Milton Keynes Multi-Modal Model

Impacts of Plan:MK

Milton Keynes Council

Project Number: 60516496

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Quality information

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1.1 Introduction

1.1.1 Milton Keynes Council (MKC) commissioned AECOM to update the Milton Keynes Multi-Modal Model (MKMMM) in advance of the need for its use to test alternative planning options for Plan:MK. The main purpose of the model was to provide a robust means of assessing alternative land-use options and development phasing and for this to withstand public scrutiny.

1.2 Report Purpose

1.2.1 The MKMMM work in relation to Plan:MK can be split into three main stages:

- Update and develop the 2016 base year multi-modal model;
- Model and assess the 2031 "Reference Case" scenario; and
- Model and assess the 2031 Plan:MK scenarios.

1.2.2 This report covers the third of these stages, developing the Scenario 1 and Scenario 2 models. Two additional scenarios, referred to as Scenario 2a and Scenario 2b, were also created for specific assessments and these are also described in this report.

1.3 Plan:MK

Scenario 1

1.3.1 Plan: MK Scenario 1 consisted of:

- 4,620 homes within Milton Keynes urban area;
- an additional 1000 homes at land north of the railway line within the South Eastern Milton Keynes Allocation (SEMK1); and
- 4,254 jobs which were allocated in South Caldecotte.

1.3.2 No additional infrastructure is planned as part of the development sites.

Scenario 2

1.3.3 Over and above Scenario 1, Plan:MK Scenario 2 consisted of:

- A further 2,000 homes at land south of the railway line within the South East Milton Keynes Allocation (SEMK2);
- 2,998 homes to the East of the M1;
- 56 homes in the Milton Keynes urban area;
- 6,330 jobs included in the East of M1; and
- 918 further/higher education jobs within central Milton Keynes.

1.3.4 Both the East of M1 site and the land south of the railway in South East Milton Keynes are associated with new highway network, including a new bridge over the M1 and a new bridge over the railway line in south east Milton Keynes.

1.4 Modelling Software

1.4.1 Highway trips were modelled using the SATURN modelling software package. As it is not possible to model public transport in SATURN, public transport trips were modelled using another modelling package called Emme. The demand modelling was also run using Emme. A customised version of the Department for Transport's Trip end model, CTripEnd, was used to produce forecast 2031 trip ends.

1.5 Supply and Demand Forecast Scenarios

1.5.1 The 2031 forecast trip ends were calculated using the trip end model containing household, jobs, population and car ownership data. Forecast figures for these data sets were produced using two different approaches:

- Within Milton Keynes district the housing and jobs growth data provided by MKC for each Scenario was used along with changes in the population and car ownership between 2016 and 2031 from the DfT National Trip End Model (NTEM) version 7.2.
- The housing and jobs growth for the SWMK development in Aylesbury Vale was also input explicitly with other growth in Aylesbury Vale constrained as much as possible to NTEM
- NTEM 7.2 forecast figures were used elsewhere for the housing, jobs, population and car ownership data.

1.5.2 An Uncertainty Log was developed in association with officers at MKC and this was used to derive future supply in terms of road and rail infrastructure schemes deemed appropriate to include based on the likelihood of them being implemented. These schemes were added to the base year networks to create the reference case networks.

1.6 Variable Demand Modelling

1.6.1 To estimate the effects of changes in infrastructure and in travel costs on patterns of demand, the 2031 trip ends produced from the trip end model were input into the variable demand model which was run using both the highway and public transport forecast model networks.

1.6.2 In the highway model the forecast 'real' values of time increase between the 2016 base year and forecast years whereas there is a forecast reduction in vehicle operating cost, due to expectation that vehicles will continue to become more efficient. For public transport a 1% real terms increase in fares per year was assumed.

1.7 Volume over Capacity Ratios and Traffic Flows

Introduction

1.7.1 Capacity issues (where V/C exceeds 85%) at junctions and links are generally concentrated in peak time periods, which means that for most of the day during the inter-peak, off-peak and at weekends the network in Milton Keynes runs within theoretical capacity.

1.7.2 This section therefore concentrates on the AM and PM peak V/C values identified for:

- 2031 Reference Case
- Impacts of Plan MK over and above the Reference Case

The Reference Case

1.7.3 As a result of the greater jobs growth than housing growth forecast in the 2031 Reference Case, the model indicated that car journeys from the rest of Milton Keynes to central Milton Keynes increase by 28% between 2016 and 2031, with car journeys from outside Milton Keynes to central Milton Keynes increasing 46%.

1.7.4 The Reference Case shows a general worsening of the situation in both peaks. The entry point links referred to above are generally more 'stressed' alongside the internal MK Central network due to the greater level of in-commuting from outside of Milton Keynes.

1.7.5 Of the entry links:

- The A421 junctions are more overloaded in both the AM and PM peaks, though now worse in the PM Peak.
- The A5 links and junctions are showing V/C ratios in excess of 85% in part because traffic seeks alternative options into Milton Keynes as well as the general growth in traffic on the network. The southern entry links are also starting to exceed the V/C threshold. This issue is more pronounced, particularly to the northern area of Central MK in the AM Peak.
- The A509 from Chicheley Hill Roundabout and down to M1 Junction 14 are more overloaded and more junctions along the A422 are showing over capacity issues.
- M1 J14 in particular shows a greater level of congestion than in the Base Year with increased congestion forecast at Northfield Roundabout, the next junction towards central Milton Keynes.
- In the Reference Case the current proposed mitigation schemes at Dansteed Way (Crownhill) and Portway (Loughton) show some entry link V/C's in excess of 85% however it is likely that further design changes based on current forecast flows will resolve these issues.
- The Child's Way junction on Watling Street is overcapacity in both the AM and PM Peak (in addition to the A421 – Elfield Park Roundabout - already over capacity in the Base year).
- Although the Reference Case schemes at Brinklow and Monkston roundabouts provide additional capacity to help accommodate growth there, there are still delays modelled in the Reference Case. As with Loughton junction further design work based on current forecast flows is likely to resolve these issues. In addition some of the capacity issues appear to have migrated to Walnut Tree Roundabout on the A421.

1.7.6 More of central Milton Keynes links and junctions, particularly on its perimeter, are over capacity. Although congestion is worse in the PM than in the AM Peak, there is a notable reassignment of traffic around central Milton Keynes in the AM Peak. The modelling indicates northbound traffic heading to central Milton Keynes re-routes from Marlborough Street and Saxon Street to the A5, accessing central Milton Keynes from further north via Portway. This is a result of increased flow on Childs Way causing greater delays on approaches to its junctions through the central Milton Keynes area.

1.7.7 The Reference Case congestion issues outlined above are highlighted in Figure 1 which shows the maximum approach delay per vehicle, the sum of the delay per vehicle on each approach to the junction, and also the total vehicle delay, in 2031. This shows the greatest delay from either the AM or PM peaks.

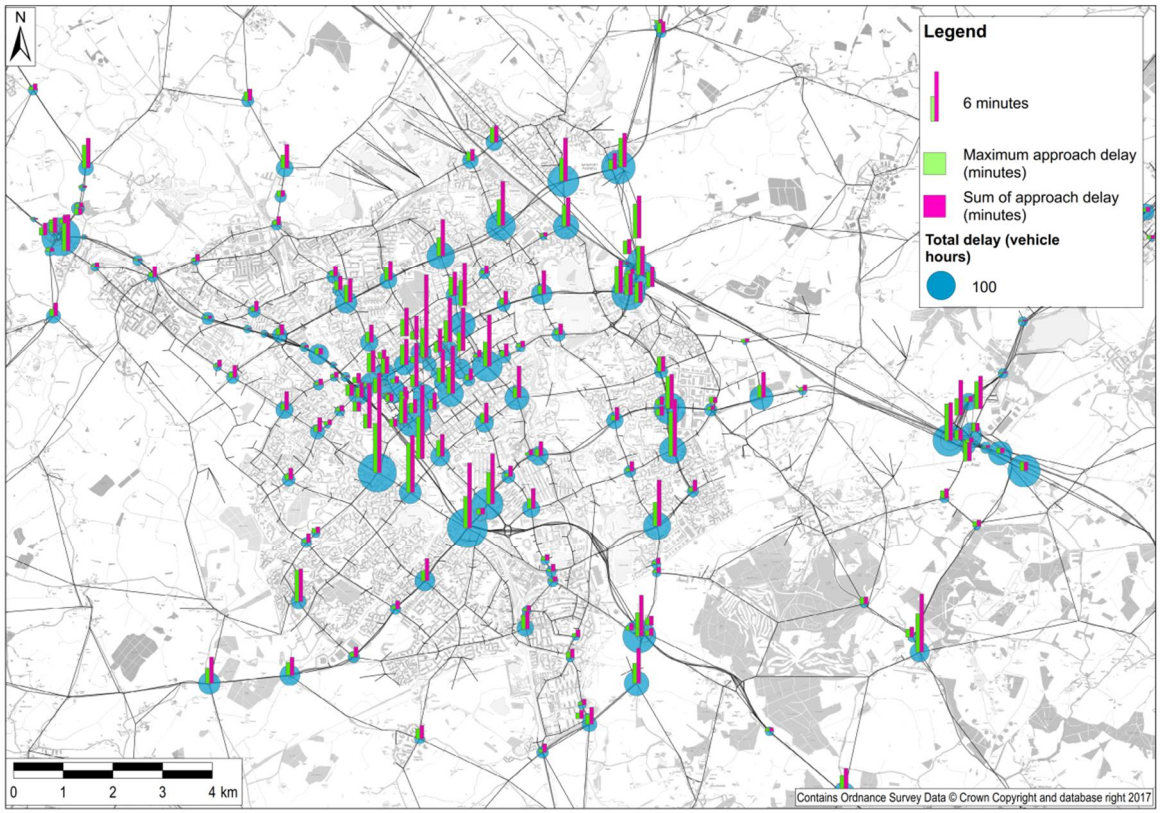


Figure 1. Junction delays 2031 Reference Case

2031 Plan:MK

1.7.8 The Plan:MK scenarios have generally been compared against the Reference Case scenario to determine and describe their traffic impacts over and above those of the Reference Case described above.

1.7.9 **Plan:MK Scenario 1** has little impact on traffic flows with the impact in the locality of the South East Milton Keynes Allocation (SEMK1) and the South Caldecotte employment site. This in turn has had a similar impact on congestion in the network with impacted junctions in the same area. The impact in terms of delay at congested junctions is shown in Figure 2.

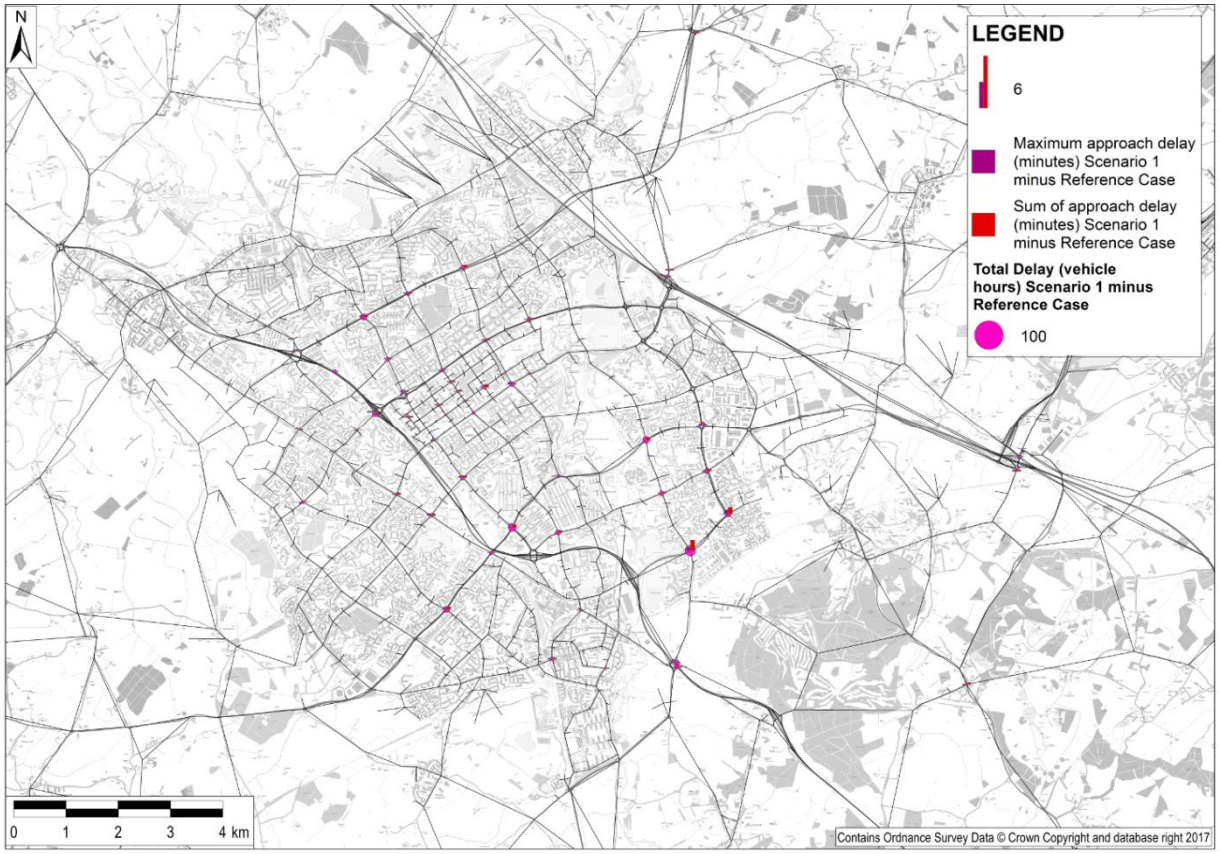


Figure 2. Change in junction delay at congestion hot spots – Scenario 1 minus Reference Case

1.7.10 **Plan:MK Scenario 2** has the most significant impact over and above the Reference Case. The additional road network for larger growth within the South East Milton Keynes Allocation (SEMK1 and SEMK2) and the East of M1 developments help mitigate some of the impacts of the additional traffic generated by these developments though the impact on surrounding junctions can still be seen in Figure 3. There is also a general increase in traffic volumes across Milton Keynes causing increased congestion that is not in the immediate locality of the additional developments such as around Central Milton Keynes and at junctions along A422, V10 and V11.

1.7.11 Many of the junctions experiencing worsening congestion were already identified in the Reference Case as having congestion issues as defined by their flow to capacity ratio. The extent to which these are exacerbated by Plan:MK Scenario 1 and Scenario 2 is described more fully in Table 1.

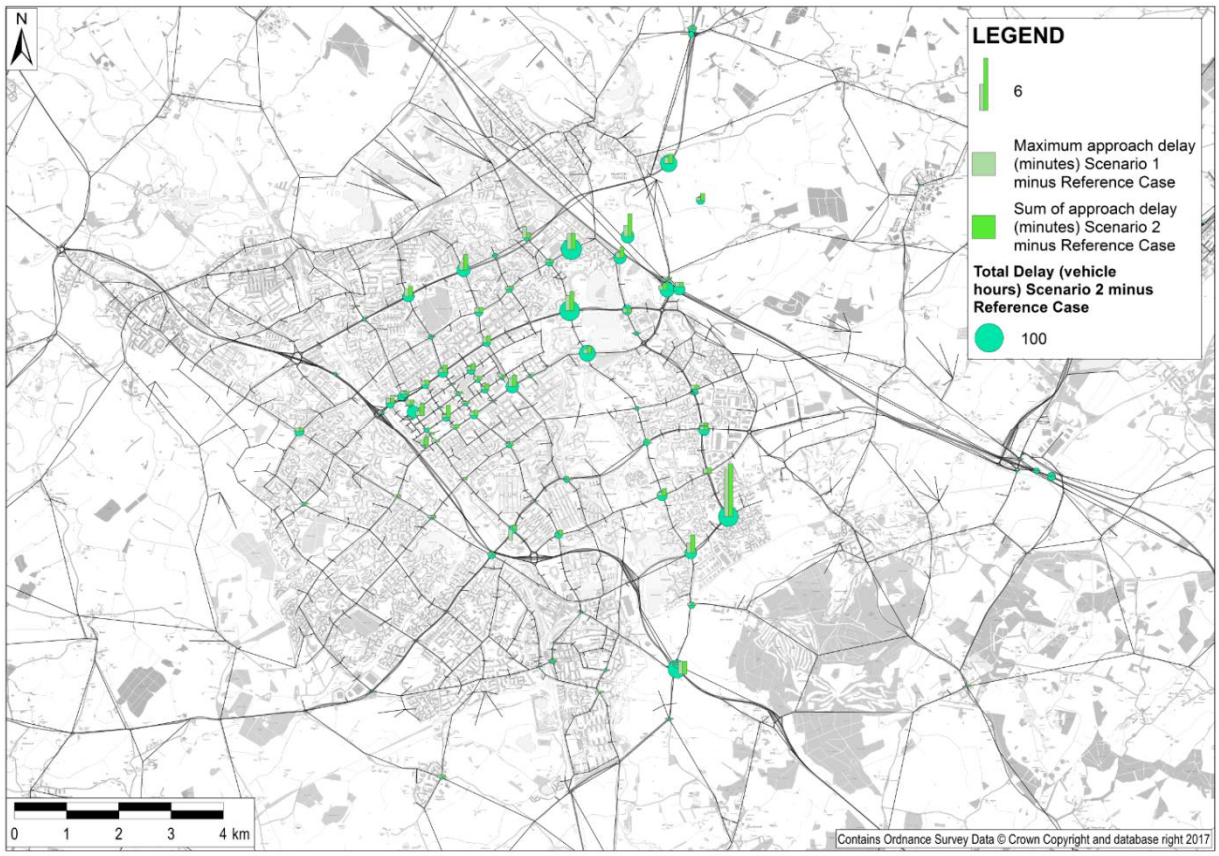


Figure 3. Change in junction delay at congestion hot spots – Scenario 2 minus Reference Case

Table 1. Forecast congestion issues caused by Plan:MK

Junction	Reference Case	Scenario 1	Scenario 2a	Scenario 2
Pagoda Roundabout	Congestion on all junction approaches except eastbound approach.	Comparable to Reference Case.	Comparable to Reference Case.	Congestion now on all approaches.
V10/H6	Congestion on Westbound and southbound approaches.	Comparable to Reference Case.	Comparable to Reference Case.	Congestion on westbound and southbound approaches and now also northbound approach.
Kent's Hill Roundabout	Congestion on all junction approaches except westbound approach.	Congestion now also on westbound approach.	Comparable to Reference Case.	Congestion now also on westbound approach.
V10/H9 Roundabout	Congestion on northbound approach, minor congestion modelled on southbound approach.	Congestion now also on westbound approach.	Congestion now also on westbound and southbound approaches.	Congestion now also on westbound and southbound approaches.

Junction	Reference Case	Scenario 1	Scenario 2a	Scenario 2
Dansteed Way/Hopper Street	Westbound approach at capacity.	Comparable to Reference Case.	Comparable to Reference Case.	Westbound approach now congested.
Brown's Wood Roundabout	Congestion on eastbound approach.	Southbound and westbound approaches now also congested.	Congestion now on all approaches.	Congestion now on all approaches.
Walnut Tree Roundabout	Congestion on all approaches except northbound approach.	Congestion now on all approaches.	Congestion now on all approaches.	Congestion now on all approaches.
South Witan Roundabout	Congestion on northbound and eastbound approaches.	Comparable to Reference Case.	Comparable to Reference Case.	Congestion now on westbound approach.
Redbridge Roundabout	Congestion on all approaches except northbound approach.	Comparable to Reference Case.	Comparable to Reference Case.	Worse congestion on all approaches, northbound approach now congested.
South Grafton Roundabout	Congestion on all approaches except northbound approach.	Comparable to Reference Case.	Comparable to Reference Case.	Congestion on all approaches as Reference case but southbound approach significantly worse.
Standing Way/ V1 / Buckingham Rd Roundabout	Eastbound and southbound approaches congested.	Northbound approach now also congested.	Northbound approach now also congested.	Northbound approach now also congested.
Emerson Roundabout	Congestion on southbound and eastbound approach.	Comparable to Reference Case.	Comparable to Reference Case.	Westbound and northbound approaches now congested.
Marina Roundabout	Congestion on southbound approach, eastbound approach nearing capacity.	Eastbound approach congested as well as southbound.	Eastbound approach congested as well as southbound.	Eastbound approach congested as well as southbound.
J14 SB on-slip	Congestion on link.	Comparable to Reference Case.	Comparable to Reference Case.	Significant worsening of congestion.

1.8 Travel Time and Average Speeds

1.8.1 Between 2016 and the 2031 Reference Case the model shows journey times increase in general across Milton Keynes with the exception of the M1 between J13 and J15 as a result of the All Lane Running scheme and on the A421 between J13 and Eagle Farm roundabout as a result of the dualling scheme. The reference case highway assignments show that the journey times across Milton Keynes increase on average by 14% and 15% in the AM and PM Peaks respectively and 5% in the Inter-Peak. In the simulation area average network speeds decrease by 10%, 4% and 8% in the AM, Inter-peak and PM respectively.

1.8.2 Both Scenarios 1 and 2 have negligible impact over and above the Reference Case, on the average network speeds across the simulation area of the model. In both Scenarios journey times along Brickhill Street between Kelly's Kitchen Roundabout and H10 are impacted due to the new access for the South Caldecotte employment site, and additional development in the South East Milton Keynes Allocation (SEMK1 and SEMK2). On average across all journey time routes there is little increase with 1% on average in AM and PM peaks in Scenario 1 compared to the Reference Case and an increase of 3% in the AM peak in Scenario 2 from the Reference case.

1.9 Model Limitations

1.9.1 It should be noted that:

- the Milton Keynes model is a strategic model where much of the highways trips internal to Milton Keynes (those that start and end within the Milton Keynes Cordon) are synthesised; i.e. based upon industry standard and accepted assumptions on trip generation rates using land use data;
- the model was not designed for use in a scheme specific assessment. For such an assessment it is recommended a revised forecast model would be produced from a recalibrated base year model using additional and more recent data and targeted to reflect a more specific geographical focus of resources and modelling effort; and
- the public transport model is, as per WebTAG guidance, an incremental model which means although it provides a good indication of travel patterns at a strategic level; it will not necessarily give a definitive view of the impact of public transport measures such as East West rail. Rather it is designed to assess impact of relatively small changes to existing services rather than the addition of a completely new service. It is therefore likely that the model may understate the impacts of new PT services and hence forecast PT trips may be higher than those indicated.

1.10 Conclusions

1.10.1 Plan:MK Scenario 1 has little impact over and above the Reference Case in terms of traffic flows and delays across the Milton Keynes urban area. Both M1 Junction 13 and Junction 14, although already experiencing issues of congestion in the Reference Case, are not significantly impacted by Plan:MK Scenario 1. Scenario 1 does however have a more notable impact around the South Caldecotte employment site and South East Milton Keynes Allocation (SEMK1 and SEMK2) with a number of junctions requiring further mitigation measures in addition to the mitigation required to address Reference Case issues.

1.10.2 Plan:MK Scenario 2 has more impact than Scenario 1 in line with the additional quantum of development, though this impact is still relatively small in relation to the 2031 Reference Case. The main impacts are in the vicinity of the South East Milton Keynes Allocation (SEMK1 and SEMK2) and the East of M1 development site, both these developments include new road infrastructure which help to mitigate some of the impacts of the additional traffic on the network, and in the case of East of M1 this new network has also helped alleviate some pressures on parallel routes. However the higher flows forecast in Scenario 2, particularly in relation to the East of M1 development, have resulted in new or additional congestion issues modelled around these development sites and further afield; with impacts on junctions in central Milton Keynes, and along the A422, V10 and V11 corridors.

2. Introduction and Overview

2.1 Study Background and Objectives

2.1.1 Milton Keynes Council (MKC) commissioned AECOM to update the Milton Keynes Multi-Modal Model (MKMMM) in advance of the need for its use to test alternative planning options for Plan:MK. The main purpose of the model was to provide a robust means of assessing alternative land-use options and development phasing and for this to withstand public scrutiny. The goal was to develop a "Reference Case" to enable testing of Plan:MK options. This required the model to be sufficiently well validated to a 2016 base year (compared to 2009 for the existing model) using additional and updated data sources.

2.1.2 It is also envisaged that the model will help to inform the development of the Milton Keynes Mobility Strategy document. As such the model will eventually also be required to inform bids for various kinds of transport infrastructure and other Milton Keynes initiatives though there is no specific current requirement to use the model to assess a major transportation scheme. It is likely that further development of the model will be required to provide a more robust evidence for such schemes as the model update has only initially been designed to inform the consideration of the impacts of Plan:MK options.

2.2 Report Structure

2.2.1 The MKMMM work in relation to Plan:MK can be split into three main stages:

- Update and develop the 2016 base year multi-modal model;
- Develop the forecast 2031 Reference Case; and
- Develop the 2031 Plan:MK scenario/s.

2.2.2 This report covers the third of these stages, describing how the 2031 Reference Case model has been adjusted and demand forecasting applied to create the forecast Plan:MK scenarios. The report has the following structure:

- Section 3: Overview of Base Year Model (Summary of previous work, description of the base year model set-up and key validation results);
- Section 4: Reference Case (the methodology, including details of the Uncertainty log, used in producing the reference case scenario and outcomes of the Reference Case)
- Section 5: Plan:MK Scenario 1 (overview of model inputs and outcomes of Scenario 1 model)
- Section 6: Plan:MK Scenario 2 (overview of model inputs and outcomes of Scenario 2 model)
- Section 7: Plan:MK Scenario 2a (overview of model inputs and outcomes of Scenario 2a model)
- Section 8: Plan:MK Scenario 2b (overview of model inputs and outcomes of Scenario 2b model)
- Section 9: Summary and Conclusions

3. Overview of Base Year Model

3.1 Introduction

3.1.1 This section gives a brief overview of the base year model. The underlying development of the base year highway and demand models is documented in the Local Model Validation Report (LMVR)[1], with the development of the Public Transport Model in the Public Transport LMVR Technical note[2].

3.2 Base Year Model Development

3.2.1 The requirement to update the model arose from the MKC's need to have a suitably robust evidence base upon which to test alternative planning options for Plan:MK.

3.2.2 The model was needed to be capable of assessing 'variable' demand impacts of trip re-distribution and frequency shift in addition to route choice. As such the highway assignment model was linked to a bespoke variable demand model.

3.3 Base Model Description and Specification

3.3.1 On the supply side, the existing highway model has been updated from 2009 to 2016 using SATURN version 11.3.12U. In addition to the updates the simulation network area was extended to better model the impacts of the proposed expansion areas. A public transport model sits alongside the highway model. The Milton Keynes Multi-Modal Model (MKMMM) public transport model was developed in INRO's Emme software, version 4.2.9, and covers both bus and rail modes. It is designed to model public transport in and around the Milton Keynes urban area.

3.3.2 On the demand side, a variable demand model has been developed using Emme to estimate the effects of changes in transport infrastructure and in travel costs upon patterns of demand. That is, the way travellers respond to changes in transport infrastructure other than choosing different routes which is forecast by the highway and public transport assignment models.

[1] MKMMM Local Model Validation Report v1.4, June 2017
[2] Milton Keynes Model Update - TN09 Public Transport LMVR v1, June 2017

3.4 Study Area

3.4.1 The model study area covers Milton Keynes and the proposed expansion areas.

3.4.2 For analysis purposes an area referred to as 'Milton Keynes urban area' was defined as shown in Figure 4, traffic zones within the Milton Keynes urban area were defined as internal and traffic zones outside were defined as external.

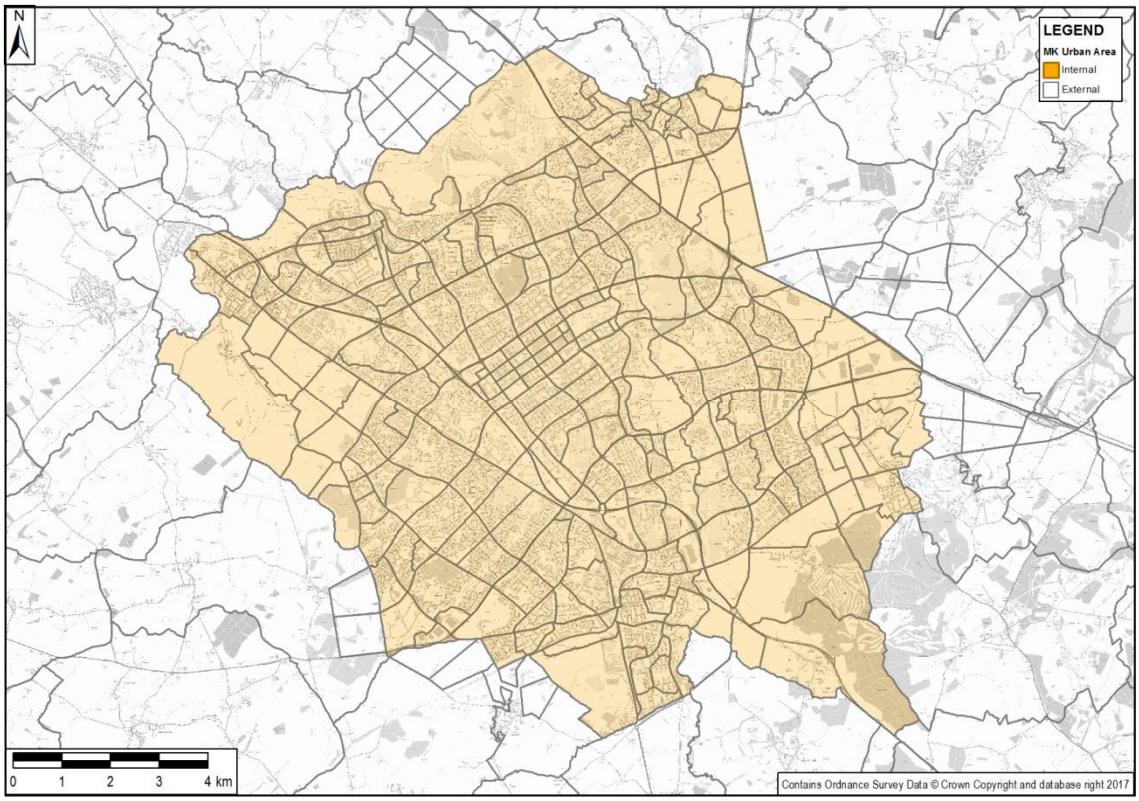


Figure 4. Milton Keynes Urban Area

3.5 Modelling Detail

3.5.1 The network and accompanying coding detail was split into three levels as shown in Figure 5:

- The simulation area which covered Milton Keynes and was extended to the north, east, south and west;
- The buffer network with speed flow curves which extended across the districts surrounding Milton Keynes; and
- The buffer network with fixed speeds which covered the network further beyond the hinterland around Milton Keynes.

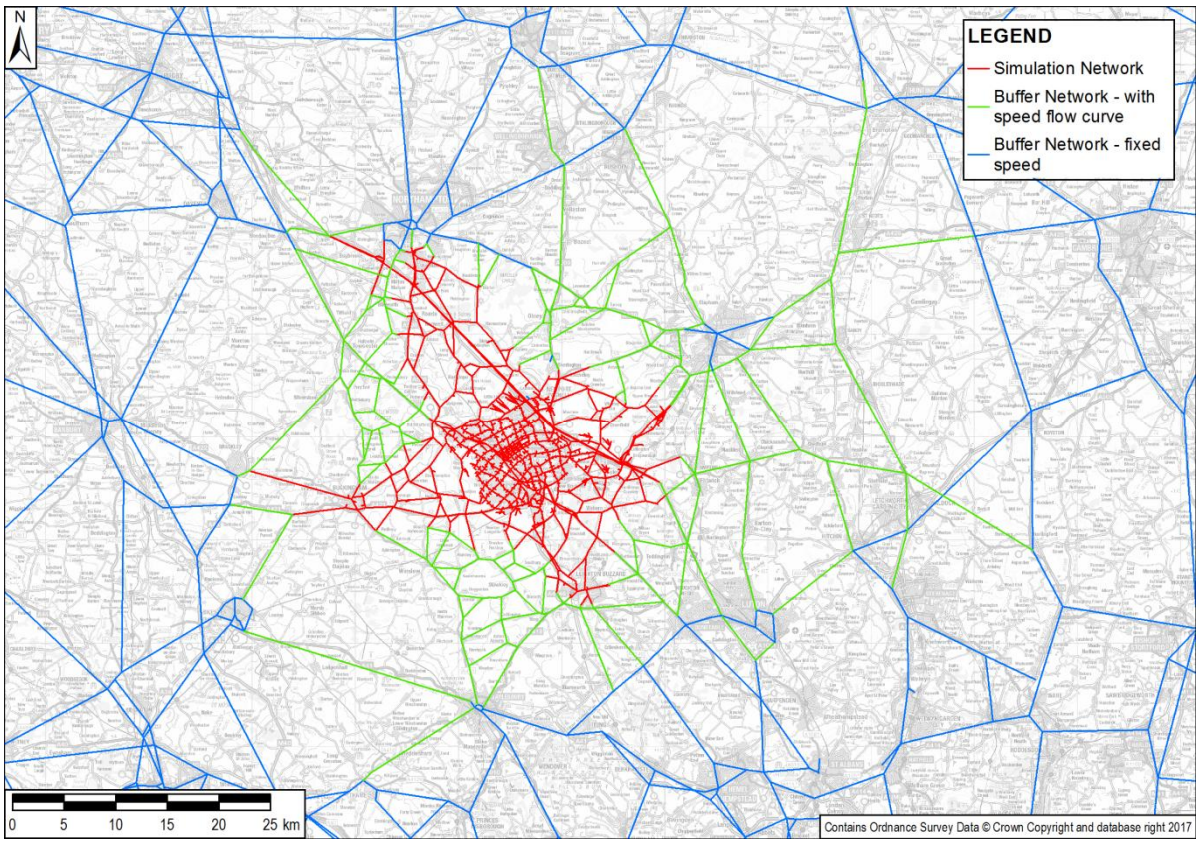


Figure 5. Network Coding Levels of Detail

3.5.2 The existing 2009 model zone system was revised, mostly in areas external to Milton Keynes, to be consistent with NTEM version 7, 2011 census and the SERTM (South-East Regional Traffic Model) zoning system. In addition zones in proposed development areas were disaggregated to provide a higher level of detail. There are 513 zones in the updated model, compared to 399[3] zones in the previous model, which are shown in Figure 6 and Figure 7.

[3] In the previous MKMMM there were a total of 523 zones but 124 of these were for representing future year developments of which only some 30 were actually used.

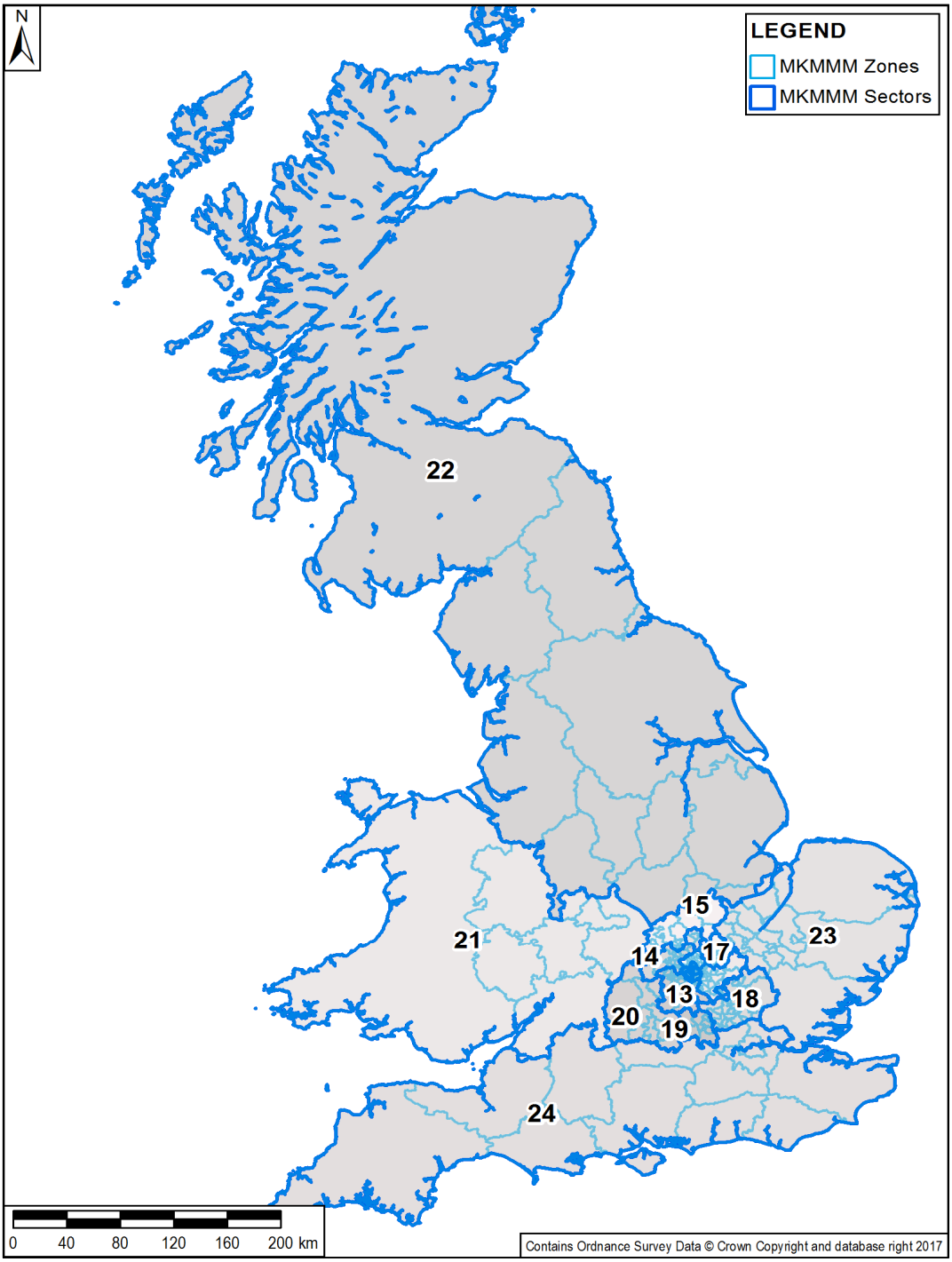


Figure 6. MKMMM Zone Plan Version 1.4 and Sectors – UK

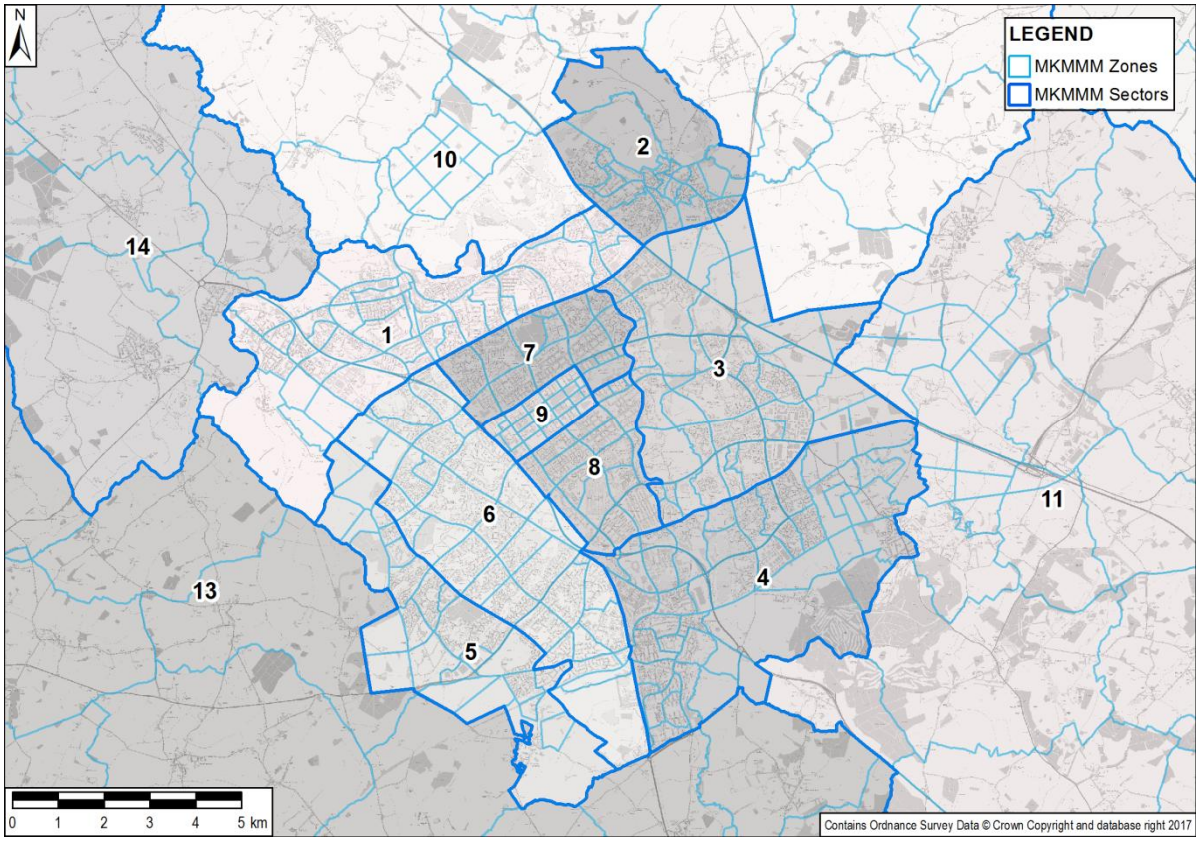


Figure 7. MKMMM Zone Plan Version 1.4 and Sectors – Milton Keynes Local Area

3.5.3 The highway network was updated to incorporate the revised zone system. At an early stage of the model updating the 2009 inter-peak matrices were converted to the revised zone system and assigned to generate initial 'travel skim' matrices for input to the matrix building process.

3.6 Time Periods

Highway Model

3.6.1 The updated base year highway model represents an average Monday to Thursday in June 2016 even though a significant amount of new traffic data were collected in autumn 2016. This was governed by the availability of Trafficmaster journey time data (data for autumn 2016 would not have been available in time to complete the model update) and disruption to the network caused by roadworks on the A421 between Kingston Roundabout and M1 J13 in spring 2016 which meant that a later neutral period was desirable.

3.6.2 The modelled time periods in the highway model remain unchanged as most historic MKC data has been collected for 60 minute periods commencing at the start of each hour. These periods being:

- AM peak – 0800-0900;
- Inter-peak – average of 1000-1600; and
- PM peak – 1700-1800.

3.6.3 Confirmation of these peak hours can be found in section 4 of the LMVR.

Public Transport Model

3.6.4 The public transport model represents an average hour within three periods during an average weekday in 2016. The three periods are the same as those represented within the highway assignment model; but in the AM Peak and PM Peak an average rather than peak hour is represented. The modelled time periods are therefore:

- an average AM period hour (07:00 to 10:00);
- an average Inter-peak hour (10:00 to 16:00); and
- an average PM period hour (16:00 to 19:00).

3.7 Highway User and Vehicle Classes

3.7.1 The SATURN model was built using the three vehicle classes based on what can be separately classified from traffic survey data i.e.:

- Cars;
- Light Goods Vehicles (LGV); and
- Heavy Goods Vehicles (HGV).

3.7.2 For model assignment purposes cars were defined as being one of three trip purposes, i.e. commuting, business or other. This resulted in there being five user classes for highway assignment purposes as shown in Table 2 along with their corresponding vehicle class:

Table 2: Model User and Vehicle Classes

User Class	Vehicle Class	Purpose
1	1	Car Commute
2	1	Car Employer's Business
3	1	Car Other
4	2	LGV
5	3	OGV

3.7.3 Bus routes and services in and around Milton Keynes were extracted from the Emme Public Transport Model and coded as fixed flows in the model.

3.8 Public Transport Modes of Travel

3.8.1 Table 3 below shows the transport modes represented within the MKMMM public transport model.

3.8.2 The external access mode '*e*' does not represent the speed of a specific mode of travel, but has a speed calibrated to broadly reproduce traveller behaviour as well as possible. '*e*' is used outside Milton Keynes only, and represents access to external rail stations (by a combination of car, walk, and bus modes).

Table 3. Transport Modes represented within the public transport Model

ID	Name	Type	Speed	Description
a	Auto	Auto	-	This was used only to enable turning data to be coded in the model, with car travel only modelled in the highway assignment model.
b	Bus	Transit	-	Bus services derived from Traveline National Dataset (TNDS)
r	Rail	Transit	-	National rail services
w	Walk	Aux	5 kph	Walk used for access to bus and pure walk trips
e	External	Aux	22 kph	External connectors to railway stations at motorised speed

3.9 Highway Model Assignment Algorithm and Method

3.9.1 The assignment of trips to the highway network was undertaken using a user-equilibrium assignment according to the first of Wardrop's principles, assumed to govern the routes chosen by drivers travelling from a given origin to a given destination.

3.9.2 This principle of equilibrium is such that: *'The journey times on all the routes actually used are equal and less than those which would be experienced by a single vehicle on any unused route*'.

3.9.3 User-equilibrium, as implemented in SATURN version 11.3.12, is based on the Frank-Wolfe algorithm, which employs an iterative process based on successive all-or-nothing assignments to generate a set of combined flows on links that minimise an objective function. The travel costs are re-calculated for each iteration and then compared to those from the previous iteration. The process is terminated when the costs obtained from successive iterations do not change significantly. At this point, the model is said to have converged to a pre-defined degree. The base model convergence as measured against WebTAG criteria was shown to be acceptable in Section 11 of the LMVR.

3.10 Public Transport Model Assignment Method

3.10.1 The MKMMM public transport model uses a frequency-based deterministic assignment method in which each desired destination is assigned a single optimal strategy. A strategy consists of a decision of what to do at every node in the model network, which may be to take an access / walk mode along a specific link, wait for the first service to arrive from a defined set of services calling at the node, or alight from a service.

3.10.2 The frequency-based nature of the model is suitable for strategic assessment in relatively high-frequency situations. This describes most local and urban bus services and rail services to and from London fairly well. Because actual timetables are not represented (only the average interval between buses and trains on a service) nor are passengers' desired departure times represented in detail below the 3 or 6 hour periods, this approach is not suitable for detailed operational or timetable planning, nor is it suitable for assessing very low frequency services where interchanges may occur.

3.10.3 Although rail and bus demand were developed separately, the demand for public transport was combined within the model and mode choices were made within the assignment process, via the Extended Transit Assignment module in Emme, which utilises strategies to implement mode and route choices.

3.10.4 Strategies enable travellers to choose from a set of attractive paths before embarking on a trip, and then lets the mode that arrives first at a stop determine which path (and mode) to take. The optimal strategy is the one which minimises the 'generalised cost' of travel between an origin and destination node.

3.11 Demand Model Validation

3.11.1 As required by WebTAG Unit M2, once a variable demand model has been constructed, it is essential to ensure that it behaves 'realistically', by changing various components of travel costs and times and checking that the overall response of demand accords with general experience. If it does not, then the values of the parameters controlling the response of demand to costs should be adjusted, within reasonable bounds, until an acceptable response is achieved. This recognises the large and unavoidable uncertainties in some of the parameter values, and the importance of reflecting local conditions in relative values.

3.11.2 A number of realism tests were undertaken to demonstrate that the modelled demand responses were plausible, both in the direction and scale of change.

3.11.3 12.11.5 WebTAG Unit M2 advises that three main realism tests should be carried out with elasticities within the appropriate corresponding range:

- **Car Fuel Cost Elasticity** is the percentage change in car vehicle kilometres with respect to the percentage change in fuel cost, and for a 10% increase in fuel cost should lie between -0.35 (high) and -0.25 (low);
- **Public Transport Trip Elasticity** is the change in public transport trips with respect to the change in public transport fare, and for a 10% increase in public transport fare should like between -0.20 and -0.90
- **Car Journey Time Elasticity** is the change in car trips with respect to the change in journey time, for a single iteration run of the demand model, and should be no stronger than -2.0.

3.11.4 The results of these tests were considered acceptable. Detailed results are given in section 12.11 of the LMVR and with headline figures summarised below:

- The outturn vehicle kilometre elasticity with respect to a 10% increase in fuel costs for car is marginally above the WebTAG range at -0.361 however excluding the M1 from the analysis the elasticity becomes -0.235 which is slightly below the WebTAG criteria. This shows the significant impact of demand on the M1 in terms of sensitivity. The traffic on the M1 is likely to be taking longer trips than local traffic and is therefore more sensitive to changes in fuel costs.
- The overall elasticity of public transport demand to a 10% increase in fares is -0.237, which is within the WebTAG range, and at the lower end of this range.
- The overall elasticity of car demand to a 10% increase in journey times is -0.063, which is within the WebTAG range of being negative and no greater in magnitude than 2.

3.12 Highway Model Validation

3.12.1 This section describes the main highway model calibration and validation outcomes that are presented in full in sections 10 and 11 of the LMVR.

3.12.2 The validation of the calibration counts for the highway assignment model is good. Post matrix estimation, the calibration sites that pass the flow or GEH criteria across the 142 sites that make up the calibration screenlines and cordons are as follows:

- AM: 134, 94%
- Inter-Peak: 140, 99%
- PM: 136: 96%

3.12.3 These compare favourably with the criteria that 85% of counts pass this flow test.

3.12.4 The model was validated using data independent from the matrices and assignments. Out of the 26 validation sites the following counts passed the flow or GEH criteria:

- AM: 13, 50%
- Inter-Peak: 11, 42%
- PM: 12, 46%

3.12.5 The corresponding results broken down by the four validation screenlines were as shown in Table 4, where again the percentages are the number of counts that pass the flow criteria and ideally 85%.

Table 4. Percentage of Counts on Each Validation Screenline Passing the WebTAG Flow Criteria

Validation Screenline	Number of Sites	DMRB or GEH 'pass' percentage		
		AM	Inter-Peak	PM
Northern SB	6	67%	50%	33%
Northern NB	6	33%	33%	67%
Railway EB	7	57%	29%	29%
Railway WB	7	43%	57%	57%

3.12.6 Table 5 summarises the total flows across the validation screenlines for which the WebTAG guidance gives a target of overall modelled flow ±5% of observed and a GEH below 4 across complete screenlines.

Table 5. Overall Screenline Observed/Modelled Flow Percentage Comparison and GEH

Validation Screenline	AM		Inter-Peak		PM	
	% Diff	GEH	% Diff	GEH	% Diff	GEH
Northern SB	1%	0.8	9%	5.0	-15%	10.3
Northern NB	-7%	5.1	2%	1.3	-14%	10.7
Railway EB	-3%	2.6	0%	0.3	-1%	0.8
Railway WB	-5%	4.4	1%	0.7	2%	2.4

3.12.7 Although the number of individual counts pass the flow of GEH criteria do not meet the WebTAG guidance, the overall screenline comparisons were within 15%. The grid system in Milton Keynes makes matching of observed flows particularly challenging. Due to the limited observed data, traffic survey and signal timings, the limited timescale and the strong flow calibration and journey time validation these results are acceptable.

3.12.8 The journey time validation was very good with 23 out of 24 routes in each of the time periods meeting the WebTAG standard of ±15% which equates to 96% of the routes passing considerably higher than the requirement of 85%.

3.12.9 The convergence criteria in WebTAG M3.1 were met for the 2016 base year model assignments.

3.12.10 Overall it was considered that the LMVR demonstrated that the Milton Keynes traffic model is sufficiently robust to be taken forward into the forecasting process at a strategic level. The report demonstrated that the MKMMM was able to replicate traffic volumes and travel times to a reasonable standard of accuracy. It is important to note that the model was not designed for use in a scheme specific economic assessment for which it is recommended the model would be recalibrated with additional and more recent data and targeted to reflect a more specific geographical focus of resources and modelling effort.

3.13 Public Transport Model Validation

3.13.1 This section briefly outlines the main public transport model calibration and validation as detailed in the Public Transport LMVR Technical note.[4]

3.13.2 Validation data for bus demand was only available for two sites:

- bus stops outside of Milton Keynes Central railway station (MKC) – data collected for a single weekday in December 2015; and
- bus stops around Milton Keynes Shopping centre (The Point) – data was collected during two weekdays in September 2016.

3.13.3 Table 6 shows the performance of the public transport assignment model when the assignment is undertaken using only the matrices derived from Arriva ETM data and the synthetic bus demand for unobserved services. This analysis highlights the performance of the bus matrices in isolation.

3.13.4 This analysis shows that, using an estimate of all-day flows based on the hourly counts and modelled flows, the model provides a good fit in terms of boarders and alighters at both Milton Keynes Central and The Point. Only alighters at Milton Keynes Central fail to meet the WebTAG criteria of ±25%.

3.13.5 There is more variation between modelled and observed flows when considering individual average hours represented within the model, with around 50% of counts meeting the WebTAG guidelines. It should be noted that there is significant uncertainty in terms of the observed data as the count at Milton Keynes Central is from a single day, and the count undertaken at The Point provided observed data for only a proportion of bus services at this location.

3.13.6 It should also be noted that all changes applied to the bus matrices, networks and assignment to achieve the validation results detailed in Table 6 were global (i.e. applied to the whole model). There is reason to expect, therefore, that the model may perform broadly similarly in other areas where we have no validation data.

[4]Milton Keynes Model Update - TN09 Public Transport LMVR v2, June 2017

Table 6. Comparison of Modelled and Observed Average Hour Bus Flows – Bus Matrix Assignment Only

	Site	AM	IP	PM	All Day
Boarding	MKC	-30%	51%	3%	7%
	The Point	-11%	40%	-3%	15%
Alighting	MKC	-40%	-22%	-35%	-32%
	The Point	11%	34%	-16%	16%

3.13.7 Table 7 shows the same comparison, but including the processed rail demand data within the assignment. The results of this comparison are not at the same level as with the assignment of bus demand only, and in particular there is a significant overstatement of bus boarders and alighters at Milton Keynes Central.

3.13.8 This is due to the specification of the public transport model whereby the choice between rail and bus modes is undertaken within the assignment. This therefore means that motorised access to rail stations is not represented, and access to rail stations must be undertaken either through walking or use of one of more bus services.

Table 7. Comparison of Modelled and Observed Average Hour Bus Flows – Bus & Rail Matrix Assignment

	Site	AM	IP	PM	All Day
Boarding	MKC	117%	239%	272%	213%
	The Point	11%	49%	13%	29%
Alighting	MKC	291%	127%	110%	181%
	The Point	36%	44%	2%	32%

3.13.9 Therefore, the majority of rail demand to / from Milton Keynes Central uses bus to access the station, whereas in reality it is assumed that a significant proportion of this demand would drive to the station. There is also the possibility of double-counting within the demand matrices, as passengers who bought both a rail and bus ticket would be included in both demand matrices.

3.13.10 If a motorised access mode was coded within the public transport assignment for access to / from railway stations, this would have to be coded with a faster travel time than the corresponding bus services in order to attract demand. However, this mode would be open to all demand and therefore would attract a significant amount of bus demand from bus services onto this motorised access mode.

3.13.11 On balance, Table 6 demonstrates that the underlying processing of the bus ticket data is valid, but Table 7 shows that there is an inconsistency between the specification of allowed modes within the public transport model and those allowed in reality. The impact of this issue is likely to be greatest at Milton Keynes Central, with a smaller impact away from railway stations.

3.14 Areas Considered

3.14.1 The trip end model is structured to allow explicit planning inputs to be entered for zones within the 'Internal' Area as shown in Figure 8.

3.14.2 In terms of development growth the primary area considered was Milton Keynes district, with strategic infrastructure schemes in the general vicinity also included, namely the M1 J11a / Dunstable Northern Bypass scheme.

3.14.3 In Aylesbury Vale, the South West Milton Keynes (SWMK) development was included due to its close proximity to Milton Keynes.

3.14.4 Originally it had been intended to input committed developments in other neighbouring districts in zones within the 'Internal' Area, however due to limited data being available (and quite often none), in part due to limited certainty on developments, due to differing formal planning time horizons, it was agreed that NTEM data should be used.

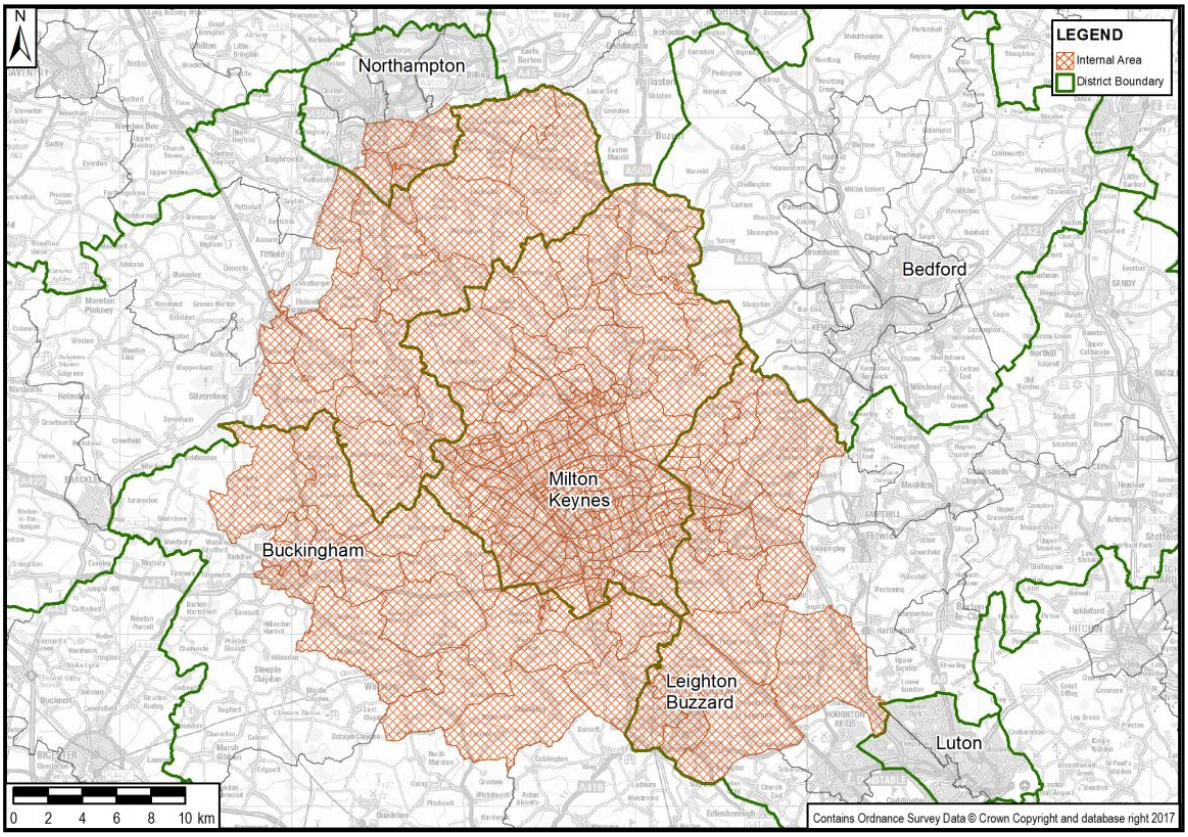


Figure 8. MKMMM 'Internal' Model Area

4. Reference Case

4.1 Introduction

4.1.1 This section of the report outlines the methodology used in producing the Reference case for the MKMMM model and the model outcomes.

4.1.2 The 2031 Reference Case scenario includes the currently planned growth in Milton Keynes district up to 2031 which includes in the region of 20,000 dwellings and 28,000 jobs with infrastructure that is expected to be in place by 2031. This growth is mostly within the currently adopted plan that extends to 2026. Plan:MK will include additional growth for the period to 2031 but modelling of that scenario is not included within this report.

4.1.3 Outside the Milton Keynes District TEMPRO growth has been applied. TEMPRO is DfT software that interrogates and computes information from their National Trip End Model (NTEM), projections in terms of demographic forecasts and trip end growth factors by traveller types. Its use to control overall forecasts ensures consistency across models nationally. Although different, the terms TEMPRO and NTEM are largely interchangeable and NTEM is the terminology generally used in this report.

4.2 Update to the Zone System

4.2.1 In the light of further information received on locations of Plan:MK growth, the zone system was updated to have a single zone representing South Caldecotte to better model the proposed Plan:MK development at that location and enable a true comparison against the Reference Case. As shown in Figure 9, this was achieved by aggregating zones 2046 and 2047 producing a larger zone 2046 and disaggregating zone 1556 with South Caldecotte now represented by zone 2047. This had negligible impact on the base year model as in 2016 no trips load from South Caldecotte.

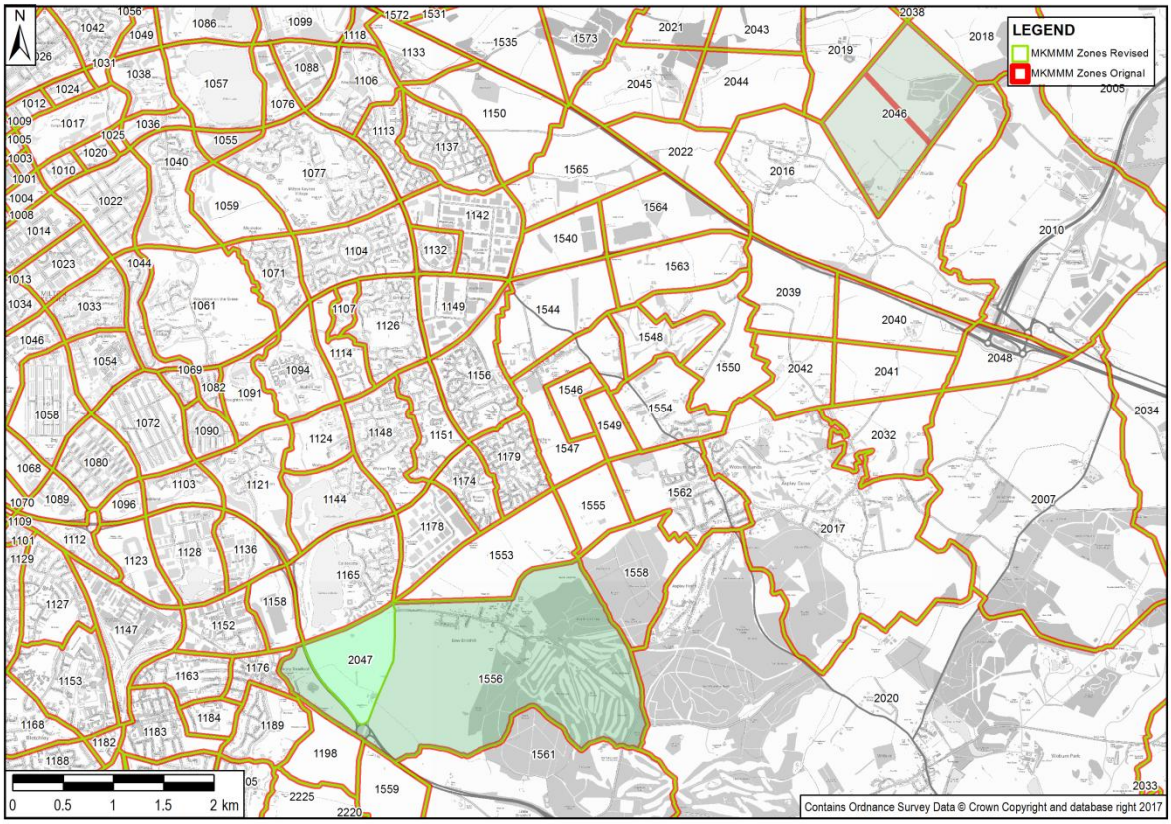


Figure 9. Updates to Zone System

4.3 Forecast Year

4.3.1 Plan:MK is intended to be delivered by 2031, as such the reference case has been built to represent this year.

4.4 Public transport and highway feedback

4.4.1 Due to the way in which MKMMM is constructed and the technical issues associated with applying a feedback loop to reflect changes in bus speeds arising from more or less highway car traffic, changes to bus speeds need to be made manually. After an initial run of the demand model the change in average speed for the highway simulation area was taken for each time period and then applied to the bus journey times. Changes were only applied on bus segments (links) within the extent of the highways simulation area. This was to prevent an unrealistic reduction in bus trips on long distance routes that start in the fixed speed buffer area in which link times are not impacted by level of flow.

