

# **Central Bedfordshire Council Local Plan (2015-2035)**

**Transport Modelling Stage 1B  
(January 2018)\***

*\*For reference only*

## 1. Introduction

### 1.1 Context – Local Plan

1.1.1 Central Bedfordshire Council (CBC) is in the process of updating the transport evidence base required to support the production of their 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).

1.1.2 It is proposed that the transport modelling be undertaken according to 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 spots' where there are network constraints;
- Stage 1b: to consolidate the 'hot spots' identified in Stage 1a for CBC's preferred growth scenario (i.e. Scenario 1), using an updated version (i.e. Base Year 2016) of the CBLTM;
- Stage 1c: to confirm the 'hot spots' identified in Stage 1b and their timescales, based on CBC's consolidated Local Plan growth assumptions;
- Stage 1d: to assess the impacts of key strategic growth sites on the 'hot spots' confirmed in Stage 1c, as well as outside CBC's boundaries;
- Stage 2a: to propose highway and public transport mitigation options for the confirmed 'hot spots', including conceptual design, initial costing and potential funding sources; and
- Stage 2b: to test the impact of the mitigation options proposed in Stage 2a on the overall network performance.

### 1.2 Objectives / Structure of the note

1.2.1 The purpose of this note is consistent with the objectives for Stage 1b i.e.:

- To present the modelling results from Stage 1b;
- To identify the 'hot spots' for which mitigation options will be proposed at later stages (i.e. Stage 2a); and
- To discuss the changes to the evidence base between Stage 1a (i.e. Regulation 18 submission) and Stage 1b.

1.2.2 As requested by CBC, additional commentary will be provided regarding the Local Plan growth impacts on Air Quality Management Areas (AQMA's) and across Central Bedfordshire's boundaries.

1.2.3 It should be noted that three Air Quality Management Areas (AQMA) have been identified<sup>1</sup> in Central Bedfordshire:

- South Bedfordshire AQMA (ref. 266, declared 17-Jan-05) includes:
  - Dunstable Town Centre;
  - The A505 from the town centre to the junction of Poynters Road / Dunstable Road;
  - The A5 from Union St to Borough Road;
  - The B489 West St from the town centre to St Marys Gate;
- AQMA No. 3 Ampthill (ref. 1589, declared 17-Aug-15) includes:
  - Part of Bedford St between Market Sq. and Brewers Lane;
  - Part of Church St between Market Sq. and St Andrews Close;
  - Part of Woburn St;
  - Part of Dunstable St from Market Sq.;
- AQMA No. 4 Sandy (ref. 1592, declared 17-Aug-15) includes ten meters:
  - From the kerbside of both sides of the A1 at the Georgetown exit; and
  - South along the A1 / London Road to the Bedford Road junction.

1.2.4 This document is structured as follows:

- CBLTM Modelling assumptions;
- CBLTM Forecast Year 2035;
- Summary and Discussion; and
- Appendix A – Link stress and Junction delays comparison

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<sup>1</sup> <https://uk-air.defra.gov.uk/aqma/maps>, last accessed 10-Nov-17

## 2. CBLTM Modelling assumptions

### 2.1 Approach in identifying 'hot spots' on the network

2.1.1 Identification of the 'hot spots' will rely on two indicators:

- Link stress, measured in %; and
- Average delays at junctions, measured in minutes (min).

2.1.2 Link stress, i.e. network congestion at road- (or model link-) level, is assessed by the Volume-over-Capacity (VoC) ratio. A ratio of 100% (or more) indicates a saturated highway network.

2.1.3 The analysis presented in this note may also refer to traffic flows i.e. the number of vehicles, which is measured in Passenger Car Unit (PCU):

- A passenger car has a PCU of 1 by definition; and
- A bus or Heavy Goods Vehicle (HGV) has a PCU of 2.2 in CBLTM.

### 2.2 Scale of impact

2.2.1 CBC wish to understand the scale of impact of each issue prior to any mitigation proposal (to be undertaken in Stage 2a).

2.2.2 A qualitative analysis framework has thus been developed incorporating the following dimensions:

- Users impacted by the issue i.e. how many vehicles are affected; and
- Level of congestion i.e. how much stress and / or junction delay is experienced by users.

2.2.3 Three levels of 'users' and 'congestion' have been defined, as indicated in **Table 1**.

**Table 1: Definition of the levels of 'users' and 'congestion'**

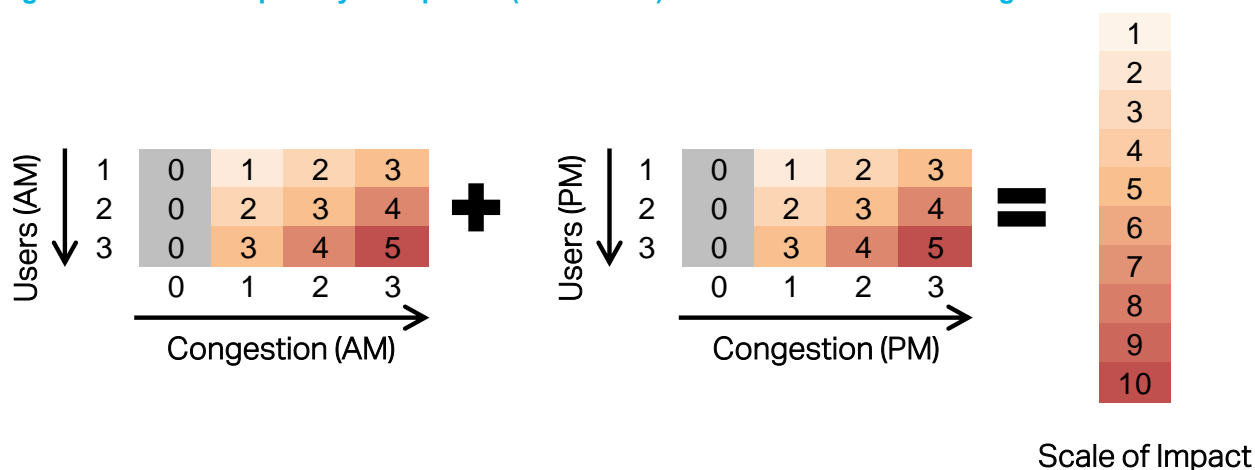
	<b>Users</b>	<b>Congestion</b>	
<b>Level</b>	Traffic flow	Link stress (VoC)	Junction delay
1	Below 1,500 PCU	75% to 90%	Below 2 min
2	1,500 to 3,000 PCU	90% to 100%	2 to 5 min
3	Above 3,000 PCU	Above 100%	Above 5 min

2.2.4 For each 'hot spot' and time period, both 'users' and 'congestion' levels are combined into a single score between 1 and 5 (see **Figure 1**):

- Should an issue cause both junction delays and link stress, a score is calculated separately for each indicator, and the higher value retained for the purpose of this analysis; and
- A score of 0 is assigned if a 'congestion' level cannot be assigned.

2.2.5 For each 'hot spot', both AM and PM peak scores are then added together to provide the total score, which varies between 1 and 10 (see **Figure 1**).

**Figure 1: Scale of impact by time period (from 1 to 5) based on ‘users’ and ‘congestion’ levels**



## 2.3 Modelling scenarios

2.3.1 The analysis presented in this note is based on Forecast Year 2035. Each forecast scenario has been derived from:

- The updated CBLTM model, calibrated and validated to represent Base Year 2016;
- Any change between 2016 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.

2.3.2 The following analysis relies on the comparison of two scenarios:

- A Reference Case model scenario, which includes all changes which are not part of the Local Plan e.g. already committed planned growth and infrastructure schemes; and
- A Local Plan model scenario, which includes all the changes expected by the end of the Local Plan period.

2.3.3 This comparative approach is required to isolate and understand the transport impacts which are specifically due to the Local Plan growth.

## 2.4 Planning Data Assumptions – 2035 Reference Case

2.4.1 Planning data assumptions for the 2035 Reference Case rely on the following data sources:

- The Uncertainty Log provided by CBC<sup>2</sup> until 2035;
- The employment growth assumptions provided by CBC<sup>3</sup> 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
- The Local Plan housing and employment growth provided by Luton Borough Council (LBC)<sup>4</sup> until 2031;
- The NTEM<sup>5</sup> v7.2 growth assumptions provided by the Department for Transport (DfT):
  - Between 2031 and 2035 in Luton; and
  - Until 2035 outside Luton and Central Bedfordshire.

2.4.2 For consistency purposes with the CBLTM version, it should be noted that:

- The evidence base in Stage 1a relied on NTEM v6.2; and
- The evidence base in Stage 1b relies on NTEM v7.2, which was the latest<sup>6</sup> version available at time of model development.

2.4.3 It is acknowledged that there are discrepancies in terms of growth assumptions between both versions of NTEM and therefore between Stages 1a and 1b:

- Within Luton between 2031 and 2035; and
- Outside Luton and Central Bedfordshire between 2016<sup>7</sup> and 2035.

2.4.4 However, these changes in growth assumptions should be considered as inherent to the model update.

2.4.5 Similarly, the model zoning system has been updated as part of the CBLTM enhancement. In particular, the process to define development zones in CBLTM has been revised.

<sup>2</sup> Email from CBC (Pru Khimasia, 02-Mar-17). All 'Deliverable' (or 'Near Certain') and 'Developable' (or 'More than Likely') developments were included.

<sup>3</sup> Email from CBC (Lynsey Hillman-Gamble, 23-Feb-17)

<sup>4</sup> Emails from LBC (Kevin Owen, 08-Oct-15 and Jake Kelley, 21-Jan-16)

<sup>5</sup> The National Trip End Model (NTEM) forecasts are accessed by the Trip End Model Presentation Program (TEMPPro) software.

<sup>6</sup> NTEM version 7.2 was released in February 2017.

<sup>7</sup> There is no need to apply demand growth between 2009 and 2016 in Stage 1b, contrary to Stage 1a, as the updated CBLTM has a Base Year of 2016.

2.4.6 **Table 2** presents the planning data assumptions applied in Stage 1b for the 2035 Reference Case scenario in Luton and Central Bedfordshire.

