

# Central Bedfordshire Local Plan – Stage 1A Transport Modelling

July 2017



## Central Bedfordshire Local Plan: Transport Modelling

### 1. Introduction & Key Findings

- 1.1 The aim of modelling the transport impacts of growth in Central Bedfordshire is to provide information on road network performance and necessary mitigation to support land use options. Central Bedfordshire Council (CBC) appointed AECOM Ltd to undertake this task.
- 1.2 Transport modelling is undertaken using a transport model. The current model for CBC is the Central Bedfordshire and Luton Transport Model (CBLTM). This was originally developed as a South Beds and Luton Model and updated and expanded to cover the area of the newly formed Central Bedfordshire and Luton by consultants Halcrow in 2009.
- 1.3 The modelling has been split into two stages of work. The explanation of these two stages and the key findings are set out below.

### 2. Growth Area Analysis

- 2.1 The first stage considers the four growth areas, identified in the Shaping Central Bedfordshire leaflet. The results of this are presented as a Technical Note and have been summarised below. The outputs of this work gave the Council some high level understanding of the locations of stress on the road network in those areas.

#### *Key Findings*

- 2.2 Growth in Area A will impact the road network but this could be mitigated with the provision of good access to public transport systems, such as the Luton-Dunstable Busway. Promoting developments along the Midland Main railway line may also create a less car-dependent growth and therefore potentially reducing the impact of the developments to the highway network.
- 2.3 All new potential growth within Area B is likely to have an impact on the A1 and cause further congestion, as it is the main strategic route in the area. Infrastructure improvements are likely to be required to accommodate further growth and avoid additional stress on the highway network if new developments are to come forward in this area.
- 2.4 There is significant levels of congestion on the network in Area C, especially on the M1 (including Junction 13), A421 and A6 so investment in infrastructure would be crucial.
- 2.5 Depending on the location, quantum and type of the developments, further growth in Area D may put additional pressure on the local roads as well as the strategic routes such as the A507, M1 and A1.

### 3. Growth Scenario Analysis

- 3.1 The second stage provides an overview of the cumulative impact of varying Local Plan growth for the morning and evening peak hours for a single Forecast Year (i.e. 2035). The aim and purpose of this is to provide a high level comparative analysis on the potential impacts on the road network of Local Plan growth. In order to assess the impact of Local Plan growth for the second stage of transport modelling the following growth scenarios were considered:
  - The impact of growth (committed planned growth and infrastructure schemes at 2035) that would occur *without* the allocation of land in the Local Plan. This no Local Plan scenario is

called the “Reference Case” in the Transport Modelling report and provides a useful starting point for understanding change in traffic conditions.

- Five further Local Plan housing growth scenarios were identified by the Council:
  - Scenario 1: high levels of growth;
  - Scenario 2: excluding growth west of Luton and east of Biggleswade;
  - Scenario 3: limited growth along the A1 corridor (Area B);
  - Scenario 4: no additional growth in the Green Belt (Area A); and
  - Scenario 5: mixed approach with higher growth in villages.

#### *Key Findings*

- 3.2 The main modelling outputs of this work are: traffic flows; Junction Delays; and Volume-over-Capacity ratios, whereby a ratio of 100% (or more) indicates saturation of the Highway network. These outputs are presented in mapping format and colour coded according to their severity.
- 3.3 All growth scenarios show stress on the road network across Central Bedfordshire. Points of stress vary according to the locations and amount of growth being considered. In total twenty hotspots are identified across Central Bedfordshire, following analysis of the Local Plan growth scenarios, with varying degrees of impact. Hotspots indicate roads or junctions where traffic conditions are poor and particularly when compared to the “No Local Plan” scenario.
- 3.4 Not all hotspots suffer from worsening conditions, in some places conditions are stable or improved, depending on the infrastructure assumptions. Certain hotspots reoccur, indicating a traffic condition that would require mitigation in any growth scenario.
- 3.5 On average, speeds across Central Bedfordshire and Luton are higher in the evening (PM) peak than in the morning (AM), indicating that traffic flows are travelling faster in the evening peak hour. Additional growth causes some reduction to average speeds.
- 3.6 The provision of public transport and access to railway will help to mitigate the impacts of growth on the road network.

#### **4. Summary of Implications**

- 4.1 The modelling identifies where road traffic conditions will worsen and therefore where mitigation might be needed, in order to deliver growth.
- 4.2 Importantly, this initial modelling suggests that if certain transport infrastructure schemes are delivered within the Plan period (i.e. the Expressway, Black Cat Improvements, A1 improvements and the Central Section of East West Rail) some worsening hotspots are improved and therefore the average travel speed increases. This proves that road improvements and public transport provision, namely rail, can minimise or neutralise the impact of additional growth in CBC.
- 4.3 At the next stage of Local Plan preparation, two further stages of work will be undertaken. The first will be to identify the potential mitigation options for those key network constraints. This will allow the Council to consider the necessary road and/or junction improvements required to support new growth.
- 4.4 In the final stage, testing the shortlisted Local Plan allocations (at development site level) will be undertaken with a new and enhanced CBLTM (with a 2016 Base Year).

**Central Bedfordshire Local Plan**

**Stage 1A**

**Transport Modelling**





# Technical Note

## Development of Central Bedfordshire Local Plan Evidence Base Central Bedfordshire Local Plan - Stage 1A - Growth Areas Analysis

<b>Specification No.</b> M009.031	<b>Client name</b> Central Bedfordshire Council	<b>Discipline</b> Transportation	<b>Project name</b> CBC Local Plan - Stage 1A
<b>Date</b> 13 October 2016	<b>Project number</b> 60504775	<b>Reference addition number</b> -	<b>Prepared by</b> Daniel Almazan
<b>Approved by</b> Ian Burrows	<b>Checked by</b> Kit Tang	<b>Verified by</b> Ian Burrows	

### Revision History

Revision	Revision date	Details	Authorised	Name	Position
V1	11/11/2016	Growth Areas Analysis	IOB	Ian Burrows	Regional Director

### 1. Introduction

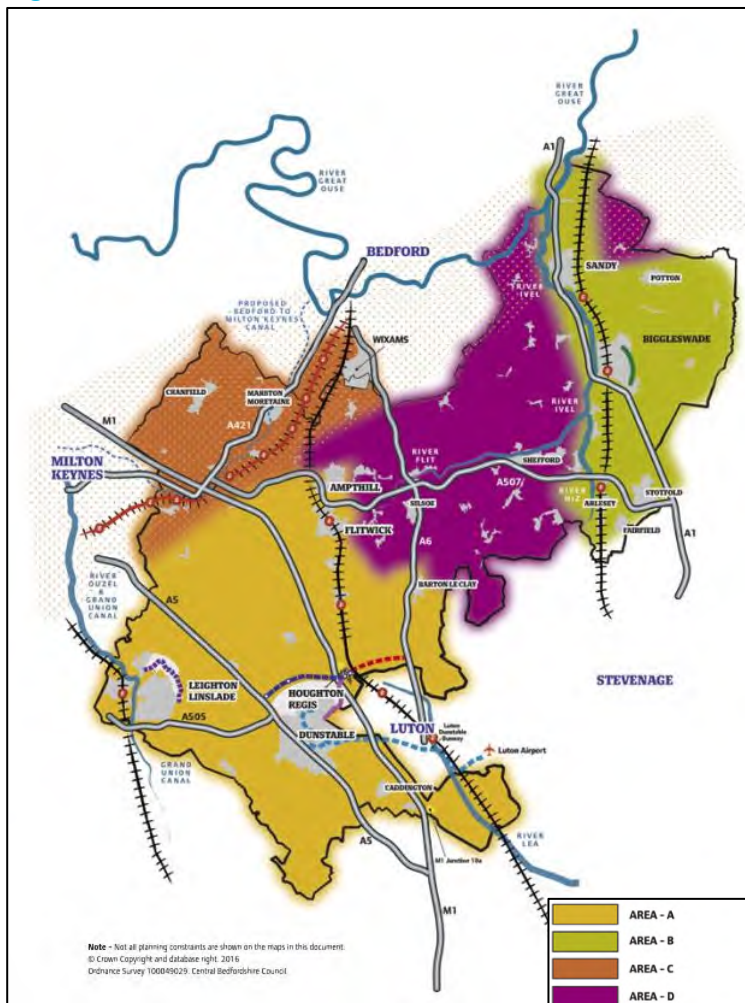
- 1.1 Central Bedfordshire Council (CBC) is currently in the process of updating its evidence base to support its forthcoming Local Plan. To assess the cumulative impact of the Local Plan growth options on the highway network, it is proposed that modelling to be undertaken using the Central Bedfordshire and Luton Transport Model (CBLTM).
- 1.2 The base year of the existing CBLTM is 2009, and the CBLTM is currently being enhanced to a 2016 base year which is expected to be completed early 2017. In order to support the emerging Local Plan, it is proposed that the transport modelling is undertaken in two stages, with Stage 1 being split into two distinct parts (Stage 1A and Stage 1B respectively):
- Stage 1A [Autumn 2016]
    - The first stage of the study will provide an overview of the cumulative impacts of the Local Plan growth options for the morning and evening peak hours for a single forecast year (i.e. 2035) using the existing CBLTM (2009 base year).
  - Stage 1B [Anticipated timing – Early Spring 2017]
    - This stage will follow directly on from Stage 1A, whereby potential mitigation options for those key network constraints identified in Stage 1A options will be considered.
  - Stage 2 [Anticipated timing – Late Spring 2017]
    - The second stage of the study will include testing the shortlisted Local Plan growth option/s using the enhanced CBLTM (2016 base year).

- 1.3 This technical note, as part of Stage 1A, has been prepared for internal use / information for CBC only to provide high level observations of the potential impact of the Central Bedfordshire Local Plan growth on the highway network for 2035. The observations are based on the broad area of the Local Plan growth areas, as shown in **Figure 2.1** and the modelled level of stress on network links and nodes from the 2035 Reference Case scenario models (i.e. without Local Plan growths).
- 1.4 This note also considers, at a high level, the potential mitigation measures that may be required to accommodate the proposed growth by 2035.
- 1.5 Following this introductory section:
- Section 2 of this technical note describes the four growth areas defined by CBC for the Local Plan;
  - Section 3 presents the results for the 2035 Reference Case scenario models;
  - Section 4 provides observations for the potential impacts of the future growth on the network; and
  - Section 5 lists the potential mitigation measures to be considered.

## 2. Growth Areas

2.1 As part of the Local Plan process, CBC has provided information to show the broad areas of growth for the Local Plan. **Figure 2.1** shows the four growth areas within Central Bedfordshire and the following paragraphs describe the planned characteristics for each area.

**Figure 2.1: Growth Areas in Central Bedfordshire<sup>2</sup>**



<sup>2</sup> Shaping Central Bedfordshire (Central Bedfordshire Council) (October 2016)

- 2.2 Area A (South and West / M1 Corridor) is believed to have potential for all levels of growth, including medium scale along the major transport corridors within the area (i.e. the M1, A5 and the railway (Midland Main Line)) and large scale for sites adjacent to Luton. The area is constrained both by the Green Belt and Chilterns Area of Outstanding Natural Beauty (AONB) although there are major sites under development at Houghton Regis and Leighton Buzzard.
- 2.3 Area B (East / A1 Corridor) also presents potential for all levels of growth, mainly along the A1 and the East Coast railway line, the main south-north transport corridors. New settlements may be created if adequate infrastructure is provided.
- 2.4 Area C (East / West Corridor) has limited growth potential in terms of existing settlements, but has potential for medium to strategic scale growth including new settlements subject to investment in infrastructure.
- 2.5 Area D (Central Section) has potential for limited small to medium growth. As the highway network in the area is formed mainly by rural roads with limited potential to be upgraded, growth in Area D is likely to be of small or medium scale and around existing settlements with good services.

### 3. 2035 Reference Case

- 3.1 2035 Reference Case (i.e. without Central Bedfordshire Local Plan growths) model run has been undertaken. The planning data and transport infrastructure assumptions for the 2035 Reference Case scenario are outlined in the Modelling Assumptions Technical Note<sup>3</sup>.
- 3.2 **Figure 3.1** and **Figure 3.2** show the volume over capacity ratio (Network stress) for the 2035 Reference Case morning and evening peak hour models respectively. These figures show the highway links and nodes which are predicted to operate at / over capacity and highlight areas with high level of network stress.
- 3.3 **Figure 3.1** and **Figure 3.2** show that sections of key north-south corridors, including the A1, M1, A5 and A6, as well as the A507 and A421 east-west corridors are expected to experience high level of network stress for the 2035 Reference Case scenario. Highway links near the urban areas of Luton, Leighton Buzzard, Biggleswade and Sandy are also predicted to be congested for the 2035 Reference Case scenario.

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<sup>3</sup> Development of Central Bedfordshire Local Plan Evidence Base, Central Bedfordshire Local Plan – Stage 1A – Modelling Assumptions (05/10/2016) (AECOM)



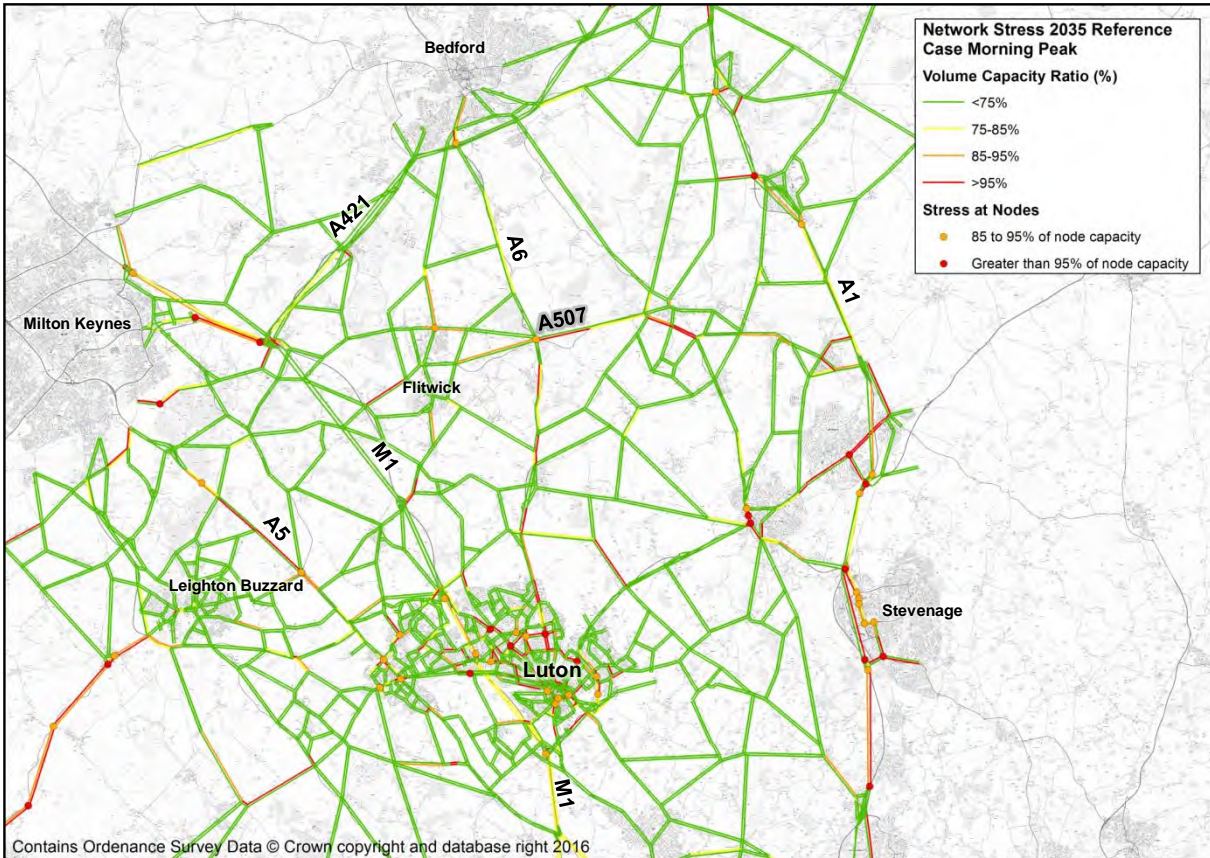


Figure 3.1: Volume over Capacity (Network Stress) (2035 Reference Case) (Morning Peak Hour, 0800 to 0900)

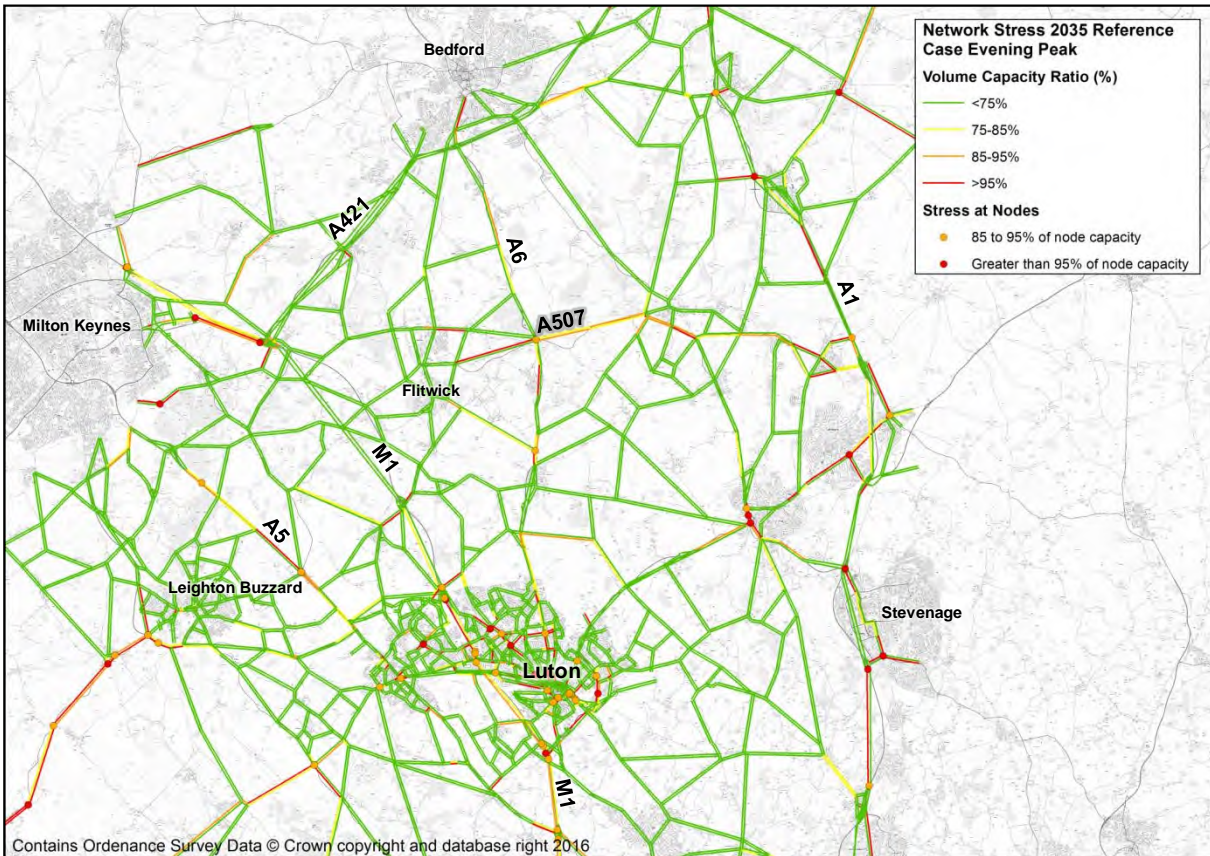


Figure 3.2: Volume over Capacity (Network Stress) (2035 Reference Case) (Evening Peak Hour, 1700 to 1800)

## 4. Potential Impact of the Local Plan Growth on the Highway Network

- 4.1 This section discusses the high level observations of the potential impact that may be caused by the Central Bedfordshire Local Plan growths on the highway network. This was undertaken by overlaying the broad areas of growth as shown in **Figure 2.1** on the 2035 Reference Case network stress plots and considering qualitatively, at a high level, how the congestion issues on the 2035 Reference Case network could be exacerbated by the proposed growth.

### Area A – South and West / M1 Corridor

- 4.2 Major sites that are already committed or under development to the north of Houghton Regis and at Leighton Buzzard in Area A, and committed highway infrastructure schemes, such as A5-M1 Link and Woodside Link, are included in the 2035 Reference Case scenario. **Figure 4.1** and **Figure 4.2** show the stress levels on links and nodes in Area A for the 2035 Reference Case scenario in the morning and evening peak hours respectively.
- 4.3 The modelling shows that the A5 and M1 corridors operate at / over capacity for the 2035 Reference Case for both morning and evening peak hours. Potential further growth along the major transport corridors in Area A are likely to increase pressure for the M1 and A5 corridors as these are the major strategic routes in this area.
- 4.4 Potential new developments in sites adjacent to Luton will likely to increase congestion for routes into Luton and other urban roads as well as links to the strategic highway network. However, this could potentially be mitigated if these developments could provide good access to public transport systems, such as the Luton-Dunstable Busway. Promoting developments along the Midland Main railway line may also create a less car-dependent growth and therefore potentially reducing the impact of the developments to the highway network.

### Area B – East / A1 Corridor

- 4.5 **Figure 4.3** and **Figure 4.4** show the stress levels on the highway links and nodes in Area B for the 2035 Reference Case scenario in the morning and evening peak hours respectively.
- 4.6 The modelling shows that in addition to the A1, the A507 to the west of Stotfold, B658 to the west of Biggleswade, B1042 at Potton and several roads in Sandy are predicted to operate under stress for the 2035 Reference Case, as shown in the **Figure 4.3** and **Figure 4.4**.
- 4.7 All new potential growth within Area B is likely to have an impact on the A1 and cause further congestion, as it is the main strategic route in the area. Infrastructure improvements are likely to be required to accommodate further growth and avoid additional stress on the highway network if new developments are to come forward in this area.



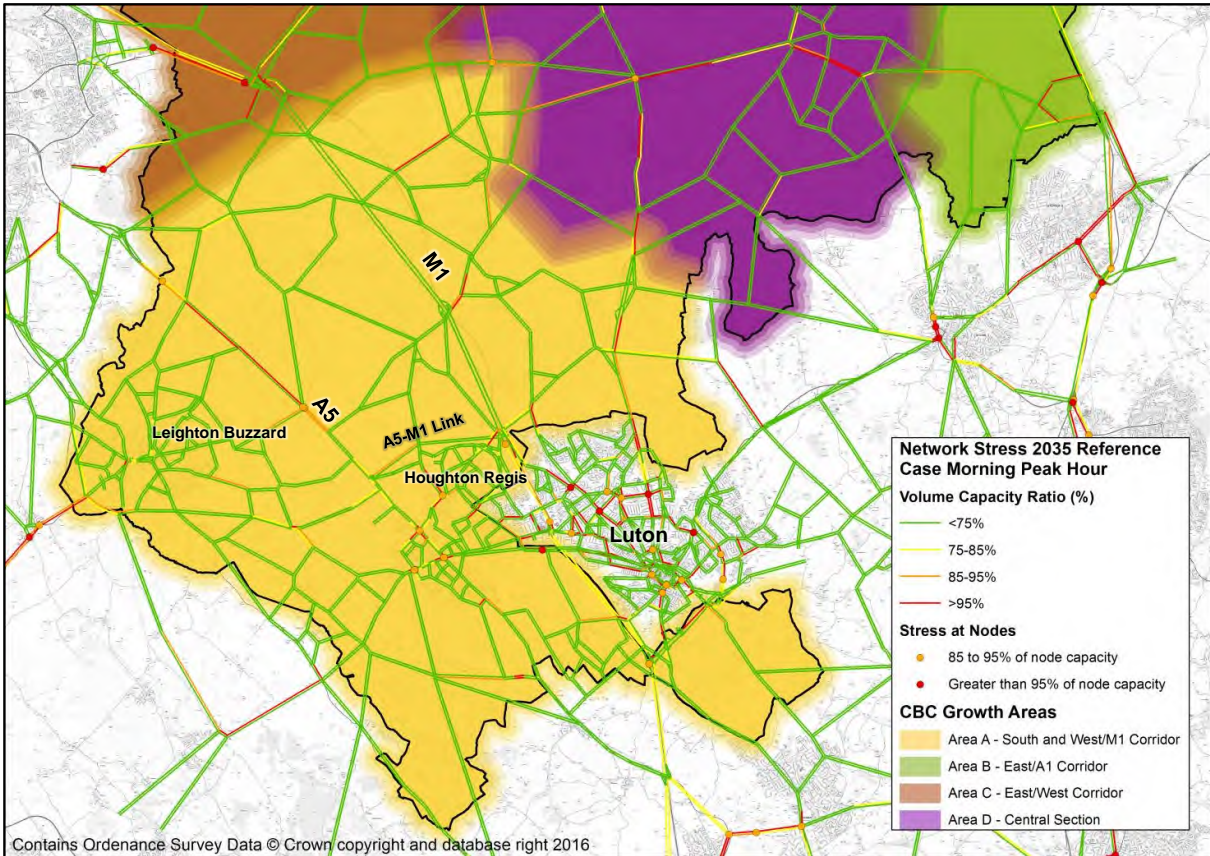


Figure 4.1: Area A – Network Stress in the 2035 Reference Case (Morning Peak Hour, 0800 to 0900)

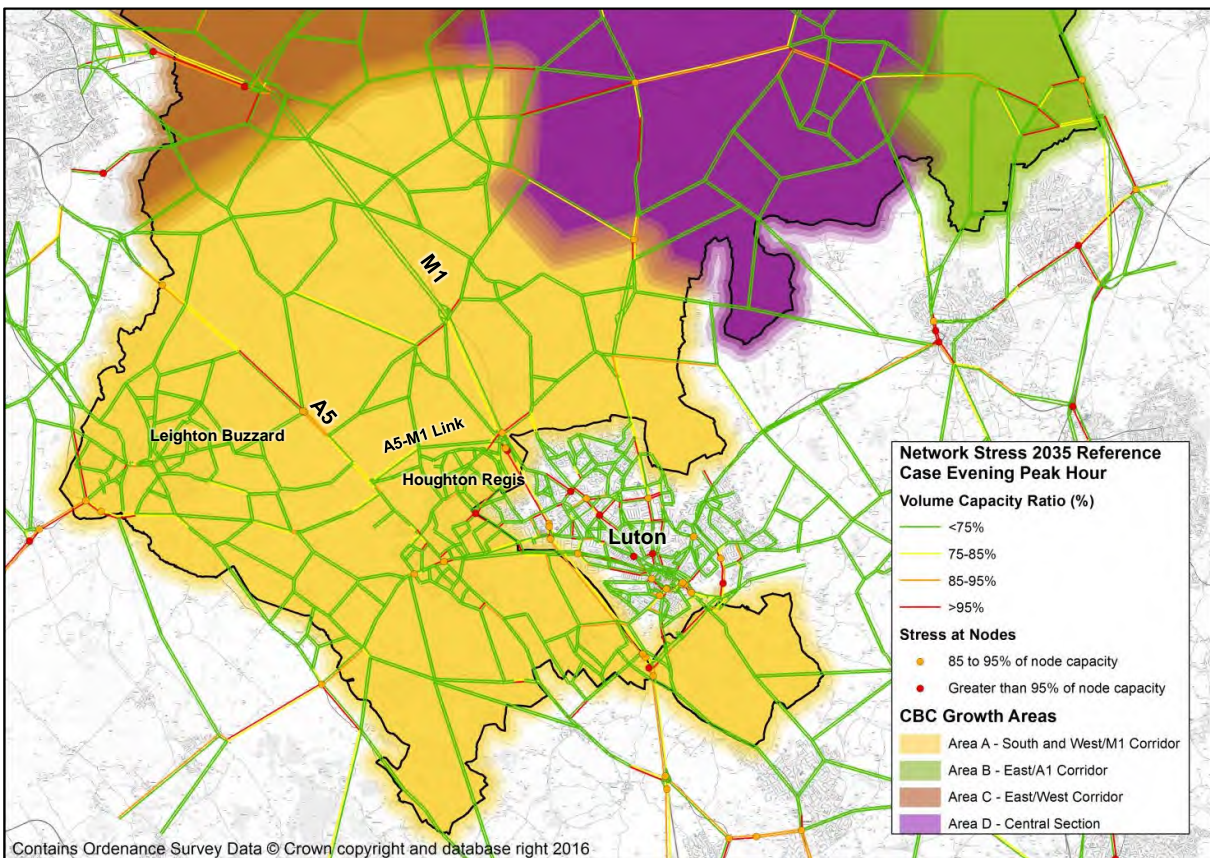


Figure 4.2: Area A – Network Stress in the 2035 Reference Case (Evening Peak Hour, 1700 to 1800)



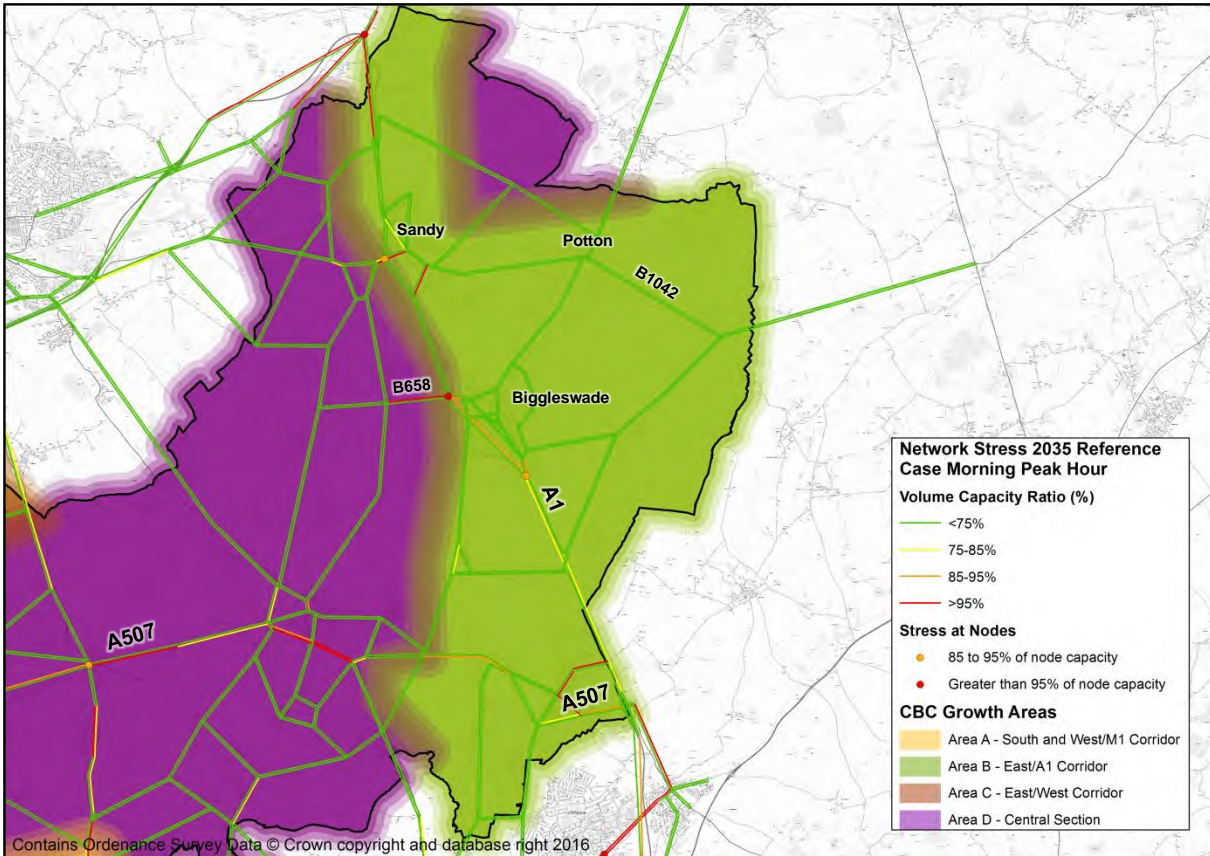


Figure 4.3: Area B – Network Stress in the 2035 Reference Case (Morning Peak Hour, 0800 to 0900)