4.4.2 For all the Plan:MK scenarios the same factors used in the Reference Case were applied. A check of model speeds for each of the Scenarios showed minimal change in average speed caused by the additional growth. As such a further iteration was not required.

4.5 Uncertainty Log

4.5.1 The purpose of the Uncertainty Log is to collate a list of future developments and scheme assumptions whilst applying a level of certainty as to how likely to be built. This is then used to inform the reference case scenario.

4.5.2 The Uncertainty Log created for this project was compiled following discussions with MKC. All the developments and schemes are categorised according to the likelihood of their construction using the four categories as outlined in WebTAG unit M4 Table A2. Although the terminology is slightly different in that WebTAG refers to a 'Core Scenario' in the context of a major infrastructure scheme or package rather than Reference Case, in essence they are the same in this case, in providing a forecast baseline or yardstick scenario from which to measure impacts of a 'Do Something' scenario intervention, which in this case is Plan:MK.

Table 8. Uncertainty Log Probability Classifications from WebTAG

Probability of Input	Status Definition	Core Scenario Assumption
Near certain (NC): The outcome will happen or there is a high probability that it will happen.	Intent announced by the proponent to regulatory agencies. Approved development proposals. Projects under construction.	This should form part of the Core Scenario.
More than likely (MTL): The outcome is likely to happen but there is some uncertainty.	Submission of planning or consent application imminent. Development application within the consent process.	This could form part of the Core Scenario.
Reasonably foreseeable (RF): The outcome may happen, but there is significant uncertainty.	Identified within a development plan. Not directly associated with the transport strategy/ scheme, but may occur if the strategy/ scheme is implemented. Development conditional upon the transport strategy/ scheme proceeding. Or, a committed policy goal, subject to tests (e.g. of deliverability) whose outcomes are subject to significant uncertainty.	These should be excluded from the Core Scenario but may form part of the alternative scenarios.
Hypothetical (H): There is considerable uncertainty whether the outcome will ever happen.	Conjecture based upon currently available information. Discussed on a conceptual basis. One of a number of possible inputs to an initial consultation process. Or, a policy aspiration.	These should be excluded from the Core Scenario but may form part of the alternative scenarios.

Source: WebTAG unit M4 Table A2. November 2014

4.6 Reference Case Growth

4.6.1 Planning data was provided by MKC for Milton Keynes district by model zone. In some instances there was a development that spanned multiple zones. In these cases it was assumed an even split of jobs and or dwellings across each zone within the development. Similarly if a development included multiple job categories, an even split was assumed. The dwellings growth is plotted by zone in Figure 10 and jobs growth by zone in Figure 11.

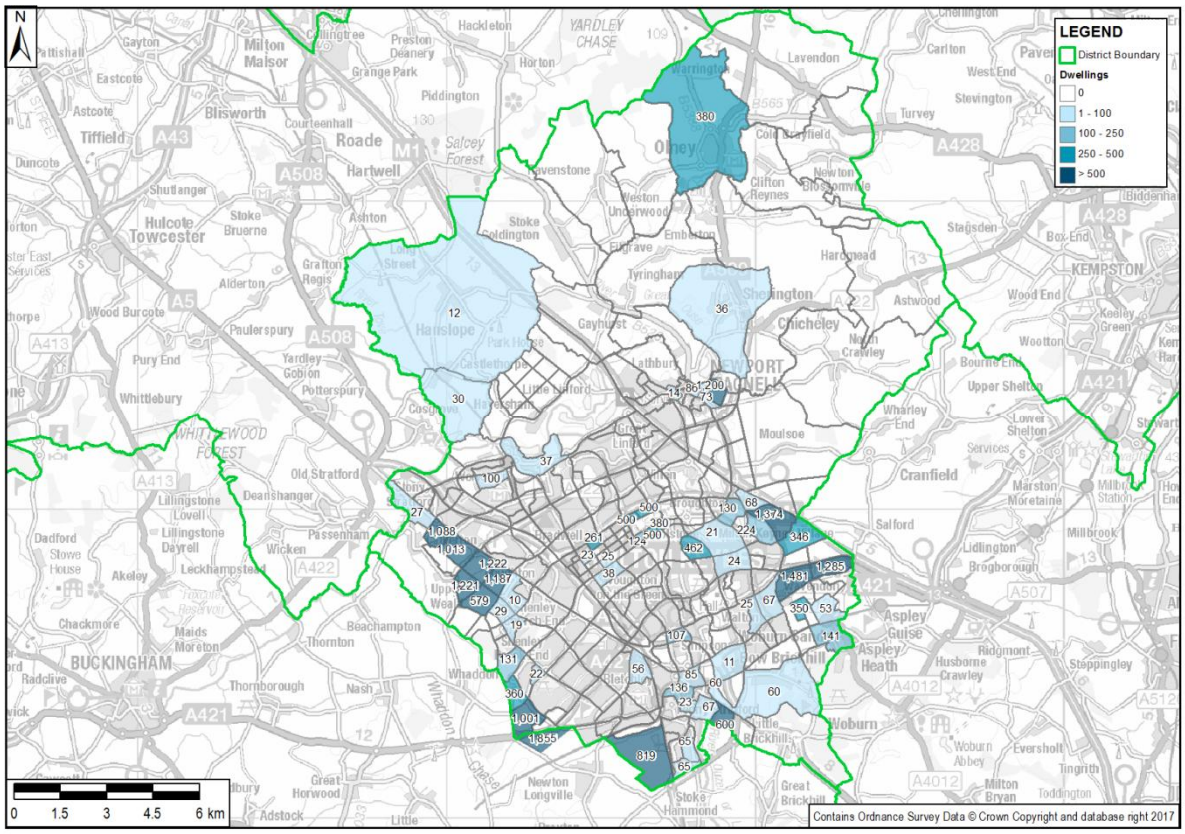


Figure 10. Dwellings Growth to 2031

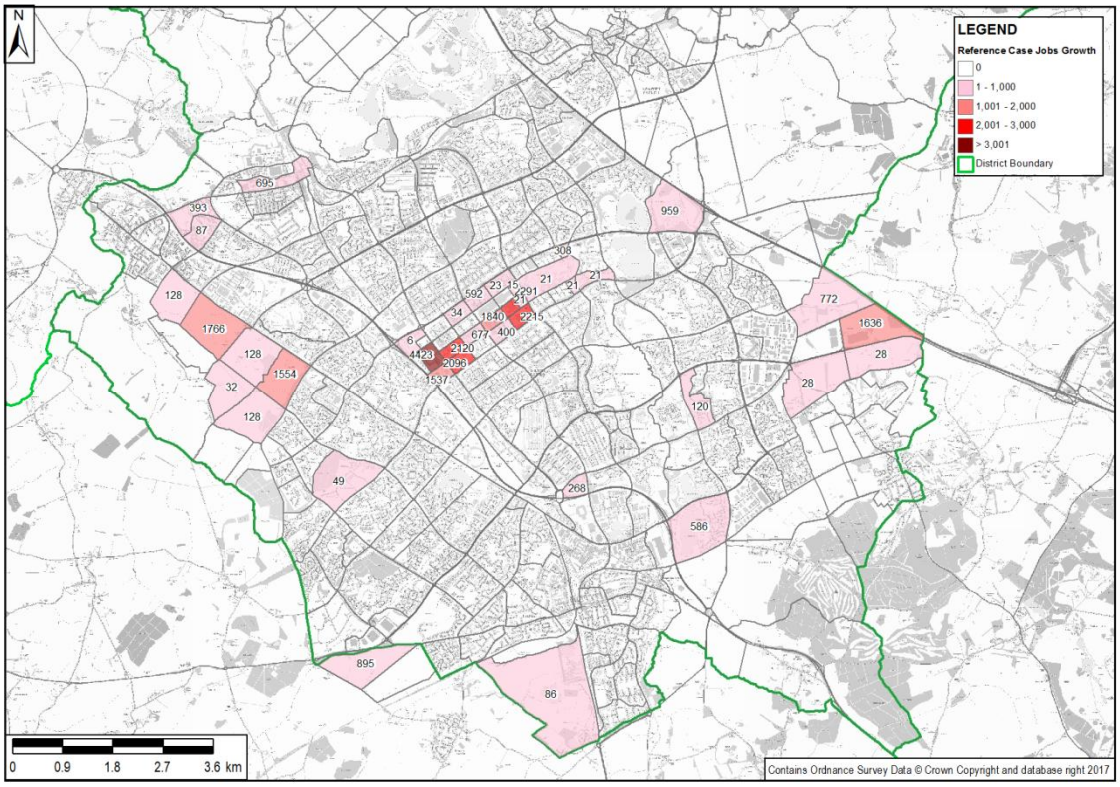


Figure 11. Jobs Growth to 2031

4.7 NTEM Adjustments for General Growth

4.7.1 As this assessment is for use in assessing the impacts of Plan:MK and not an economic appraisal of a specific scheme, the forecast growth provided by MKC has been used as given and has not been constrained to NTEM within Milton Keynes District.

4.7.2 However with the inclusion of SWMK development in Aylesbury Vale the remaining 'Internal' zones within Aylesbury Vale were constrained to NTEM in terms of dwellings growth. However, although the jobs growth was constrained as much as possible, due to the large jobs growth in SWMK there is a net increase across Aylesbury Vale in jobs growth of 160 above that of NTEM.

4.8 Modelled Schemes

4.8.1 The schemes listed in Table 9 and shown in Figure 12 are those included in the highway model. East-West rail was the only scheme added to the Public Transport Model. Apart from East-West Rail, no information was available on any proposed amendments to bus and rail services so PT routes and frequencies were assumed to remain the same as in 2016.

4.8.2 East-West rail was represented in the public transport model with the addition of hourly services in each direction between Oxford and Bedford, Oxford and Milton Keynes and between Aylesbury and Milton Keynes, all of which route via a new station added to the model at Winslow.

4.8.3 East-West rail is expected to increase the train frequency across the level crossings from one per hour in each direction to two per hour. This change was applied to the highway model by halving the cycle time, from 30 minutes to 15 minutes, at the signal nodes representing the

level crossings. The inter-green time (representing the barrier down time) was kept the same, but the total green time was reduced accordingly.

Table 9. Forecast Year Transport Schemes included in Reference Case

Scheme	Delivered by
A421 Dualling	By 2031
Monkston & Brinklow Junctions	2019
Crownhill & Loughton Junctions	2019
A5 Improvements	By 2031
Bletchley Station Highway Improvements	2017
Brooklands City Street Phase 2	2017
Nova City Street	2018
Calverton Lane/Fairways	2021
Kiln Farm Junction	2016
Bridge over Broughton Brook	2018
H10 Extension	2018
V2/H4 Extension	2021
East-West Rail	2024
M1 J13-J16 SMP	By 2031
M1 J16-J19 SMP	2021
M1 J11a / Dunstable Northern Bypass	2017

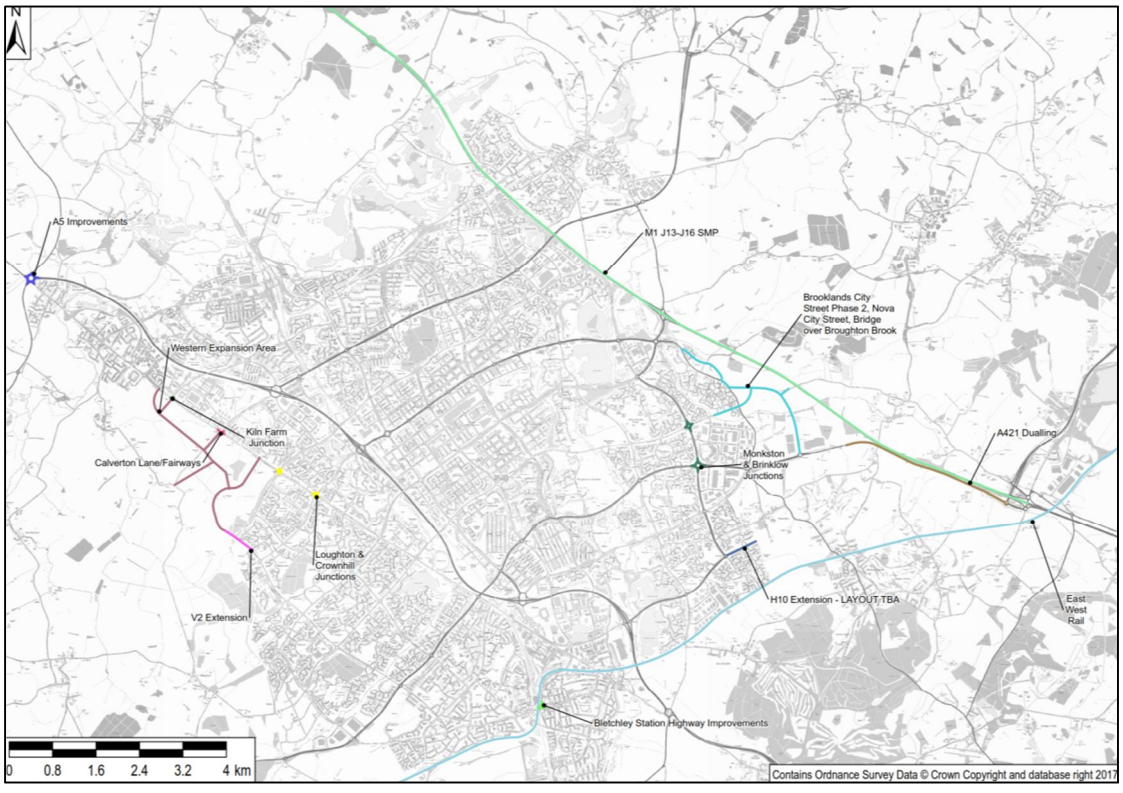


Figure 12. Uncertainty Log Schemes to 2031 included in Reference Case

4.9 Trip End Model Outputs

4.9.1 The trip end model produces 24 hour trip ends by mode:

- Car,
- PT and
- Active Mode,

4.9.2 and by purpose:

- Home based employers business (HBEB)
- Home based other (HBO)
- Home based work (HBW)
- Non-home based employers business (NHBEB)
- Non-home based Other (NHBO)

4.9.3 As shown in Table 10, within the Milton Keynes Urban Area, Car production trip ends increase the most, with growth in attractions comparable across each mode and higher than growth in productions. The large employment growth as resulted in this large increase in attractions.

Table 10. Comparison of 2016 and 2031 trip ends for zones within the MK Urban Area

Mode	Purpose	Total Daily Productions				Total Daily Attractions			
		2016	2031 Ref	2031 - 2016	% Diff	2016	2031 Ref	2031 - 2016	% Diff
Car	TOTAL	472,672	552,217	79,546	17%	665,297	856,784	191,487	29%
	HBEB	14,926	16,230	1,304	9%	23,041	27,400	4,358	19%
	HBO	258,109	307,430	49,322	19%	398,377	527,946	129,569	33%
	HBW	119,573	127,336	7,763	6%	156,036	182,170	26,134	17%
	NHBEB	14,950	17,839	2,889	19%	13,596	16,422	2,826	21%
	NHBO	65,114	83,382	18,268	28%	74,246	102,845	28,599	39%
PT	TOTAL	45,565	48,500	2,935	6%	76,804	98,909	22,105	29%
	HBEB	1,446	1,427	-19	-1%	804	1,009	205	25%
	HBO	24,342	26,202	1,860	8%	59,579	76,656	17,078	29%
	HBW	13,673	12,890	-784	-6%	11,253	13,589	2,337	21%
	NHBEB	591	713	122	21%	521	692	172	33%
	NHBO	5,512	7,269	1,756	32%	4,648	6,962	2,314	50%
Active Mode	TOTAL	156,091	170,798	14,708	9%	184,659	232,530	47,871	26%
	HBEB	1,165	1,156	-10	-1%	999	1,131	132	13%
	HBO	107,647	116,410	8,764	8%	153,848	194,332	40,484	26%
	HBW	22,039	20,915	-1,123	-5%	14,381	16,193	1,812	13%
	NHBEB	1,487	1,767	279	19%	2,019	2,387	369	18%
	NHBO	23,753	30,550	6,797	29%	13,413	18,487	5,074	38%

4.10 Demand model impacts

Matrix Totals

4.10.1 Table 11 and Table 12 below provide a comparison between trips in the pre-demand model, post demand model and base year matrices for AM and PM peak hours and the average inter-peak. These totals exclude trips that do not pass through the boundary of the Milton Keynes urban area (as shown in Figure 4), defined as external to external (ext – ext) to focus the assessment on trips to, from and within Milton Keynes.

Table 11. Highway Matrix Totals (car, all purposes excluding ext – ext Trips)

	2016	2031 Pre-Demand Model	2031 Post Demand Model
AM	57895	67500	66688
IP	34609	43264	44288
PM	60407	72849	72019

Table 12. Public Transport Matrix Totals (all purposes excluding ext – ext Trips)

	2016	2031 Pre-Demand Model	2031 Post Demand Model
AM	5296	6146	6253
IP	3831	4947	5111
PM	4896	6014	6195

4.10.2 As shown in Figure 13 applying the trip ends produced from the trip end model results in a 17% increase in car trips in the AM peak, 25% in the inter-peak and 21% in the PM peak. The impact of the demand model is to reduce car trips by 1% in the AM and PM peaks but increase them by 2% in the inter-peak. In the AM and PM peaks the decrease in fuel operating costs is outweighed by the impacts of congestion and increased travel time, whereas in the inter-peak which is less congested the reduction in operating costs has made car trips more attractive.

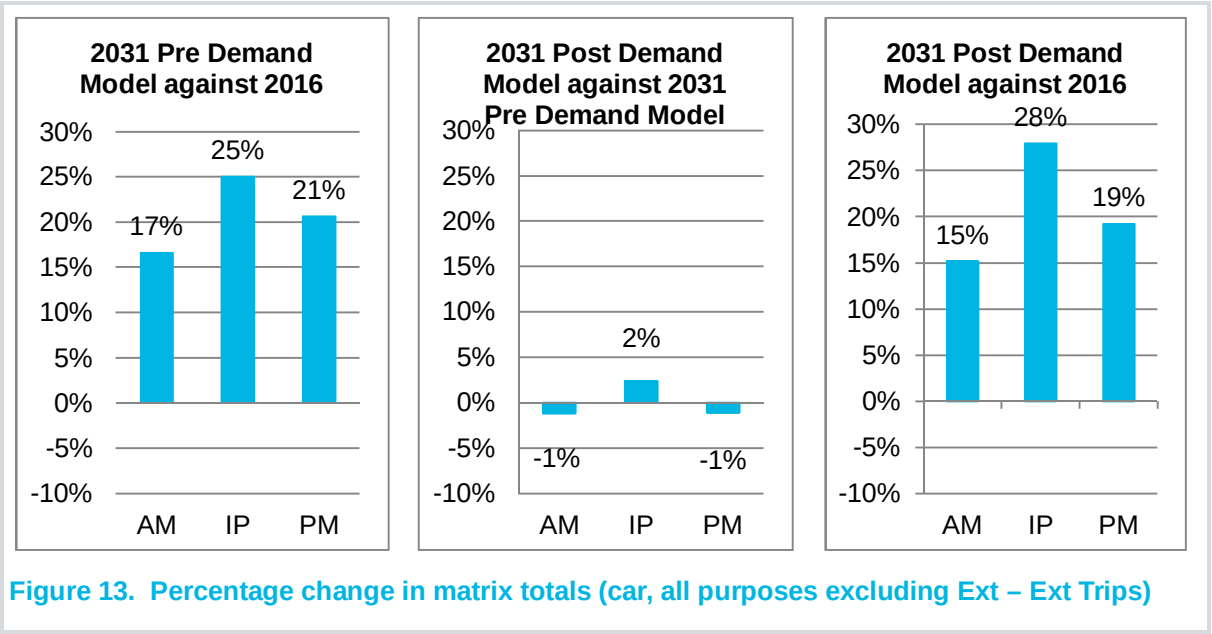


Figure 13. Percentage change in matrix totals (car, all purposes excluding Ext – Ext Trips)

4.10.3 As shown in Figure 14, the demand model increases the PT trips to, from and within Milton Keynes, by 2% in the AM average hour and 3% in the inter-peak and PM average hour.

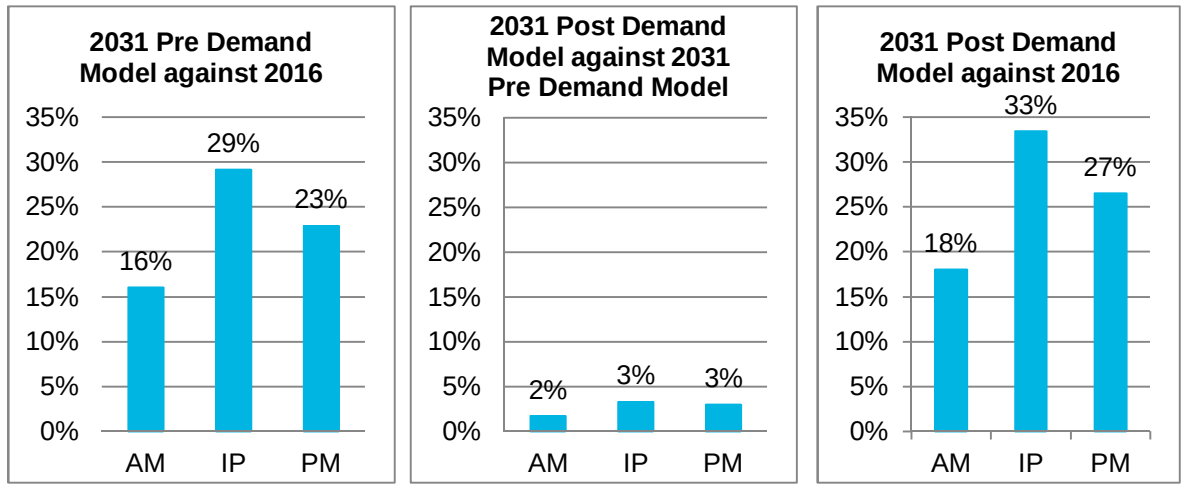


Figure 14. Percentage change in matrix totals (PT, all purposes excluding Ext – Ext Trips)

4.10.4 Further analysis by sectoring the zones in the Milton Keynes urban area as internal and outside as external was carried out. Table 13 shows that car trips travelling into Milton Keynes reduce as result of the demand model, and conversely in the PM peak trips from Milton Keynes reduce. This is due to the congestion caused by the tidal flows into Milton Keynes in the AM peak and out of Milton Keynes in the PM peak. Across all three time periods the trips within Milton Keynes urban area reduce, by 2% in AM peak, 3% in PM peak and by 1% in the inter-peak. This is due to the higher levels of congestion within Milton Keynes.

Table 13. Demand model Car trip percentage change by sector

	AM Peak Hour		Average IP		PM Peak Hour	
Sector	Internal	External	Internal	External	Internal	External
Internal	-2%	10%	-1%	9%	-3%	-2%
External	-3%	1%	8%	1%	5%	1%

4.10.5 Table 28 shows the impact of the demand model on public transport trips. Within Milton Keynes urban area there is a reduction of 4% in the AM Period and a reduction of 3% in the PM. The increase in highway journey times, and therefore bus journey times are the likely the reason for this change, with trips switching to active mode; i.e. walking and cycling, or to the inter-peak period. Although in the inter-peak the demand model has a net impact of zero per cent within Milton Keynes, it is possible some trips have switched to active mode or car cancelling out the effect of time period shift. The changes in the AM Period are the greatest due to the largest reduction in average speeds.

4.10.6 There is a larger change in the AM period as the AM period has the bigger increase in highway journey times out of the two period.

Table 14. Demand model Public Transport trip percentage change by sector

	Average AM hour		Average IP		Average PM hour	
Sector	Internal	External	Internal	External	Internal	External
Internal	-4%	8%	0%	10%	-3%	9%
External	5%	4%	10%	11%	7%	5%

Vehicle Kilometres

4.10.7 The vehicle kilometres are presented in Table 15 and Table 16 for total car users and all vehicles, approximated by Passenger Car Unit (pcu) kilometres[5], within the simulation area of the highway model, and the PT model which represents the local buses serving Milton Keynes and train journeys to or passing through Milton Keynes Central (MKC). Base year figures are included as a point of reference.

4.10.8 Car vehicle kilometres increase as a result of the demand model, with the largest increase in the inter-peak. Similarly all vehicle (pcu) kilometres also increase in the same pattern but with the magnitude reduced by the limited changes in LGV and HGV which are not subject to the demand model and in the case of HGV more likely to continue with direct routes. This suggests that although trips decrease in AM and PM, average trip length increases, partly an impact of reduced vehicle operating costs and partly down to longer routes being chosen to avoid congestion.

Table 15. Percentage change in vehicle kilometres (Car, All purposes, Simulation Network)

Time Period	2016	2031		
		Pre-Demand Model	Post Demand Model	Post - Pre demand model %diff
AM	828440	951441	994669	5%
IP	509350	630303	706276	12%
PM	875097	1034277	1086533	5%

Table 16. Percentage change in vehicle kilometres (Car, LGV, HGV (pcu), All purposes, Simulation Network)

Time Period	2016	2031		
		Pre-Demand Model	Post Demand Model	Post - Pre demand model %diff
AM	1102172	1276269	1316454	3%
IP	835646	1021559	1094172	7%
PM	1097356	1301054	1353451	4%

4.10.9 As shown in Table 17, rail passenger kilometres increase in the AM and PM average hours but decrease in the inter-peak. Bus passenger kilometres decrease in all three time periods but considerably more in the PM peak and inter-peak periods.

[5] In the model files from which these statistics are extracted, PCUS are used throughout. For all user classes other than User Class 5 (HGV), vehicles and PCUS are equivalent. For HGVs, each vehicle is represented by 2.5 pcu.

Table 17. Percentage change in passenger kilometres (PT, 'Internal' area only)

Time Period	Mode	2016	2031		
			Pre-Demand Model	Post Demand Model	Post - Pre demand model %diff
AM	Bus	52004	51738	50076	-3%
	Rail	396442	405686	439278	8%
	Total	448446	457425	489355	7%
IP	Bus	35326	57738	41870	-27%
	Rail	224767	266355	271497	2%
	Total	260093	324093	313367	-3%
PM	Bus	41660	57667	44011	-24%
	Rail	486855	504592	559949	11%
	Total	528514	562259	603959	7%

Vehicle Hours

4.10.10 The vehicle hours from the highway model are presented for the simulation network area only, with passenger hours from the PT model presented for all passengers within the internal area.

4.10.11 As shown in Table 18 and Table 19, for car and highway trips there is a very small increase in the AM and PM peaks with a more significant increase in the inter-peak, which reflects the increase in average trip length across each time period as well as the congestion and subsequent decrease in trips in AM and PM.

Table 18. Percentage change in vehicle hours (Car, All purposes, Simulation Network)

Time Period	2016	2031		
		Pre-Demand Model	Post Demand Model	Post - Pre demand model %diff
AM	14247	19023	19070	0.2%
IP	7440	9535	10594	11.1%
PM	14656	19725	19895	0.9%

Table 19. Percentage change in vehicle hours (All Vehicles (pcu), All purposes, Simulation Network)

Time Period	2016	2031		
		Pre-Demand Model	Post Demand Model	Post - Pre demand model %diff
AM	18193	24073	24112	0.2%
IP	11556	14549	15689	7.8%
PM	17710	23623	23821	0.8%

4.10.12 For PT, as presented in Table 20, the pattern is similar to that of passenger kilometres, the demand model increases PT passenger hours by 4% in AM, 0% in PM and reduces them by 12% in the inter-peak, in part due to car trips being made more attractive by reduced operating costs and minimal congestion in the inter-peak and also in part due to passenger kilometres reducing, i.e. trips getting shorter.

Table 20. Percentage change in passenger hours (PT, 'Internal' area only)

Time Period	Mode	2016	2031		
			Pre-Demand Model	Post Demand Model	Post - Pre demand model %diff
AM	Bus	1643	1811	1757	-3%
	Rail	2979	3033	3289	8%
	Total	4623	4844	5046	4%
IP	Bus	1133	1847	1386	-25%
	Rail	1504	1823	1830	0%
	Total	2637	3670	3216	-12%
PM	Bus	1311	1927	1523	-21%
	Rail	3371	3516	3896	11%
	Total	4682	5443	5419	0%

Summary

The demand model results in a decrease of trips in the AM and PM peak periods for cars but an increase in the inter-peak, when there are generally fewer trips and therefore overall there is less congestion. As shown in Figure 15, the overall distance travelled by car in the simulation area increases across all three time periods. This suggests that the demand model is reducing shorter distance urban trips the AM and PM peaks. Travel time only increases in the inter-peak which corresponds with the pattern of trip growth. Although the number of PT trips increase, as shown in Figure 15, the total passenger kilometres travelled and passenger hours spent within the 'Internal' area decrease for bus across all three time periods and for PT combined in the inter-peak. This suggests that as a result of the demand model PT trips by bus and by both bus and rail in the Inter-peak are shorter, which is balanced out by an increase in passenger hours and passenger distance for rail in the AM and PM periods and for car in the inter-peak.

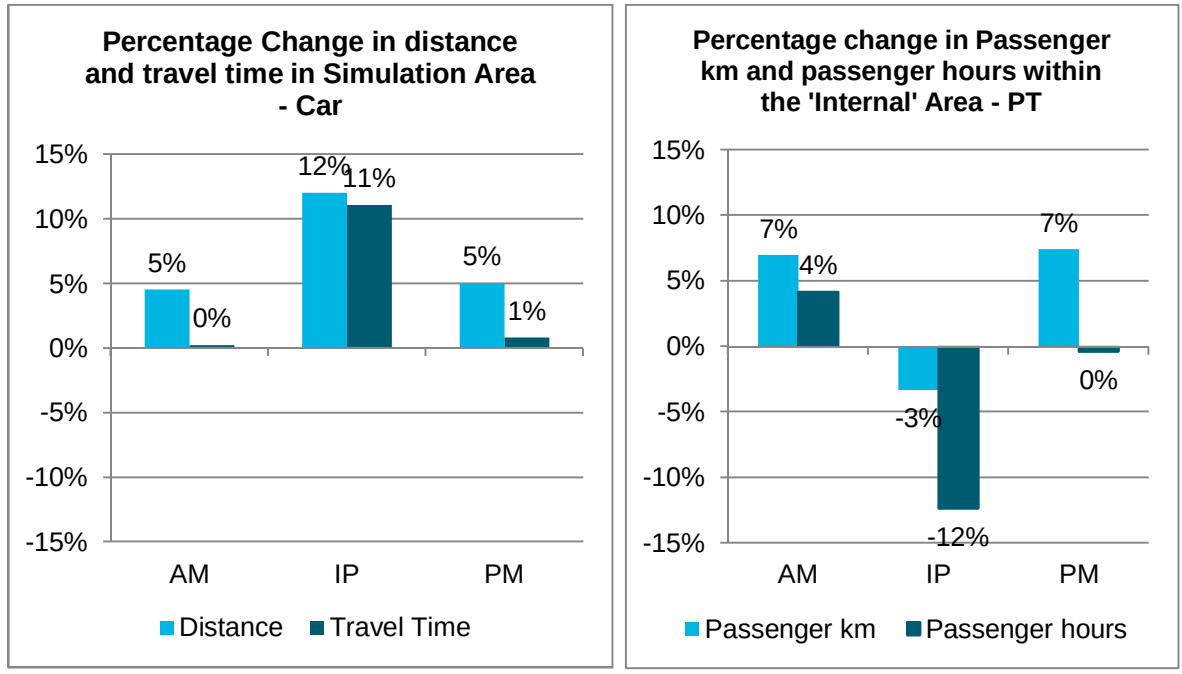


Figure 15. Demand Model impacts in terms of percentage change in distance and travel times

Traffic Flows

4.10.13 This section compares the 2031 reference case flows with those of 2016. The flow difference is plotted as bandwidths to the left side of each link by direction, with an increase in actual flow between 2016 and 2031 shown in green and a decrease in blue. It is also important to note that where links have been split to code in forecast reference case schemes then no comparison can be plotted but flows would be similar to those on adjacent links.

4.10.14 As shown in Figure 16 there is a significant amount of re-routing in the AM period. With increases on the main arterial routes such as the M1, A5, A421and A509.

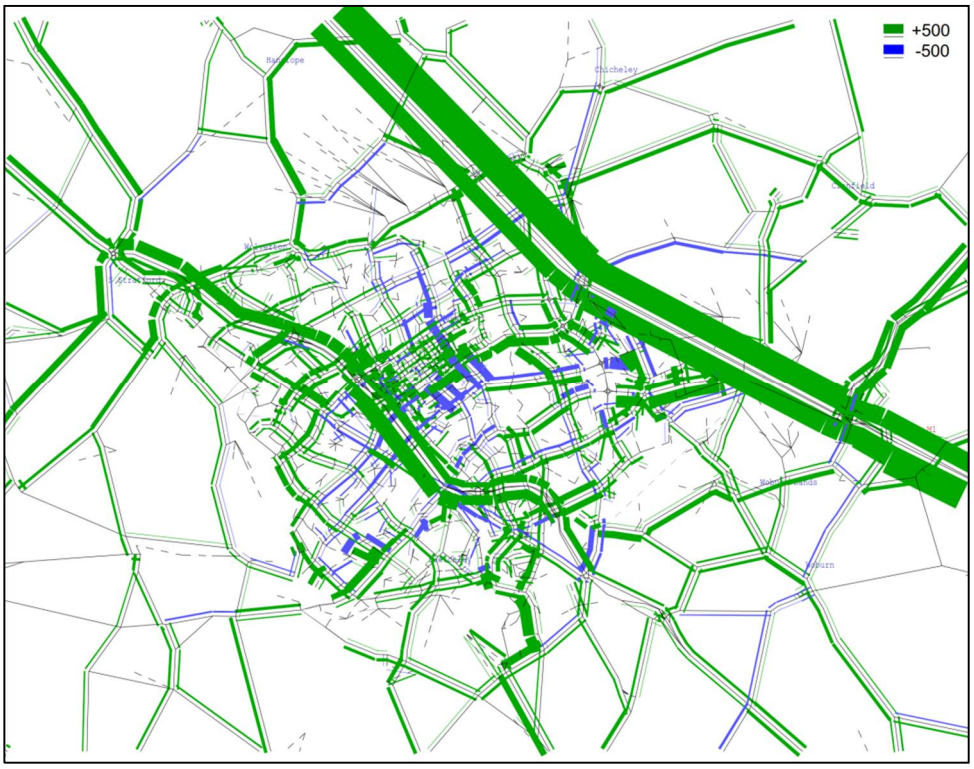


Figure 16. Flow Difference – 2031 Reference case Minus 2016 AM (Actual Flow, pcu/hr)

4.10.15 As shown in Figure 17 there is a noticeable decrease in northbound flows on V8, Marlborough Street north of Childs Way and in both directions south of Childs Way, similarly there is a significant decrease in both directions on Saxon St. These flows have re-routed to the A5 and V6 Grafton Street, which run parallel. These northbound flow reductions are due to the northbound approach to the junction at both South Saxon Roundabout and South Secklow roundabouts exceeding capacity in 2031 AM reference case, caused by the increased flow on Childs Way and therefore increased flow crossing the entry.

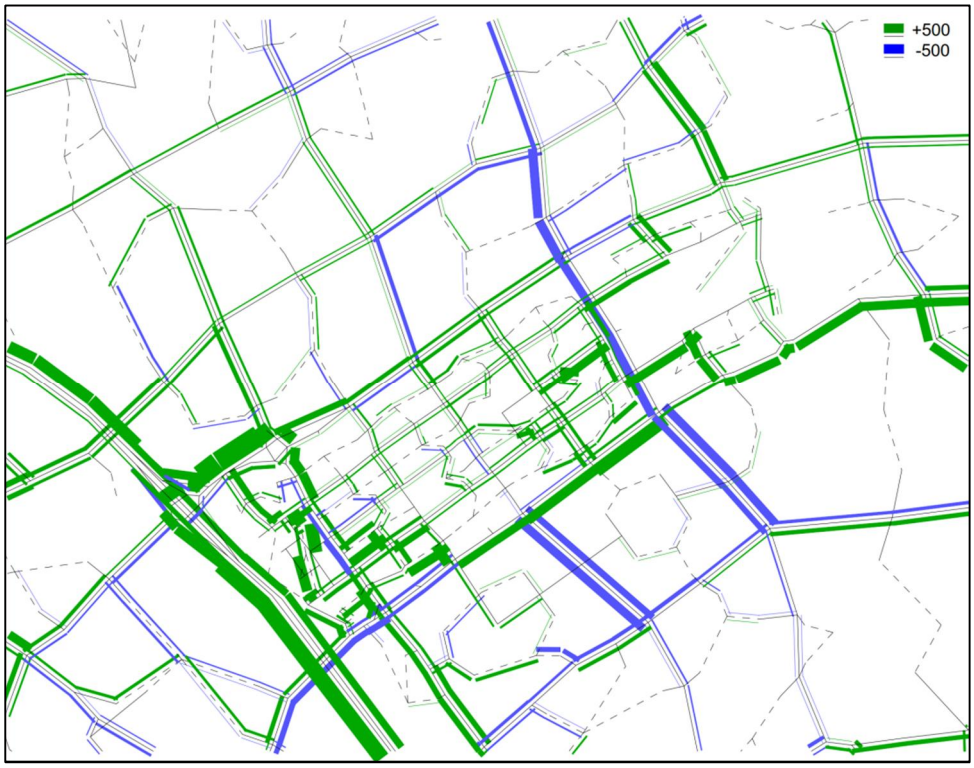


Figure 17. CMK Flow Difference – 2031 Reference case Minus 2016 AM (Actual Flow, pcu/hr)

4.10.16 Figure 18 shows there is a general uplift in actual flow in the inter-peak between 2016 and 2031. This reflects the 28% increase in trips to, from and within Milton Keynes. The trunk roads in particular have large increases in flow as do the A422, A509 and H6 Childs Way across Milton Keynes. Figure 19 shows a general uplift in flows both to and from central Milton Keynes.

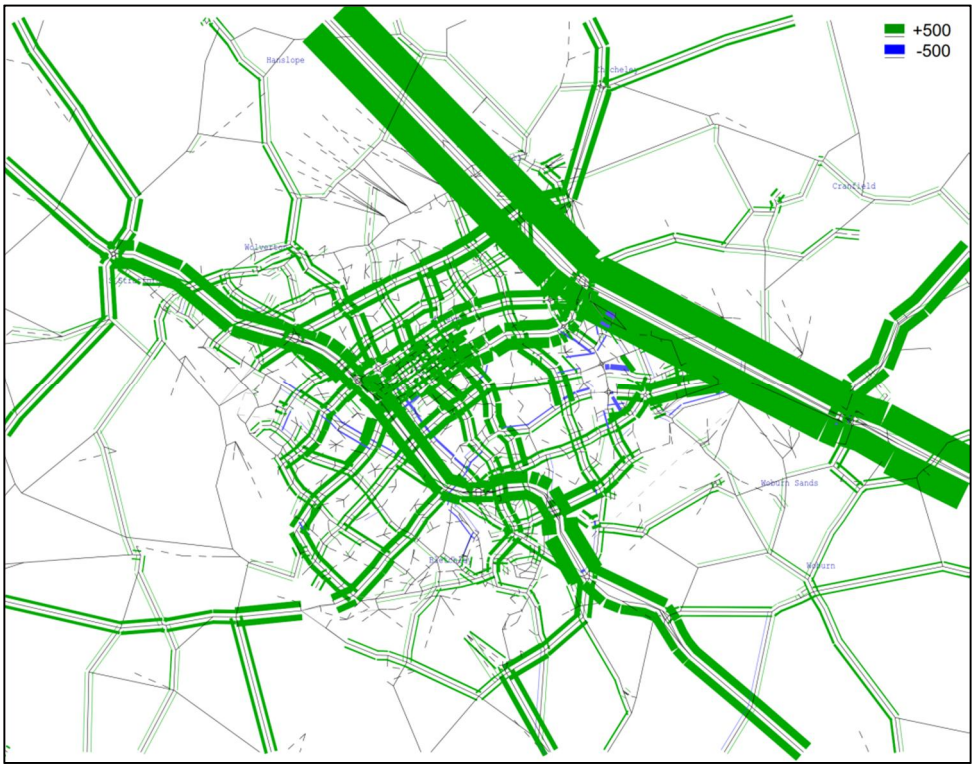


Figure 18. Flow Difference – 2031 Reference case Minus 2016 IP (Actual Flow, pcu/hr)

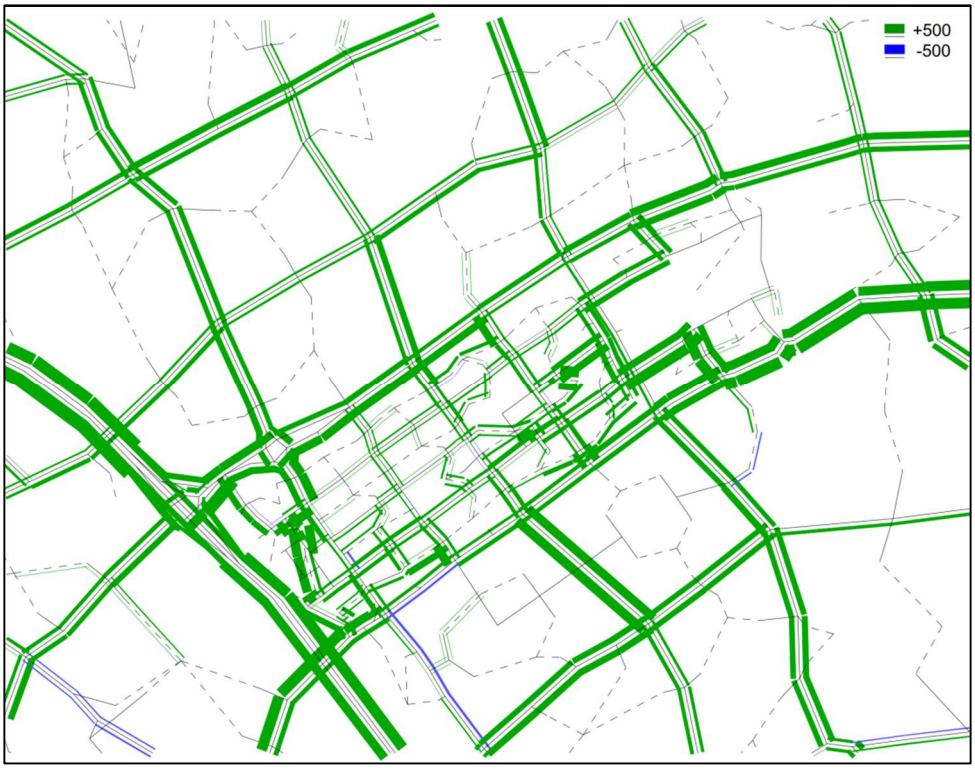


Figure 19. CMK Flow Difference – 2031 Reference case Minus 2016 IP (Actual Flow, pcu/hr)

4.10.17 As in the AM peak, it can be seen from Figure 20 there is considerable increase in flows on the A5 and M1and on the A421 to the East of Kingston Roundabout. Figure 21 shows notable increase in flow both in and out of central Milton Keynes.

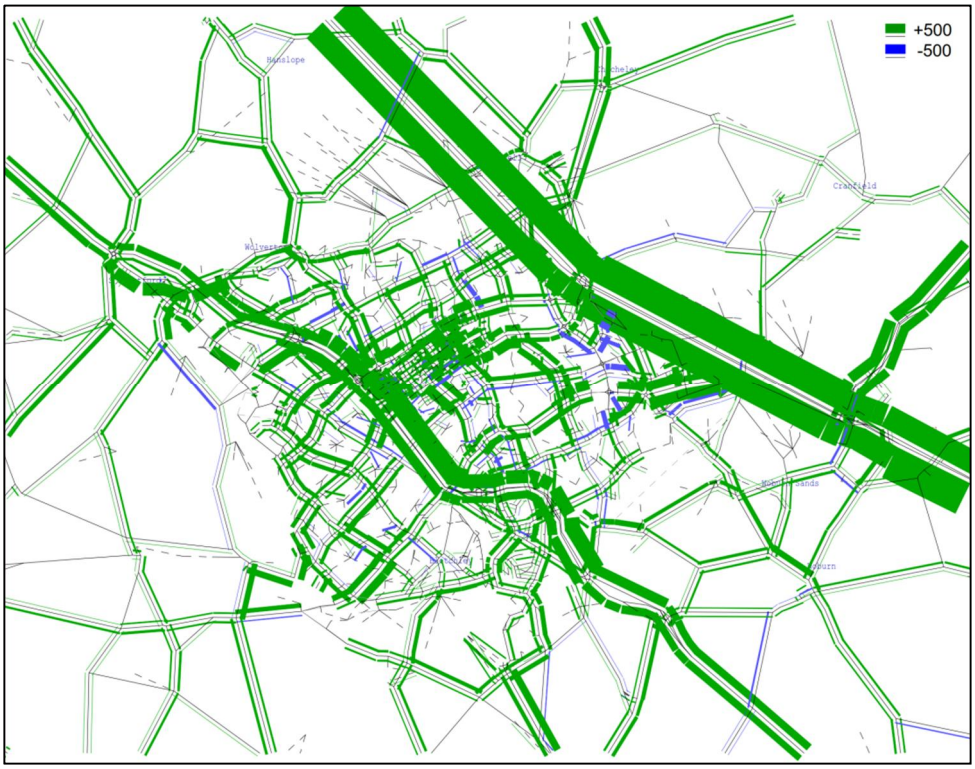


Figure 20. Flow Difference – 2031 Reference case Minus 2016 PM (Actual Flow, pcu/hr)

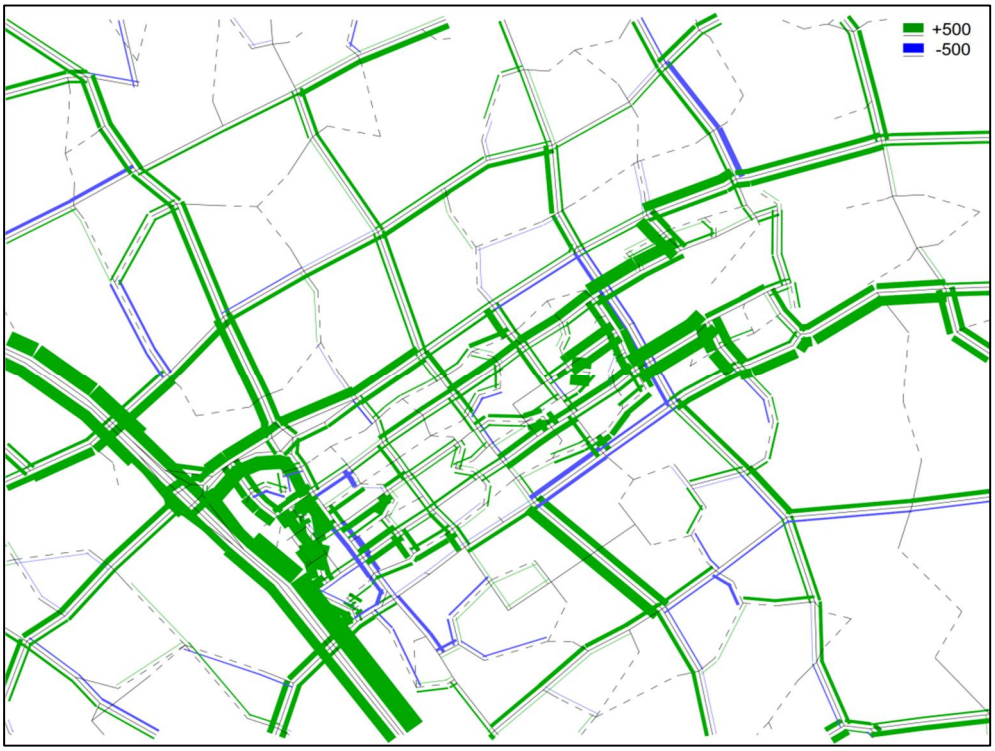


Figure 21. CMK Flow Difference – 2031 Reference case Minus 2016 PM (Actual Flow, pcu/hr)

4.10.18 In addition to actual flow comparison plots, the percentage change in actual flow crossing the cordons and screenlines used as part of the calibration and validation of the base year networks (as shown in Figure 22) has been calculated and is shown in Table 21. The inter-peak period has an uplift of around 30% across most screenlines and cordons with an increase between 55% and 63% in flow crossing the CMK cordon. The comparison for AM and PM is more varied but the flow changes across the CMK cordon are among the largest for each time period. Due to re-routing, flows crossing the Canal cordon eastbound, railway and western screenlines westbound reduce by between three and five per cent.

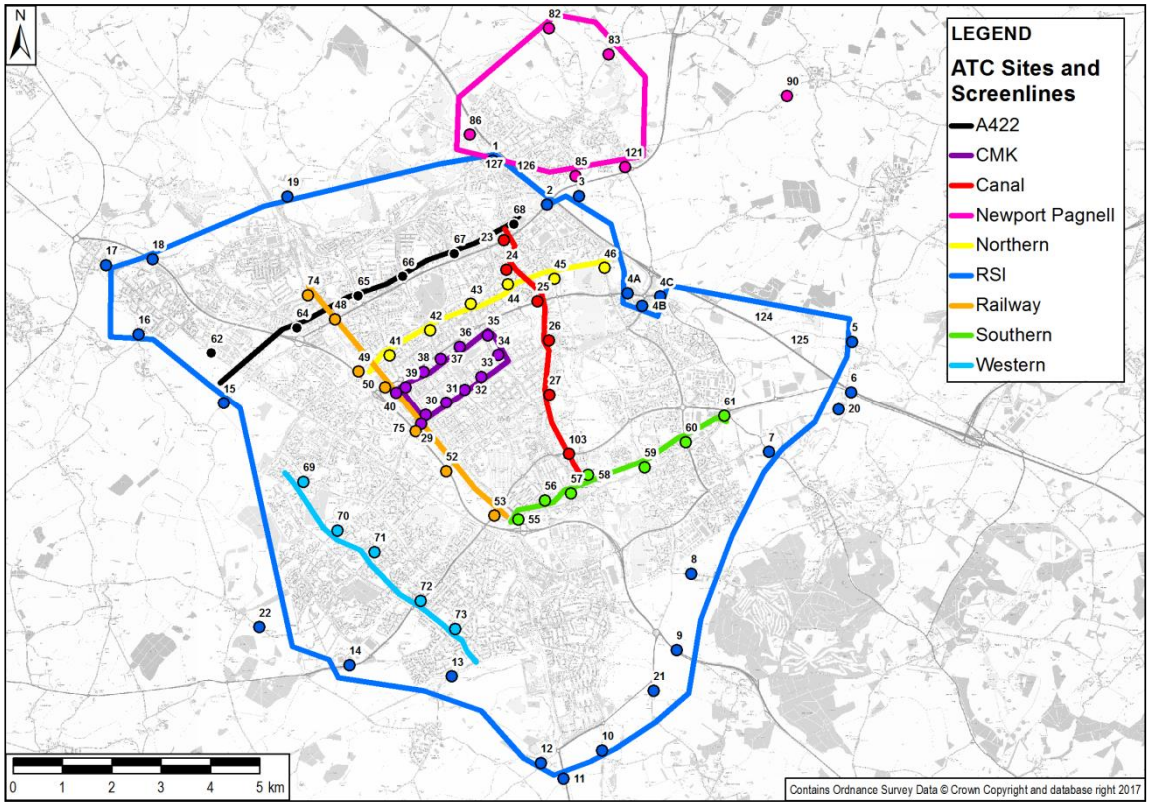


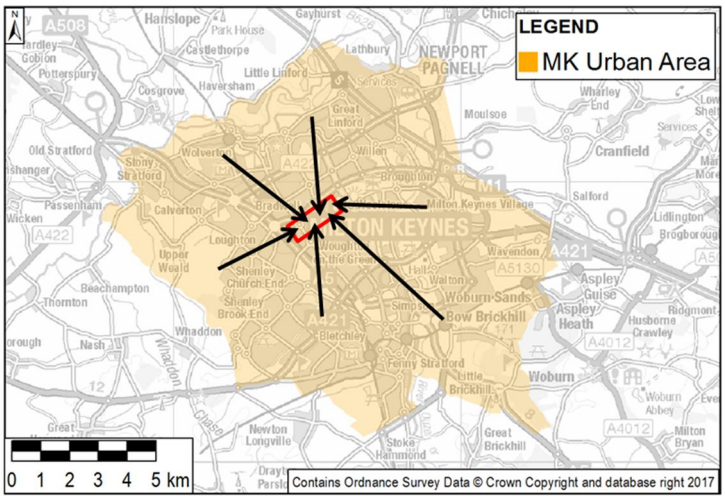
Figure 22. Highway Model Cordons and Screenlines

Table 21. Cordons and SL Flow percentage difference 2016 to 2031 Reference Case

Cordon/Screenline	AM	Inter-Peak	PM
RSI Inbound Cordon	19%	37%	23%
RSI Outbound Cordon	5%	34%	18%
Canal Eastbound	-5%	29%	12%
Canal Westbound	11%	35%	16%
CMK Inbound	35%	63%	48%
CMK Outbound	23%	55%	38%
Northern Southbound	4%	29%	19%
Northern Northbound	5%	27%	23%
Railway Eastbound	14%	29%	15%
Railway Westbound	-3%	26%	15%
Southern Southbound	13%	31%	7%
Southern Northbound	7%	29%	9%
A422 Northbound	2%	28%	11%
A422 Southbound	13%	25%	11%
Western Eastbound	11%	33%	22%
Western Westbound	0%	28%	17%
M1 Northbound	23%	28%	30%
M1 Southbound	27%	30%	26%

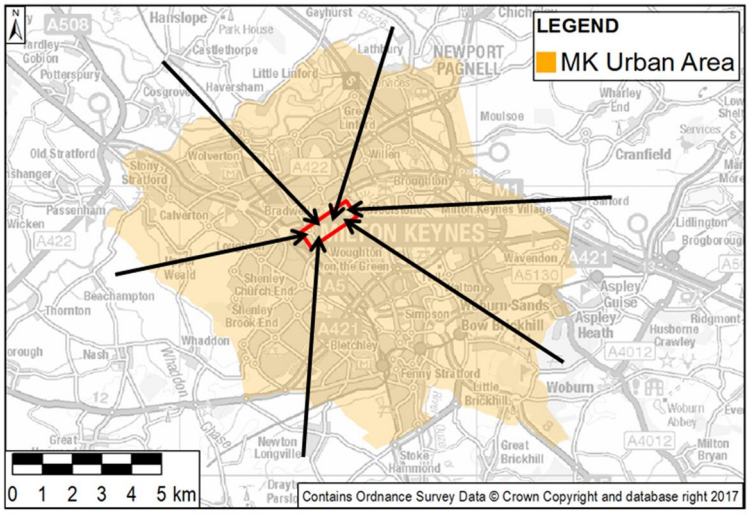
4.11 Trips to and from Central Milton Keynes

4.11.1 A select link analysis has been conducted using the central Milton Keynes cordon to enable trips to and from central Milton Keynes to be compared between the 2031 Reference Case and 2016 base year. For the AM Peak trips into central Milton Keynes have been compared and for the PM peak trips out of central Milton Keynes have been compared. The increase in trips between central Milton Keynes and outside Milton Keynes is around twice the increase in trips within the town. The results are presented below in Figure 23 to Figure 26.



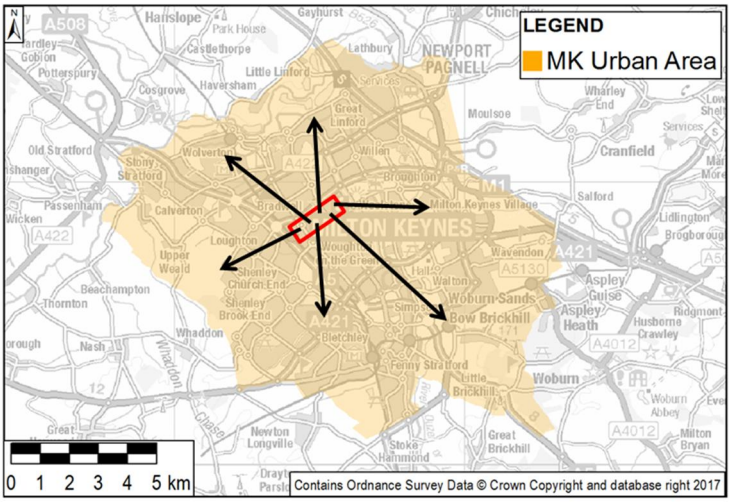
2016 Base Year	5737
2031 Reference Case	7359
Percentage Increase:	28%

Figure 23. Car trips from non-central Milton Keynes to Central Milton Keynes, AM peak



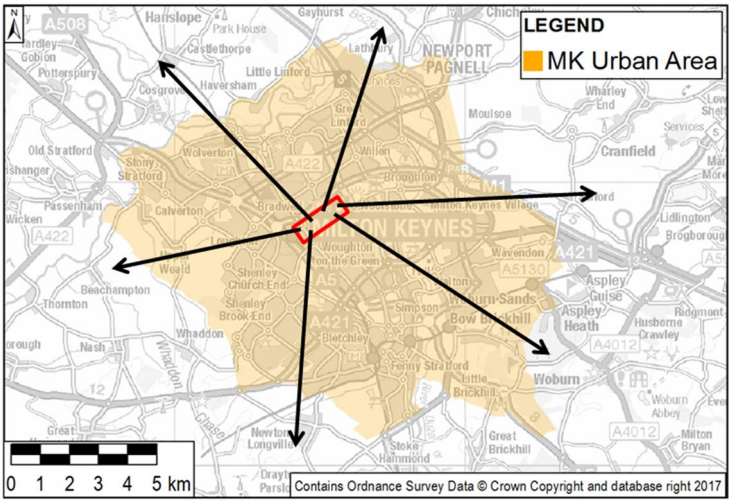
2016 Base Year:	3136
2031 Reference Case:	4574
Percentage Increase:	46%

Figure 24. Car trips from outside the MK Urban Area to Central Milton Keynes, AM peak



2016 Base Year:	5792
2031 Reference Case:	7078
Percentage Increase:	22%

Figure 25. Car trips from Central Milton Keynes to non-central Milton Keynes, PM peak



2016 Base Year:	2609
2031 Reference Case:	4217
Percentage Increase:	62%

Figure 26. Car trips from Central Milton Keynes to outside the MK Urban Area, PM peak

4.12 Volume over Capacity Ratios

4.12.1 It is generally considered that a V/C of over 85% indicates a notable level of congestion. As such plots have been produced showing average junction V/C ratio over 85%, weighted by the turn flows, and link V/C over 85%. The data has been displayed separately to give a clearer indication of where junctions and links are approaching or at capacity in the 2016 base year model, as presented in Figure 27 to Figure 29, and where in the 2031 Reference Case the junctions are similarly impacted, as presented in Figure 30 to Figure 32.

4.12.2 Capacity issues at junctions and links are generally concentrated in the peak time periods, which means that for most of the day during the inter-peak, off-peak and at weekends the network in Milton Keynes runs within theoretical capacity.

4.12.3 This section therefore concentrates on the V/C values identified for:

- 2016 Base Year – AM Peak
- 2016 Base Year – PM Peak
- 2031 Reference Case – AM Peak
- 2031 Reference Case – PM Peak

Base Year 2016

4.12.4 The V/C's for links and junctions in the 2016 Base Model are generally worse in the AM peak than the PM peak. This largely reflects in-commuting to Central MK and circulation of traffic within Central MK (including links to / from the station/shopping centre and other key destinations).

4.12.5 Some of these capacity issues are already dealt with by the Reference Case where schemes have been identified and included within the Local Improvement Plan as Reference Case Schemes i.e.:

- Brinklow/Monkston roundabouts (to be signalised)
- The A421 between M1 J13 and Eagle Farm (to be dualled as part of Central Beds scheme)

4.12.6 Those junctions/links identified in just the AM or both the AM and PM peaks that are not associated with Reference Case Schemes include:

- M1 J14 and Northfield Roundabout (worse in AM Peak) entry point from the M1
- The A422 corridor including the MK entry point to the north east on the A509 – worse in the AM peak with in-commuting and pass through than in the PM peak.
- A5 at Old Stratford Roundabout to the north ease entry and further to the south east at Woburn Road (both AM only)
- The A421 entry links and corridor, including those referred to above but also including MK entry at the south west and key junctions including Watling Street and Grafton Street roundabout junctions (in both peaks).
- Central MK junctions
- Watling Street junctions – (Standing Way/Chaffron Street in both peaks)

4.12.7 It should be noted that Watling Street/Dansteed Way and Watling Street/Portway are Reference Case schemes though do not have high V/C ratios in the Base Year as they are associated with growth in the Western Expansion Area.