**Table 2: Planning Data Assumptions, 2035 Reference Case**

Source	Data Type	Development Zone	Location	2035 Growth
Luton Borough (Local Plan growth)	Dwellings	Yes	Power Court	600
		No	Growth in dispersed developments	4,568
		<b>Sub-total</b>		<b>5,168</b>
	Jobs	Yes	Power Court	3,016
			Butterfield Park	4,013
			Century Park	2,599
		No	Growth in dispersed developments	9,708
		<b>Sub-total</b>		<b>19,336</b>
Central Bedfordshire (Near Certain and More than Likely growth)	Dwellings	Yes	Wixams	3,145
			Houghton Regis North 1	2,820
		No	Growth in dispersed developments	13,799
		<b>Sub-total</b>		<b>19,764</b>
	Jobs	Yes	East Leighton Buzzard	2,400
			Houghton Regis North 1	2,961
			Stratton Farm	2,200
		No	Growth in dispersed developments	16,339
		<b>Sub-total</b>		<b>23,900</b>

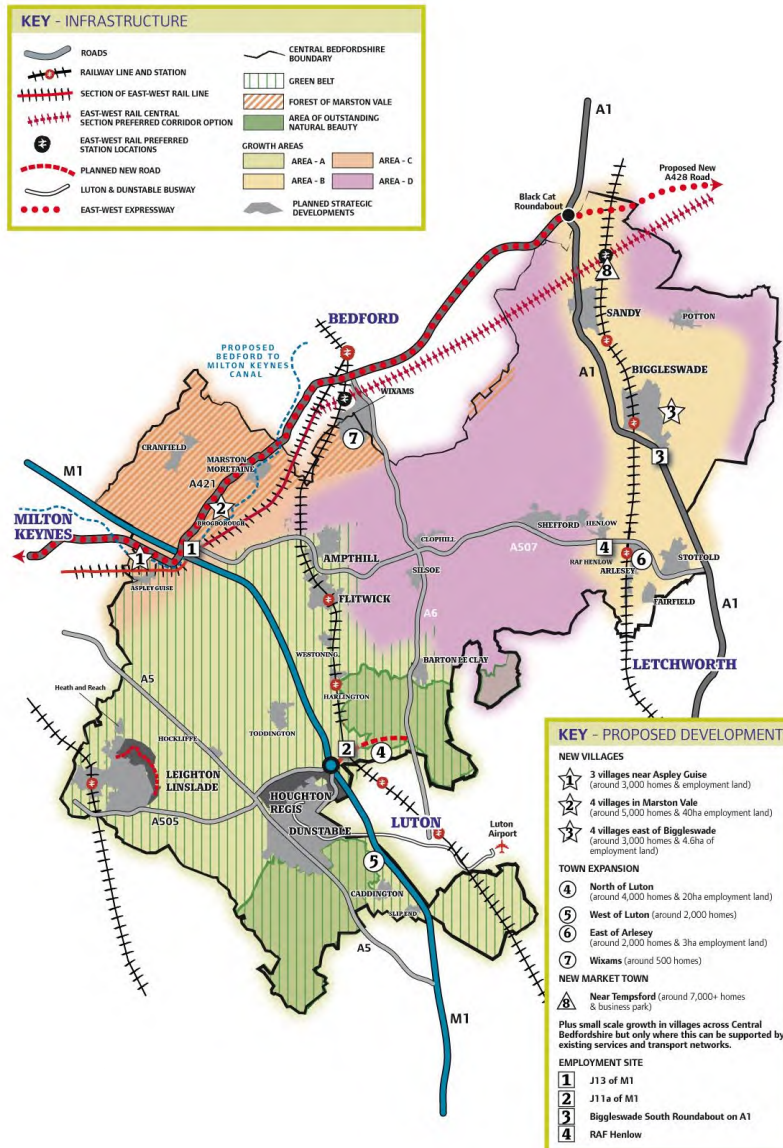
2.4.7 It should be noted that, for the purpose of Local Plan work, the above growth assumptions within CBC and LBC boundaries have not been constrained to NTEM growth.

2.4.8 By definition, growth assumptions outside CBC and LBC boundaries have been constrained to NTEM growth.

## 2.5 Planning Data Assumptions – 2035 Local Plan

2.5.1 **Figure 2** shows the four Local Plan dwelling growth areas within Central Bedfordshire.

**Figure 2: Proposed development and transport infrastructure in Central Bedfordshire<sup>8</sup>**



2.5.2 In addition, the three following Local Plan employment growth sites have been identified<sup>9</sup>:

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

<sup>8</sup> <http://www.centralbedfordshire.gov.uk/planning/policy/local-plan/local-plan.aspx>, last accessed 10-Nov-17

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



2.5.3 **Table 3** summarises the Local Plan dwelling and job growth assumptions for each strategic location in Central Bedfordshire.

**Table 3: Local Plan growth assumptions – Strategic Growth Locations<sup>10</sup>**

Growth Area	Strategic Growth Location	Dwellings		Jobs
A	North of Luton	4,000	<b>8,000</b>	
	GB Villages	2,000		
	West of Luton	2,000		
	Sundon Rail Freight Interchange			2,375
B	North of Sandy	7,000	<b>12,000</b>	
	East of Biggleswade	3,000		
	East of Arlesey	2,000		
	Biggleswade, west of A1			2,000
C	Aspley Guise	3,000	<b>9,000</b>	
	Marston Valley	5,000		
	Wixams Southern	1,000		
	Ridgmont, M1 Junction 13			1,750
D	RAF Henlow	1,000	<b>1,500</b>	
	Villages	500		
<b>Total (Dwellings)</b>		<b>30,500</b>		<b>6,125</b>

## 2.6 Transport Infrastructure assumptions

2.6.1 There are two types of infrastructure assumptions to consider:

- Transport schemes which have been identified or proposed to be completed within the Local Plan period i.e. by 2035; and
- Specific access assumptions to/from the CBLTM development zones.

2.6.2 There was limited information regarding access assumptions at time of model development:

- Some development site access assumptions were defined as part of previous work and applied in Stage 1b:
  - Century Park (Luton);
  - Power Court (Luton);
  - North of Luton / Sundon Rail Freight Interchange;
  - East Leighton Buzzard; and
- Access assumptions to / from all development zones will need to be refined at later stages (i.e. Stage 1c).

<sup>10</sup> 220217 CBC Growth Scenarios 1\_5.xlsx, email from CBC (Connie Frost-Bryant, 23-Feb-17)

2.6.3 **Table 4** outlines the transport infrastructure scheme assumptions, for both 2035 Reference Case and Local Plan model scenarios. As discussed and agreed with CBC:

- All committed and highly likely schemes should be included in the 2035 Reference Case model scenario (and thus in the 2035 Local Plan); 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. These schemes (highlighted **green** in **Table 4**) have therefore been included in the 2035 Local Plan model scenario.

2.6.4 In addition, CBC have identified four schemes (highlighted **blue** in **Table 4**) which may support the Local Plan growth in certain areas. These are presented in **Figure 3**:

- A1 East of England improvements:
  - The A1 was coded in CBLTM with 3 lanes and grade-separated junctions within CBC boundaries;
  - As part of the A1 route upgrade, some of the existing local accesses were removed, as indicated in **Figure 3**;
- A428 Black Cat to Caxton Gibbet (outside CBC): the Pink Route and Black Cat Roundabout Option B, as defined in Highways England's public consultation<sup>11</sup>, were coded in CBLTM;
- Oxford to Cambridge Expressway (outside CBC): as agreed with CBC<sup>12</sup>, the Expressway was coded in CBLTM 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 CBLTM i.e. has no capacity restrictions; and
- East-West Rail Central section: based on the Final Report dated 08-Aug-14<sup>13</sup>, two additional hourly services were introduced:
  - Cambridge to Oxford (in 60 minutes) and Cambridge to Bedford (in 24 minutes); and
  - Both services were coded in CBLTM with a stop within CBC.

2.6.5 It should be noted that information on the specific A428 Black Cat to Caxton Gibbet / Black Cat roundabout improvement options applied in Stage 1b was not available during the development of Stage 1a. Coding assumptions for this specific scheme therefore differ between Stages 1a and 1b, as generic assumptions on Black Cat's grade separation were applied in Stage 1a.

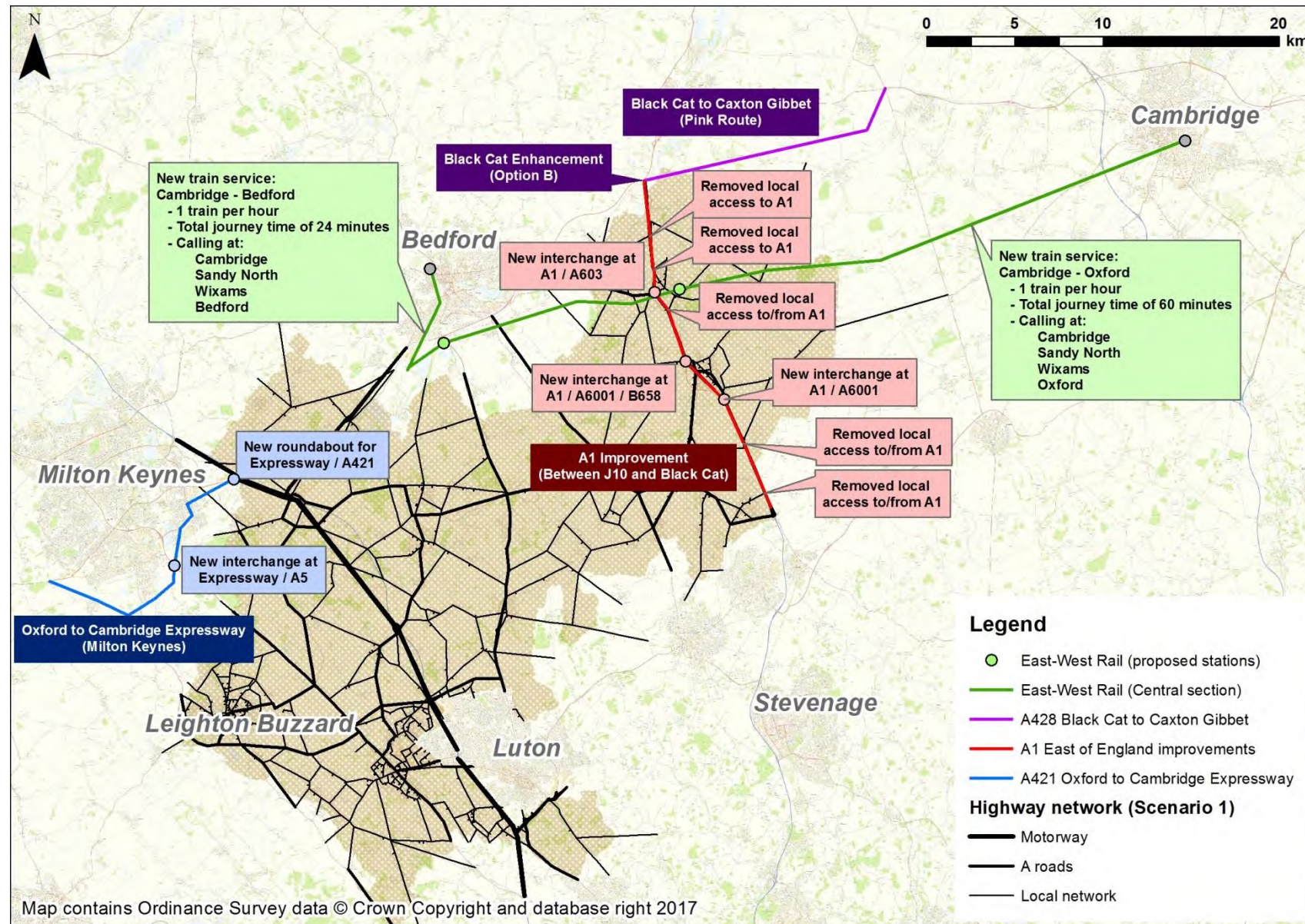
2.6.6 As there was limited information on these four schemes at time of model development, it has been agreed to test these proposed schemes independently and at high-level. These schemes were therefore tested in an additional scenario, titled Scenario 1\*. This scenario is otherwise identical to Scenario 1 (including in terms of demand growth assumptions).