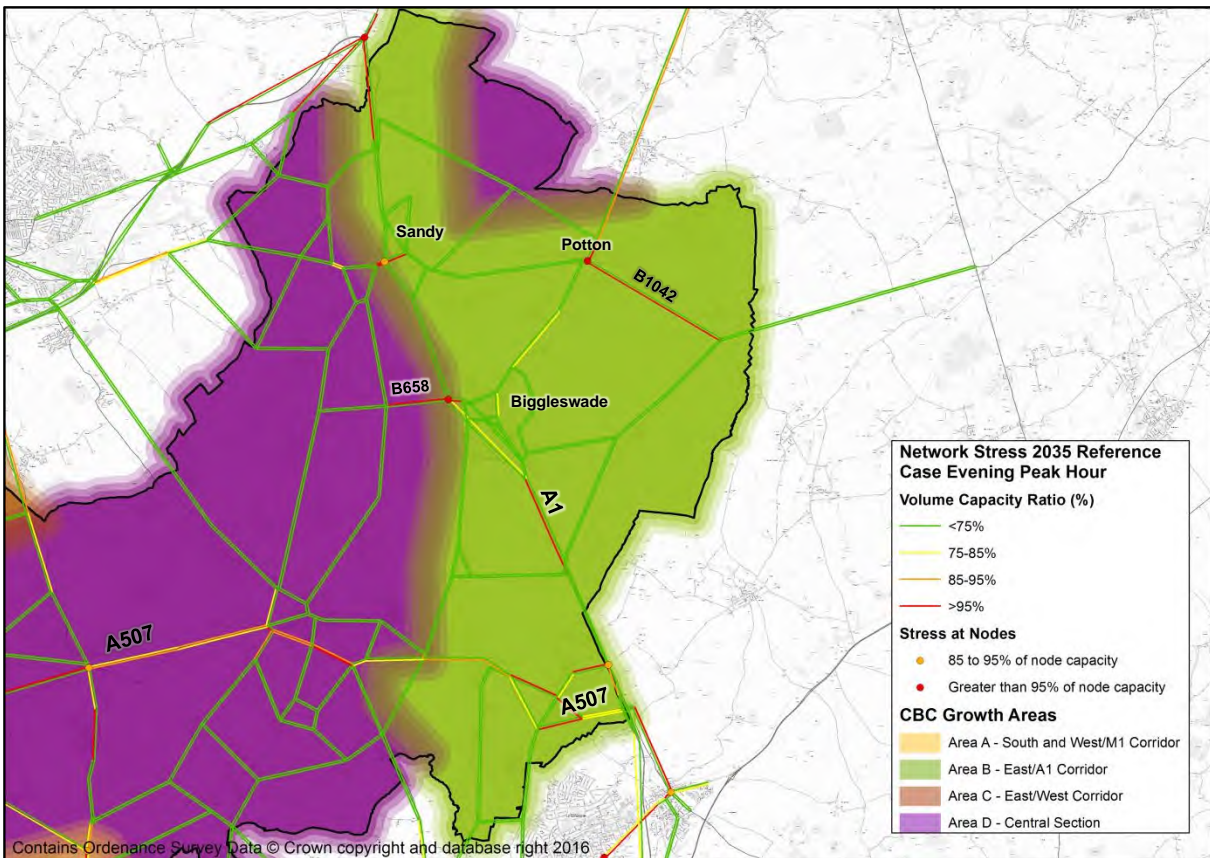


Figure 4.4: Area B – Network Stress in the 2035 Reference Case (Evening Peak Hour, 1700 to 1800)

### **Area C – East / West Corridor**

- 4.8 **Figure 4.5** and **Figure 4.6** show the stress levels on the highway links and nodes in Area C for the 2035 Reference Case scenario in the morning and evening peak hours respectively.
- 4.9 The modelling shows that for the 2035 Reference Case, there is significant level of congestion on the network in Area C, especially on the M1 (including Junction 13), A421 and A6.
- 4.10 This area has potential for significant growth, especially in the form of new settlements, however, investment in infrastructure would be crucial, given that the levels of stress on the strategic routes are expected to be high already in the 2035 Reference Case.
- 4.11 New developments along the A6 are likely to impact the performance of the A6 as well as the A421 and M1, while growths between Bedford and Milton Keynes is likely to have a direct impact on the A421, M1, M1 Junction 13 and local roads in the area.

### **Area D – Central Section**

- 4.12 **Figure 4.7** and **Figure 4.8** show the stress levels on the highway links and nodes in Area D for the 2035 Reference Case scenario in the morning and evening peak hours respectively.
- 4.13 As shown in **Figure 4.7** and **Figure 4.8**, the A507 and the A6 are under high levels of stress in the 2035 Reference Case scenario, including the A507 / A6 junction at Clophill and links to the north of Ampthill (e.g. Church Street).
- 4.14 Depending on the location, quantum and type of the developments, further growth in Area D may put additional pressure on the local roads as well as the strategic routes such as the A507, M1 and A1.



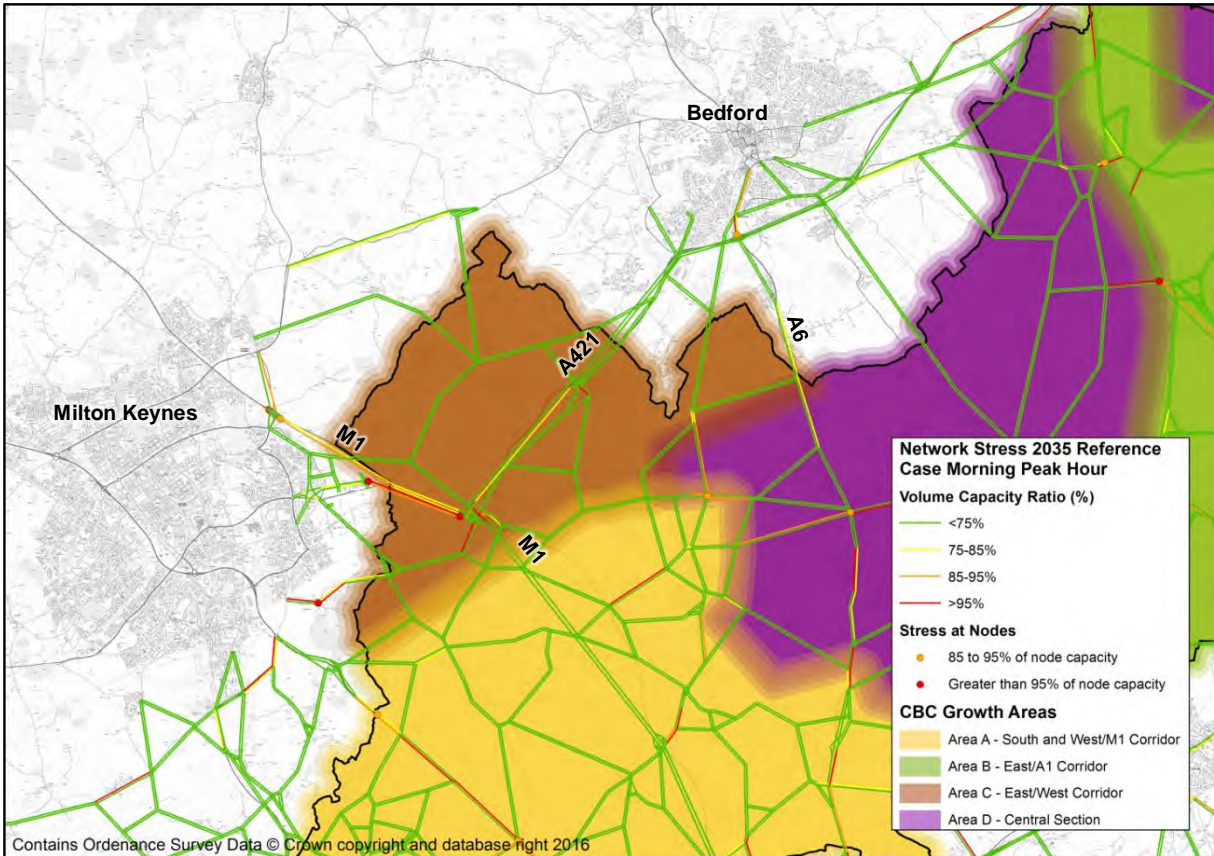


Figure 4.5: Area C – Network Stress in the 2035 Reference Case (Morning Peak Hour, 0800 to 0900)

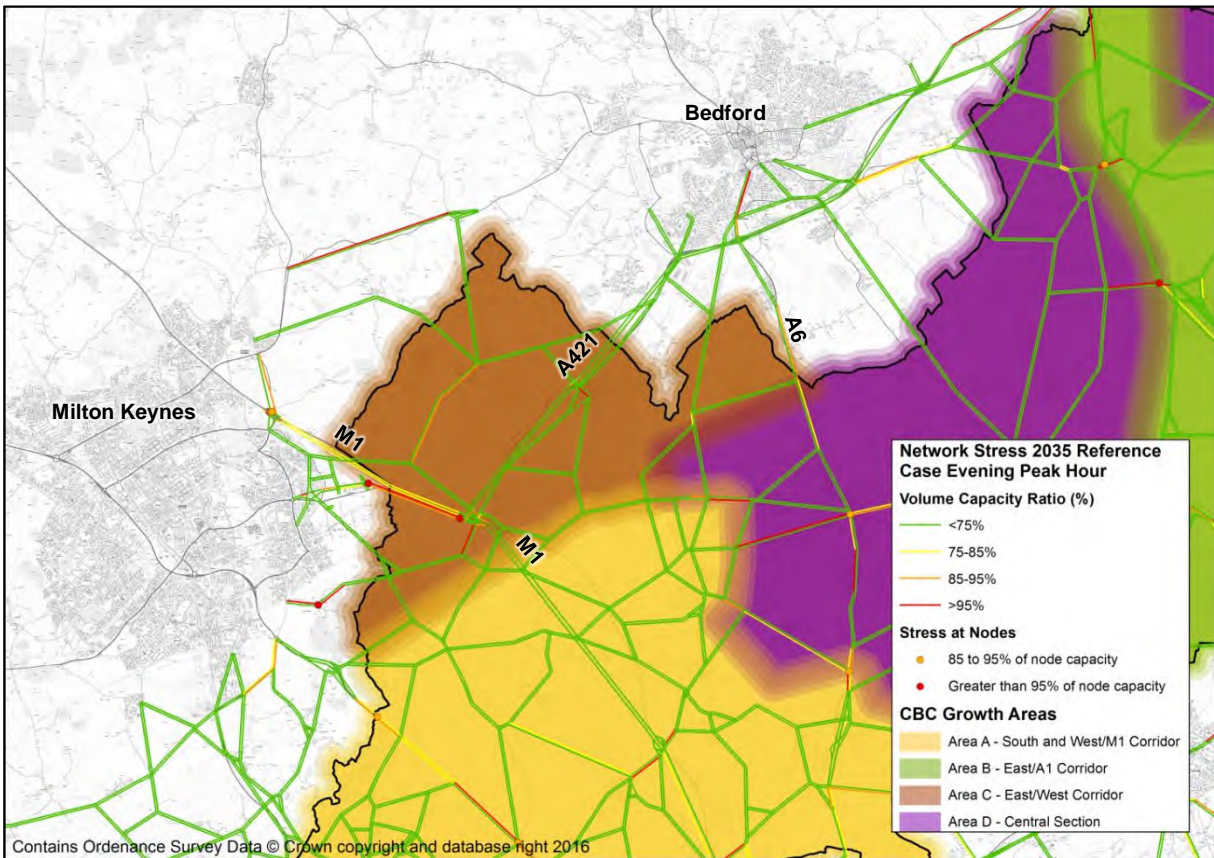


Figure 4.6: Area C – Network Stress in the 2035 Reference Case (Evening Peak Hour, 1700 to 1800)



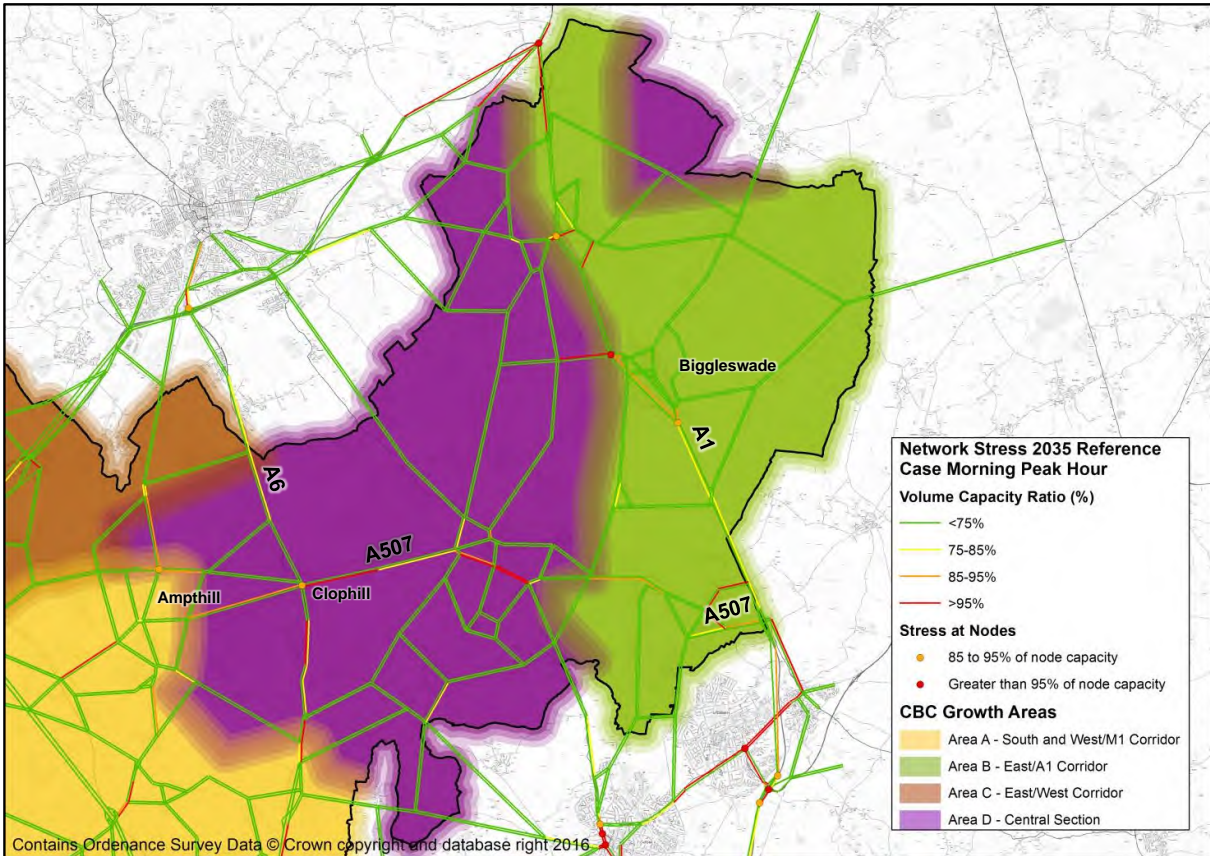


Figure 4.7: Area D – Network Stress in the 2035 Reference Case (Morning Peak Hour, 0800 to 0900)

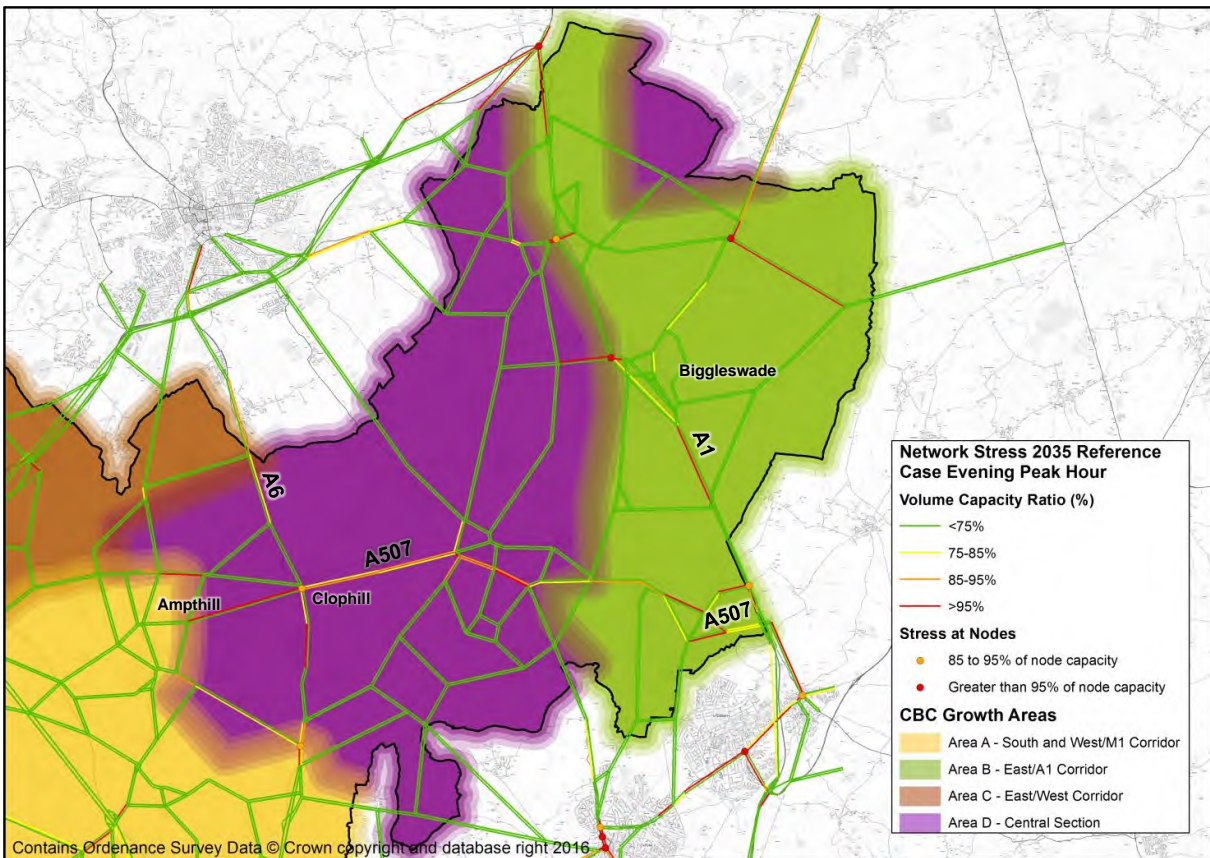


Figure 4.8: Area D – Network Stress in the 2035 Reference Case (Evening Peak Hour, 1700 to 1800)

## 5. Mitigation Considerations

- 5.1 As described in the previous sections, parts of the highway network in Central Bedfordshire are expected to experience high levels of stress for the 2035 Reference Case scenario, and further growth is expected to exacerbate the congestion issues.
- 5.2 The predicted hot spots for the 2035 Reference Case for the four growth areas were discussed and this section considers potential mitigation measures that may be required to accommodate further growth for the Central Bedfordshire highway network.

### **A421 / M1**

- 5.3 The A421 is currently a dual carriageway road between Bedford and the M1 Junction 13, and between Eagle Farm roundabout and Milton Keynes. The central section, which runs parallel to the M1 for two miles, is a single carriageway road. Outputs from the 2035 Reference Case scenario model run show a volume over capacity ratio close to 100% for the A421, which indicate the need for capacity improvement for the A421. The M1 Junction 13 also shows high level of stress and mitigation measures will be required if growth and additional traffic from further developments are expected along the A421 corridor.

### **M1**

- 5.4 Sections of M1 to the west of Luton and the M1 in the vicinity of Junction 13 show high level of stress for the 2035 Reference Case scenario. Highways England's Smart Motorway scheme may provide additional capacity for the M1, reducing the level of stress during peak hours, however growth in Central Bedfordshire are expected to increase pressure for the M1 as this is a key strategic route within the area.

### **A1**

- 5.5 The outputs from the 2035 Reference Case scenario show congestion on several sections of the A1 for both morning and evening peak hours. This situation is likely to deteriorate if new developments are expected in Central Bedfordshire, particularly for Area B and Area D. Improvements on the A1 junctions at Biggleswade and Sandy may be necessary to accommodate further growth in the these areas.

### **North of Luton**

- 5.6 The 2035 Reference Case scenario outputs show high levels of stress on the A5, M1 and A6 in the Luton-Dunstable area. With new developments in Luton, Dunstable and Houghton Regis, a new bypass to the north of Luton may improve east-west connectivity for the area and also reduce congestion, especially from Luton town centre and the local road network. The bypass would be formed by the combination of the M1-A6 Link Road with the committed A5-M1 Link.

### **A507**

- 5.7 The A507 is also expected to experience high levels of stress for the 2035 Reference Case scenario. This is a key east-west route for the Central Bedfordshire and growth in the Area C and Area D will likely put additional pressure on this route and infrastructure improvements will likely be required for the A507 to support further growth in these areas.

### **Local Highway Network within Central Section of Central Bedfordshire**

- 5.8 The modelling shows that some congestion can be expected for the local highway networks within and surrounding key villages and towns within Central Bedfordshire, such as Houghton Regis, Leighton Buzzard, Ampthill, Clophill and Sandy, for the 2035 Reference Case scenario. Depending on the location, quantum and type of developments, infrastructure improvements may be required to mitigate the additional traffic and congestion caused by the developments.

## 6. Summary

The 2035 Reference Case model outputs showed a series of network links and nodes that may present high levels of stress by 2035. The main potential issues are summarised below, by growth area:

- Area A: High level of network stress expected on the M1 and A5. Further growth along the main strategic corridors is likely to create additional stress on and these routes and key junctions connecting to these routes.
- Area B: model outputs show a high level of stress on the A1 and on highway links at Biggleswade and Sandy. Infrastructure improvements on the A1 are essential to accommodate growths in this area.
- Area C: the most stressed parts of the network are likely to be the A421, A6, and the M1 at Milton Keynes (including M1 Junction 13). Large scale settlements in this area will have a direct impact on the A421 and M1, exacerbating the predicted congestion issues.
- Area D: both the A507 (east-south) and the A6 (north-south) will present high levels of congestion by 2035, including the A507 / A6 junction at Clophill. Although no large scale growths are expected in this area, the conditions for the A507 and the A6 are likely to deteriorate as developments and growths in adjacent areas will increase traffic demand on these routes.

In summary, the highway network for the 2035 Reference Case scenario is expected to be congested for most key strategic routes and junctions within Central Bedfordshire, and infrastructure improvements will likely be required to support further growth in all growth areas.

# Technical Note

## Central Bedfordshire Local Plan – Stage 1a

<b>Document No.</b> 2	<b>Client name</b> Central Bedfordshire Council	<b>Client reference</b> CBC	<b>Discipline</b> Transportation
<b>Project name</b> Central Bedfordshire Local Plan – Stage 1a	<b>Date</b> 27-Apr-17	<b>Project number</b> 60504775	<b>Reference addition number</b>
<b>Prepared by</b> AG	<b>Reviewed by</b> JKF	<b>Approved by</b> IB	

### Revision History

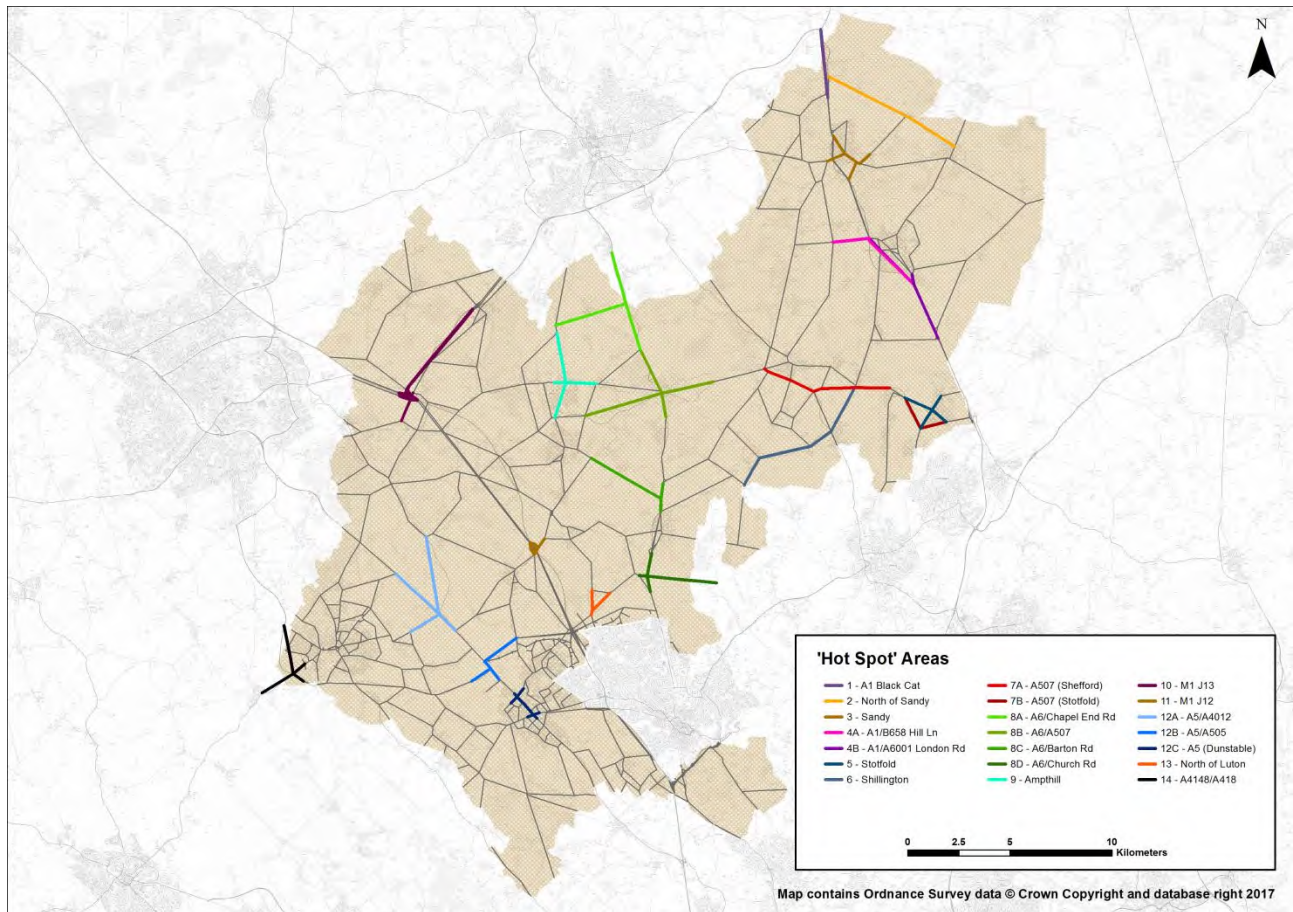
<b>Revision</b>	<b>Revision date</b>	<b>Details</b>	<b>Authorised Position</b>	
1	07-Apr-17	Draft for client feedback	JKF	Principal Consultant
2	27-Apr-17	Revision following client meeting and feedback	IB	Regional Director
3	10-May-17	Final version following client feedback	IB	Regional Director
3.1	06-Jun-17	Update following client request	JKF	Principal Consultant



## 1. Executive Summary

- 1.1.1 Central Bedfordshire Council (CBC) is in the process of updating its Local Plan. The evidence base for this Local Plan will rely on the authority's existing strategic transport model, the Central Bedfordshire and Luton Transport Model (CBLTM).
- 1.1.2 At this initial stage of the Local Plan process, five indicative growth scenarios are envisaged for Forecast Year 2035. The impact of each scenario has been analysed using the existing Base Year 2009 CBLTM. This has led to the identification of twenty 'hot spot' (HS) areas within Central Bedfordshire (CBeds), as shown in **Figure 1**.

**Figure 1: Central Bedfordshire's 'hot spots' and their location (from east to west)**



- 1.1.3 Detailed results from this analysis are presented in this document.

## 2. Introduction

### 2.1 Context – Local Plan

2.1.1 Central Bedfordshire Council (CBC) is in the process of updating its evidence base to support the production of its forthcoming Local Plan. To assess the cumulative impact of the Local Plan growth scenarios on the highway network, it is proposed that transport modelling is undertaken using the Central Bedfordshire and Luton Transport Model (CBLTM).

2.1.2 It is proposed that the transport modelling is undertaken in the following stages:

- Stage 1A: to provide a comparative overview of the cumulative impacts of five Local Plan growth scenarios for both AM and PM peak hours, and to define ‘hot spot’ areas where there are network constraints;
- Stage 1B: to propose mitigation options for key ‘hot spots’ and test their impact on overall network performance (considering potential concept designs, constraints and associated infrastructure costs); and
- Stage 2: to consolidate the preferred Local Plan growth scenario and the proposed mitigation measures e.g. to test with more detailed assumptions and for intermediate Forecast Years.

### 2.2 Objectives / Structure of the note

2.2.1 The purpose of this note is to present results from Stage 1a and to discuss the potential ‘hot spots’, for which mitigation options will be proposed at a later stage (i.e. Stage 1b).

2.2.2 The rest of this document is structured as follows:

- Modelling assumptions;
- Analysis of the 2035 Reference Case and all scenarios;
- Conclusions; and
- Appendix A: Detailed Local Plan growth assumptions.

### 3. Modelling assumptions

#### 3.1 CBLTM

3.1.1 It should be noted that the Base Year for the existing CBLTM is 2009. For work of a strategic nature (e.g. sifting high-level growth scenarios), it is common practice to use a model with a Base Year as old as 10 years (e.g. East of England Regional Model), although it is preferable to use a model with a Base Year not older than 5 years, as trip patterns are likely to change within that period of time<sup>1</sup>.

3.1.2 Calibration of an updated CBLTM (Base Year 2016) was completed in early March 2017 for Central Bedfordshire and Luton Council, and model development is expected to be finalised in early June 2017. It is then anticipated this new enhanced model will be used:

- For the Local Plan evidence, once more detailed planning information becomes available; and
- To aid the understanding of potential mitigation schemes.

3.1.3 The main modelling outputs used for the purpose of this work are:

- Traffic flows in Passenger Car Units (PCU);
- Junction delays in minutes (min); and
- Volume-over-Capacity (VoC) ratios in %, whereby a ratio of 100% (or more) indicates saturation of the Highway network. The VoC indicator is used to measure link stress i.e. network congestion at road- (or link-) level.

#### 3.2 Forecasting and Reference Case

3.2.1 The analysis presented in this note will be based in Forecast Year 2035. Each forecast scenario is derived from:

- The CBLTM model which has been calibrated and validated to represent Base Year 2009;
- Any change between 2009 and 2035 which could potentially impact the number of trips, trip patterns and travel behaviours e.g.:
  - Socio-demographic changes such as housing, population and employment;
  - Economic changes such as sensitivity to travel time and costs; and
  - Changes to the transport infrastructure (for both highways and Public Transport).