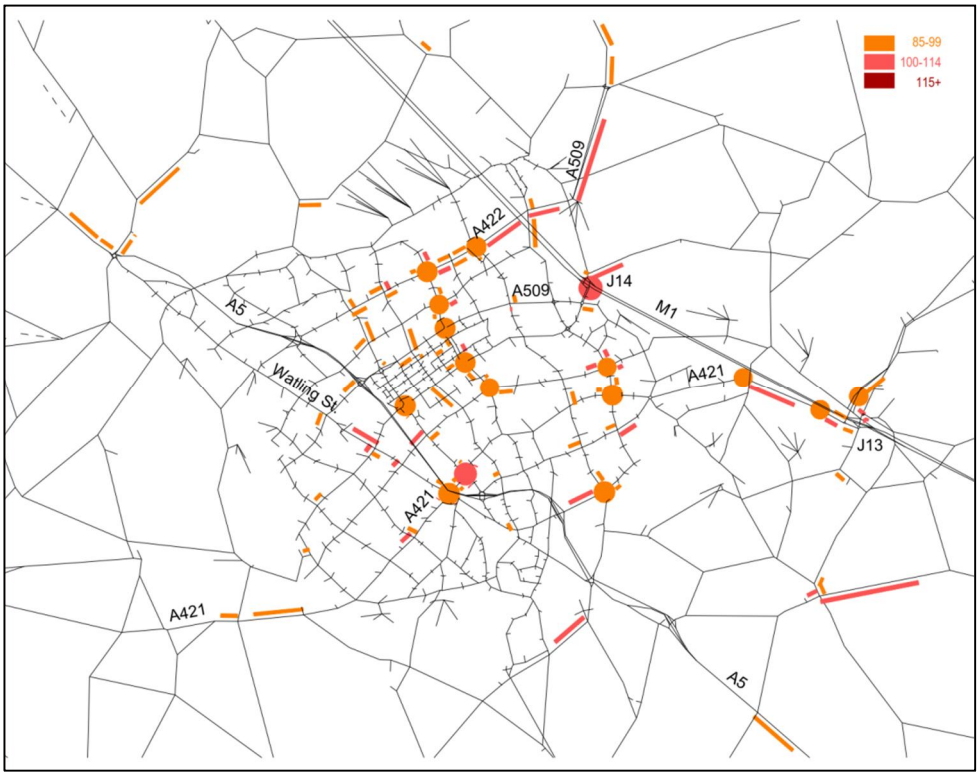


Figure 27. 2016 Base link and junction V/C over 85%, AM Peak

Figure 28. 2016 Base link and junction V/C over 85%, Inter-peak

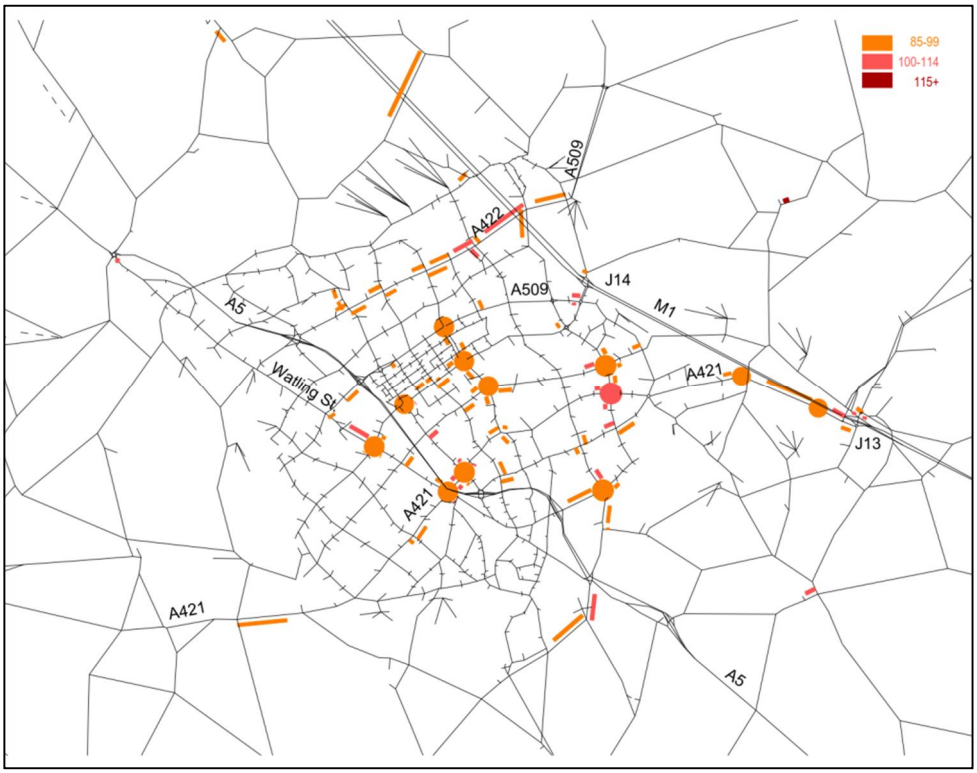


Figure 29. 2016 Base link and junction V/C over 85%, PM Peak

The Reference Case

4.12.1 As shown in Figure 30 to Figure 32, the Reference Case shows a general worsening of the situation in both peaks. The entry point links referred to above are generally more 'stressed' alongside the internal Central MK network due to the greater level of in-commuting from outside of Milton Keynes.

4.12.2 Of the entry links:

- The A421 junctions are more overloaded in both the AM and PM peaks, though now worse in the PM Peak.
- The A5 links and junctions are showing V/C ratios in excess of 85% in part because traffic seeks alternative options into Milton Keynes as well as the general growth in traffic on the network. The southern entry links are also starting to exceed the V/C threshold. This issue is more pronounced, particularly to the north of Central MK in the AM Peak.
- The A509 entry links are more overloaded and more junctions along the A422 are showing over capacity issues.
- M1 J14 in particular shows a greater level of over capacity than the Base with further stress at Northfield Roundabout, the next junction into Milton Keynes.
- The Reference Case schemes at Dansteed Way (Crownhill) and Portway (Loughton) show some entry link V/C's in excess of 85% however it is likely that further design based on current forecast flows will resolve these issues.
- Watling Street's Junction with Child's Way is now overcapacity in both the AM and PM Peak (as with its junction with the A421 – Elfield Park Roundabout - already referred to in the Base).

- Although the Reference Case schemes at Brinklow and Monkston roundabouts provide additional capacity to help accommodate growth there, there are still delays modelled in the Reference Case. As with Loughton junction further design work based on current forecast flows is likely to resolve these issues. In addition some of the capacity issues appear to have migrated to Walnut Tree Roundabout on the A421.

4.12.3 It is also apparent that the capacity issues at the junctions along Marlborough Street have reduced which is consistent with the reduced flow attributable to re-routing as shown in Figure 17.

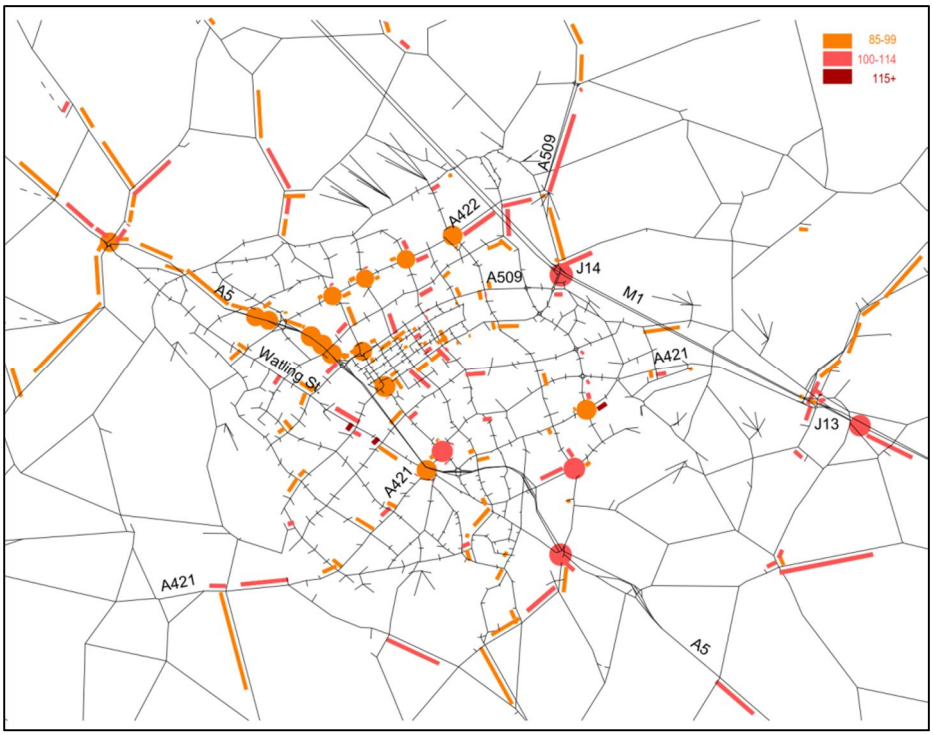


Figure 30. 2031 Reference Case, link and junction V/C over 85%, AM Peak

Figure 31. 2031 Reference Case, link and junction V/C over 85%, Inter-Peak

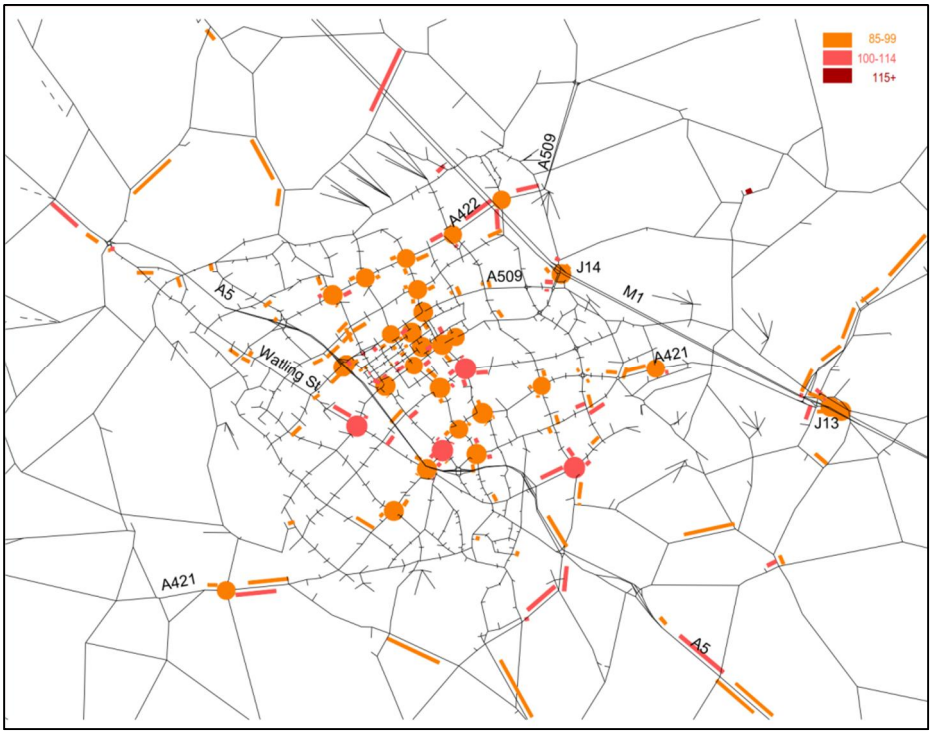


Figure 32. 2031 Reference Case, link and junction V/C over 85%, PM Peak

4.13 Junction Delays

4.13.1 The observations made from the V/C analysis are reflected in Figure 33 and Figure 34 which show the extent of delays in the 2016 base and 2031 Reference Case models respectively. The plots display the maximum approach delay per vehicle, the sum of the delay per vehicle on each approach to the junction, and also the total vehicle delay, showing plots the worst case for each junction out of the AM or PM peaks.

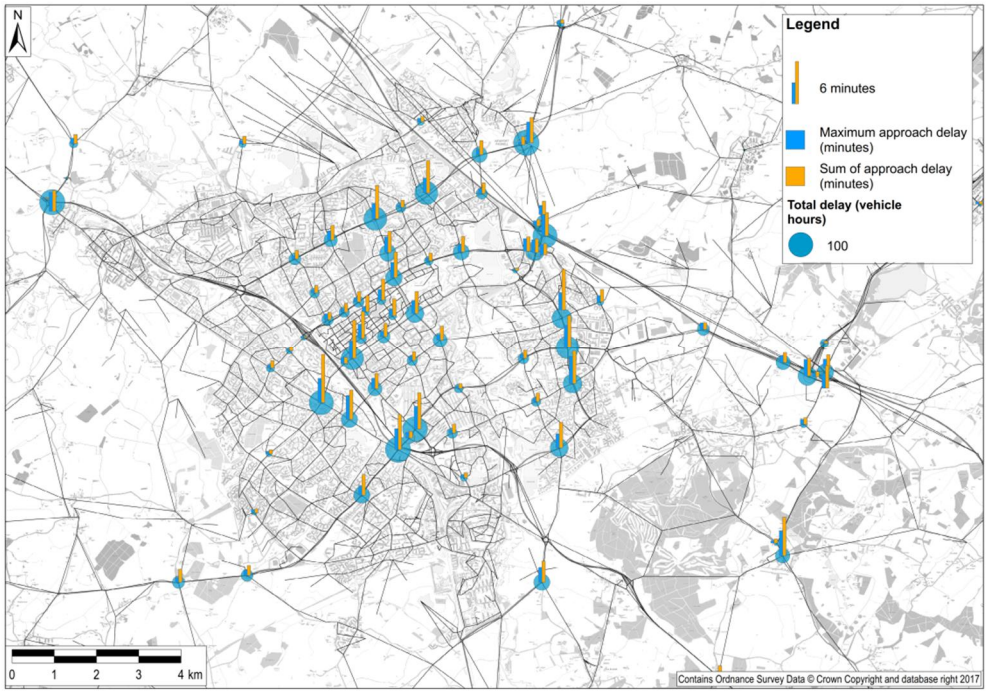


Figure 33. Junction delays 2016 Base

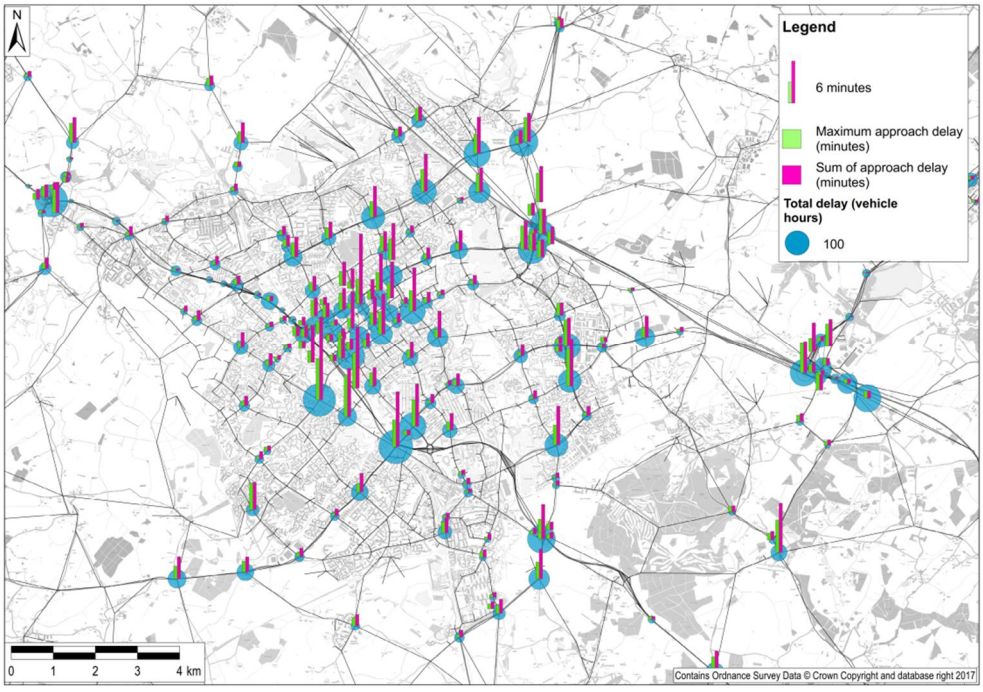


Figure 34. Junction delays 2031 Reference Case

4.14 Travel Times

4.14.1 The journey time routes used as part of the model validation as shown in Figure 35 have been used to provide a measure of the impacts of the reference case scenario on travel times. The changes in total travel time along each of the journey time routes are presented in Table 22. Overall the travel time across all routes increases by 14% in the AM peak, 15% in the PM peak and 5% in the inter-peak.

- There is little change on route 7, M1 between J13 and J15 southbound and a reduction northbound as result of the All Lane Running (ALR) scheme which has increased the capacity on that stretch.
- Similarly route 13EB, Milton Keynes Central to M1 J13 via M1 J14, also decreased in the AM because of the reduced travel time on M1. However in the IP and PM the time savings on the M1 are outweighed by increased delays on the rest of the route through Milton Keynes.
- The dualling of the A421 between M1 J13 and Milton Keynes has also reduced the impact on routes 1 and 12.
- The largest increase in journey time is on route 9 northbound in the AM peak. This is the shortest journey time route so the absolute change is smaller than on longer routes. The increase is due to the high V/C ratio at the Bletcham Way Brickhill Street roundabout.

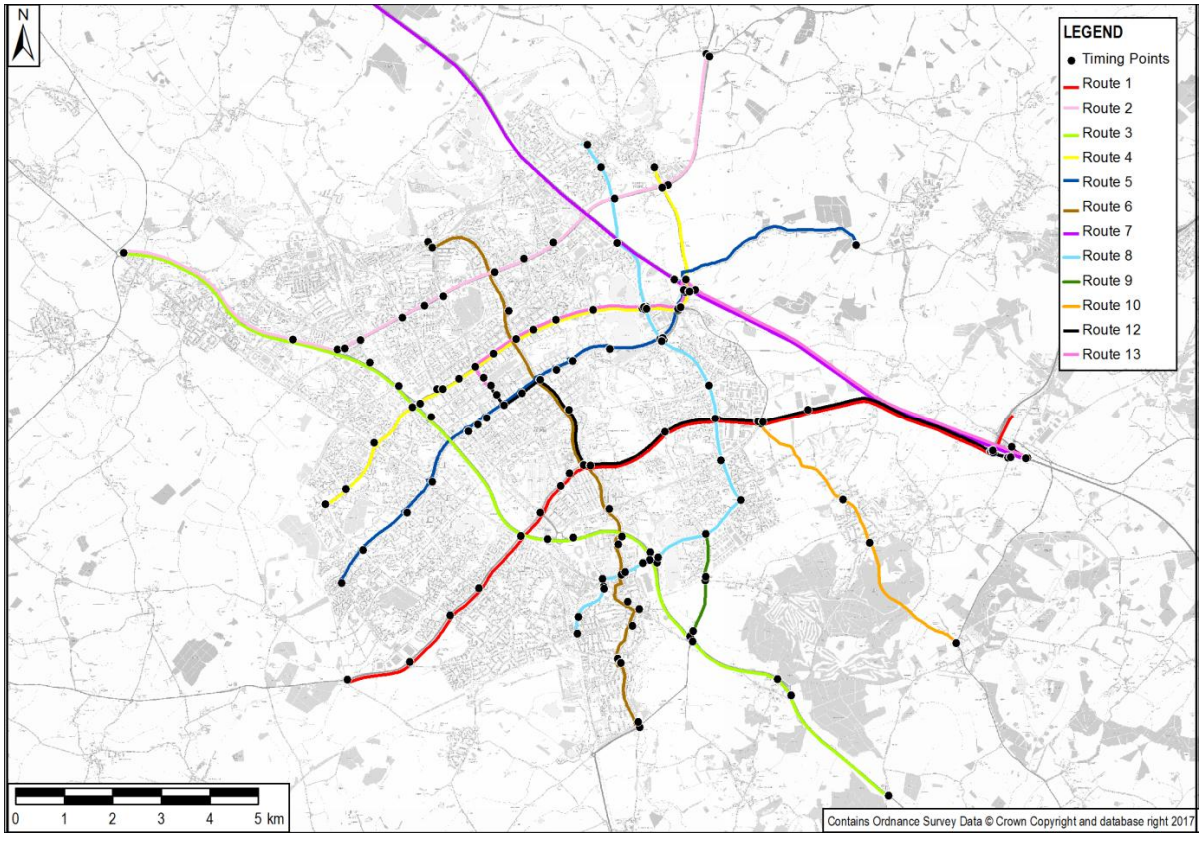


Figure 35. Journey Time Routes

Table 22. Percentage change in journey times 2016 to 2031 Reference Case

Route	Route Description	Percentage Change		
		AM	IP	PM
1EB	A421 to M1 J13	11%	8%	12%
1WB	A421 from M1 J13	15%	3%	5%
2EB	Old Stratford to Chicheley	13%	2%	22%
2WB	Chicheley to Old Stratford	18%	3%	16%
3SB	Old Stratford to Watling, Little Brickhill	9%	5%	20%
3NB	Watling, Little Brickhill to Old Stratford	26%	4%	13%
4EB	Portway/Fulmer St to Newport Pagnell	16%	3%	25%
4WB	Newport Pagnell to Portway/Fulmer St	16%	5%	15%
5EB	Moulsoe to Child's Way / Tattenhoe St.	19%	9%	18%
5WB	Child's Way / Tattenhoe St. to Moulsoe	33%	7%	17%
6SB	Saxon St. / Newport Rd. to A4146 / Stoke Rd.	4%	3%	18%
6NB	A4146 / Stoke Rd. to Saxon St. / Newport Rd.	22%	3%	8%
7SB	M1 J15 to M1 J13	0%	1%	0%
7NB	M1 J13 to M1 J15	-3%	-2%	-3%
8SB	Newport Pagnell to Bletchley	17%	8%	12%
8NB	Bletchley to Newport Pagnell	8%	7%	19%
9SB	Brickhill Street Southbound	7%	16%	14%
9NB	Brickhill Street Northbound	63%	12%	43%
10SB	A5130 through Woburn Sands SB	9%	9%	15%
10NB	A5130 through Woburn Sands NB	14%	9%	10%
12EB	MK central to M1 J13 via A421	1%	10%	32%
12WB	M1 J13 to MK Central via A421	18%	0%	10%
13EB	MK Central to M1 J13 via M1 J14	-2%	5%	40%
13WB	M1 J13 to MK Central via M1 J14	22%	5%	11%
Total		**14%**	**5%**	**15%**

4.15 Average speeds

4.15.1 The average network speeds by time period are presented in Table 23. Corresponding with the levels of congestion in the models, the largest reduction is in the AM peak where speed reduces by 10% with the least reduction in the inter-peak.

Table 23. Average speeds change

HW	AM Peak	Inter-Peak	PM Peak
Average Network Speed	-10%	-4%	-8%

5. Plan:MK Scenario 1

5.1 Introduction

5.1.1 Plan:MK Scenario 1 includes the same growth as the Reference Case plus an additional 5620 dwellings (5435 Households) and 4254 additional jobs.

5.1.2 It is important to consider when assessing the impacts of Plan:MK Scenario 1 the size of the additional growth relative to the 110,000 dwellings and 170,000 jobs already in Milton Keynes Borough in 2016. The Reference Case increases these by 20% and 17% respectively. Although Plan:MK Scenario 1 growth is equivalent to 26% (dwellings) and 15% (jobs) of the Reference Case growth, Plan:MK Scenario 1 only accounts for an additional 4% increase in dwellings and a 2% increase in jobs compared to total dwellings and jobs forecast by 2031. As such the impacts of Plan:MK would be expected to be of a much smaller magnitude compared to that resulting from the Reference Case growth.

5.2 Plan MK Growth

5.2.1 Scenario 1 consisted of the following growth assumptions over and above the housing and employment tested within the Reference Case 2031.

Housing:

- 4,620 homes within the urban area of Milton Keynes. This consisted of around 1,200 homes from permissions granted after the Reference Case was defined and additional Neighbourhood Plan allocations, and 3,420 from urban housing sites considered deliverable or developable within MKC's draft SHLAA 2017.
- 1,000 homes at land north of the railway within the South East Milton Keynes Allocation (SEMK1) contained within the Draft Plan:MK March 2017

Employment:

- 4,254 jobs within the industrial and logistics sector associated with the South Caldecotte allocation within the Draft Plan:MK March 2017

5.2.2 The dwellings and employment growth is plotted in Figure 36. Whilst the dwellings growth is spread across Milton Keynes borough the jobs growth is focussed in South Caldecotte. The largest housing development site is 1000 dwellings in the Strategic Urban Extension South East near Woburn Sands.

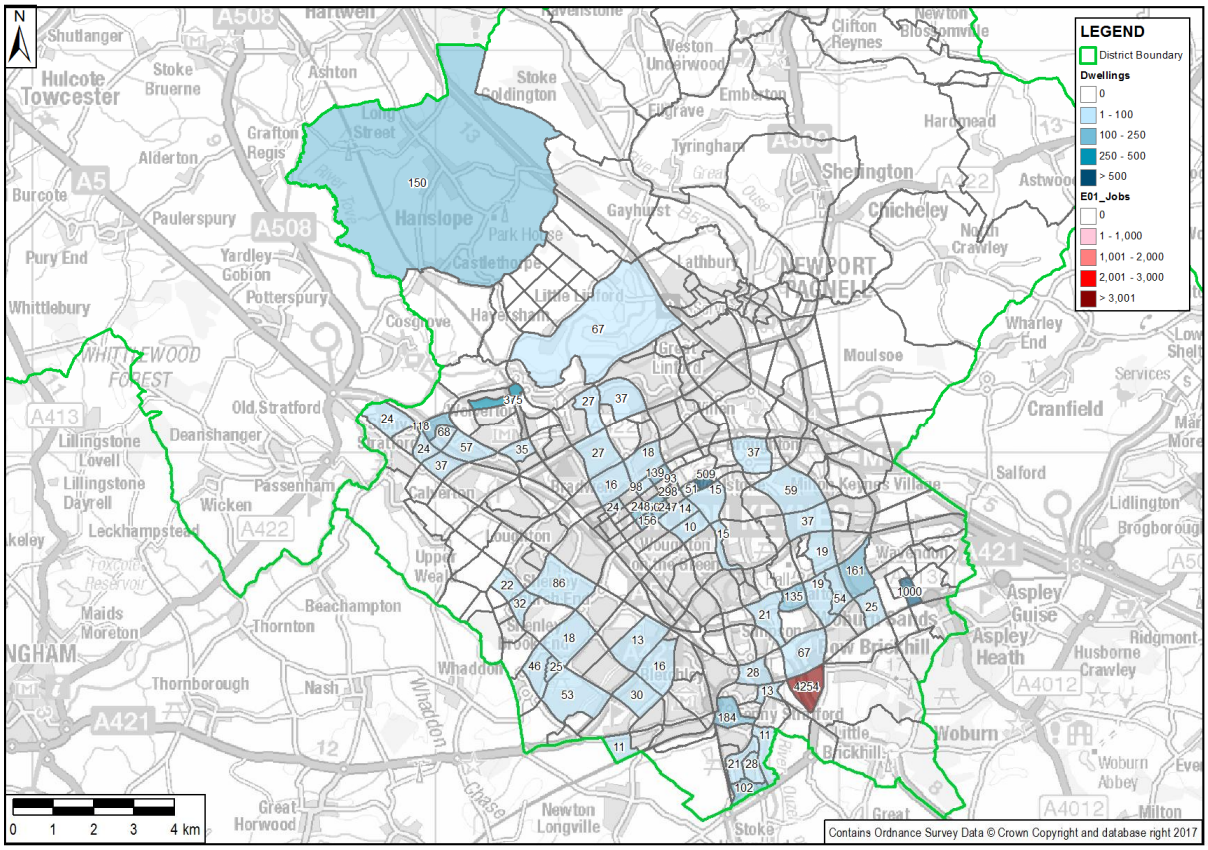


Figure 36. Scenario 1 Plan:MK Additional Dwellings and Jobs Growth to 2031

5.3 Trip End Model Outputs

5.3.1 The trip end model produces 24 hour trip ends by mode:

- Car,
- Public transport and
- Active Mode,

5.3.2 and by purpose:

- Home based employers business (HBEB)
- Home based other (HBO)
- Home based work (HBW)
- Non-home based employers business (NHBEB)
- Non-home based Other (NHBO)

5.3.3 The Trip ends within the 'Internal' Area as shown in Figure 8, are presented in Table 24. The proportion of productions growth to housing growth is a similar ratio to that in the Reference Case. However growth in attractions internally is much lower, with the increase in attractions almost entirely happening externally, to a similar extent to the increase in productions internally.

5.3.4 In the Reference Case the growth in productions is higher than attractions, suggesting the housing growth is not enough to keep additional commuting trips local. However in Plan:MK Scenario 1 there is more housing than jobs growth which means there are more trips from Milton Keynes to the external area along with existing jobs being taken locally reducing the number of trips from outside Milton Keynes.

Table 24 Comparison of Reference Case and Plan:MK trip ends within Internal Area

Mode	Purpose	Total Daily Productions				Total Daily Attractions			
		Ref	Scenario 1	Sc1 less Ref	% Diff	2031 Ref	2031 Scenario 1	Sc1 - Ref	% Diff
Car	**TOTAL**	**513,132**	**527,525**	**14,393**	**2.8%**	**818,839**	**820,584**	**1,746**	**0.2%**
	HBEB	14,891	15,409	518	3.5%	26,280	26,282	2	0.0%
	HBO	283,972	293,531	9,558	3.4%	503,328	504,921	1,593	0.3%
	HBW	117,480	121,716	4,236	3.6%	175,158	175,203	44	0.0%
	NHBEB	17,115	17,121	6	0.0%	15,755	15,756	1	0.0%
	NHBO	79,674	79,748	75	0.1%	98,318	98,422	105	0.1%
PT	**TOTAL**	**45,478**	**47,031**	**1,553**	**3.4%**	**95,247**	**95,495**	**248**	**0.3%**
	HBEB	1,325	1,381	56	4.2%	990	990	0	0.0%
	HBO	24,449	25,419	970	4.0%	73,484	73,727	243	0.3%
	HBW	12,041	12,564	523	4.3%	13,304	13,308	3	0.0%
	NHBEB	688	689	0	0.0%	682	682	0	0.0%
	NHBO	6,975	6,979	4	0.1%	6,787	6,789	2	0.0%
Active Mode	**TOTAL**	**160,676**	**165,673**	**4,997**	**3.1%**	**218,307**	**218,783**	**476**	**0.2%**
	HBEB	1,075	1,118	43	4.0%	1,049	1,050	1	0.1%
	HBO	109,235	113,326	4,091	3.7%	182,557	183,007	450	0.2%
	HBW	19,556	20,397	841	4.3%	15,195	15,208	13	0.1%
	NHBEB	1,694	1,695	1	0.0%	2,188	2,189	1	0.0%
	NHBO	29,116	29,138	22	0.1%	17,318	17,330	12	0.1%

5.4 Key Statistics for Scenario 1 Plan:MK

5.4.1 Table 25 and Table 26 below provide a comparison between trips in the post demand model and base year matrices for AM and PM Peak hours and the average inter-peak. These totals exclude trips that do not pass through the Milton Keynes urban area, defined as external to external (ext – ext) to focus the assessment on trips to, from and within Milton Keynes urban area itself. The trip growth for car is less than 2%, ranging from 1% in the Inter-Peak to 1.6% in the AM peak. This reflects the small step change in going from the total number of jobs and dwellings in the Reference Case to the totals in Plan:MK Scenario 1.

5.4.2 Trips increase slightly more for public transport suggesting that the increase demand and therefore congestion in the highway network in the Plan:MK Scenario 1 scenario is making public transport more attractive.

Table 25 Highway Matrix Totals (car, all purposes excluding ext – ext Trips)

	2016	2031 Reference Case Post demand model	2031 Scen 1 Post Demand Model	% increase between Ref and Scen 1
AM	56180	66688	67725	1.6%
IP	33578	44288	44733	1.0%
PM	58591	72018	72912	1.2%

Table 26 Public Transport Matrix Totals (all purposes excluding ext – ext Trips)

	2016	2031 Reference Case Post demand model	2031 Scen 1 Post Demand Model	% increase between Ref and Scen 1
AM	5296	6253	6409	2.5%
IP	3831	5111	5199	1.7%
PM	4896	6195	6316	2.0%

5.4.3 The impacts of the demand model are presented in Figure 37 and Figure 38 for car and PT trips respectively. It can be seen that the demand model has a comparable impact in both the Reference Case and Plan:MK Scenario 1 scenarios, with congestion in the AM and PM peaks dampening demand for car trips.

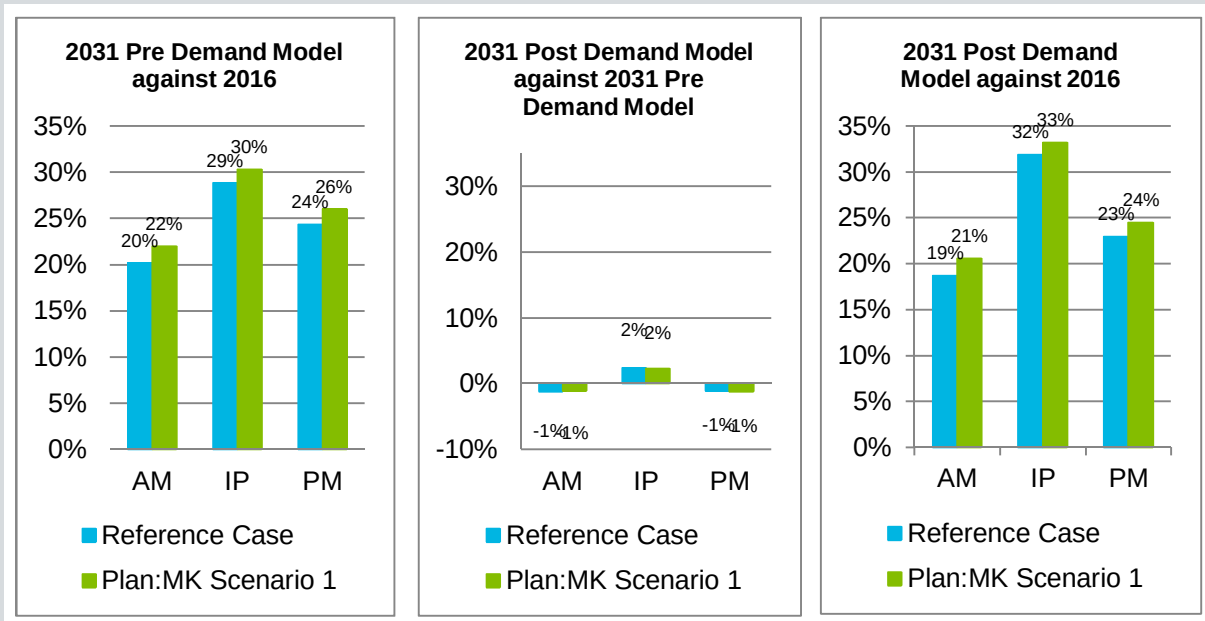


Figure 37. Percentage change in matrix totals (car, all purposes excluding Ext – Ext Trips)

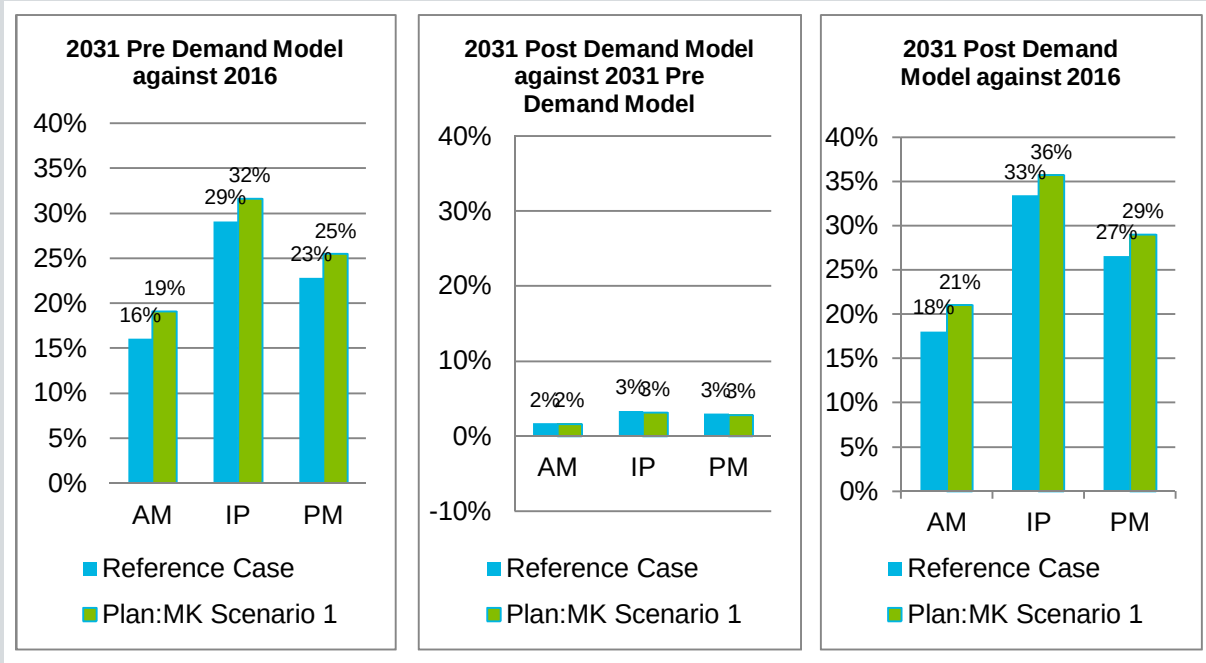


Figure 38. Percentage change in matrix totals (PT, all purposes excluding Ext – Ext Trips)

5.4.4 Table 27 compares the trip change at a sector level for traffic zones internal to the MK urban area and those external to the urban area. It can be seen that the Scenario 1 growth has the most significant impact on trips internal to the MK urban area with an increase between 2.4 and 2.9%. There is virtually no impact on trip numbers outside the MK urban area. In the AM peak trips from within the MK urban area to external areas increase as do (albeit by a negligible amount) trips external to internal in the PM Peak. These trips are going against the peak hour tidal flows so experience less congestion which results in less impact by the demand model.

Table 27 Demand model Car trip percentage change by sector, Scenario 1

	AM Peak Hour		Average IP		PM Peak Hour	
Sector	Internal	External	Internal	External	Internal	External
Internal	2.9%	3.0%	2.4%	-1.4%	2.6%	-1.1%
External	-1.3%	0.0%	-1.3%	0.0%	0.3%	0.0%

Table 28. Demand model Public Transport trip percentage change by sector, Scenario 1

	Average AM hour		Average IP		Average PM hour	
Sector	Internal	External	Internal	External	Internal	External
Internal	3.7%	7.2%	3.9%	-5.5%	5.1%	-2.2%
External	-4.2%	0.0%	6.2%	0.0%	-5.3%	0.1%

Vehicle Kilometres

5.4.5 The vehicle kilometres are presented for total car users and all vehicles, approximated by Passenger Car Unit (PCU) kilometres, within the simulation area of the highway model, and the public transport model which represents the local buses serving Milton Keynes and train journeys to or passing through Milton Keynes Central (MKC). Reference Case and base year figures are included as points of reference.

5.4.6 It is clear from Table 29 and Table 30 that Plan:MK Scenario 1 has little impact on the total distance travelled within the simulation area, with the percentage changes for car, bus and rail all less than 1%.

Table 29. Percentage change in vehicle kilometres (Car, All purposes, Simulation Network)

Time Period	2016	2031		
		Reference Case	Plan:MK Scenario 1	Scenario1 – Reference %diff
AM	828440	994669	1000517	0.6%
IP	509350	706276	705665	-0.1%
PM	875097	1086533	1088439	0.2%

Table 30. Percentage change in vehicle kilometres (Car, LGV, HGV (PCU), All purposes, Simulation Network)

Time Period	2016	2031		
		Reference Case	Plan:MK Scenario 1	Scenario1 – Reference %diff
AM	1102172	1316454	1322829	0.5%
IP	835646	1094172	1093833	0.0%
PM	1097356	1353451	1355640	0.2%

Table 31. Percentage change in passenger kilometres (Public Transport, 'Internal' area only)

Time Period	Mode	2016	2031		
			Reference Case	Plan:MK Scenario 1	Scenario1 – Reference %diff
AM	Bus	52004	50076	50440	0.7%
	Rail	396442	439278	441157	0.4%
	Total	448446	489355	491597	0.5%
IP	Bus	35326	41870	42010	0.3%
	Rail	224767	271497	270633	-0.3%
	Total	260093	313367	312644	-0.2%
PM	Bus	41660	44011	44221	0.5%
	Rail	486855	559949	561280	0.2%
	Total	528514	603959	605501	0.3%

Vehicle Hours

5.4.7 The vehicle hours from the highway model are presented in Table 32 and Table 33 for the simulation area only, with passenger hours from the public transport model presented for all passengers within the internal area in Table 34.

5.4.8 As with total distance travelled, Plan:MK Scenario 1 has a negligible impact on total vehicle hours travelled within the simulation area. Bus vehicle hours within the internal area have the largest change out of all modes, in the AM average hour, but that is only 1.2%.

Table 32. Percentage change in vehicle hours (Car, All purposes, Simulation Network)

Time Period	2016	2031		
		Reference Case	Plan:MK Scenario 1	Scenario1 – Reference %diff
AM	14247	19070	19185	0.6%
IP	7440	10594	10590	0.0%
PM	14656	19895	19972	0.4%

Table 33. Percentage change in vehicle hours (Car, LGV, HGV (PCU), All purposes, Simulation Network)

Time Period	2016	2031		
		Reference Case	Plan:MK Scenario 1	Scenario1 – Reference %diff
AM	18193	24112	24234	0.5%
IP	11556	15689	15676	-0.1%
PM	17710	23821	23907	0.4%

Table 34. Percentage change in passenger hours (Public Transport, 'Internal' area only)

Time Period	Mode	2016	2031		
			Reference Case	Plan:MK Scenario 1	Scenario1 – Reference %diff
AM	Bus	1643	1757	1779	1.2%
	Rail	2979	3289	3306	0.5%
	Total	4623	5046	5085	0.8%
IP	Bus	1133	1386	1399	0.9%
	Rail	1504	1830	1824	-0.4%
	Total	2637	3216	3222	0.2%
PM	Bus	1311	1523	1537	0.9%
	Rail	3371	3896	3904	0.2%
	Total	4682	5419	5441	0.4%

5.5 Summary

5.5.1 As shown in Figure 39, trip distance and travel time changes for both car and public transport are negligible. In both the AM and PM peaks both distance travelled and travel time in the simulation area for car increases marginally, as does passenger hours and passenger km in for public transport. However in the Inter-Peak there is a marginal decrease in distance travelled and travel time for car suggesting that trips are fractionally shorter in terms of both time and distance in the Plan:MK Scenario1 Inter-Peak, Inter-Peak passenger km also decreases marginally in the public transport model but passenger hours is marginally higher.

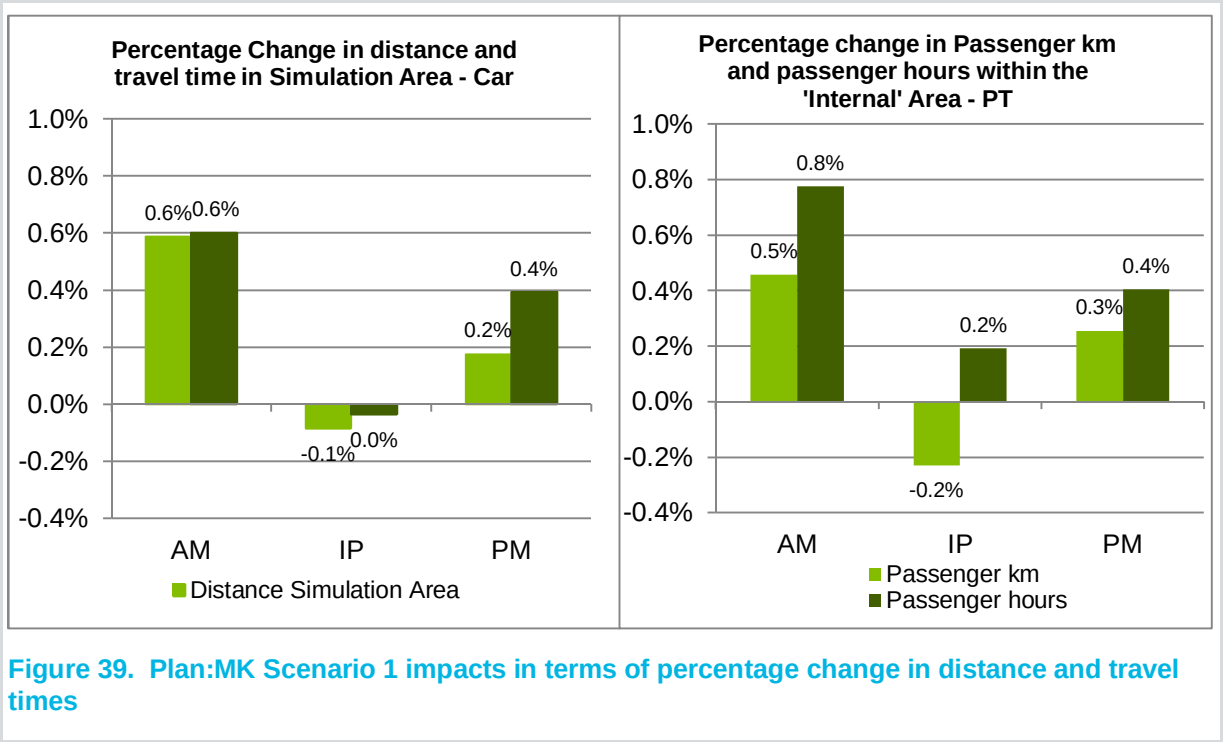


Figure 39. Plan:MK Scenario 1 impacts in terms of percentage change in distance and travel times

5.6 Traffic Flows

5.6.1 As shown by Figure 40 to Figure 45, Plan:MK Scenario 1 has limited impact on traffic flows in Milton Keynes. The changes in flow reflect the additional 1000 dwellings in the South East Milton Keynes Allocation (SEMK1) accessing the network via the H10 extension and 4254 jobs in South Caldecotte employment site. There is also a marginal increase on H6 Childs Way due to the dwellings growth within CMK.

5.6.2 On Brickhill Street between Kelly's Kitchen roundabout and the site access for South Caldecotte there is an increase in flow northbound in the AM to around 600 passenger car units (PCU), an increase of around 200 PCU, with an increase of around 300 PCU southbound in the PM to a total of around 1100 PCU. On Tongwell Street between H9 and H10, there is in the region of 200 extra PCU travelling northbound in the AM peak totalling 1300-1500 PCU.

5.6.3 The A5 southbound between H9 and Kelly's Kitchen roundabout in the AM peak, has the largest increase of around 300 PCU to 1400 PCU. There is also an increase of 100 PCU northbound on this part of the A5 in the PM where flows on this stretch are higher with 2000 PCU northbound. In the Inter-peak it is notable that some traffic re-assigns using the A5 and H10 from V10 Brickhill Street, this is likely to also occur in the AM and PM peaks but is masked by the increase in commuting trips to and from South Caldecotte. There is also an increase of around 100 PCU travelling towards Bletchley in the PM from Kelly's Kitchen roundabout along Watling Street up to 500-600 PCU.

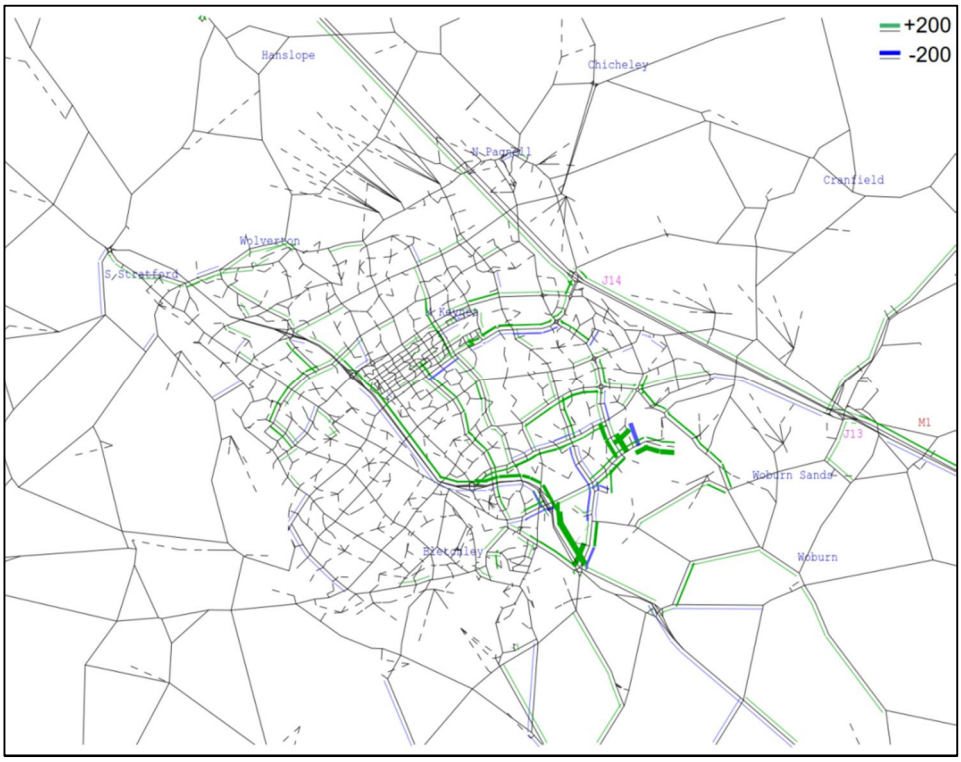


Figure 40. Change in Modelled flow, Scenario 1 less Reference Case AM peak

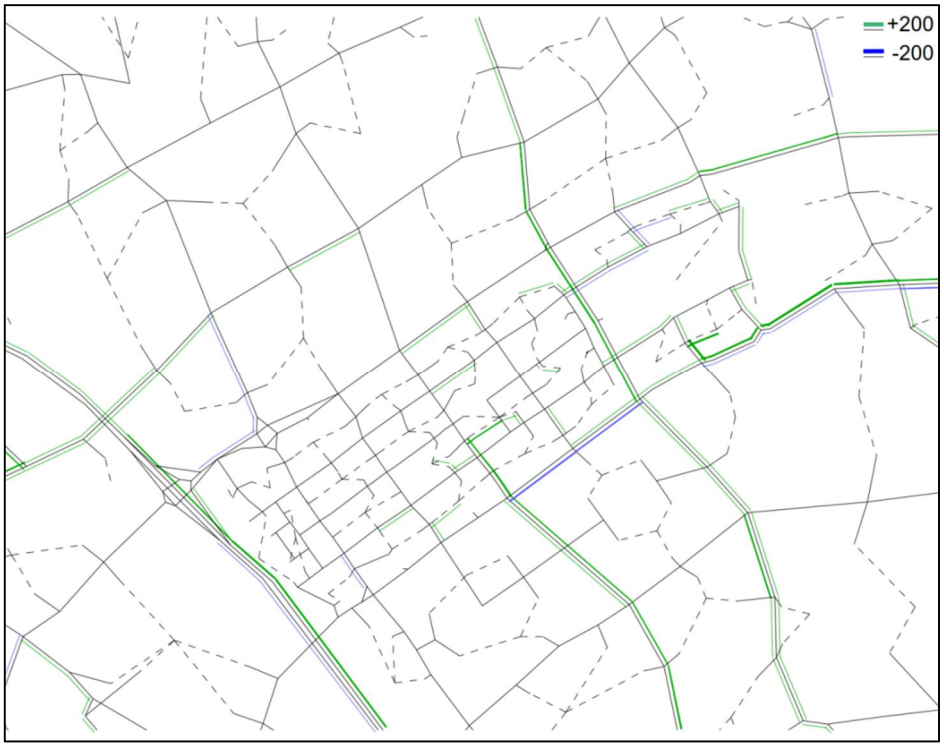


Figure 41. Change in Modelled flow CMK, Scenario 1 less Reference Case AM

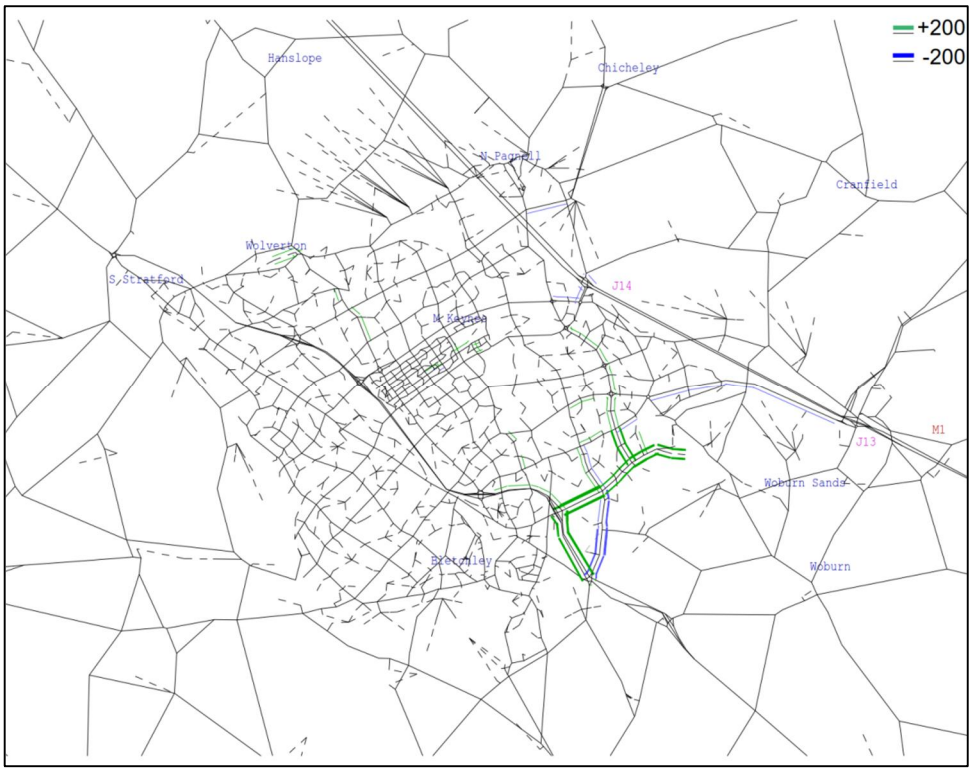


Figure 42. Change in Modelled flow, Scenario 1 less Reference Case IP

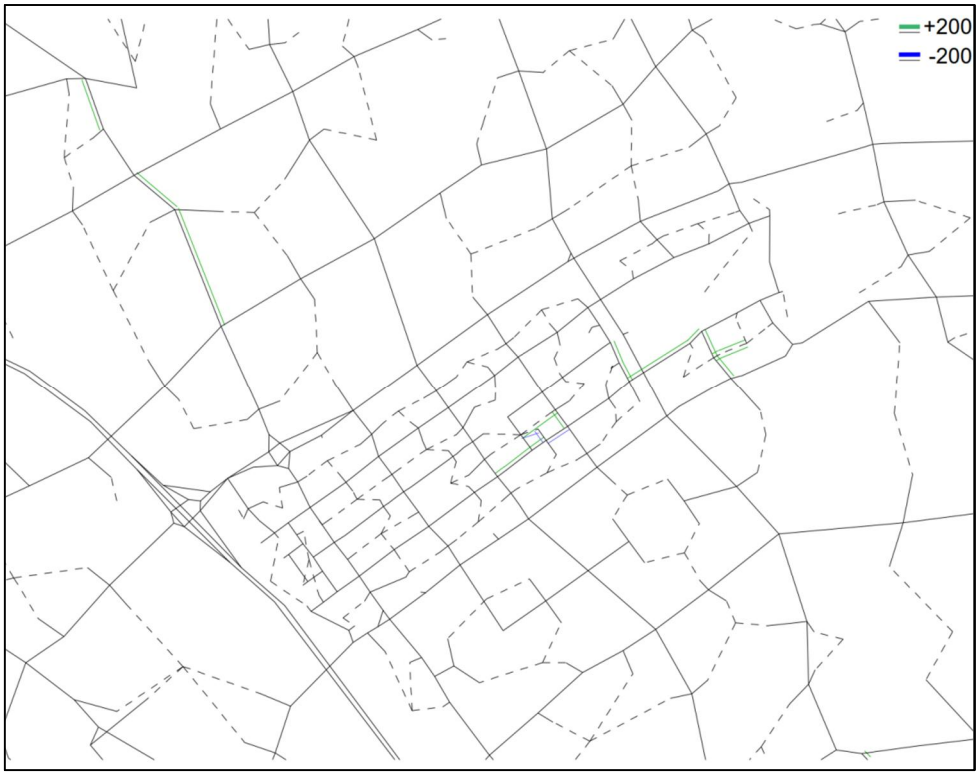


Figure 43. Change in Modelled flow CMK, Scenario 1 less Reference Case IP

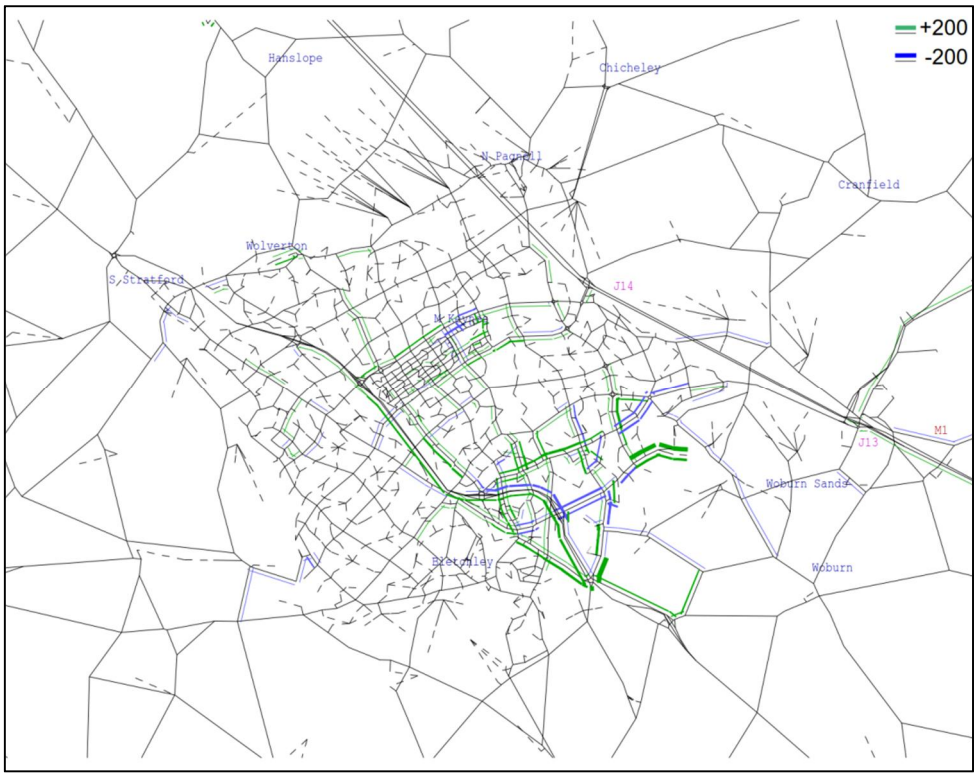


Figure 44. Change in Modelled flow, Scenario 1 less Reference Case PM peak

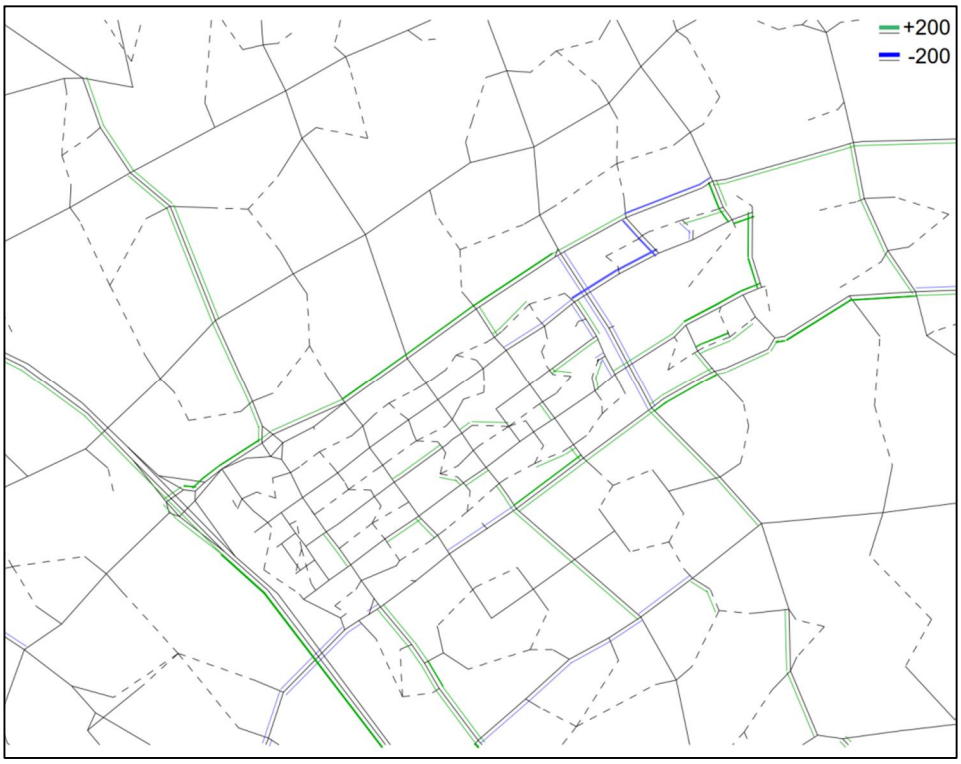


Figure 45. Change in Modelled flow CMK, Scenario 1 – Reference Case PM

5.7 Screenline Flows

5.7.1 In addition to actual flow comparison plots, the percentage change in actual flow crossing the cordons and screenlines used as part of the calibration and validation of the base year networks (as shown in Figure 46) has been determined.

5.7.2 The impact of Plan:MK Scenario 1 on screenline flows is presented in Table 35. The changes are broadly in line with those of trips, though in the AM peak there is a 5% increase in actual flow crossing the CMK cordon heading outbound which is due to the housing growth in CMK.