<sup>11</sup> <http://roads.highways.gov.uk/projects/a428-black-cat-to-caxton-gibbet/>, last accessed 10-Nov-17

<sup>12</sup> Email from CBC (Dave Buck, 13-Feb-17)

<sup>13</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 transport schemes specific to Scenario 1\*





**Table 4: Transport Infrastructure scheme assumptions**

Source	Certainty	Scheme	Reference Case	Local Plan / Scen. 1	Scenario 1*
Central Beds	Open	M1 – A5: - A5 – M1 Link - A5505 (Woodside Link)	Y	Y	Y
	Committed	A421 Dualling (including between Eagle Farm and M1) <sup>14</sup>	Y	Y	Y
	H. likely	M1 – A5: - Poynters Road Scheme - Connection to Woodside Link from Parkside Drive	Y	Y	Y
		Houghton Regis (HR) North Development 1: - Access to Early Release Kestrel Way - Access Road to Distribution Centre (DC) - HR DC development access over CBC land	Y	Y	Y
		Houghton Regis North Development 2: - Distributor Road	Y	Y	Y
		Leighton Buzzard improvements: - East Leighton Distributor Road - Leighton Buzzard Town Centre Schemes	Y	Y	Y
	Proposed	M1-A6 link	N	Y	Y
Luton Borough	Open	Dunstable Rd scheme: - Reallocation of 1 lane between NWB and SEB movements between Telford Way and Cardiff Rd	Y	Y	Y
	Committed	Dualling of Airport Access Road	Y	Y	Y
	H. likely	Power Court development access	Y	Y	Y
		Airport Link to Century Park	Y	Y	Y
		Luton Airport – Mass Passenger Transit system: - Code the MPT and an assumed headway of 10 min (as per current shuttle bus services) - Cancel shuttle bus services on Luton Airport Parkway Bus-Loop - Re-phase signal at New Airport Way / B653 Gipsy Ln	Y	Y	Y
Highways England	Open	M1 J11a Dumbbell Junction	Y	N	N
	Proposed	M1 J11a Dumbbell Junction with capacity-increase measures and access to M1-A6 link	N	Y	Y
		A428 Black Cat to Caxton Gibbet (Pink Route / Option B)	N	N	Y
		A421 Oxford to Cambridge Expressway (Milton Keynes)	N	N	Y
		A1 East of England improvements: - Upgrade to 3 lanes between J10 and Black Cat roundabout - All grade-separated junctions	N	N	Y

<sup>14</sup> Email from CBC (Jim Tombe, 03-Mar-17)

Source	Certainty	Scheme	Reference Case	Local Plan / Scen. 1	Scenario 1*
Rail	Committed	East West Rail (Western Section)	Y	Y	Y
	Proposed	East West Rail (Central Section)	N	N	Y

## 2.7 Summary of the modelling assumptions

2.7.1 **Table 5** summarises the assumptions for all three Forecast Year 2035 scenarios.

**Table 5: Summary of CBLTM scenarios**

Scenario	CBC	Luton Borough	Outside CBC / LBC	Infrastructure
Reference Case	Committed growth	LBC Local Plan growth until 2031	TEMPRO (NTEM v7.2) growth	Committed + Highly likely in CBC and LBC
Local Plan / Scenario 1	CBC Local Plan growth	& TEMPRO (NTEM v7.2) growth beyond 2031		Reference Case + M1-A6 link
Scenario 1*		Local Plan / Scenario 1 + All other proposed		

## 3. CBLTM Forecast Year 2035

### 3.1 Introduction

3.1.1 The following section presents the CBLTM model results for the 2035 Reference Case and Local Plan (for both Scenarios 1 and 1\*), in the morning (AM) and evening (PM) peak hours.

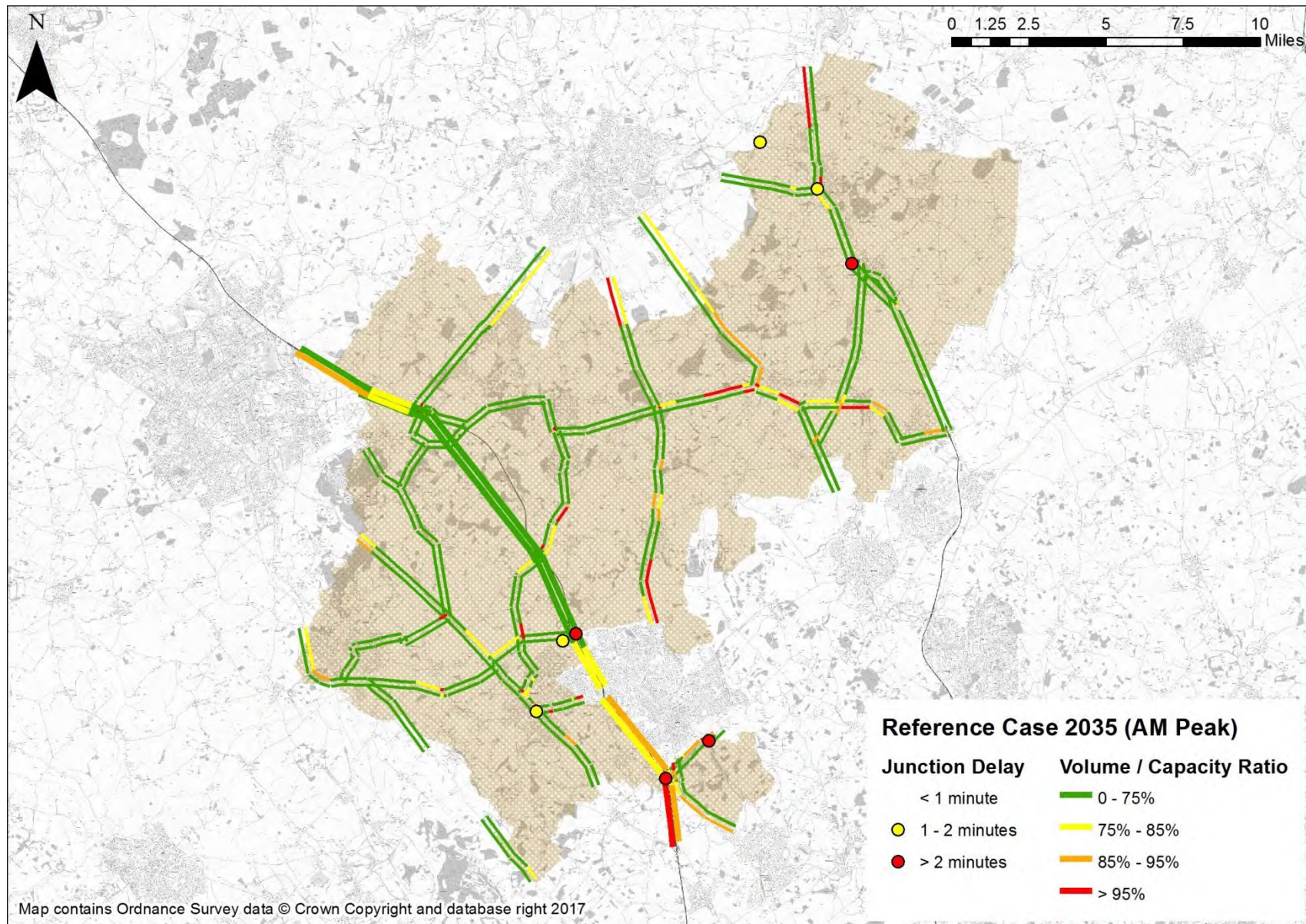
3.1.2 These results will be used to:

- Identify the network issues (i.e. 'hot spots') across Central Bedfordshire by the end of the Local Plan period (i.e. 2035); and
- Compare the identified 'hot spots' to the Stage 1a results (i.e. the Regulation 18 evidence base).

### 3.2 Link stress and Junction delays

3.2.1 **Figure 4 – Figure 9** present the link stress (see §2.1 for more explanation) and junction delays for the 2035 Reference Case and Local Plan (Scenario 1 / 1\*), in AM and PM.