3.2.2 In order to assess the impact of Local Plan growth, it is therefore necessary to isolate the changes which are due to this specific growth from the other potential changes. A Reference Case scenario is thus required to test the impact of all non-Local-Plan-related changes, including committed planned growth and infrastructure schemes for Forecast Year 2035.

3.2.3 Analysis of each Local Plan scenario will be based on a comparative approach. In particular, this analysis will rely on traffic flow differences (in PCU) and junction delay differences (in min) between the results from the Local Plan scenarios and the results from the 2035 Reference Case.

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<sup>1</sup> For instance, WebTAG recommends that data from less than six years be used for Base Year validation (see WebTAG Unit M3.1, §8.1.1). In other words, a 2009 Base Year may rely on data from 2004.



### 3.3 Planning Data Assumptions – 2035 Reference Case

3.3.1 Planning data assumptions for the 2035 Reference Case relied on:

- The Uncertainty Log provided by both CBC<sup>2</sup> until 2035 and Luton Borough Council (LBC)<sup>3</sup> until 2031 to inform the shared CBLTM model;
- The employment growth assumptions provided<sup>4</sup> by CBC until 2035:
  - In total, 23,900 additional jobs are expected;
  - Non-development-zone growth “would primarily be distributed across the mixed-use proposals / potential Options” which have been identified for dwelling growth; and
- NTEM v6.2 for growth:
  - Between 2031 and 2035 in Luton, in order for all planning data to be consistent with Forecast Year 2035; and
  - Until 2035 outside Luton and Central Bedfordshire.

3.3.2 **Table 1** presents the planning data assumptions for the 2035 Reference Case scenario for Luton and Central Bedfordshire.

**Table 1: Planning Data Assumptions, 2035 Reference Case**

Authority	Data Type	Development Zone	Location	2035 Growth	
Luton	Dwellings	Yes	Power Court	600	
		No	Growth in dispersed developments	7,759	
		<b>Sub-total</b>		<b>8,359</b>	
	Jobs	Yes		Power Court	2,074
				Century Park	2,599
		No	Growth in dispersed developments	16,069	
		<b>Sub-total</b>		<b>20,742</b>	
	Central Bedfordshire	Dwellings	Yes	Leighton Linlade	2,500
Houghton Regis North 1				2,650	
Houghton Regis North 2				1,912	
No			Growth in dispersed developments	20,777	
<b>Sub-total</b>		<b>27,839</b>			
Jobs		Yes		Leighton Linlade	2,400
				Houghton Regis North 1	2,961
				Houghton Regis North 2	550
				Thorn Turn	262
		No	Growth in dispersed developments	17,727	
<b>Sub-total</b>		<b>23,900</b>			

3.3.3 It should be noted that, for the purpose of Local Plan work, the planned growth applied to the Reference Case scenario has not been constrained to NTEM growth.

<sup>2</sup> Email from CBC (Pru Khimasia, 02-Mar-17). All 'Near Certain' and 'More than Likely' developments were included, except for Wixams Southern Extension (HT118), as advised by CBC.

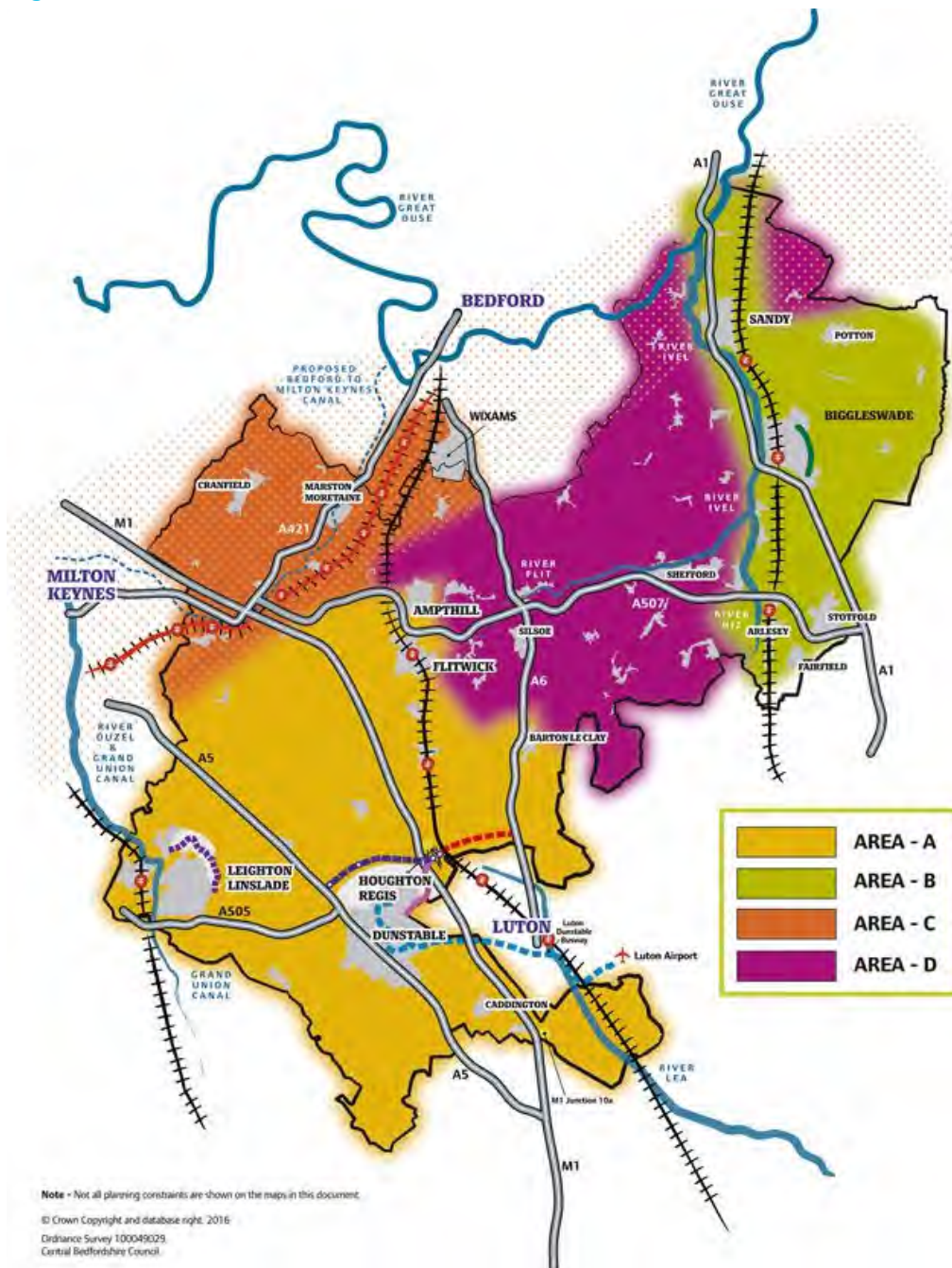
<sup>3</sup> Emails from 08-Oct-15 and 21-Jan-16

<sup>4</sup> Email from CBC (Lynsey Hillman-Gamble, 23-Feb-17)

### 3.4 Planning Data Assumptions – Local Plan scenarios

3.4.1 **Figure 2** shows the four growth areas within Central Bedfordshire.

**Figure 2: Growth Areas in Central Bedfordshire<sup>5</sup>**



3.4.2 Five Local Plan housing growth scenarios have been defined by CBC<sup>6</sup> for this study:

- Scenario 1: high levels of growth;
- Scenario 2: excluding growth in West of Luton and East of Biggleswade;
- Scenario 3: limited growth in Area B;
- Scenario 4: no additional growth in Area A; and
- Scenario 5: mixed approach with higher growth in villages.

<sup>5</sup> *Shaping Central Bedfordshire*, Central Bedfordshire Council, October 2016

<sup>6</sup> Growth Scenarios CBC amendments 280217.docx, email from CBC (Pru Khimasia, 02-Mar-17)  
220217 CBC Growth Scenarios 1\_5.xlsx, email from CBC (Connie Frost-Bryant, 23-Feb-17)

3.4.3 In addition, two Local Plan employment growth scenarios have been defined by CBC<sup>7</sup> for this study, based on the following three development sites:

- Sundon Rail Freight Interchange;
- Biggleswade (west of A1); and
- Ridgmont (near M1 Junction 13).

3.4.4 Each Local Plan growth scenario is defined as a combination of one ‘housing’ and one ‘employment’ growth scenarios. **Table 2** and **Table 3** summarise the dwelling and job growth by strategic sites for each Local Plan growth scenario.

**Table 2: Local Plan Growth Scenarios - Strategic Growth Sites (Dwellings)<sup>8</sup>**

Growth Area	Strategic Growth Location	Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5	
A	North of Luton	4,000	<b>8,000</b>	4,000	<b>6,000</b>	4,000	<b>8,000</b>	-	-	4,000	<b>7,000</b>
	GB Villages	2,000		2,000		2,000		-		3,000	
	West of Luton	2,000		-		2,000		-		-	
B	North of Sandy	7,000	<b>12,000</b>	7,000	<b>9,000</b>	-	<b>3,000</b>	7,000	<b>12,000</b>	-	<b>4,500</b>
	East of Biggleswade	3,000		-		500		3,000		-	
	East of Arlesey	2,000		2,000		2,000		2,000		2,000	
	Villages	-		-		500		-		2,500	
C	Aspley Guise	3,000	<b>9,000</b>	3,000	<b>9,000</b>	3,000	<b>9,000</b>	3,000	<b>9,000</b>	-	<b>6,650</b>
	Marston Valley	5,000		5,000		5,000		5,000		5,000	
	Wixams Southern	1,000		1,000		1,000		1,000		1,000	
	Villages	-		-		-		-		650	
D	RAF Henlow	1,000	<b>1,500</b>	1,000	<b>1,500</b>	1,000	<b>1,500</b>	1,000	<b>1,500</b>	1,000	<b>2,500</b>
	Villages	500		500		500		500		1,500	
<b>Total (Dwellings)</b>		<b>30,500</b>		<b>25,500</b>		<b>21,500</b>		<b>22,500</b>		<b>20,650</b>	

**Table 3: Local Plan Growth Scenarios - Strategic Growth Sites (Jobs)**

Growth Area	Growth Location	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
A	Sundon Rail Freight Interchange	2,375 jobs	2,375 jobs	2,375 jobs	-	2,375 jobs
B	Biggleswade, west of A1	2,000 jobs	2,000 jobs	2,000 jobs	2,000 jobs	2,000 jobs
C	Ridgmont, M1 Junction 13	1,750 jobs	1,750 jobs	1,750 jobs	1,750 jobs	1,750 jobs
<b>Total (Jobs)</b>		<b>6,125 jobs</b>	<b>6,125 jobs</b>	<b>6,125 jobs</b>	<b>3,750 jobs</b>	<b>6,125 jobs</b>

3.4.5 **Appendix A** shows the dwelling growth in more disaggregated format for each growth scenario “based on the results of the technical site assessment process undertaken by the Council. The Council has estimated the capacity of each village to support Scenario 5 but the figures do not take account of cumulative impact and therefore are indicative only.”<sup>9</sup>

<sup>7</sup> Email from CBC (Pru Khimasia, 29-Mar-17)

<sup>8</sup> 220217 CBC Growth Scenarios 1\_5.xlsx, email from CBC (Connie Frost-Bryant, 23-Feb-17)

<sup>9</sup> Email from CBC (Pru Khimasia, 29-Mar-17)

### 3.5 Transport Infrastructure assumptions

3.5.1 At time of writing, there is limited information regarding access to / from the growth locations:

- Exceptions are North of Luton and Sundon Rail Freight Interchange, for which specific development zones have been defined in previous work and been applied in this work; and
- Assumptions on access to development sites will need to be refined at later stages (i.e. Stage 2), once CBC have shortlisted the site submissions for allocation.

3.5.2 **Table 4** outlines the infrastructure assumptions for the 2035 Reference Case and all Local Plan growth scenarios, as discussed and agreed with CBC:

- All committed schemes should be included in the 2035 Reference Case; and
- It is assumed that the M1-A6 Link and associated M1 J11a enhanced-capacity signalised junction will be required to support the North of Luton development and Sundon Rail Freight Interchange. Therefore these transport network schemes (highlighted **green** in **Table 4**) will be included in any Local Plan growth scenario which includes these developments.

3.5.3 In addition, four schemes (highlighted **blue** in **Table 4**) have been identified by CBC as potentially offering infrastructure support for Local Plan growth in certain areas. These are presented in **Figure 3**:

- A1 improvements: the A1 was coded with 3 lanes and grade-separated junctions;
- Black Cat improvements: a 3-lane bypass along the A1 was introduced on top of the existing layout;
- ‘Oxford to Cambridge’:
  - As agreed with CBC<sup>10</sup>, both sections of the Expressway were coded as a dual 2-lane with grade-separated junctions;
  - It should be noted that the highway network west of Milton Keynes is coded as buffer network in the CBLTM model i.e. has no capacity restrictions; and
- East-West Rail Central section: based on the Final Report dated 08-Aug-14<sup>11</sup>, two additional hourly services were introduced:
  - Cambridge to Oxford (in 60 minutes); and
  - Cambridge to Bedford (in 24 minutes).

3.5.4 There was limited information on these four schemes at time of specification. It has therefore been agreed to test these schemes independently and at high-level. These schemes are therefore only tested in an additional scenario, titled Scenario 1\*. This scenario is otherwise identical to Scenario 1 (including in terms of demand growth assumptions).

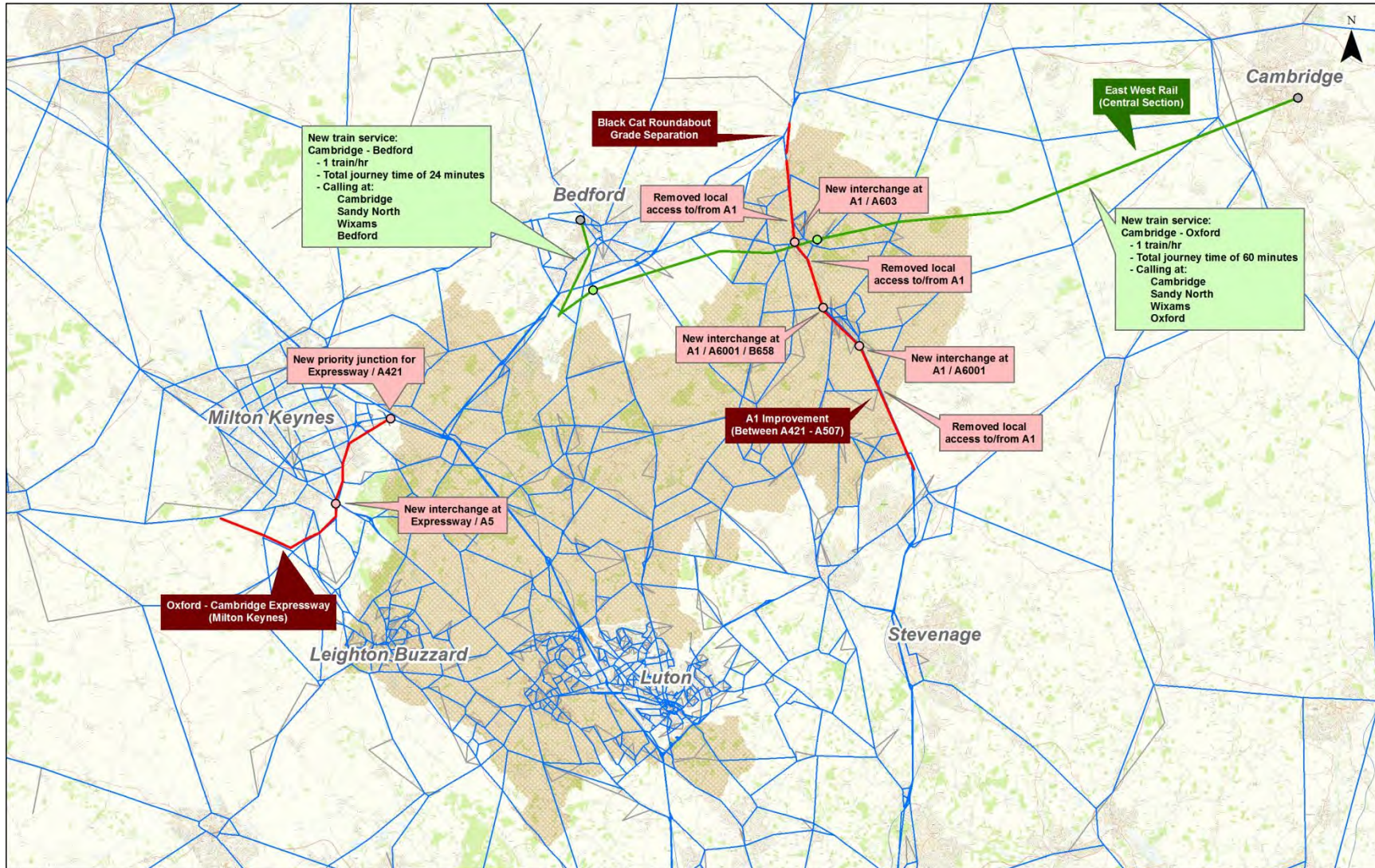
3.5.5 It should be noted that, for the purpose of analysis (see section 4.4), comparison of Scenario 1\* has been undertaken with Scenario 1 (instead of the 2035 Reference Case). The purpose of this scenario is indeed to understand the impact of these four additional infrastructure schemes regarding congestion and network issues.

<sup>10</sup> Email from CBC (Dave Buck, 13-Feb-17)

<sup>11</sup> [http://www.eastwestrail.org.uk/wp-content/uploads/2015/04/ewr-cs - cos - final\\_report\\_08-08-2014.pdf](http://www.eastwestrail.org.uk/wp-content/uploads/2015/04/ewr-cs - cos - final_report_08-08-2014.pdf) (accessed 17-Mar-17), p14 and p54



Figure 3: Additional schemes for Scenario 1\*



<b>AECOM</b>	Map:	<b>CBC Local Plan Scheme Assumptions</b>	Date:	17/03/2017
	Project:	Development of Central Bedfordshire Local Plan Evidence Base Central Bedfordshire Local Plan - Stage 1A	Scale:	0 5 10 km
	File Path:	F:\Projects\Transport Planning - CBC Modelling Framework\03 EXECUTION\M009 CBC AdHoc\M009.03x CBC Local Plan\Stage 1A\GIS\CBLTM_Stage1A_NetworkCoding_V3.mxd	Map contains Ordnance Survey data © Crown Copyright and database right 2017	

**Table 4: Transport Infrastructure Assumptions**

Source	Committed	Scheme	Ref. Case	Sc. 1	Sc. 1*	Sc. 2	Sc. 3	Sc. 4	Sc. 5
Bedford	Yes	Bedford Western Bypass Phase 1	✓	✓	✓	✓	✓	✓	✓
		Bedford Western Bypass Phase 2	✓	✓	✓	✓	✓	✓	✓
		A421 Dualling (including Eagle Farm to M1) <sup>12</sup>	✓	✓	✓	✓	✓	✓	✓
HE	Yes	M1 J10a	✓	✓	✓	✓	✓	✓	✓
		M1 J10-13	✓	✓	✓	✓	✓	✓	✓
		M1 J11a Dumbbell Junction	✓	x	x	x	x	✓	x
	No	Oxford to Cambridge Expressway (Milton Keynes)	x	x	✓	x	x	x	x
		A1 East of England Improvements (3 lanes and grade separation)	x	x	✓	x	x	x	x
		Black Cat grade separation	x	x	✓	x	x	x	x
		M1 J11a Enhanced Capacity Signalised Junction (Dumbbell Junction improvement for M1-A6 link)	x	✓	✓	✓	✓	x	✓
CBeds	Yes	Morrisons Houghton Regis	✓	✓	✓	✓	✓	✓	✓
		Luton & Dunstable Guided Busway	✓	✓	✓	✓	✓	✓	✓
		Luton Town Centre	✓	✓	✓	✓	✓	✓	✓
		Luton Parkway Northern Access	✓	✓	✓	✓	✓	✓	✓
		Luton 20mph	✓	✓	✓	✓	✓	✓	✓
		A5 - M1 Link	✓	✓	✓	✓	✓	✓	✓
		Woodside Link	✓	✓	✓	✓	✓	✓	✓
		Biggleswade Eastern Relief Road	✓	✓	✓	✓	✓	✓	✓
	No	Poynters Road Scheme	✓	✓	✓	✓	✓	✓	✓
		Connection to Woodside Link from Parkside Drive	✓	✓	✓	✓	✓	✓	✓
		Access to Early Release Kestrel Way	✓	✓	✓	✓	✓	✓	✓
		Access Road to Distribution Centre	✓	✓	✓	✓	✓	✓	✓
		HRDC development access over CBC land	✓	✓	✓	✓	✓	✓	✓
		Houghton Regis North Development 2 - Distributor Road	✓	✓	✓	✓	✓	✓	✓
		East Leighton Distributor Road	✓	✓	✓	✓	✓	✓	✓
		Leighton Buzzard Town Centre Schemes	✓	✓	✓	✓	✓	✓	✓
		M1-A6 Link	x	✓	✓	✓	✓	x	✓
Luton	No	Dunstable Road Pinch Points	✓	✓	✓	✓	✓	✓	✓
		Airport Link to Century Park	✓	✓	✓	✓	✓	✓	✓
		Dualling of Airport Access Road	✓	✓	✓	✓	✓	✓	✓
		Airport Junction Mitigation	✓	✓	✓	✓	✓	✓	✓
		Luton Airport Parkway Bus-Loop	✓	✓	✓	✓	✓	✓	✓
Rail	Yes	East West Rail (Western Section)	✓	✓	✓	✓	✓	✓	
	No	East West Rail (Central Section)	x	x	✓	x	x	x	

<sup>12</sup> Email from CBC (Jim Tombe, 03-Mar-17)

## 4. Analysis

- 4.1.1 The following section discusses the results of the 2035 Reference Case and each Local Plan growth scenario, for both morning (AM) and evening (PM) peak hours.
- 4.1.2 Each significant issue or constraint on the Central Bedfordshire network will be discussed by location. For reference purposes, a total of twenty locations i.e. 'hot spot' (HS) areas have been identified across all scenarios (see **Figure 1**).

### 4.2 2035 Reference Case

- 4.2.1 **Figure 4** and **Figure 5** present the VoC (i.e. link stress – see section 3.1.3 for more explanation) and junction delays for the 2035 Reference Case scenario, in AM and PM peak respectively.



Figure 4: Link stress and Junction delays, 2035 Reference Case, AM

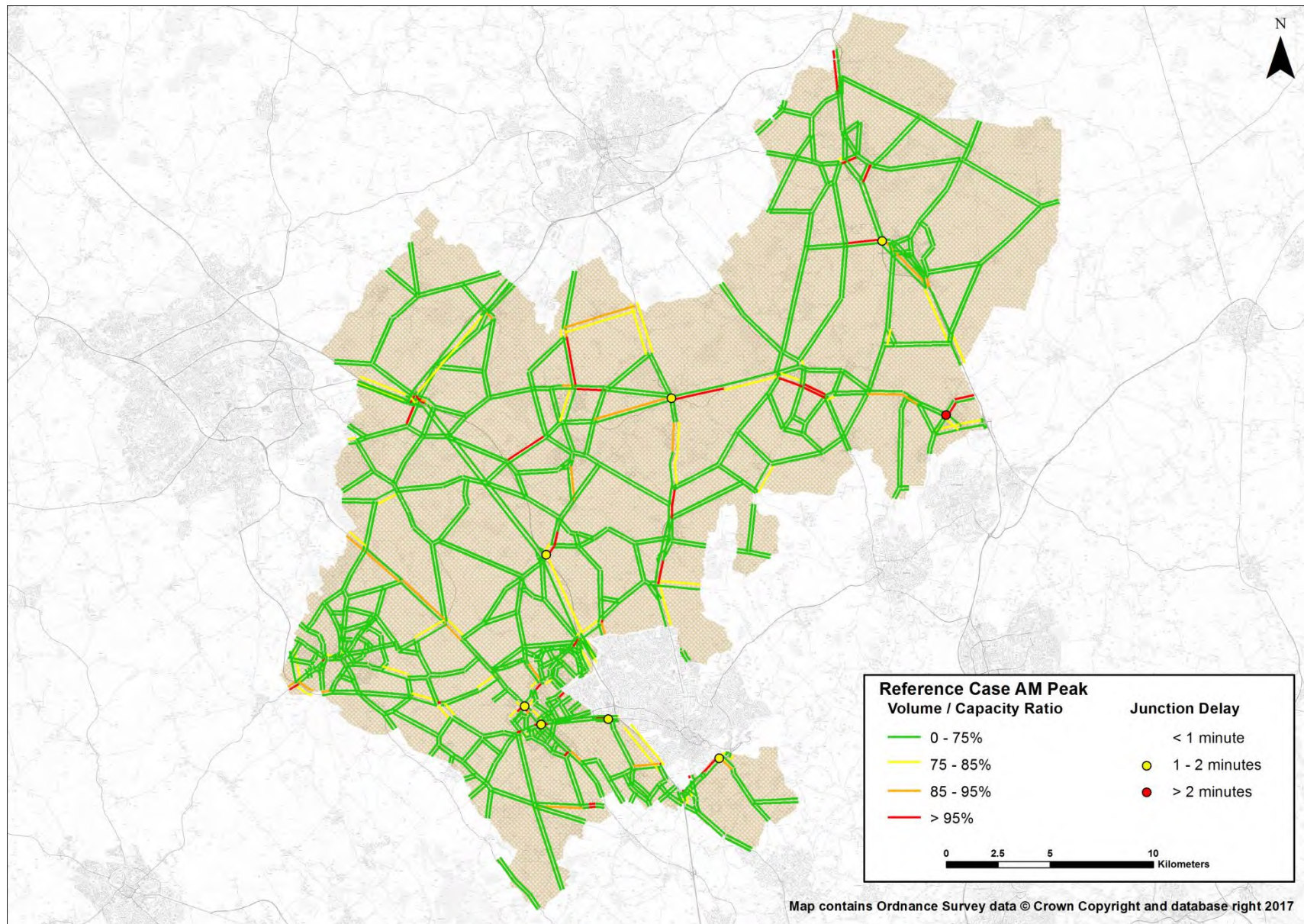
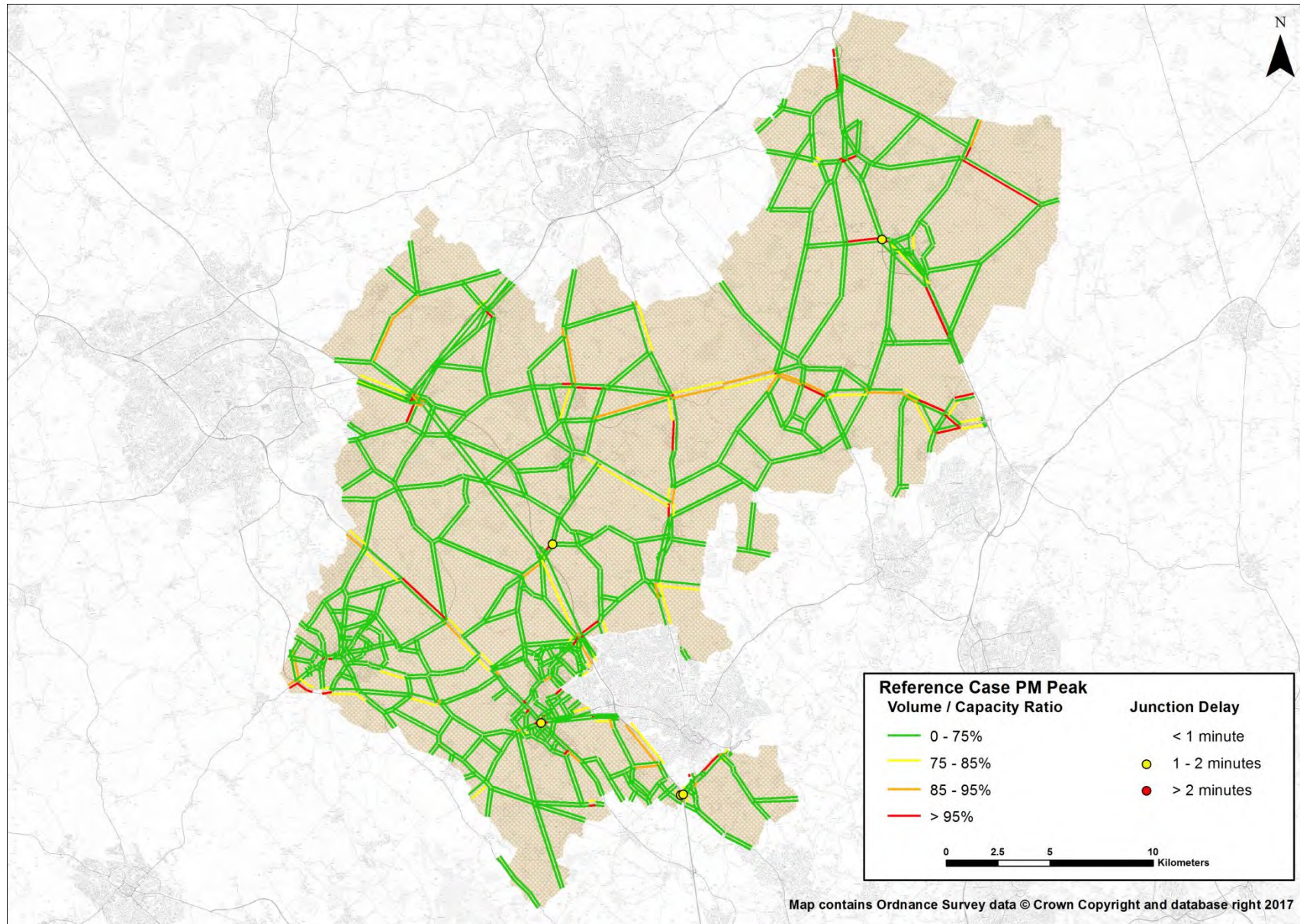




Figure 5: Link stress and Junction delays, 2035 Reference Case, PM



4.2.2 It should be noted that the Highway network will experience some stress with regards to the committed growth in Forecast Year 2035, as highlighted in **Table 5**. These areas of stress are not listed in any specific order.