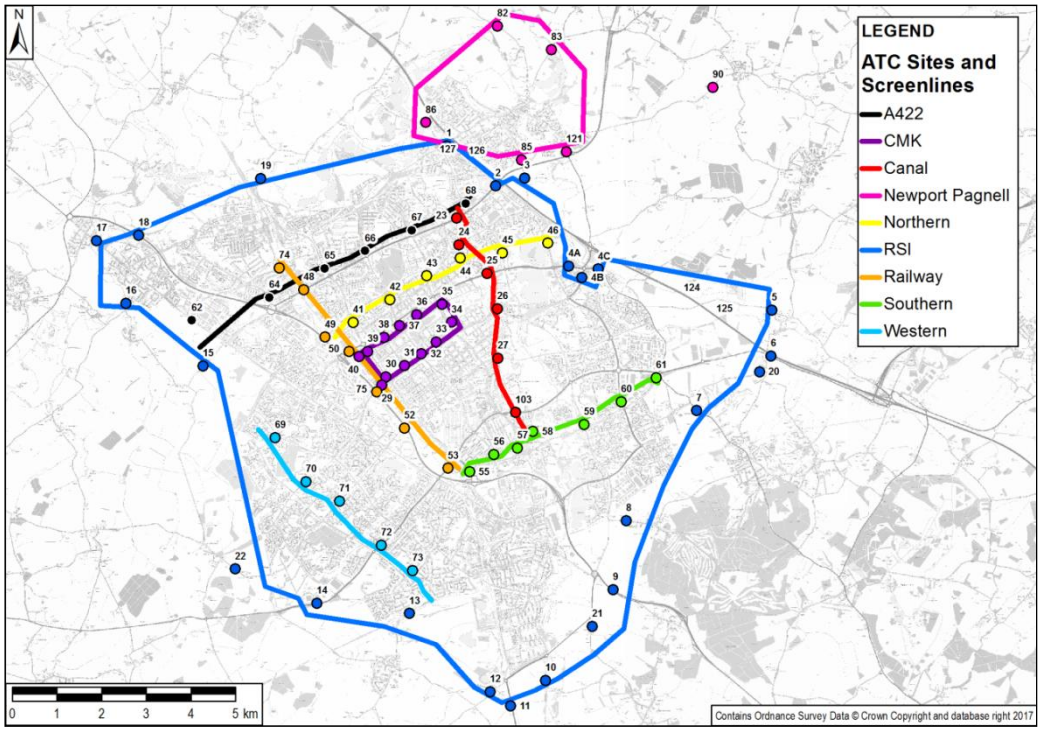


Figure 46. Highway Model Cordons and Screenlines

Table 35. Percentage change in highway screenline flows between Reference Case and Plan:MK Scenario 1

Cordon/Screenline	AM	Inter-Peak	PM
RSI Inbound Cordon	0%	-1%	0%
RSI Outbound Cordon	2%	-1%	-1%
Canal Eastbound	3%	-1%	0%
Canal Westbound	0%	0%	1%
CMK Inbound	0%	1%	2%
CMK Outbound	5%	1%	0%
Northern Southbound	0%	1%	1%
Northern Northbound	2%	1%	0%
Railway Eastbound	0%	0%	0%
Railway Westbound	1%	0%	0%
Southern Southbound	2%	1%	1%
Southern Northbound	2%	2%	1%
A422 Northbound	0%	1%	1%
A422 Southbound	0%	1%	1%
Western Eastbound	0%	0%	1%
Western Westbound	1%	0%	0%
M1 Northbound	0%	0%	0%
M1 Southbound	0%	0%	0%

5.8 Average Speeds

5.8.1 The change in average simulation network speeds is presented in Table 36. It is clear that Plan:MK Scenario 1 has negligible impact on average network speed.

Table 36. Change in Average Network Speed between Scenario 1 and Reference Case

HW	AM Peak	Inter-Peak	PM Peak
Average Network Speed	0.0%	0.1%	-0.2%

5.9 Travel Times

5.9.1 The routes used for the journey time validation have been used as a measure of the impacts of Plan:MK Scenario 1. The route map is presented in Figure 47 and the percentage increase in travel times on each route by time period is presented in Table 37. With the exception of Route 8 between Bletchley and Newport Pagnell, and Route 9, along Brickhill Street, the journey time routes are not significantly impacted by Plan:MK Scenario 1.

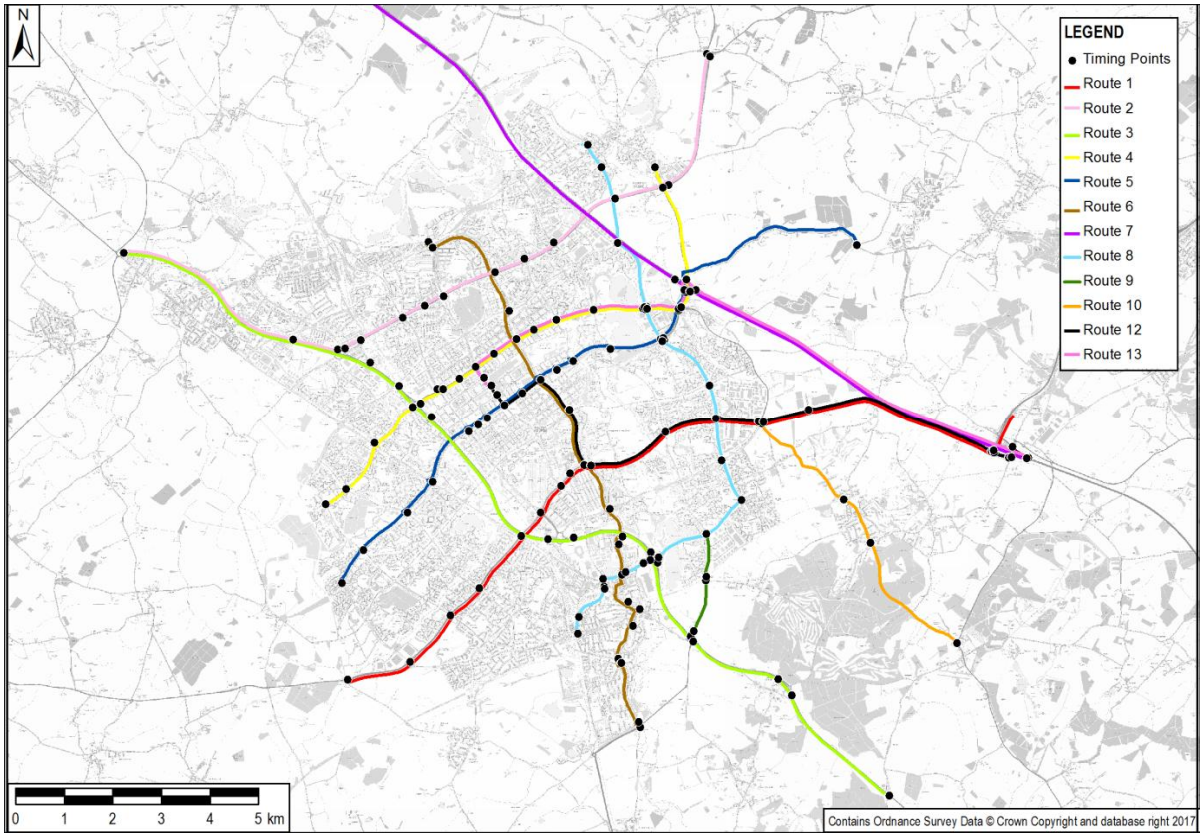


Figure 47. Journey Time Routes

Table 37 : Change in travel times from Reference Case as result of Plan:MK Scenario 1

Route	Route Description	AM	IP	PM
1EB	A421 to M1 J13	1%	0%	0%
1WB	A421 from M1 J13	-1%	0%	2%
2EB	Old Stratford to Chicheley	0%	0%	0%
2WB	Chicheley to Old Stratford	0%	0%	0%
3SB	Old Stratford to Watling, Little Brickhill	1%	0%	0%
3NB	Watling, Little Brickhill to Old Stratford	0%	0%	0%
4EB	Portway/Fulmer St to Newport Pagnell	1%	0%	-1%
4WB	Newport Pagnell to Portway/Fulmer St	0%	0%	0%
5EB	Moulsoe to Child's Way / Tattenhoe St.	1%	0%	0%
5WB	Child's Way / Tattenhoe St. to Moulsoe	1%	0%	1%
6SB	Saxon St. / Newport Rd. to A4146 / Stoke Rd.	2%	0%	0%
6NB	A4146 / Stoke Rd. to Saxon St. / Newport Rd.	0%	0%	1%
7SB	M1 J15 to M1 J13	0%	0%	0%
7NB	M1 J13 to M1 J15	0%	0%	0%
8SB	Newport Pagnell to Bletchley	2%	0%	1%
8NB	Bletchley to Newport Pagnell	1%	0%	2%
9SB	Brickhill Street Southbound	3%	1%	3%
9NB	Brickhill Street Northbound	7%	7%	25%
10SB	A5130 through Woburn Sands SB	1%	0%	-1%
10NB	A5130 through Woburn Sands NB	0%	0%	0%
12EB	MK central to M1 J13 via A421	1%	0%	-1%
12WB	M1 J13 to MK Central via A421	-1%	0%	1%
13EB	MK Central to M1 J13 via M1 J14	0%	0%	-1%
13WB	M1 J13 to MK Central via M1 J14	-1%	0%	1%
Total		**1%**	**0%**	**1%**

5.9.2 As shown in Figure 47, Route 8 runs down V11 Tongwell Street and along H10 Bletcham Way which will be used by traffic travelling to and from the 1000 dwelling development in the Strategic Urban Extension South East. The Brickhill street route is used to access the South Caldecotte employment site and is also near the South East Milton Keynes Allocation (SEMK1) and the increase in journey time reflects the localised impacts of these developments.

5.9.3 The impacts on Route 8 appear much less significant in terms of percentage increase as the route is much longer than that of route 9, however looking at the journey time plots comparing Plan:MK Scenario 1 journey times against Reference Case as presented in Figure 48 to Figure 51, there is a notable increase in delay of around 30 seconds the eastbound approach to Brickhill Street/H10 junction in the PM peak with around 20 seconds additional delay on the westbound approach in the AM.

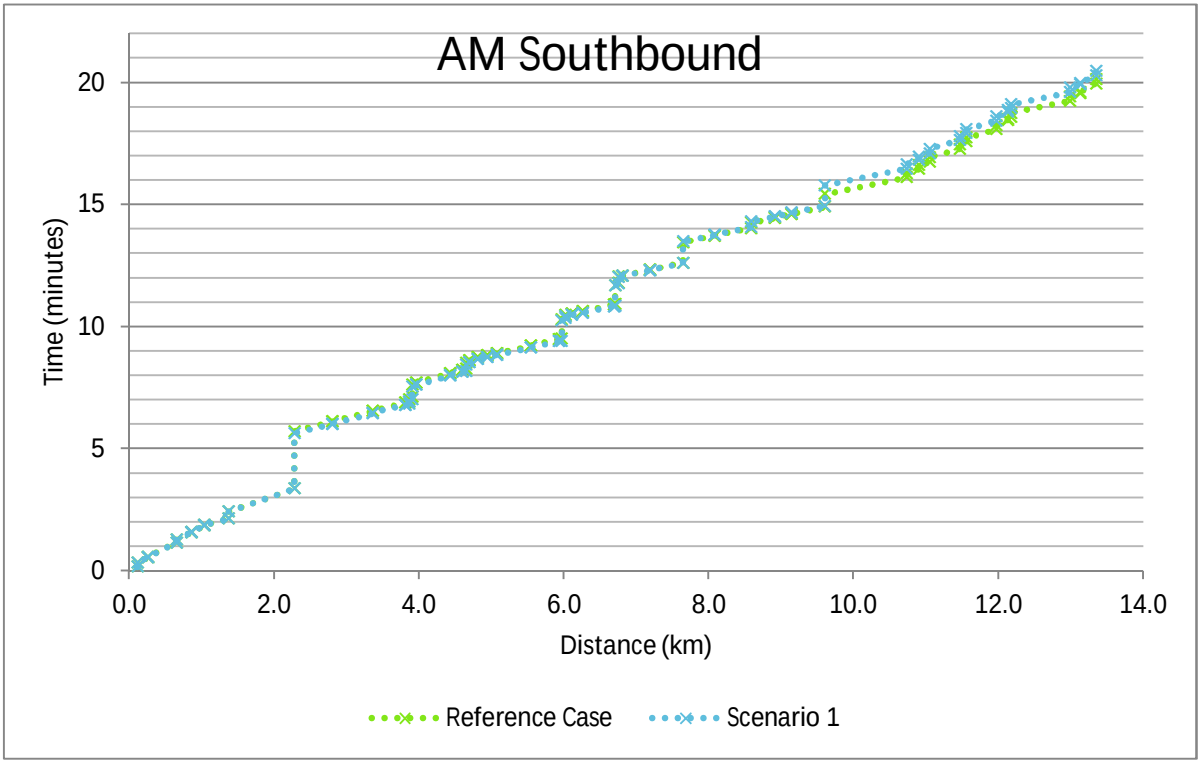


Figure 48. Route 8 AM Southbound

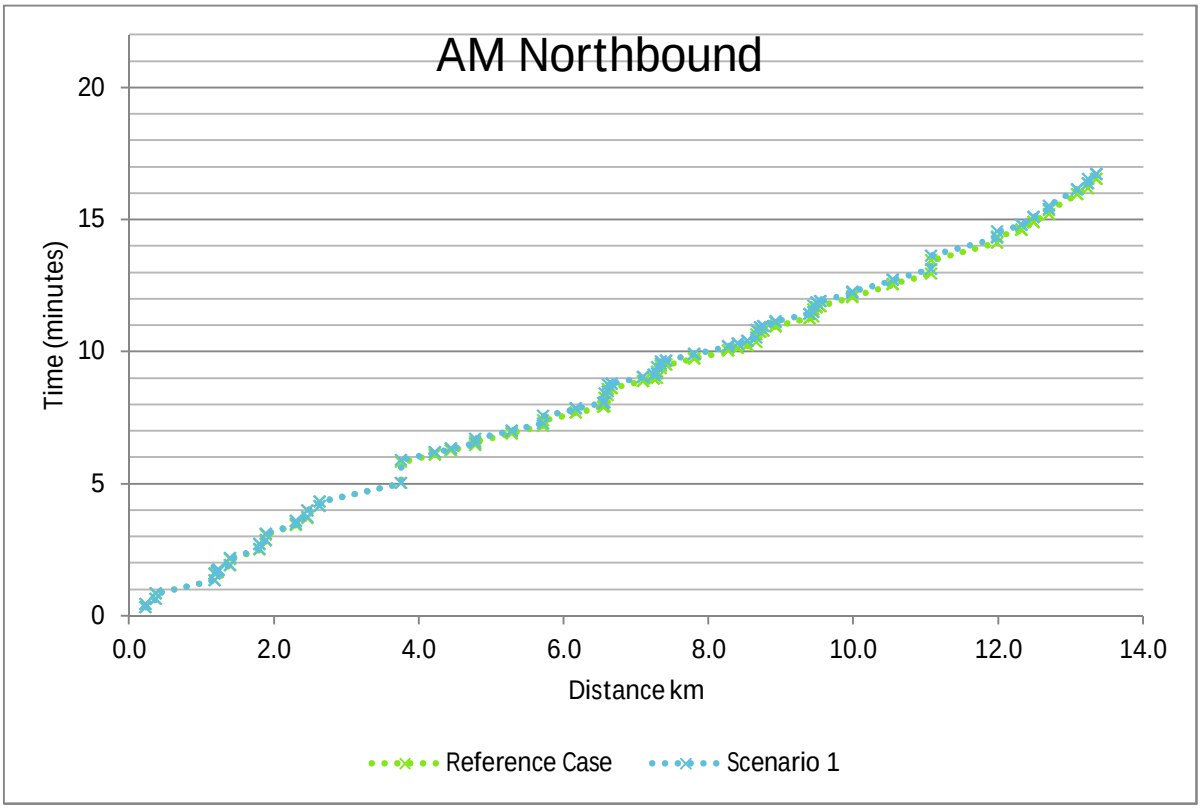


Figure 49. Route 8 AM Southbound

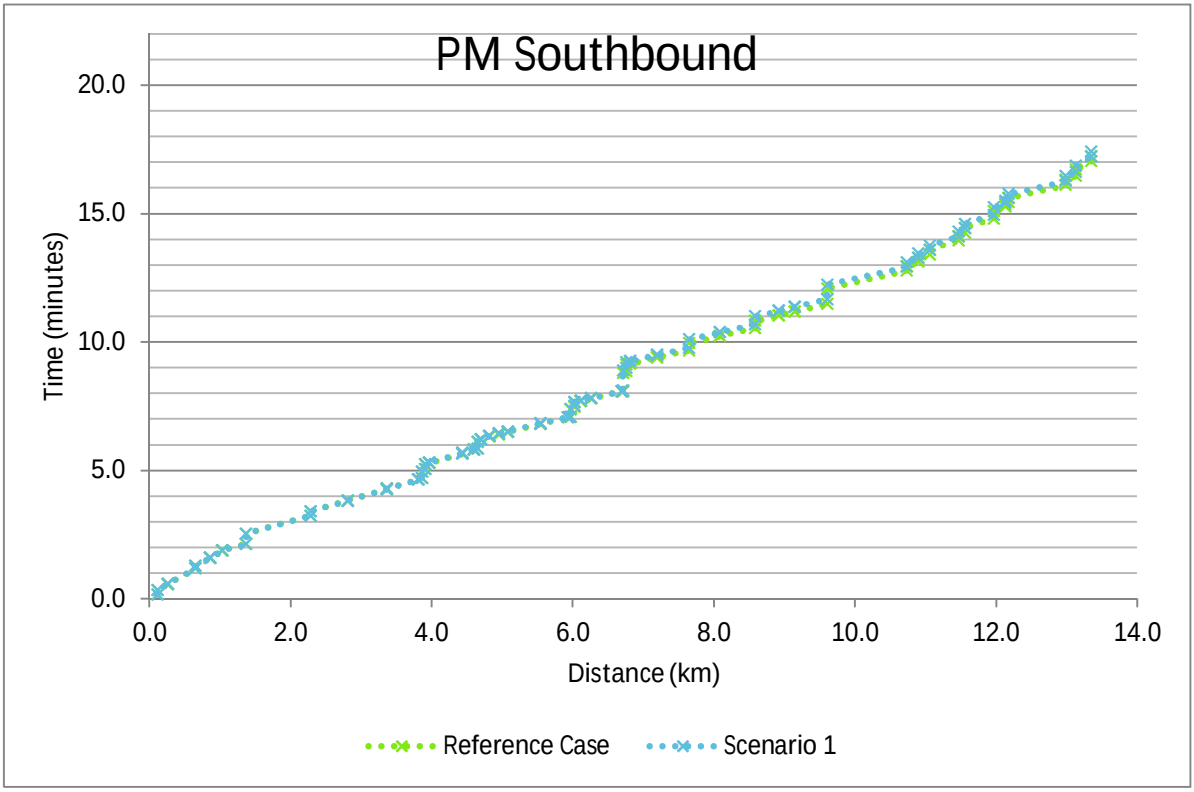


Figure 50. Route 8 AM Southbound

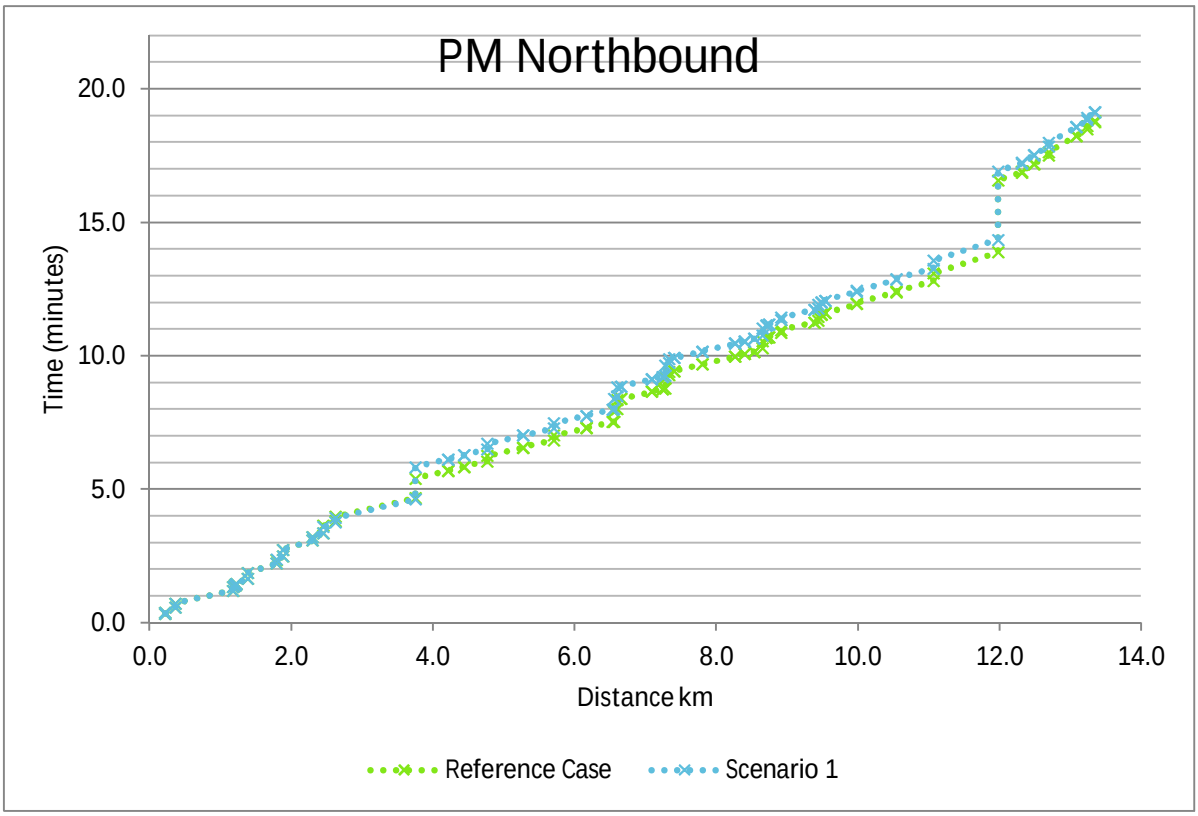


Figure 51. Route 8 AM Southbound

5.9.4 The relatively large percentage increase in journey times along route 9 are due the short length of the route resulting in a small change in time producing a relatively large percentage difference. The journey time plots of Route 9 Brickhill Street, presented in Figure 52 and

Figure 53, show little change between Scenario 1 and the Reference Case. There is extra delay caused by the new roundabout to access the South Caldecotte site, the largest increase is 12 seconds northbound in AM. Northbound there is worsening of the delay at the junction of Brickhill Street and H10. This is most impacted in the PM where there is almost a minute additional delay compared to the Reference Case.

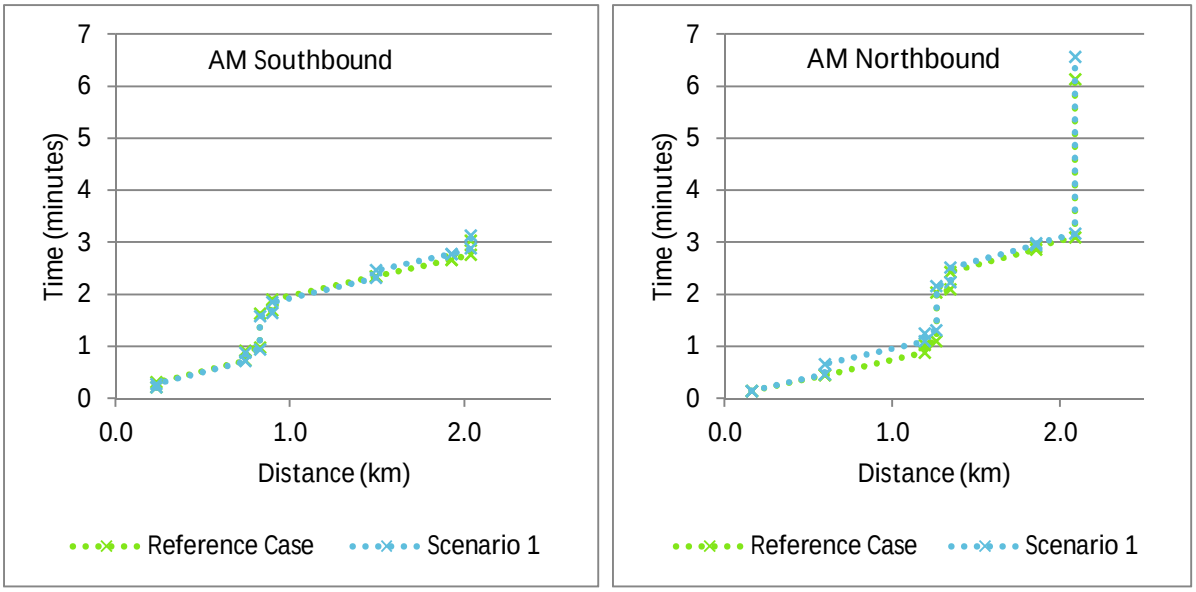


Figure 52. AM JT Route 9 Comparison Scenario 1 against Reference Case

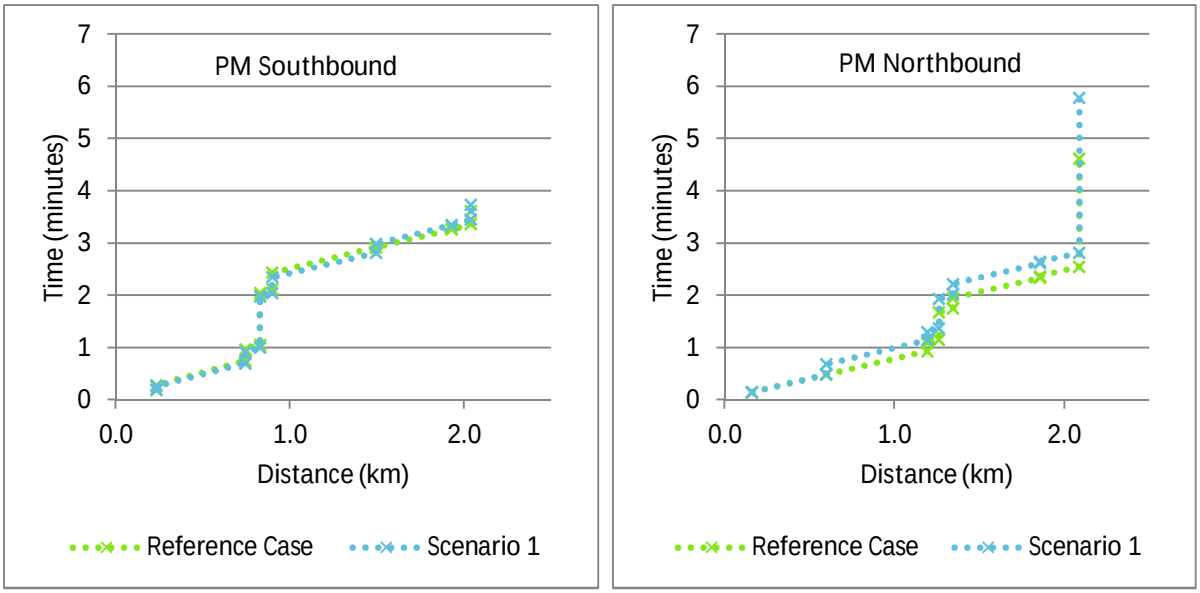
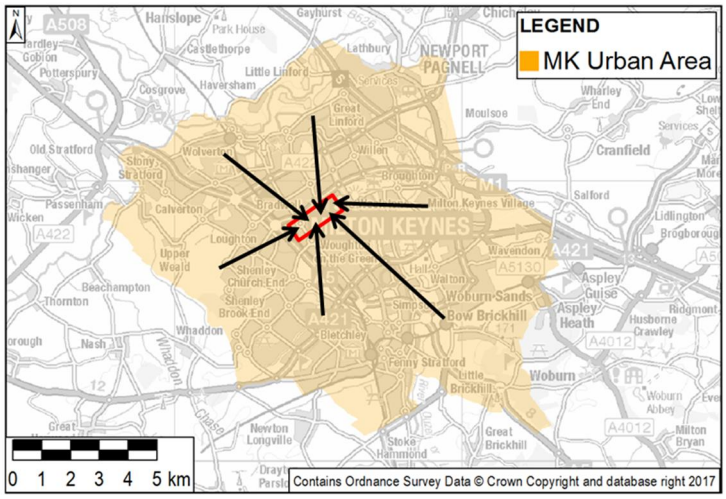


Figure 53. PM JT Route 9 Comparison Scenario 1 against Reference Case

5.10 Trips to and from Milton Keynes

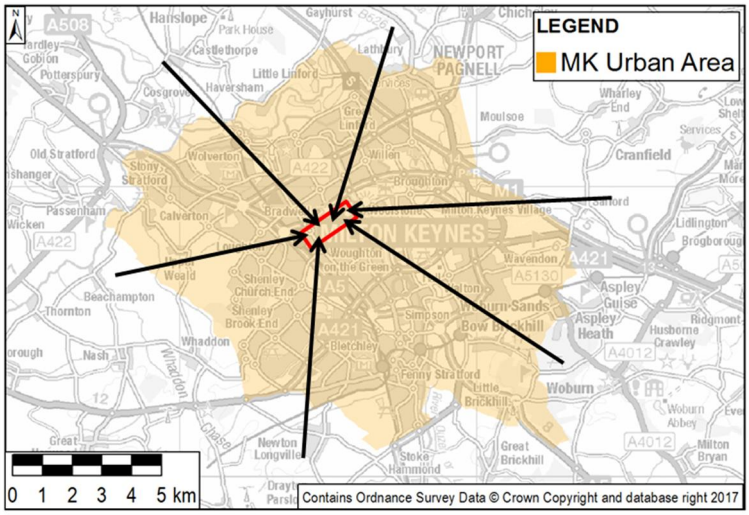
5.10.1 As a result of no jobs growth in Central Milton Keynes in Scenario 1, the total number of trips crossing into CMK in the AM peak and crossing out of CMK in the PM peak is comparable in both the Scenario 1 and Reference Case scenarios.

5.10.2 However as shown in Figure 54 to Figure 57 there has been a 1% increase in trips coming into CMK from within MK urban area in the AM and a 2% increase in trips leaving CMK and travelling within the MK urban area, conversely trips from outside MK urban area in the AM peak have decreased by 2% and those travelling from CMK to outside MK urban area in the PM peak have also reduced by 2%. This is likely to be a result of the additional housing in Milton Keynes urban area meaning more jobs are taken up locally. It is also worth noting that the jobs growth in Plan:MK Scenario 1 is outside the CMK cordon so jobs within the cordon remain the same those in the Reference Case resulting in little change in total trips crossing into CMK during the AM peak and out of CMK during the PM peak.



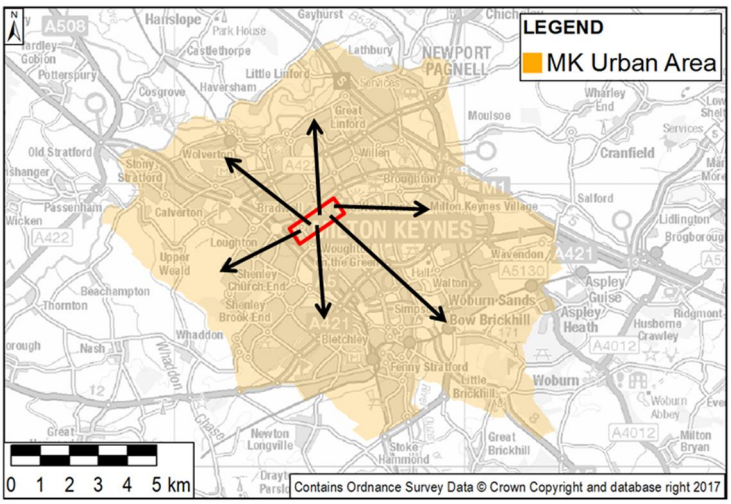
2031 Reference Case	7359
2031 Plan:MK Scenario 1	7434
Percentage Difference	1%

Figure 54. Car trips from non-central Milton Keynes to Central Milton Keynes, AM peak



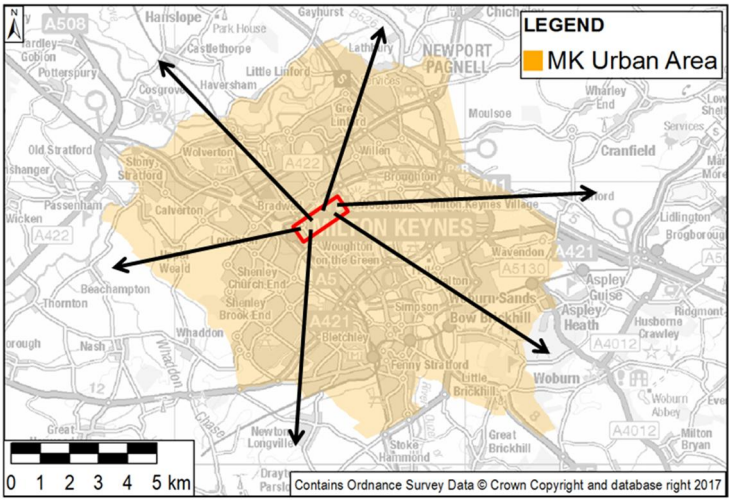
2031 Reference Case	4574
2031 Plan:MK Scenario 1	4484
Percentage Difference	-2%

Figure 55. Car trips from outside the MK Urban Area to Central Milton Keynes, AM peak



2031 Reference Case	7078
2031 Plan:MK Scenario 1	7185
Percentage Difference:	2%

Figure 56. Car trips from non-central Milton Keynes to Central Milton Keynes, PM peak



2031 Reference Case	4217
2031 Plan:MK Scenario 1	4135
Percentage Difference:	-2%

Figure 57. Car trips from Central Milton Keynes to outside the MK Urban Area, PM peak

5.11 Delays

5.11.1 As presented in Figure 58, Plan:MK Scenario 1 has little impact on junction delay over and above those of the Reference Case. The most significant increase being an average delay of 19 seconds in the PM Peak at the H10 Bletcham Way/ V10 Brickhill Street Roundabout.

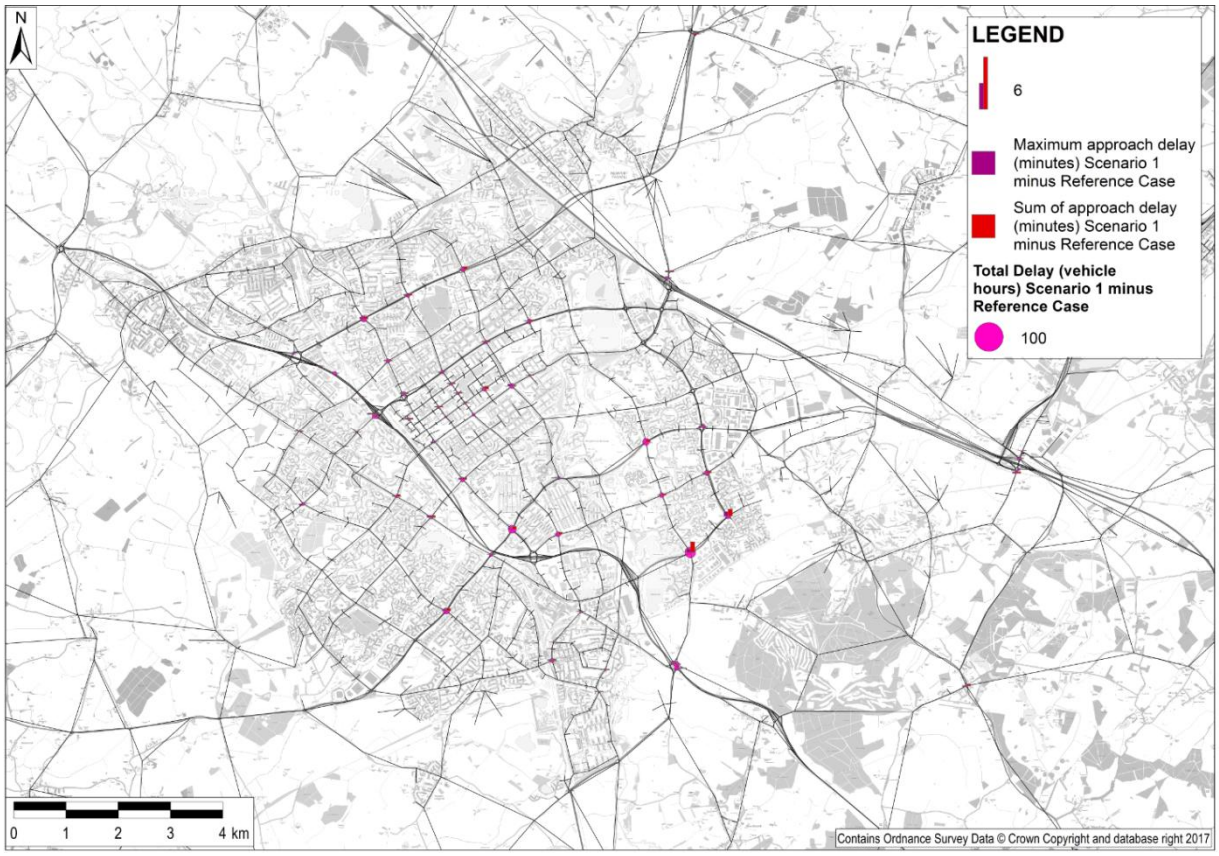


Figure 58. Change in junction delay at congestion hot spots – Scenario 1 minus Reference Case

5.12 Volume over Capacity Ratios

5.12.1 Due to much lower levels of congestion in the Inter-Peak period, Plan:MK Scenario 1 has little impact in that time period. As such, this section focusses on the AM and PM Peaks. Figure 59 and Figure 60 show where links and junctions have changed band between the Reference Case and Scenario 1, where the bands are defined as <85%, 85-100% and >100%. It is considered that a V/C of 85% and above is when a junction starts experiencing issues of congestion.

5.12.2 Figure 61 and Figure 62 show the total V/C ratio in Plan:MK Scenario 1.

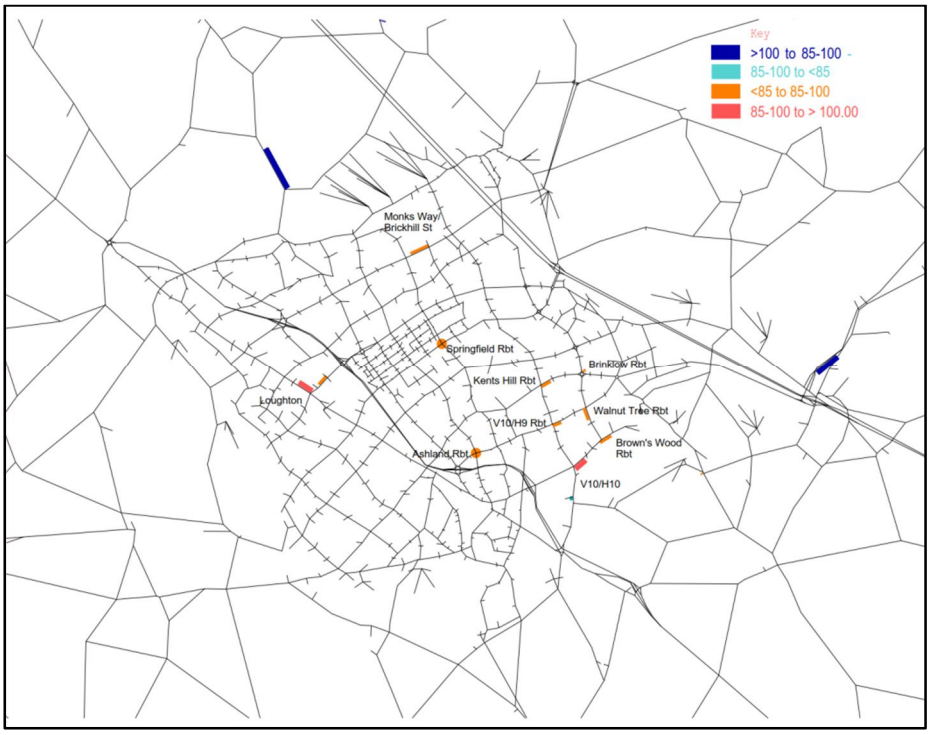


Figure 59. V/C ratio band changes between Reference and Scenario 1, AM

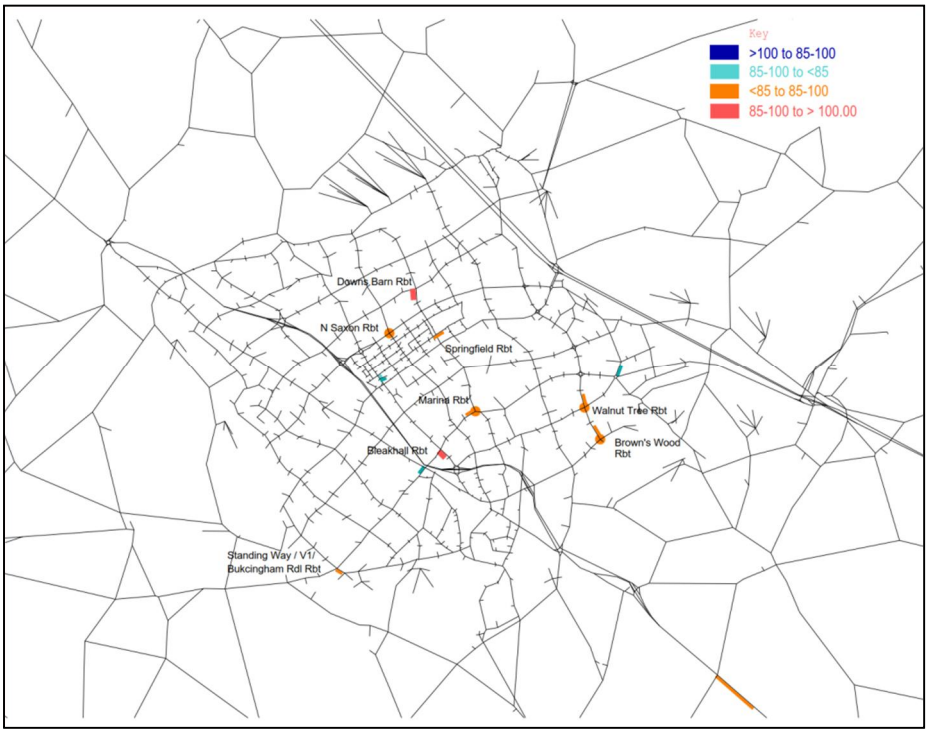


Figure 60. V/C ratio band changes between Reference and Scenario 1, PM

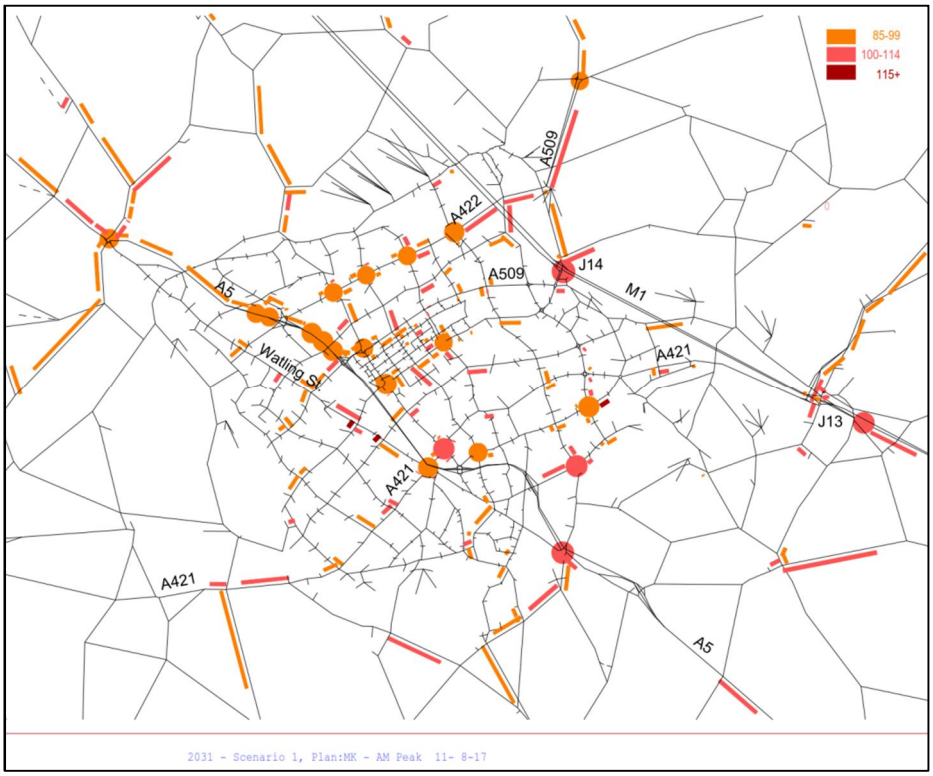


Figure 61. 2031 Plan:MK Scenario 1, link and junction V/C over 85%, AM Peak

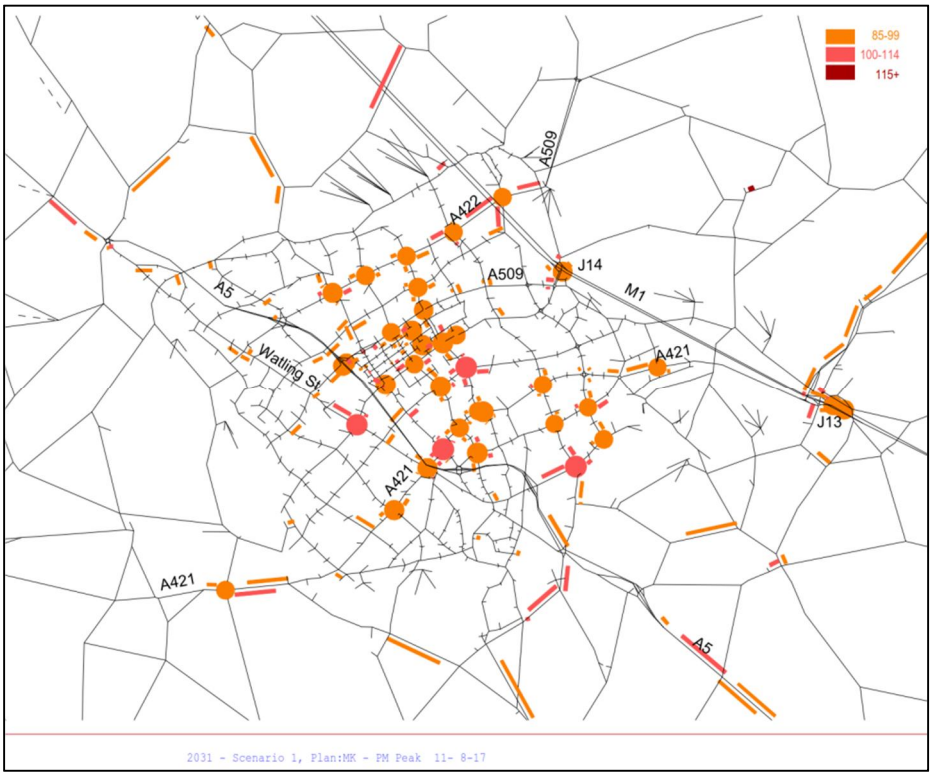


Figure 62. 2031 Plan:MK Scenario 1, link and junction V/C over 85%, PM Peak

5.13 Junctions

5.13.1 The junctions flagged up as changing band in Figure 59 and Figure 60 have been looked at and compared across both time periods to establish the extent of the impacts of Plan:MK Scenario 1 against the Reference Case. Junctions which are forecast in the MKMM model to be particularly impacted by Plan:MK Scenario 1, are highlighted Table 38.

Table 38. Junctions impacted by Plan:MK Scenario 1

Junction	Issue in Reference Case?		Issue in Scenario 1		Conclusion
	AM	PM	AM	PM	
Springfield Roundabout	southbound approach V/C over 85%, northbound approach V/C over 100%	Average junction V/C over 85%, Westbound and Northbound approaches 85% and above, Southbound and Eastbound approaches over 100%	Average V/C now over 85%	As Reference Case	Reference Case issue
Loughton Roundabout	Southbound approach 99%	Westbound Approach over 85%	Southbound approach now 100%	As Reference Case	Impact on Southbound approach only 1% increase
Portway//Attingham Hill junction	No modelled issues	Westbound approach over 85%	Eastbound Approach now over 85%	As Reference Case	Change in AM only 1% changed from 84 to 85%
Ashland Roundabout	eastbound approach 96% westbound approach 91%	eastbound approach 93% westbound approach 100%, southbound approach 101% northbound 86%	Average jct V/C over 85%	As reference case	Reference Case issue
Kent's Hill Roundabout	Southbound approach over 85%	average junction V/C over 85%, all approaches except Westbound over 85%	Westbound approach in AM now over 85% Average junction V/C	As reference case	Westbound approach due to plan MK
Brinklow Roundabout	Eastbound approach 110% Southbound approach 84%	Southbound eastbound and Westbound Approaches over 85%	Southbound approach now 85% as well	As Reference Case	Reference Case issue
Walnut Tree Roundabout	southbound approach 101%, eastbound approach 93% westbound approach 115%	Southbound approach 84%, Eastbound approach 101% Westbound approach 102%	Northbound approach now also over 85%	Average Junction V/C now over 85%	Northbound approach due to Plan:MK
V10/H9 Roundabout	Northbound approach to jct	Northbound and	Westbound approach now	As reference case	Westbound

Junction	Issue in Reference Case?		Issue in Scenario 1		Conclusion
	AM	PM	AM	PM	
	over 85%	southbound approaches over 85%	over 85%		approach due to Plan:MK
V10/H10 Roundabout	Average junction V/C over 100%	Average junction V/C over 100%	Westbound approach now over 100%	As reference case	Reference Case issue
Brown's Wood Roundabout	No modelled issues	Eastbound approach 90%	Northbound and Westbound approaches over 85%	Average junction V/C over 85% and Southbound approach over 85%	Southbound and westbound approach issues due to Plan:MK
New Saxon Roundabout	Southbound approach over 100%	Northbound and westbound approaches over 100%	As reference case	Average junction V/C over 85% in PM 86% compared to 84% in reference case	Reference Case issue
Marina Roundabout	No modelled issues	Southbound approach over 85%	As reference case	Eastbound approach and average junction V/C over 85%	Due to Plan :Mk
Down's Barn Roundabout	westbound approach 105, southbound approach 81%	Average junction V/C over 85%, Northbound approach 99%	No modelled issues	Northbound Approach now 100%	Reference Case issue
Bleakhall Roundabout	Average V/C over 100%	Average V/C over 100%	As reference case	Northbound Approach now 100%	Primarily Reference Case issue
Standing Way/ V1 / Buckingham Rd Roundabout	Eastbound and Southbound approaches over 85%	Northbound approach 83%	As reference case	Northbound Approach now over 85%	Primarily Reference Case Issue, NB approach Scenario 1 issue.

5.14 Conclusion

5.14.1 Plan:MK Scenario 1 has little impact over and above the Reference Case in terms of traffic flows and delays across the Milton Keynes urban area. Both M1 Junction 13 and Junction 14, although already experiencing issues of congestion in the Reference Case, are not significantly impacted by Plan:MK Scenario 1. Plan:MK Scenario 1 does however impact around the South Caldecotte employment site and South East Milton Keynes Allocation (SEMK1) with a number of junctions requiring further mitigation measures in addition to the mitigation required to address Reference Case issues

6. Plan:MK Scenario 2

6.1 Introduction

6.1.1 Plan:MK Scenario 2 includes the same growth as the Reference Case plus an additional 10674 dwellings (10322 Households) and 11502 additional jobs.

6.1.2 It is important to consider when assessing the impacts of Plan:MK Scenario 2 the size of the additional growth relative to the 110,000 dwellings and 170,000 jobs already in Milton Keynes Borough. The Reference Case increases these by 20% and 17% respectively. Plan:MK Scenario 2 growth is equivalent to 49% (dwellings) and 40% (jobs) of the Reference Case growth, this equates to only a 10% increase in dwellings and a 7% increase in jobs, compared to the total number of dwellings and jobs in the 2031 Reference Case. This growth is more significant than that of Scenario 1 and would therefore be expected to have a more significant impact on the highway network.

6.2 Plan:MK Scenario 2 Growth

6.2.1 Scenario 2 consisted of the following growth assumptions over and above the housing and employment tested within the Reference Case 2031 and Plan:MK Scenario 1.

Housing:

- A further 2,000 homes at land south of the railway within the South East Milton Keynes Allocation (SEMK2) contained within the Draft Plan:MK March 2017
- 2,998 homes at land East of the M1 contained within the Draft Plan:MK March 2017
- A further 56 homes across two urban housing sites considered deliverable or developable within the draft SHLAA 2017

Employment:

- 6,330 jobs within the industrial and logistics sector associated with the land East of the M1 contained within the Draft Plan:MK
- 918 jobs within office/research sector associated with the proposed further/higher education establishment on Block B4 in Central Milton Keynes

6.2.2 Within Scenario 2, a variation was tested that excluded the East of M1 housing and employment growth and the employment growth on Block B4 to understand the impact upon the network with just the additional 2,000 homes at the proposed South East Milton Keynes allocation. This is referred to as Scenario 2a and is discussed later in this report.

6.2.3 Another variation to Scenario 2 was tested that increased the amount of housing to 5,000 homes within the East of M1 development. This is referred to as Scenario 2b and is also discussed later in this report

6.2.4 The Scenario 2 dwellings and employment growth is plotted in Figure 63 and Figure 64 respectively.

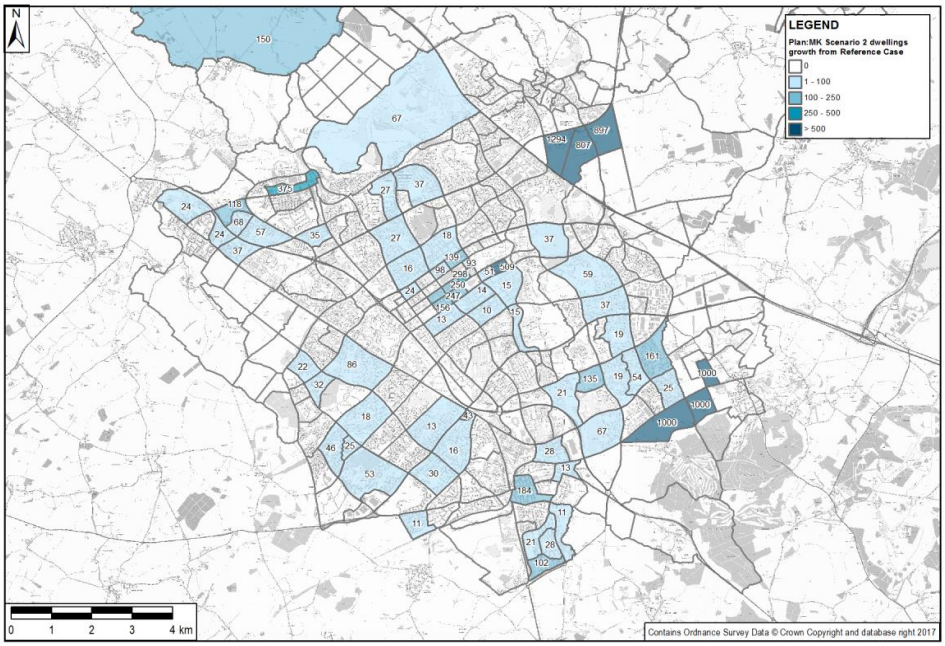


Figure 63. Plan:MK Scenario 2 Additional Dwellings Growth to 2031

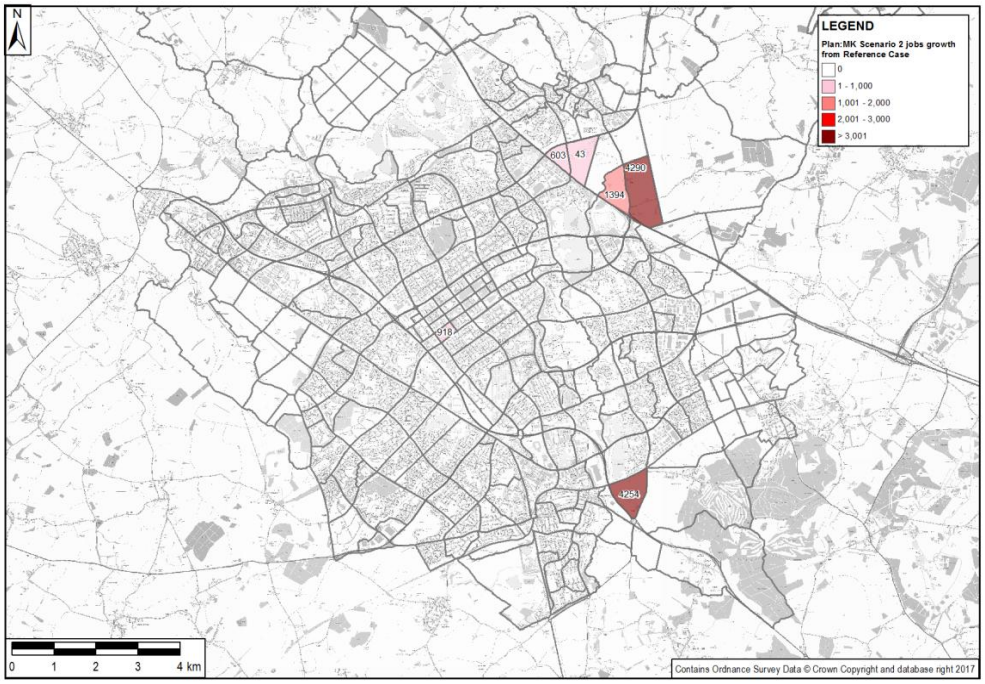


Figure 64. Plan:MK Scenario 2 Additional Jobs Growth to 2031

6.3 Additional Network

East of M1

6.3.1 To facilitate the East of M1 growth a revised road layout is proposed as shown in Figure 65. This includes a new primary route between the dualled A509 to the south of Interchange Park through to M1 J14. A new route from Renny Lodge roundabout bridging the motorway and connecting to Tongwell Street, with the existing A509 between these new routes remaining as access to the development. In addition there is an east-west link between the two routes to the north of the site with an east-west route linking Willen Road through to a re-aligned Newport Road. Signal timings have not been provided for the new signalised junctions and hence these have been estimated based on forecast flow ratios. It has been assumed the three entry lanes on the A509 southbound approach to M1 J14 will remain.

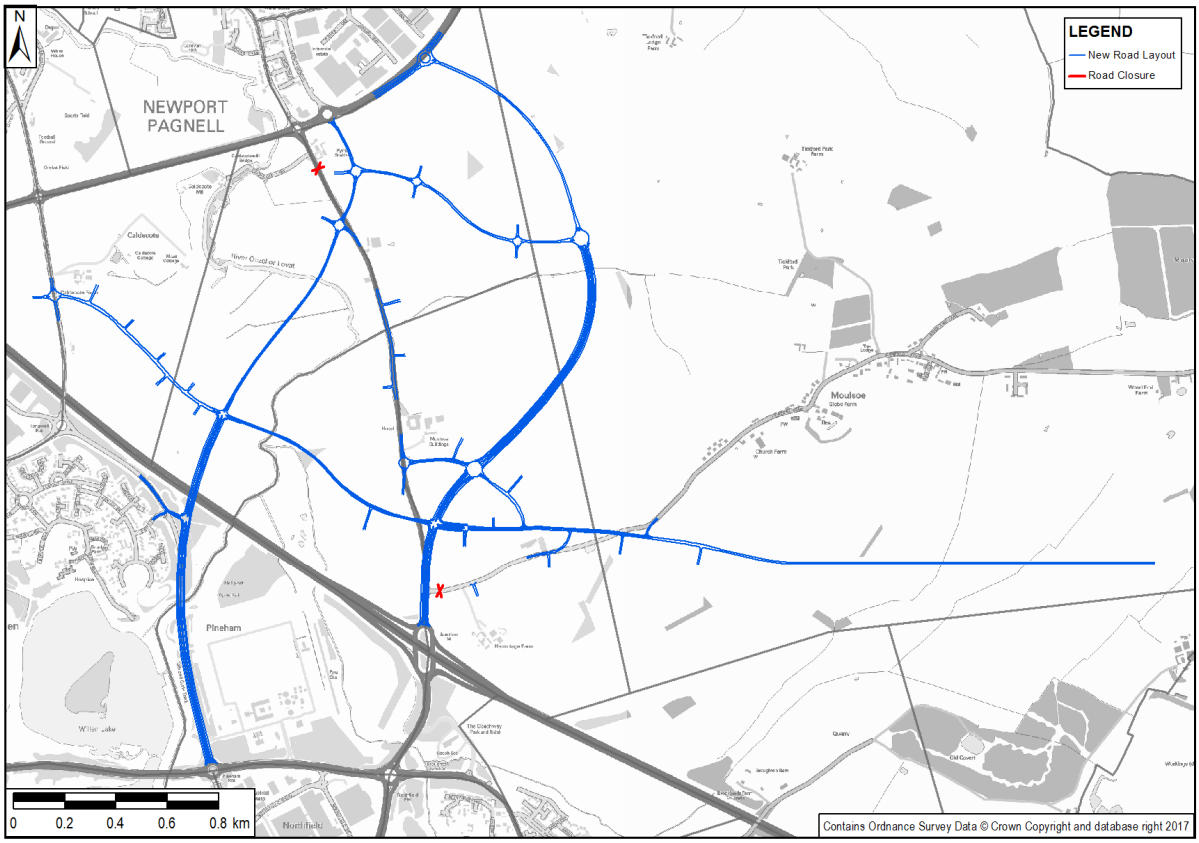


Figure 65. Indicative Additional Road Network – East of M1

South East Milton Keynes Allocation

6.3.2 Iin addition to the new road network East of M1, it is proposed that the South East Milton Keynes Allocation (SEMK1 and SEMK2) is served by additional road network as shown in Figure 66. This includes extending H10 as a single carriageway across to the A5130 Newport Road. There is also a connection included between the A5130 Newport Road and Bow Brickhill Road, which intersects the H10 extension and bridges the railway line. In addition there is a development spine road to the south of the railway line through the SEMK2

6.3.3 Following further discussion the junction arrangement on Brickhill Street north of the railway crossing was modified such that the only revision was the addition of a fourth arm at the Caldecotte Lake Drive roundabout.