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





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

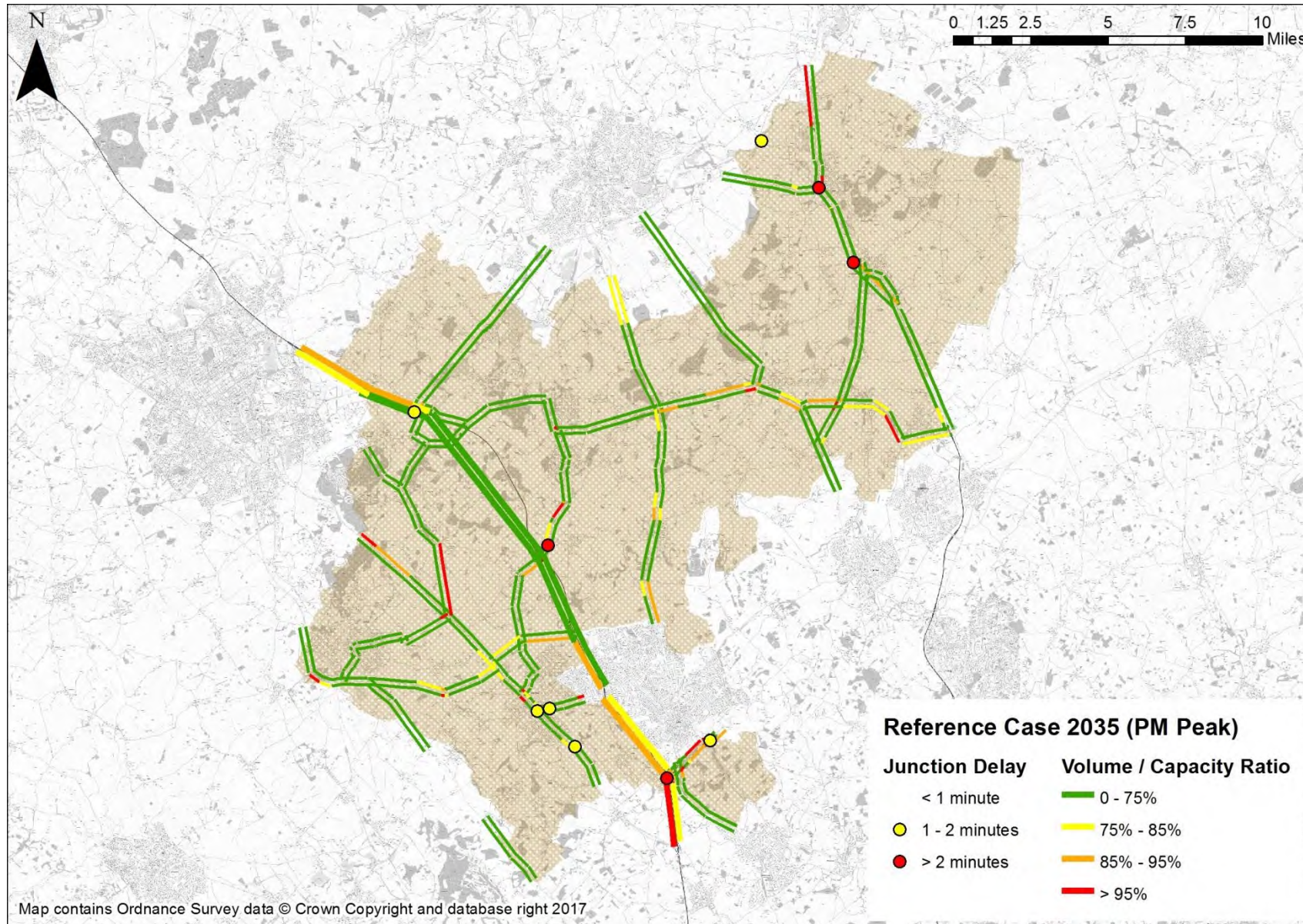




Figure 6: Link stress and Junction delays, Local Plan / Scenario 1, AM

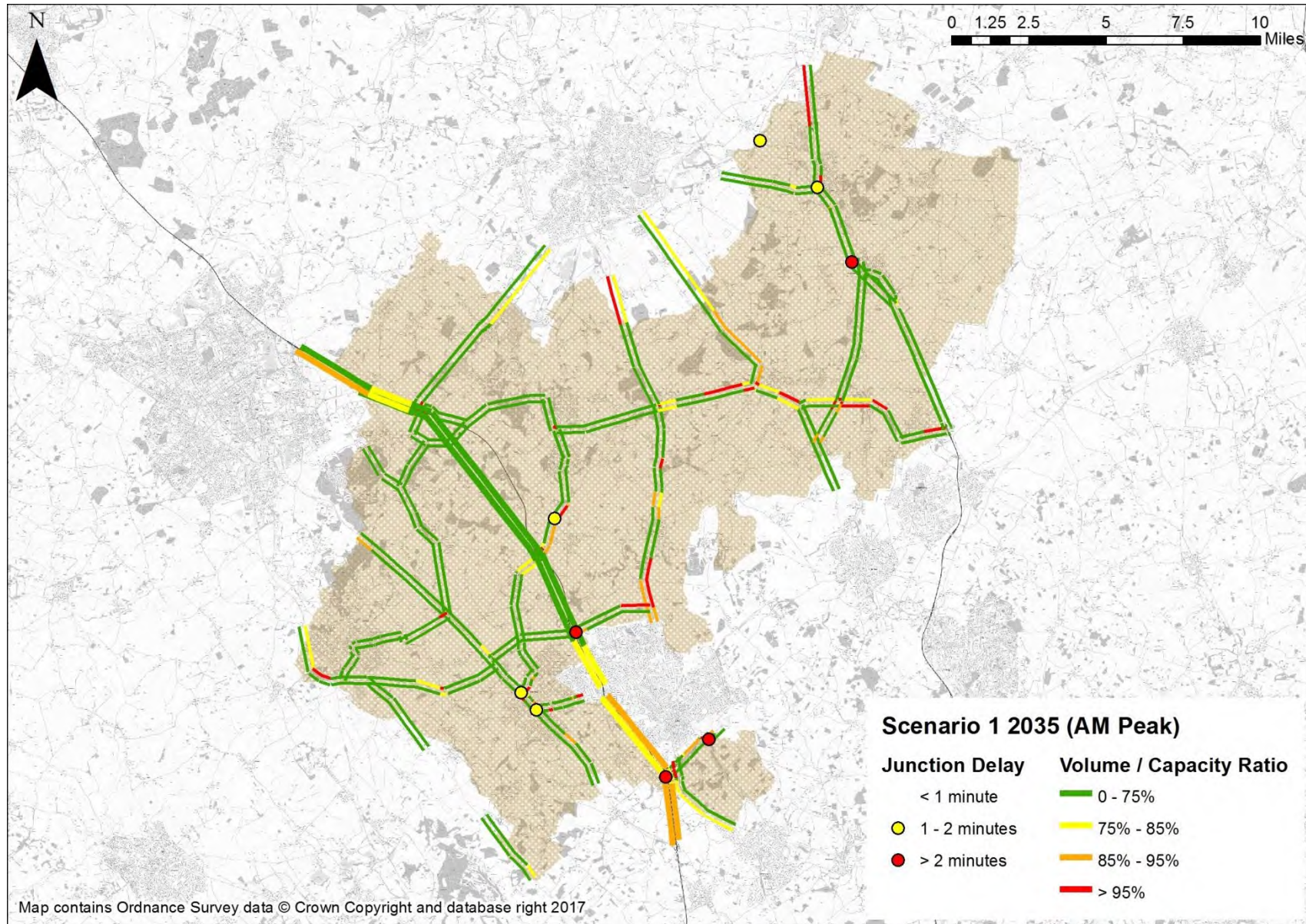




Figure 7: Link stress and Junction delays, Local Plan / Scenario 1, PM

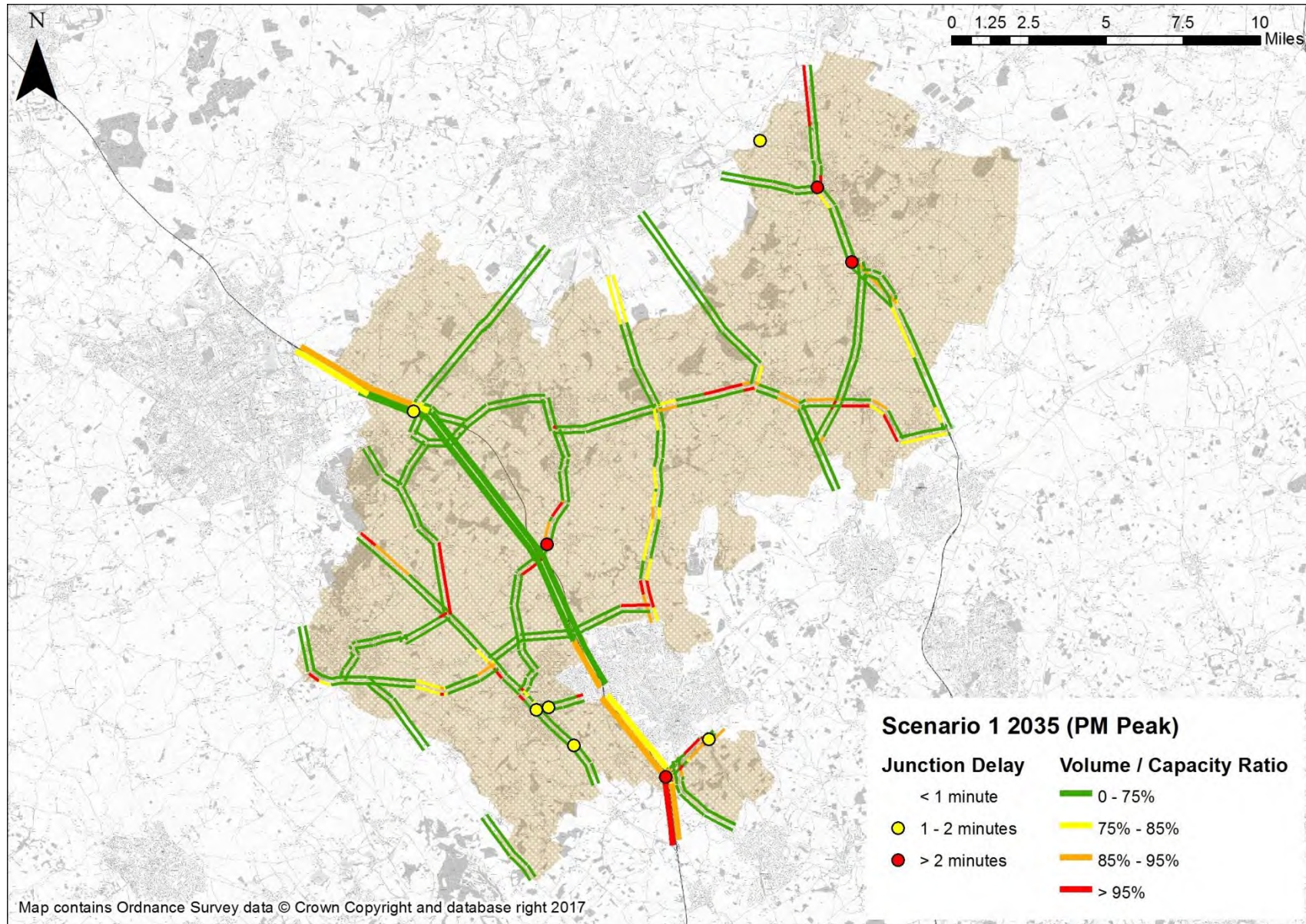
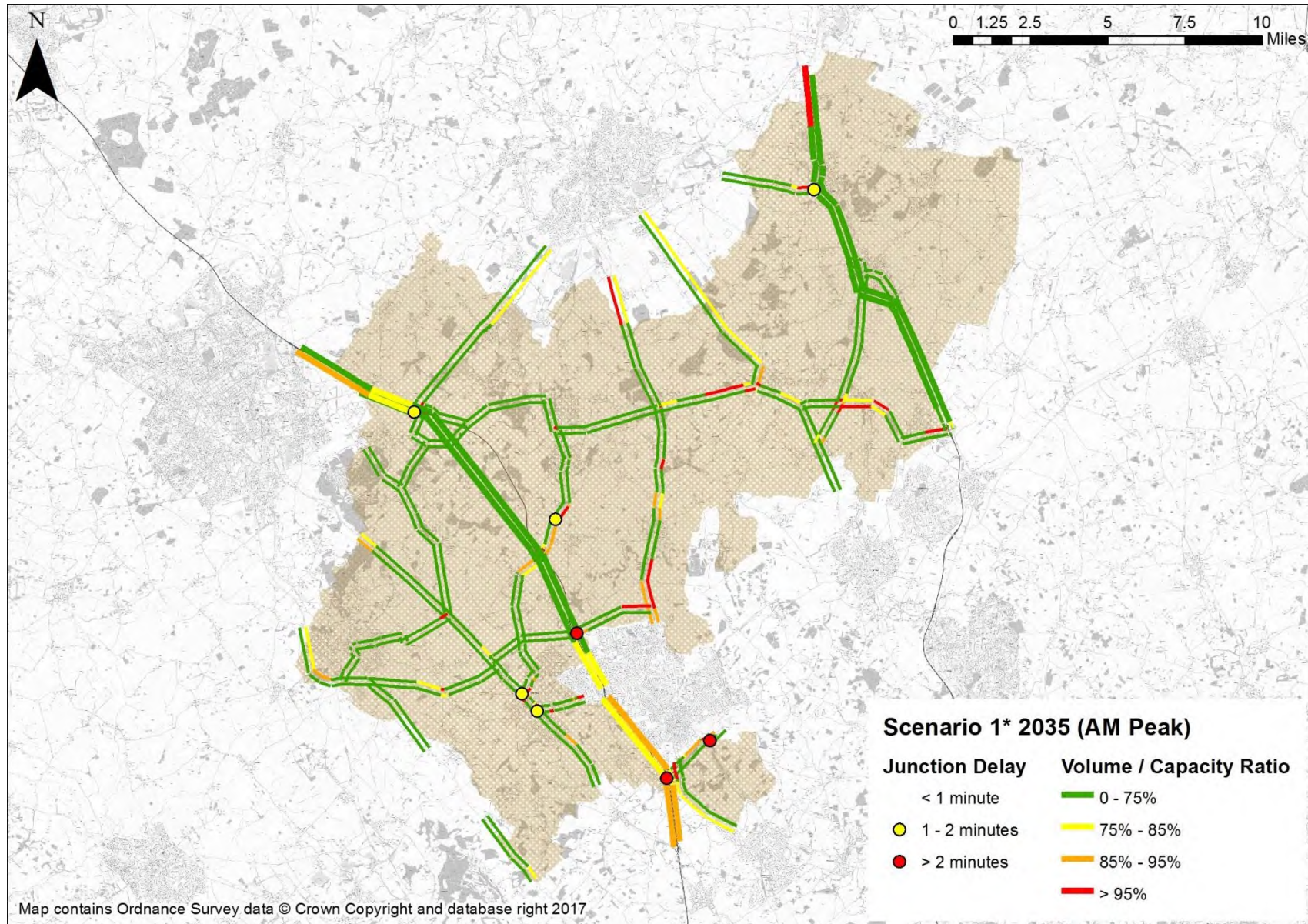