**Table 5: Networks issues, 2035 Reference Case**

Location	Growth Area	Description	HS <sup>13</sup> Ref
A1 Black Cat	B	Traffic through this roundabout experiences in average between 4 min and 9 min delays depending on the time period. Most approaches to this roundabout show link stress. In particular, the A1 northbound approach is significantly congested (around 110% VoC with 1,650 PCU) in both peak hours. It should be noted that around half this traffic originates from Luton and C Beds.	1
Sandy	B	Access routes to the A1 show congestion during peak hour, and in particular: <ul style="list-style-type: none"> <li>▪ B1042: 100% VoC in AM and PM with 850 to 900 PCU; and</li> <li>▪ New Rd: 100% in AM with 250 PCU at the priority junction with the A1.</li> </ul>	3
A1 / B658 Hill Ln	B	Traffic through this roundabout experiences 1.5 min to 2 min delays in both AM and PM peaks. The B658 eastbound approach is at saturation (100% VoC) in both AM and PM peaks with respectively 650 PCU and 600 PCU. There is also congestion on the B658 westbound approach (95% / 105% VoC with 900 / 1,100 PCU in AM / PM respectively).	4A
A1 / A6001 London Rd	B	There is congestion on all approaches to this roundabout in both peak hours: <ul style="list-style-type: none"> <li>▪ A1 northbound: 80% VoC in AM (2,100 PCU) and 95% in PM (2,450 PCU);</li> <li>▪ A1 southbound: 85% VoC in AM (1,800 PCU) and 80% VoC in PM (1,600 PCU); and</li> <li>▪ A6001 southbound: 90% VoC in AM (1,050 PCU)</li> </ul>	4B
Stotfold	B	The urban area presents significant levels of stress and congestion (6 min delays in AM). However this is more likely due to the limited level of modelling details in this area, which should be explored further as the Local Plan work progresses.	5
A507 (Shefford)	D	There is some congestion in both directions between Clophill and Henlow, in both AM and PM peaks. In particular there is significant link stress south of Shefford (110% VoC in AM and 100% in PM) with up to 1,400 PCU in each direction.	7A
A507 (Stotfold)	B	There is congestion on the A507 as this route gives access to both the A1 and Stotfold urban area: <ul style="list-style-type: none"> <li>▪ AM eastbound: 85% VoC (1,800 PCU) towards A1(M) Junction 10; and</li> <li>▪ PM westbound: 105% VoC (1,600 PCU) towards Hitchin Rd.</li> </ul>	7B

<sup>13</sup> Hot Spot (HS) Reference number –see section 4.1.2 for more detail on 'hot spot'

Location	Growth Area	Description	HS <sup>13</sup> Ref
A6	D / A	<p>In peak hours, there are local congestion issues around specific junctions along the corridor e.g.:</p> <ul style="list-style-type: none"> <li>▪ A6 / Chapel End Rd: there is some congestion on the northbound approach in AM (75% VoC with 1,100 PCU)</li> <li>▪ A6 / A507: traffic through the roundabout experiences in average 1.5 min delay in AM and 1 min in PM. There is limited congestion on the northbound approach in PM (80% VoC with 950 PCU)</li> <li>▪ A6 / Barton Rd: the A6 reaches saturation in both AM and PM peaks. The peak direction varies depending on the time period; there is 95% VoC with 1,400 PCU southbound in AM and 105% VoC with 1,500 PCU northbound in PM. The SB approach also shows congestion in PM (90% VoC with 1,100 PCU).</li> <li>▪ A6 / Church Rd: the A6 is congested in the peak direction in each peak hour (100% VoC with 1,800 PCU southbound in AM and 90% VoC with 900 PCU northbound in PM)</li> </ul>	8
Amphill	D / A	<p>Approaches to the B530 / Church St junction are congested, and in particular:</p> <ul style="list-style-type: none"> <li>▪ B530 southbound: between 80% and 105% VoC with 750 to 950 PCU depending on the time period;</li> <li>▪ Church St westbound: between 80% and 100% VoC with 250 to 450 PCU depending on the time period; and</li> <li>▪ B530 eastbound: around 95% VoC in both peak periods with 300 PCU.</li> </ul>	9
M1 Junction 13	C	<p>Approaches to this junction are congested in both peak hours, and in particular:</p> <ul style="list-style-type: none"> <li>▪ A421 southbound: 80% VoC with 2,650 PCU in AM;</li> <li>▪ A421 eastbound: up to 100% VoC and 2,350 PCU depending on the time period; and</li> <li>▪ Bedford Rd northbound: up to 105% VoC and 500 PCU depending on the time period.</li> </ul>	10
M1 Junction 12	A	<p>Traffic on the A5120 to / from the M1 Junction 12 experiences congestion and delays during peak hours:</p> <ul style="list-style-type: none"> <li>▪ About 1 min junction delay in both AM and PM peaks; and</li> <li>▪ 105% VoC with 1,300 PCU westbound in AM and 105% VoC with 1,350 PCU eastbound in PM.</li> </ul>	11
A5 / A4012	A	<p>Approaches to this signalised junction are congested in both peak hours, and in particular:</p> <ul style="list-style-type: none"> <li>▪ A5 southbound: up to 100% VoC and 1,450 PCU;</li> <li>▪ A5 northbound: up to 90% VoC and 1,400 PCU depending on the time period; and</li> <li>▪ A4012 eastbound: 75% VoC with 500 PCU depending on the time period.</li> </ul>	12A
A5 (Dunstable)	A	<p>There are junction delays along the A5 across the urban area in both peak hours. In average, total delays are 3 min in AM and 2.5 min in PM. These delays would impact less than 1,400 PCU in each direction and time period.</p>	12C
North of Luton	A	<p>There is localised congestion in AM on Sundon Rd (100% VoC with 1,000 PCU southbound).</p>	13

Location	Growth Area	Description	HS <sup>13</sup> Ref
A4146 / A418	A	Approaches to this roundabout are congested in both peak hours, and in particular: <ul style="list-style-type: none"> <li>▪ A4146 southbound: up to 90% VoC with 1,250 PCU;</li> <li>▪ A4146 northbound: 80% VoC with 1,200 in AM, 100% VoC with 1,500 PCU in PM; and</li> <li>▪ A418 eastbound: up to 95% VoC with 1,300 PCU.</li> </ul>	14

### 4.3 Scenario 1

4.3.1 **Figure 6** and **Figure 7** present the VoC (i.e. link stress – see section 3.1.3 for more explanation) and junction delays for Scenario 1, in AM and PM peak respectively.



Figure 6: Link stress and Junction delays, Scenario 1, AM

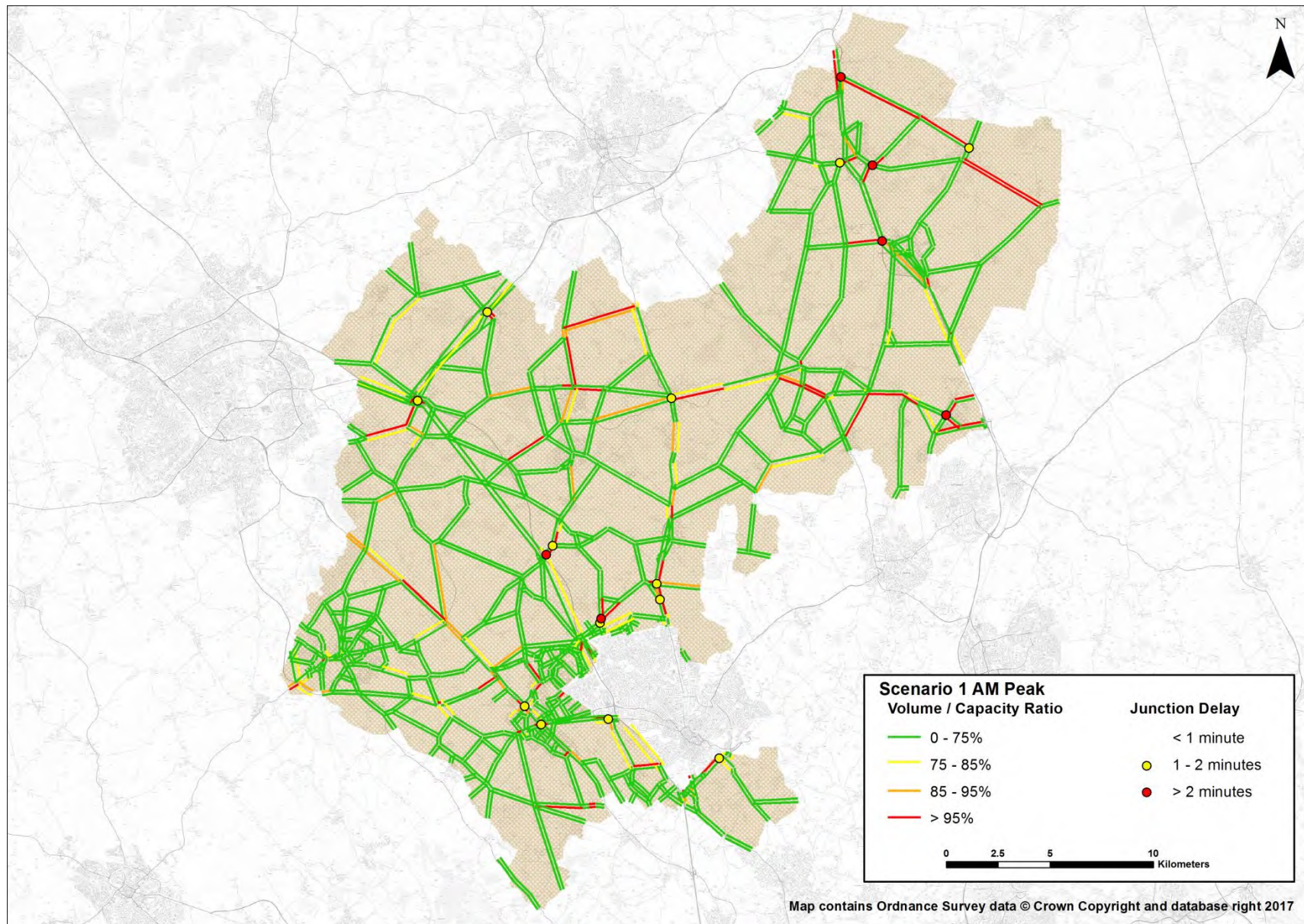
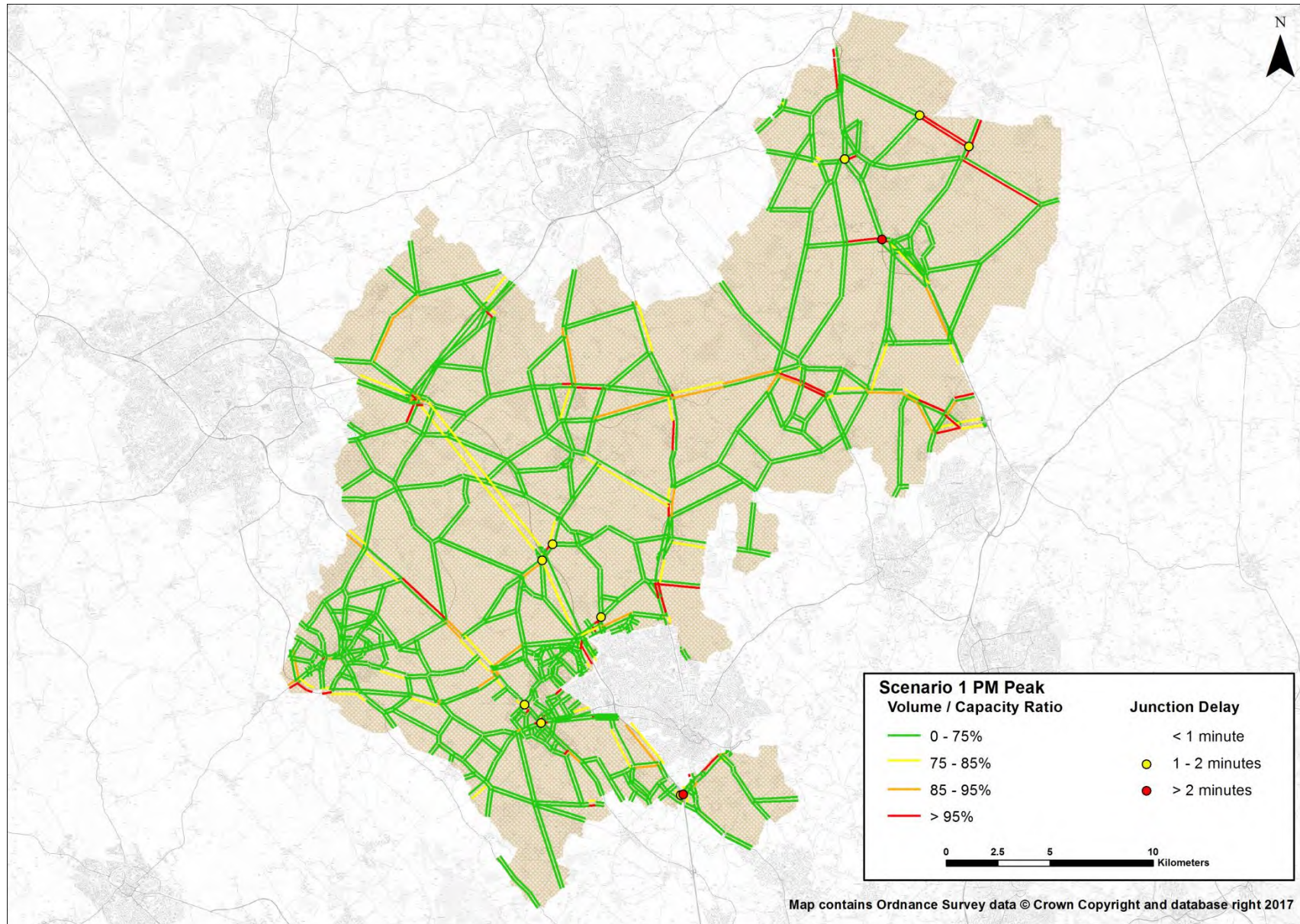




Figure 7: Link stress and Junction delays, Scenario 1, PM



4.3.2 **Table 6** summarises the Highway network issues observed as the result of Scenario 1’s transport infrastructure and Local Plan growth assumptions (compared to the 2035 Reference Case). These areas of stress are not listed in any specific order.

**Table 6: Networks issues, Scenario 1**

Location	Growth Area	Description	HS <sup>14</sup> Ref
North of Sandy	B / D	There is additional traffic on Tempsford Rd and Potton Rd due to the development site, which causes: <ul style="list-style-type: none"> <li>▪ Congestion on Tempsford Rd (110%VoC) in AM westbound;</li> <li>▪ Congestion on Potton Rd (120% / 100% VoC) caused by +500 PCU eastbound / +200 PCU westbound in AM / PM respectively; and</li> <li>▪ Additional delays: +4.5 min / +3 min in average across the corridor in AM / PM peak.</li> </ul>	2
Sandy	B	In terms of access to the A1: <ul style="list-style-type: none"> <li>▪ Both B1042 and New Rd experience the same level of saturation as in the 2035 Reference Case; and</li> <li>▪ There is additional congestion on St Neots Rd in AM (95% VoC), due to the additional traffic from the development site.</li> </ul> <p>There are also additional delays (+2 min) in AM at the B1042 / Swaden junction.</p>	3
A1 / B658 Hill Ln	B	Delays at this junction increase by +1 min in AM and +30s in PM due to additional traffic.	4A
Stotfold	B	There is a nominal decrease in delays in AM. However this is more likely due to the limited level of modelling details in this area, which should be explored further as the Local Plan work progresses.	5
Shillington	D	There is some congestion (up to 95% VoC) on High Rd in AM due to additional traffic (+200 PCU) from nearby development sites.	6
A507 (Stotfold)	B	There is some saturation (105% VoC) on the A507 towards the A1(M) Junction 10, due to additional traffic (+300 PCU eastbound) in AM.	7B
A6 / Church Rd	D	In both peak hours, the M1-A6 link attracts additional traffic which causes additional delays on the A6 between the new junction and the Church Rd junction (+2 min in AM and +1 min in PM). Changes in re-routeing mainly impact the A6 northbound with +500 / +200 PCU in AM / PM. This causes significant stress in both peak hours (up to 105% VoC). In PM, there is also an increase in traffic and saturation levels on the A6 southbound (+250 PCU for 85% VoC). These increases in traffic reduce the capacity of the A6 / Church Rd roundabout for each minor approach, which reach saturation (105% VoC) in AM (Church Rd, eastbound) and PM (Lilley, westbound).	8D
Ampthill	D / A	The B530 / Church St junction is operating close to saturation in the 2035 Reference Case. Impacts of the additional traffic to / from the Wixams development site are therefore limited: <ul style="list-style-type: none"> <li>▪ The main difference is on the northbound approach (Dunstable Rd), with 90% VoC (and +100 PCU) in AM; and</li> <li>▪ Residual capacity of the double mini roundabouts is further reduced.</li> </ul>	9

<sup>14</sup> Hot Spot (HS) Reference number –see section 4.1.2 for more detail on ‘hot spot’

Location	Growth Area	Description	HS <sup>14</sup> Ref
M1 Junction 13	C	<p>There is additional traffic to / from the Marston Vale and Aspley Guise development sites on the A421 and the M1 (up to +200 PCU SB in PM) which reduces capacity at this junction.</p> <p>Some of the eastbound traffic from the A421 therefore re-routes to less strategic routes e.g. the A5130 and the A5, particularly in the AM peak.</p> <p>As a result:</p> <ul style="list-style-type: none"> <li>▪ On the A421 southbound approach, congestion increases with 85% VoC / +250 PCU in AM and 75% VoC / +100 PCU in PM;</li> <li>▪ On the A421 eastbound approach, there is no particular congestion in AM (-400 PCU). However saturation is identical in PM; and</li> <li>▪ On the Bedford Rd northbound approach, there is additional traffic and saturation in AM (+150 PCU for 110% VoC). This causes additional queues which extend further south.</li> </ul>	10
M1 Junction 12	A	<p>There are additional delays (+2.5 min) in AM on the A5120 to / from the M1 Junction 12 following the introduction of the M1-A6 link (and the resulting re-routeing).</p>	11
A5 / A4012	A	<p>In AM, there is additional traffic (thus congestion) due to wider re-routeing (see M1 Junction 13) on both:</p> <ul style="list-style-type: none"> <li>▪ The A5 southbound: +100 PCU for 100% VoC; and</li> <li>▪ The A4012 southbound: +100 PCU for 85% VoC.</li> </ul>	12A
A5 / A505	A	<p>There is some additional traffic, particularly on the A5, which causes additional congestion and reduces capacity for the minor arms at this junction:</p> <ul style="list-style-type: none"> <li>▪ A5 northbound: +200 PCU in AM (85% VoC) and +100 PCU in PM (80% VoC); and</li> <li>▪ A505 eastbound: +50 to +100 PCU with 85% to 95% VoC.</li> </ul> <p>Congestion on the A5 southbound in PM is similar to the 2035 Reference Case.</p>	12B
A5 (Dunstable)	A	<p>There is some increase in traffic on the A5 northbound (between +100 and +200 PCU depending on the time period) which has no significant impact, with the exception of some additional congestion.</p>	12C
North of Luton	A	<p>Based on the current assumptions, some of the additional traffic from the North of Luton development site causes significant local stress to Sundon Rd:</p> <ul style="list-style-type: none"> <li>▪ Traffic through Sundon Rd experiences +4 min delays in AM and +2.5 min delays in PM;</li> <li>▪ Sundon Rd is operating at saturation in both AM southbound and PM northbound (100% VoC for 1,050 PCU in total); and</li> <li>▪ Both Church Rd and Manor Rd are also at saturation (110% VoC) in AM.</li> </ul>	13

#### 4.4 Scenario 1\*

4.4.1 **Figure 8** and **Figure 9** present the VoC (i.e. link stress – see section 3.1.3 for more explanation) and junction delays for Scenario 1\*, in AM and PM peak respectively.



Figure 8: Link stress and Junction delays, Scenario 1\*, AM

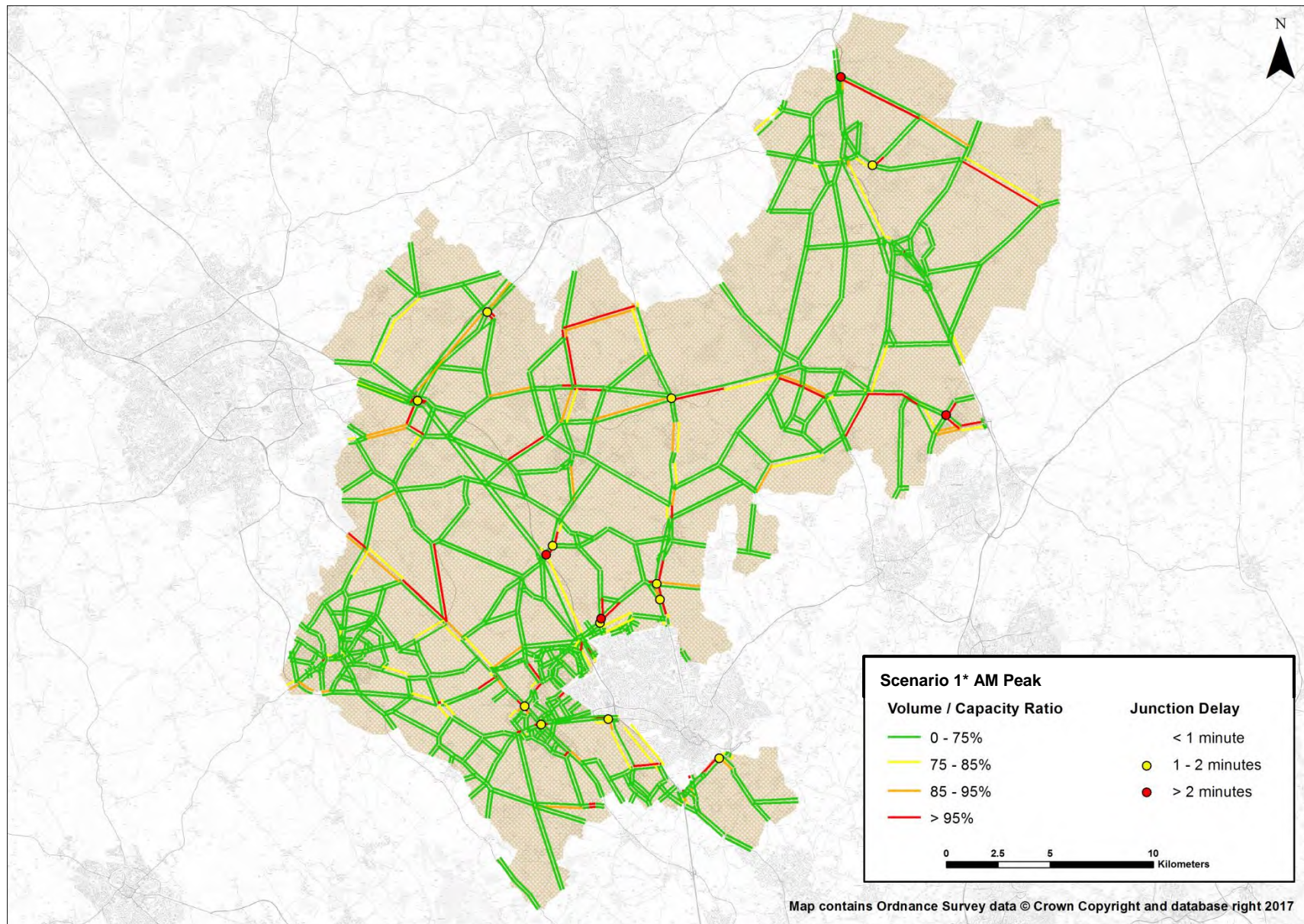
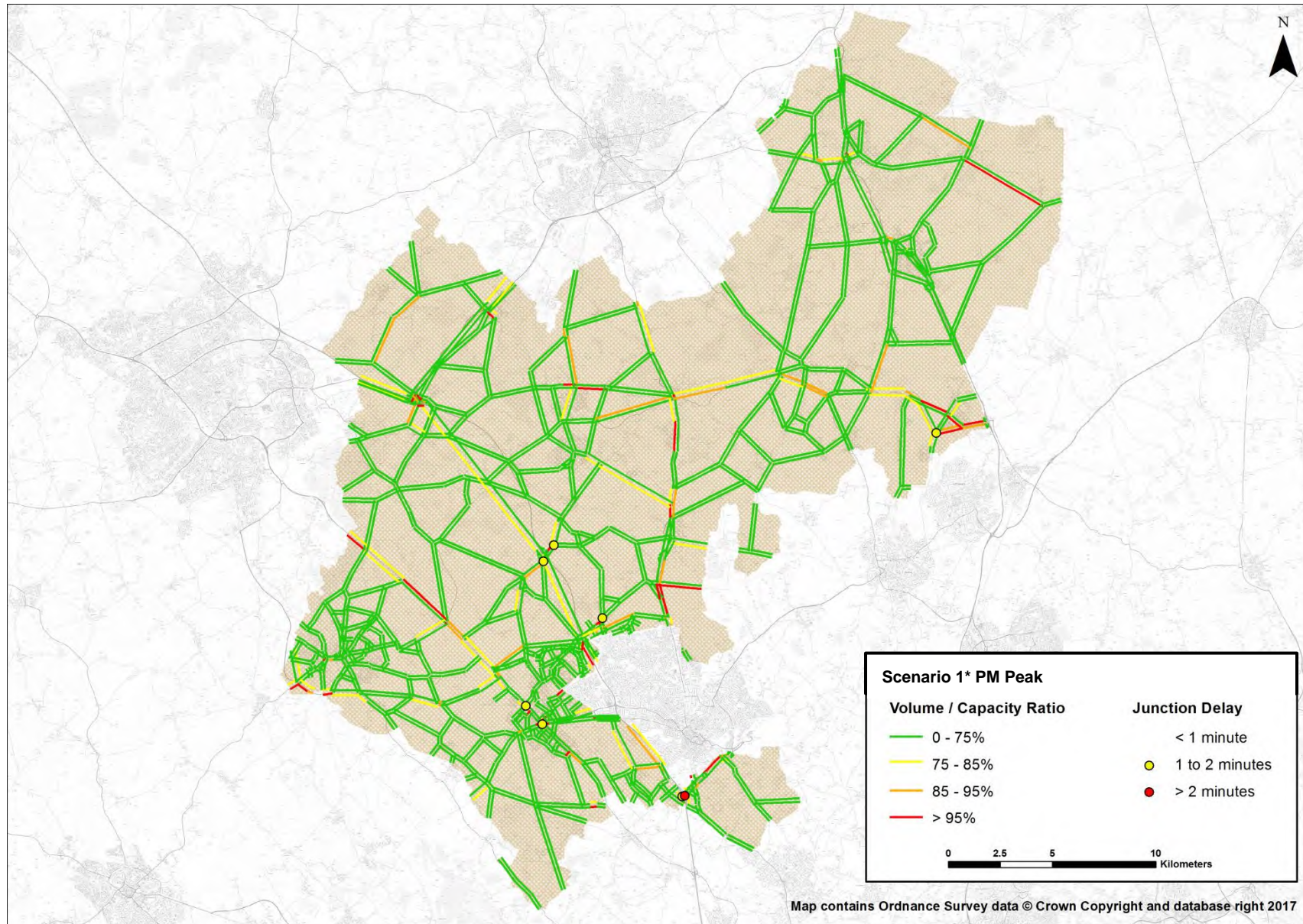




Figure 9: Link stress and Junction delays, Scenario 1\*, PM



4.4.2 **Table 7** summarises the Highway network issues observed as the result of Scenario 1\*\*s transport infrastructure and Local Plan growth assumptions (compared to Scenario 1). These areas of stress are not listed in any specific order.

**Table 7: Networks issues, Scenario 1\***

Location	Growth Area	Description	HS <sup>15</sup> Ref
A1 Black Cat	B	Grade separation at this junction causes a reduction in the average delays (-6 min in both AM and PM peaks).	1
North of Sandy	B / D	Changes to the A1 access in Sandy causes minor re-routing and flow reductions on Tempsford Rd (-50 PCU in AM) and Potton Rd (up to -100 PCU). However, this reduction does not cause significant improvements in terms of congestion or junction delays.	2
Sandy	B	Improvements on the A1 associated with grade-separated junctions provide additional capacity to both the A1 mainline and the feeding routes. There is therefore very limited congestion in Sandy urban area (with the exception of the Swaden approach to the B1042 in AM) and no significant junction delays.	3
A1 / B658 Hill Ln	B	Improvements on the A1 associated with grade-separated junctions provide additional capacity to both the A1 mainline and the feeding routes. There is therefore very limited congestion on the B658 and no significant junction delays.	4A
Stotfold	B	There are additional traffic and delays (+1.5 min) in AM. However this is more likely due to the limited level of modelling details in this area, which should be explored further as the Local Plan work progresses.	5
A507 (Stotfold)	B	Improvements on the A1 north of Junction 10 attract additional traffic to / from this junction. In particular in PM, there is additional stress (105% VoC) and delays (up to +1 min) on the A507 due to this additional traffic (+100 PCU westbound).	7B
M1 Junction 13	C	The ExpressWay attracts additional traffic on the A421 eastbound (+450 PCU in AM and +200 PCU in PM). This causes additional stress (90% to 105% VoC depending on the time period) and delays (+1 min in PM).	10

## 4.5 Scenario 2

4.5.1 **Figure 10** and **Figure 11** present the VoC (i.e. link stress – see section 3.1.3 for more explanation) and junction delays for Scenario 2, in AM and PM peak respectively.