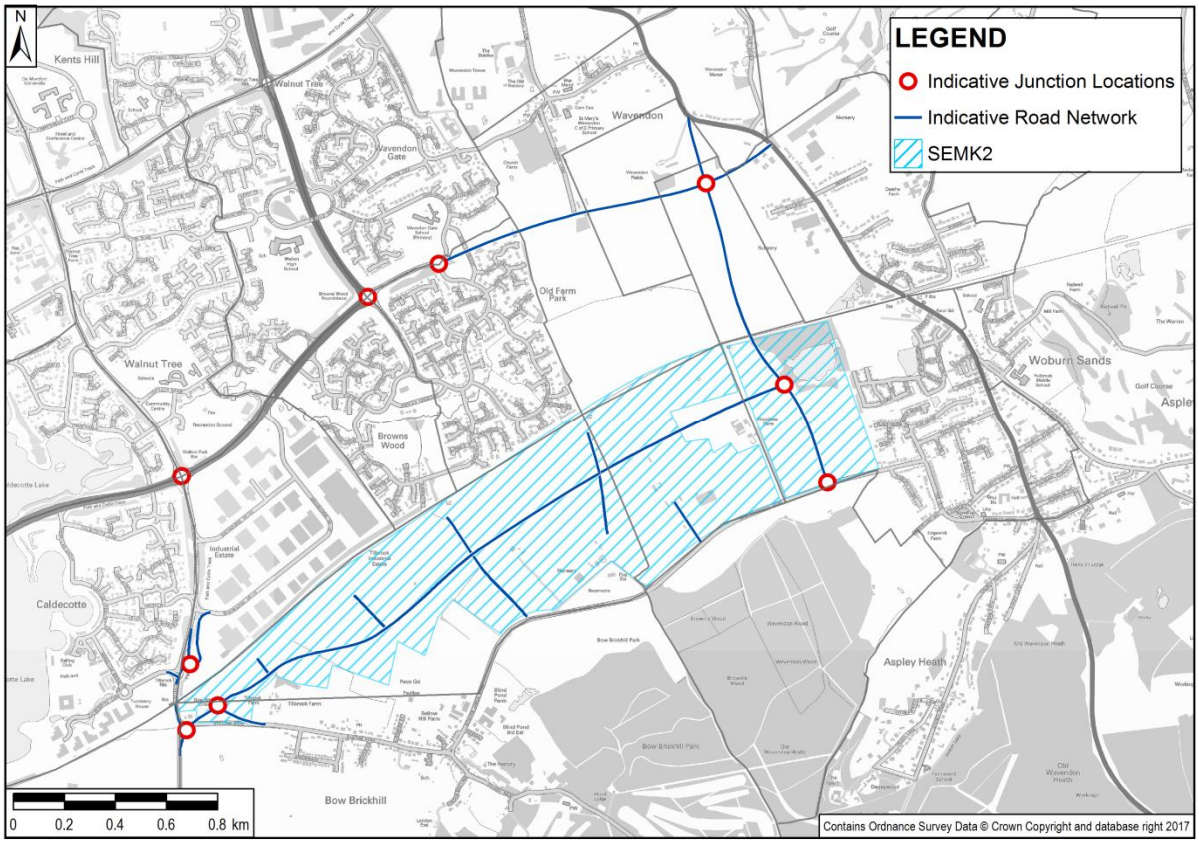


Figure 66. Indicative Additional Road Network

6.4 Trip End Model Outputs

6.4.1 The trip ends within the model 'Internal' area as shown in Figure 8, are presented in Table 39. In the trip end model, trips are 'produced' by households and attracted to 'non-households' i.e. employment sites. The proportion of productions growth to housing growth is a similar ratio to that in the Reference Case. However growth in attractions internally is much lower, with the increase in attractions almost entirely happening externally, similar to the increase in productions internally.

6.4.2 Within the internal area in the Reference Case, the growth in attractions is higher than productions, UK wide the growth in productions is equal to the growth in attractions. The imbalance within the internal area suggests a greater number of trips are being attracted from outside the internal area in the Reference Case. However in Scenario 2, as with Scenario 1 due to the dwellings growth being higher than jobs growth there is now greater increase in productions than attractions.

Table 39 Comparison of Reference Case and Plan:MK Scenario 2 trip ends within Internal Area

Mode	Purpose	Total Daily Productions				Total Daily Attractions			
		Ref	Scenario 2	Sc2 less Ref	% Diff	2031 Ref	2031 Scenario 2	Sc2 - Ref	% Diff
Car	**TOTAL**	**513,132**	**532,448**	**19,315**	**3.8%**	**818,839**	**827,767**	**8,929**	**1.1%**
	HBEB	14,891	15,554	664	4.5%	26,280	26,407	127	0.5%
	HBO	283,972	296,304	12,331	4.3%	503,328	510,714	7,386	1.5%
	HBW	117,480	122,808	5,328	4.5%	175,158	175,955	796	0.5%
	NHBEB	17,115	17,231	116	0.7%	15,755	15,849	94	0.6%
	NHBO	79,674	80,551	877	1.1%	98,318	98,843	526	0.5%
PT	**TOTAL**	**45,478**	**47,385**	**1,907**	**4.2%**	**95,247**	**96,814**	**1,567**	**1.6%**
	HBEB	1,325	1,391	66	4.9%	990	1,001	11	1.1%
	HBO	24,449	25,603	1,154	4.7%	73,484	74,870	1,386	1.9%
	HBW	12,041	12,648	607	5.0%	13,304	13,418	114	0.9%
	NHBEB	688	694	6	0.9%	682	691	9	1.4%
	NHBO	6,975	7,049	74	1.1%	6,787	6,834	47	0.7%
Active Mode	**TOTAL**	**160,676**	**166,938**	**6,262**	**3.9%**	**218,307**	**221,206**	**2,899**	**1.3%**
	HBEB	1,075	1,126	52	4.8%	1,049	1,056	7	0.7%
	HBO	109,235	114,172	4,937	4.5%	182,557	185,173	2,616	1.4%
	HBW	19,556	20,536	980	5.0%	15,195	15,286	91	0.6%
	NHBEB	1,694	1,706	12	0.7%	2,188	2,203	15	0.7%
	NHBO	29,116	29,398	282	1.0%	17,318	17,488	170	1.0%

6.5 Key Statistics for Plan:MK Scenario 2

6.5.1 Table 40 and Table 41 provide a comparison between trips in the post demand model 2031 matrices and those in the 2016 base year matrices for the three modelled time periods. These totals exclude trips that do not pass right through the Milton Keynes urban area, [defined as external to external (ext – ext)] so as to focus the assessment on trips to, from and within Milton Keynes itself.

6.5.2 Compared to the 2031 Reference Case the trip growth for car ranges from 2.7% in the inter-peak to 4.6% in the AM Peak. Public transport trips similarly increase between 3.7% in the PM peak and 4.4% in the AM peak. This growth is reflective of the step change in going from the total number of jobs and dwellings in the Reference Case to the totals in Plan:MK Scenario 2.

Table 40 Car Trip Matrix Totals (All purposes excluding Ext – Ext)

	2016	2031 Reference Case Post demand model	2031 Scenario 2 Post Demand Model	% increase between 2031 Ref and Scen 2
AM	56180	66688	69785	4.6%
IP	33578	44288	45487	2.7%
PM	58591	72019	74897	4.0%

Table 41 Public Transport Matrix Totals (all purposes excluding Ext – Ext trips)

	2016	2031 Reference Case Post demand model	2031 Scen 2 Post Demand Model	% increase between Ref and Scen 2
AM	5296	6253	6530	4.4%
IP	3831	5111	5316	4.0%
PM	4896	6195	6424	3.7%

6.5.3 The impacts of the demand model are presented in Figure 67 and for car and Public transport trips respectively. These graphs show the percentage growth from 2016 and the impacts of the demand model on the Reference Case 2031 and Scenario 2. It can be seen that the demand model has a comparable impact in both the Reference Case and Plan:MK Scenario 2 scenarios, with congestion in the AM and PM peaks dampening demand for car trips.

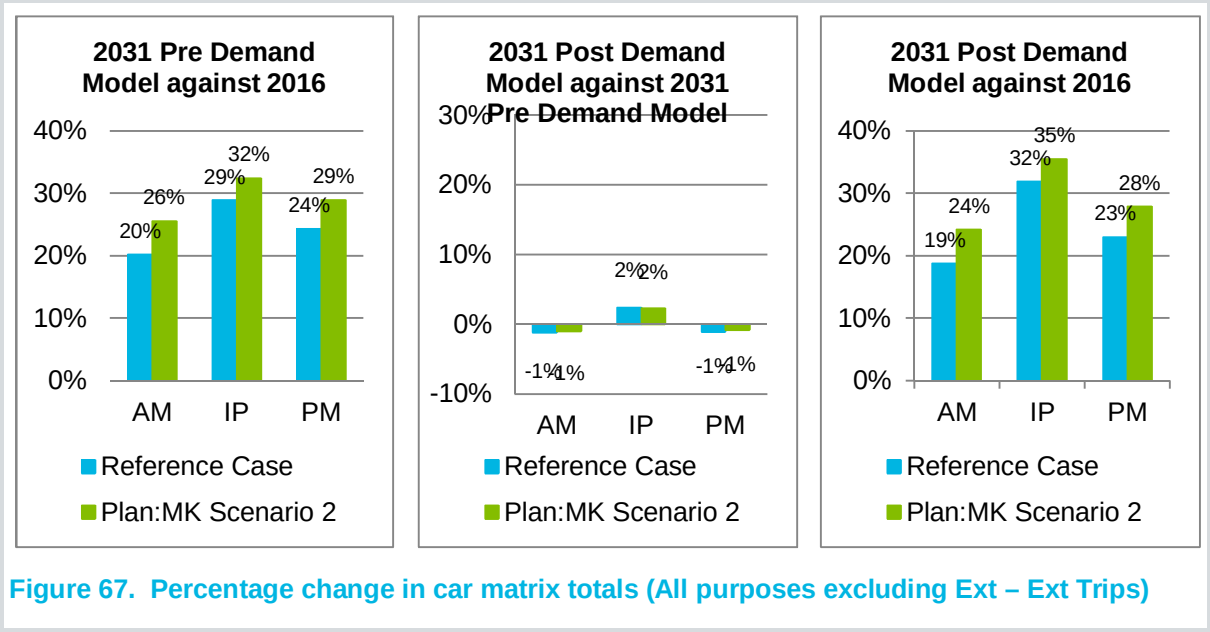


Figure 67. Percentage change in car matrix totals (All purposes excluding Ext – Ext Trips)

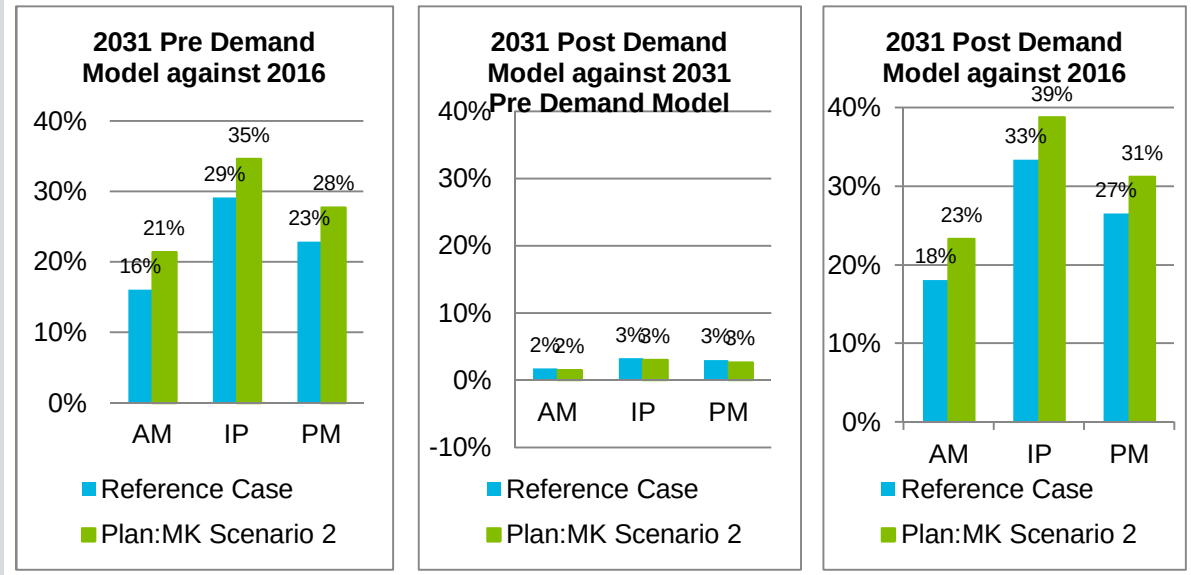


Figure 68. Percentage change in public transport matrix totals (All purposes excluding Ext – Ext Trips)

6.5.4 Table 42 compares the trip change at a sector level between the 2031 Reference Case and Scenario 2 for traffic zones internal to the Milton Keynes urban area and those external to the urban area. It can be seen that on average across all time periods the Scenario 2 growth has the most significant impact on trips internal to the MK urban area with an increase between 4.6% and 8.0%.

6.5.5 In the AM peak trips from within the MK urban area to external areas increase as do trips external to internal in the PM peak. These trips are going against the peak hour tidal flows so experience less congestion which results in less change within the demand model. As would be expected, with no additional growth outside the Milton Keynes urban area, there is virtually no impact on the numbers of external to external trips.

Table 42 Demand model percentage change by sector, Car trips, Scenario 2

	AM Peak Hour		Average IP		PM Peak Hour	
Sector	Internal	External	Internal	External	Internal	External
Internal	6.8%	7.0%	4.6%	-0.4%	5.5%	2.5%
External	-0.1%	0.0%	-0.6%	0.0%	1.5%	0.0%

Table 43. Demand model percentage change by sector, Public Transport trips, Scenario 2

	Average AM hour		Average IP		Average PM hour	
Sector	Internal	External	Internal	External	Internal	External
Internal	7.8%	7.8%	8.0%	-1.2%	7.3%	-5.1%
External	-4.3%	0.0%	-4.0%	0.0%	6.6%	0.0%

Vehicle Kilometres

6.5.6 Vehicle (PCU) kilometre statistics are presented for total car users and all vehicles within the simulation area of the highway model. Also shown are the public transport passenger kilometre values based on local buses serving Milton Keynes and train journeys to or passing through Milton Keynes Central (MKC).

6.5.7 It can be seen from Table 44 and Table 45 that Plan:MK Scenario 2 has a small impact on the total distance travelled within the simulation area compared to the Reference Case. The percentage changes for car are around 2% higher, bus between 2 and 3% higher and negligible impact on rail with changes of under 0.5%.

Table 44. Percentage change in vehicle kilometres (Car, All purposes, Simulation Network)

Time Period	2016	2031		
		Reference Case	Plan:MK Scenario 2	Scen 2 – Reference %diff
AM	828440	994669	1015378	2.1%
IP	509350	706276	710154	0.5%
PM	875097	1086533	1104760	1.7%

Table 45. Percentage change in vehicle kilometres (Car, LGV, HGV (PCU), All purposes, Simulation Network)

Time Period	2016	2031		
		Reference Case	Plan:MK Scenario 2	Scen 2 – Reference %diff
AM	1102172	1316454	1337751	1.6%
IP	835646	1094172	1098208	0.4%
PM	1097356	1353451	1372118	1.4%

Table 46. Percentage change in passenger kilometres (Public Transport, 'Internal' area only)

Time Period	Mode	2016	2031		
			Reference Case	Plan:MK Scenario 2	Scen 2 – Reference %diff
AM	Bus	52004	50076	51442	2.7%
	Rail	396442	439278	441130	0.4%
	Total	448446	489355	492572	0.7%
IP	Bus	35326	41870	43068	2.9%
	Rail	224767	271497	270853	-0.2%
	Total	260093	313367	313921	0.2%
PM	Bus	41660	44011	45089	2.4%
	Rail	486855	559949	561400	0.3%
	Total	528514	603959	606489	0.4%

Vehicle Hours

6.5.8 The vehicle hours from the highway model are presented in Table 47 and Table 33 for the simulation area only, with passenger hours from the public transport model presented for all passengers within the internal area in Table 34.

6.5.9 As with vehicle-km travelled, Plan:MK Scenario 2 has a small impact on total vehicle hours travelled within the simulation area. Bus vehicle hours within the internal area have the largest change out of all modes at 3.4% in the inter-peak. Car vehicle hours are 3.2% and 2% in the AM and PM peaks respectively with little change for car in the inter-peak. There is negligible change for rail travel.

Table 47 Percentage change in vehicle hours (Car, All purposes, Simulation Network)

Time Period	2016	2031		
		Reference Case	Plan:MK Scenario 2	Scenario 2 – Reference %diff
AM	14247	19070	19672	3.2%
IP	7440	10594	10667	0.7%
PM	14656	19895	20302	2.0%

Table 48. Percentage change in vehicle hours (Car, LGV, HGV (PCU), All purposes, Simulation Network)

Time Period	2016	2031		
		Reference Case	Plan:MK Scenario 2	Scenario 2– Reference %diff
AM	18193	24112	24736	2.6%
IP	11556	15689	15755	0.4%
PM	17710	23821	24246	1.8%

Table 49. Percentage change in passenger hours (Public Transport, 'Internal' area only)

Time Period	Mode	2016	2031		
			Reference Case	Plan:MK Scenario 2	Scen 2 – Reference %diff
AM	Bus	1643	1757	1816	3.3%
	Rail	2979	3289	3307	0.6%
	Total	4623	5046	5123	1.5%
IP	Bus	1133	1386	1433	3.4%
	Rail	1504	1830	1826	-0.2%
	Total	2637	3216	3259	1.3%
PM	Bus	1311	1523	1571	3.1%
	Rail	3371	3896	3906	0.3%
	Total	4682	5419	5477	1.1%

Summary

6.5.10 As shown in Figure 69, trip distance and travel time changes for car are largest in the AM peak, similarly for public transport the largest increases are in the average AM hour. For car the inter-peak growth in the vehicle kilometres and travel time is the least significant, however for public transport the growth is comparable across all time periods.

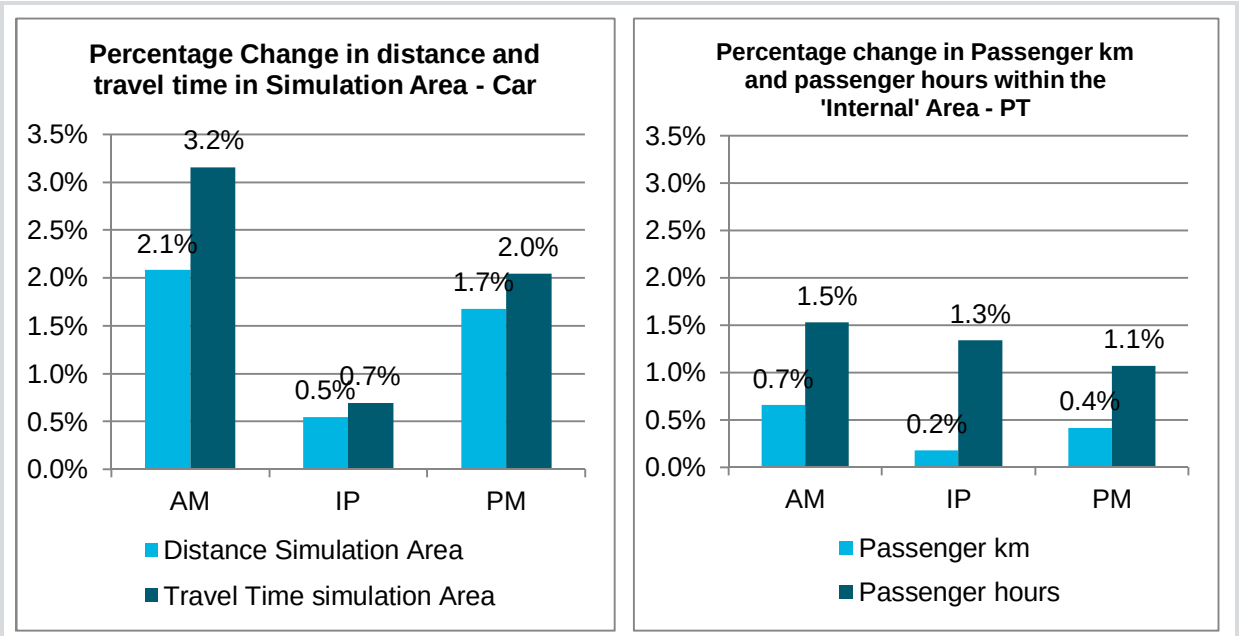


Figure 69. Plan:MK Scenario 1 impacts in terms of percentage change in distance and travel times

6.6 Traffic Flows

6.6.1 This section compares the Plan:MK Scenario 2 traffic flows with those of the Reference Case. The flow difference is plotted as bandwidths to the left side of each link by direction, with an increase in actual flow between the Reference Case and Scenario 2 shown in green and a decrease in blue. It is also important to note that where new links have been added no comparison is shown.

6.6.2 As shown by Figure 70 to Figure 75, the most notable impacts in terms of traffic flows are around the South East Milton Keynes Allocation (SEMK2) and the East of M1 development to the north east. These are looked at in more detail further on in this section.

6.6.3 In the AM peak there is some re-assignment of traffic flow in the area between Newport Road in New Bradwell and Dansteed Way north of central Milton Keynes. In the inter-peak the re-assignment is focussed on the two major development sites mentioned above. Similarly in the PM peak most of the re-assignment is due to these sites, but there is a small impact on the north east periphery of central Milton Keynes.

6.6.4 There is little impact in central Milton Keynes although there is an increase in flows adjacent to the new education establishment on Block B4 and the housing immediately south of Campbell Park. In the PM peak there is a reduction in flow on V8 Marlborough street across central Milton Keynes with a decrease in flows westbound towards the centre of Milton Keynes along Portway.

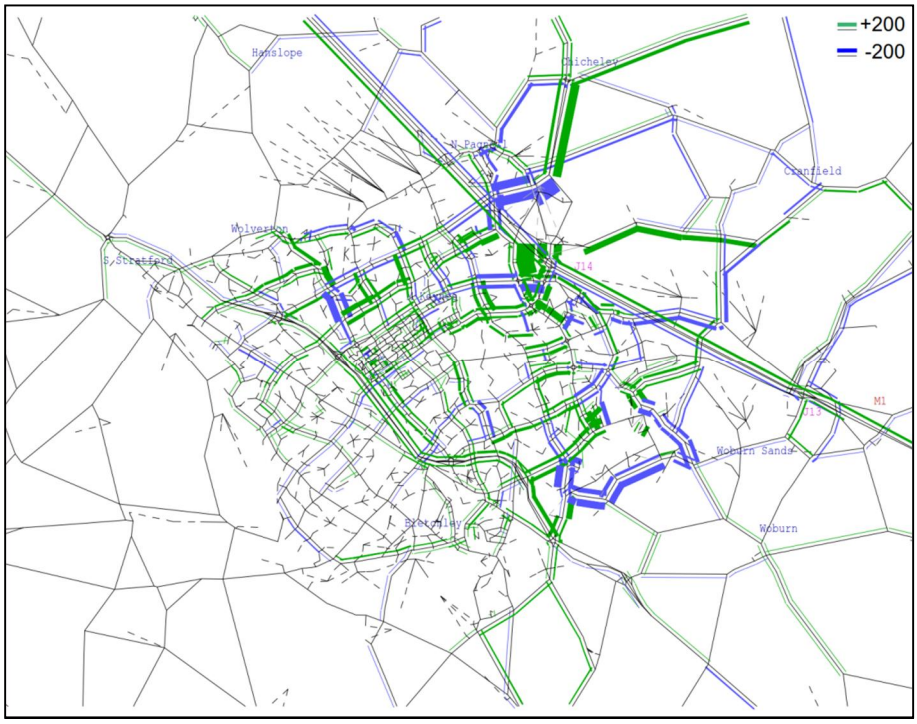


Figure 70. Change in Modelled flow, Scenario 2 less Reference Case AM peak

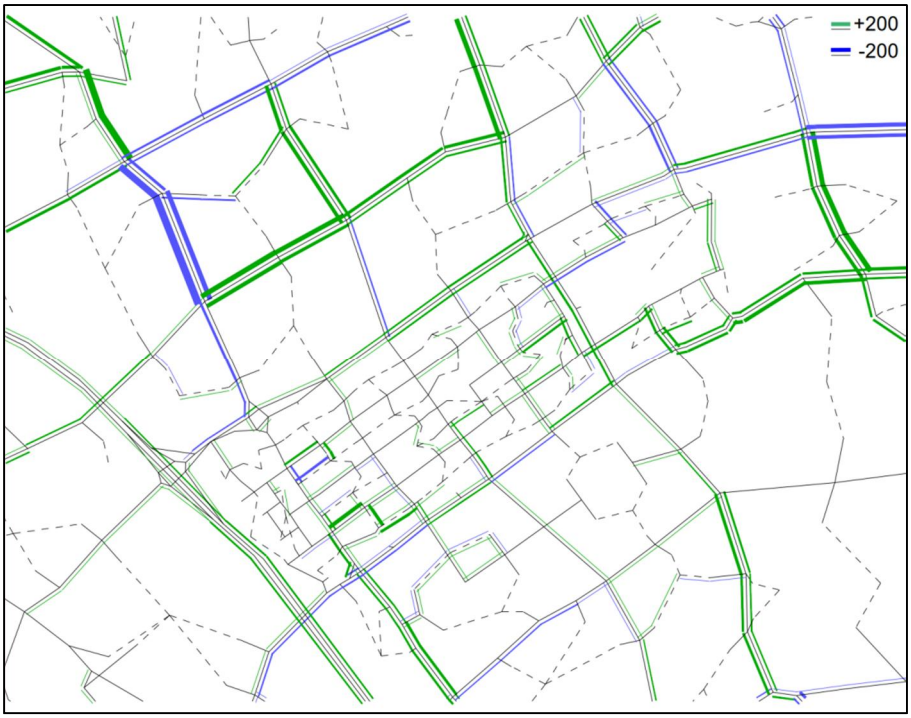


Figure 71. Change in Modelled flow CMK, Scenario 2 less Reference Case AM peak

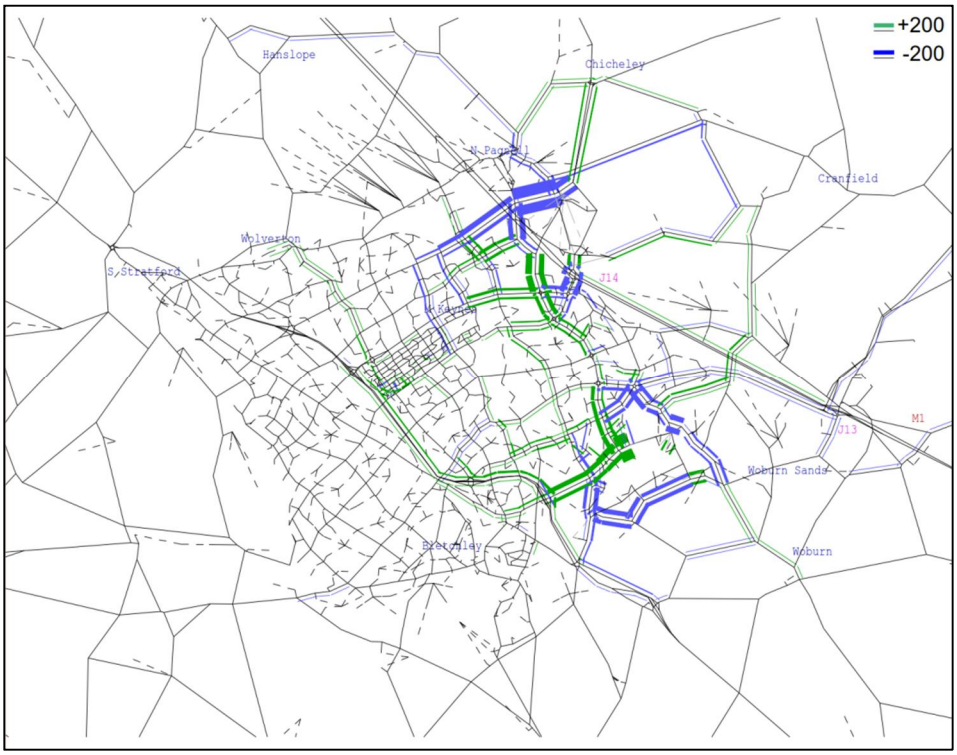


Figure 72. Change in Modelled flow, Scenario 2 less Reference Case, Inter-Peak

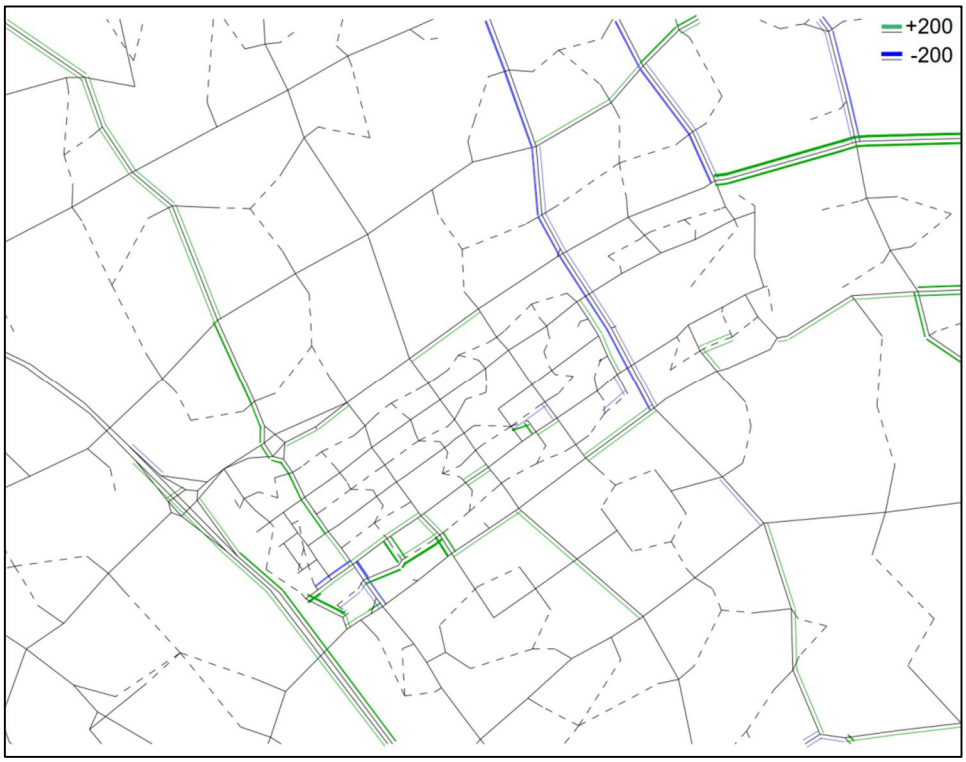


Figure 73. Change in Modelled flow CMK, Scenario 2 less Reference Case, Inter-Peak

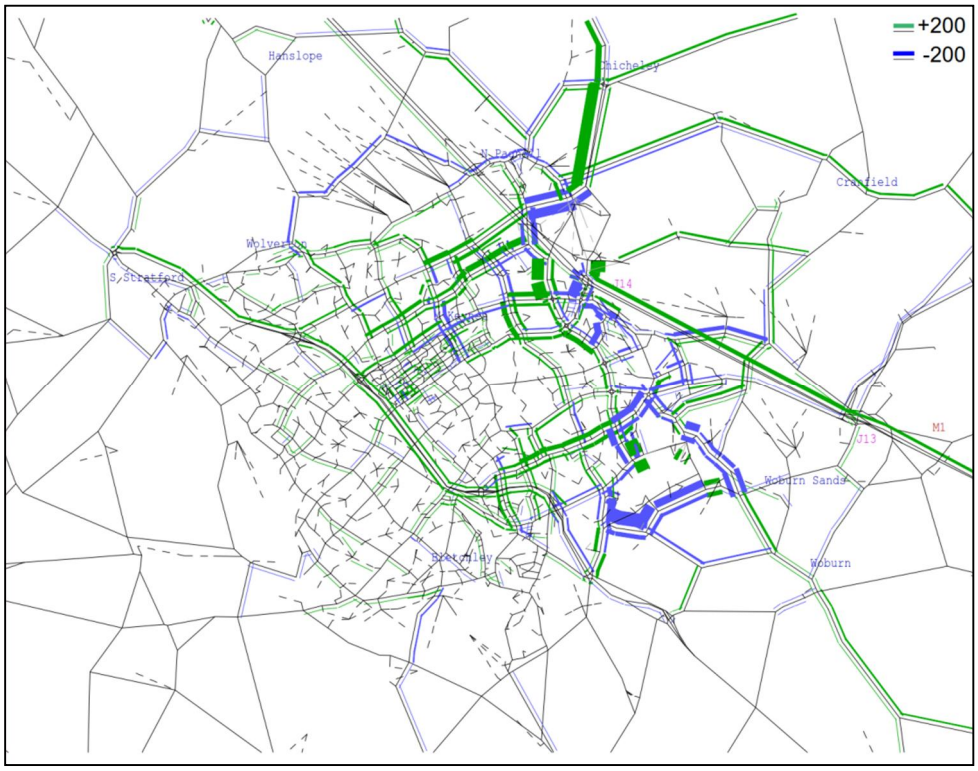


Figure 74. Change in Modelled flow, Scenario 2 less Reference Case PM peak

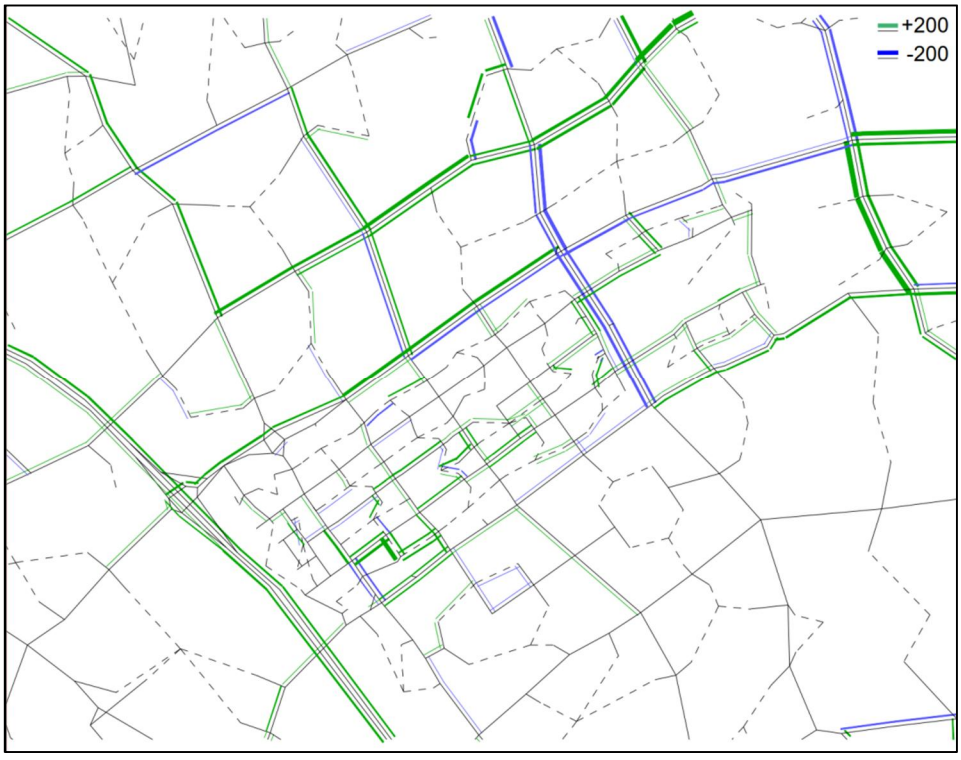


Figure 75. Change in Modelled flow CMK, Scenario 2 less Reference Case PM peak

South East Milton Keynes Area

6.6.5 As shown by Figure 76 to Figure 78, there is some reassignment due to the additional road network and bridge over the railway. The largest change in flow in the Bow Brickhill area is along Station Road and Woburn Sands Road through Brickhill with through traffic transferring to the new development road. In the AM peak there is a reduction of around 400 PCU's westbound whilst in the PM peak there is forecast reduction of around 700 PCU's eastbound.

6.6.6 There is an increase in east–west traffic using H10 as a result of it being extended eastwards, with traffic using Lower End Road rather than Broughton Road to travel to and from Cranfield and Salford. Some of this traffic has moved off H9 Groveway which in turn attracts traffic off Standing Way. There is also reduced flow through Bow Brickhill and Woburn Sands as the new roads allow traffic to bypass them these areas

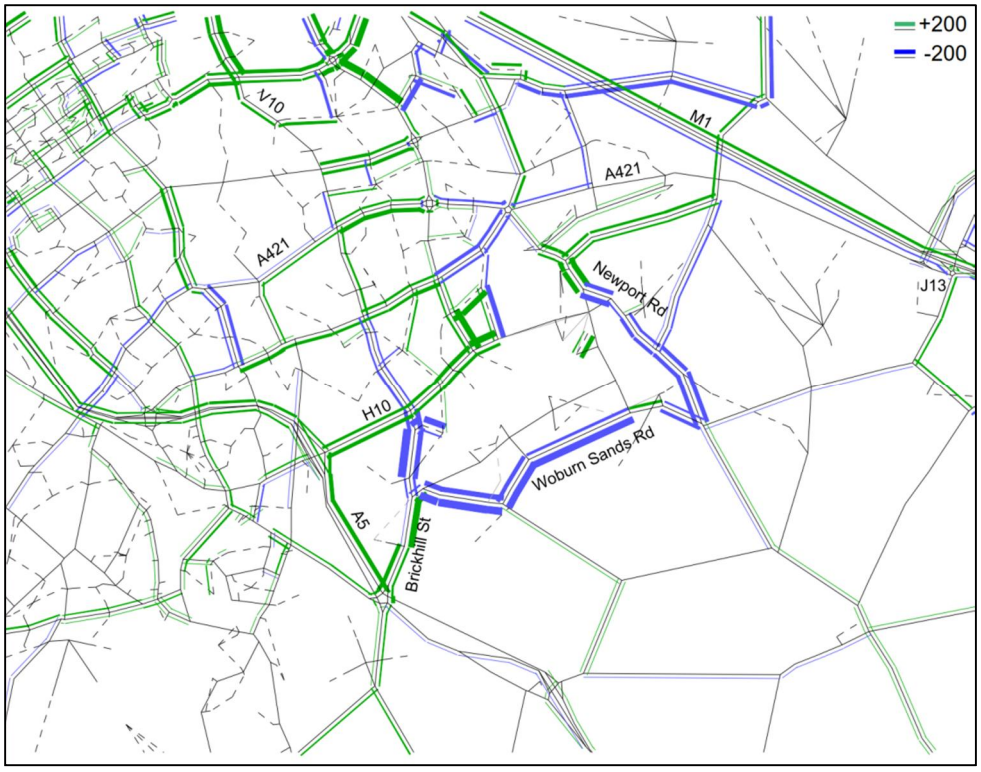


Figure 76. Change in Modelled flow, Bow Brickhill, Scenario 2 less Reference Case AM peak

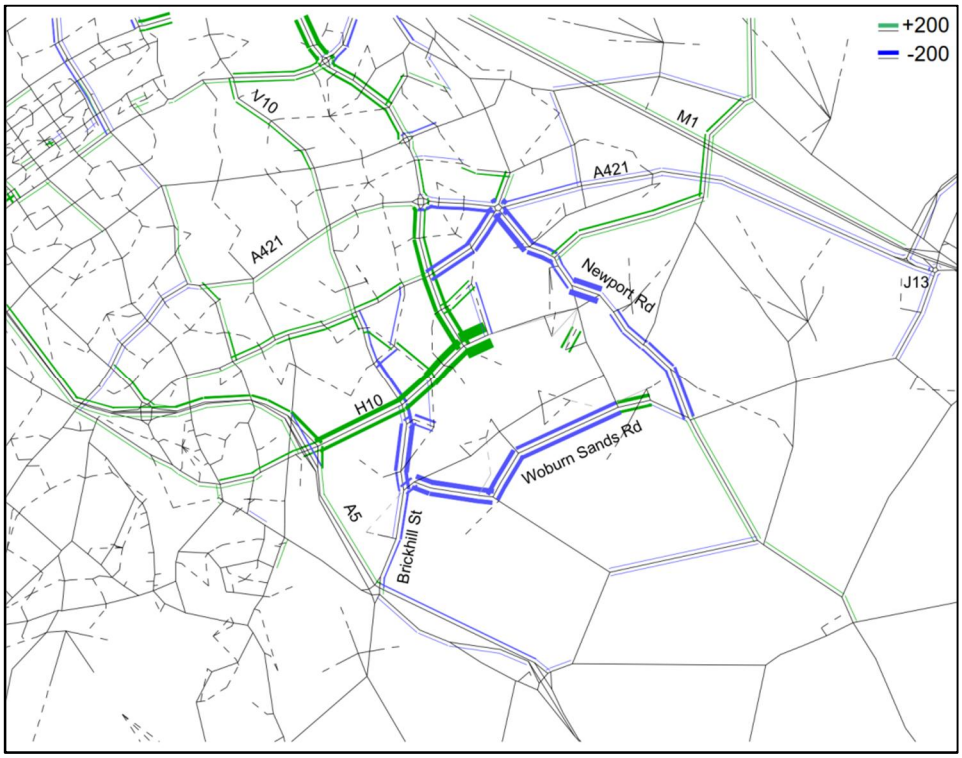


Figure 77. Change in Modelled flow CMK, Bow Brickhill, Scenario 2 less Reference Case Inter-Peak

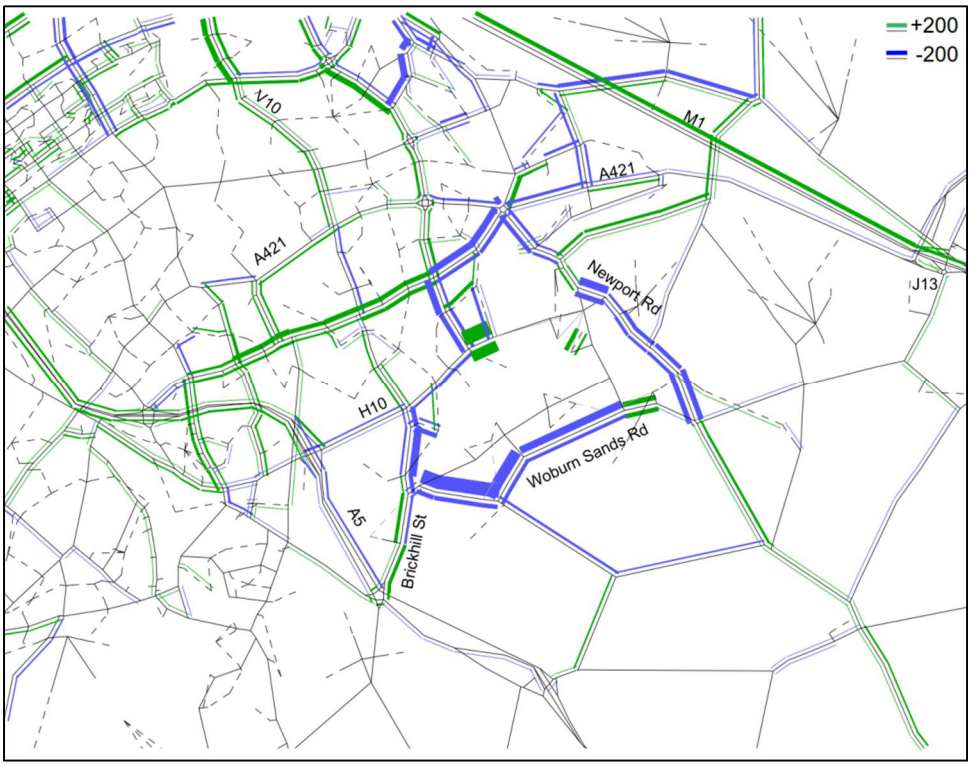


Figure 78. Change in Modelled flow, Bow Brickhill, Scenario 2 less Reference Case, Inter-Peak

North Eastern Milton Keynes Area

6.6.7 As shown by Figure 79 to Figure 81, there is some reassignment due to the additional road network both around the east of M1 development, including the new motorway crossing, and in south east Milton Keynes which includes the new road bridge over the railway. Although there will be some interaction between the two development sites on the A421 Childs Way in general the impacts to the north are likely to be a result of the East of M1 site with those South a result of the South East Milton Keynes Allocation (SEMK2).

6.6.8 In terms of the area around 'East of M1', in the AM peak there is an increase in trips into Milton Keynes on the A422 east of Chicheley Hill roundabout, and along the Newport Road through Moulsoe. There is also an increase of around 450 PCU on the A509 southbound from Chicheley Hill roundabout. There is also a large increase in southbound traffic on Tongwell Street towards Pineham roundabout of 1000 PCU increasing from around 450 PCU in the Reference Case. Conversely there is a reduction in flow into Milton Keynes along Sherington Road and North Crawley Road. There is a reduction in traffic on A422 between Tickford roundabout and Marsh End roundabout. There is also a small reduction in flow southbound on the A509 from junction 14.

6.6.9 In the PM peak there is an increase outbound from Milton Keynes along the A422 east of Chichley Hill roundabout and along the Newport Road through Moulsoe. There is an increase of around 550 PCU northbound towards Chicheley Hill roundabout mirroring the AM peak. There is also an increase on North Crawley Road outbound and there is a forecast decrease outbound along Broughton Road, which is less impacted in the AM peak. There is an increase of close to 650 PCU northbound on Tongwell Street from Pineham roundabout bringing flows up to around 1300 PCU. As in the AM peak there is a reduction in traffic on A422 between Tickford roundabout and Marsh End roundabout. There is a notable decrease in traffic northbound on the A509 towards M1 J14.

6.6.10 In the inter-peak there is clear re-assignment from the A422 west of Tickford farm roundabout and along the A509 across M1 J14.

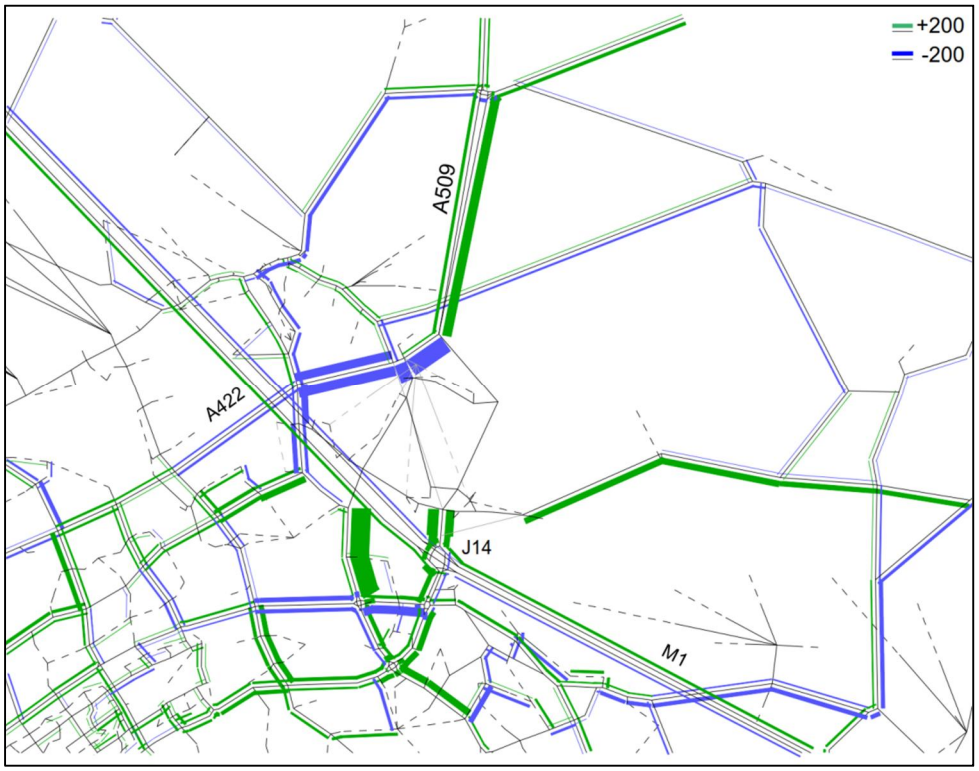


Figure 79. Change in Modelled flow, East of M1,Scenario 2 less Reference Case AM peak

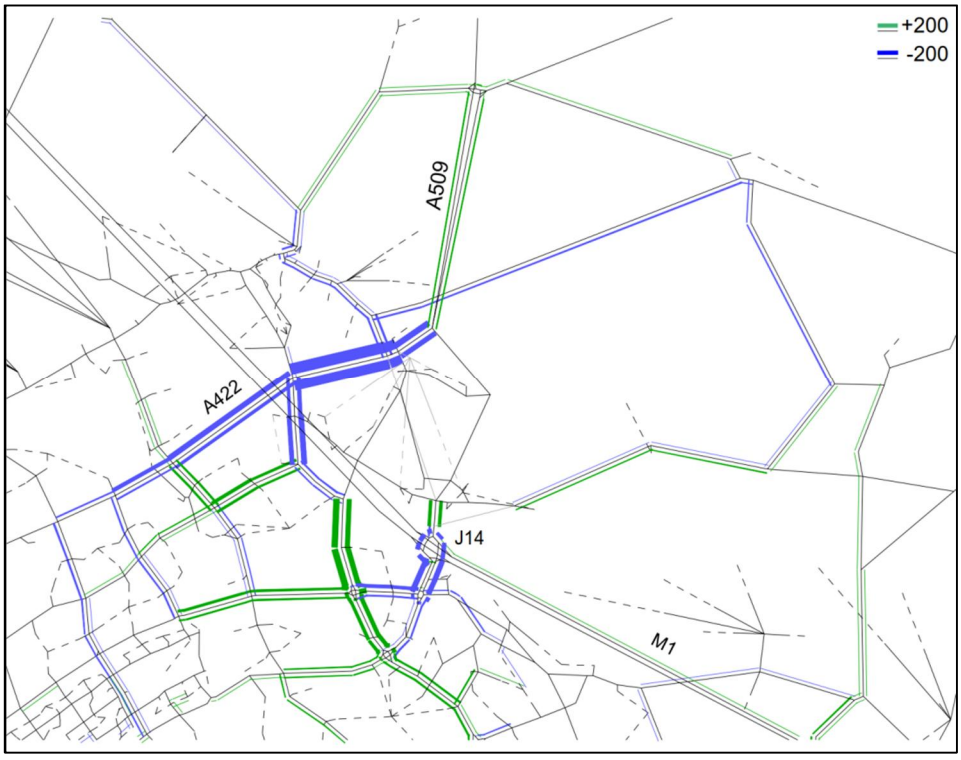


Figure 80. Change in Modelled flow, East of M1, Scenario 2 less Reference Case Inter-Peak

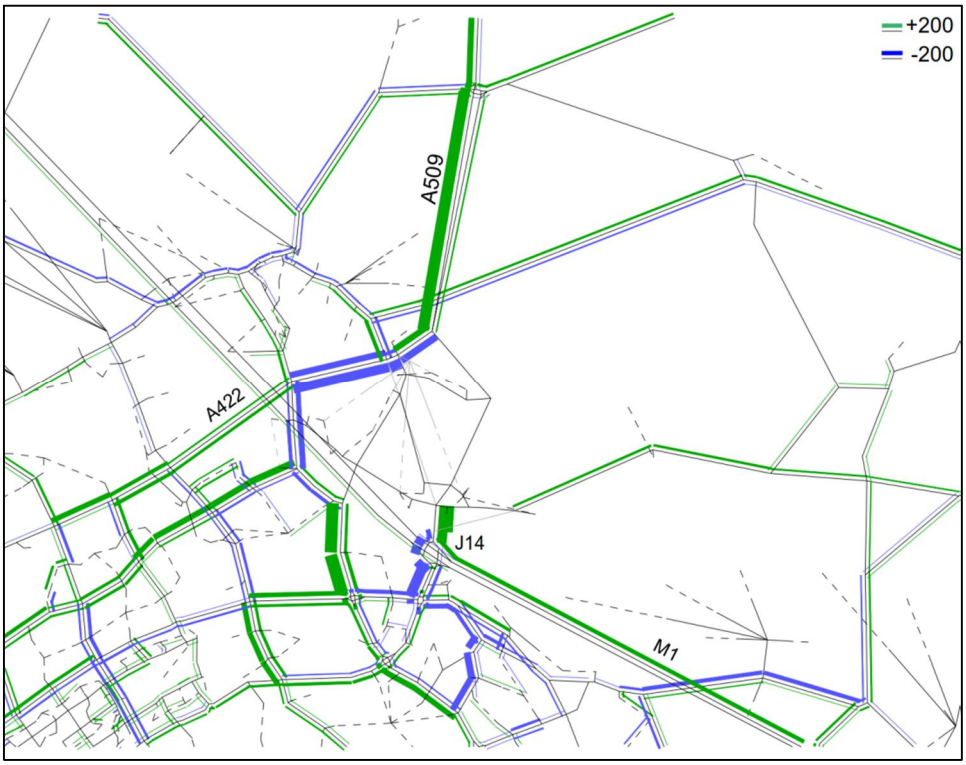


Figure 81. Change in Modelled flow, East of M1, Scenario 2 less Reference Case, PM peak

6.7 Screenline Flows

6.7.1 In addition to actual flow comparison plots, the percentage change in actual flow crossing the cordons and screenlines used as part of the calibration and validation of the base year networks (as shown in Figure 82) has been determined. The traffic flows using the new bridge crossing over the M1 which is part of the East of M1 proposed infrastructure have been included in the RSI Cordon totals.

6.7.2 The impact of Plan:MK Scenario 2 on screenline flows is presented in Table 50. The changes are broadly in line with those of trips, though in the AM peak there is an 8% increase in actual flow crossing the CMK cordon heading outbound which is due to the housing growth in CMK and additional jobs east of the M1. The notable increase in flow crossing the northern screenline can also be attributed to the growth east of M1 and the new motorway bridge which brings traffic across the screenline,

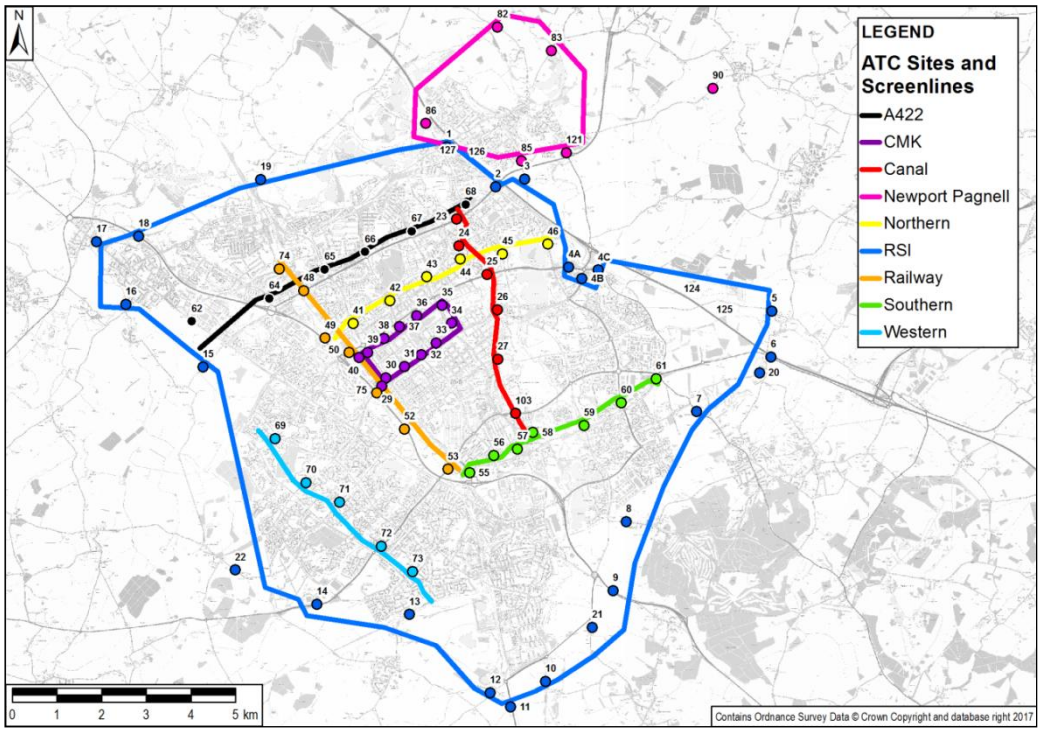


Figure 82. Highway Model Cordons and Screenlines

Table 50. Percentage change in highway screenline flows between Reference Case and Plan:MK Scenario 2

Cordon/Screenline	AM	Inter-Peak	PM
RSI Inbound Cordon	3%	-1%	3%
RSI Outbound Cordon	8%	-2%	1%
Canal Eastbound	6%	0%	4%
Canal Westbound	3%	1%	3%
CMK Inbound	2%	1%	2%
CMK Outbound	7%	1%	0%
Northern Southbound	13%	4%	-2%
Northern Northbound	-2%	5%	8%
Railway Eastbound	1%	0%	2%
Railway Westbound	1%	0%	0%
Southern Southbound	-1%	0%	-1%
Southern Northbound	-4%	1%	-4%
A422 Northbound	2%	1%	0%
A422 Southbound	1%	1%	5%
Western Eastbound	-2%	0%	2%
Western Westbound	0%	0%	0%
M1 Northbound	0%	0%	0%
M1 Southbound	1%	0%	1%

6.8 Average Speeds

6.8.1 The change in average simulation network speeds is presented in Table 51. It is clear that Plan:MK Scenario 2 has minimal impact on average network speed.

Table 51. Change in Average Network Speed between Reference Case and Scenario 2

	AM Peak	Inter-Peak	PM Peak
Average Network Speed	-1.1%	-0.1%	-0.2%

6.9 Journey Times

6.9.1 The routes used for the journey time validation have been used as a measure of the impacts of Plan:MK Scenario 2. The route map is presented in Figure 83 and the percentage increase in travel times on each route by time period is presented in Table 52. This table indicates that a number of routes have been notably impacted by Scenario 2.

6.9.2 Route 2 is 10% faster westbound in the AM peak and 8% faster eastbound in the PM peak. This is due to the East of M1 development and the provision of the new M1 crossing reducing traffic through Tickford roundabout and Renny Lodge Roundabout on the A509 and reducing delay at these junctions.

6.9.3 Journey times have worsened most in the AM peak. In the inter-peak and PM peak the impacts are attributable to the two main development sites, however in the AM peak there is a general worsening in other parts of the network. For example, the journey time along route 3 northbound and route 6 southbound have both increased by 7%.

6.9.4 With the exception of the PM peak in the eastbound direction, times on route 4 are also forecast to significantly increase. This is due to the re-routing of the A509 between south of Interchange Park and Junction 14 which results in a longer distance and more junctions. However in the PM, this has been negated by the time savings on the eastbound approach to Northfield roundabout due to the new road network, resulting in an overall decrease in journey time.

6.9.5 Route 9 along Brickhill has the highest percentage increase; this is in part due to it being the shortest route. As seen in the flow difference plots it is impacted by the South Caldecotte jobs site with new roundabout access and the housing growth from the SEMK2 site.

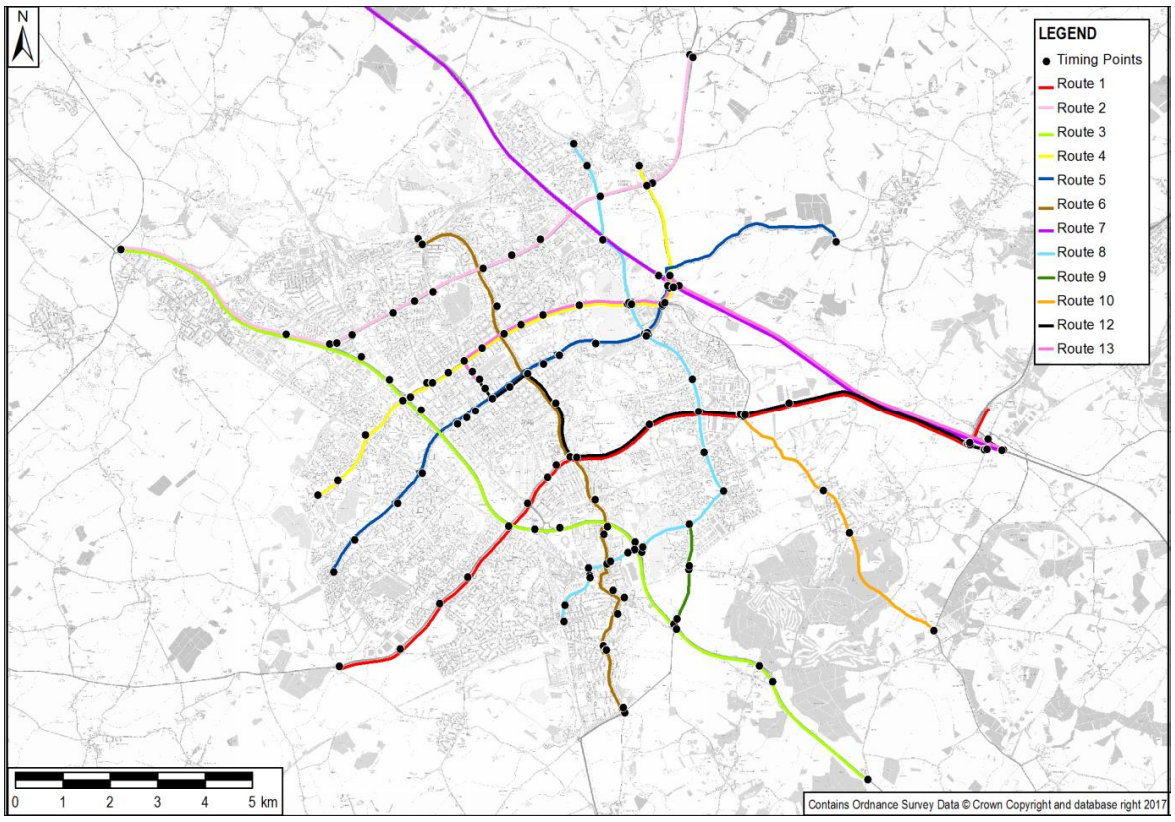


Figure 83. Journey Time Routes

Table 52 : Change in travel times from Reference Case as result of Plan:MK Scenario 2

Route	Route Description	AM	IP	PM
1EB	A421 to M1 J13	2%	-1%	-1%
1WB	A421 from M1 J13	4%	1%	0%
2EB	Old Stratford to Chicheley	1%	1%	-8%
2WB	Chicheley to Old Stratford	-10%	1%	1%
3SB	Old Stratford to Watling, Little Brickhill	1%	0%	-2%
3NB	Watling, Little Brickhill to Old Stratford	7%	0%	-1%
4EB	Portway/Fulmer St to Newport Pagnell	11%	10%	-5%
4WB	Newport Pagnell to Portway/Fulmer St	11%	9%	9%
5EB	Moulsoe to Child's Way / Tattenhoe St.	4%	3%	-1%
5WB	Child's Way / Tattenhoe St. to Moulsoe	-6%	4%	4%
6SB	Saxon St. / Newport Rd. to A4146 / Stoke Rd.	7%	0%	2%
6NB	A4146 / Stoke Rd. to Saxon St. / Newport Rd.	3%	0%	2%
7SB	M1 J15 to M1 J13	0%	0%	1%
7NB	M1 J13 to M1 J15	0%	0%	0%
8SB	Newport Pagnell to Bletchley	5%	5%	10%
8NB	Bletchley to Newport Pagnell	5%	3%	0%
9SB	Brickhill Street Southbound	5%	1%	-3%
9NB	Brickhill Street Northbound	18%	8%	15%
10SB	A5130 through Woburn Sands SB	3%	0%	1%
10NB	A5130 through Woburn Sands NB	0%	-1%	-1%
12EB	MK central to M1 J13 via A421	1%	-1%	0%
12WB	M1 J13 to MK Central via A421	5%	0%	2%
13EB	MK Central to M1 J13 via M1 J14	1%	0%	-7%
13WB	M1 J13 to MK Central via M1 J14	5%	0%	2%
Total		3.0%	1.6%	0.3%
Total excluding route 4		2.2%	0.8%	0.2%

6.9.6 As shown in Figure 83, Route 8 runs from Marsh End Road in Newport Pagnell along V11 Tongwell Street and along H10 Bletcham Way. This route is likely to be used by traffic travelling to and from the two additional major housing development sites within Scenario 2. The new road infrastructure for the East of M1 scheme also links into this route with a new junction on Willen road and Tongwell Street. The Brickhill street route is used to access the South Caldecotte employment site and is also near the South East Milton Keynes Allocation and the increase in journey time reflects the localised impacts of these developments.