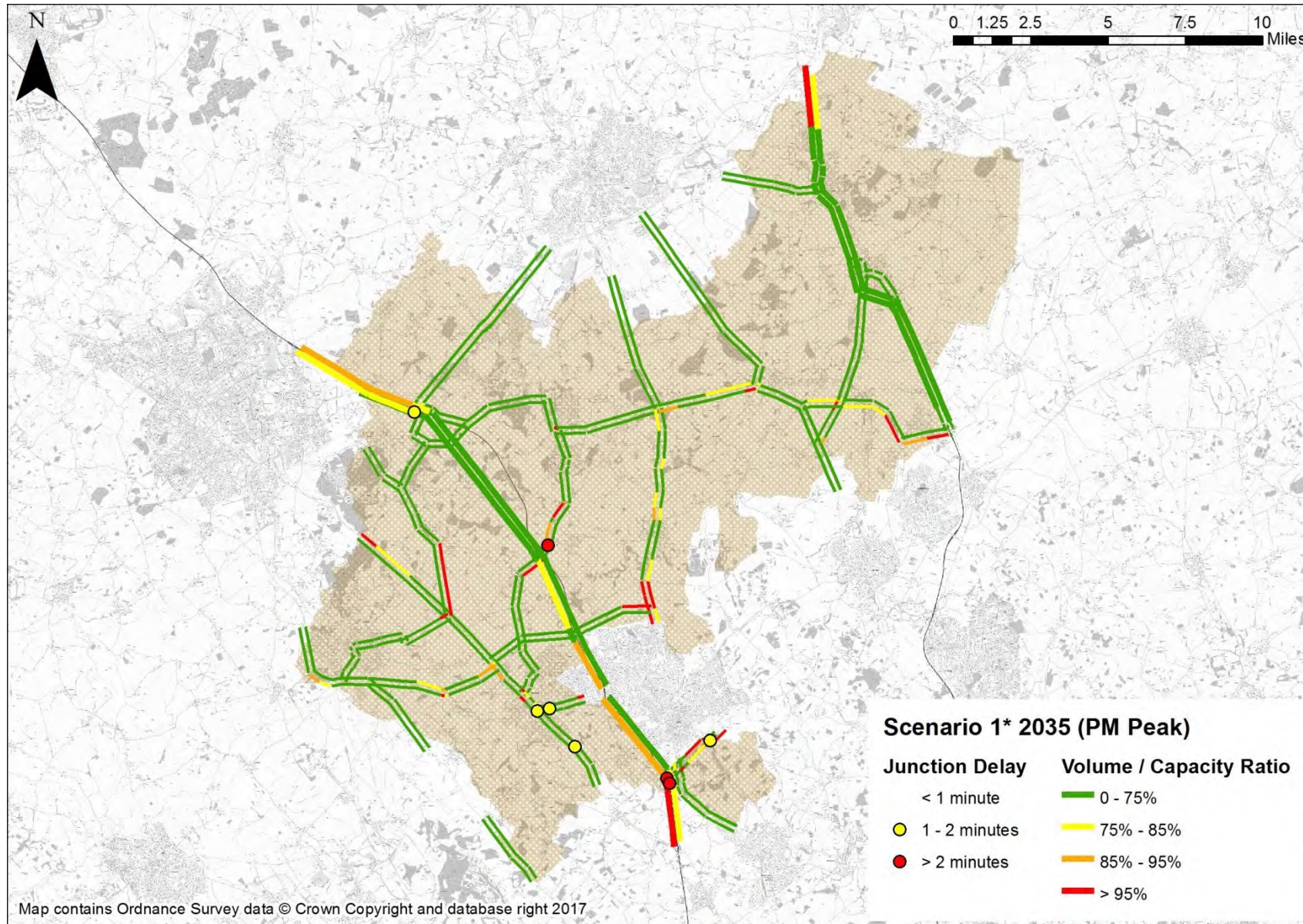


Figure 8: Link stress and Junction delays, Scenario 1\*, AM





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



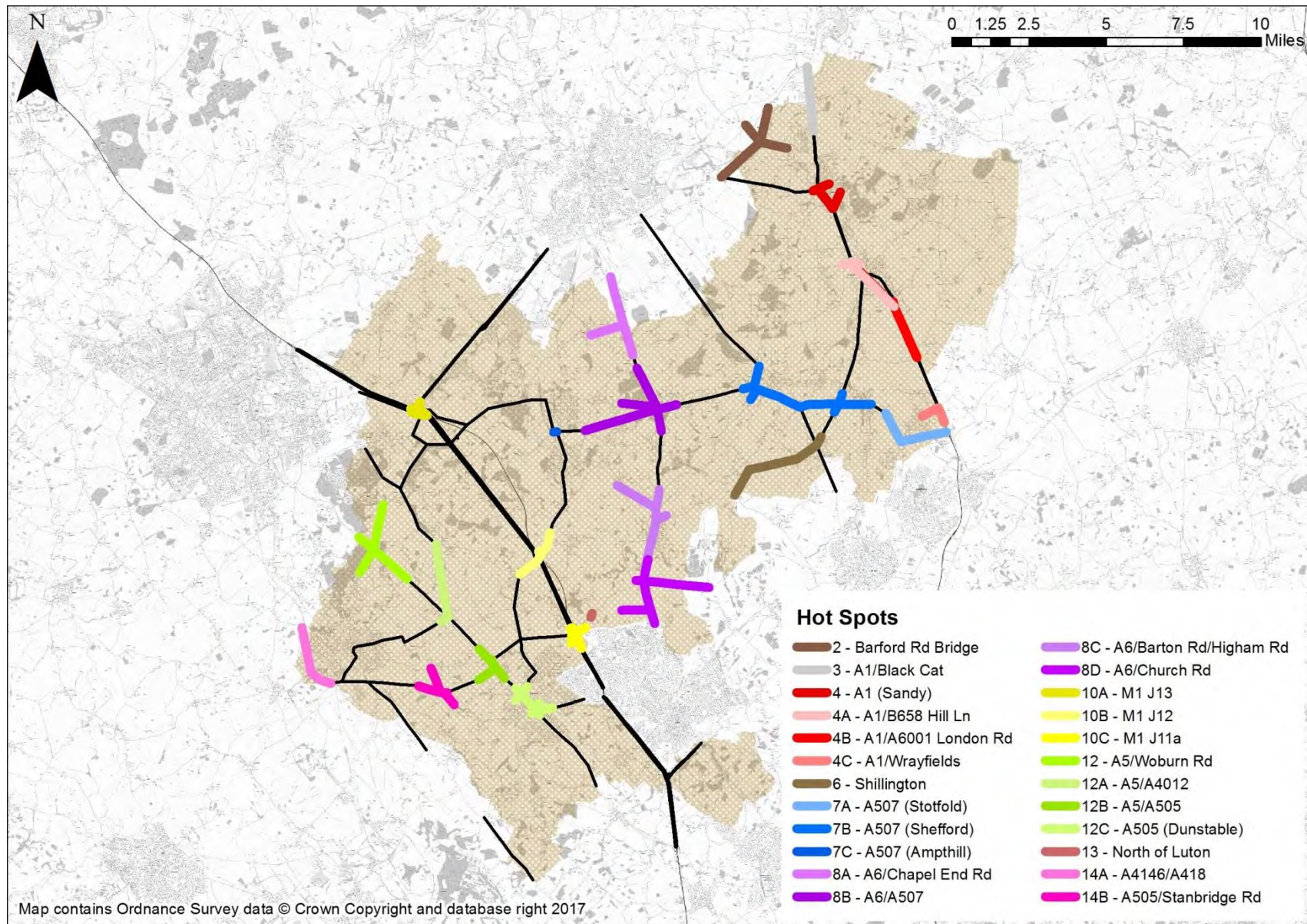
### 3.3 'Hot Spots' and scales of impact

3.3.1 The network issues identified above have been grouped into twenty-four 'hot spots', as shown in **Figure 10**:

- Twenty-three of these 'hot spots' are located within Central Bedfordshire:
  - All 'hot spots' are located on major local roads within CBC and on Highways England's (HE) Strategic Road Network;
  - Hot Spot 4 – A1 (Sandy) is located within AQMA No. 4 Sandy;
  - Hot Spot 12C – A505 (Dunstable) is located within South Bedfordshire AQMA; and
- The A1/Black Cat 'hot spot' is located outside Central Bedfordshire:
  - Mitigation at the roundabout has already been identified by Highways England as part of the A428 Black Cat to Caxton Gibbet scheme.



Figure 10: Central Bedfordshire's 'hot spots'



3.3.2 The scale of impact for each ‘hot spot’ has been assessed using the methodology defined in §2.2. **Figure 11** presents the results of this high-level, qualitative assessment.

3.3.3 It is acknowledged that an identical scale of impact between the 2035 Reference Case and Local plan may mask some changes to the number of vehicles (i.e. ‘users’) impacted by the network issue and/or the level of link stress or junction delay (i.e. ‘congestion’) experienced at the ‘hot spot’.

**Figure 11: ‘Hot spot’ scales of impact**

ID	Hot Spot	Managed by	Ref. Case	Local Plan	Scen. 1*
2	Barford Rd bridge	CBC	6	6	6
3	A1/Black Cat	HE	10	10	8
4	A1 (Sandy)	HE, CBC	10	10	7
4A	A1/B658 Hill Ln	HE, CBC	10	10	1
4B	A1/A6001 London Rd	HE, CBC	3	3	0
4C	A1/Wrayfields	HE, CBC	3	4	0
6	Shillington	CBC	2	5	4
7A	A507 (Stotfold)	CBC, HE	3	5	8
7B	A507 (Shefford)	CBC	9	9	9
7C	A507 (Amphill)	CBC	3	3	5
8A	A6/Chapel End Rd	CBC	3	3	2
8B	A6/A507	CBC	4	4	4
8C	A6/Barton Rd/Higham Rd	CBC	5	5	5
8D	A6/Church Rd	CBC	5	8	9
10A	M1 J13	HE, CBC	9	10	8
10B	M1 J12	HE, CBC	6	7	7
10C	M1 J11a	HE, CBC	6	6	6
12	A5/Woburn Rd	HE, CBC	4	3	3
12A	A5/A4012	HE, CBC	6	6	6
12B	A5/A505	HE, CBC	2	3	3
12C	A505 (Dunstable)	HE, CBC	9	10	10
13	North of Luton	CBC	5	5	5
14A	A4146/A418	CBC	4	4	3
14B	A505/Stanbridge Rd	CBC	7	7	7

3.3.4 The scales of impact tend to be higher on the strategic road network, due to the number of vehicles potentially impacted by the network issue. In particular, the scale of impact is significant (i.e. above 8 / 10) for the following locations:

- Along the A1 corridor, including at the AQMA No. 4 Sandy (Hot Spot 4);
- At the M1 J13, which connects the M1, A421 and A507 (Hot Spot 10A);
- On the A6 north of Luton (Hot Spot 8D);
- On the A505 within Dunstable, including at the South Bedfordshire AQMA (Hot Spot 12C); and
- Along the A507 corridor south of Shefford, particularly in relation to the A600 (Hot Spot 7B).

3.3.5 It should be noted that most issues are already expected in the 2035 Reference Case i.e. with the committed growth only. As requested by CBC, the mitigation to be proposed in Stage 2a (out of this scope) will therefore address all ‘hot spots’ identified.