<sup>15</sup> Hot Spot (HS) Reference number –see section 4.1.2 for more detail on 'hot spot'



Figure 10: Link stress and Junction delays, Scenario 2, AM

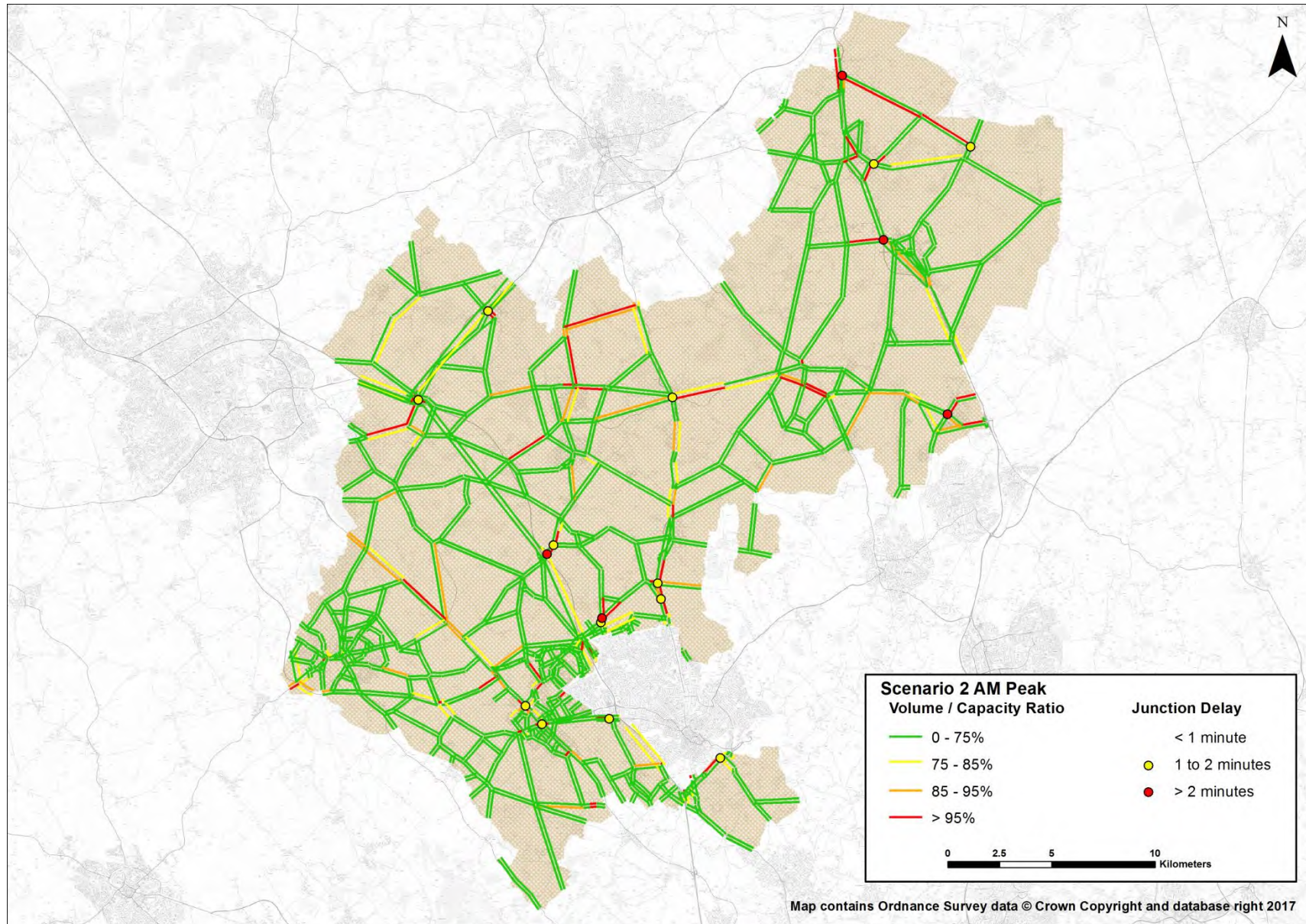
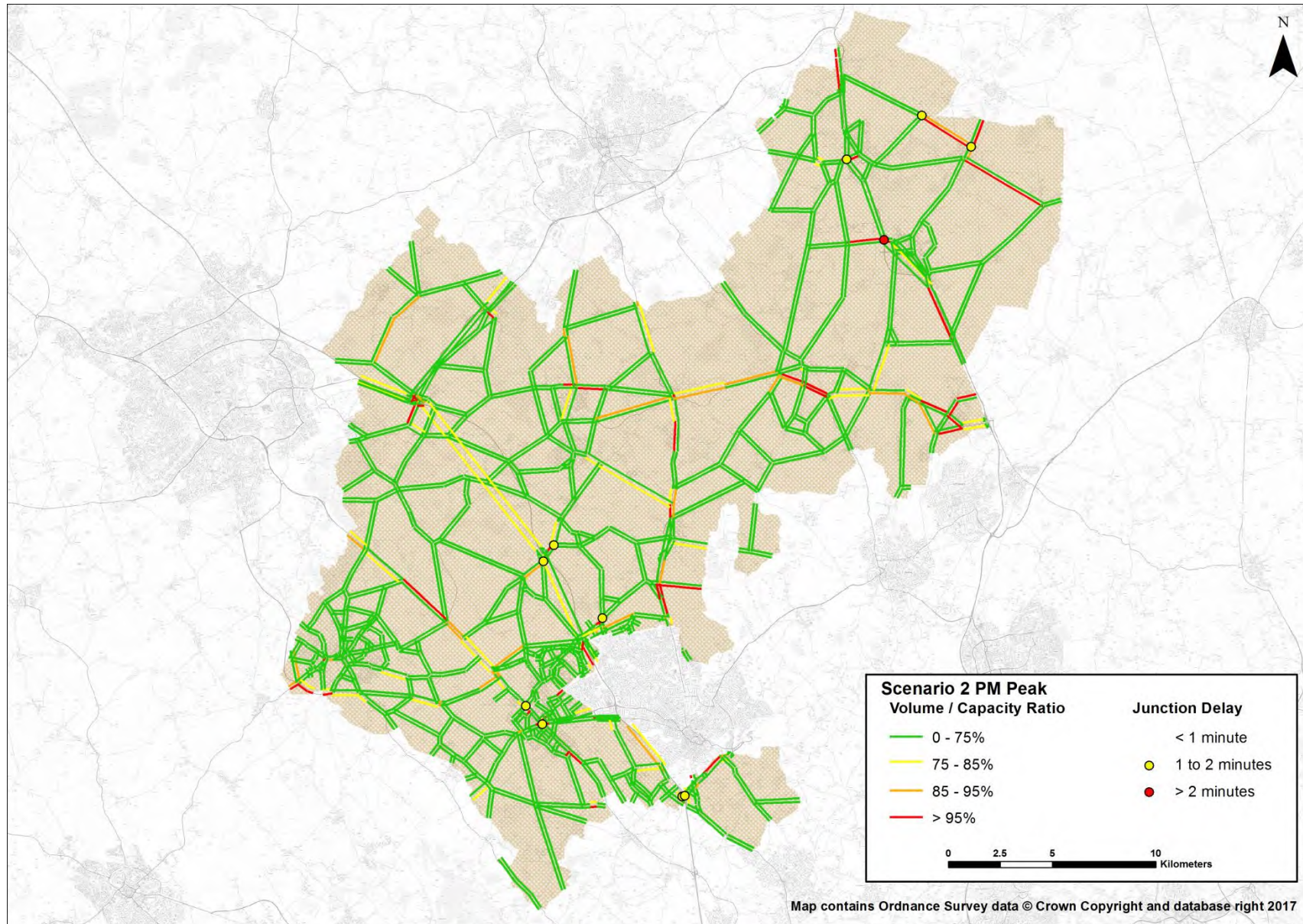




Figure 11: Link stress and Junction delays, Scenario 2, PM



4.5.2 **Table 8** summarises the Highway network issues observed as the result of Scenario 2's transport infrastructure and Local Plan growth assumptions (compared to the 2035 Reference Case). These areas of stress are not listed in any specific order.

**Table 8: Networks issues, Scenario 2**

Location	Growth Area	Description	HS <sup>16</sup> Ref
North of Sandy	B / D	There is additional traffic on Tempsford Rd and Potton Rd due to the development site, which causes: <ul style="list-style-type: none"> <li>▪ Congestion on Tempsford Rd (110%VoC) in AM westbound;</li> <li>▪ Congestion on Potton Rd (115% / 110% VoC) caused by +500 PCU eastbound / +400 PCU westbound in AM / PM respectively; and</li> <li>▪ Additional delays: +4.5 min / +1.5 min in average across the corridor in AM / PM peak.</li> </ul>	2
Sandy	B	In terms of access to the A1: <ul style="list-style-type: none"> <li>▪ Both B1042 and New Rd experience the same level of saturation as in the 2035 Reference Case; and</li> <li>▪ There is additional congestion on St Neots Rd in AM (105% VoC), due to the additional traffic from the development site.</li> </ul> <p>There are also additional delays (+2 min) in AM at the B1042 / Swaden junction.</p>	3
A1 / B658 Hill Ln	B	Delays at this junction increase by +1 min in AM and +30s in PM due to additional traffic.	4A
Stotfold	B	There is a nominal decrease in delays in AM. However this is more likely due to the limited level of modelling details in this area, which should be explored further as the Local Plan work progresses.	5
Shillington	D	There is some congestion (up to 90% VoC) on High Rd in AM due to additional traffic (+150 PCU) from nearby development sites.	6
A507 (Stotfold)	B	There is some saturation (100% VoC) on the A507 towards the A1(M) Junction 10, due to additional traffic (+300 PCU eastbound) in AM.	7B
A6 / Church Rd	D	In both peak hours, the M1-A6 link attracts additional traffic which causes additional delays on the A6 between the new junction and the Church Rd junction (+2 min in AM and +1 min in PM). Changes in re-routing mainly impact the A6 northbound with +500 / +200 PCU in AM / PM. This causes significant stress in both peak hours (up to 105% VoC). In PM, there is also an increase in traffic and saturation levels on the A6 southbound (+250 PCU for 85% VoC). These increases in traffic reduce the capacity of the A6 / Church Rd roundabout for both minor approaches, which reach saturation (105% VoC) in AM (Church Rd, eastbound) and PM (Lilley, westbound).	8D
Ampthill	D / A	The B530 / Church St junction is operating close to saturation in the 2035 Reference Case. Impacts of the additional traffic to / from the Wixams development site are therefore limited: <ul style="list-style-type: none"> <li>▪ The main difference is on the northbound approach (Dunstable Rd), with 90% VoC (and +100 PCU) in AM; and</li> <li>▪ Residual capacity of the double mini roundabouts is further reduced.</li> </ul>	9

<sup>16</sup> Hot Spot (HS) Reference number –see section 4.1.2 for more detail on 'hot spot'



Location	Growth Area	Description	HS <sup>16</sup> Ref
M1 Junction 13	C	<p>There is additional traffic to / from the Marston Vale and Aspley Guise development sites on the A421 and the M1 (up to +250 PCU SB in PM) which reduces capacity at this junction.</p> <p>Some of the eastbound traffic from the A421 therefore re-routes to less strategic routes e.g. the A5130 and the A5, particularly in the AM peak.</p> <p>As a result:</p> <ul style="list-style-type: none"> <li>▪ On the A421 southbound approach, congestion increases in AM only with 85% VoC / +250 PCU;</li> <li>▪ On the A421 eastbound approach, there is no particular congestion in AM (-350 PCU). However saturation is identical in PM; and</li> <li>▪ On the Bedford Rd northbound approach, there is additional traffic and saturation in AM (+150 PCU for 110% VoC). This causes additional queues which extend congestion further south.</li> </ul>	10
M1 Junction 12	A	<p>There are additional delays (+2.5 min) in AM on the A5120 to / from the M1 Junction 12 following the introduction of the M1-A6 link (and the resulting re-routeing).</p>	11
A5 / A4012	A	<p>In AM, there is additional traffic (thus congestion) due to wider re-routeing (see M1 Junction 13) on both:</p> <ul style="list-style-type: none"> <li>▪ The A5 southbound: +100 PCU for 100% VoC; and</li> <li>▪ The A4012 southbound: +100 PCU for 90% VoC.</li> </ul>	12A
A5 / A505	A	<p>There is some additional traffic, particularly on the A5, which causes additional congestion and reduces capacity for the minor arms at this junction:</p> <ul style="list-style-type: none"> <li>▪ A5 northbound: +200 PCU in AM (85% VoC) and +100 PCU in PM (80% VoC); and</li> <li>▪ A505 eastbound: +50 to +100 PCU with 85% to 95% VoC.</li> </ul> <p>Congestion on the A5 southbound in PM is similar to the 2035 Reference Case.</p>	12B
A5 (Dunstable)	A	<p>There is some increase in traffic on the A5 northbound (between +100 and +200 PCU depending on the time period) which has no significant impact, with the exception of some additional congestion.</p>	12C
North of Luton	A	<p>Based on the current assumptions, some of the additional traffic from the North of Luton development site causes significant local stress to Sundon Rd:</p> <ul style="list-style-type: none"> <li>▪ Traffic through Sundon Rd experiences +3.5 min delays in AM and +1.5 min delays in PM;</li> <li>▪ Sundon Rd is operating at saturation in both AM southbound and PM northbound (105% VoC for 1,050 PCU in total); and</li> <li>▪ Both Church Rd and Manor Rd are at saturation (110% VoC) in AM.</li> </ul>	13

## 4.6 Scenario 3

4.6.1 **Figure 12** and **Figure 13** present the VoC (i.e. link stress – see section 3.1.3 for more explanation) and junction delays for Scenario 3, in AM and PM peak respectively.

Figure 12: Link stress and Junction delays, Scenario 3, AM

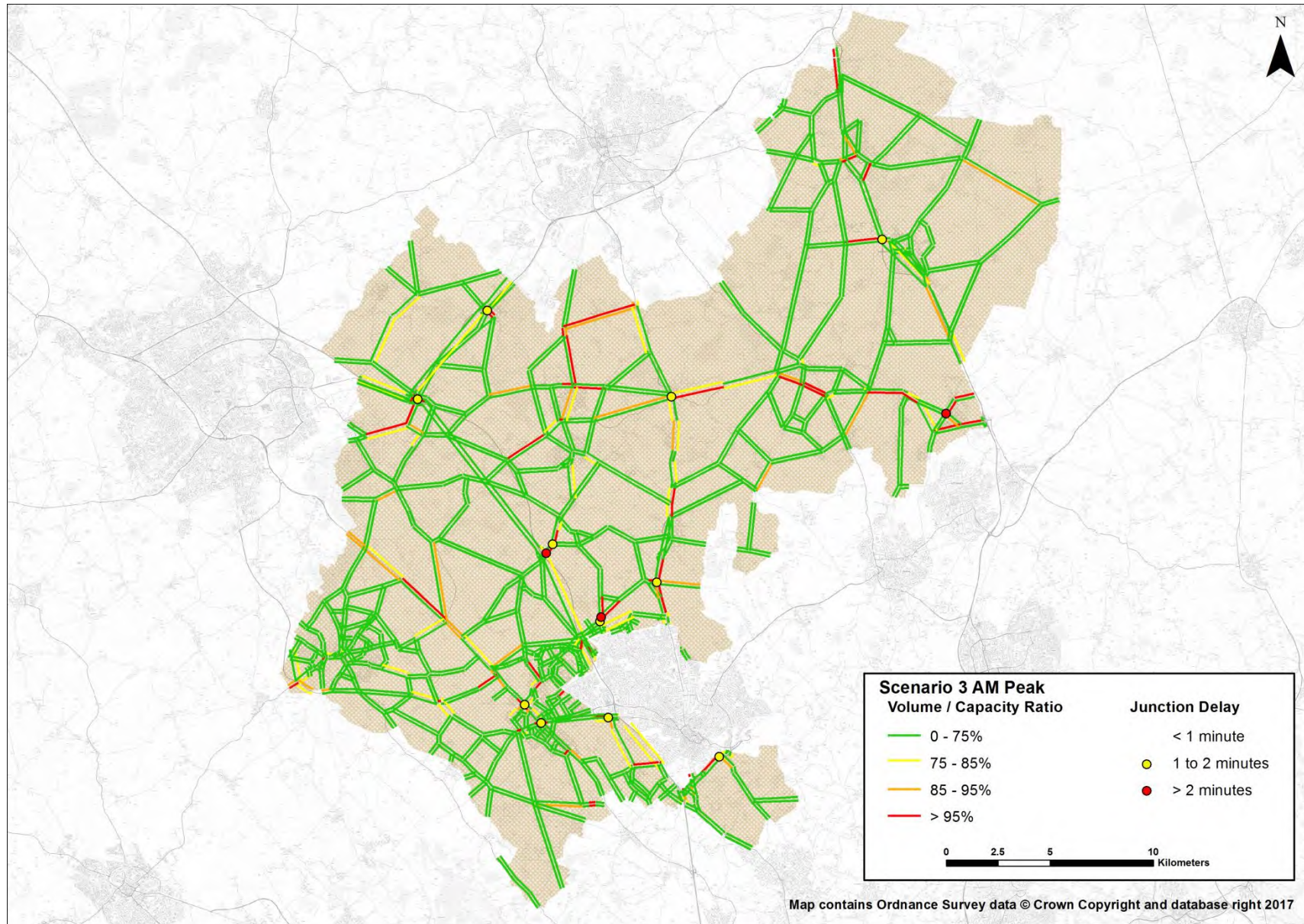
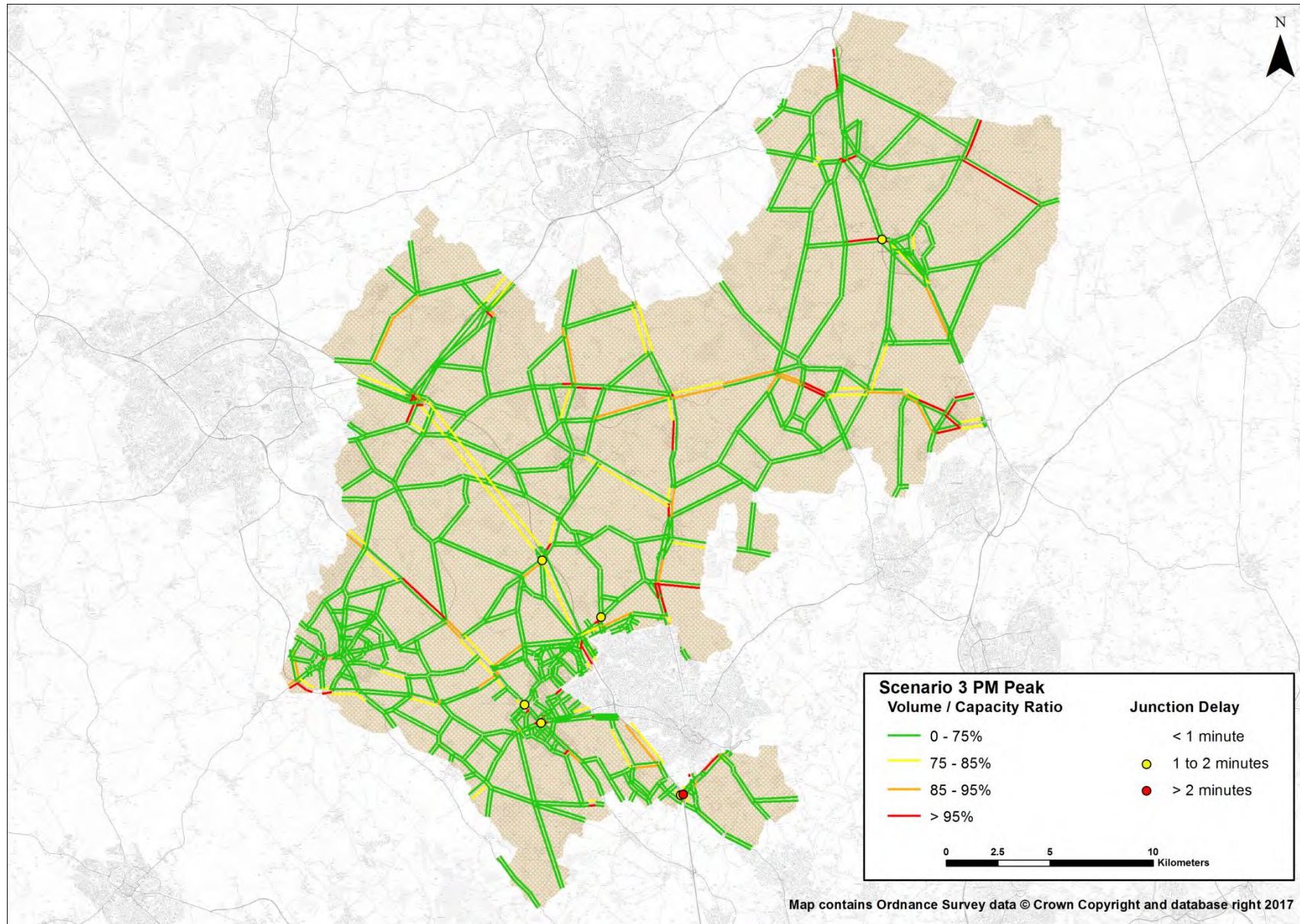




Figure 13: Link stress and Junction delays, Scenario 3, PM





4.6.2 **Table 9** summarises the Highway network issues observed as the result of Scenario 3's transport infrastructure and Local Plan growth assumptions (compared to the 2035 Reference Case). These areas of stress are not listed in any specific order.

**Table 9: Networks issues, Scenario 3**

Location	Growth Area	Description	HS <sup>17</sup> Ref
Shillington	D	There is some congestion (up to 90% VoC) on High Rd in AM due to additional traffic (+150 PCU) from nearby development sites.	6
A507 (Stotfold)	B	There is some saturation (100% VoC) on the A507 towards the A1(M) Junction 10, due to additional traffic (+300 PCU eastbound) in AM.	7B
A6 / Church Rd	D	In both peak hours, the M1-A6 link attracts additional traffic which causes additional delays on the A6 between the new junction and the Church Rd junction (+1 min in both AM and PM). Changes in re-routeing mainly impact the A6 northbound with +550 / +200 PCU in AM / PM. This causes significant stress in both peak hours (95% VoC). In PM, there is also an increase in traffic and saturation levels on the A6 southbound (+250 PCU for 85% VoC). These increases in traffic reduce the capacity of the A6 / Church Rd roundabout for both minor approaches, which reach saturation (105% VoC) in AM (Church Rd, eastbound) and PM (Lilley, westbound).	8D
Amphill	D / A	The B530 / Church St junction is operating close to saturation in the 2035 Reference Case. Impacts of the additional traffic to / from the Wixams development site are therefore limited: <ul style="list-style-type: none"> <li>▪ The main difference is on the northbound approach (Dunstable Rd), with 90% VoC (and +100 PCU) in AM; and</li> <li>▪ Residual capacity of the double mini roundabouts is further reduced.</li> </ul>	9
M1 Junction 13	C	There is additional traffic to / from the Marston Vale and Aspley Guise development sites on the A421 and the M1 (up to +250 PCU SB in PM) which reduces capacity at this junction. Some of the eastbound traffic from the A421 therefore re-routes to less strategic routes e.g. the A5130 and the A5, particularly in the AM peak. As a result: <ul style="list-style-type: none"> <li>▪ On the A421 southbound approach, congestion increases in AM only with 85% VoC / +150 PCU;</li> <li>▪ On the A421 eastbound approach, there is no particular congestion in AM (-300 PCU). However saturation is identical in PM; and</li> <li>▪ On the Bedford Rd northbound approach, there is additional traffic and saturation in AM (+150 PCU for 110% VoC). This causes additional queues which extend further south.</li> </ul>	10
M1 Junction 12	A	There are additional delays (+2 min) in AM on the A5120 to / from the M1 Junction 12 following the introduction of the M1-A6 link. This is mainly due to re-routeing (+150 PCU southbound in AM).	11
A5 / A4012	A	In AM, there is additional traffic (thus congestion) due to wider re-routeing (see M1 Junction 13) on both: <ul style="list-style-type: none"> <li>▪ The A5 southbound: +100 PCU for 100% VoC; and</li> <li>▪ The A4012 southbound: +100 PCU for 85% VoC.</li> </ul>	12A

<sup>17</sup> Hot Spot (HS) Reference number –see section 4.1.2 for more detail on 'hot spot'

Location	Growth Area	Description	HS <sup>17</sup> Ref
A5 / A505	A	<p>There is some additional traffic, particularly on the A5, which causes additional congestion and reduces capacity for the minor arms at this junction:</p> <ul style="list-style-type: none"> <li>▪ A5 northbound: +200 PCU in AM (85% VoC) and +100 PCU in PM (80% VoC); and</li> <li>▪ A505 eastbound: +50 to +100 PCU with 85% to 95% VoC.</li> </ul> <p>Congestion on the A5 southbound in PM is similar to the 2035 Reference Case.</p>	12B
A5 (Dunstable)	A	<p>There is some increase in traffic on the A5 northbound (between +100 and +200 PCU depending on the time period) which has no significant impact, with the exception of some additional congestion.</p>	12C
North of Luton	A	<p>Based on the current assumptions, some of the additional traffic from the North of Luton development site causes significant local stress to Sundon Rd:</p> <ul style="list-style-type: none"> <li>▪ Traffic through Sundon Rd experiences +3.5 min delays in AM and +1.5 min delays in PM;</li> <li>▪ Sundon Rd is operating at saturation in both AM southbound and PM northbound (110% VoC for 1,050 PCU in total); and</li> <li>▪ Both Church Rd and Manor Rd are at saturation (105% to 110% VoC) in AM.</li> </ul>	13

## 4.7 Scenario 4

4.7.1 **Figure 14** and **Figure 15** present the VoC (i.e. link stress – see section 3.1.3 for more explanation) and junction delays for Scenario 4, in AM and PM peak respectively.

Figure 14: Link stress and Junction delays, Scenario 4, AM

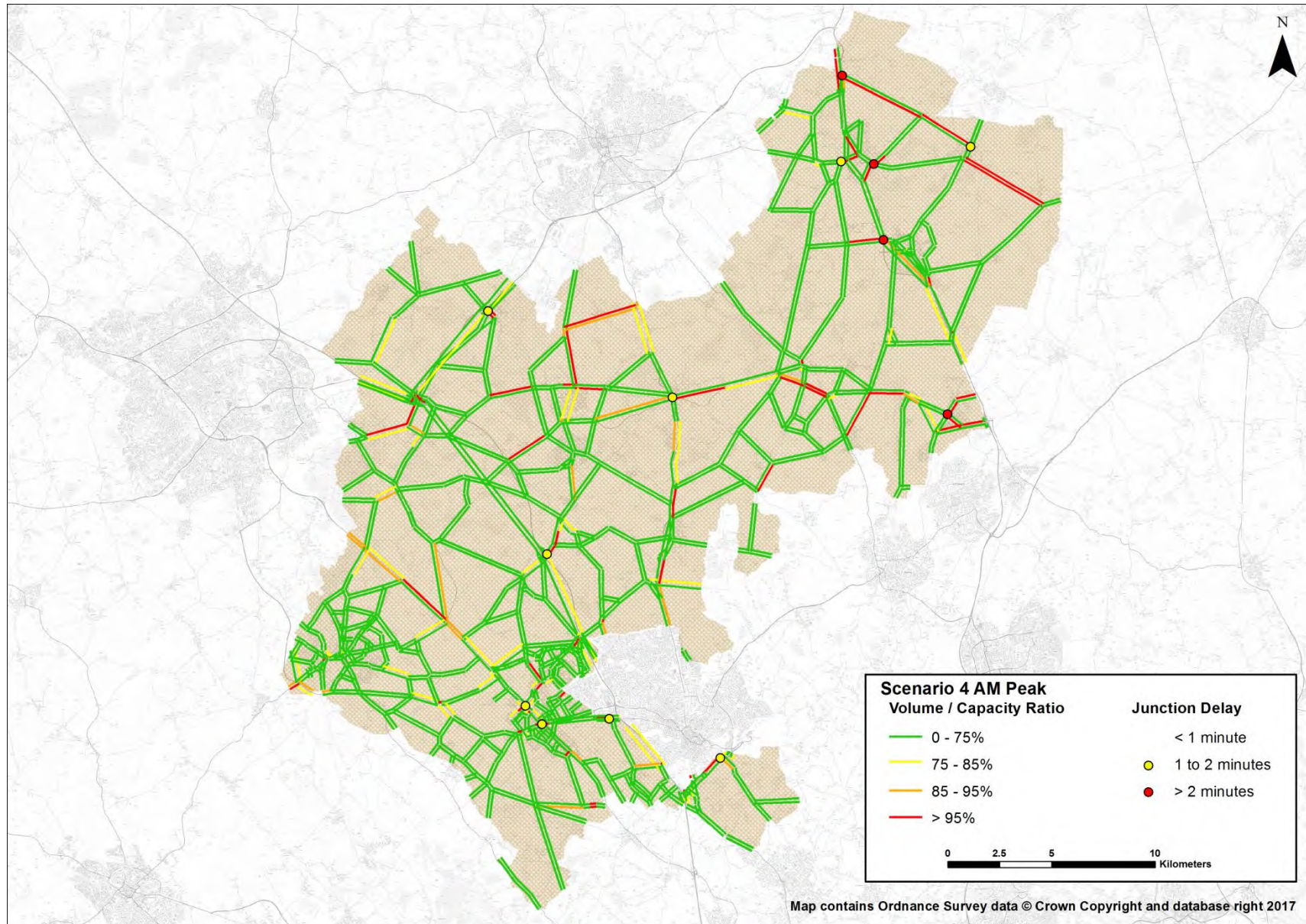
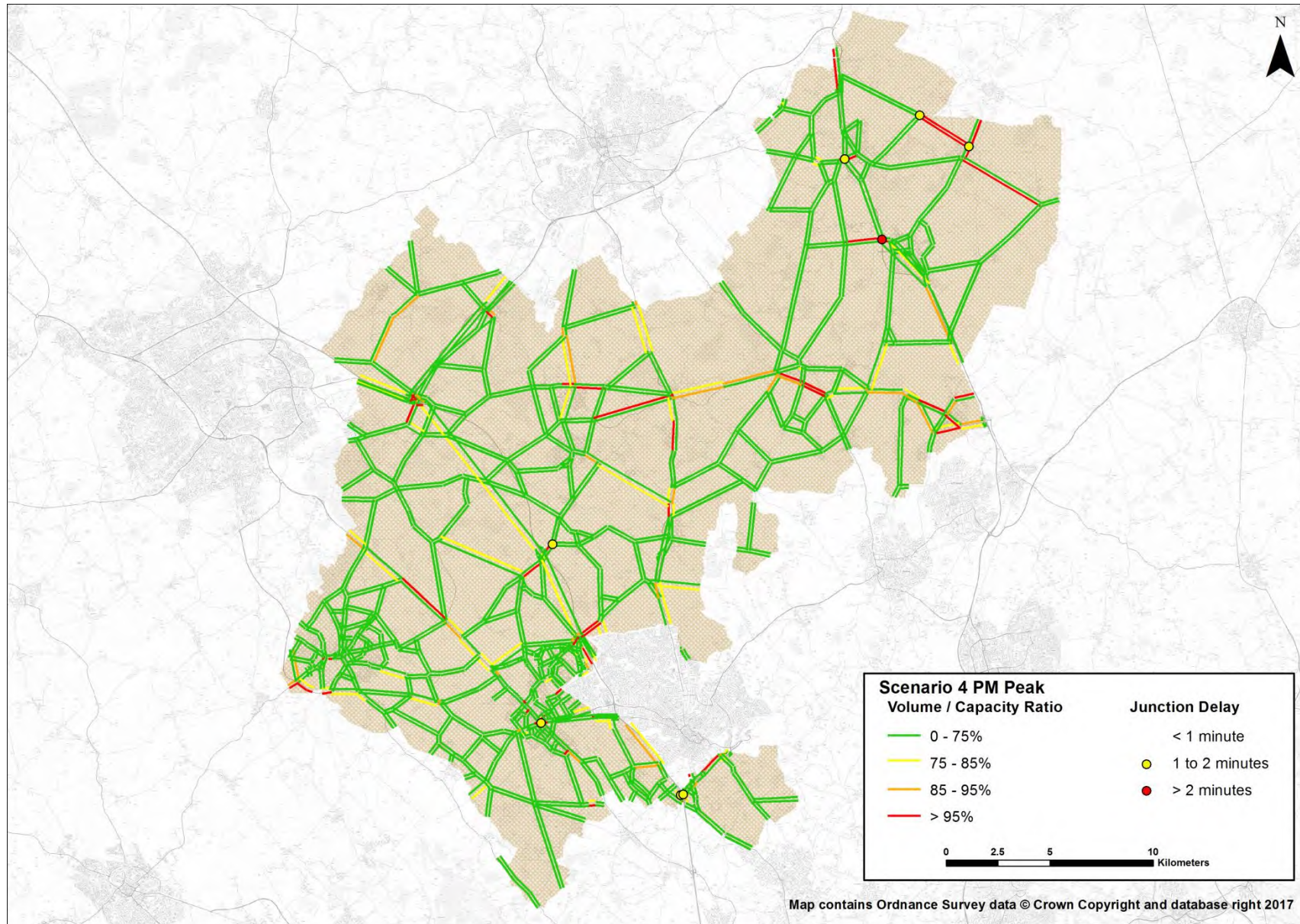




Figure 15: Link stress and Junction delays, Scenario 4, PM



4.7.2 **Table 10** summarises the Highway network issues observed as the result of Scenario 4’s transport infrastructure and Local Plan growth assumptions (compared to the 2035 Reference Case). These areas of stress are not listed in any specific order.