6.9.7 Journey time graphs for route 8 are presented in Figure 84 to Figure 87. The reduced flows on Willen Road have resulted in a reduction in delay at Tongwell roundabout of almost 2 minutes on the southbound approach in the AM peak. However the general increase in traffic has meant an increase in journey time along the rest of the route of 30 seconds southbound and 20 seconds northbound in the AM peak. In the PM peak southbound the main cause of the additional journey time along the route is the extra delay at Pineham Roundabout of almost a minute. Southbound in the PM the slight overall increase in journey time along the route is negated by the reduction in delay at Marsh End Roundabout as a result of the reduced flows due to the new East of M1 road infrastructure.

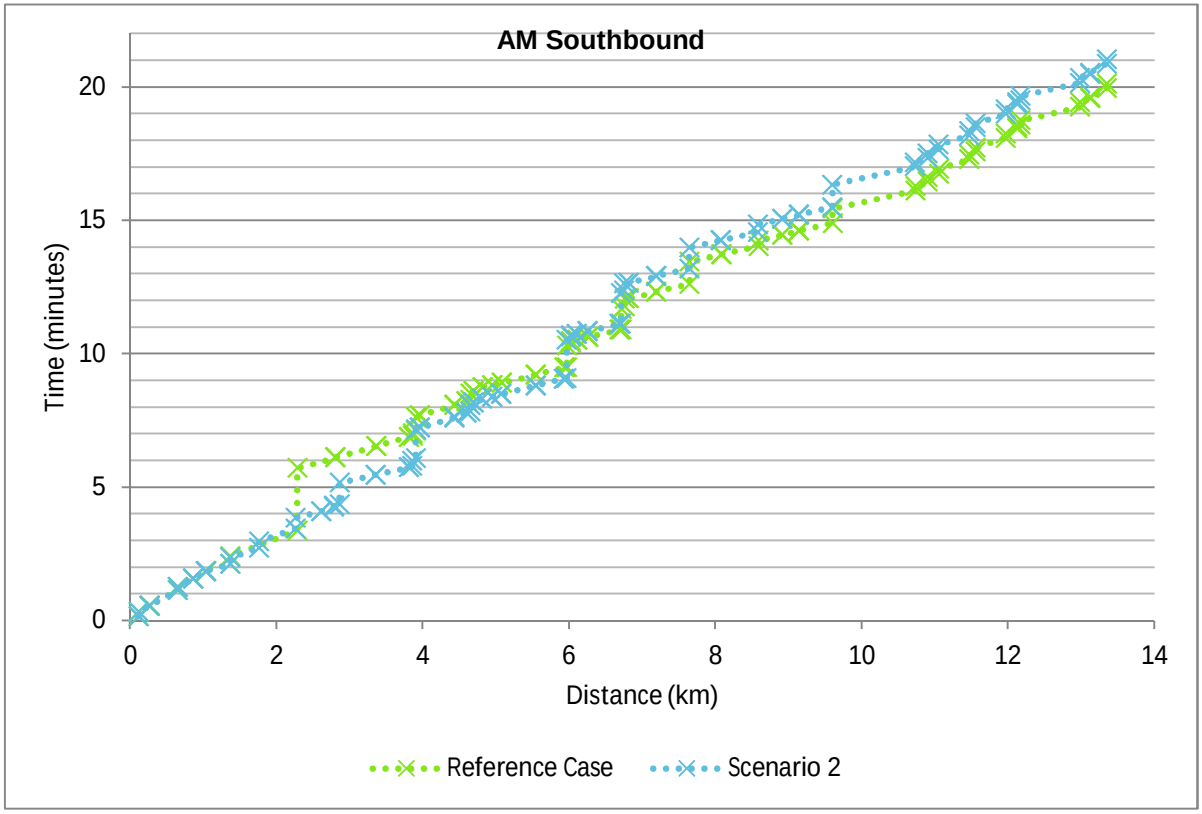


Figure 84. Route 8 AM Southbound, Reference Case and Scenario 2

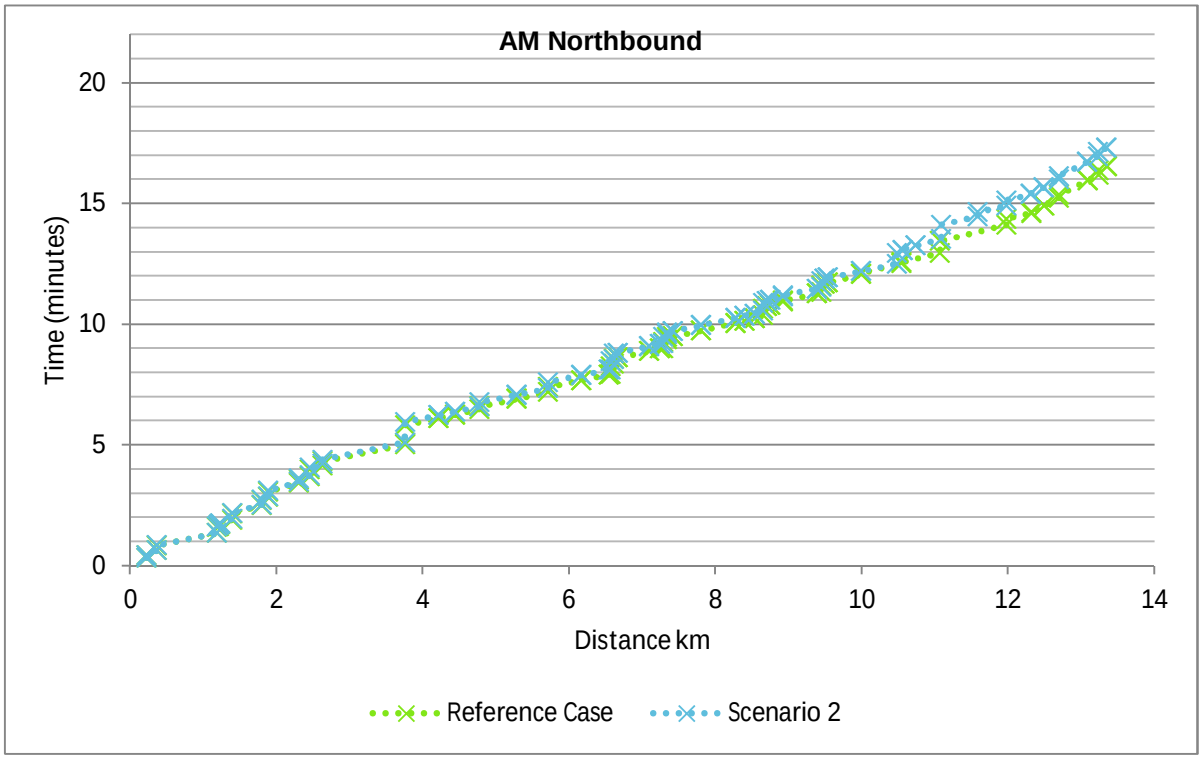


Figure 85. Route 8 AM Southbound, Reference Case and Scenario 2

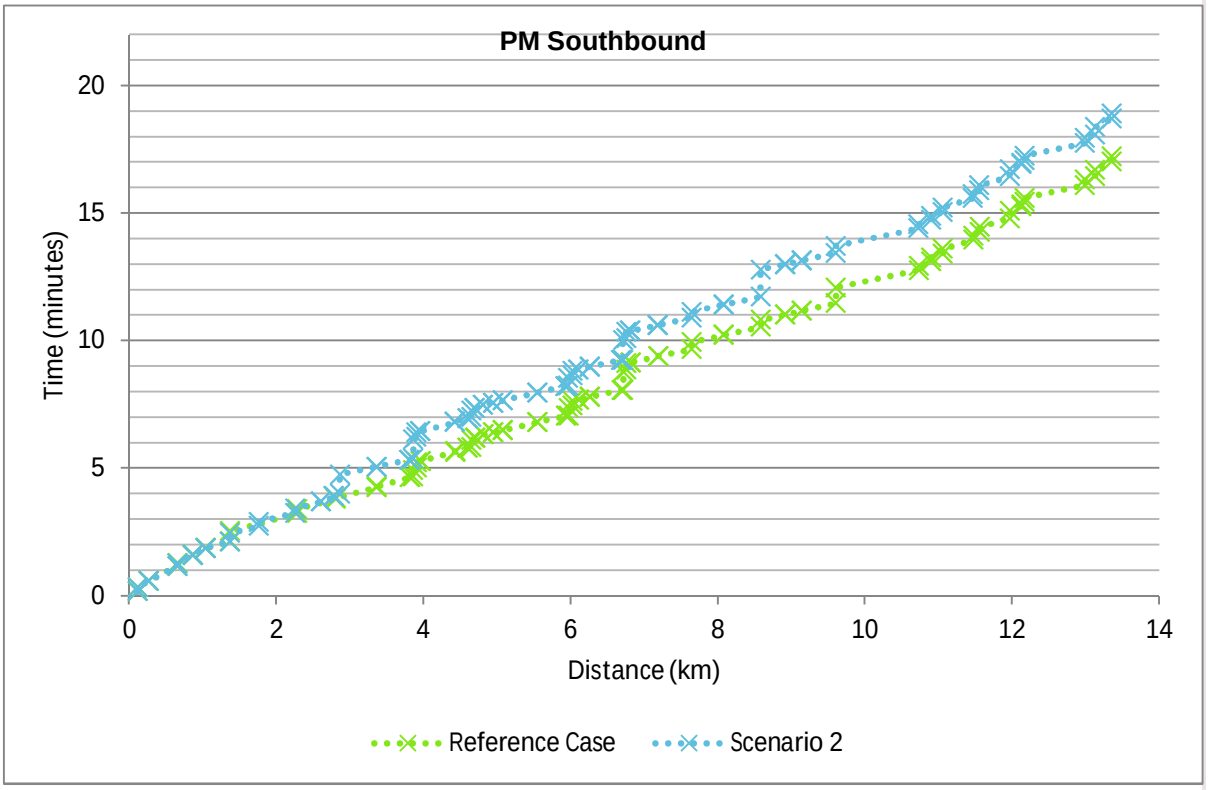


Figure 86. Route 8 AM Southbound, Reference Case and Scenario 2

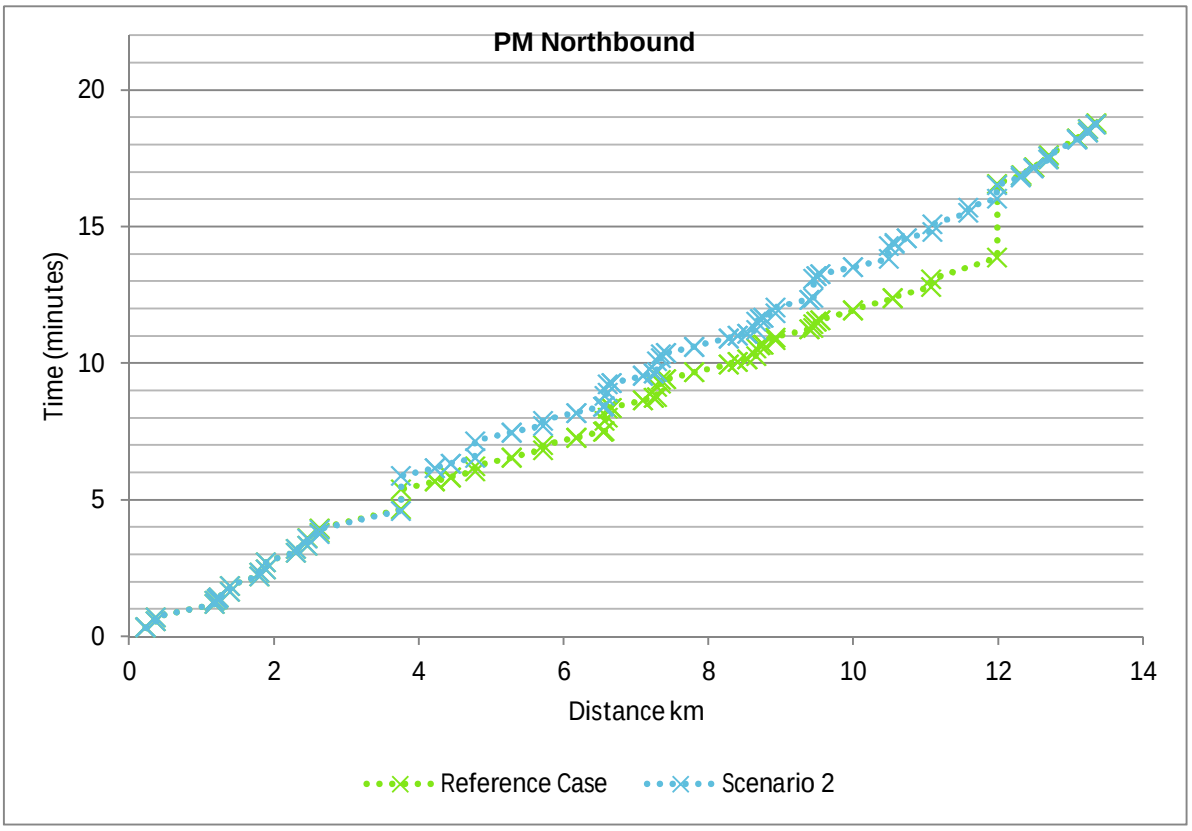


Figure 87. Route 8 AM Southbound, Reference Case and Scenario 2

6.9.8 The relatively large percentage increase in journey times along route 9 are primarily due to the short length of the route resulting in a small change in time producing a relatively large percentage difference. The journey time plots of Route 9 Brickhill Street are presented in Figure 88 and Figure 89. As with Scenario 1 there is little change along Brickhill Street between Scenario 2 and the Reference Case.

6.9.9 Similarly there is extra delay caused by the new roundabout to access the South Caldecotte site and the main impact is the extra delay at the junction of Brickhill Street and H10 due to the increased flows along H10. There is around 40 seconds additional delay in the PM peak which is less than the minute increase modelled in Scenario 1, but around a minute additional delay in the AM peak, which is an additional 30 seconds compared to that of Scenario 1.

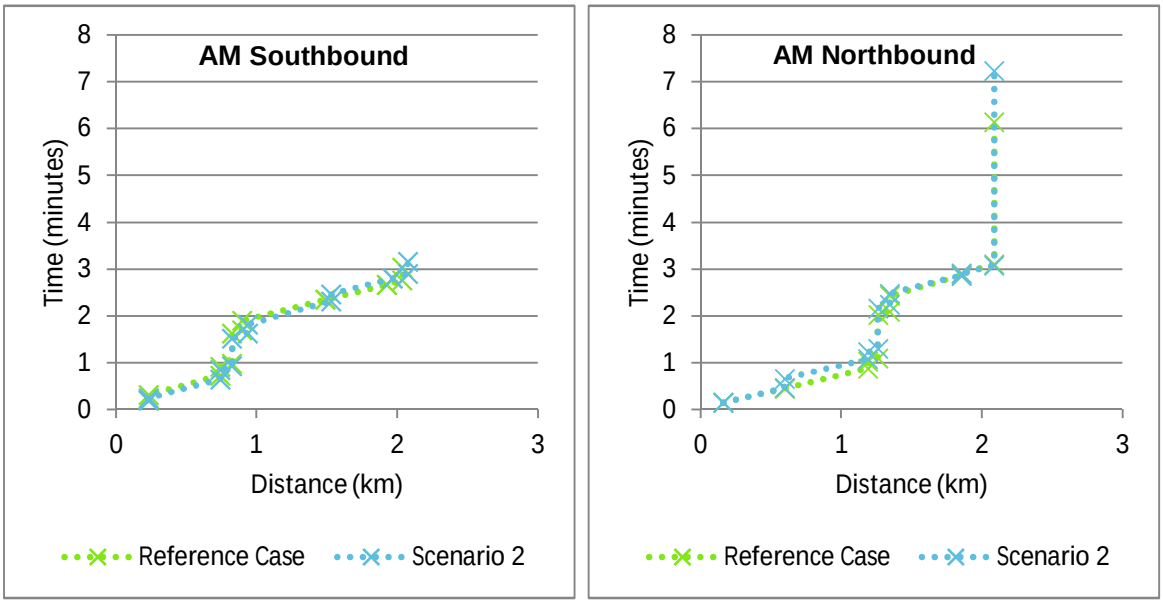


Figure 88. AM JT Route 9 Reference Case and Scenario 2

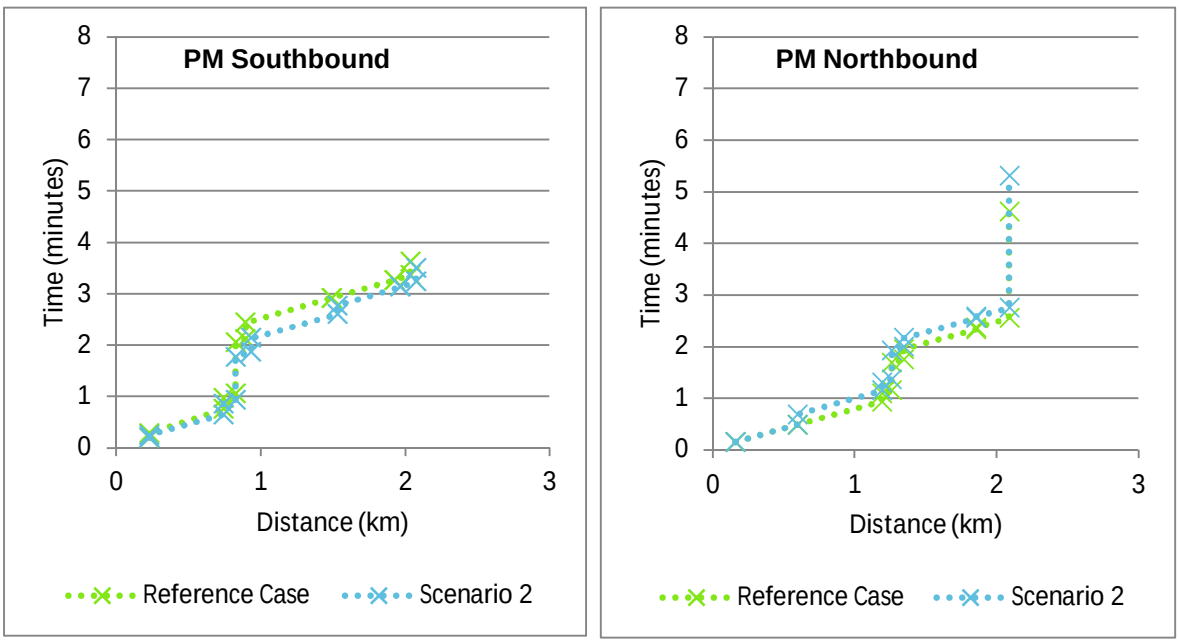
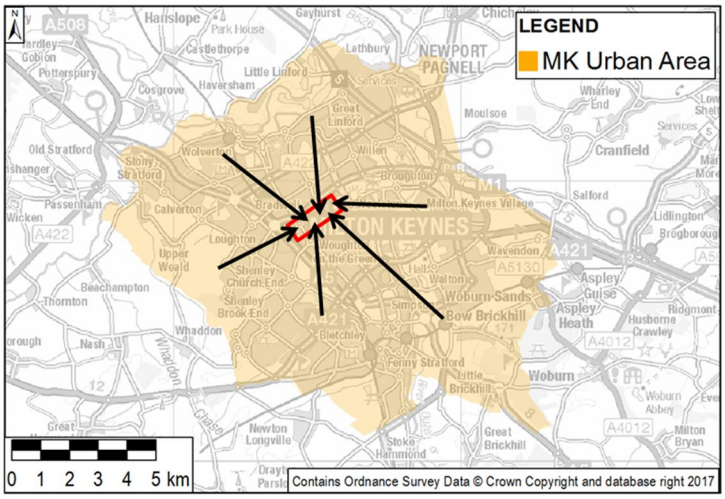


Figure 89. PM JT Route 9 Reference Case and Scenario 2

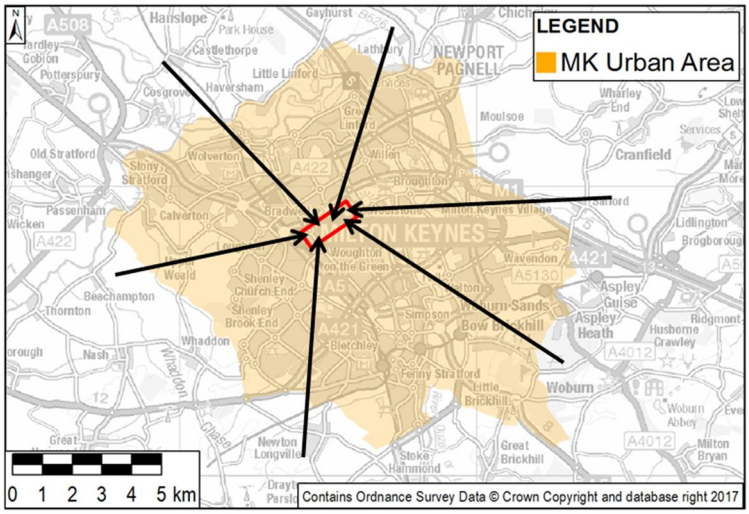
6.10 Trips to and from Milton Keynes

6.10.1 As shown in Figure 90 to Figure 93 there is a forecast 4% increase in trips coming into CMK from within MK Urban Area in the AM and a 2% increase in trips leaving CMK and travelling within the MK urban Area in the PM peak, conversely trips from outside MK urban Area in the AM peak have decreased by 2% and those travelling from CMK to outside MK Urban Area in the PM peak have reduced by 1%. This is likely to be in part due to the additional housing in the Milton Keynes Urban Area resulting in more jobs taken up by local residents and in part because, with the exception of the new education establishment in central Milton Keynes, jobs growth in Scenario 2 is outside central Milton Keynes.



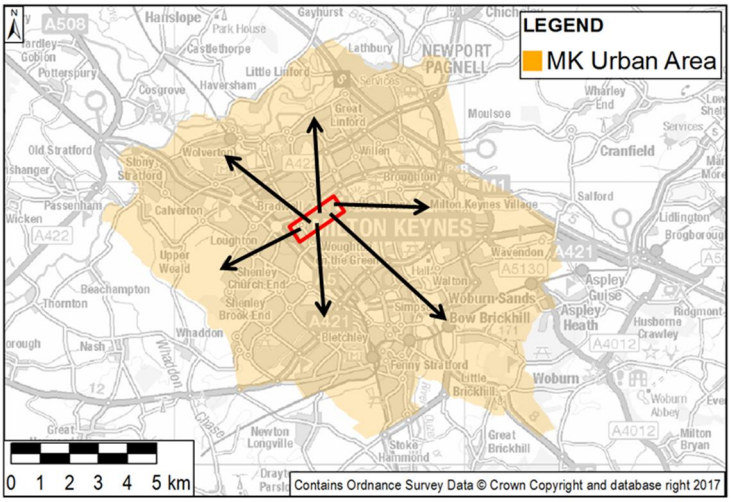
2031 Reference Case	7359
2031 Plan:MK Scenario 2	7682
Percentage Difference	+4%

Figure 90. Car trips from non-central Milton Keynes to Central Milton Keynes, AM peak



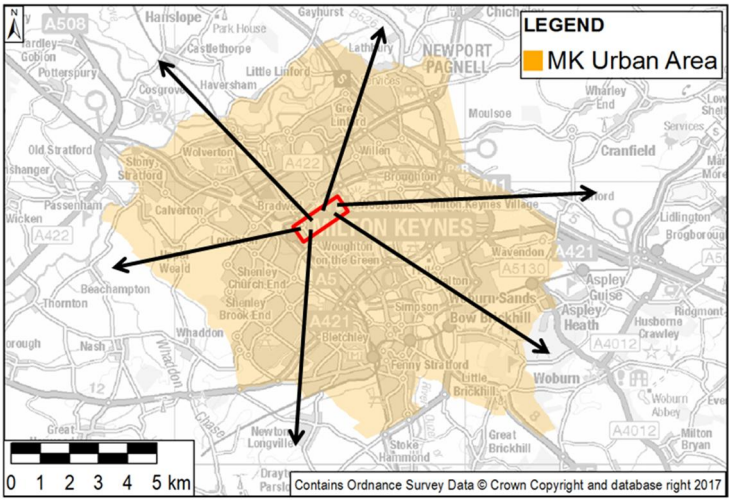
2031 Reference Case	4574
2031 Plan:MK Scenario 2	4484
Percentage Difference	-2%

Figure 91. Car trips from outside the MK Urban Area to Central Milton Keynes, AM peak



2031 Reference Case	7078
2031 Plan:MK Scenario 2	7204
Percentage Difference:	2%

Figure 92. Car trips from Central Milton Keynes to non-central Milton Keynes, PM peak



2031 Reference Case	4217
2031 Plan:MK Scenario 2	4182
Percentage Difference:	-1%

Figure 93. Car trips from Central Milton Keynes to outside the MK Urban Area, PM peak

6.11 Review of Network Delays

6.11.1 Plan:MK Scenario 2 generally has little impact on average junction delay over and above the Reference Case, as shown in Figure 94 and Figure 95. The new road network for the East of M1 development results in less delay at Renny Lodge roundabout and Tongwell roundabout in the AM and Marsh End roundabout and Northfield roundabout in the PM peak. There is also a slight reduction in delay at M1 Junction 14 although there is still significant congestion forecast at this major junction.

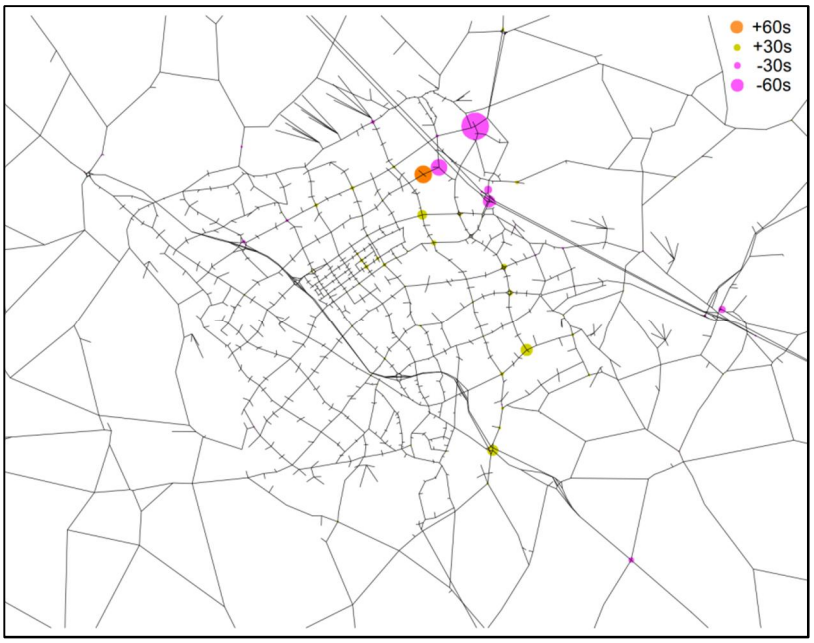


Figure 94. Change in Average Junction Delay (seconds), Scenario 2 less Reference Case AM peak

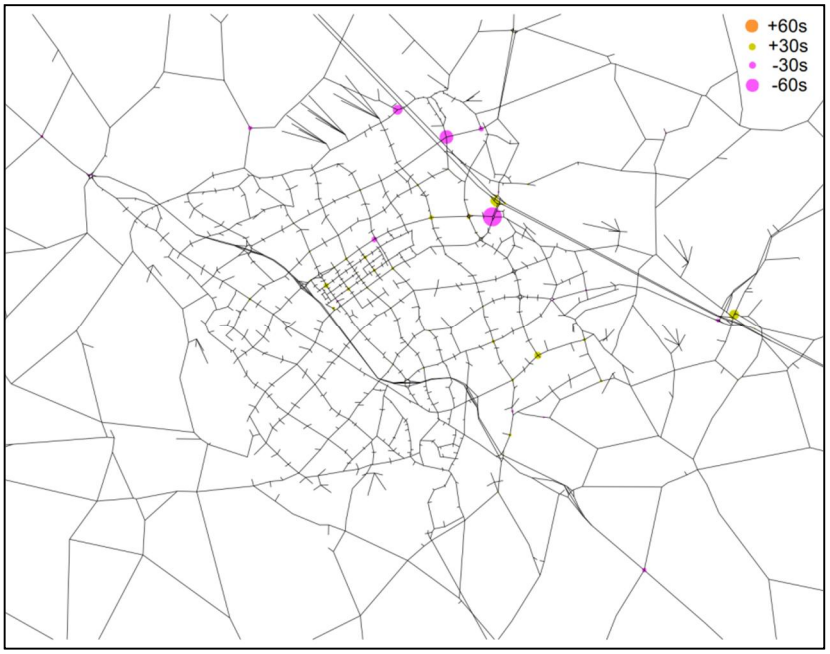


Figure 95. Change in Average Junction Delay (seconds), Scenario 2 less Reference Case PM peak

6.11.2 The change in total delay per junction at congestion hot spots (V/C ration 85% and over) is more noticeable as shown in Figure 96. Junctions around central Milton Keynes are impacted as well as along corridors such as the A422, V10 and V11.

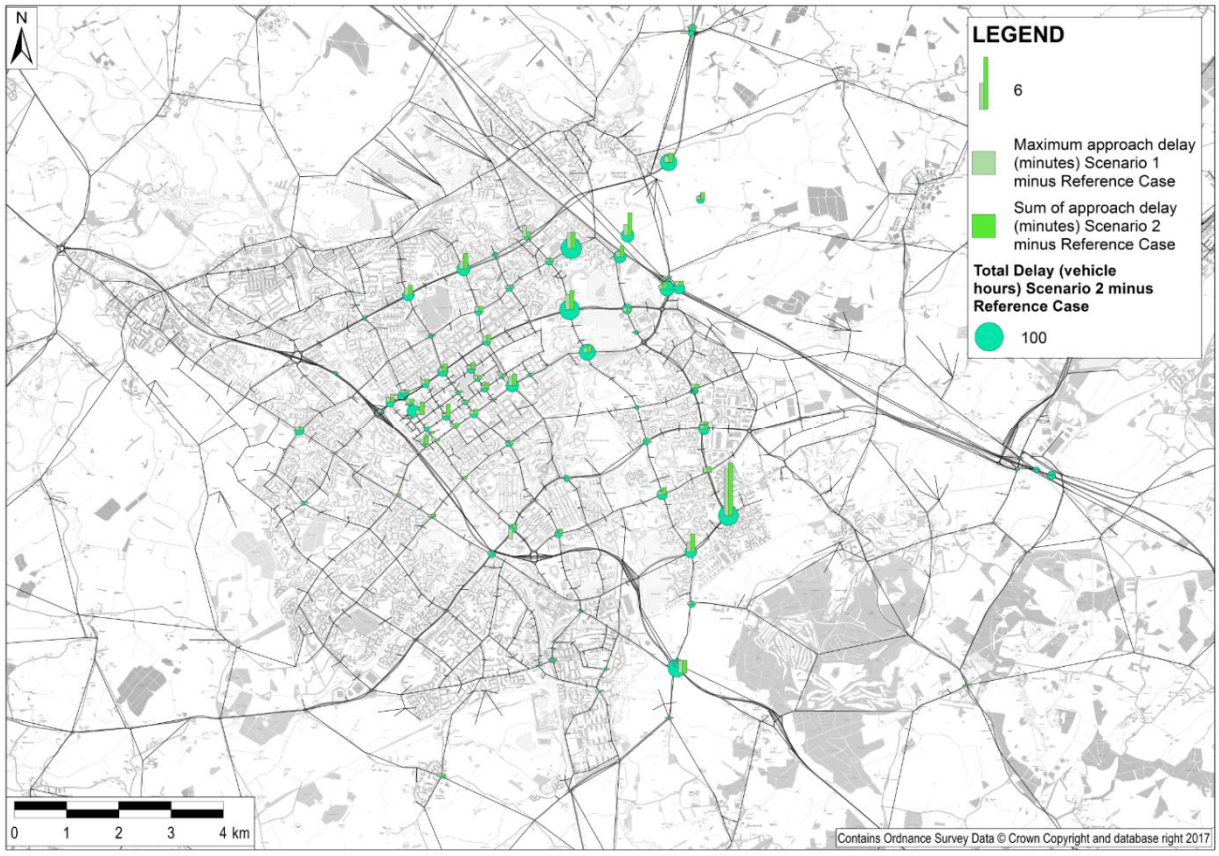


Figure 96. Change in junction delay at congestion hot spots – Scenario 2 minus Reference Case

6.13 Volume over Capacity Ratios

6.13.1 Due to there generally being lower levels of congestion in the Inter-Peak period, Plan:MK Scenario 2 has little impact in this time period. As such, this section focusses on the AM and PM peaks. It is considered that a V/C ratio of 85% and above is when a junction starts experiencing issues of congestion. Figure 97 and Figure 98 show where links and junctions have changed band between the Reference Case and Scenario 2, where the bands are defined as <85%, 85-100% and >100%. Note that dark blue shows that although there model forecasts a decrease in congestion, the V/C ratio still remains over 85%.

6.13.2 Figure 99 and Figure 100 show the total V/C ratio in Plan:MK Scenario 1.

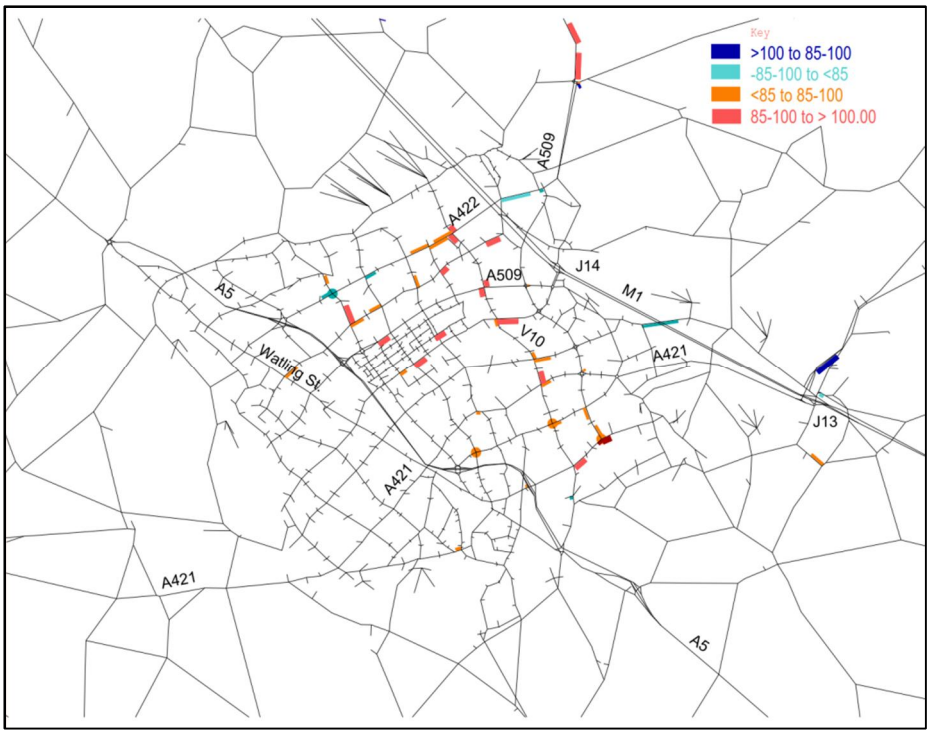


Figure 97. V/C ratio band changes between Reference and Scenario 2, AM peak

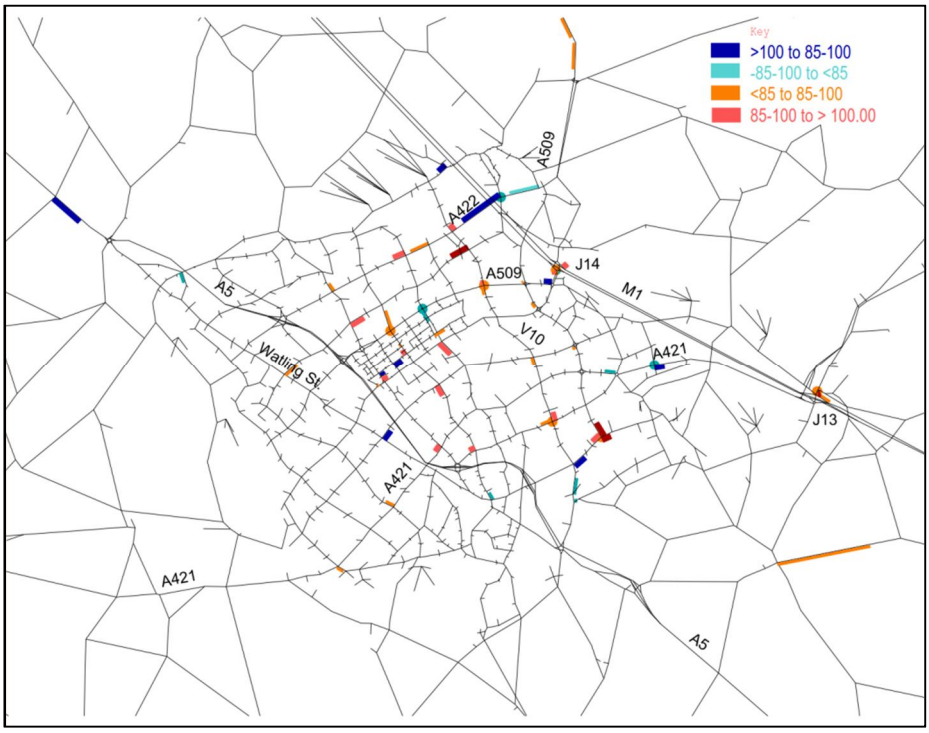


Figure 98. V/C ratio band changes between Reference and Scenario 2, PM peak

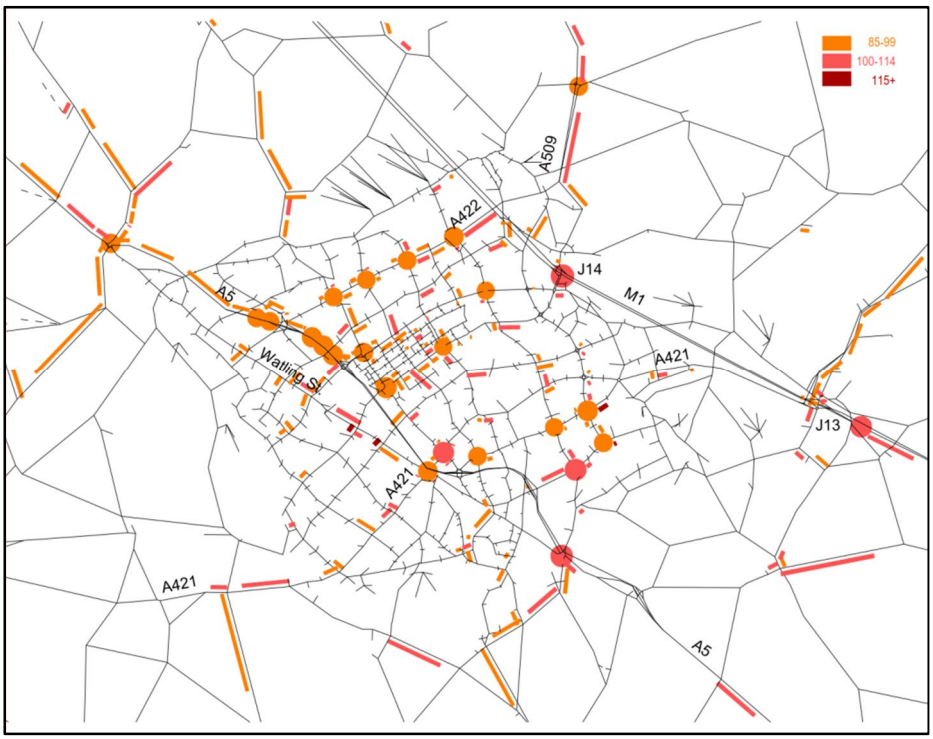


Figure 99. 2031 Plan:MK Scenario 2, link and junction V/C over 85%, AM peak

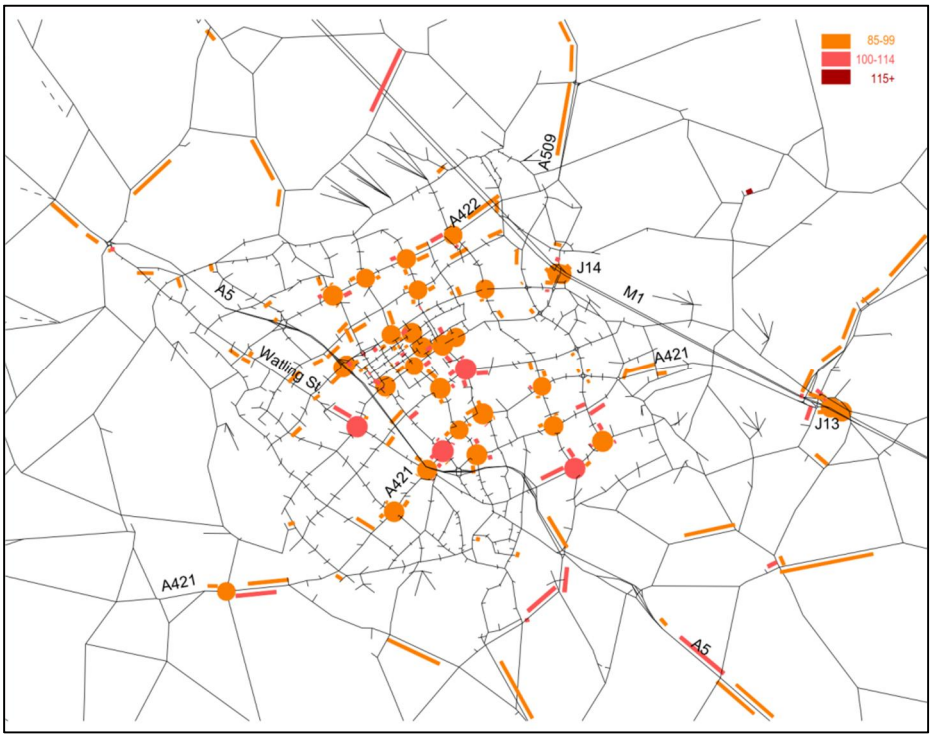


Figure 100. 2031 Plan:MK Scenario 2, link and junction V/C over 85%, PM peak

6.14 Junctions

6.14.1 The junctions flagged up as changing band in either the AM or PM peaks (as shown in Figure 97 and Figure 98) have been looked at and compared across both time periods to establish the extent of the impacts of Plan:MK Scenario 2 against the Reference Case. Junctions which are forecast in the MKMM model to be particularly impacted by Plan:MK Scenario 2, are highlighted within Table 53.

Table 53. Junctions impacted by Plan:MK Scenario 2

Junction	Corridor	Issue in Reference Case		Issue in Scenario 2		Conclusion
		AM	PM	AM	PM	
n/a	A509 North of Chichley Hill Roundabout	Link V/C 98 to 115% SB	Link V/C 77 to 89%	link V/C 101 to 116	link V/C 86 to 101% NB	Reference Case worsened by Scenario 2
H3/V10 Roundabout	V10 junctions Between H3 and H9	westbound approach 109% Northbound and southbound approaches 95 and 96% respectively, eastbound 82%	northbound approach 104% southbound approach 97% and eastbound 107%	westbound approach 110% northbound approach 100% southbound approach 101% eastbound approach 85%	northbound approach 102% eastbound approach 107% southbound approach 100%	Reference Case worsened by Scenario 2
Pagoda Roundabout	V10 junctions Between H3 and H9	Pagoda Roundabout northbound and southbound approaches 99%, westbound 100%	southbound approach 89%, eastbound approach 87%	northbound and southbound approaches 101 and 100% respectively westbound approach 107%	northbound and southbound approaches 95 and 96% respectively eastbound approach 101%	Primarily Reference Case issue. Eastbound approach issue due to Scenario 2.
H6/V10	V10 junctions Between H3 and H9	Northbound approach 84%, westbound 96%	southbound approach 92%	northbound approach 98% westbound approach 102%	southbound approach 91%	westbound and southbound approaches Reference Case issue, northbound approach due to Scenario 2
Oakgrove Roundabout	V10 junctions Between H3 and H9	Westbound approach 82%	northbound approach close to capacity 83%	westbound approach 92%, southbound approach 85%	northbound approach 88%	Reference Case issue
Kent's Hill Roundabout	V10 junctions Between H3 and H10	Southbound approach 97% Westbound approach 80%	southbound approach 98% eastbound approach 100% and northbound approach 87%	southbound approach 101% westbound approach 91%	southbound approach 98% eastbound approach 100% northbound approach 96%	Westbound approach due to Scenario 2

Junction	Corridor	Issue in Reference Case		Issue in Scenario 2		Conclusion
		AM	PM	AM	PM	
V10/H9 Roundabout		Northbound approach to jct 88%, westbound approach 84%	Northbound approach 94% and southbound approach 88%	northbound approach 93%, westbound approach 95%	northbound approach 99% southbound approach 100%	Northbound approach Reference Case Westbound and Southbound approaches Scenario 2
V10/H10 Roundabout		Southbound approach 101%, northbound approach 107%, eastbound approach 101% and westbound approach 99%	southbound approach 103%, northbound approach 104% eastbound 101, westbound 100%	eastbound and westbound approaches 101%, northbound approach 111% and southbound approach 103%	southbound approach 104% northbound approach 105% eastbound 102% westbound approach 93%	Reference Case issue
Dansteed Way/Hopper Street	Dansteed Road	westbound approach 85%	no modelled issues	westbound approach 104%	no modelled issues	Scenario 2 issue
Neath Hill Roundabout	Dansteed Road	westbound approach 90%	no modelled issues	westbound approach 100%	no modelled issues	Reference Case worsened by Scenario 2
Downs Barn Roundabout	Dansteed Road	westbound approach 105, southbound approach 81%	northbound approach 99%, eastbound approach 91%	westbound approach 107, southbound approach 85%	westbound approach 91%, eastbound approach 94% and northbound approach 99%	Reference Case issue
Stanton Wood Roundabout	Dansteed Road / Saxon St.	No modelled issues	no modelled issues	eastbound approach 86%	no modelled issues	Scenario 2 issue on eastbound approach
Rooksley Roundabout	Dansteed Road	southbound approach 97%, eastbound approach 102%	northbound approach 91%, eastbound 87% and westbound 98%	southbound and eastbound approaches 100%, westbound 91%	northbound approach 95% westbound approach 100% and eastbound approach 91%	Reference Case issue
Crownhill junction	Dansteed Road	westbound approach 82% and eastbound 102%	westbound approach 82%	westbound approach 85%, eastbound approach 104%	westbound approach 98%	Reference Case issue

Junction	Corridor	Issue in Reference Case		Issue in Scenario 2		Conclusion
		AM	PM	AM	PM	
Brown's Wood Roundabout		No modelled issues	Eastbound approach 90%	westbound now 116%, northbound approach 100% and southbound 86%	eastbound approach 101% westbound approach 100% and southbound approach 101%	Scenario 2 issue
Walnut Tree Roundabout		southbound approach 101%, eastbound approach 93% westbound approach 115%	Southbound approach 84%, Eastbound approach 101% Westbound approach 102%	westbound approach 117%, southbound approach 101%, northbound approach 88% and eastbound approach 98%	westbound approach 102% eastbound approach 102%	Primarily Reference Case issue, Northbound approach due to Scenario 2
Ashland Roundabout		eastbound approach 96% westbound approach 91%	eastbound approach 93% westbound approach 100%, southbound approach 101% northbound 86%	eastbound approach 97%, westbound approach 96%	southbound approach 101% eastbound and westbound approaches 100% northbound approach 93%	Reference Case issue (worsened by Scenario 2)
North Witan Roundabout		Eastbound approach 86%, westbound approach 98%	northbound approach 106%	eastbound approach 87% and westbound approach 100%	westbound approach 91%, northbound approach 107%	Reference Case Issue
South Witan Roundabout		northbound approach 91%, eastbound approach 90% and westbound 82%	no modelled issues	northbound approach 96%, eastbound approach 94% and westbound approach 85%	no modelled issues	primarily Reference Case issue, westbound approach due to Scenario 2.
Great Linford Roundabout	A422	westbound approach 82% and eastbound 83%	no modelled issues	westbound approach 85%, eastbound approach 88%	eastbound approach 91%	Reference Case issue
Redbridge Roundabout	A422	southbound approach 103, westbound approach 106, eastbound approach 89%	westbound approach 99%, northbound approach 87	Southbound approach 107% westbound approach 107%, eastbound approach 96%	westbound approach 97%, northbound approach 94% and eastbound approach 101%	southbound and westbound approaches Reference Case Northbound and eastbound approaches Scenario 2

Junction	Corridor	Issue in Reference Case		Issue in Scenario 2		Conclusion
		AM	PM	AM	PM	
Bancroft Roundabout	A422	southbound approach 105%, westbound approach 96% and eastbound 91%	Eastbound and westbound approaches 101%, northbound 94%	southbound approach 101% westbound approach 95%	eastbound approach 102%, westbound approach 101%, northbound approach 91%	Reference Case issue
Bankfield Roundabout		westbound approach 92%	westbound approach 84%	westbound approach 100%	westbound approach 87%	Reference Case Issue made worse by Scenario 2
Eaglestone Roundabout		no modelled issues	southbound approach 96%, northbound approach 98% and westbound approach 102%	no modelled issues	westbound approach 102% eastbound 92% and northbound approach 100%	Reference Case issue
Springfield Roundabout		westbound and northbound approaches 107%, southbound 94	westbound approach 85%, northbound approach 97%, Eastbound approach 103 southbound approach101%	northbound approach 108% southbound approach 94% and westbound approach 111%	eastbound approach103% westbound approach 89% northbound approach 100 southbound approach 102%	Reference Case issue
South Gratfton Roundabout		westbound 101%, northbound approach 104%, eastbound approach 91% and southbound approach 94%.	eastbound approach 107%, northbound approach 95%, westbound approach 91% and southbound approach 115%	westbound approach 101% northbound approach 103% eastbound approach 91% and southbound approach 95%	southbound approach 116%, westbound approach 107% northbound 95%	Reference Case issues, but southbound approach significantly worse in Scenario 2
N Saxon Roundabout	V7 Saxon St.	southbound approach 103%, eastbound 98%, westbound 87%	eastbound approach 100%, northbound approach 104%	southbound approach 104%, westbound 88%	southbound approach 94%, westbound approach 101, northbound approach 105%	Reference Case issue
Saxon Gate / Aylesbury Boulevard	V7 Saxon St.	No modelled issues	eastbound approach 99%	no modelled issues	eastbound approach 100%	Reference Case issue

Junction	Corridor	Issue in Reference Case		Issue in Scenario 2		Conclusion
		AM	PM	AM	PM	
S Saxon Roundabout	V7 Saxon St.	westbound approach 98%, northbound approach 107%	southbound approach 108%, westbound approach 104% and eastbound approach 97%	westbound approach 100% and northbound approach 108%	southbound approach 109% westbound approach 104% and eastbound approach 97%	Reference Case issue
Standing Way/ V1 / Buckingham Rd Roundabout	A421	Eastbound and Southbound approaches over 85%	Northbound approach 83%	southbound approach 91%, eastbound approach 86%	northbound approach over 85%	eastbound and southbound Reference Case issue northbound approach Scenario 2 issue
Emerson Roundabout	A421	southbound approach 100%, eastbound approach 102%	southbound approach 87%, eastbound approach 84%	southbound approach 100%, eastbound approach 102%	southbound approach 85% westbound approach 98% northbound approach 100% eastbound approach 96%	southbound and eastbound approach Reference Case issues westbound and northbound approaches due to Scenario 2
Bleak Hall Roundabout	A421	eastbound approach 112%, westbound 94% and northbound 109%	eastbound approach 97%, westbound approach 111%, northbound approach 97% and southbound approach 102%	eastbound approach 104% westbound 107% and northbound 104%	eastbound approach 100% westbound approach 111% northbound approach 99% and southbound approach 103%	Reference Case issue
Marina Roundabout	A421	no modelled issues	Southbound approach 87%, eastbound approach 84%	westbound approach 85%	Southbound approach 87%, eastbound approach 84%	Approaching capacity in Reference Case, Scenario 2 causes issues on western approach
J14 A509 northbound approach to junction		no modelled issues	87%	no modelled issues	100%	Scenario 2 issue but, J14 as a whole Reference Case issue
J14 SB onlsip		no modelled issues	89%	no modelled issues	100%	Scenario 2 issue

Junction	Corridor	Issue in Reference Case		Issue in Scenario 2		Conclusion
		AM	PM	AM	PM	
J13 SB on-slip		no modelled issues	link 84%	no modelled issues	link 85%	Reference Case and Scenario 2
Salford Rd / Bedford rd. left filter		link V/C of 107%	no modelled issues	link V/C 107	link V/C 100%	Reference Case Issue

6.15 Conclusions

6.15.1 Plan:MK Scenario 2 has some impact over and above the 2031 Reference Case. Although the main impacts are in the vicinity of the South East Milton Keynes Allocation (SEMK1 and SEMK2) near Bow Brickhill and the East of M1 development site, both these developments include new road infrastructure which helps mitigate some of the impacts of the additional traffic on the network, and in the case of East of M1 this new network has also helped alleviate some pressures on parallel routes. However the higher flows forecast in Scenario 2 have resulted in new or additional congestion issues modelled around Central Milton Keynes, and at junctions along the A422, V10 and V11 corridors.

7. Plan:MK Scenario 2a

7.1 Introduction

7.1.1 Scenario 2a was run to assess the need for a new bridge crossing over the railway to accommodate an additional 2,000 homes south of the railway within the South East Milton Keynes Allocation (SEMK2) . This assessment was run as a partial Scenario 2 that excluded the East of M1 development and new education establishment to sensitivity test to impacts associated with the additional housing within the South East Milton Keynes Allocation (SEMk2). This is referred to as Scenario 2a.

7.1.2 To assess the impacts of these two developments Scenario 2a results were originally compared against the 2031 Plan:MK Scenario 1. As Scenario 2a is now considered to be the 'preferred' Plan:MK scenario it has subsequently been compared against the Reference Case.

7.2 Plan:MK Scenario 2a Growth

7.2.1 Scenario 2a dwellings and jobs growth is plotted in Figure 101. Scenario 2a includes the 2000 additional dwellings south of the railway line as part of the South East Milton Keynes Allocation (SEMK2) which is split evenly across the two zones north of Bow Brickhill.

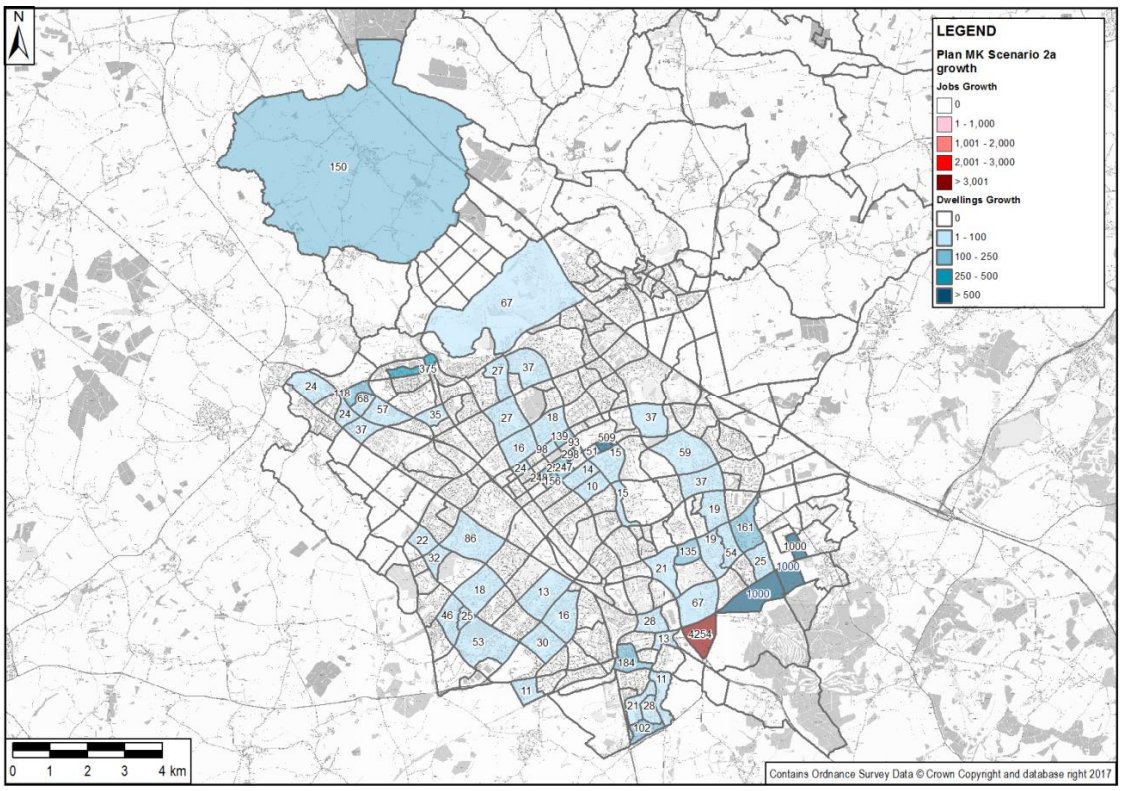


Figure 101. Plan:MK Scenario 2a Additional Dwellings and Jobs Growth to 2031

7.3 Additional Network

7.3.1 It is proposed that the larger South East Milton Keynes Allocation (SEMK1 and SEMK2 together) is served by additional road network as shown in Figure 102. This includes extending H10 as a single carriageway across to the A5130 Newport Road. There is also a

connection included between the A5130 Newport Road and Bow Brickhill Road, which intersects the H10 extension and bridges the railway line. In addition there is a development spine road to the south of the railway line through SEMK2.

7.3.2 Following further discussion the junction arrangement on Brickhill Street north of the railway crossing was modified such that the only revision was the addition of a fourth arm at the Caldecotte Lake Drive roundabout.

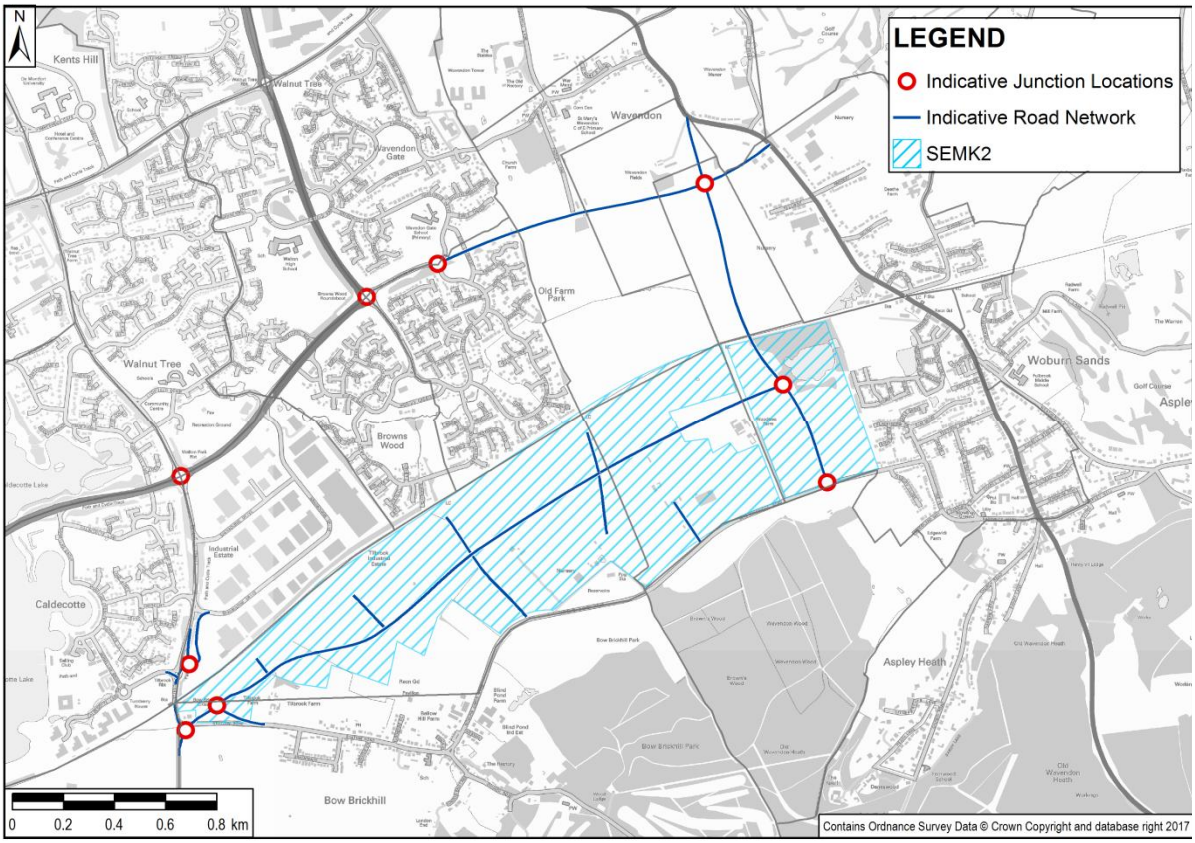


Figure 102. Indicative Additional Road Network

7.4 Traffic Flow Changes

7.4.1 This section compares the Plan:MK Scenario 2a flows with those of the Reference Case and also against Scenario 1. The comparisons against the Reference Case show the impacts over and above the committed growth of the Reference Case.

7.4.2 The flow difference is plotted as bandwidths by direction, with green indicating an increase in actual flow between the Reference Case or Scenario 1 and Scenario 2a and blue a decrease. It is also important to note that no comparisons are plotted on new links added as part of the South East Milton Keynes Allocation (SEMK1 and SEMK2).

Scenario 2a against Scenario 1

7.4.3 As shown by Figure 103 to Figure 108, there is some reassignment due to the additional road network and bridge over the railway. The largest change in flow is along Station Road and Woburn Sands Road through Brickhill with through traffic transferring to the new development road. In the AM peak there is a reduction of around 400 PCU's westbound whilst in the PM peak there is forecast reduction of around 650 PCU's eastbound.