3.3.6 The Scenario 1\* results suggest that the introduction of the A1 East of England and Black Cat roundabout improvements may reduce the scales of impact of Hot Spots 3, 4, 4A and 4B. It was assumed that the local Wrayfields access (Hot Spot 4C) be removed as part of the A1 improvement scheme. However, additional capacity along the A1 also seems to cause additional stress on the A507 in the vicinity of the A1(M) Junction 10 (Hot Spot 7A).

### 3.4 Stage 1b vs. Stage 1a

#### Model changes

- 3.4.1 Changes to the evidence base between Stage 1a and Stage 1b should be expected due to the change in the CBLTM model version which is underlying the ‘hot spot’ analysis.
- 3.4.2 The main changes are summarised below:
- The Base Year was updated from 2009 to 2016, including:
    - Changes to the underlying Base Year Highway and Public Transport networks;
    - Changes to the Base Year demand;
    - Changes to the data underlying the Base Year model validation;
  - Fundamental assumptions to the model development were revisited e.g.:
    - The CBLTM zoning system was reviewed and updated, particularly in light of the latest definition of Output Areas;
    - The CBLTM Public Transport model was built up on a different software platform (i.e. EMME);
  - Some of the forecast assumptions were reviewed:
    - Growth between 2009 and 2016 needed to be excluded in Stage 1b, as this growth was reflected in the Base Year 2016 demand update;
    - NTEM v7.2 was applied in Stage 1b for consistency purposes;
    - Development zone allocation was revised; and
    - The A428 Black Cat to Caxton Gibbet scheme (including the Black Cat roundabout improvement) was updated based on the latest information available at time of development.

#### Network statistics

- 3.4.3 **Table 6** and **Table 7** present the summary statistics across the CBLTM simulation network by time period, for both Stages 1a and 1b. **Table 8** presents the comparison between Stages 1a and 1b for these statistics.

**Table 6: Network Statistics, by time period (Stage 1a)**

Statistics	AM			PM		
	Reference Case	Scenario 1	Scenario 1*	Reference Case	Scenario 1	Scenario 1*
Total Travel Time (PCU-hr)	53,800	57,200	56,900	52,300	55,000	54,700
Total Travel Distance (PCU-km)	2,723,800	2,826,700	2,891,100	2,731,700	2,821,100	2,902,400
Average Speed (kph)	50.6	49.4	50.8	52.2	51.3	53.1

**Table 7: Network Statistics, by time period (Stage 1b)**

Statistics	AM			PM		
	Reference Case	Local Plan / Scen. 1	Scenario 1*	Reference Case	Local Plan / Scen. 1	Scenario 1*
Total Travel Time (PCU-hr)	56,200	56,700	56,700	58,900	59,500	59,800
Total Travel Distance (PCU-km)	2,727,300	2,756,500	2,810,200	2,748,000	2,778,500	2,854,900
Average Speed (kph)	48.5	48.6	49.6	46.7	46.7	47.7



**Table 8: Network Statistics comparison, by time period (Stage 1b vs. Stage 1a)**

Statistics	AM			PM		
	Reference Case	Local Plan / Scen. 1	Scenario 1*	Reference Case	Local Plan / Scen. 1	Scenario 1*
Total Travel Time (PCU-hr)	+4.5%	-0.9%	-0.4%	+12.6%	+8.2%	+9.3%
Total Travel Distance (PCU-km)	+0.1%	-2.5%	-2.8%	+0.6%	-1.5%	-1.6%
Average Speed (kph)	-4.2%	-1.6%	-2.4%	-10.5%	-9.0%	-10.2%

3.4.4 It should be noted that the average speed for the Reference Case is lower in Stage 1b (i.e. with the updated CBLTM) compared to Stage 1a (-2 kph / -4.2% in AM and -6 kph / -10.5% in PM):

- This is mainly due to more overall congestion on the network with the updated CBLTM (+4.5% / +12.6% travel time in AM / PM peaks). The travel distances in the 2035 Reference Case have indeed not changed significantly between Stages 1a and 1b (+0.1% / +0.6% in AM / PM); and
- This suggests that there might be more network issues in Stage 1b and/or similar issues with a higher scale of impact (compared to Stage 1a).

3.4.5 Another key difference is that the modelling results suggest congestion is higher in the PM peak in Stage 1b, as the average speed is lower by -2 kph when compared to the AM peak. The evidence presented in Stage 1a suggested the opposite i.e. the average speed was higher by +1.5 kph in the PM peak.

3.4.6 The additional Local Plan growth has relatively less impact when compared to the 2035 Reference Case in Stage 1b. For instance, the average speed does not change significantly between both scenarios in Stage 1b, while it decreased by approximately -1 kph in Stage 1a.

3.4.7 Similarly, the overall impact of the proposed schemes in Scenario 1\* (i.e. the A421 Cambridge to Oxford Expressway, East-West Rail Central section, A1 East of England improvement and A428 Black Cat to Caxton Gibbet) is more limited in Stage 1b (+1 kph in both time periods compared to +1.5 to +2 kph in Stage 1a).

#### Hot spots

3.4.8 **Figure 12** presents the comparison between the ‘hot spots’ identified in Stage 1a and the ones from Stage 1b, as well as the changes to their scale of impacts. The same methodology was applied to assess the scale of impact in both cases (see §2.2).

**Figure 12: ‘Hot spot’ scales of impact, Stage 1a vs. Stage 1b**

ID (S1A)	Hot Spot (S1A)	Ref. Case	Scen. 1	Scen. 1*	Ref. Case	Scen. 1	Scen. 1*	Hot Spot (S1B)	ID (S1B)
1	A1 Black Cat	8	8	2	10	10	8	A1/Black Cat	3
2	North of Sandy	0	6	6					
3	Sandy	5	5	2	10	10	7	A1 (Sandy)	4
4A	A1/B658 Hill Ln	6	8	0	10	10	1	A1/B658 Hill Ln	4A
4B	A1/A6001 London Rd	6	6	0	3	3	0	A1/A6001 London Rd	4B
5	Stotfold	4	4	4					
6	Shillington	0	2	2	2	5	4	Shillington	6
7A	A507 (Shefford)	8	9	8	9	9	9	A507 (Shefford)	7B
7B	A507 (Stotfold)	6	8	8	3	5	8	A507 (Stotfold)	7A
8A	A6/Chapel End Rd	3	3	3	3	3	2	A6/Chapel End Rd	8A
8B	A6/A507	6	6	6	4	4	4	A6/A507	8B
8C	A6/Barton Rd	5	5	5	5	5	5	A6/Barton Rd/Higham Rd	8C
8D	A6/Church Rd	7	7	7	5	8	9	A6/Church Rd	8D
9	Amphill	6	6	6					
10	M1 J13	6	8	8	9	10	8	M1 J13	10A
11	M1 J12	4	5	5	6	7	7	M1 J12	10B
12A	A5/A4012	5	6	6	6	6	6	A5/A4012	12A
12B	A5/A505	0	6	6	2	3	3	A5/A505	12B
12C	A5 (Dunstable)	4	4	4	9	10	10	A505 (Dunstable)	12C
13	North of Luton	3	6	6	5	5	5	North of Luton	13
14	A4146/A418	4	4	4	4	4	3	A4146/A418	14A



3.4.9 Three of the 'hot spots' identified in Stage 1a are not confirmed in Stage 1b:

- North of Sandy;
- Stotfold town centre; and
- Ampthill town centre.

3.4.10 Conversely, there are six additional 'hot spots' in Stage 1b compared to Stage 1a, as shown in **Figure 11**:

- Hot Spot 2 – Barford Rd bridge;
- Hot Spot 4C – A1/Wrayfields;
- Hot Spot 7C – A507 (Ampthill);
- Hot Spot 10C – M1 J11a;
- Hot Spot 12 – A5/Woburn Rd; and
- Hot Spot 14B – A505/Stambridge Rd.

3.4.11 As suggested by the network statistics, the scales of impact tend to be higher in Stage 1b compared to Stage 1a across all three model scenarios.

### 3.5 Cross-boundary impacts

3.5.1 It was noted (see §3.3.1) that the Hot Spot 3 – A1/Black Cat was located outside Central Bedfordshire yet was causing network issues within Central Bedfordshire.

3.5.2 Similarly, some of the 'hot spots' identified in Stage 1b may have impacts on traffic external to Central Bedfordshire and therefore on neighbouring Local Authorities, as detailed in **Table 9**.

**Table 9: 'Hot spot' cross-boundary impacts**

ID	Hot Spot	Description of issue (2035 Local Plan)
2	Barford Rd bridge	There is limited capacity on the bridge crossing the Great Ouse river. Bridge access is regulated by signals which cause delays for traffic to / from Bedford Borough (1,050 PCU / 850 PCU impacted in AM / PM).
8A	A6/Chapel End Rd	There is some stress on the A6 southbound due to traffic accessing Houghton Conquest via Chapel End Rd (300 / 400 PCU in AM / PM).

3.5.3 In addition, the CBLTM is able to provide high-level indications of the CBC Local Plan growth impacts on the Highway network in the vicinity of Central Bedfordshire (see Appendix A).

3.5.4 However, it should be noted that the CBLTM has been developed and validated solely for the purpose of representing Central Bedfordshire and Luton. Any result outside Central Bedfordshire is therefore strictly indicative.

3.5.5 These results suggest that the Local Plan growth has overall limited impacts outside Central Bedfordshire boundaries. **Table 10** presents the indicative impacts of CBC Local Plan growth outside Central Bedfordshire.