**Table 10: Networks issues, Scenario 4**

Location	Growth Area	Description	HS <sup>18</sup> Ref
North of Sandy	B / D	There is additional traffic on Tempsford Rd and Potton Rd due to the development sites, which causes: <ul style="list-style-type: none"> <li>▪ Congestion on Tempsford Rd (110%VoC) in AM westbound;</li> <li>▪ Congestion on Potton Rd (120% / 105% VoC) caused by +550 PCU eastbound / +450 PCU westbound in AM / PM respectively; and</li> <li>▪ Additional delays: +4.5 min / +2 min in average across the corridor in AM / PM peak.</li> </ul>	2
Sandy	B	In terms of access to the A1: <ul style="list-style-type: none"> <li>▪ Both B1042 and New Rd experience the same level of saturation as in the 2035 Reference Case; and</li> <li>▪ There is additional congestion on St Neots Rd in AM (95% VoC), due to the additional traffic from the development site.</li> </ul> <p>There are also additional delays (+2 min) in AM at the B1042 / Swaden junction.</p>	3
A1 / B658 Hill Ln	B	Delays at this junction increase by +1 min in both AM and PM peaks due to additional traffic.	4A
Stotfold	B	There is a nominal decrease in delays in AM. However this is more likely due to the limited level of modelling details in this area, which should be explored further as the Local Plan work progresses.	5
Shillington	D	There is some congestion (up to 95% VoC) on High Rd in AM due to additional traffic (+200 PCU) from nearby development sites.	6
A507 (Stotfold)	B	There is some saturation (100% VoC) on the A507 towards the A1(M) Junction 10, due to additional traffic (+300 PCU eastbound) in AM.	7B
Amphill	D / A	The B530 / Church St junction is operating close to saturation in the 2035 Reference Case. Impacts of the additional traffic to / from the Wixams development site are therefore limited: <ul style="list-style-type: none"> <li>▪ The main difference is on the northbound approach (Dunstable Rd), with 85% VoC (and +50 PCU) in AM; and</li> <li>▪ Residual capacity of the double mini roundabouts is further reduced.</li> </ul>	9
M1 Junction 13	C	There is additional traffic to / from the Marston Vale and Aspley Guise development sites on the A421 and the M1 (up to +250 PCU NB in PM) which reduces capacity at this junction. Some of the eastbound traffic from the A421 therefore re-routes to less strategic routes e.g. the A5130 and the A5, particularly in the AM peak. As a result: <ul style="list-style-type: none"> <li>▪ On the A421 southbound approach, congestion increases in AM only with 85% VoC / +200 PCU;</li> <li>▪ On the A421 eastbound approach, there is no particular congestion in AM (-350 PCU). However saturation is identical in PM; and</li> <li>▪ On the Bedford Rd northbound approach, there is additional traffic and saturation in AM (+100 PCU for 110% VoC). This causes additional queues which extend further south.</li> </ul>	10

<sup>18</sup> Hot Spot (HS) Reference number –see section 4.1.2 for more detail on ‘hot spot’

Location	Growth Area	Description	HS <sup>18</sup> Ref
A5 / A4012	A	In AM, there is additional traffic (thus congestion) due to wider re-routeing (see M1 Junction 13) on both: <ul style="list-style-type: none"> <li>▪ The A5 southbound: +100 PCU for 100% VoC; and</li> <li>▪ The A4012 southbound: +100 PCU for 90% VoC.</li> </ul>	12A

## 4.8 Scenario 5

4.8.1 **Figure 16** and **Figure 17** present the VoC (i.e. link stress – see section 3.1.3 for more explanation) and junction delays for Scenario 5, in AM and PM peak respectively.



Figure 16: Link stress and Junction delays, Scenario 5, AM

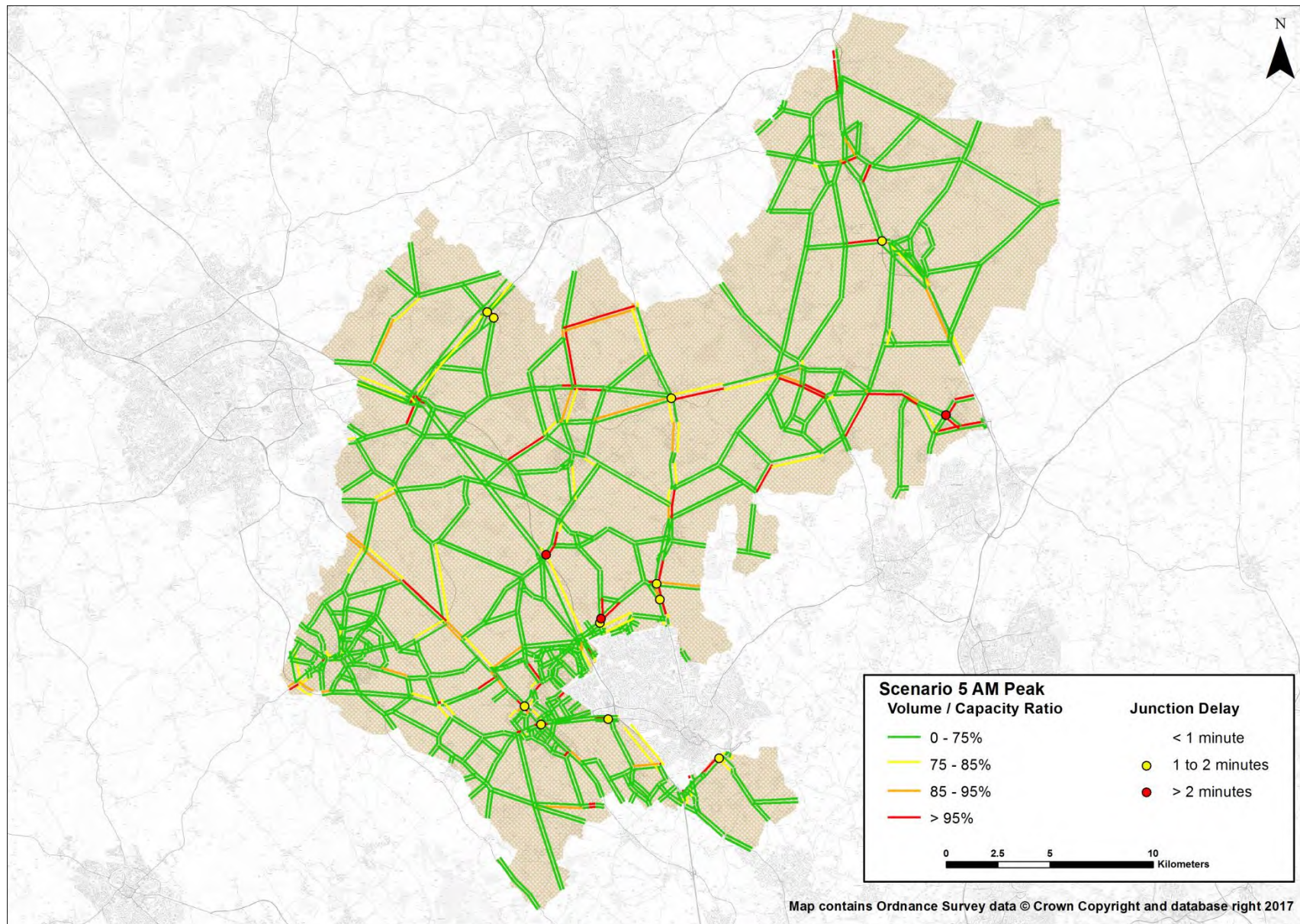
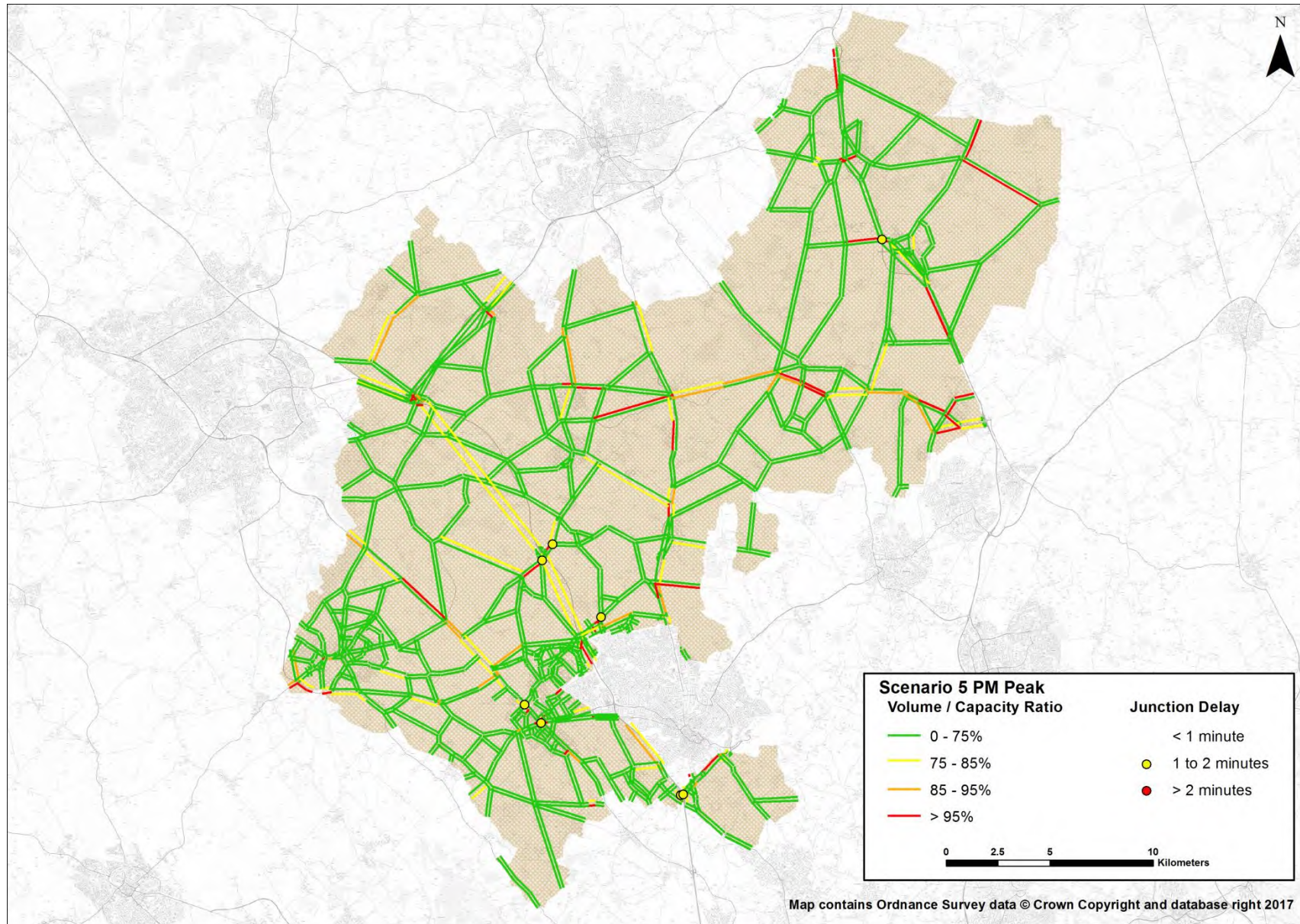




Figure 17: Link stress and Junction delays, Scenario 5, PM



4.8.2 **Table 11** summarises the Highway network issues observed as the result of Scenario 5’s transport infrastructure and Local Plan growth assumptions (compared to the 2035 Reference Case). These areas of stress are not listed in any specific order.

**Table 11: Networks issues, Scenario 5**

Location	Growth Area	Description	HS <sup>19</sup> Ref
Stotfold	B	There is a nominal increase in delays in AM. However this is more likely due to the limited level of modelling details in this area, which should be explored further as the Local Plan work progresses.	5
Shillington	D	There is some congestion (up to 95% VoC) on High Rd in AM due to additional traffic (+200 PCU) from nearby development sites.	6
A507 (Stotfold)	B	There is some saturation (100% VoC) on the A507 towards the A1(M) Junction 10, due to additional traffic (+300 PCU eastbound) in AM.	7B
A6 / Church Rd	D	In both peak hours, the M1-A6 link attracts additional traffic which causes additional delays on the A6 between the new junction and the Church Rd junction (+2 min in AM and +1 min in PM). Changes in re-routeing mainly impact the A6 northbound with +500 / +200 PCU in AM / PM. This causes significant stress in both peak hours (up to 105% VoC). In PM, there is also an increase in traffic and saturation levels on the A6 southbound (+250 PCU for 85% VoC). These increases in traffic reduce the capacity of the A6 / Church Rd roundabout for both minor approaches, which reach saturation (105% VoC) in AM (Church Rd, eastbound) and PM (Lilley, westbound).	8D
Ampthill	D / A	The B530 / Church St junction is operating close to saturation in the 2035 Reference Case. Impacts of the additional traffic to / from the Wixams development site are therefore limited: <ul style="list-style-type: none"> <li>▪ The main difference is on the northbound approach (Dunstable Rd), with 90% VoC (and +100 PCU) in AM; and</li> <li>▪ Residual capacity of the double mini roundabouts is further reduced.</li> </ul>	9
M1 Junction 13	C	There is additional traffic to / from the Marston Vale development site on the A421 and the M1 (up to +300 PCU SB in PM) which reduces capacity at this junction. Some of the eastbound traffic from the A421 therefore re-routes to less strategic routes e.g. the A5130 and the A5, particularly in the AM peak. As a result: <ul style="list-style-type: none"> <li>▪ On the A421 southbound approach, congestion increases in AM only with 85% VoC / +200 PCU;</li> <li>▪ On the A421 eastbound approach, there is no particular congestion in AM (-300 PCU). However saturation is identical in PM; and</li> <li>▪ On the Bedford Rd northbound approach, there is additional traffic and saturation in AM (+150 PCU for 105% VoC).</li> </ul>	10
M1 Junction 12	A	There are additional delays (+2.5 min) in AM on the A5120 to / from the M1 Junction 12 following the introduction of the M1-A6 link (and the resulting re-routeing).	11
A5 / A4012	A	In AM, there is additional traffic (thus congestion) due to wider re-routeing (see M1 Junction 13) on both: <ul style="list-style-type: none"> <li>▪ The A5 southbound: +100 PCU for 100% VoC; and</li> <li>▪ The A4012 southbound: +50 PCU for 80% VoC.</li> </ul>	12A

<sup>19</sup> Hot Spot (HS) Reference number –see section 4.1.2 for more detail on ‘hot spot’



Location	Growth Area	Description	HS <sup>19</sup> Ref
A5 / A505	A	There is some additional traffic, particularly on the A5, which causes additional congestion and reduces capacity for the minor arms at this junction: <ul style="list-style-type: none"> <li>▪ A5 northbound: +200 PCU in AM (90% VoC) and +100 PCU in PM (80% VoC); and</li> <li>▪ A505 eastbound: +50 to +100 PCU with 85% to 100% VoC.</li> </ul> Congestion on the A5 southbound in PM is similar to the 2035 Reference Case.	12B
A5 (Dunstable)	A	There is some increase in traffic on the A5 northbound (between +100 and +200 PCU depending on the time period) which has no significant impact, with the exception of some additional congestion.	12C
North of Luton	A	Based on the current assumptions, some of the additional traffic from the North of Luton development site causes significant local stress to Sundon Rd: <ul style="list-style-type: none"> <li>▪ Traffic through Sundon Rd experiences +3.5 min delays in AM and +1.5 min delays in PM;</li> <li>▪ Sundon Rd is operating at saturation in both AM southbound and PM northbound (110% VoC for 1,050 PCU in total); and</li> <li>▪ Both Church Rd and Manor Rd are at saturation (110% VoC) in AM.</li> </ul>	13

## 5. Conclusions

### 5.1 Summary – Overall

5.1.1 **Table 12** and **Table 13** present the summary statistics across the CBLTM simulation network for both peak hours.

**Table 12: Network Statistics, AM**

Statistics	Ref. Case	Sc. 1	Sc. 1*	Sc. 2	Sc. 3	Sc. 4	Sc. 5
Total Travel Time (PCU-hr)	53,800	57,200	56,900	56,700	56,200	56,400	56,300
Travel Distance (PCU-km)	2,723,800	2,826,700	2,891,100	2,813,400	2,803,200	2,797,800	2,802,200
Average Speed (kph)	51	49	51	50	50	50	50

**Table 13: Network Statistics, PM**

Statistics	Ref. Case	Sc. 1	Sc. 1*	Sc. 2	Sc. 3	Sc. 4	Sc. 5
Total Travel Time (PCU-hr)	52,300	55,000	54,700	54,500	54,100	54,400	54,200
Travel Distance (PCU-km)	2,731,700	2,821,100	2,902,400	2,807,300	2,797,500	2,798,700	2,800,200
Average Speed (kph)	52	51	53	52	52	51	52

5.1.2 In average, speeds across Central Bedfordshire and Luton are higher (up to +2 kph) in the PM peak than in the AM, indicating that traffic flows are travelling faster in the evening peak hour within this area.

5.1.3 Additional growth in the Local Plan scenarios causes some reduction to average speeds (-4% for Scenario 1 in AM). However, the transport infrastructure schemes considered in Scenario 1\* increase the average travel speed (+2 kph compared to Scenario 1 in both peak hours).

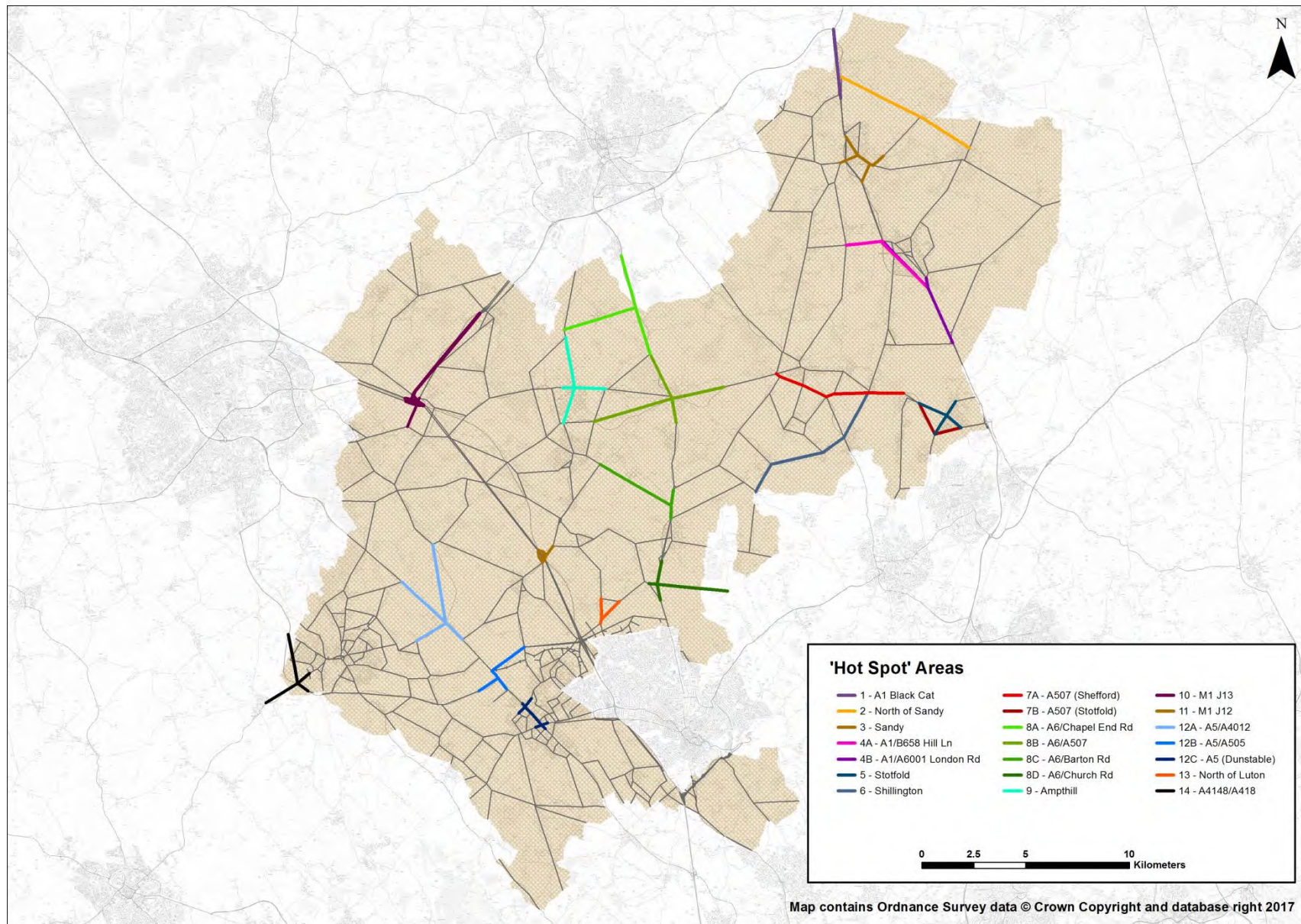
### 5.2 Summary – Hot Spots

5.2.1 **Figure 18** presents the twenty 'hot spots' identified across Central Bedfordshire, following analysis of the 2035 Reference Case and the five Local Plan growth scenarios.

5.2.2 **Table 14** presents a summary of the network issues (i.e. 'hot spots') and provides for each:

- Information on whether the issue occurs in the 2035 Reference Case scenario (highlighted **yellow**);
- Information on the issue's evolution in each scenario compared to the 2035 Reference Case:
  - “=” indicates stable conditions, highlighted **yellow** where relevant;
  - “+” indicates worsens traffic conditions, highlighted **orange** where relevant;
  - “-“ indicates improved traffic conditions, highlighted **green** where relevant;
- Potential authorities concerned by the issue and responsible for addressing the issue; and
- A brief comment on the issue.

Figure 18: Central Bedfordshire's 'hot spots' and their location (from east to west)





**Table 14: ‘Hot spot’ areas, comparison between scenarios**

ID	Hotspots	Ref. Case	Sc. 1	Sc. 1*	Sc. 2	Sc. 3	Sc. 4	Sc. 5	Responsible Authority	Comments
1	A1 Black Cat	Issue identified	=	-	=	=	=	=	HE	Delays at junction. Mitigation required to support committed growth.
2	North of Sandy		+	+	+	=	+	=	CBC	Congestion due to Local Plan growth. Mitigation required to support Local Plan growth.
3	Sandy	Issue identified	+	-	+	=	+	=	CBC, HE	Congested urban area, particularly with Local Plan growth. Mitigation required to support both committed and Local Plan growth.
4A	A1 / B658 Hill Ln	Issue identified	+	-	+	=	+	=	HE, CBC	Delays at junction. Mitigation required to support both committed and Local Plan growth.
4B	A1 / A6001 London Rd	Issue identified	=	-	=	=	=	=	HE, CBC	Congestion at junction. Mitigation required to support committed growth.
5	Stotfold	Issue identified	?	?	?	?	?	?	CBC	Congested urban area. Mitigation required to support committed growth. Additional work required as level of detail is limited in the model.
6	Shillington		+	+	+	+	+	+	CBC	Congestion due to Local Plan growth, in AM only. Mitigation required to support Local Plan growth.
7A	A507 (Shefford)	Issue identified	=	=	=	=	=	=	CBC	Congested corridor, with limited growth in the Local Plan scenarios. Mitigation required to support committed growth.
7B	A507 (Stotfold)	Issue identified	+	+	+	+	+	+	CBC	Congested corridor. Mitigation required to support both committed and Local Plan growth.
8A	A6 / Chapel End Rd	Issue identified	=	=	=	=	=	=	CBC	Congested corridor. Mitigation required to support committed growth.
8B	A6 / A507	Issue identified	=	=	=	=	=	=	CBC	Congested corridor. Mitigation required to support committed growth.
8C	A6 / Barton Rd	Issue identified	=	=	=	=	=	=	CBC	Congested corridor. Mitigation required to support committed growth.
8D	A6 / Church Rd	Issue identified	+	+	+	+	=	+	CBC	Congested corridor. Additional delays and stress due to M1-A6 link. Mitigation required to support both committed and Local Plan growth.
9	Amphill	Issue identified	=	=	=	=	=	=	CBC	Congestion at junction, particularly in AM. Mitigation required to support committed growth.

ID	Hotspots	Ref. Case	Sc. 1	Sc. 1*	Sc. 2	Sc. 3	Sc. 4	Sc. 5	Responsible Authority	Comments
10	M1 J13	Issue identified	+	+	+	+	+	+	HE, CBC	Congestion at junction. Additional stress due to Local Plan growth and potentially the ExpressWay. Mitigation required to support both committed and Local Plan growth.
11	M1 J12	Issue identified	+	+	+	+	=	+	HE, CBC	Congested access road to the junction. Additional delays and stress due to M1-A6 link. Mitigation required to support both committed and Local Plan growth.
12A	A5 / A4012	Issue identified	+	+	+	+	+	+	HE, CBC	Congested corridor. Mitigation required to support both committed and Local Plan growth.
12B	A5 / A505		+	+	+	+	=	+	HE, CBC	Congestion due to Local Plan growth. Mitigation required to support Local Plan growth.
12C	A5 (Dunstable)	Issue identified	=	=	=	=	=	=	HE, CBC	Congestion and junction delays in urban area. Mitigation required to support committed growth.
13	North of Luton	Issue identified	+	+	+	+	=	+	CBC	Congestion due to Local Plan growth. Mitigation required to support both committed and Local Plan growth.
14	A4146 / A418	Issue identified	=	=	=	=	=	=	CBC	Congestion at junction. Mitigation required to support committed growth.

5.2.3 The following ‘hot spot’ areas are observed in all seven forecast scenarios, regardless of how planned growth is delivered and/or supported by transport infrastructure schemes:

- Along the M1 at Junctions 12 and 13;
- Along the A6 at Chapel End Rd, A507, Barton Rd and Church Rd junctions;
- Along the A507 around Shefford and Stotfold;
- At the A5 / A4012 and A4146 / A418 junctions; and
- Within Stotfold, Ampthill and Dunstable urban areas, as well as north of Luton.

### 5.3 Next steps – Stage 1B preparation

5.3.1 In addition to identifying ‘hot spot’ areas, CBC wishes to understand the severity of each issue prior to any mitigation proposal (which would be part of Stage 1b).

5.3.2 A qualitative analysis has been developed based on the following two dimensions:

- Impact of the issue i.e. how many vehicles will be potentially facing this issue; and
- Gravity of the issue i.e. how much stress and / or delay is caused by this issue.

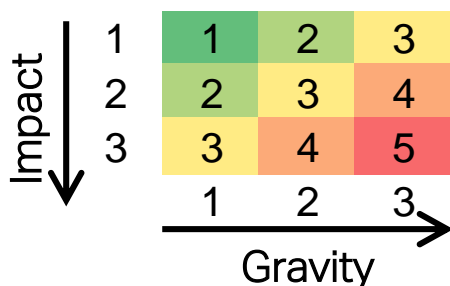
5.3.3 For each ‘hot spot’ and time period, three levels of ‘impact’ and ‘gravity’ have been defined, as indicated in **Table 15**.

**Table 15: Definition of the levels of ‘impact’ and ‘gravity’**

	Impact	Gravity	
Level	PCU	VoC i.e. link stress	Junction delay
1	Below 1,500 PCU	75% to 90%	Below 2 min
2	1,500 to 3,000 PCU	90% to 100%	2 to 5 min
3	Above 3,000 PCU	Above 100%	Above 5 min

5.3.4 For each ‘hot spot’ and time period, the level of ‘impact’ and ‘gravity’ is combined (see **Figure 19**) to form a grade on a 5-point scale. Should an issue cause both junction delays and link stress, a grade is calculated separately for both indicators and the highest one retained for the purpose of this analysis.

**Figure 19: ‘Hot Spot’ 5-point scale based on ‘impact’ and ‘gravity’**





5.3.5 For each ‘hot spot’, both AM and PM peak grades are added together to form the final grade on a 10-point scale. Final grades for each ‘hot spot’ area are presented in **Figure 20**. It should be noted that:

- In the absence of significant issues, the grade attributed is 0;
- Due to the methodology applied, some of the additional issues identified in **Table 14** may not be reflected in **Figure 20**. For instance:
  - The additional traffic which experiences this issue is not significant enough for the level of ‘impact’ to change; or
  - Local Plan growth causes junction delays within the ‘hot spot’ area in addition to the network stress from the committed growth. This would not necessarily cause the level of ‘gravity’ to change; and
- Similarly, a small change in traffic in the vicinity of a level threshold may cause a change in the final grade, despite traffic conditions being relatively stable (see HS 7A).

**Figure 20: Qualitative assessment (on a 10-point scale) of each ‘hot spot’**

ID	Hot Spot	Ref Case	Sc 1 / Sc 2	Sc 1*	Sc 3 / Sc 5	Sc 4
1	A1 Black Cat	8	8	2	8	8
2	North of Sandy	0	6	6	0	6
3	Sandy	5	5	2	5	5
4A	A1/B658 Hill Ln	6	8	0	6	8
4B	A1/A6001 London Rd	6	6	0	6	6
5	Stotfold	4	4	4	4	4
6	Shillington	0	2	2	2	2
7A	A507 (Shefford)	8	9	8	9	9
7B	A507 (Stotfold)	6	8	8	8	8
8A	A6/Chapel End Rd	3	3	3	3	3
8B	A6/A507	6	6	6	6	6
8C	A6/Barton Rd	5	5	5	5	5
8D	A6/Church Rd	7	7	7	7	7
9	Ampthill	6	6	6	6	6
10	M1 J13	6	8	8	8	8
11	M1 J12	4	5	5	5	4
12A	A5/A4012	5	6	6	6	6
12B	A5/A505	0	6	6	6	0
12C	A5 (Dunstable)	4	4	4	4	4
13	North of Luton	3	6	6	6	3
14	A4146/A418	4	4	4	4	4

## 5.4 Next steps – Stages 1B & 2

- 5.4.1 Stage 1B will follow directly on from Stage 1A, whereby potential mitigation options for the key network constraints (i.e. 'hot spot' areas) presented in this report will be considered. It will be possible during Stage 1B to consider potential concept design options, constraints and associated infrastructure costs, as the overall strategic performance is tested following the introduction of mitigation.
- 5.4.2 In light of the results obtained from the performance of the Local Plan growth scenarios in Stage 1A and Stage 1B, it will be possible to identify the most viable growth scenario/s from a transport perspective for Stage 2. It may be that elements from several growth scenarios are amalgamated to create a revised option to be considered in Stage 2.
- 5.4.3 Stage 2 of the study will include testing the shortlisted Local Plan growth scenarios using the enhanced CBLTM (i.e. 2016 Base Year). At this stage, it is anticipated that more detailed information for the Local Plan growth scenarios will be available, and that growth will be provided at development site level.
- 5.4.4 Mitigation options for the 'hot spot' areas will be investigated for the preferred growth option/s, based on Stage 1B where relevant as a starting point. In addition, the performance of the mitigation schemes will be evaluated in line with Local Plan growth option/s.
- 5.4.5 In Stage 2, it is envisaged that model runs be undertaken for 2035 as well as interim years at five year intervals (i.e. 2020, 2025 and 2030). By undertaking the assessment at five-year intervals, the performance of the network and associated congestion over the Local Plan period can be understood. This will help provide an indication of when the mitigation schemes will be required and associated prioritisation.

## Appendix A Detailed Local Plan growth assumptions

**Figure 21–Figure 25** show the detailed breakdown of Local Plan dwelling growth for each scenario (based on the LUC growth locations<sup>20</sup>).

For the extension to various villages to towns, growth has been distributed based on the estimated capacity (to 2035) for each growth location, as detailed in the LUC North Central Bedfordshire Growth Options Study Report (Table 3.10) and Luton HMA Growth Options Study Report (Table 4.1)<sup>21</sup>.