7.4.4 There is an increase in east–west traffic using H10 as a result of the extension, with traffic using Lower End Road rather than Broughton Road to travel to and from Cranfield and Salford. Some of this traffic has moved off H9 Groveway which in turn attracts traffic off Standing Way. There is also reduced flow through Bow Brickhill and Woburn Sands as the new roads allow traffic to bypass them these areas.

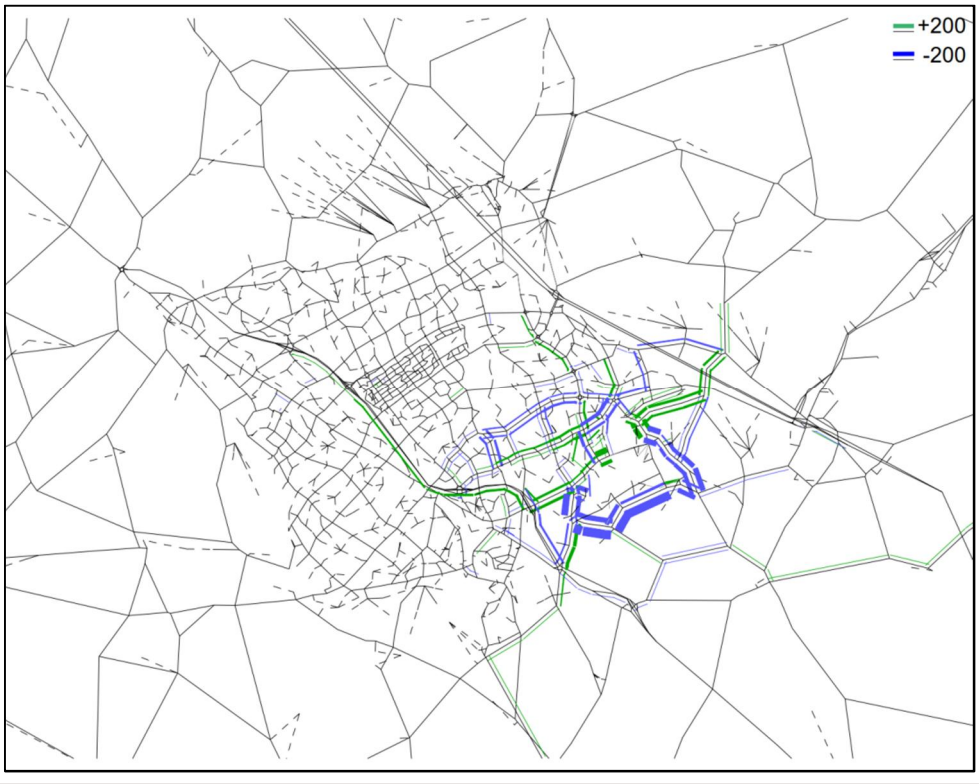


Figure 103. Change in Modelled flow MK, Scenario 2a less Scenario 1, AM peak

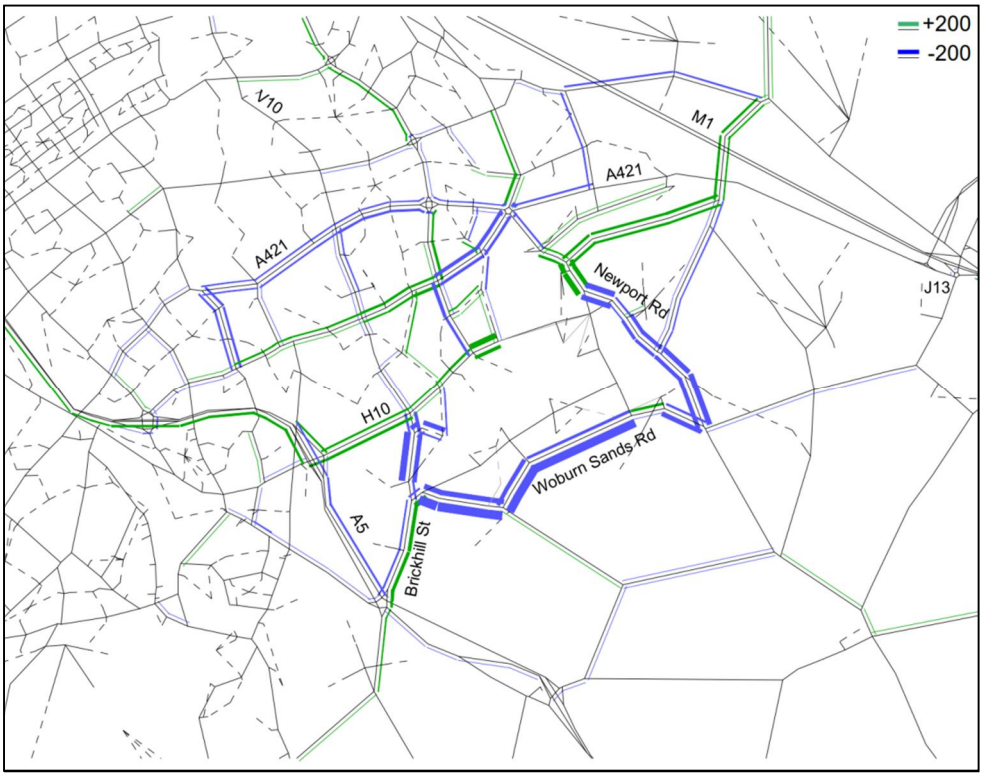


Figure 104. Change in Modelled flow SW MK, Scenario 2a less Scenario 1, AM peak

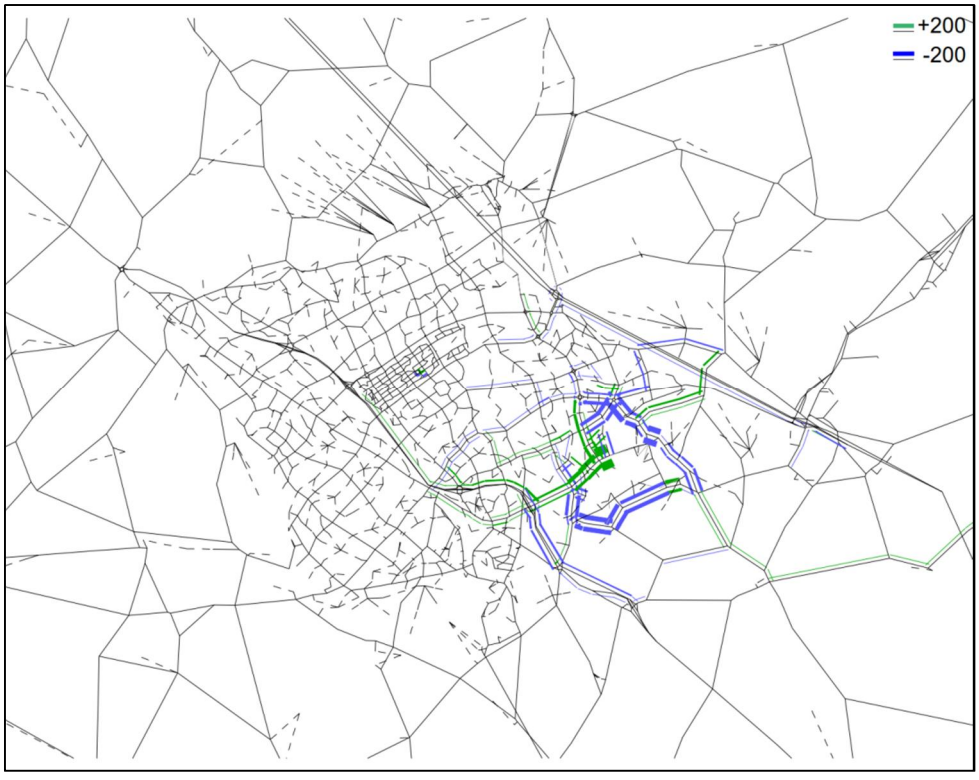


Figure 105. Change in Modelled flow MK, Scenario 2a less Scenario 1, inter-peak

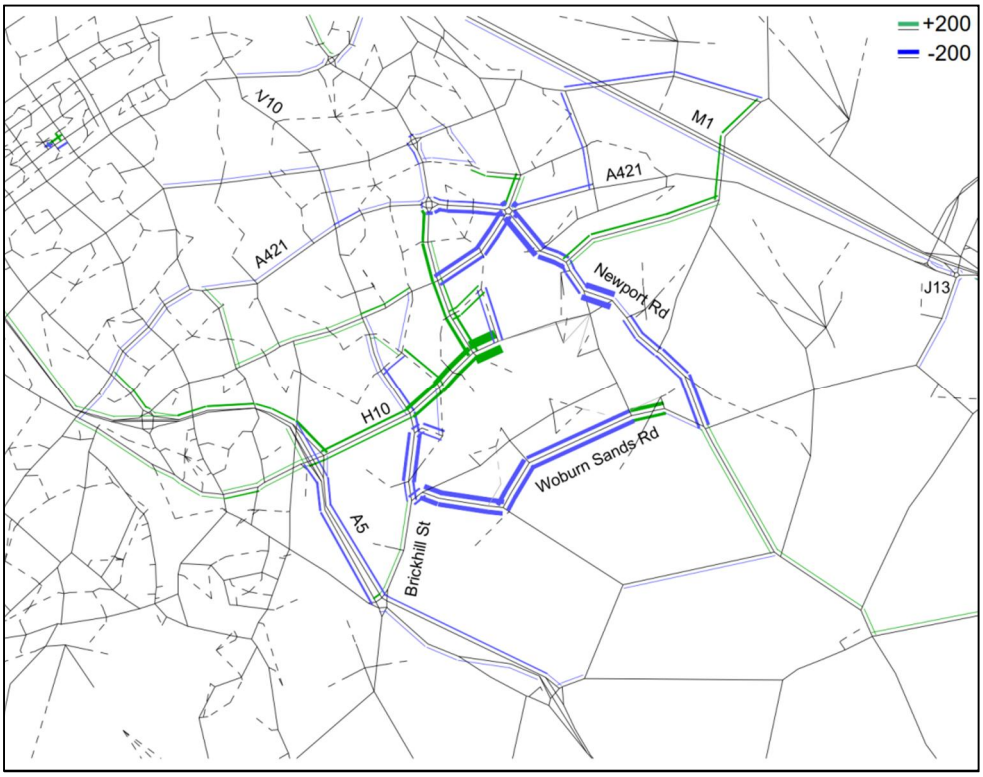


Figure 106. Change in Modelled flow SW MK, Scenario 2a less Scenario 1, inter-peak

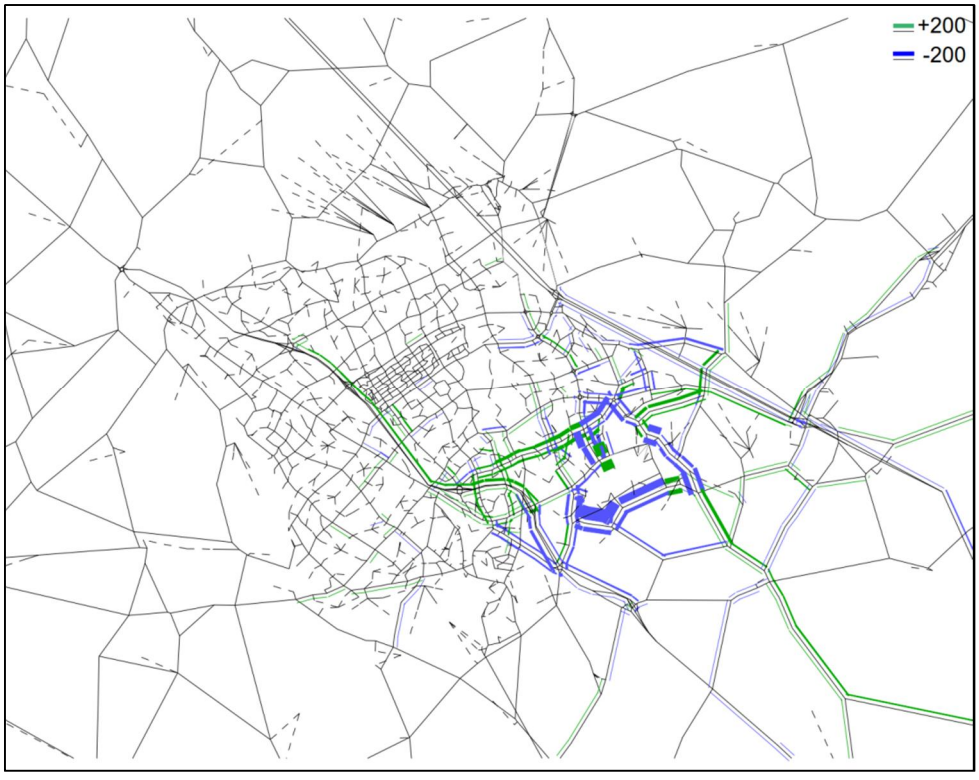


Figure 107. Change in Modelled flow MK, Scenario 2a less Scenario 1, PM peak

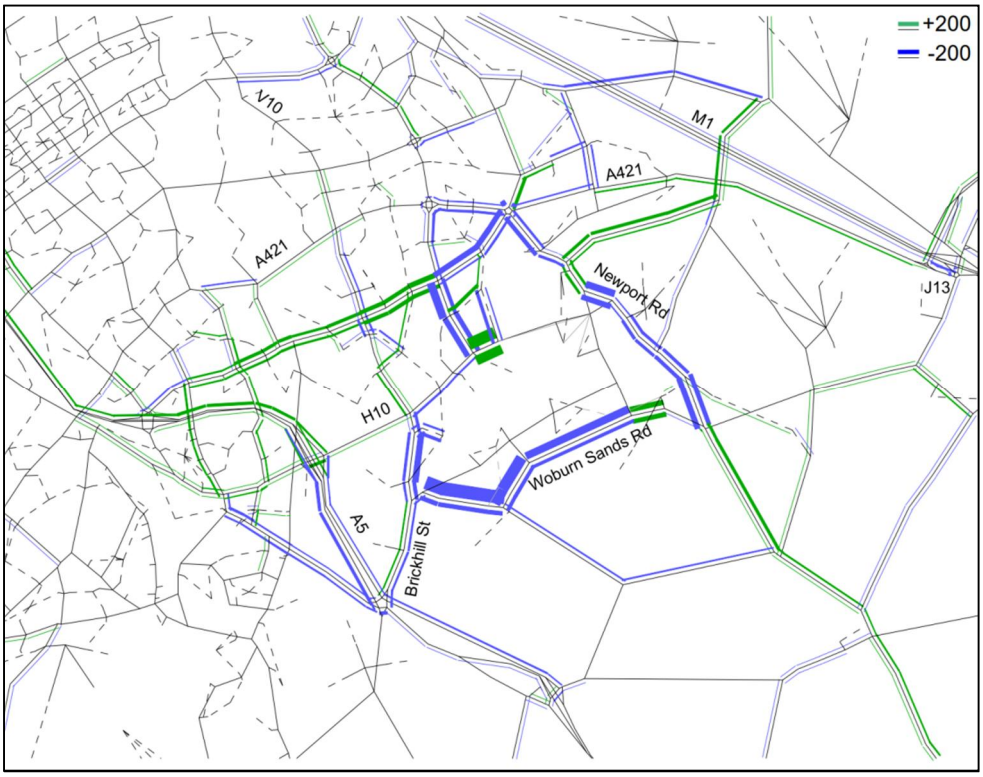


Figure 108. Change in Modelled flow SW MK, Scenario 2a less Scenario 1, PM peak

Scenario 2a against Reference Case

7.4.5 As presented in Figure 109 to Figure 114 the re-assignment around SW Milton Keynes is similar to the comparison with Scenario 1. However there is also the slight uplift in traffic flows across Milton Keynes due to the additional growth in Scenario 2.

7.4.6 There is a notable increase in flows on the A5 between H10 and Brickhill Street in the AM peak due to the South Caldecotte site. There is also an increase in flows on Brickhill Street between Kelly's Kitchen roundabout and Station Road. In the AM peak these are flows heading towards South Caldecotte and in the PM peak flows heading away. However despite the additional traffic caused by the South Caldecotte development there is a decrease in flows modelled between Station Road and H10.

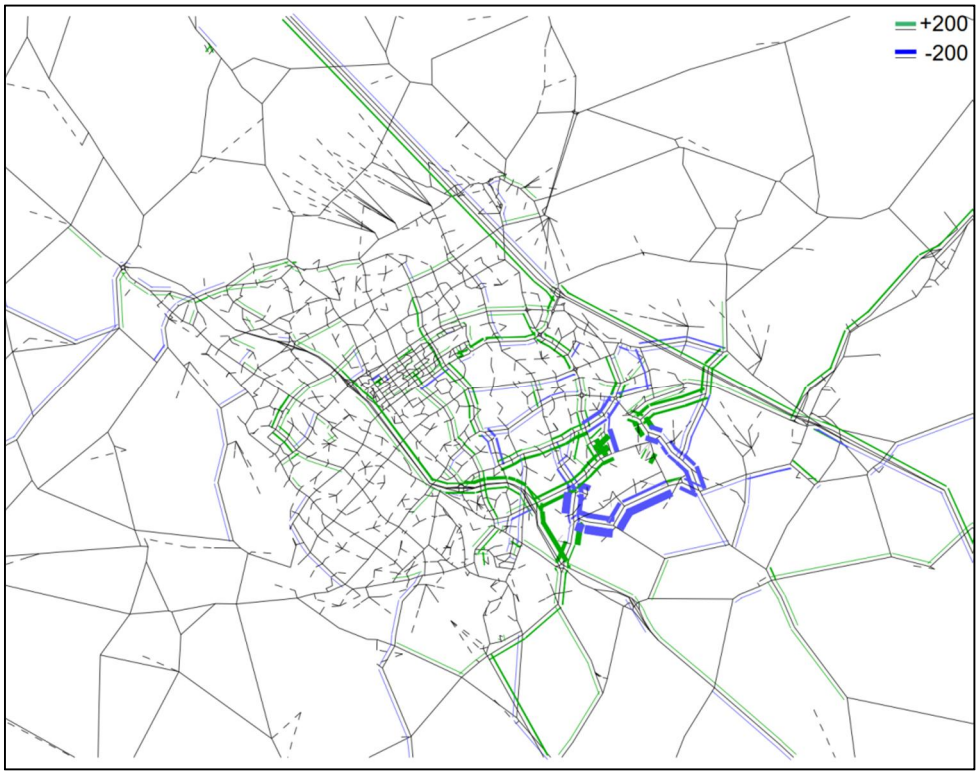


Figure 109. Change in Modelled flow MK, Scenario 2a less Reference Case, AM peak

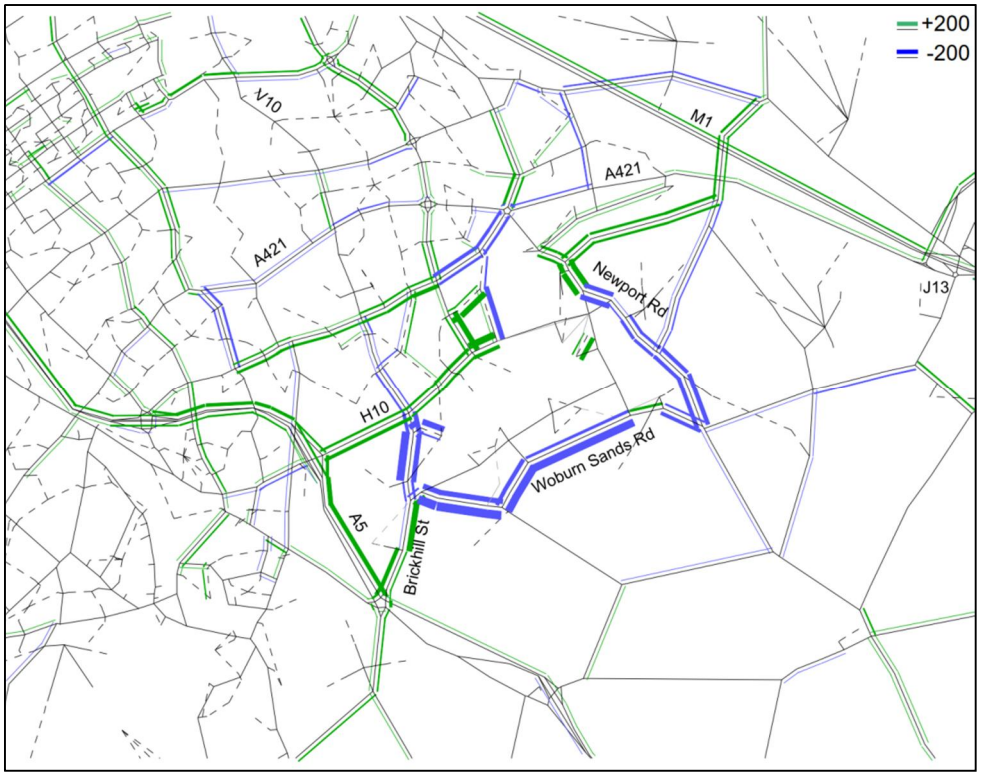


Figure 110. Change in Modelled flow SW MK, Scenario 2a less Reference Case, AM peak

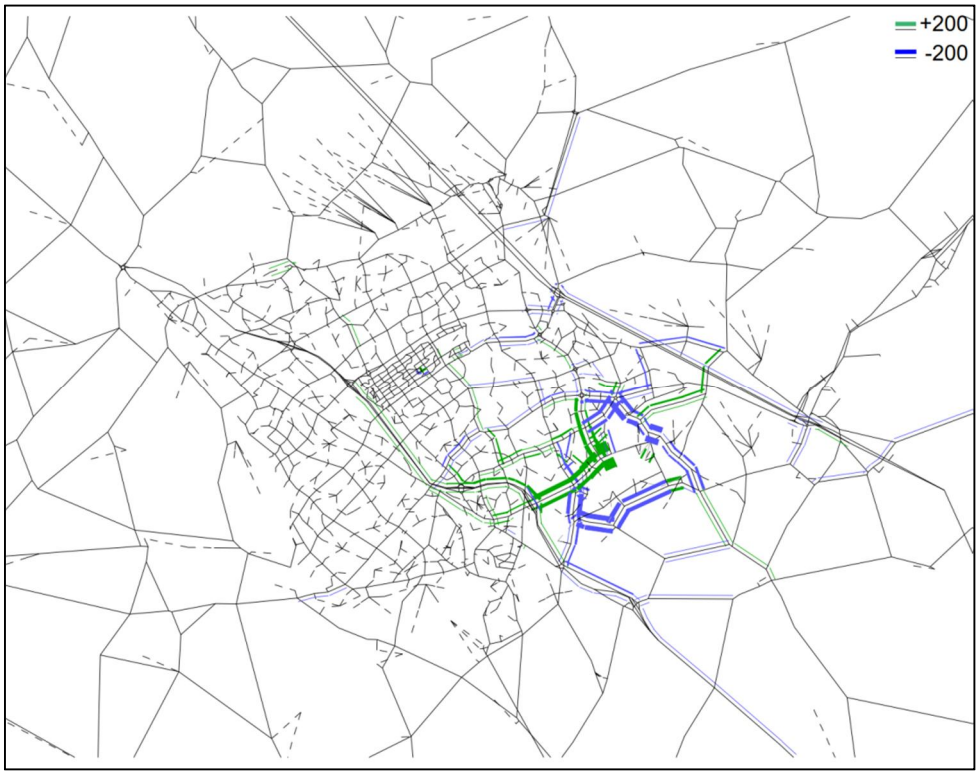


Figure 111. Change in Modelled flow MK, Scenario 2a less Reference Case, inter-peak

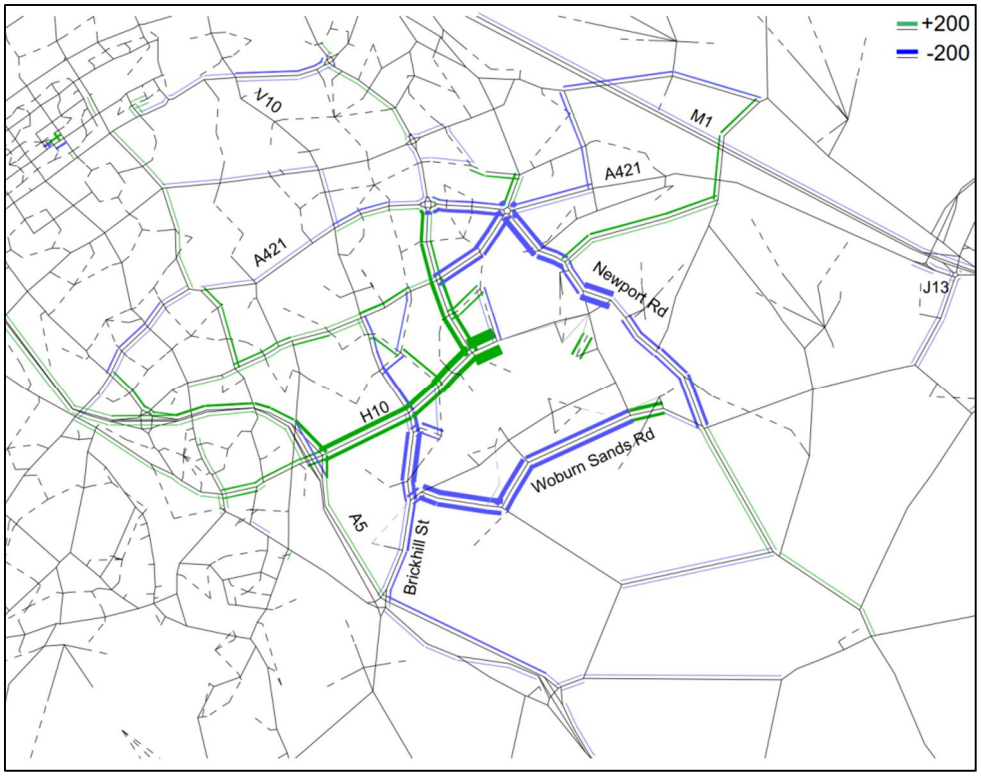


Figure 112. Change in Modelled flow SW MK, Scenario 2a less Reference Case, inter-peak

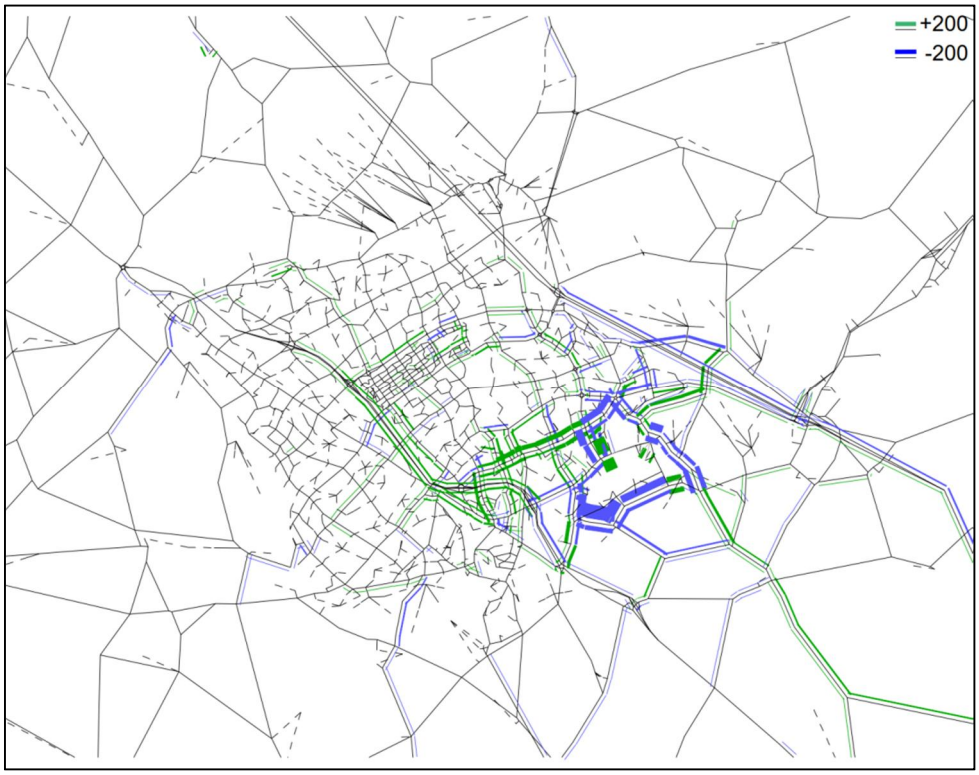


Figure 113. Change in Modelled flow MK, Scenario 2a less Reference Case, PM peak

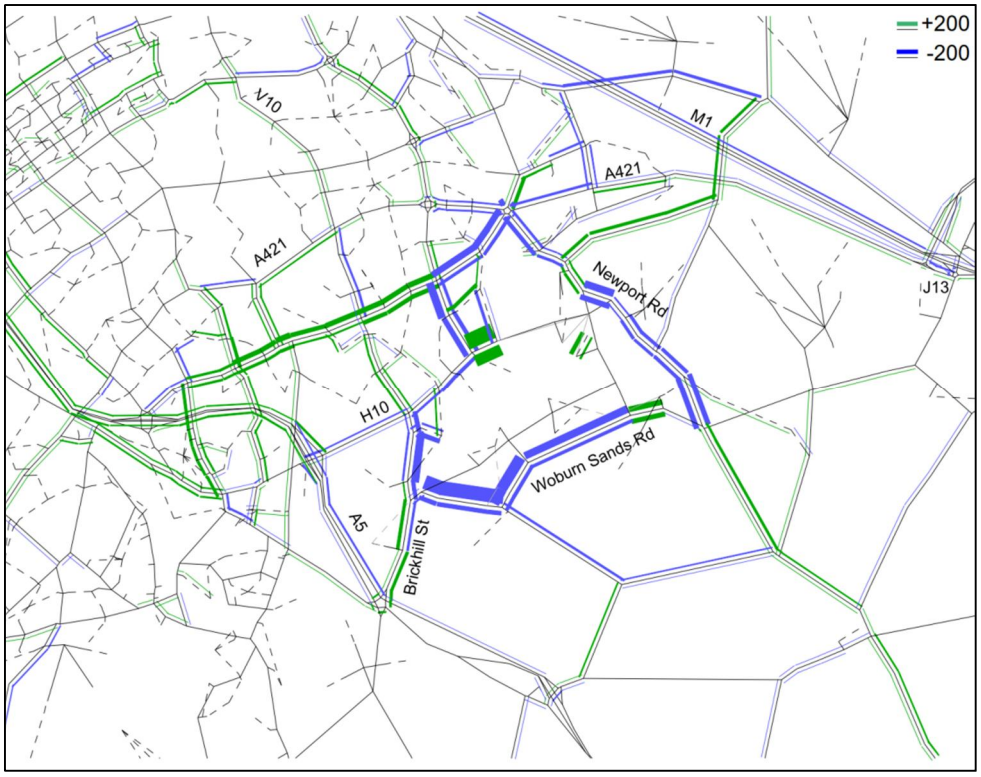


Figure 114. Change in Modelled flow SW MK, Scenario 2a less Reference Case, PM peak

7.4.7 A comparison of flows across the railway line between Bow Brickhill and Woburn Sands is presented in Table 54 and Table 55. Northbound in the AM peak and southbound in the PM peak there are around 500 additional PCU's crossing the railway. The new railway bridge crossing between Bow Brickhill and Woburn Sands carries in the range of 630 and 850 PCU

in the busier directions. , With the exception of the AM peak in the northbound direction, this new bridge takes some existing traffic off Brickhill Street, and significantly reduces the traffic through Woburn Sands in both peak hours.

Table 54. Northbound traffic flows across the Marston Vale railway (PCU)

	AM				PM			
	Bow Brickhill Level Crossing	New railway bridge	Woburn Sands Level Crossing	**Total**	Bow Brickhill Level Crossing	New railway bridge	Woburn Sands Level Crossing	**Total**
Reference Case	998	n/a	262	**1260**	291	n/a	106	**397**
Scenario 1	913	n/a	524	**1437**	436	n/a	337	**773**
Scenario 2a	932	631	354	**1917**	345	654	167	**1166**

Table 55. Southbound traffic flows across the Marston Vale railway (PCU)

	AM				PM			
	Bow Brickhill Level Crossing	New railway bridge	Woburn Sands Level Crossing	**Total**	Bow Brickhill Level Crossing	New railway bridge	Woburn Sands Level Crossing	**Total**
Reference Case	579	n/a	138	**717**	1064	n/a	336	**1400**
Scenario 1	555	n/a	365	**920**	1053	n/a	518	**1571**
Scenario 2a	484	648	144	**1276**	902	853	381	**2136**

7.5 Delays

7.5.1 The difference in delay in the AM peak between Scenario 2a and Scenario 1 is presented in Figure 115 and Figure 116. To add context the total delay in Scenario 2a is presented in Figure 117 and Figure 118. As also shown by the travel times, it is clear that there is little impact on Brickhill Street, with Browns Wood Roundabout experiencing the only notable change in delay. The impacts are similar in the PM period.

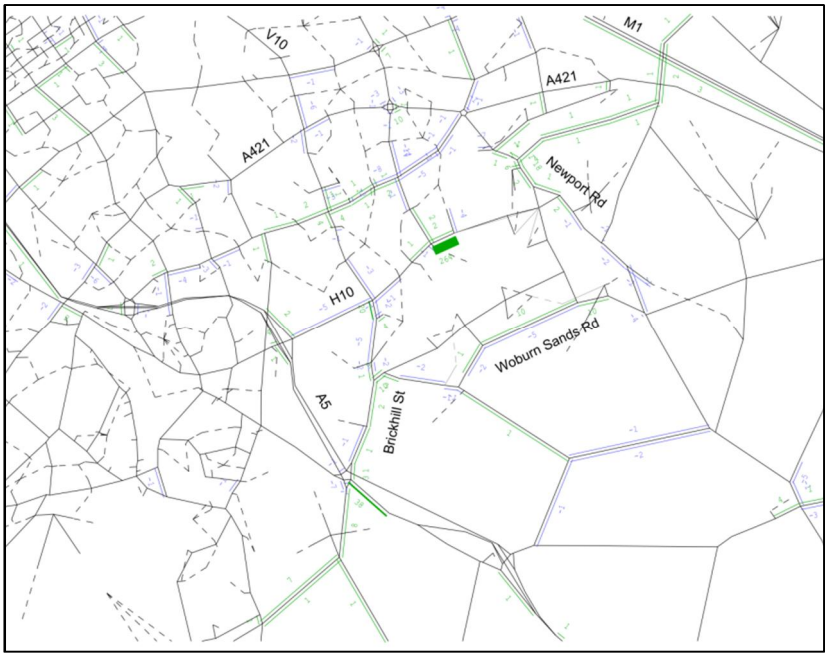


Figure 115. Change in Average Delay (seconds), Scenario 2a less Scenario 1 AM

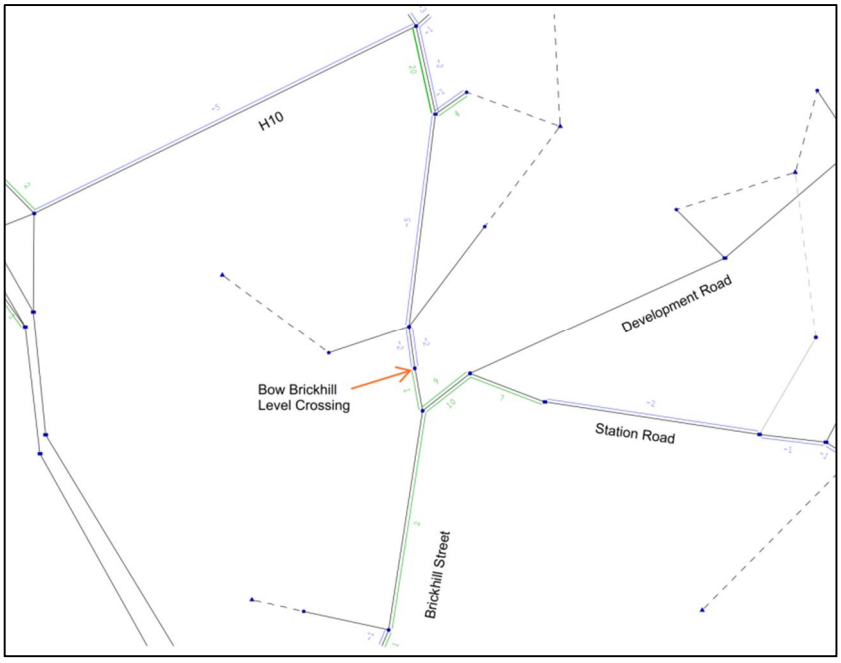


Figure 116. Change in Average Delay (seconds), Scenario 2a less Scenario 1 AM – Bow Brickhill Level Crossing

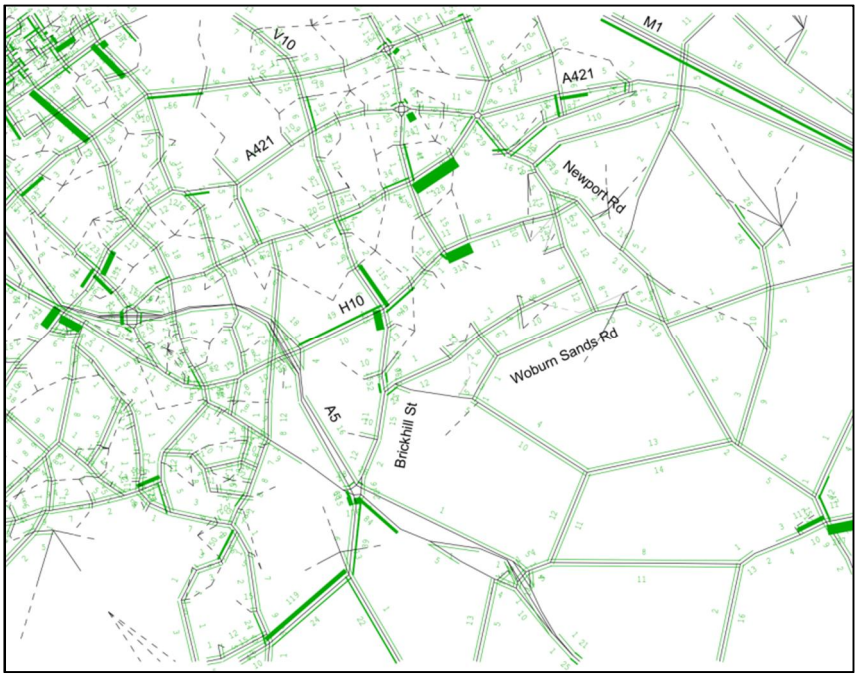


Figure 117. Average Delay (seconds), Scenario 2a AM

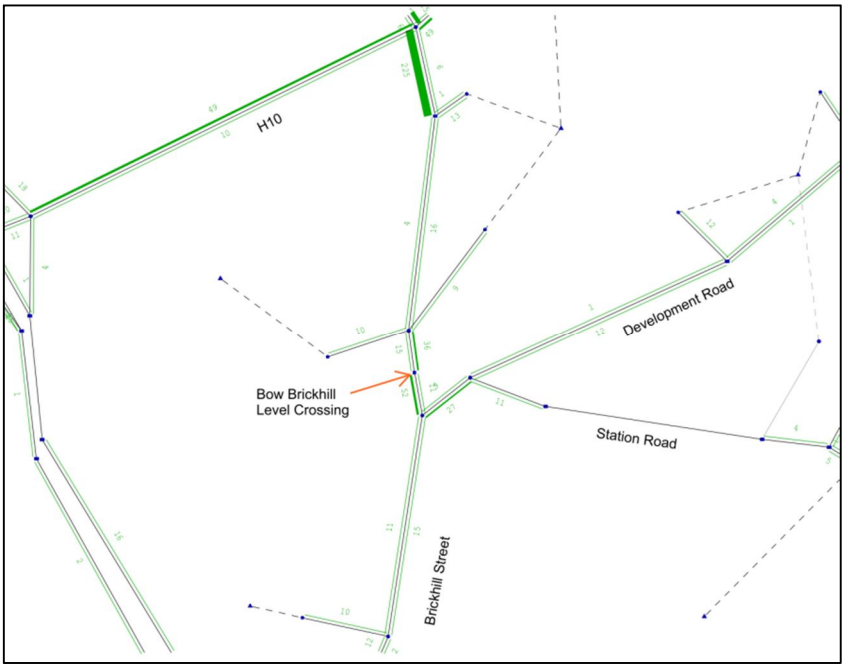


Figure 118. Average Delay (seconds), Scenario 2a AM – Bow Brickhill Level Crossing

7.5.2 A comparison of delay at Bow Brickhill level crossing between scenarios is presented in Table 56. The most significant impact is that of the additional barrier down time caused by East-West rail. In the base year model two trains an hour crossing has been represented in the model. In the 2031 Reference Case and Plan:MK scenarios this has been doubled to four periods of barrier down time per hour, due to the additional services (one more in each direction per hour) as part of the East-West Rail scheme.

7.5.3 Due to some reassignment of through traffic along Brickhill Street in both Plan:MK scenarios 1 and 2, because of the South Caldecotte jobs site, delay actually decreases slightly at the railway crossing compared to the Reference Case.

Table 56. Average Delay at Bow Brickhill Level Crossing

Scenario	Average Delay per PCU (seconds)	
	AM NB	PM SB
2016 Base	27	33
2031 Reference Case	56	60
2031 Scenario 1	51	59
2031 Scenario 2a	52	51

7.6 Transient Queues

7.6.1 The maximum transient queue at the Bow Brickhill crossing for AM and PM time periods are presented in Table 57. The transient queue length is the maximum queue which clears during the operation of the crossing. The transient queue will occur each time the level crossing barriers come down.

7.6.2 It is can be seen Scenario 2a has little impact on the maximum queue length, with an increase of one PCU compared to scenario 1 in the AM and a decrease of nine PCU in the PM, with both scenario 2 figures being lower than the Reference Case. The main reason for this is due to re-assignment of traffic as a result of the additional jobs in South Caldecotte as shown by the Scenario 1 results. However in Scenario 2a, it is possible some through traffic that was using Brickhill Street is now using alternative routes. However as the flows are not greatly different from those in Scenario 1 it appears any decrease is being cancelled out by the new development trips using Brickhill Street.

Table 57. Maximum Transient Queue at Bow Brickhill Level Crossing

Scenario	Max Transient Queue (PCU)	
	AM (NB)	PM (SB)
2016 Base	57	67
2031 Reference Case	60	64
2031 Scenario 1	55	63
2031 Scenario 2a	56	54

7.7 Travel Times

7.7.1 Journey time route 9 runs the length of Brickhill Street between Kelly's Kitchen Roundabout and H10 as shown in Figure 119.

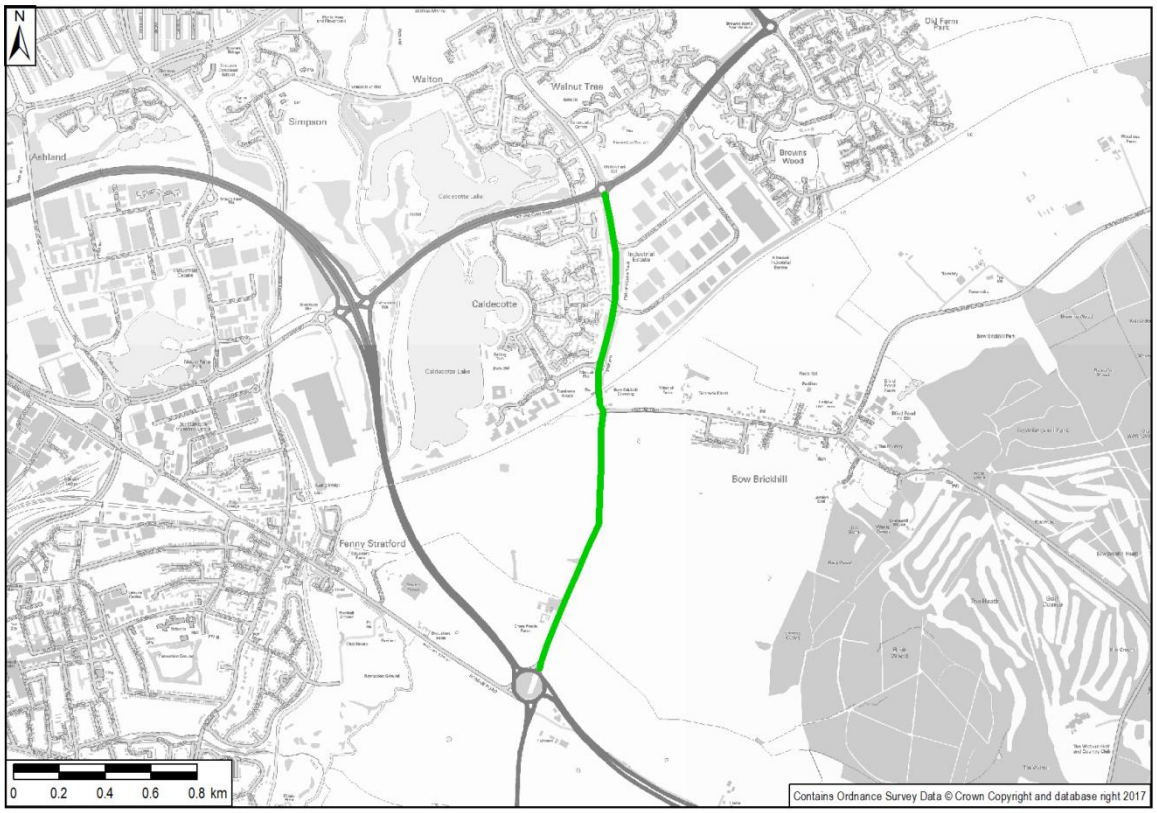


Figure 119. Journey Time Route 9

7.7.2 Scenario 2a has little impact on travel times along Brickhill Street as indicated in Figure 121 and Figure 122. Although northbound travel times in the AM increase by 15 seconds, there is a 30 second reduction northbound in the PM. The biggest cause of delay in all three of the scenarios shown, is that at the roundabout where Brickhill Street meets H10 at the end of the route northbound.

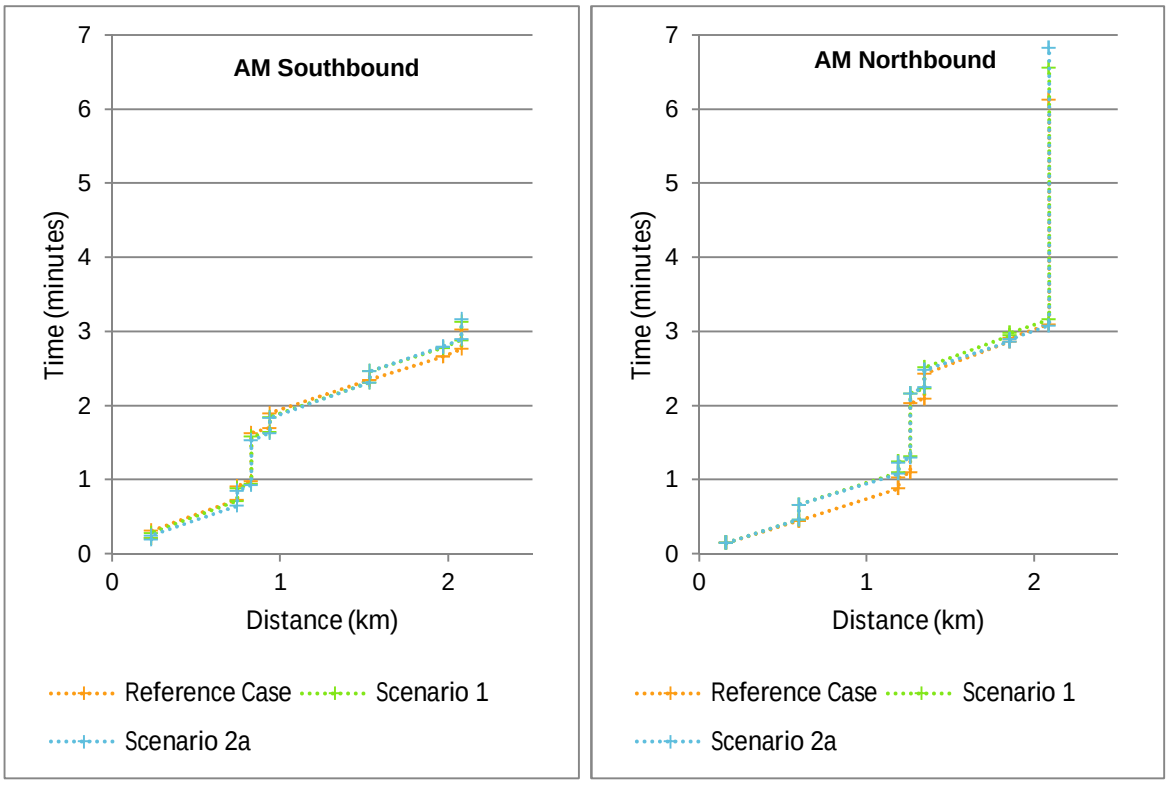


Figure 120. AM JT Route 9 Comparison Scenario 2a against Scenario 1 and Reference Case

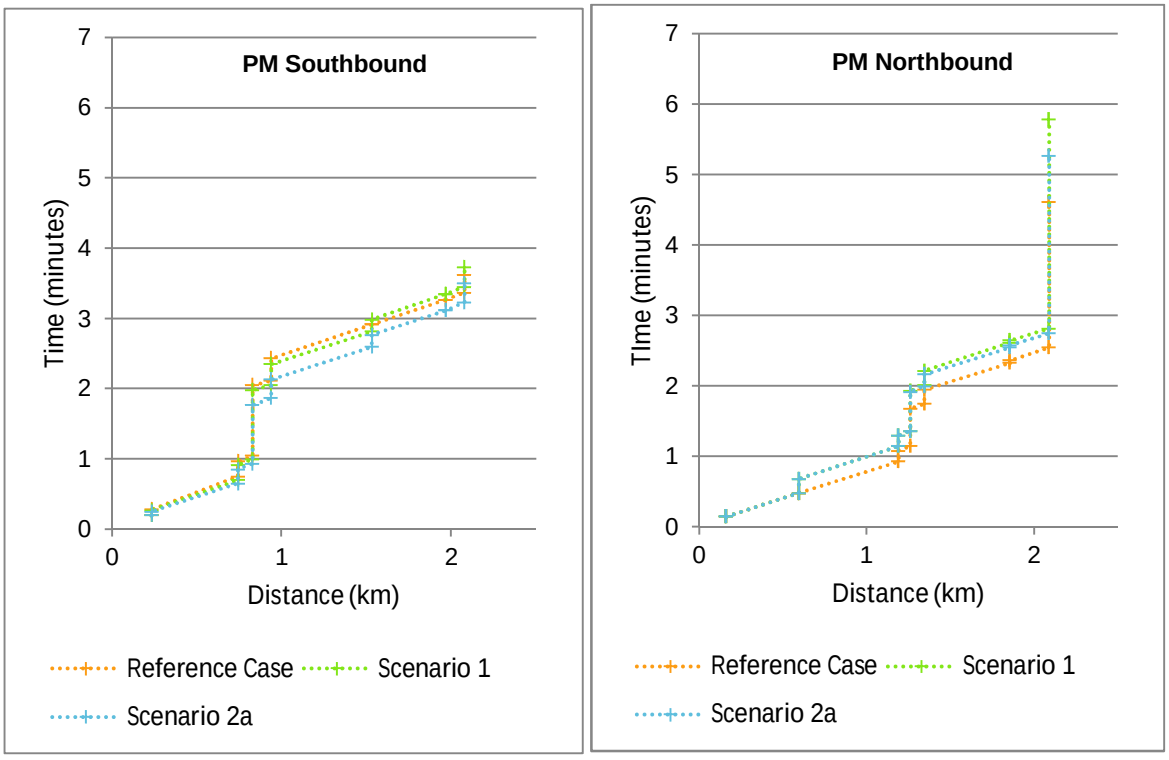


Figure 121. PM JT Route 9 Comparison Scenario 2a against Scenario 1 and Reference Case

7.8 Volume over Capacity Ratios

7.8.1 To assess the impacts on congestion across Milton Keynes over and above the Reference Case the change in the volume over capacity ratio has been calculated for the AM and PM peaks. Due to generally lower levels of congestion in the Inter-Peak period, Plan:MK Scenario 2a has little impact in this time period as such the focus is on the AM and PM peaks.

7.8.2 Figure 122 and Figure 123 show where links and junctions have changed band between the Reference Case and Scenario 2, where the bands are defined as <85%, 85-100% and >100%. Note that dark blue shows that although there model forecasts a decrease in congestion, the V/C ratio still remains over 85%. It can be seen as with Scenario 1 the main impacts are focussed around the South East Milton Keynes Allocation, with limited impact elsewhere in the network.

7.8.3 Figure 124 and Figure 125 show the total V/C ratios 85% and above in Scenario 2a.

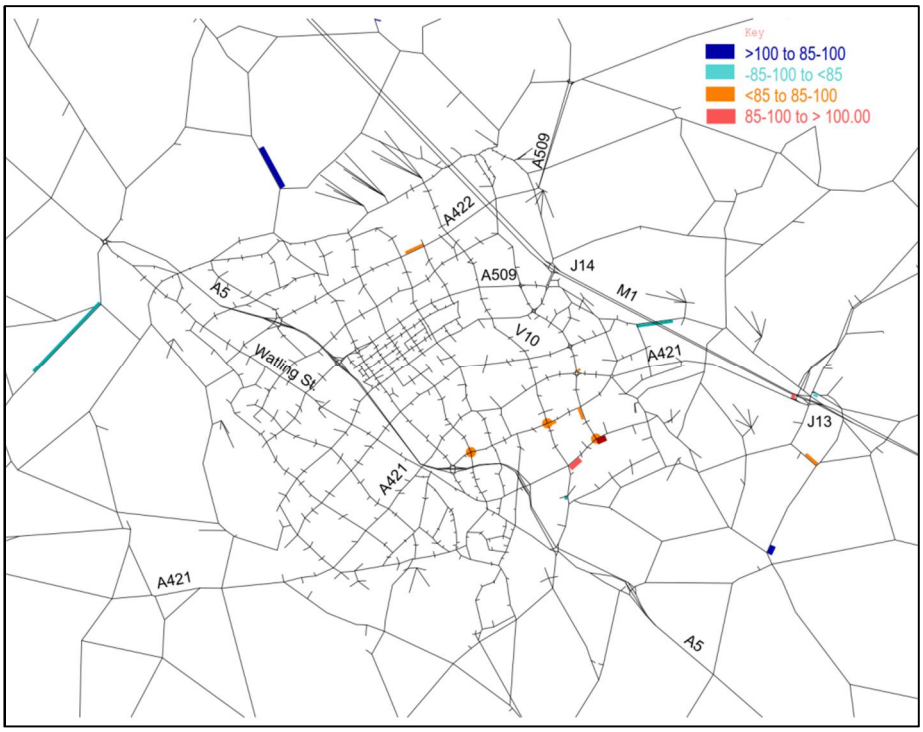


Figure 122. V/C ratio band changes between Reference and Scenario 2a, AM peak

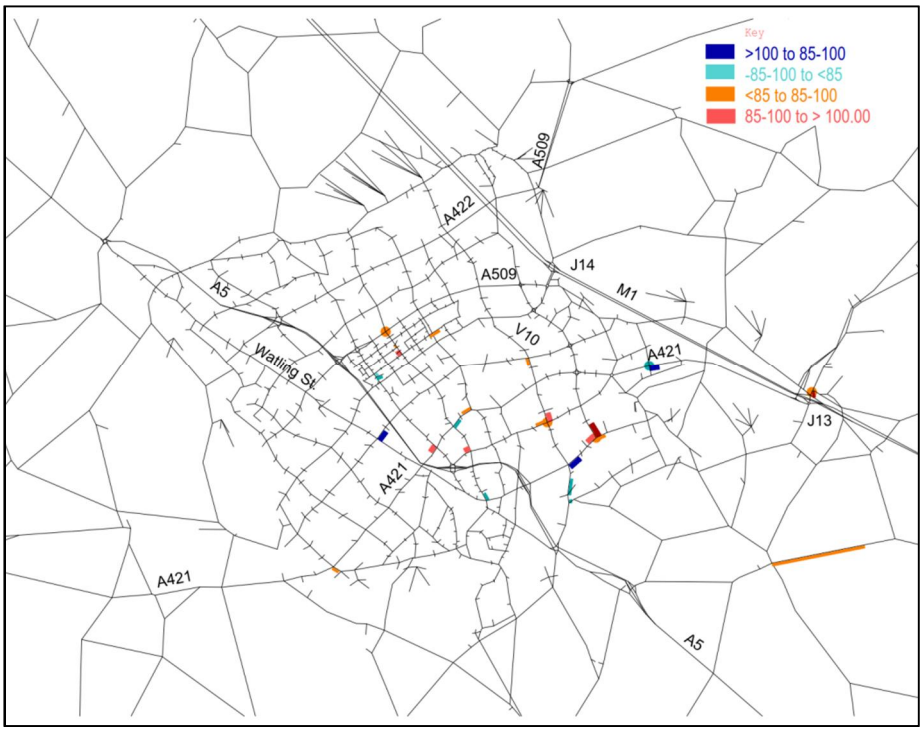


Figure 123. V/C ratio band changes between Reference and Scenario 2a, PM peak

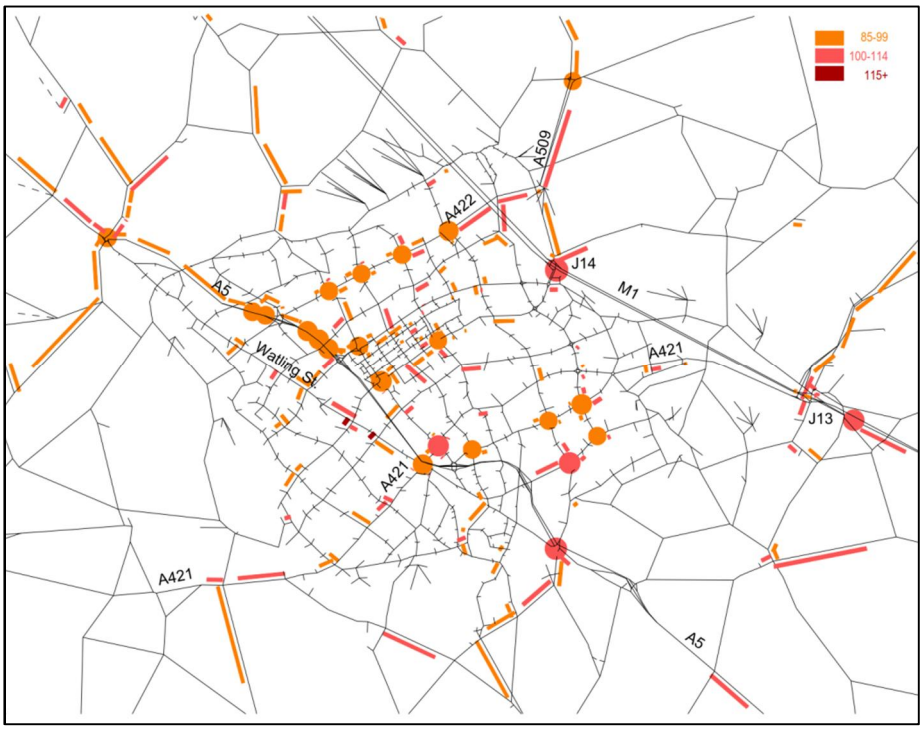


Figure 124. 2031 Plan:MK Scenario 2a, link and junction V/C over 85%, AM peak

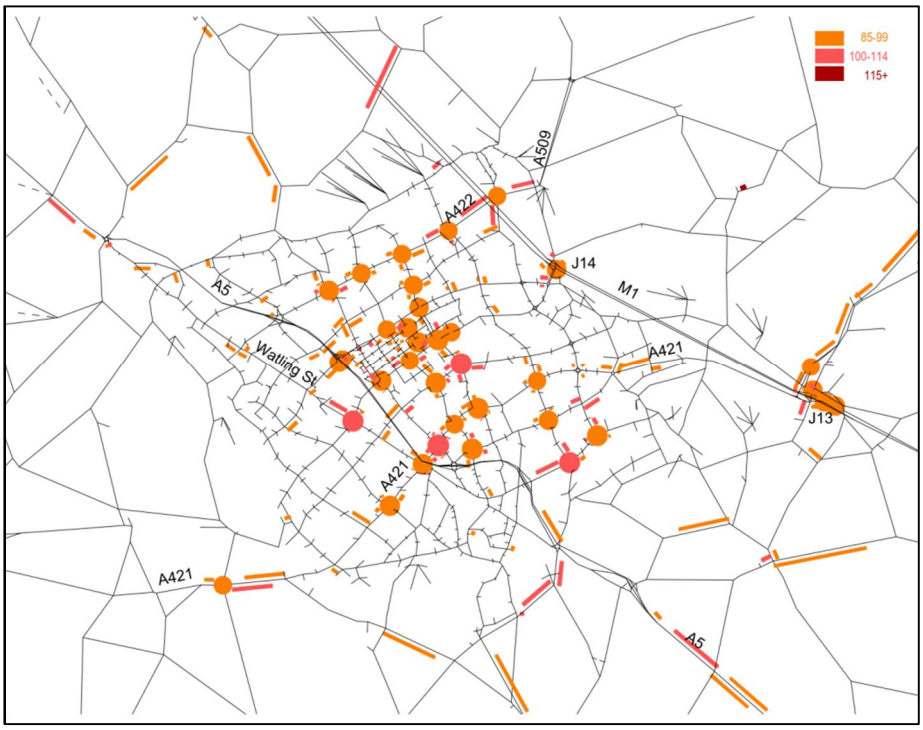


Figure 125. 2031 Plan:MK Scenario 2a, link and junction V/C over 85%, PM peak

7.9 Congestion Issues

7.9.1 The junctions flagged up as changing band in either the AM or PM peaks (as shown in Figure 122 and Figure 123) have been looked at and compared across both time periods to establish the extent of the impacts of Plan:MK Scenario 2a against the Reference Case. Junctions which are forecast in the MKMM model to be particularly impacted by Scenario 2a, are highlighted within the table.