**Table 10: Indicative impacts outside Central Bedfordshire**

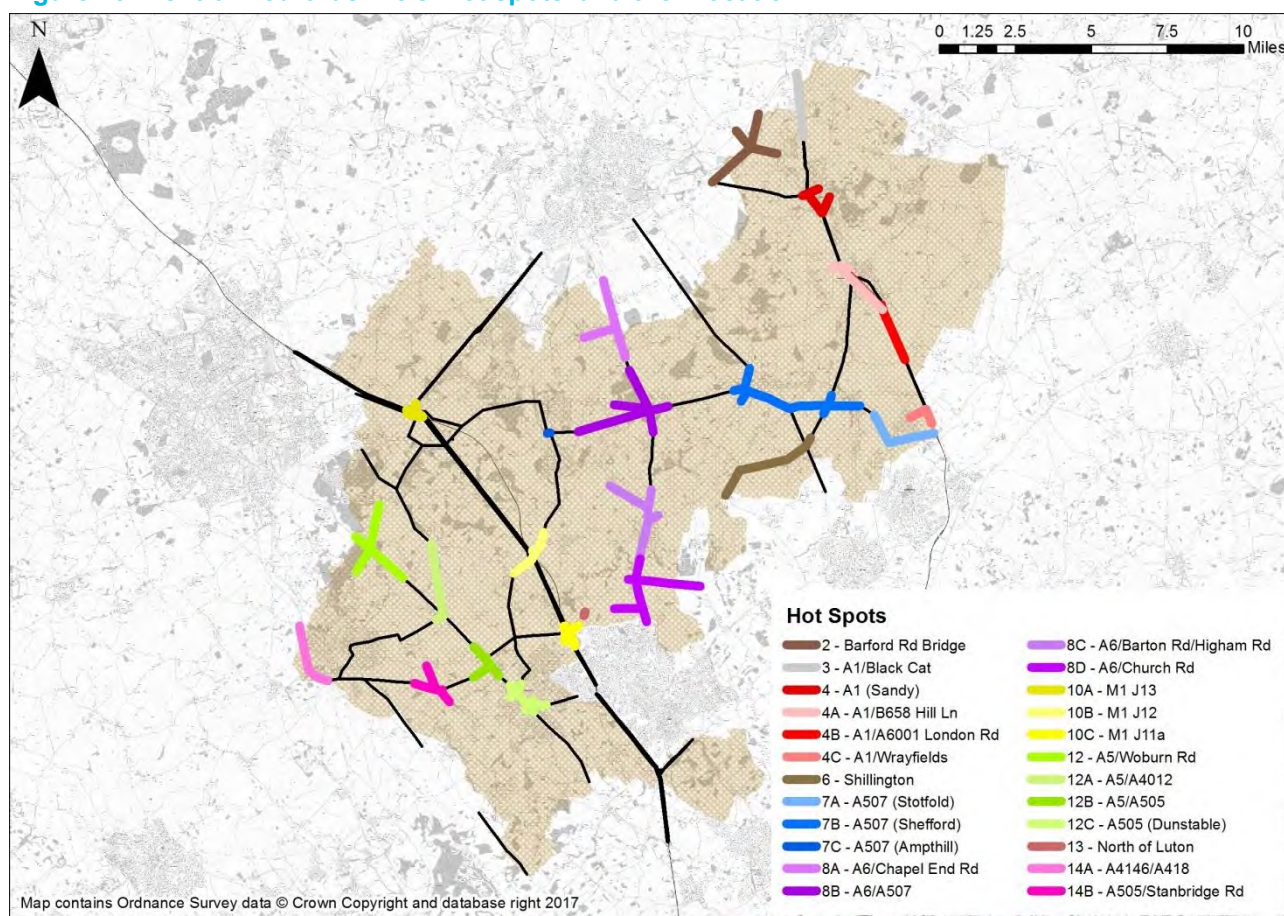
<b>Authority</b>	<b>Location</b>	<b>Description of issue (2035 Local Plan vs. Reference Case)</b>
Buckinghamshire County	B440 (Edlesborough)	In AM, additional southbound traffic on the B440 (+100 PCU) causes limited additional stress (88% vs. 81% VoC) at the High St junction.
Hertfordshire County	Letchworth Garden City	In AM, additional eastbound traffic on Arlesey New Rd (+150 PCU) causes limited additional delays (+15s) at the Stotfold Rd / Wilbury Rd junction.
	A600 (Hitchin)	In AM, additional southbound traffic on the A600 Bedford Rd (+50 PCU) causes additional stress and saturation (102% vs. 93% VoC) on the approach to Turnpike Ln junction.
	A505 (Hitchin)	In PM, additional eastbound traffic on the A505 (+50 PCU) causes limited additional stress (87% vs. 83% VoC) at the B655 Pirton Rd junction.
	B440 Leighton Buzzard Rd	In AM, limited additional southbound traffic on the B440 (less than +50 PCU) causes limited additional delays (+15s) at the A4147 Link Rd junction.
Luton Borough	A6 Barton Rd	In PM, additional northbound traffic on the A6 (+150 PCU) causes additional stress and saturation (100% vs. 94% VoC) at the Icknield Way junction.

## 4. Summary and Discussion

### 4.1 Summary

- 4.1.1 Central Bedfordshire Council (CBC) is in the process of updating their Local Plan. The evidence base for the CBC Local Plan will rely on the authority's existing strategic transport model: the Central Bedfordshire and Luton Transport Model (CBLTM).
- 4.1.2 It should be noted that the CBLTM has been revised and enhanced in-between the Regulation 18 and Regulation 19 submissions. In particular, the model's base year was updated from 2009 to 2016. It is therefore necessary to assess the impact of the model update on the evidence base for the Local Plan.
- 4.1.3 It was agreed that the transport evidence base for CBC Local Plan be provided in a staged approach. Two stages have been completed to date:
- Stage 1a: transport evidence base used for the Regulation 18 submission; and
  - Stage 1b: comparison between the Base Year 2009 and Base Year 2016 CBLTM.
- 4.1.4 As part of Stage 1b, CBC's preferred growth scenario was tested using the updated Base Year 2016 CBLTM. The updated results were used to identify twenty-three<sup>15</sup> 'hot spots' within Central Bedfordshire and one outside the CBC boundaries, as shown in **Figure 13**.

**Figure 13: Central Bedfordshire's 'hot spots' and their location**



<sup>15</sup> The A1/Black Cat roundabout, which is also identified as a 'hot spot', is located outside Central Bedfordshire.

4.1.5 Comparison with the Stage 1a results indicates that no significant change in the evidence base should be expected from this model update. In particular:

- Seventeen of the twenty 'hot spots' identified in Stage 1a were confirmed with the updated CBLTM. There are no significant network issues in the updated model at the three other 'hot spots' previously identified in Stage 1a; and
- Six additional 'hot spot' locations have been identified with the updated model.

## 4.2 Next steps

4.2.1 Several stages of work have been identified to pursue the development of the evidence base in view of the Regulation 19 submission (to be expected in January 2018). These stages are presented below:

- Stage 1c: Transport Evidence Base (without mitigation)
  - CBC will confirm the latest growth and development access assumptions for both Forecast Years 2025 and 2035;
  - The revised Reference Case and Local Plan – strategic growth model scenarios will be tested in the (Base Year 2016) CBLTM for both Forecast Years, in order to confirm the network constraints (i.e. 'hot spots') identified in Stage 1b, their scale of impacts and timescales;
- Stage 1d: Development impact analysis
  - This analysis will rely on the Stage 1c results;
  - The objectives of this analysis are to identify the cross-boundary impacts of the six strategic sites identified by CBC, as well as their high-level potential contribution to the 'hot spots' confirmed in Stage 1c;
- Stage 2a: Mitigation proposal, concept design, costing and funding
  - The purpose of this stage is to define potential highway and public transport mitigation concepts, based on the transport evidence provided in Stage 1c;
  - We will also provide the initial cost ranges associated with each mitigation, for CBC to identify and allocate potential funding sources; and
- Stage 2b: Transport Evidence Base (with initial mitigation)
  - The purpose of this stage is to implement the mitigation options agreed and confirmed in Stage 2a by CBC into the CBLTM model, and assess the impacts of these options on the highway network.

## Appendix A Link stress and Junction delays comparison

**Figure 14 – Figure 25** present the link stress and junction delays for each Forecast Year 2035 scenario, from both the Base Year 2009 CBLTM (Stage 1a) and the Base Year 2016 CBLTM (Stage 1b).

In addition to the results presented in this note, the plots from the Base Year 2016 CBLTM have also been extended to include:

- CBC's local network;
- Luton's highway network; and
- To some extent, the highway network beyond Central Bedfordshire.

It is acknowledged that the Stage 1a plots, which are presented below for reference purposes, only include CBC's local network.

**It should be noted that the CBLTM has been developed and validated for the purpose of representing Central Bedfordshire and Luton. Any result outside Central Bedfordshire is presented for indicative purposes only.**



Figure 14: Link stress and Junction delays, 2035 Reference Case, AM (Stage 1a)

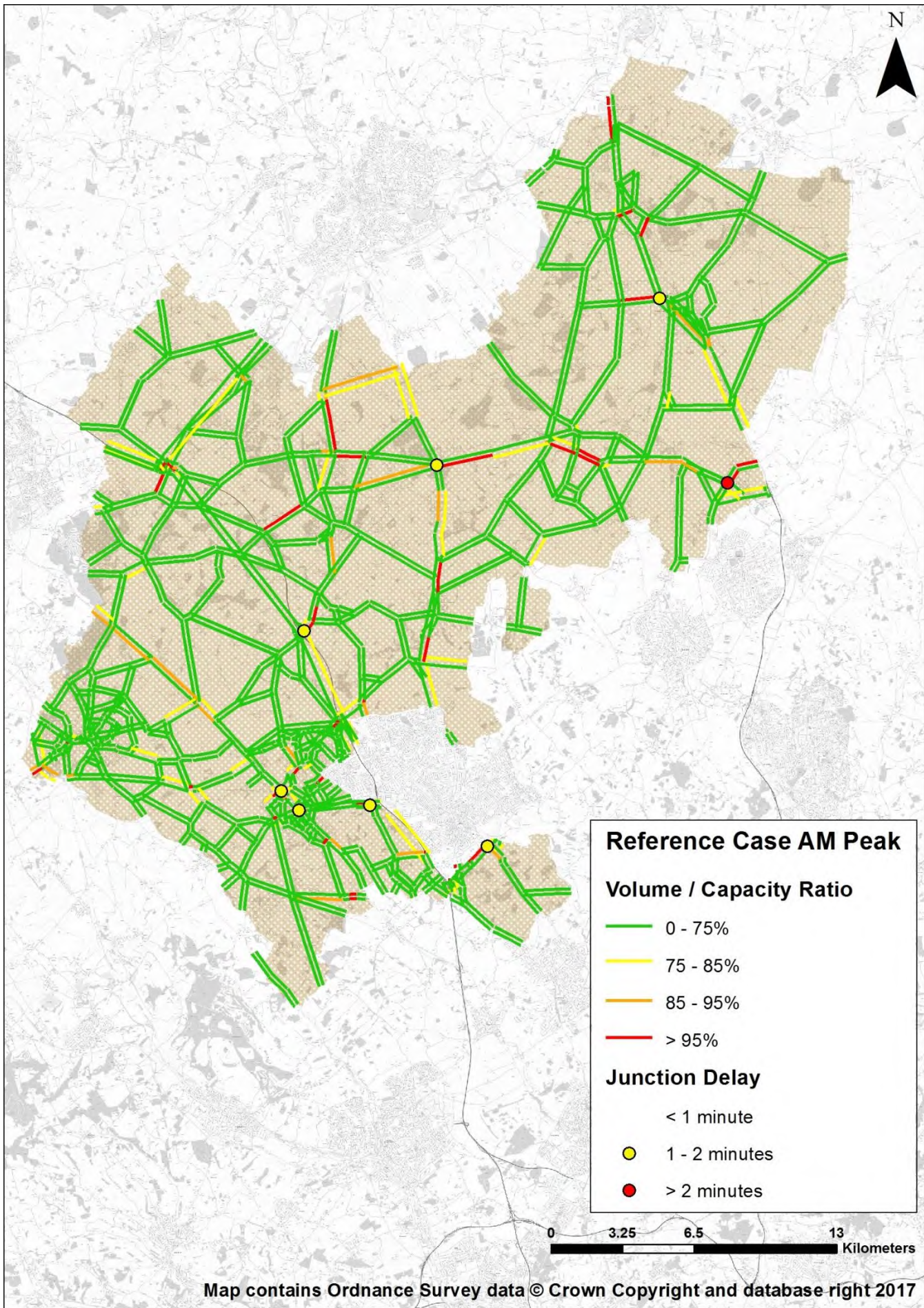


Figure 15: Link stress and Junction delays, 2035 Reference Case, AM (Stage 1b)