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<sup>20</sup> *CBC\_20161021\_LutonHMA\_AssessmentLocations\_v7.zip*, email from CBC (Pru Khimasia, 28-Oct-16)  
*CBC\_20161031\_Location\_v3.zip*, email from CBC (Pru Khimasia, 02-Nov-16)

<sup>21</sup> *North Central Beds Growth Options Study - Draft Report v.23.11.16.pdf* and *Luton HMA Growth Options Study Final Report 23 11 16.pdf*, respectively, email from CBC (Pru Khimasia, 29-Nov-16)



Figure 21: Detailed Local Plan growth assumptions (Dwellings), Scenario 1

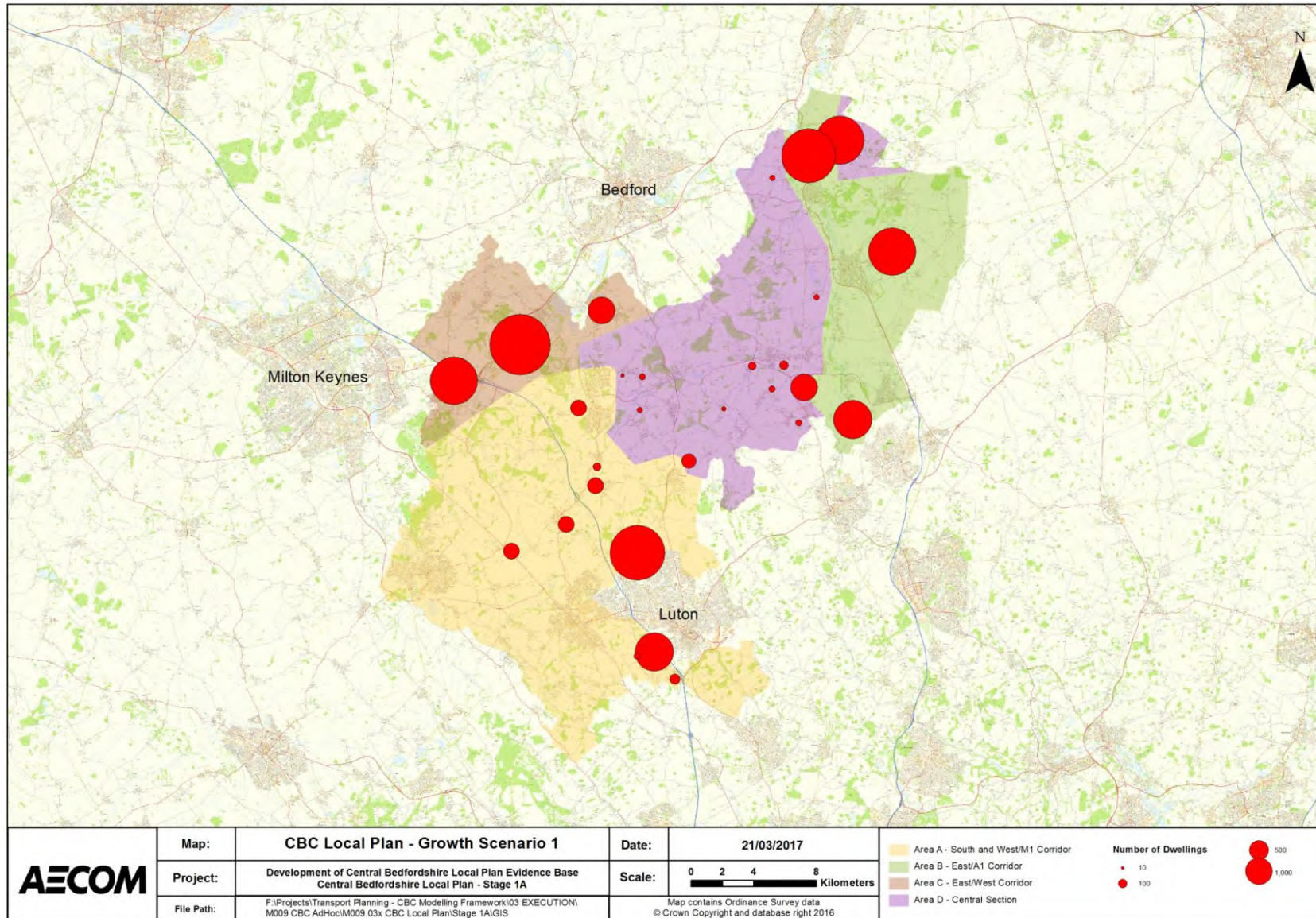




Figure 22: Detailed Local Plan growth assumptions (Dwellings), Scenario 2

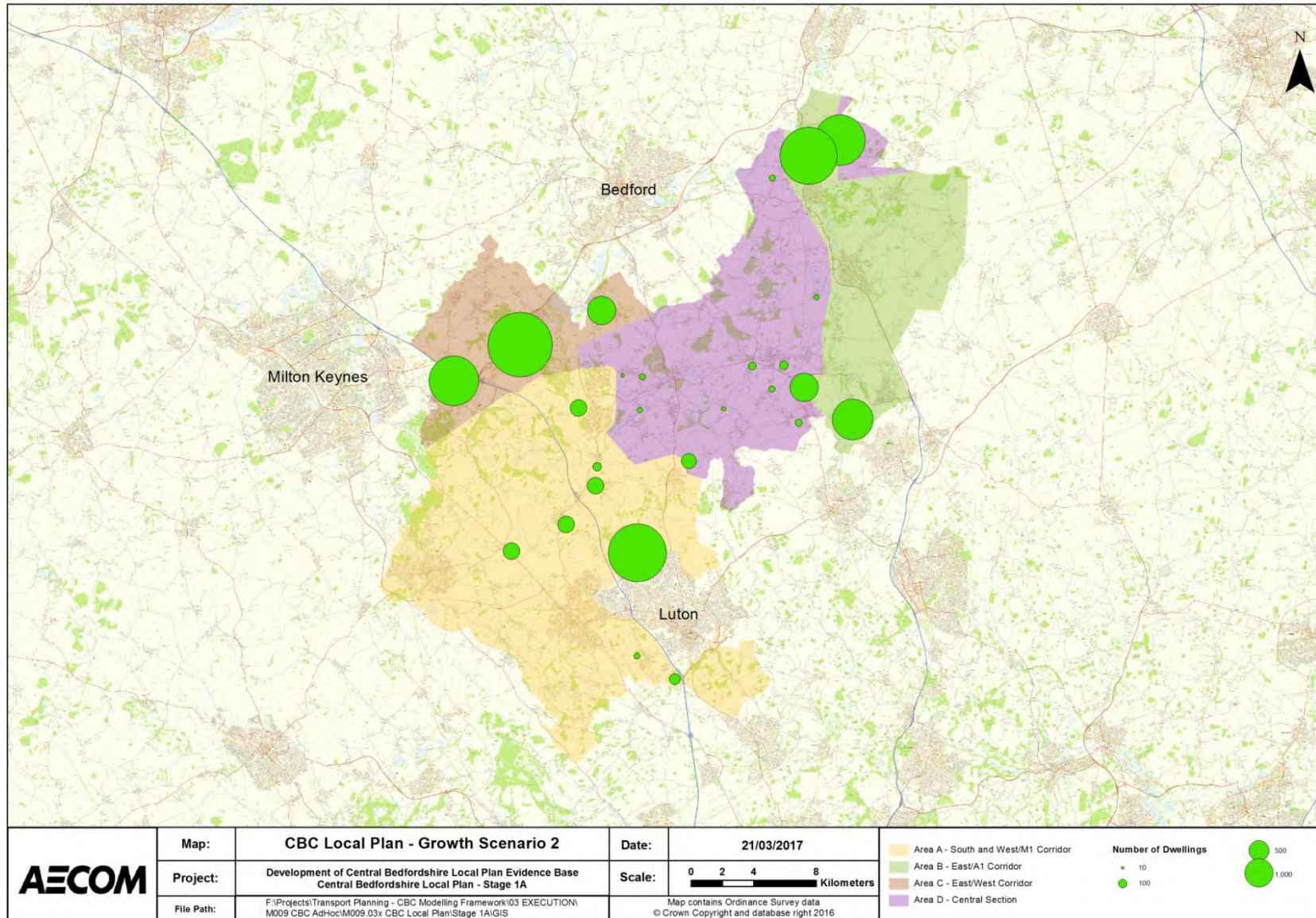




Figure 23: Detailed Local Plan growth assumptions (Dwellings), Scenario 3

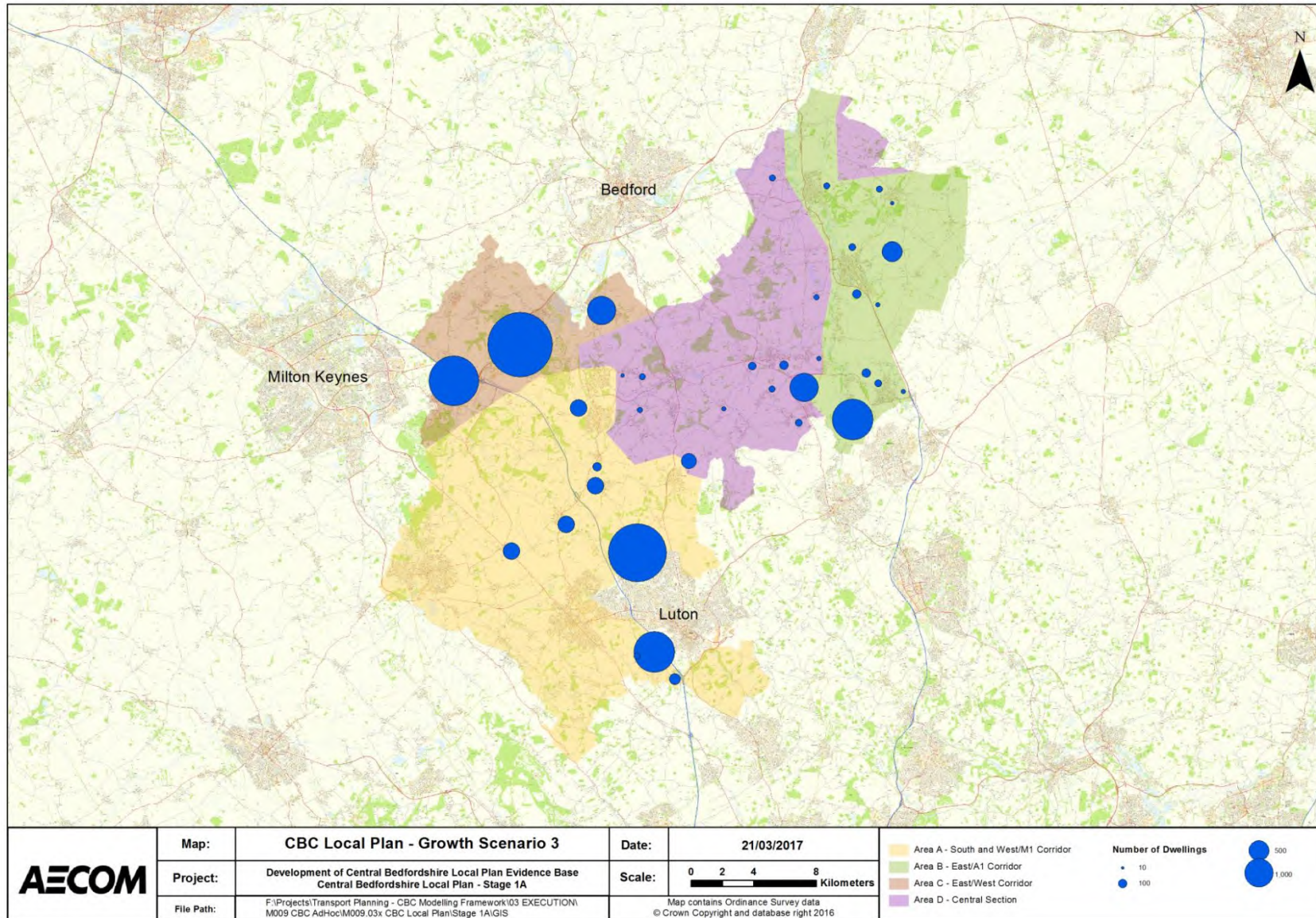




Figure 24: Detailed Local Plan growth assumptions (Dwellings), Scenario 4

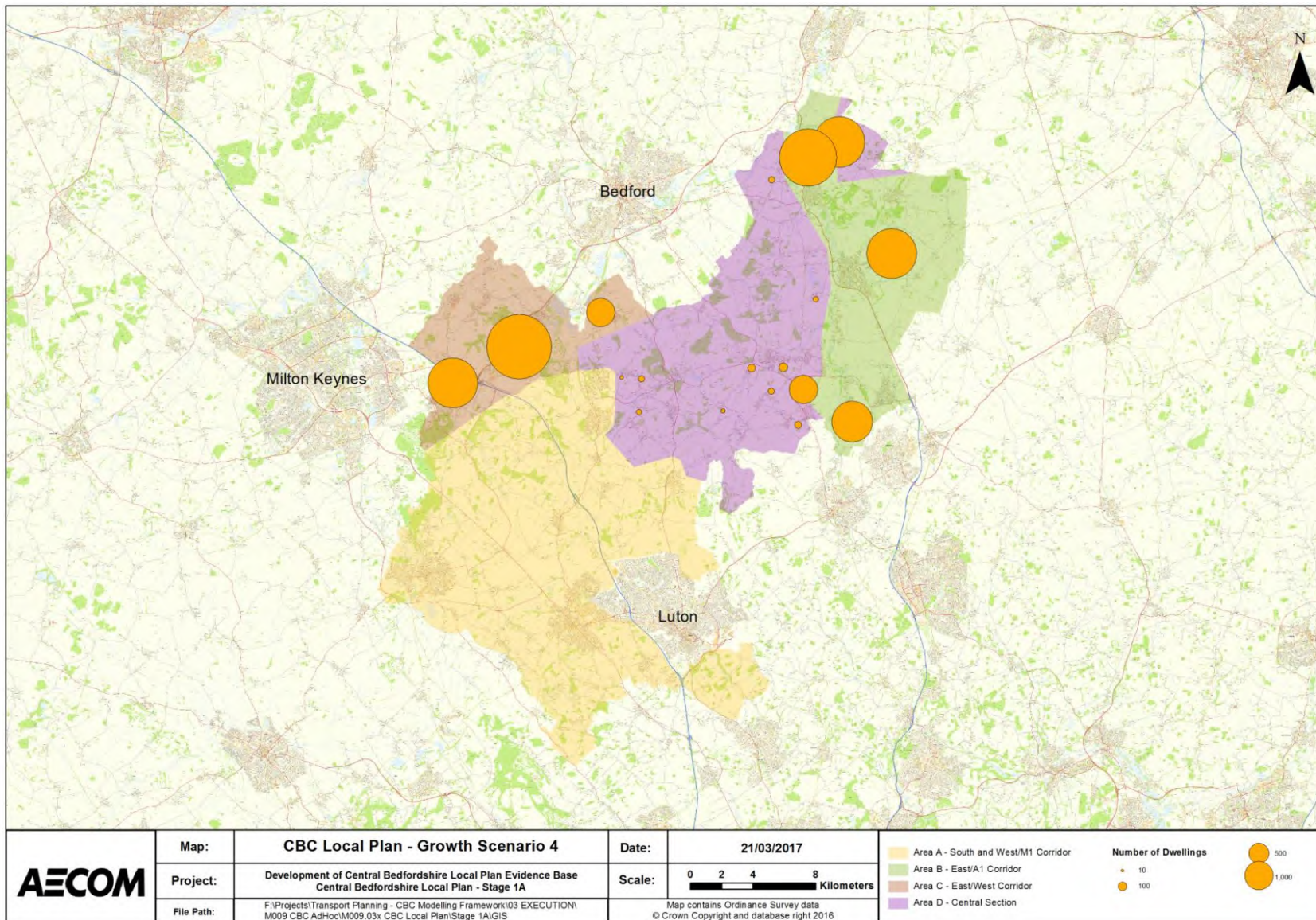
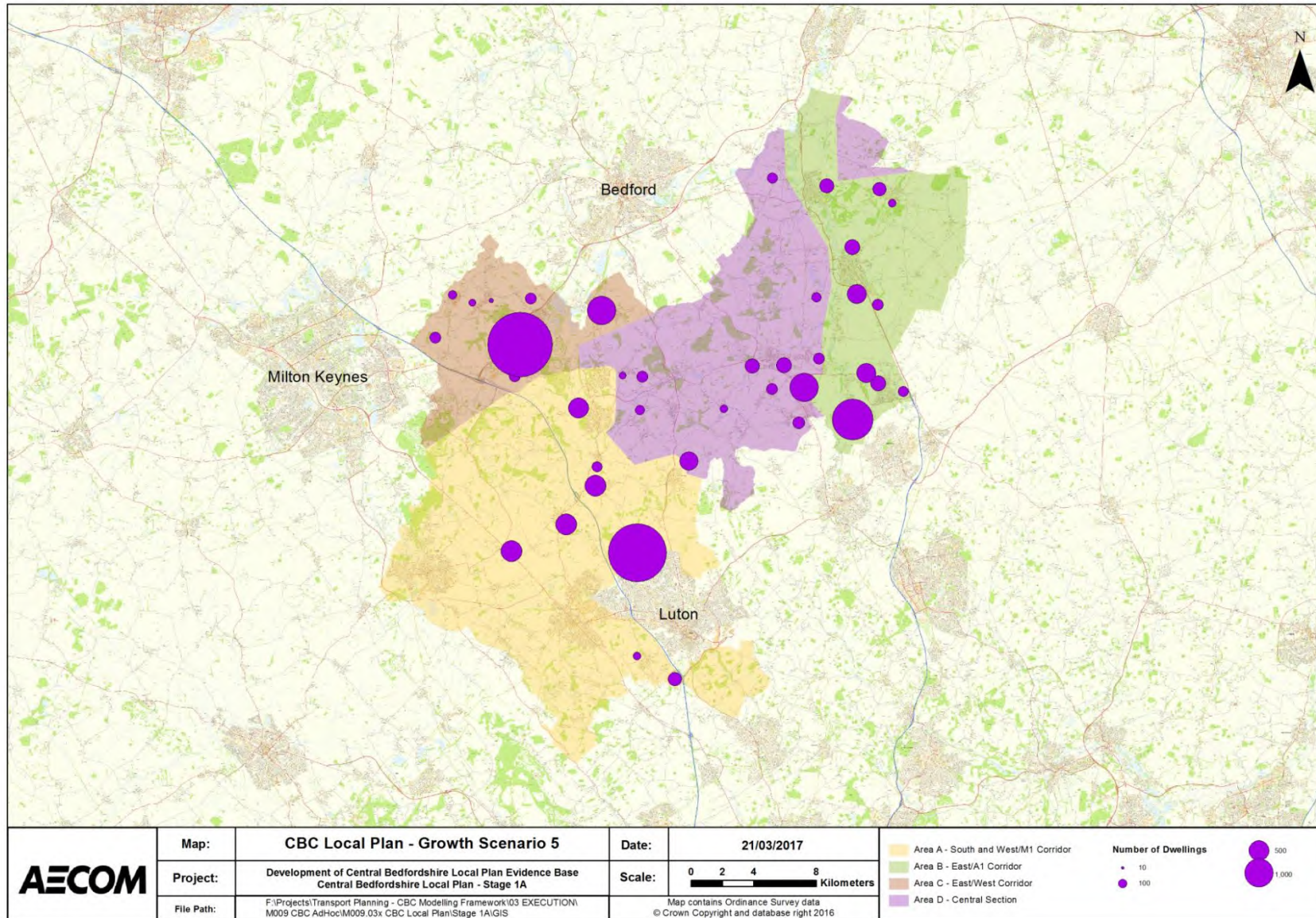




Figure 25: Detailed Local Plan growth assumptions (Dwellings), Scenario 5



## Appendix B Flow and Junction Delay Differences (Local Plan growth scenarios)

**Figure 26–Figure 37** present both flow and junction delay differences for each Local Plan growth scenario when compared to:

- The 2035 Reference Case scenario for Scenarios 1 to 5; and
- Scenario 1 for Scenario 1\*.

The purpose of this appendix is to highlight the incremental changes in terms of traffic and delays which are due to the additional Local Plan growth and/or changes to the transport network infrastructure (e.g. M1-A6 link or A1 improvements):

- Increases in traffic are highlighted **purple**;
- Decreases in traffic (e.g. due to re-routeing) are highlighted **blue**;
- Increases in junction delays are highlighted **orange / red**; and
- Decreases in junction delays are highlighted **green**.



