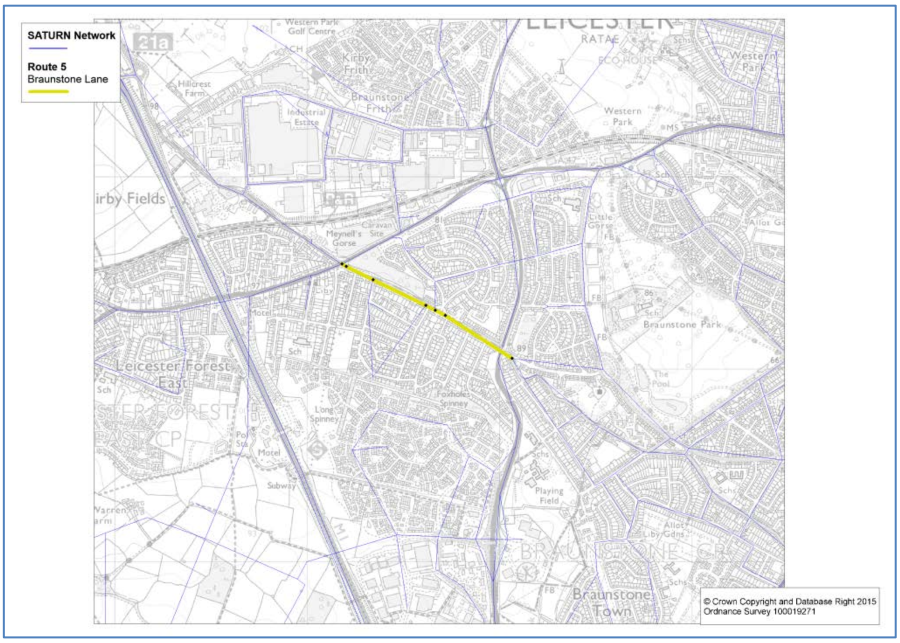


Figure 9-13: Braunstone Lane, between the A47 and the bridge over the A563 (Lubbesthorpe Way)

Direction	Metric	2016 AM Core	2031 AM Core	2031 AM Development	2031 Dev-2031 Core
Northbound	Travel Time (secs)	428.8	542.1	545.4	3.30
	Avg. Speed (kph)	8.7	6.9	6.8	-0.10
	Traffic (pcu.kms)	198.4	202.2	205.3	3.10
Southbound	Travel Time (secs)	110.6	115.7	115.7	0.00
	Avg. Speed (kph)	33.6	32.1	32.1	0.00
	Traffic (pcu.kms)	620.1	713.3	711.4	-1.90

Table 9-9: Route 5 summary statistics, AM Peak

Direction	Metric	2016 PM Core	2031 PM Core	2031 PM Development	2031 Dev-2031 Core
Northbound	Travel Time (secs)	192.9	210.6	209.6	-1.00
	Avg. Speed (kph)	19.3	17.6	17.7	0.10
	Traffic (pcu.kms)	626.9	540.7	537.2	-3.50
Southbound	Travel Time (secs)	104.4	105.8	106	0.20
	Avg. Speed (kph)	35.6	35.1	35.1	0.00
	Traffic (pcu.kms)	423.5	473.7	481.8	8.10