Table 58 Congestion issues modelled in Scenario 2a

Junction	Reference Case		Scenario 2a		Conclusion
	AM	PM	AM	PM	
Great Linford Roundabout	westbound approach 82% and eastbound 83%	no modelled issues	eastbound approach 85%	no modelled issues	Reference Case issue
Ashland Roundabout	eastbound approach 96% westbound approach 91%	eastbound approach 93% westbound approach 100%, southbound approach 101% northbound 86%	eastbound approach 97% westbound approach 95% average jct V/C now over 85%	eastbound and westbound approaches 100%, southbound 101% and northbound 95%	northbound approach Scenario 2a issue
Brinklow Roundabout	Eastbound approach 110% Southbound approach 84%	Southbound eastbound and Westbound Approaches over 85%	southbound approach 85%westbound approach 110%	eastbound approach 92%, southbound approach 93% and westbound 89%	Reference Case issue
Oakgrove Roundabout	Westbound approach 82%	northbound approach close to capacity 83%	westbound approach 79%	northbound approach 85%	Reference Case issue
Walnut Tree Roundabout	southbound approach 101%, eastbound approach 93% westbound approach 115%	Southbound approach 84%, Eastbound approach 101% Westbound approach 102%	southbound approach 100% eastbound approach 96% westbound approach 114% northbound approach 89%	eastbound and westbound approaches 102%	northbound approach Scenario 2a, other approaches Reference Case issue
V10/H9 Roundabout	Northbound approach to jct 88%, westbound approach 84%	Northbound approach 94% and southbound approach 88%	northbound approach 94% westbound approach 94%	southbound approach 100% northbound approach 99% and eastbound approach 87%	Northbound approach Reference Case Westbound and Southbound approaches Scenario 2
V10/H10 Roundabout	Southbound approach 101%, northbound approach 107%, eastbound approach 101% and westbound approach 99%	southbound approach 103%, northbound approach 104% eastbound 101, westbound 100%	eastbound and westbound approaches 101%, southbound 102% and northbound 109%	eastbound approach 103% westbound 95% northbound 105% and southbound 104%	Reference Case issue
Brown's Wood Roundabout	No modelled issues	Eastbound approach 90%	westbound approach 114% northbound approach 97% Southbound approach 82%	eastbound approach 100% southbound approach 101% and westbound approach 99%	Scenario 2a issue
North Saxon Roundabout	southbound approach 103%, eastbound 98%, westbound 87%	eastbound approach 100%, northbound approach 104%	southbound approach 103% westbound approach 89%	westbound approach 100% northbound approach 104%	Reference Case issue
Marina Roundabout	No modelled issues	Southbound approach over 85%	no modelled issues	southbound approach 88% eastbound approach 85%	southbound approach Reference Case issue eastbound approach Scenario 2a

Junction	Reference Case		Scenario 2a		Conclusion
	AM	PM	AM	PM	
Bleakhall Roundabout	eastbound approach 112%, westbound 94% and northbound 109%	eastbound approach 97%, westbound approach 111%, northbound approach 97% and southbound approach 102%	eastbound and northbound approaches 103%, southbound 91% westbound approach 106%	southbound approach 102% eastbound 101% westbound 111% and northbound approach 99%	Reference Case issue
Standing Way/ V1 / Buckingham Rd Roundabout	Eastbound and Southbound approaches over 85%	Northbound approach 83%	southbound approach 91%, eastbound approach 86%	northbound approach 89%	eastbound and southbound Reference Case issue northbound approach Scenario 2a issue
A421 / A421 roundabout J13	eastbound approach 98%	east bound approach 112%	eastbound approach 100%	eastbound approach 110%	Reference Case issue
Bankfield Roundabout	westbound approach 92%	westbound approach 84%	westbound approach 93%	westbound approach 85%	Reference Case issue
Saxon Gate Avery Bld	No modelled issues	eastbound approach 99%	no modelled issues	eastbound approach 100%	Reference Case issue

7.10 Scenario 2a Sensitivity Test

7.10.1 As noted in the results above, there is significant delay at the roundabout between Brickhill Street and H10. It is likely that any improvements at this junction would impact the level of flows on Brickhill Street, and therefore delay at Bow Brickhill level crossing, particularly in the northbound direction. As such additional test assignments were completed using a modified network in which capacity at this junction was increased to include three lane approaches on the NB and SB approach arms, and the final demand matrices from the full scenario 2a model run. Similarly additional assignments were run using a modified Scenario 1 network and final demand matrices for comparison purposes.

7.10.2 From Table 59 it can be seen that there is a notable impact on northbound flows, with 23% uplift NB in Scenario 2a AM peak, the direction with the largest flow. There is also an 81% increase NB in the PM peak in Scenario 2a test but the flows remain lower than those SB in the PM period.

Table 59. Modelled Flow on Brickhill Street

Scenario	AM		PM	
	NB	SB	NB	SB
Scenario 1	913	555	436	1053
Scenario 1 Test	1103	542	757	1039
Scenario 2a	932	484	345	902
Scenario 2a Test	1145	490	625	917

7.10.3 It can be seen in Table 60 and Table 61 that northbound there is an increase in delay of 12 seconds (24%) and 14 seconds (27%) in the AM for Scenario 1 and Scenario 2 respectively. This leads to an increase in transient queue of around 12 PCU's.

Table 60 Delay Bow Brickhill Level Crossing, Scenario 2a and 2a Test

Scenario	Delay (Seconds)	
	AM NB	PM SB
Scenario 1	51	59
Scenario 1 Test	63	58
Scenario 2a	52	51
Scenario 2a Test	66	51

Table 61 Maximum Transient Queue Bow Brickhill Level Crossing, Scenarios 2a and 2a Test

Scenario	Max Transient Q (PCU)	
	AM (NB)	PM (SB)
Scenario 1	55	63
Scenario 1 Test	66	62
Scenario 2a	56	54
Scenario 2a Test	68	55

7.10.4 These results show that the impact of releasing the bottleneck at the H10 / Brickhill Street junction would not be expected to cause a major change in flow on Brickhill Street. Although the model expects the delay to increase at the level crossing this impact occurs in Scenario 1 as well Scenario 2a and from the earlier comparisons between Scenario 2a and Reference Case it is likely there would be a similar impact in that scenario also.

7.10.5 Although not notably influenced by the Scenario 2a compared to Scenario 1, any intervention at the H10 and Brickhill Street junction is likely to increase flows on Brickhill Street and therefore worsen delays at other junctions along it. It is recommended that any intervention measures proposed in the future at this junction are tested at a local level as well as at a strategic level.

7.11 Conclusion

7.11.1 Scenario 2a has little impact on Bow Brickhill level crossing, in terms of flow and delay with a maximum flow circa 900 PCU using the crossing which is within an acceptable volume for the crossing to accommodate given the train service frequency assumed. Although there is significant extra housing growth, the impacts are mitigated by the new link between H10 and Bow Brickhill Road bridging the railway line just to the west of Woburn Sands, and the additional road network linking H10 through to A5130, Newport Road. The impact is particularly small relative to that of the additional barrier down time caused by additional trains associated with East-West Rail.

7.11.2 Although not notably influenced by the Scenario 2a compared to Scenario 1, any intervention at the H10 and Brickhill Street junction is likely to increase flows on Brickhill Street and therefore worsen delays at other junctions along it. It is recommended that any intervention measures proposed in the future at this junction are tested at a local level as well as at a strategic level.

7.11.3 In terms of impacts over and above the Reference Case as with Scenario 1 there are limited additional congestion issues forecast to be caused by the Plan:MK growth. There are five junctions where one or more approaches are congested in the model as a result of Scenario 2a growth and one junction where modelled congestion issues have arisen solely as a result of Scenario 2a.

8. Plan:MK Scenario 2b

8.1 Introduction

8.1.1 Scenario 2b was used to assess the impact of higher growth at land East of M1 upon the proposed new road infrastructure through the site and on M1 Junction 14 .

8.1.2 To assess the impacts of Scenario 2b results have been compared against the 2031 Reference Case. This growth includes the currently 'committed' growth in Milton Keynes district up to 2031.

8.2 Plan MK Scenario 2b Growth

8.2.1 The dwellings growth above the Reference Case is plotted in Figure 126 with the jobs growth above the Reference Case plotted in Figure 127. Scenario 2b includes all the Scenario 1 and 2 growth, which together amounts to an additional 10674 dwellings and 11502 jobs compared to the Reference Case. In addition a further 2000 dwellings have been included in the East of M1 development, giving a total of 4998 dwellings East of the M1 (and 12674 dwellings overall) Although planned after the Plan:MK 2031 horizon year these have been included to better measure the impacts on the road network in this area.

8.2.2 Figure 126 shows this growth as well as the 2031 Scenario 1 growth above that for the Reference Case.

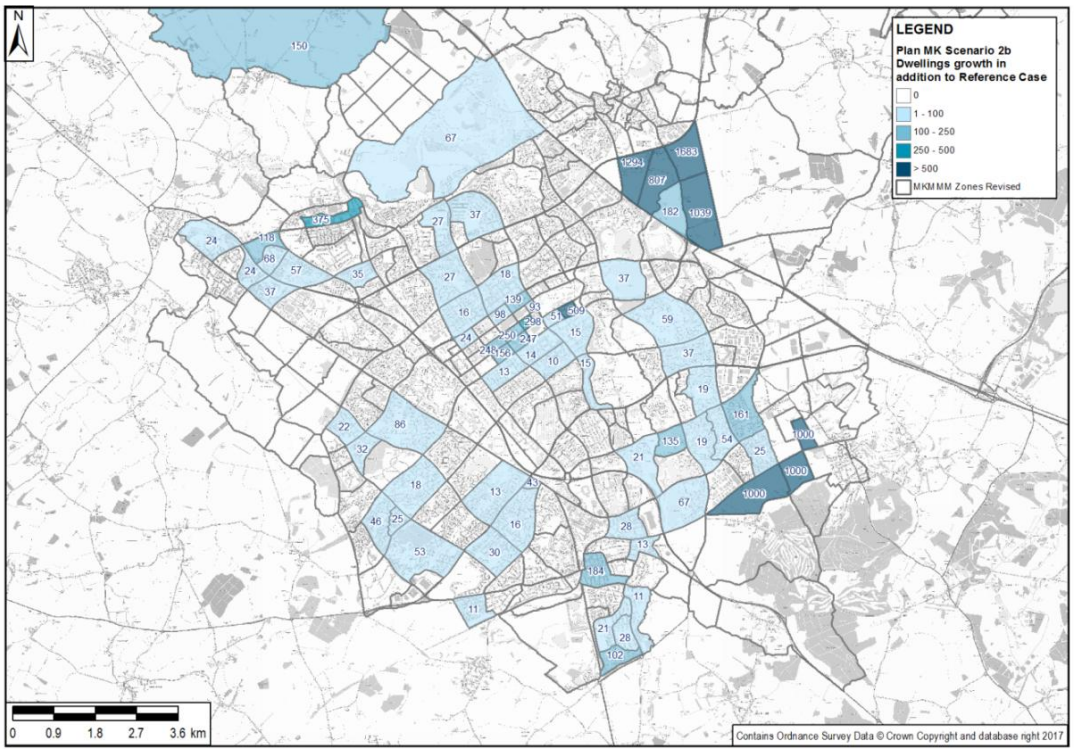


Figure 126. Plan:MK Scenario 2b, Additional Dwellings Growth to 2031

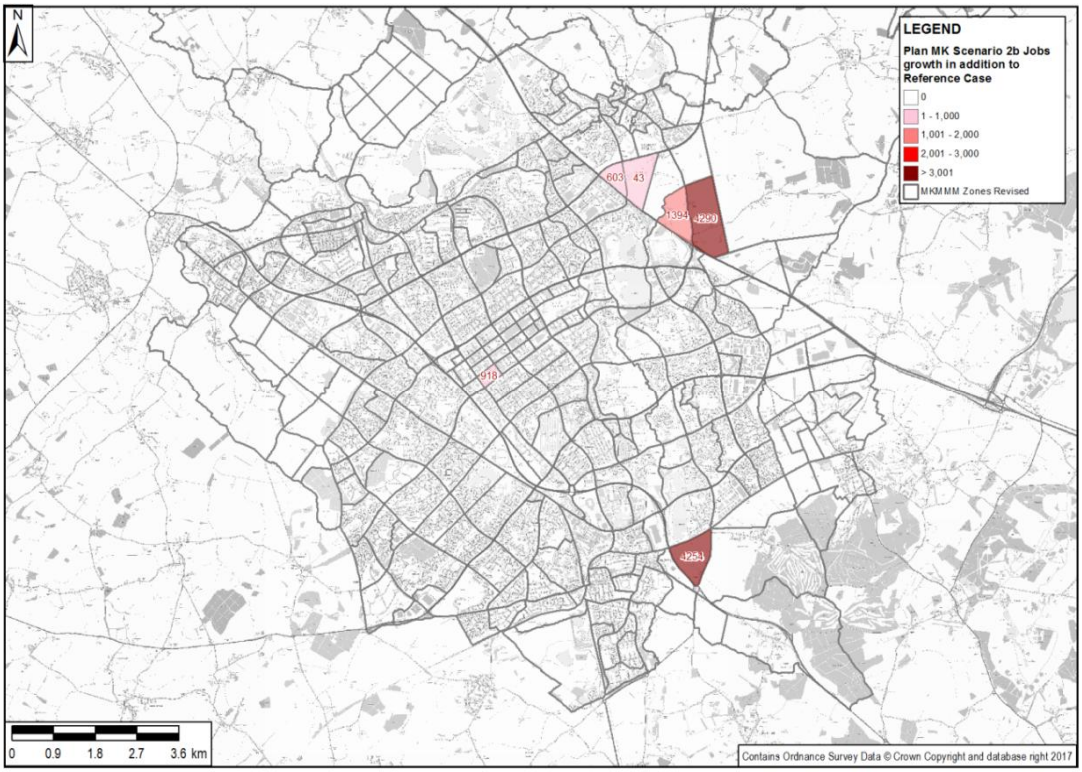


Figure 127. Plan:MK Scenario 2b, Additional Jobs Growth to 2031

8.3 Additional Network

East of M1

8.3.1 To facilitate the East of M1 growth a revised road layout is proposed as shown in Figure 128. This includes a new primary route between the dualled section of the A509 to the south of Interchange Park through to M1 J14. A new route from Renny Lodge roundabout bridging the motorway and connecting to Tongwell Street, with the existing A509 between these new routes remaining as the main access to the development. In addition there is an east-west link between the two routes to the north of the site with an east-west route linking Willen Road through to a re-aligned Newport Road. Signal timings have been estimated based on forecast flow ratios. It has been assumed the three entry lanes on the A509 southbound approach to M1 J14 will remain.

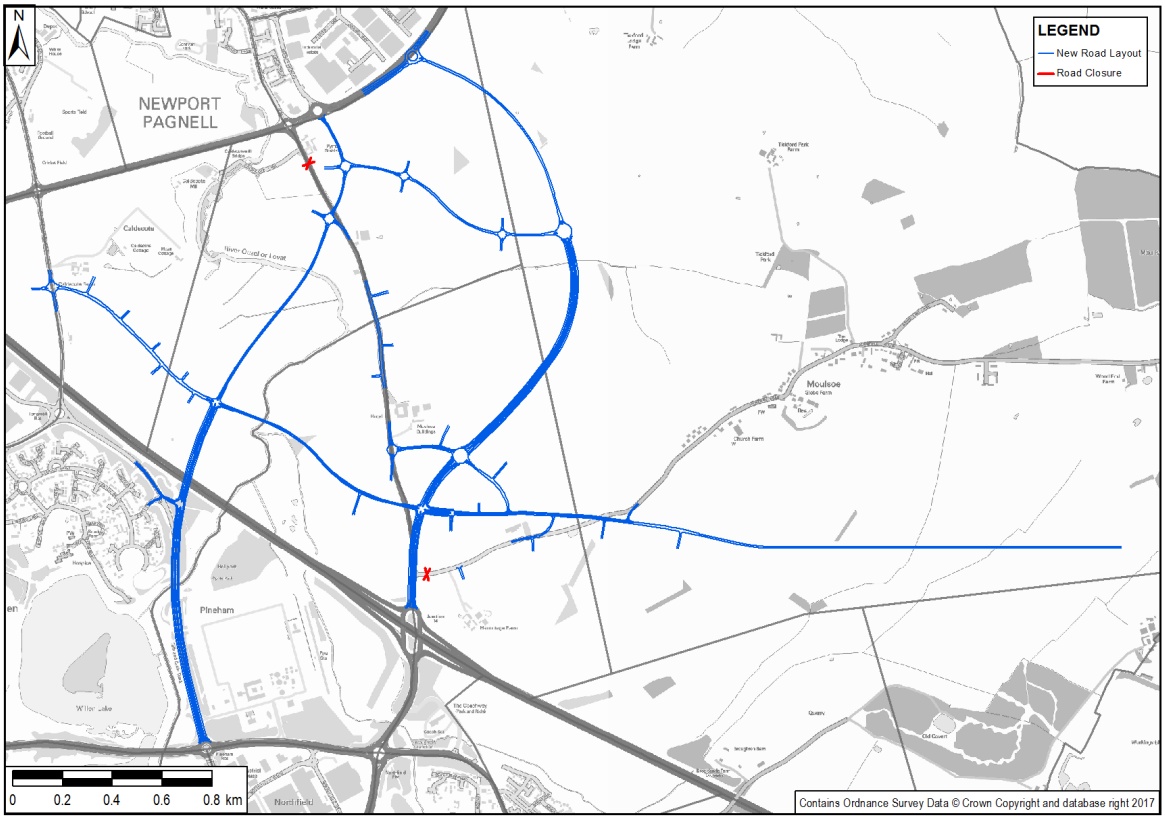


Figure 128. Indicative Additional Road Network – East of M1

SEMK2 Development

8.3.2 Within Scenario 2b, in addition to the new road network east of M1, the new road network associated with the South East Milton Keynes Allocation (SEMK1 and 2) used within Scenario 2 has also been included, as shown in Figure 129.

8.3.3 Following further discussion the junction arrangement on Brickhill Street north of the railway crossing was modified such that the only revision was the addition of a fourth arm at the Caldecotte Lake Drive roundabout.

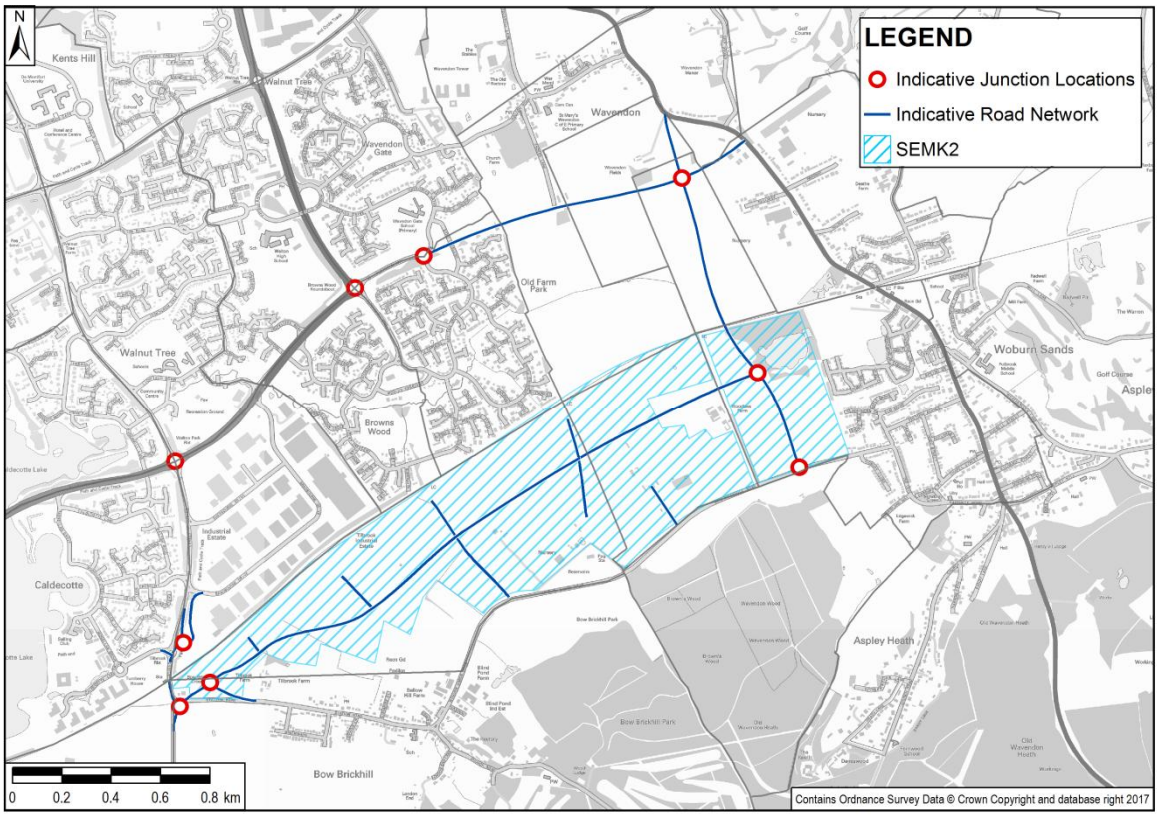


Figure 129. Indicative Additional Road Network

8.4 Public Transport

8.4.1 A park and ride site has been proposed as part of the East of M1 development. However in its current form it is not possible to model park and ride explicitly within the MKMMM. Due to time constraints and to give a worse case impact on the road network, no changes to public transport have been made compared to the Reference Case.

8.5 Traffic Flow Changes

8.5.1 This section compares the Plan:MK Scenario 2b flows with those of the Reference Case. The flow difference is plotted as bandwidths to the left side of each link by direction, with an increase in actual flow between the Reference Case and Scenario 2b shown in green and a decrease in blue. It is also important to note that where new links have been added no comparison is shown.

8.5.2 As shown by Figure 130 to Figure 135, there is some reassignment due to the additional road network both around the east of M1 development, including a new crossing of the M1, and in south east Milton Keynes, which includes a new bridge over the railway. Although there will be some interaction between the two development sites on the A421 Childs Way in general the impacts to the north are likely to be a result of the East of M1 site with those to the south a result of the SEMK2 Site.

8.5.3 In terms of the area around 'East of M1' there is an increase in trips into Milton Keynes on the A422 east of Chicheley Hill roundabout, along the Newport Road through Moulsoe. There is also an increase of around 400 passenger car units (PCU) on the A509 southbound from Chicheley Hill roundabout. There is also a large increase in southbound traffic on Tongwell Street towards Pineham roundabout of 1000 PCU from around 450 PCU in the Reference Case. Conversely there is a reduction in flow into Milton Keynes along Sherington Road and North Crawley Road. There is a reduction in traffic on the A422 between Tickford roundabout and Marsh End roundabout. There is also a small reduction in flow southbound on the A509 from M1 Junction 14.

8.5.4 In the PM peak there is an increase outbound from Milton Keynes along the A422 east of Chichley Hill roundabout and along the Newport Road through Moulsoe. There is an increase of around 450 PCU northbound towards Chicheley Hill roundabout mirroring the AM peak. There is also an increase on North Crawley Road outbound and there is a forecast decrease outbound along Broughton Road, which is less impacted in the AM peak. There is an increase of close to 650 PCU northbound on Tongwell Street from Pineham roundabout bringing flows up to around 1300 PCU. As in the AM peak there is a reduction in traffic on A422 between Tickford roundabout and Marsh End roundabout. There is a notable decrease in traffic northbound on the A509 towards M1 J14.

8.5.5 In the inter-peak there is clear re-assignment from the A422 west of Tickford farm roundabout and along the A509 across M1 J14.

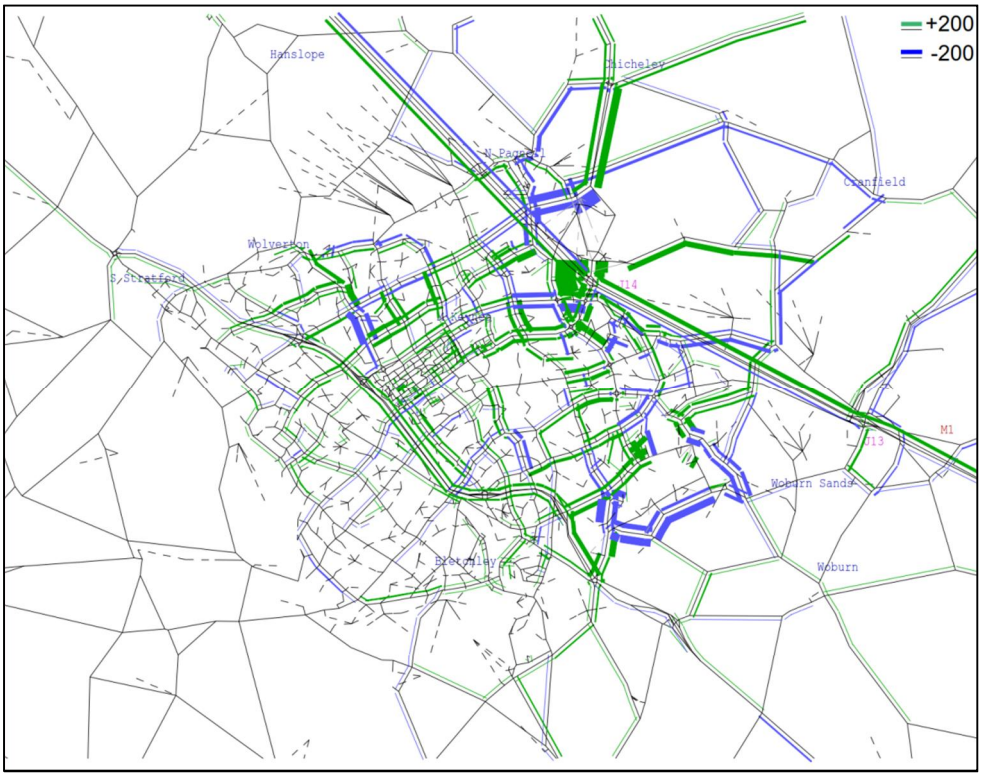


Figure 130. Change in modelled flow CMK, Scenario 2b less Reference Case AM

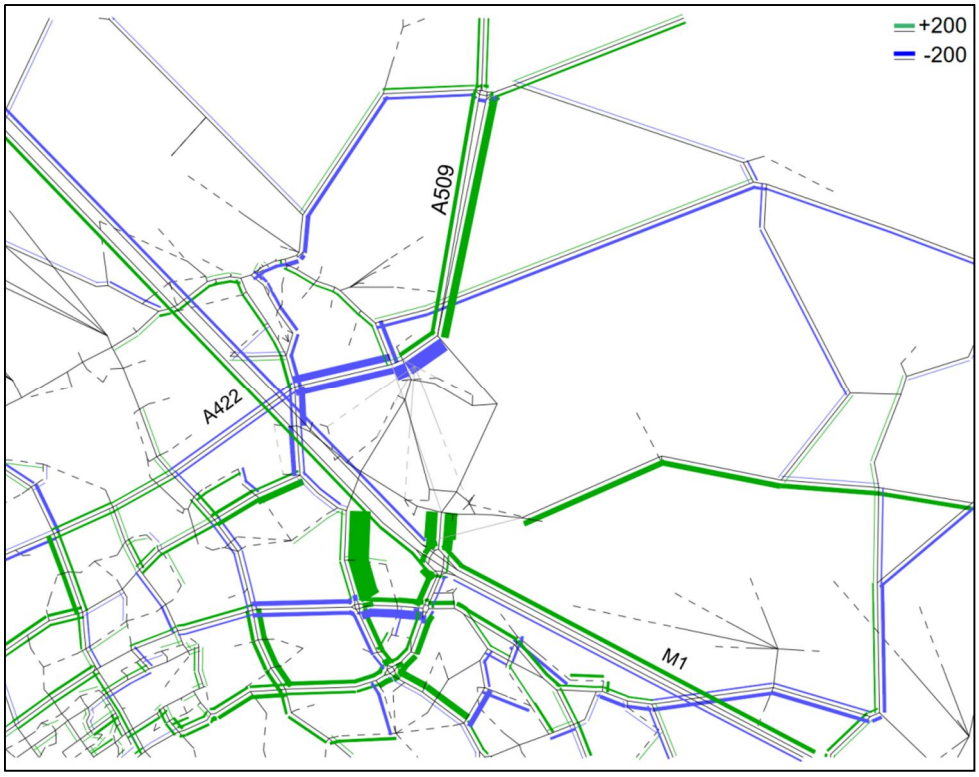


Figure 131. Change in modelled flow East of M1, Scenario 2b less Reference Case AM

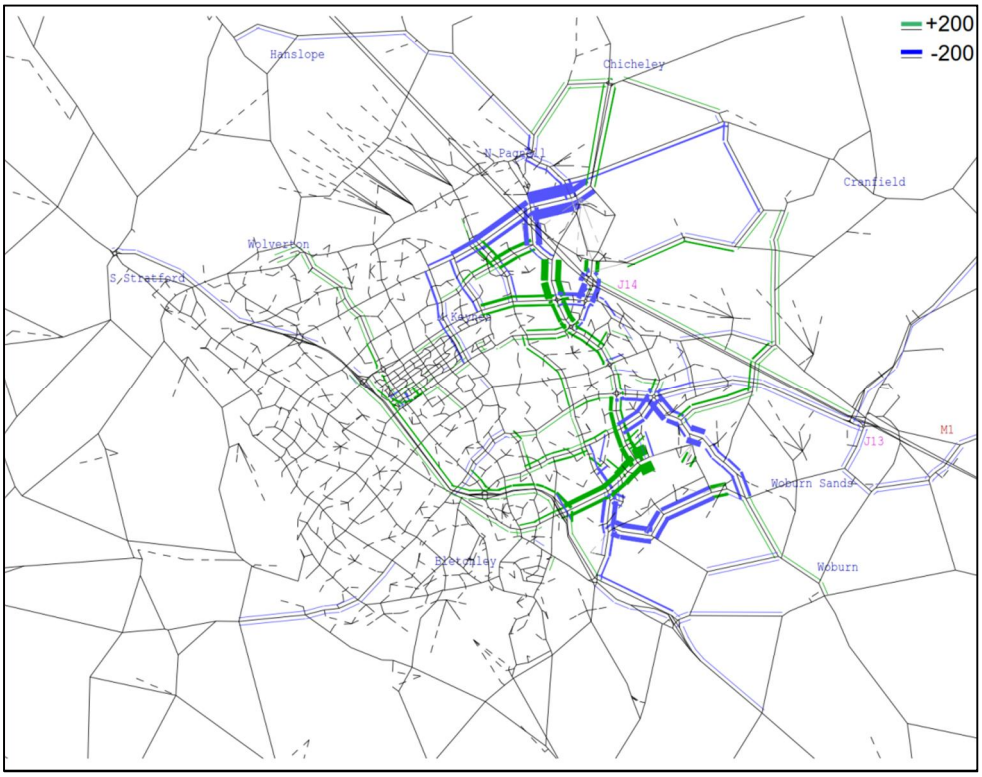


Figure 132. Change in modelled flow CMK, Scenario 2b less Reference Case Inter-peak

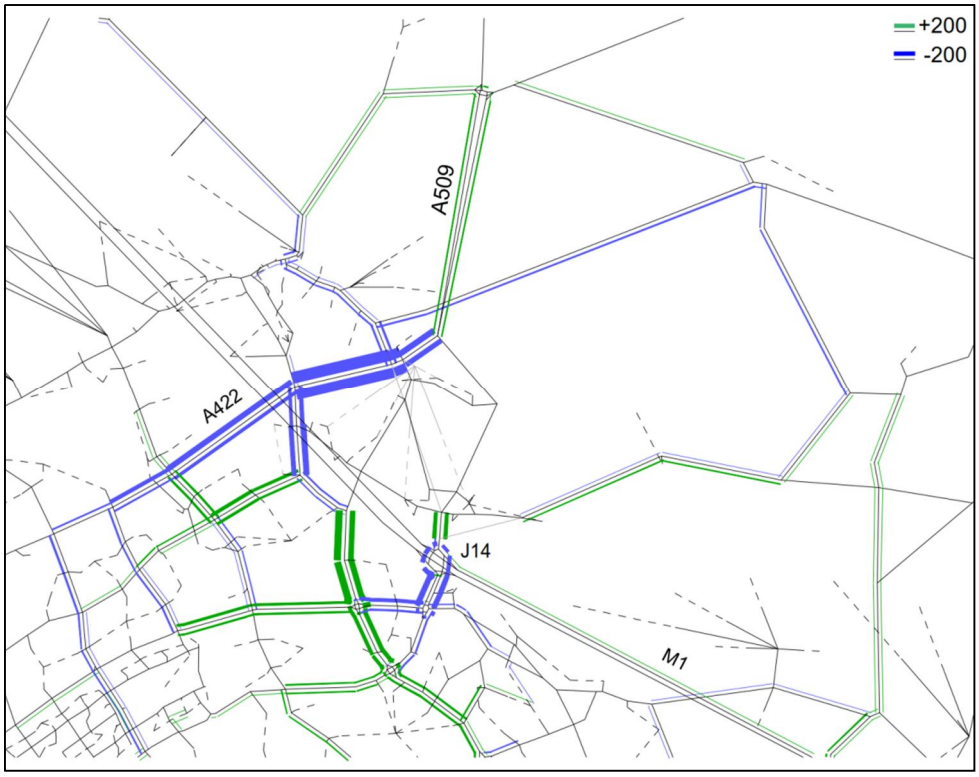


Figure 133. Change in modelled flow East of M1, Scenario 2b less Reference Case Inter-peak

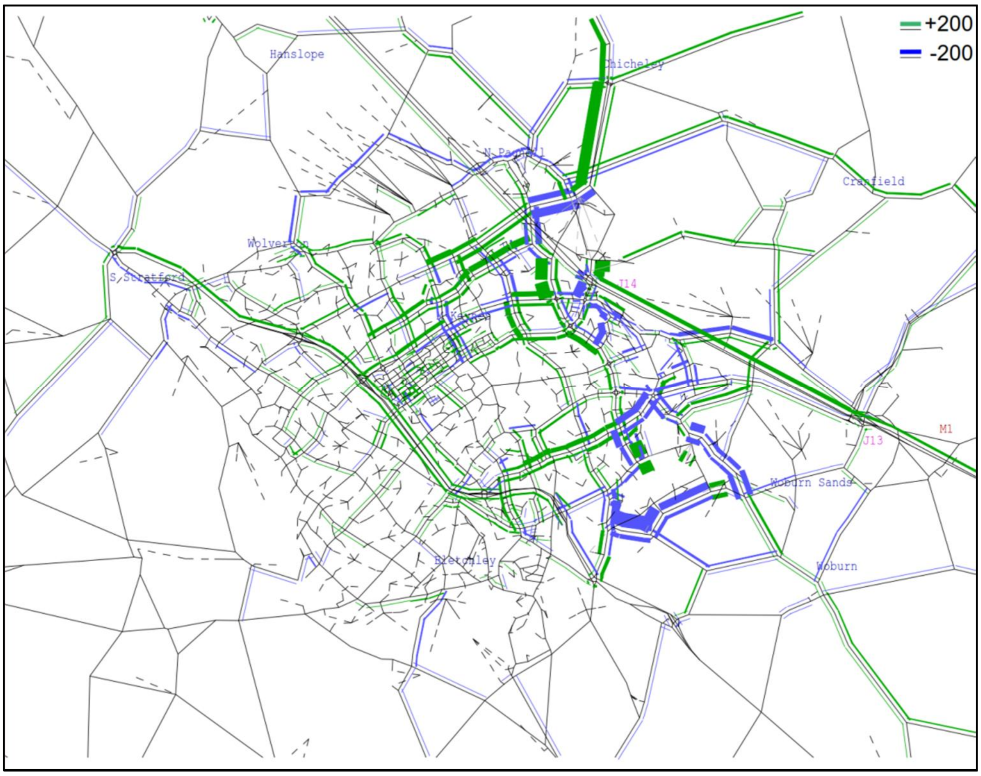


Figure 134. Change in modelled flow CMK, Scenario 2b less Reference Case PM

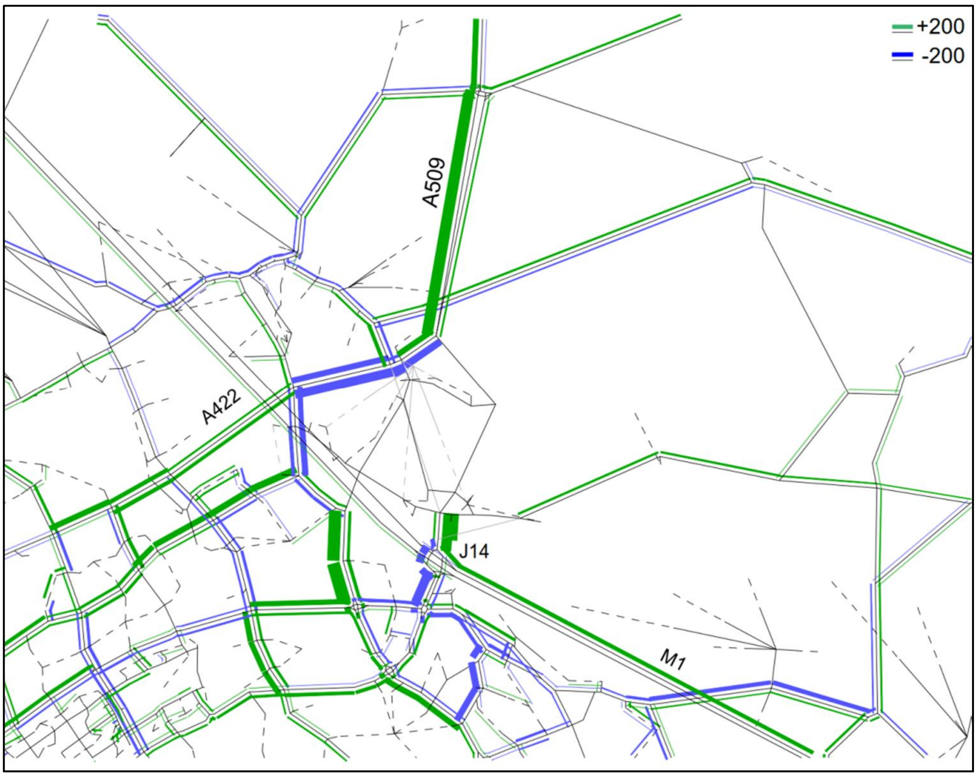


Figure 135. Change in modelled flow East of M1, Scenario 2b less Reference Case PM

8.5.6 A comparison of flows on the roads which cross the M1 motorway between the A422 and M1 J14 inclusive, as shown in Figure 136, are presented in Table 62 and Table 63.

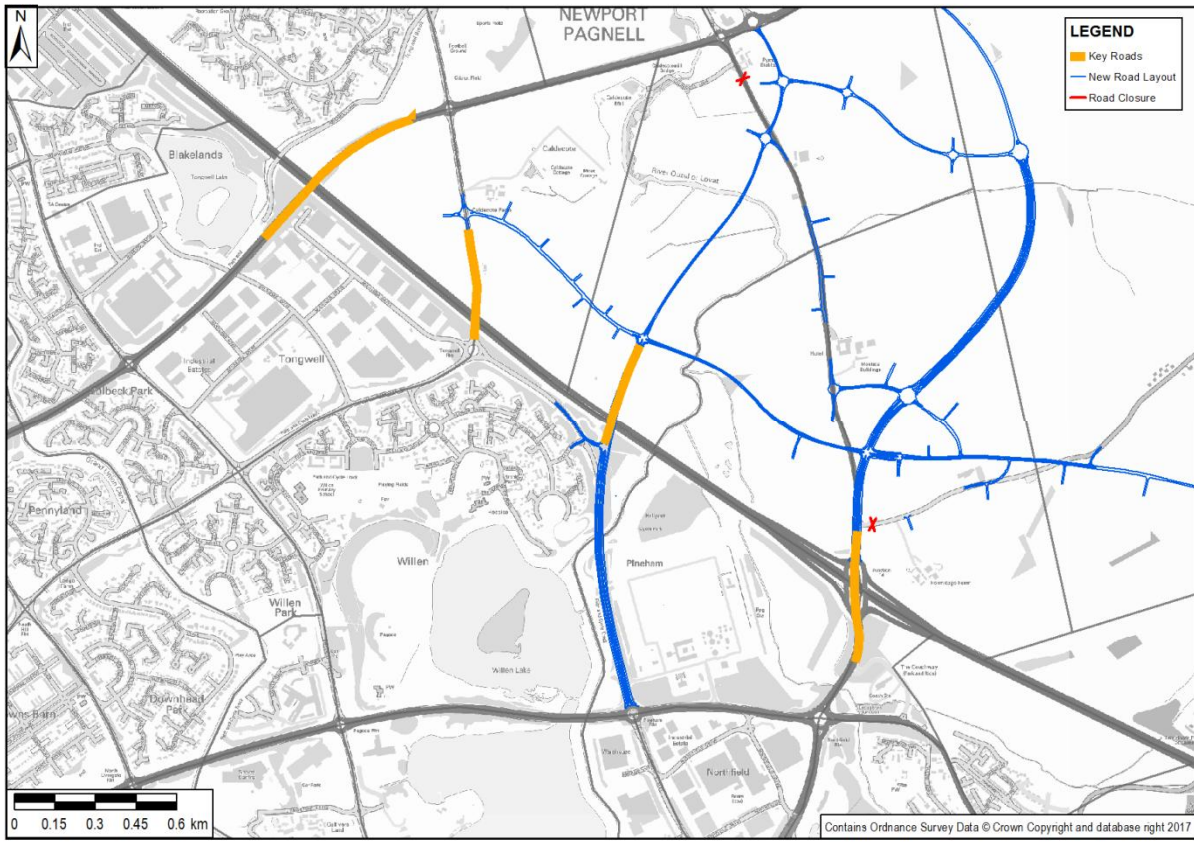


Figure 136. Motorway crossings between East of M1 and Milton Keynes

8.5.7 As expected with the tidal flows into Milton Keynes in the AM peak and out of Milton Keynes in the PM peak the largest changes are towards MK in the AM with 1787 additional PCU's crossing the motorway and towards the east of M1 in the PM peak with an additional 1213 PCU crossing the M1. Although flows on A422 between Tickford roundabout and Marsh End roundabout, west of Marsh End roundabout there is little change in flows. There is a slight decrease in AM Westbound and an relatively small increase in both directions in the PM peak.

8.5.8 Willen road sees a reduction in flows in both directions in both the AM and PM. The new bridge is modelled to carry a flow of 1666 southbound in AM and 1545 northbound in PM. Despite the significant volumes of flow on the new bridge there is still an increase in flow crossing M1 J14 in the AM peak. Flows crossing northbound in the PM peak are much lower than those crossing southbound in the AM. This is due to the long delays at Northfield roundabout in the PM encouraging no motorway traffic to take alternative routes. It is possible that if junction improvements were made at Northfield roundabout there would be an increase in flows across junction 14.

Table 62. Comparison of flows from East of M1 towards MK (PCU)

Time Period	Scenario	A422	Willen Road	New Bridge	J14 through Traffic	Total
AM	Reference Case	1164	1651	n/a	1195	**4010**
	Scenario 2b	1110	1576	1666	1445	**5797**
	Difference	*-54*	*-75*	*n/a*	*250*	***1787***
PM	Reference Case	1066	768	n/a	815	**2649**
	Scenario 2b	1210	467	856	802	**3335**
	Difference	*144*	*-301*	*n/a*	*-13*	***686***

Table 63, Comparison of flows from MK towards East of M1 (PCU)

Time Period	Scenario	A422	Willen Road	New Bridge	J14 through Traffic	Total
AM	Reference Case	1037	559	n/a	154	**1750**
	Scenario 2b	977	343	593	323	**2236**
	Difference	*-60*	*-216*	*n/a*	*169*	***486***
PM	Reference Case	1714	1148	n/a	307	**3169**
	Scenario 2b	1790	985	1545	62	**4382**
	Difference	*76*	*-163*	*n/a*	*-245*	***1213***

8.6 Delays

8.6.1 The difference in delay between Scenario 2b and Reference Case in the AM and PM peaks is presented in Figure 137 and Figure 138 respectively, with the total delay in Scenario 2b presented in Figure 138 and Figure 140 to add some context. As with the flow difference plots, a comparison is not shown where there are new links.

8.6.2 In the AM the additional junction on A509 through to the East of M1 development has reduced delay at Renny Lodge and Tickford roundabouts resulting in the delay moving further along the A422 and onto Dansteed way. The model shows there is negligible impact on delay at M1 Junction 14.

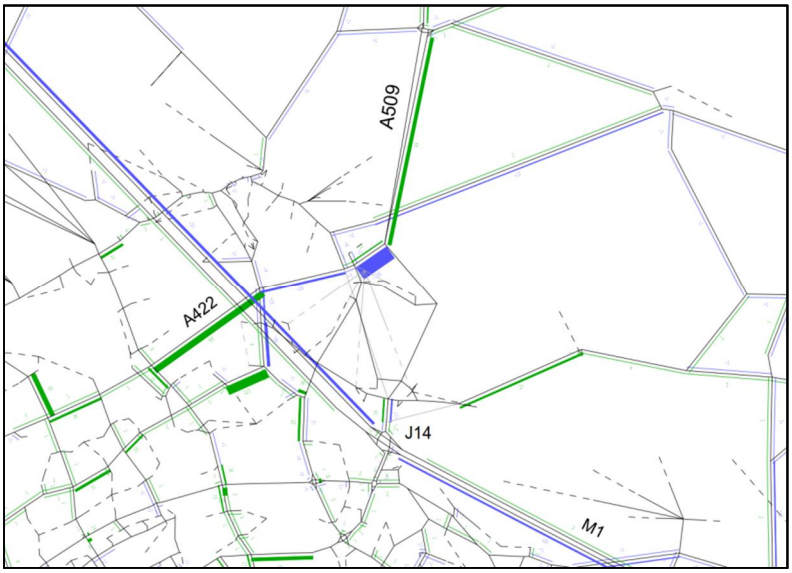


Figure 137. Change in Average Delay (seconds), Scenario 2b less Reference Case, AM

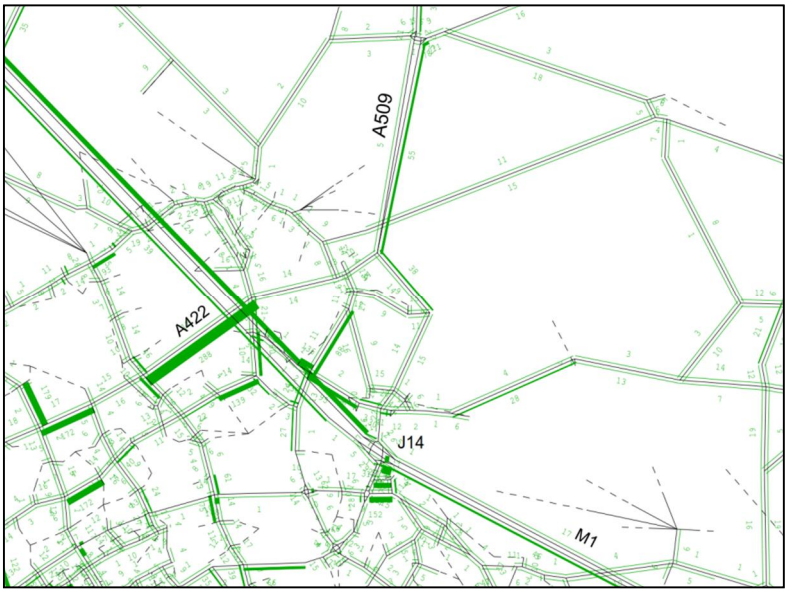


Figure 138. Average Delay (seconds), Scenario 2b AM

In the PM peak there is a notable reduction in delay on the A422 and also on the eastbound approach to Northfield roundabout. However this delay has moved downstream to the southwest part of the J14 circulatory. There is also a 17 second increase in delay on the southbound off slip approach to

the junction, and a 28 second increase in delay at the end of the southbound on-slip the latter due to additional traffic joining the motorway.

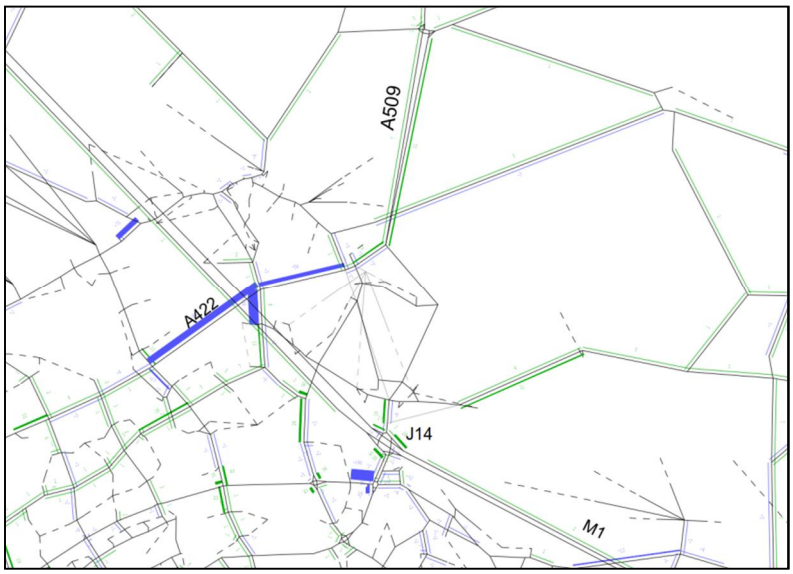


Figure 139. Change in Average Delay (seconds), Scenario 2b less Reference Case, PM

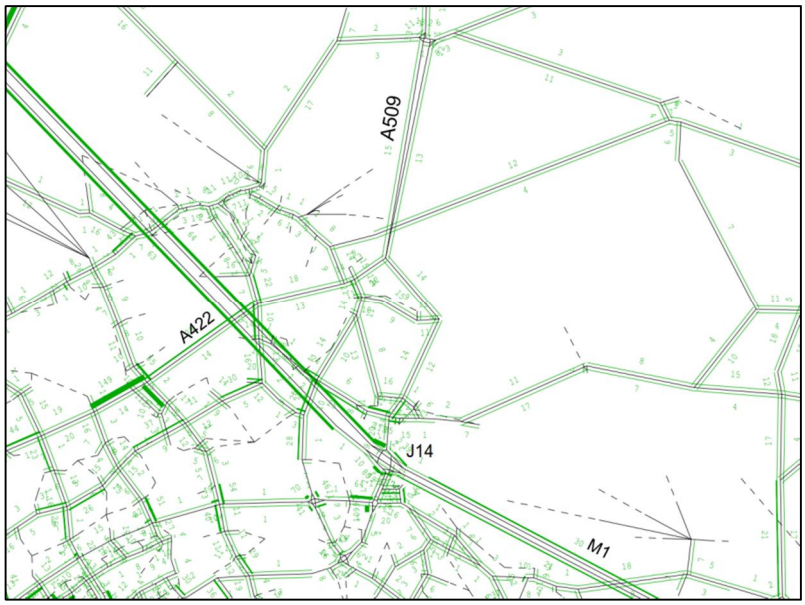


Figure 140. Average Delay (seconds), Scenario 2b, PM

8.7 Conclusion

8.7.1 The new road bridge is predicted to take a significant volume of flow (1500-1700 PCU in the direction of peak tidal flow), which helps mitigate the impact of the East of M1 development. In the AM Peak there is still an increase in flow crossing J14 towards Milton Keynes of around 250 PCU, however the model is showing little impact in delay at J14, partly due to addition of the dual carriageway link on southbound approach alleviating a current pinch point.

8.7.2 It is also possible that amending the signal timings at the junctions on the new link would encourage a further shift in through trips away from J14. (The increased delay shown in the PM peak is due to the extra delay experienced by traffic joining the M1.). It is clear that without the additional infrastructure there would be significant additional pressure on the existing roads and associated junctions across the motorway; along the A422, on Willen Road and on the A509 through J14.

8.7.3 The modelling has indicated that there will still be significant congestion at M1 Junction 14. Although the new M1 crossing removes some through A509 traffic from J14 the majority of traffic at J14 remains (as it is accessing the M1) and some of the additional highway capacity is taken up by the additional development related traffic. It is possible that the proposed Park & Ride site on the north side of Junction 14 may reduce traffic volumes at J14 but this cannot be modelled at the current time.

9. Summary and Conclusions

9.1.1 Milton Keynes Council (MKC) commissioned AECOM to update the Milton Keynes Multi-Modal Model (MKMMM) in advance of the need for its use to test alternative planning options for Plan:MK. The main purpose of the model is to provide a robust means of assessing alternative land-use options and development phasing and for this to withstand public scrutiny. The objective was to develop a Reference Case to enable testing of plan options. This requires the model to be sufficiently well validated to 2016 using additional new data sources.

9.2 Reference Case

9.2.1 The 2031 Reference Case includes the planned growth in Milton Keynes District up to 2031, this being in the region of 20,000 dwellings and 28,000 jobs in Milton Keynes district, along with highway and rail infrastructure in Milton Keynes and its vicinity that is expected to be in place by 2031. Development in Aylesbury Vale (the South West Milton Keynes development, circa 2000 dwellings and 1000 jobs) has also been included in the Reference Case due to its close proximity to Milton Keynes.

9.3 Supply and Demand Forecast Scenarios

9.3.1 The 2031 forecast trip ends were calculated using the trip end model containing household, jobs, population and car ownership data. Forecast figures for these data sets were produced using two different approaches:

- Within Milton Keynes district the housing and jobs growth data provided by MKC for each scenario was used along with changes in the population and car ownership between 2016 and 2031 from the DfT National Trip End Model (NTEM) version 7.2.
- The housing and jobs growth for the SWMK development in Aylesbury Vale was also input explicitly with other growth in Aylesbury Vale constrained as much as possible to NTEM
- NTEM 7.2 forecast figures were used elsewhere for the housing, jobs, population and car ownership data.

9.3.2 An Uncertainty Log was developed in association with officers at MKC and this was used to derive future supply in terms of road and rail infrastructure schemes deemed appropriate to include based on likelihood. These schemes were added to the base year networks to create the reference case networks.

9.4 Variable Demand Modelling

9.4.1 To estimate the demand the 2031 trip ends produced from the trip end model were input into the variable demand model which was run using the forecast networks. In the highway model the forecast values of time increased and there was also a change in vehicle operating cost. For public transport a 1% increase in fares per year was assumed, with the fares in the modelled factored up accordingly.

9.5 Flows and Congestion

9.5.1 Plan:MK Scenario 1 has little impact on traffic flows with the impact in the locality of the Strategic Expansion Area South East and the South Caldecotte site. This in turn has had a similar impact on congestion in the network with impacted junctions in the same area.

9.5.2 Scenario 2a has a more noticeably impact than Scenario 1 due to the extra 2000 dwellings north of Brickhill. However the additional road network as part of the SEMK2 development mitigates some of the impacts resulting in the additional congestion issues over and above the Reference Case being comparable with Scenario 1.

9.5.3 Scenario 2 has the most significant impact over and above the Reference Case. Although the additional road network for the SEMK2 site and the East of M1 developments again help mitigate some of the impacts of the additional traffic there is still a general increase in traffic flows across Milton Keynes causing further issues of congestion which are not in the immediate locality of the additional developments. However many of the junctions with worsening congestion already have congestion issues on other approaches in the Reference Case. It is generally the Reference Case growth that causes the most significant impact compared to current conditions with the additional Plan:MK growth having a generally lesser impact over above the Reference Case.

9.5.4 A comparison of congestion for all junctions notably impacted by any of the Plan:MK scenarios is presented in Table 64.

Table 64. Forecast congestion issues caused by Plan:MK

Junction	Reference Case	Scenario 1	Scenario 2a	Scenario 2
Pagoda Roundabout	congestion on all junction approaches except eastbound approach	comparable to Reference Case	comparable to Reference Case	congestion now on all approaches
V10/H6	congestion on Westbound and southbound approaches	comparable to Reference Case	comparable to Reference Case	congestion on westbound and southbound approaches and now also northbound approach
Kents Hill Roundabout	congestion on all junction approaches except westbound approach	congestion now also on westbound approach	comparable to Reference Case	congestion now also on westbound approach
V10/H9 Roundabout	congestion on northbound approach, minor congestion modelled on southbound approach	congestion now also on westbound approach	congestion now also on westbound and southbound approaches	congestion now also on westbound and southbound approaches
Dansteed Way/Hopper Street	westbound approach at capacity	comparable to Reference Case	comparable to Reference Case	westbound approach now congested
Brown's Wood Roundabout	congestion on eastbound approach	Southbound and westbound approaches now also congested	congestion now on all approaches	congestion now on all approaches

Junction	Reference Case	Scenario 1	Scenario 2a	Scenario 2
Walnut Tree Roundabout	congestion on all approaches except northbound approach	congestion now on all approaches	congestion now on all approaches	congestion now on all approaches
South Witan Roundabout	congestion on northbound and eastbound approaches	comparable to Reference Case	comparable to Reference Case	congestion now on westbound approach
Redbridge Roundabout	congestion on all approaches except northbound approach	comparable to Reference Case	comparable to Reference Case	worse congestion on all approaches, northbound approach now congested
South Gratfton Roundabout	congestion on all approaches except northbound approach	comparable to Reference Case	comparable to Reference Case	congestion on all approaches as Reference case but southbound approach significantly worse
Standing Way/ V1 / Buckingham Rd Roundabout	eastbound and southbound approaches congested	northbound approach now also congested	northbound approach now also congested	northbound approach now also congested
Emerson Roundabout	congestion on southbound and eastbound approach	comparable to Reference Case	comparable to Reference Case	westbound and northbound approaches now congested
Marina Roundabout	congestion on southbound approach, eastbound approach nearing capacity	eastbound approach congested as well as southbound	eastbound approach congested as well as southbound	eastbound approach congested as well as southbound
J14 SB on-slip	congestion on link	comparable to Reference Case	comparable to Reference Case	significant worsening of congestion

9.6 Travel Time and Average Speeds

9.6.1 Average speeds within the simulation area of the model remain virtually unchanged between Scenario 1 and the Reference Case, which is reflected in the journey time routes with the exception of Route 8 along Brickhill Street between Kelly's kitchen Roundabout and H10 which has additional delay due to the new junction for the South Caldecotte site.

9.6.2 Scenario 2 similarly has little impact on average speed in the simulation network. On average across all routes the maximum increase is 3% in the AM peak. However there is a notable impact on a number of the journey time routes.

9.6.3 Route 2 along the A509 and A422 is actually faster in Scenario 2 as a result of the new motorways crossing as part of the East of M1 development alleviating pressure on Tickford roundabout and Renny Lodge roundabout.

9.6.4 Route 4 which runs through the East of M1 development is now longer but it also longer in distance due to the new road layout through the site. Route 8 along Brickhill Street is also impacted as a result of the South Caldecotte jobs sites and now also the South East Milton Keynes Allocation (SEMK1 and SEMK2). There has also been an increase on other routes away from these development sites of up to 7% as a result of the increase in traffic flows.

9.7 Model Limitations

9.7.1 It should be noted that the Milton Keynes model is a strategic model where much of the highway trips internal to Milton Keynes (originate and are destined within the Milton Keynes Cordon) are synthesised; i.e. based upon industry standard and accepted assumptions on trip generation rates using land use data.

9.7.2 It is also important to note that the model was not designed for use in a scheme specific assessment. For such an assessment it is recommended a revised forecast model would be produced from a recalibrated base year model using additional and more recent data and targeted to reflect a more specific geographical focus of resources and modelling effort.

9.7.3 It is important to consider that the public transport model is, as per WebTAG guidance, an incremental model which means although it provides a good indication of travel patterns at a strategic level; it will not necessarily give a definitive view of the impact of public transport measures such as East West rail. Rather it is designed to assess impact of relatively small changes to existing services rather than the addition of a completely new service.

9.8 Overall Conclusions

Plan:MK Scenario 1

9.8.1 Plan:MK Scenario 1 has little impact over and above the Reference Case in terms of traffic flows and delays across the Milton Keynes urban area. Both M1 Junction 13 and Junction 14, although already experiencing issues of congestion in the Reference Case, are not significantly impacted by Plan:MK Scenario 1. Plan:MK Scenario 1 does however impact around the South Caldecotte employment site and South East Milton Keynes Allocation (SEMK1) with a number of junctions requiring further mitigation measures in addition to the mitigation required to address Reference Case issues

Plan:MK Scenario 2

9.8.2 Plan:MK Scenario 2 has some impact over and above the 2031 Reference Case. Although the main impacts are in the vicinity of the South East Mitlon Keynes Allocation (SEMK1 and SEMK2) near Bow Brickhill and the East of M1 development site, both these developments include new road infrastructure which helps mitigate some of the impacts of the additional traffic on the network, and in the case of East of M1 this new network has also helped alleviate some pressures on parallel routes. However the higher flows forecast in Scenario 2 have resulted in new or additional congestion issues modelled around Central Milton Keynes, and at junctions along the A422, V10 and V11 corridors.

Plan:MK Scenario 2a

9.8.3 Scenario 2a has little impact on Bow Brickhill level crossing, in terms of flow and delay with a maximum flow circa 900 PCU using the crossing which is within an acceptable volume for the crossing to accommodate given the train service frequency assumed. Although there is significant extra housing growth, the impacts are mitigated by the new link between H10 and Bow Brickhill Road bridging the railway line just to the west of Woburn Sands, and the additional road network linking H10 through to A5130 (Newport Road). The impact is particularly small relative to that of the additional barrier down time caused by additional trains associated with East-West Rail.

9.8.4 Although not notably influenced by the Scenario 2a compared to Scenario 1, any intervention at the H10 and Brickhill Street junction is likely to increase flows on Brickhill Street and therefore worsen delays at other junctions along it. It is recommended that any intervention measures proposed in the future at this junction are tested at a local level as well as at a strategic level.

9.8.5 In terms of impacts over and above the Reference Case as with Scenario 1 there are limited additional congestion issues forecast to be caused by the Plan:MK growth. There are five junctions where one or more approaches are congested in the model as a result of Scenario 2a growth and one junction where modelled congestion issues have arisen solely as a result of Scenario 2a.

Plan:MK Scenario 2b

9.8.6 The new road bridge is predicted to take a significant volume of flow (1500-1700 PCU in the direction of peak tidal flow), which helps mitigate the impact of the East of M1 development. In the AM Peak there is still an increase in flow crossing J14 towards Milton Keynes of around 250 PCU, however the model is showing little impact in delay at J14, partly due to addition of the dual carriageway link on southbound approach alleviating a current pinch point.

9.8.7 It is also possible that amending the signal timings at the junctions on the new link would encourage a further shift in through trips away from J14. (The increase delay shown in the PM peak is due to the extra delay experienced by traffic joining the M1.). It is clear without the additional infrastructure there would be significant extra pressure on the existing roads and associated junctions across the motorway; along the A422, on Willen Road and the A509 through J14.

9.8.8 The modelling has indicated that there will still be significant congestion at M1 Junction 14. Although the new M1 crossing removes some through A509 traffic from J14 the majority of traffic at J14 remains (as it accessing the M1) and some of the additional highway capacity is taken up by the additional development related traffic. It is possible that the proposed Park & Ride site on the north side of Junction 14 may reduce traffic volumes at J14 but this cannot be modelled at the current time.

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