Figure 26: Flow and Delay differences, Scenario 1 vs. 2035 Reference Case, AM

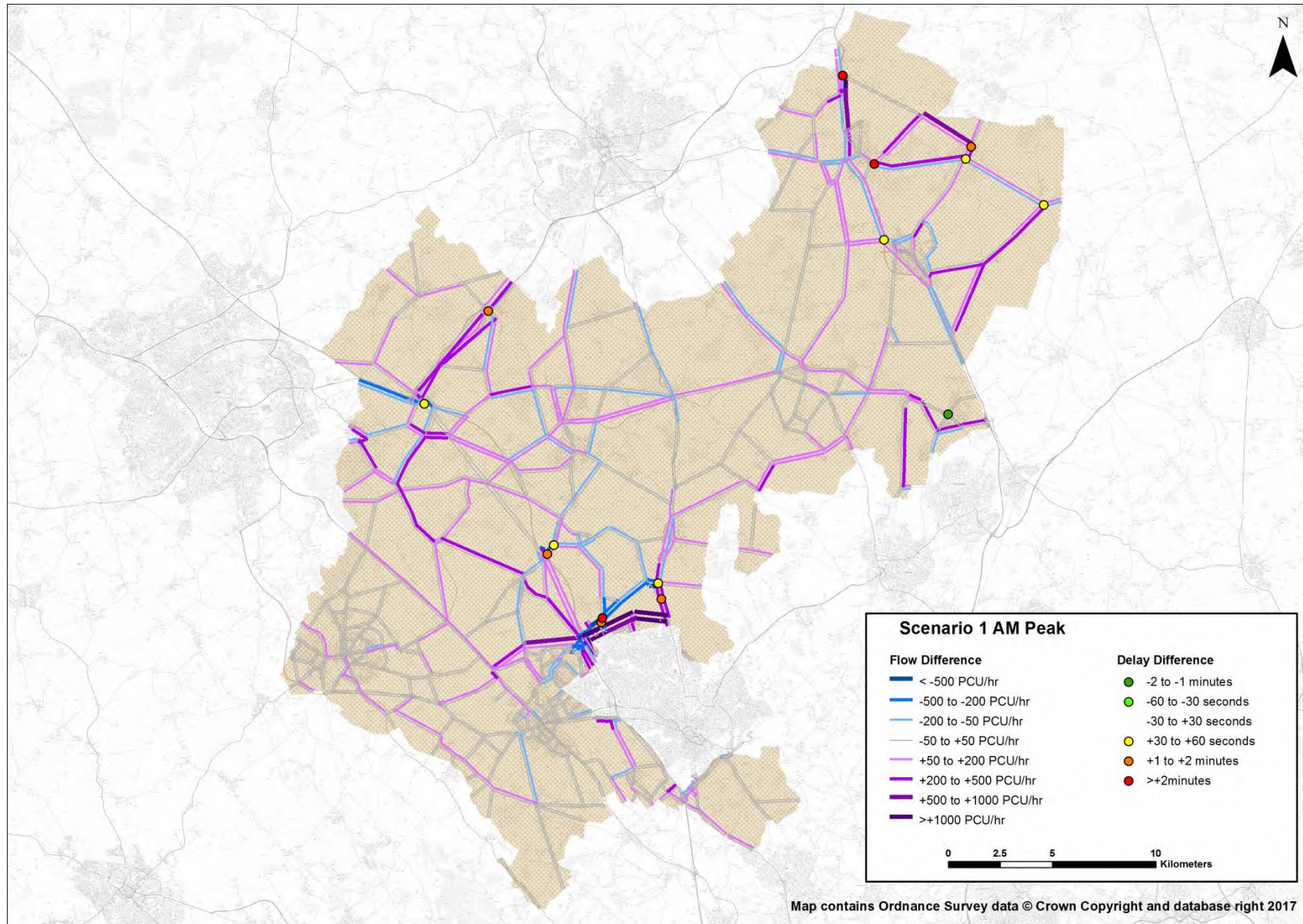




Figure 27: Flow and Delay differences, Scenario 1 vs. 2035 Reference Case, PM

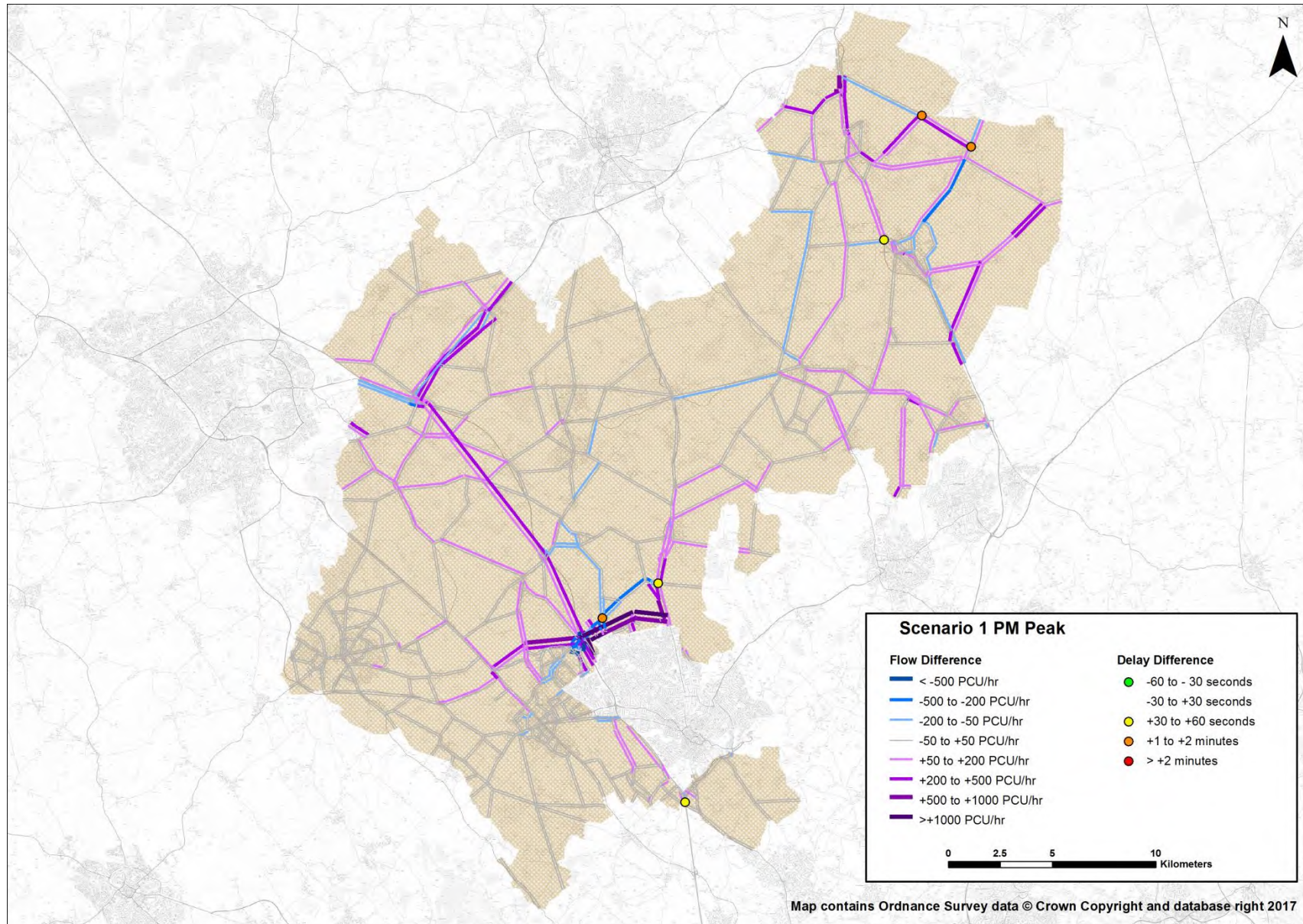




Figure 28: Flow and Delay differences, Scenario 1\* vs. Scenario 1, AM

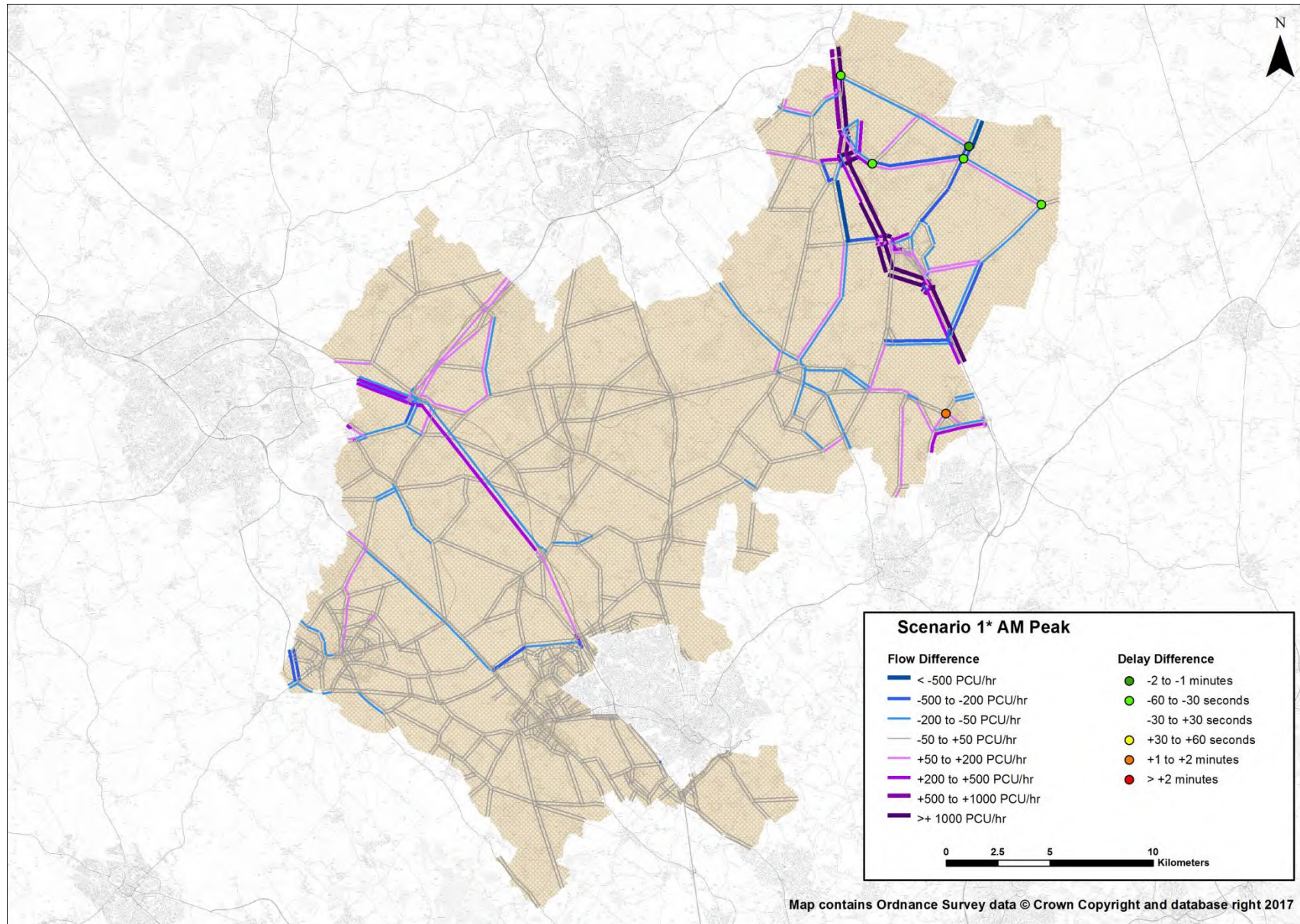




Figure 29: Flow and Delay differences, Scenario 1\* vs. Scenario 1, PM

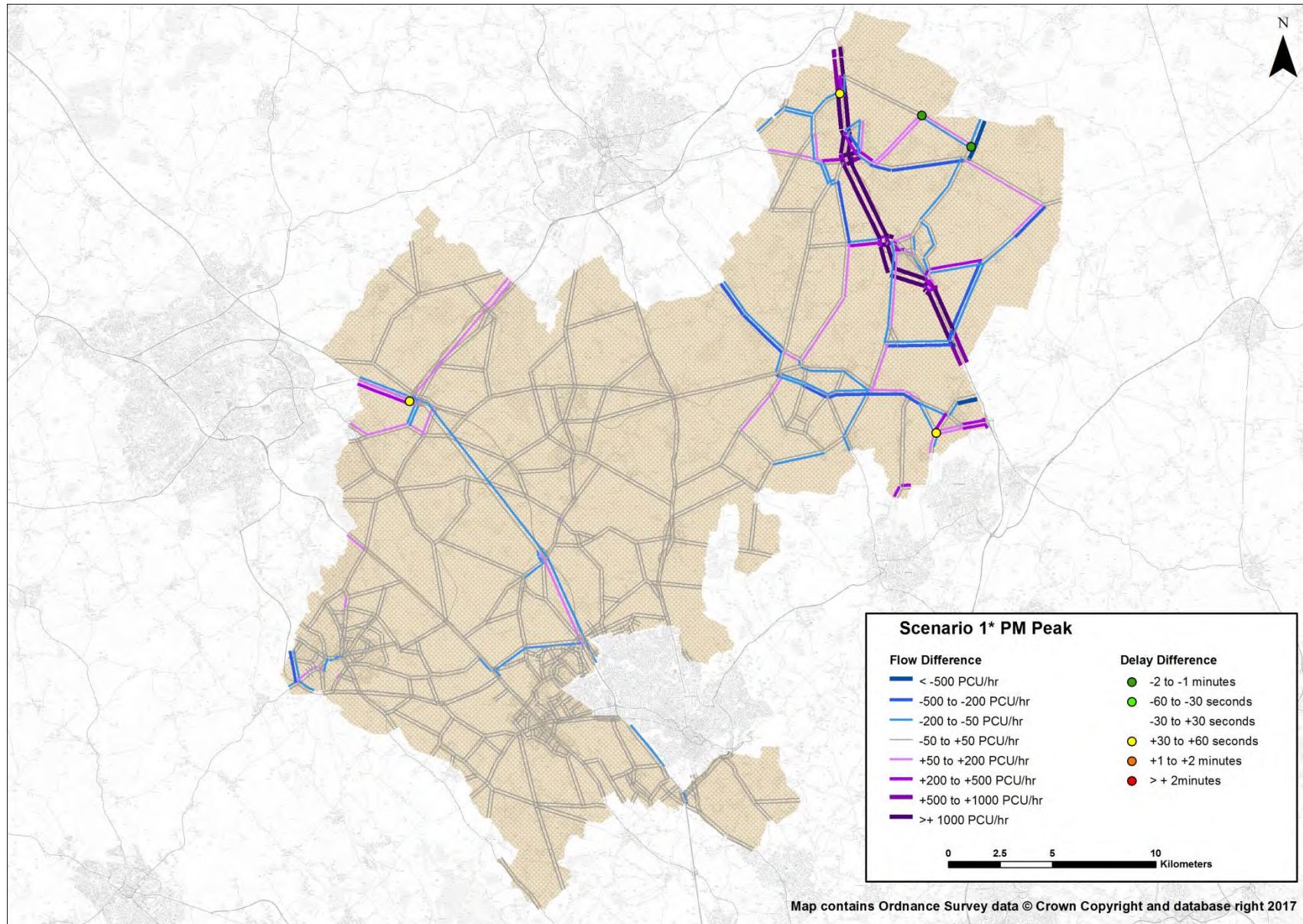




Figure 30: Flow and Delay differences, Scenario 2 vs. 2035 Reference Case, AM

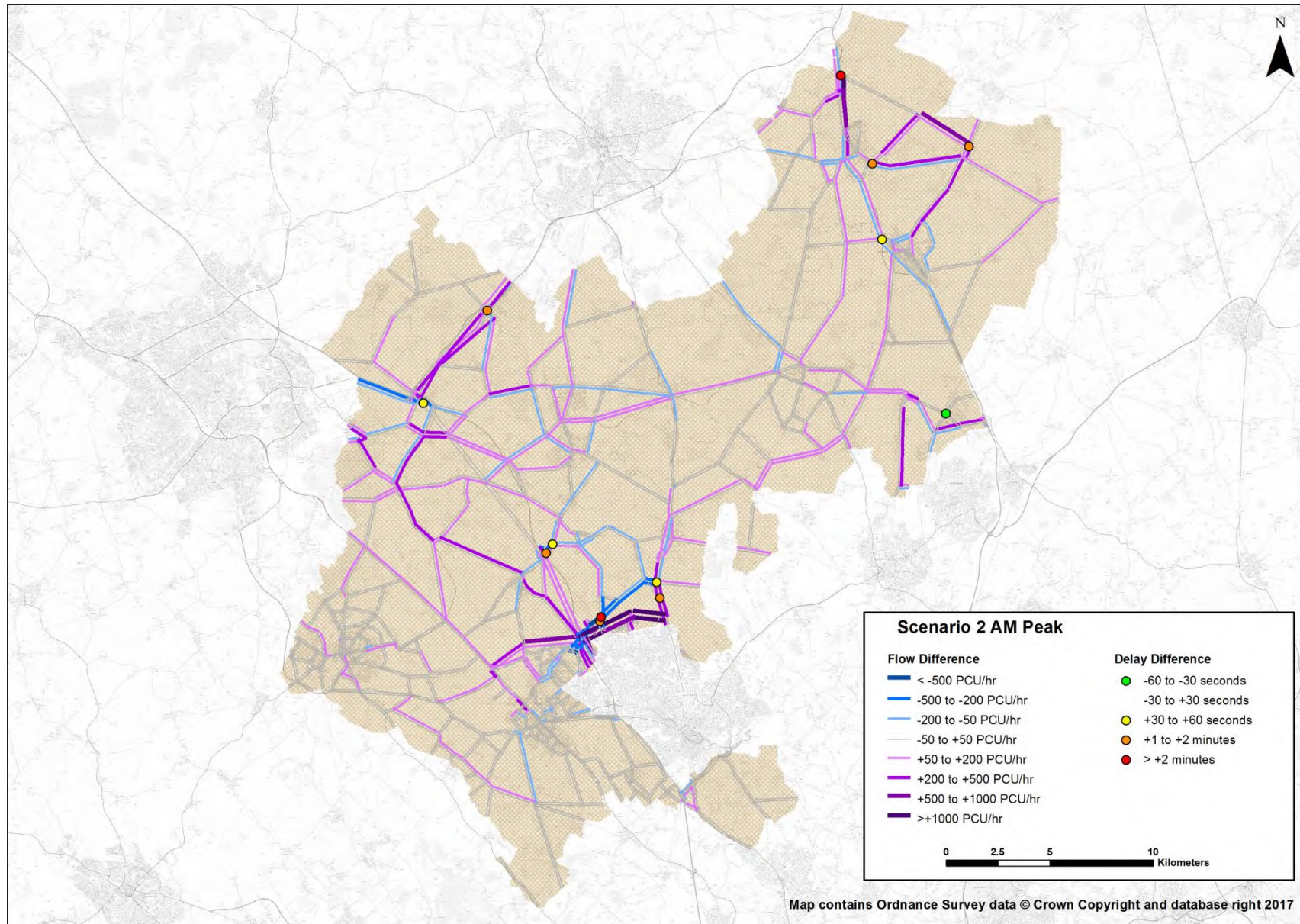




Figure 31: Flow and Delay differences, Scenario 2 vs. 2035 Reference Case, PM

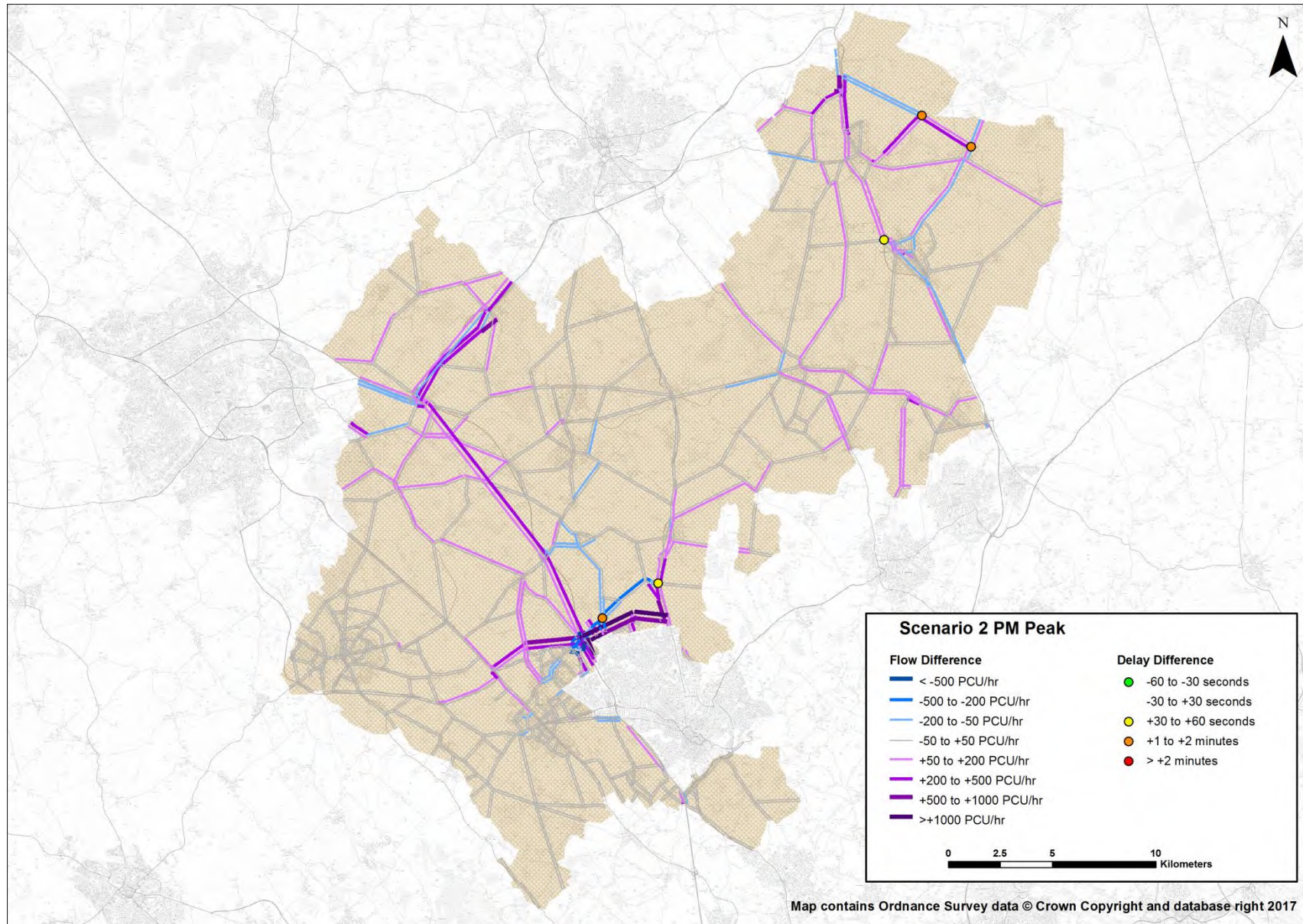




Figure 32: Flow and Delay differences, Scenario 3 vs. 2035 Reference Case, AM

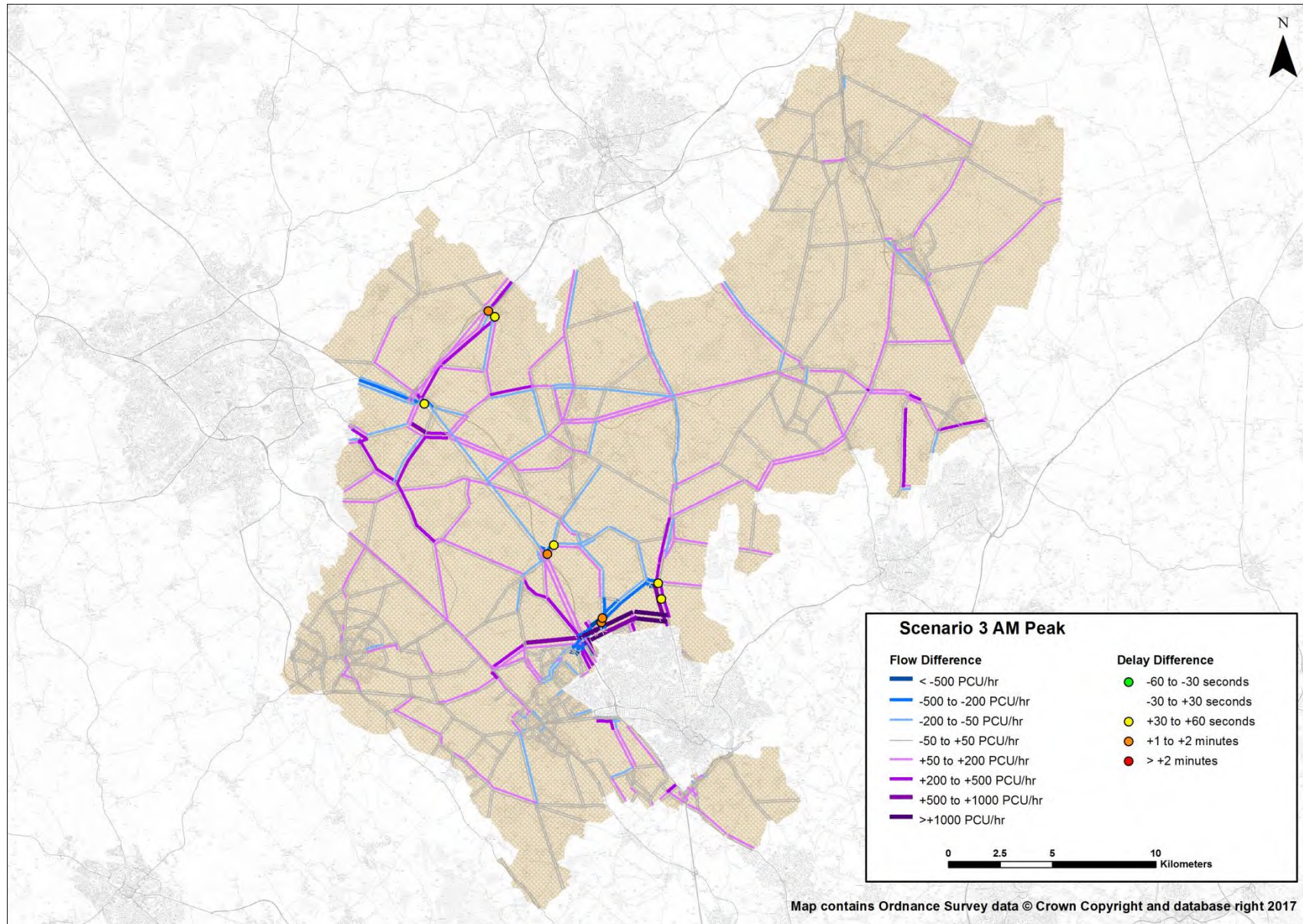




Figure 33: Flow and Delay differences, Scenario 3 vs. 2035 Reference Case, PM

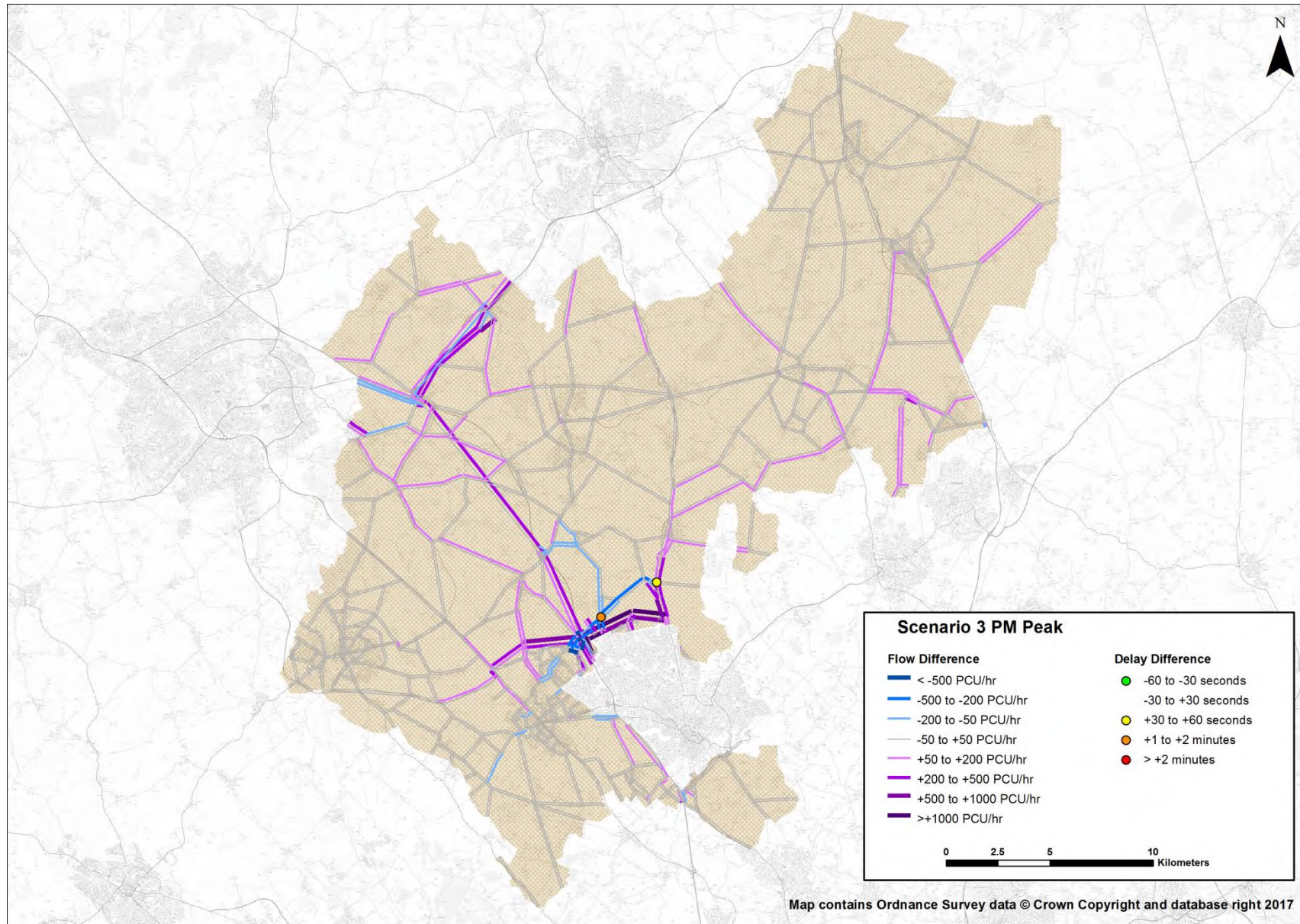




Figure 34: Flow and Delay differences, Scenario 4 vs. 2035 Reference Case, AM

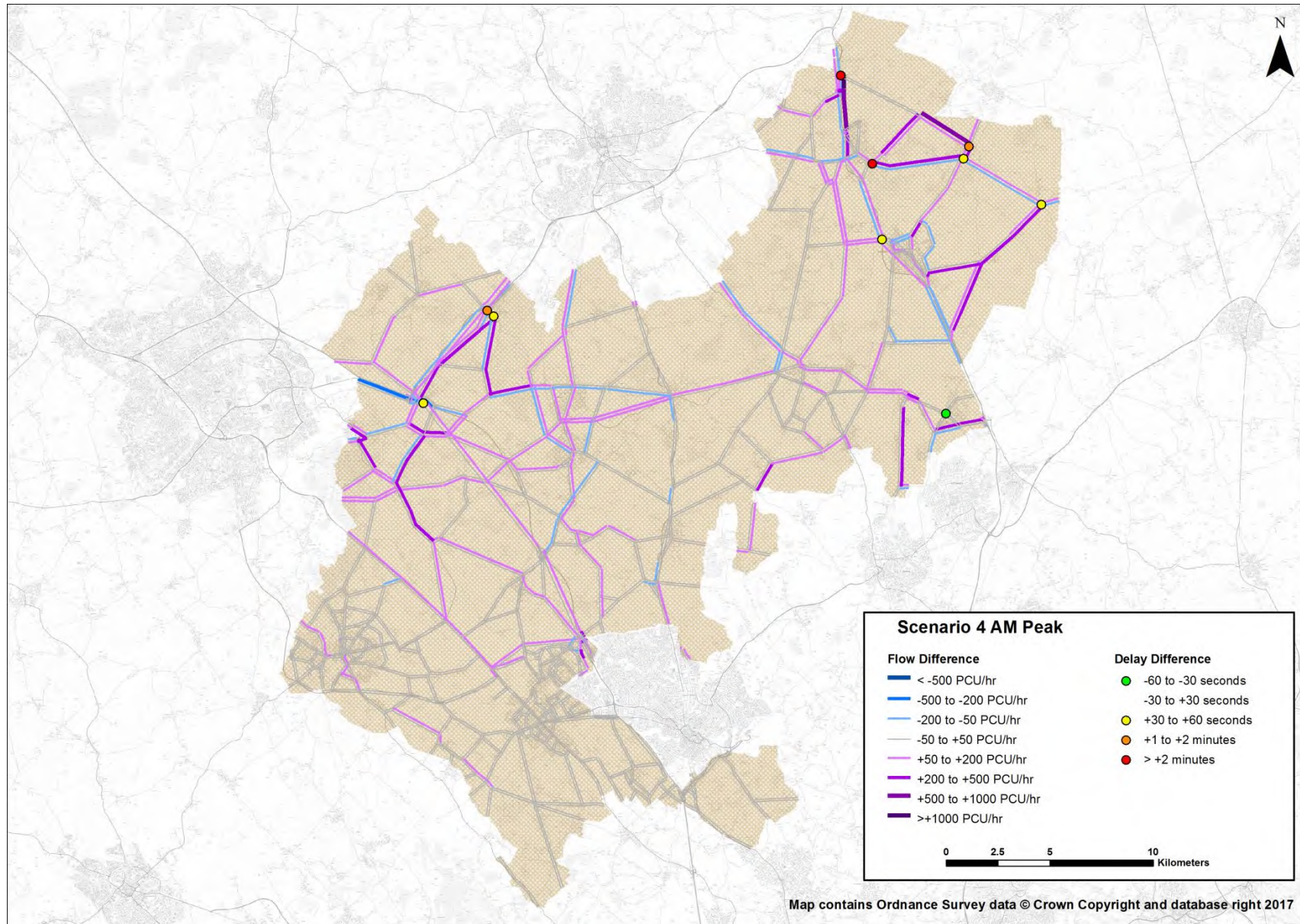




Figure 35: Flow and Delay differences, Scenario 4 vs. 2035 Reference Case, PM

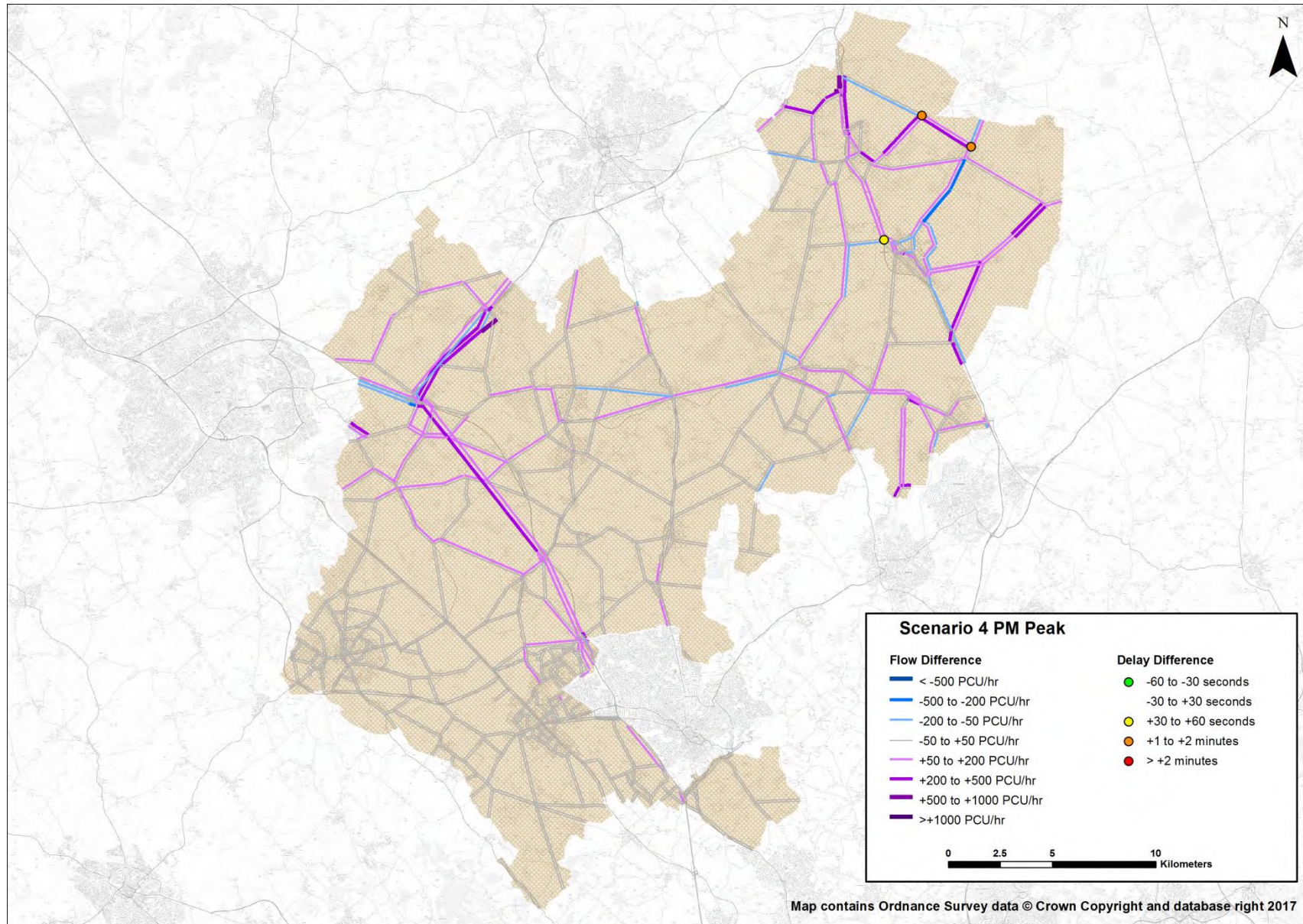




Figure 36: Flow and Delay differences, Scenario 5 vs. 2035 Reference Case, AM

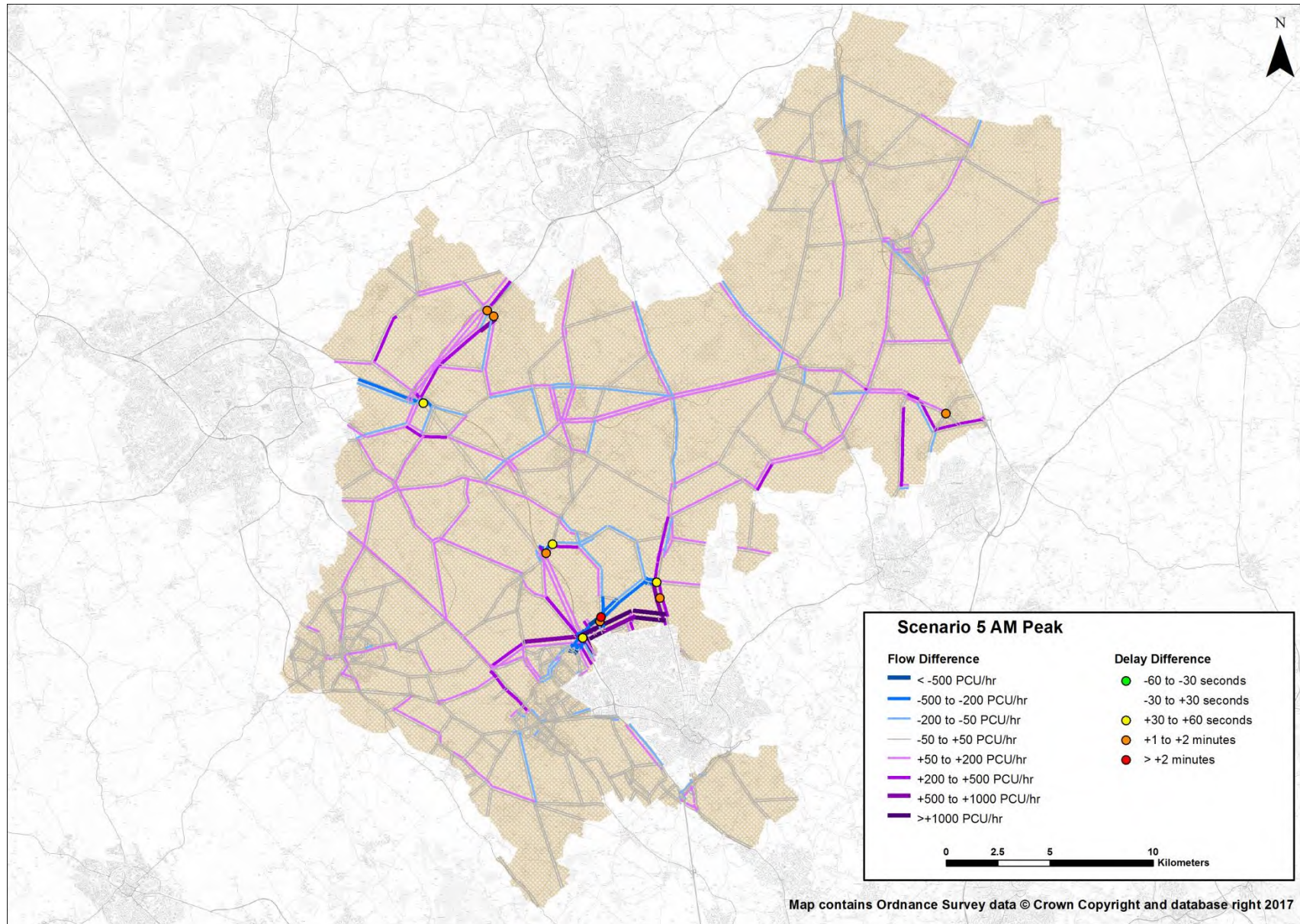




Figure 37: Flow and Delay differences, Scenario 5 vs. 2035 Reference Case, PM