Table 9-10: Route 5 summary statistics, PM Peak

Route 6

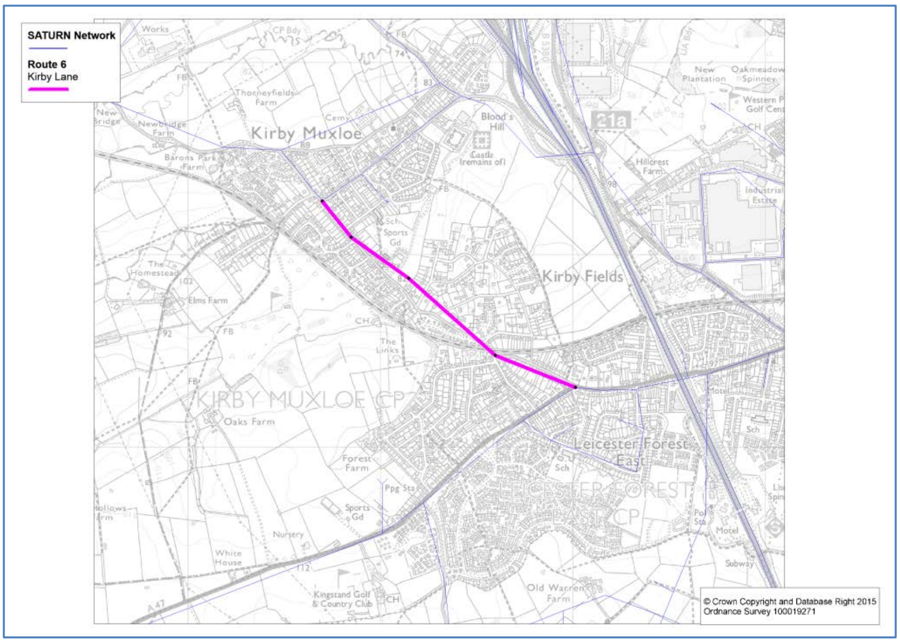


Figure 9-14: Kirby Lane near to the A47

Direction	Metric	2016 AM Core	2031 AM Core	2031 AM Development	2031 Dev-2031 Core
Northbound	Travel Time (secs)	141.2	142.9	144.2	1.30
	Avg. Speed (kph)	44.1	43.5	43.2	-0.30
	Traffic (pcu.kms)	884.3	968.4	1030.5	62.10
Southbound	Travel Time (secs)	265.1	330.1	338.3	8.20
	Avg. Speed (kph)	23.5	18.8	18.4	-0.40
	Traffic (pcu.kms)	518	519.3	513.1	-6.20

Table 9-11: Route 6 summary statistics, AM Peak

Direction	Metric	2016 PM Core	2031 PM Core	2031 PM Development	2031 Dev-2031 Core
Northbound	Travel Time (secs)	138.6	142.8	143	0.20
	Avg. Speed (kph)	44.9	43.6	43.5	-0.10
	Traffic (pcu.kms)	727	943.6	946.2	2.60
Southbound	Travel Time (secs)	168.5	278	269.1	-8.90
	Avg. Speed (kph)	36.9	22.4	23.1	0.70
	Traffic (pcu.kms)	610.4	693	786.2	93.20

Table 9-12: Route 6 summary statistics, PM Peak

Route 7

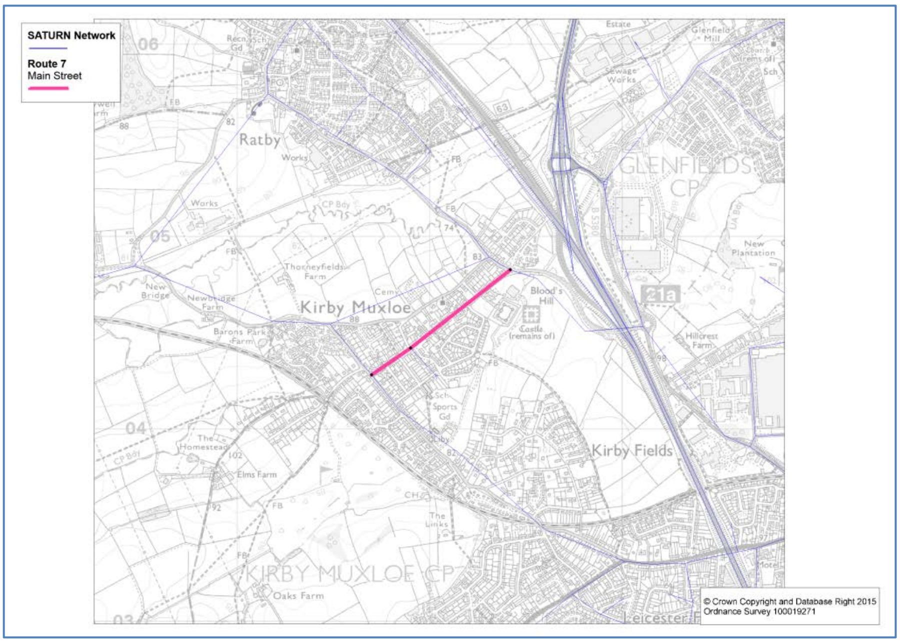


Figure 9-15: Main Street, Kirby Muxloe

Direction	Metric	2016 AM Core	2031 AM Core	2031 AM Development	2031 Dev-2031 Core
Eastbound	Travel Time (secs)	79.9	80.1	80.7	0.60
	Avg. Speed (kph)	41.2	41.1	40.8	-0.30
	Traffic (pcu.kms)	663	666.4	691.7	25.30
Westbound	Travel Time (secs)	71.8	72.2	72.4	0.20
	Avg. Speed (kph)	45.9	45.6	45.5	-0.10
	Traffic (pcu.kms)	231.9	264.4	278	13.60

Table 9-13: Route 7 summary statistics, AM Peak

Direction	Metric	2016 PM Core	2031 PM Core	2031 PM Development	2031 Dev-2031 Core
Eastbound	Travel Time (secs)	75.4	77.1	77.5	0.40
	Avg. Speed (kph)	43.7	42.7	42.5	-0.20
	Traffic (pcu.kms)	381.1	445.6	446.2	0.60
Westbound	Travel Time (secs)	75.1	74.7	75.3	0.60
	Avg. Speed (kph)	43.9	44.1	43.8	-0.30
	Traffic (pcu.kms)	422.9	406.2	434.9	28.70

Table 9-14: Route 7 summary statistics, PM Peak

Route 8

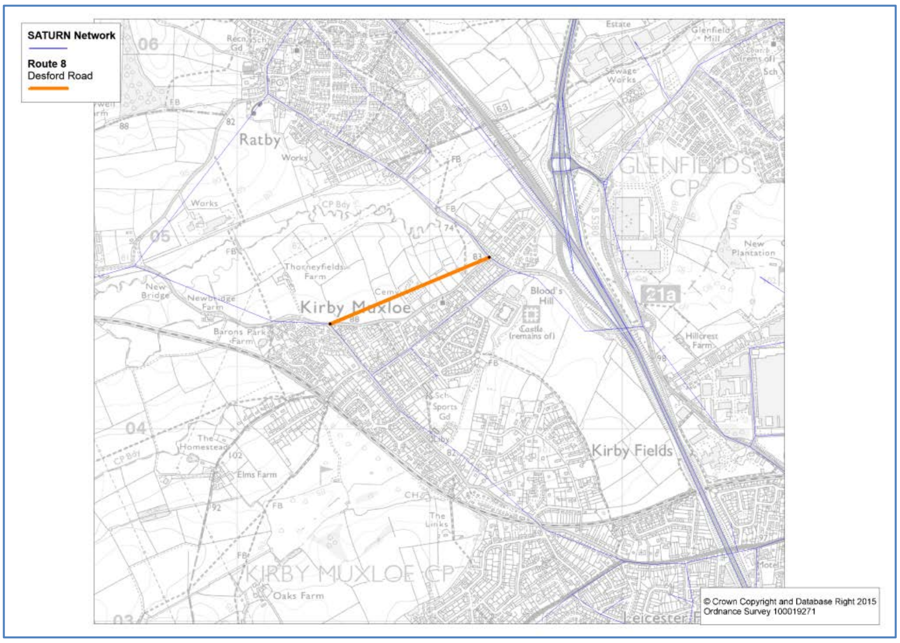


Figure 9-16: Desford Road, Kirby Muxloe

Direction	Metric	2016 AM Core	2031 AM Core	2031 AM Development	2031 Dev-2031 Core
Eastbound	Travel Time (secs)	68.6	68.7	69	0.30
	Avg. Speed (kph)	47	47	46.7	-0.30
	Traffic (pcu.kms)	219.2	229.3	258.4	29.10
Westbound	Travel Time (secs)	68.3	70.3	70.6	0.30
	Avg. Speed (kph)	47.3	45.9	45.7	-0.20
	Traffic (pcu.kms)	187.8	352.8	376.8	24.00

Table 9-15: Route 8 summary statistics, AM Peak

Direction	Metric	2016 PM Core	2031 PM Core	2031 PM Development	2031 Dev-2031 Core
Eastbound	Travel Time (secs)	67.7	68.8	68.8	0.00
	Avg. Speed (kph)	47.7	46.9	46.9	0.00
	Traffic (pcu.kms)	114.2	243.3	243.7	0.40
Westbound	Travel Time (secs)	68.4	69.1	69.4	0.30
	Avg. Speed (kph)	47.2	46.7	46.5	-0.20
	Traffic (pcu.kms)	201.1	269	290.6	21.60

Table 9-16: Route 8 summary statistics, PM Peak