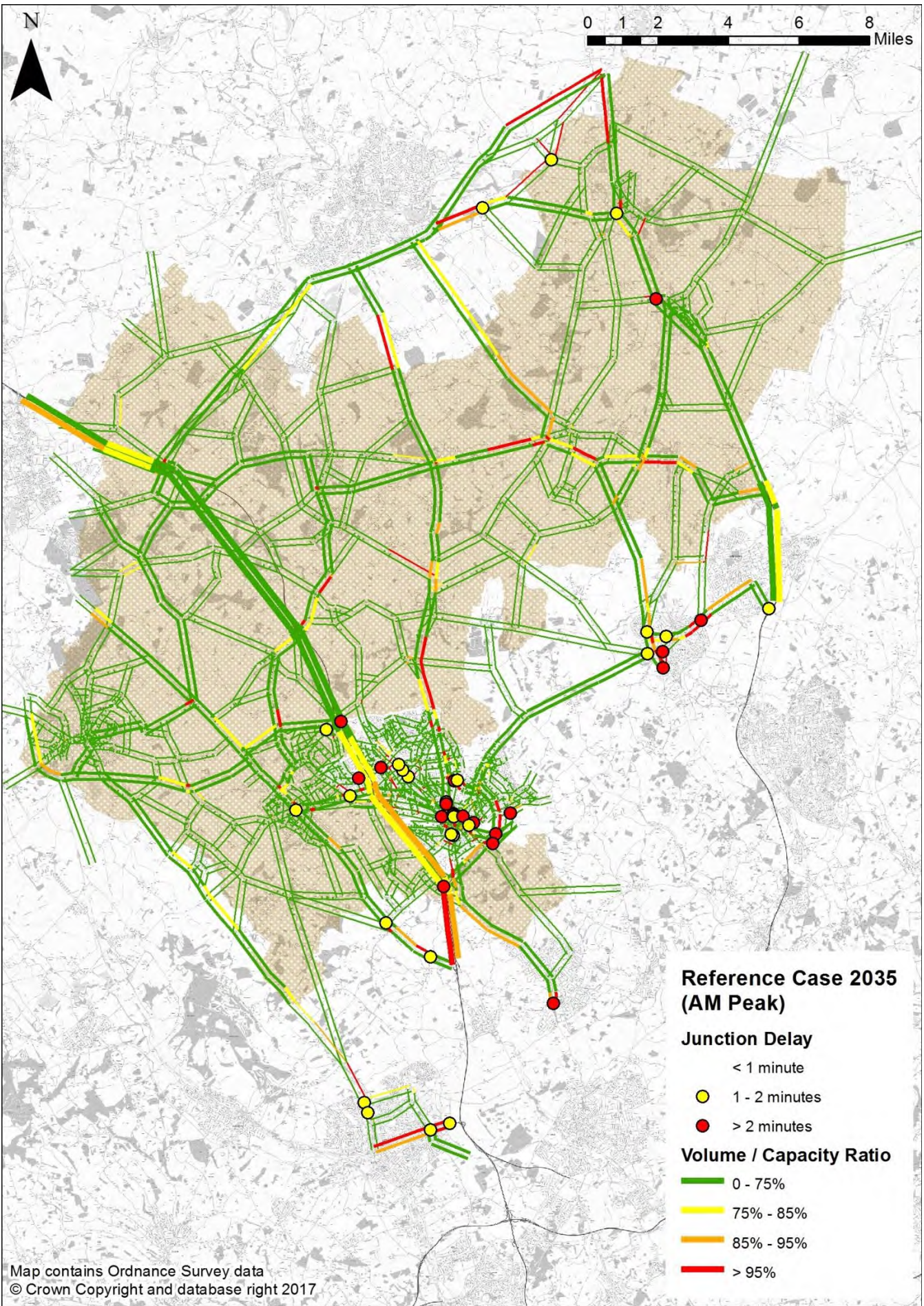




Figure 16: Link stress and Junction delays, 2035 Reference Case, PM (Stage 1a)

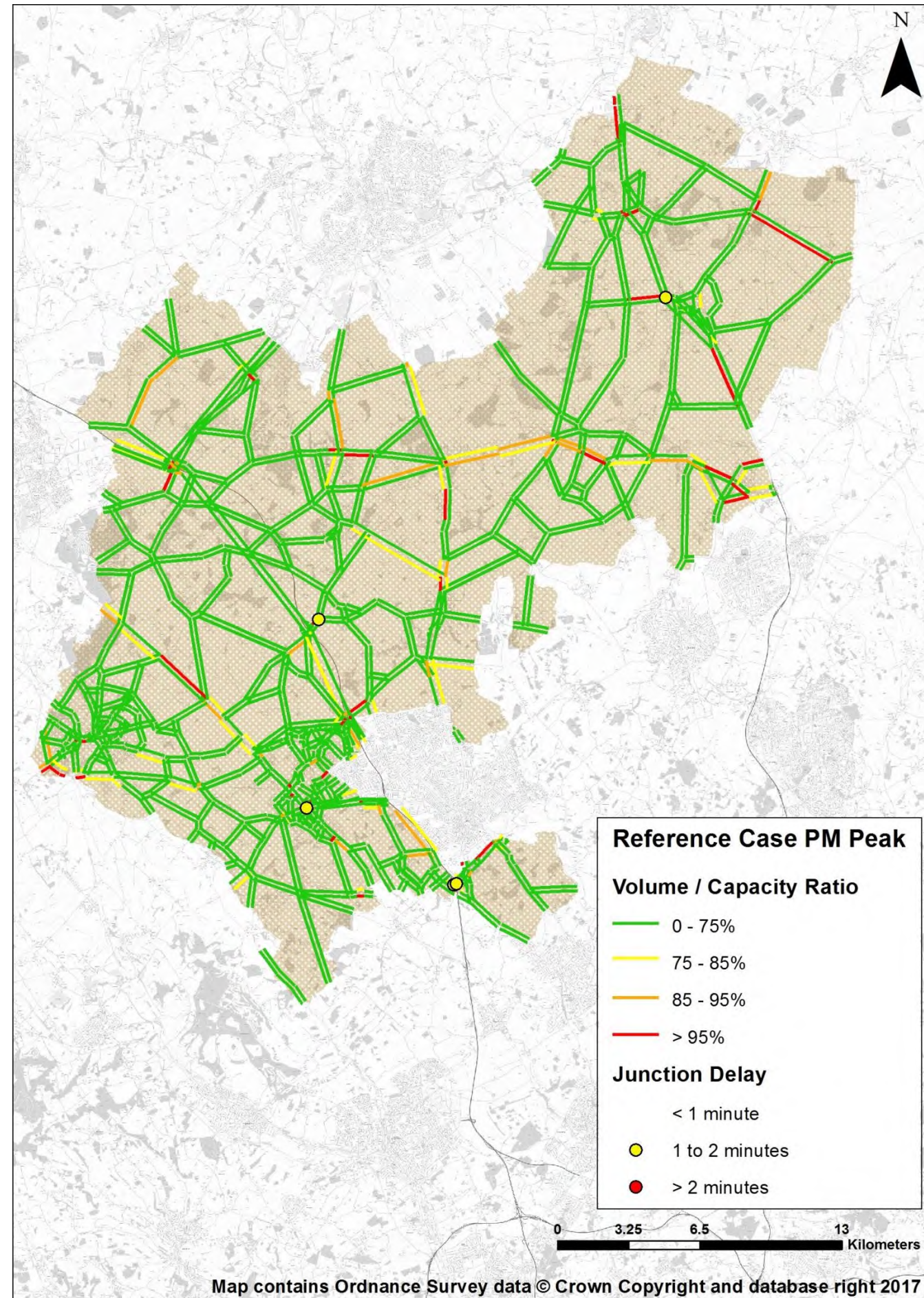


Figure 17: Link stress and Junction delays, 2035 Reference Case, PM (Stage 1b)

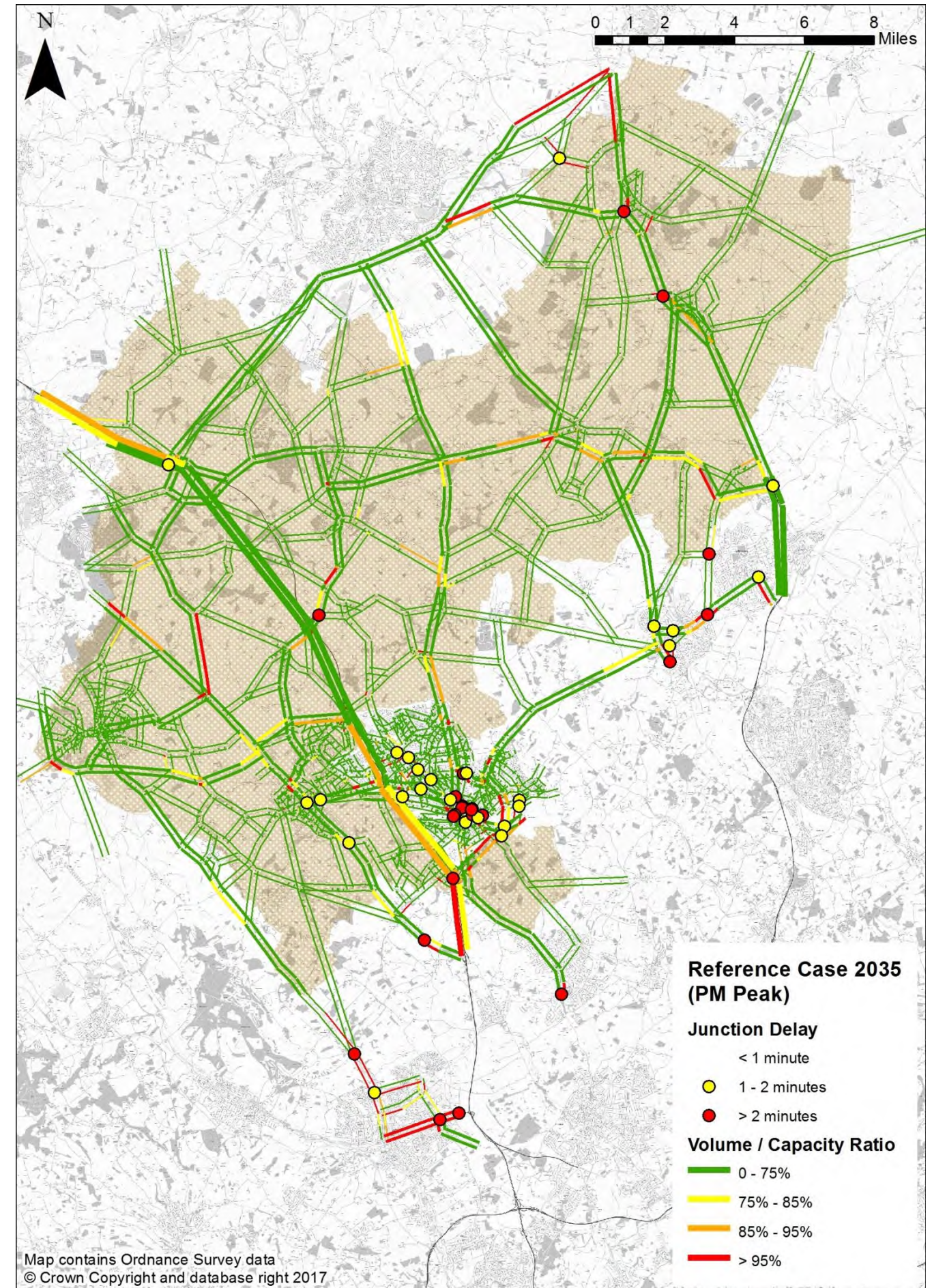




Figure 18: Link stress and Junction delays, Scenario 1, AM (Stage 1a)

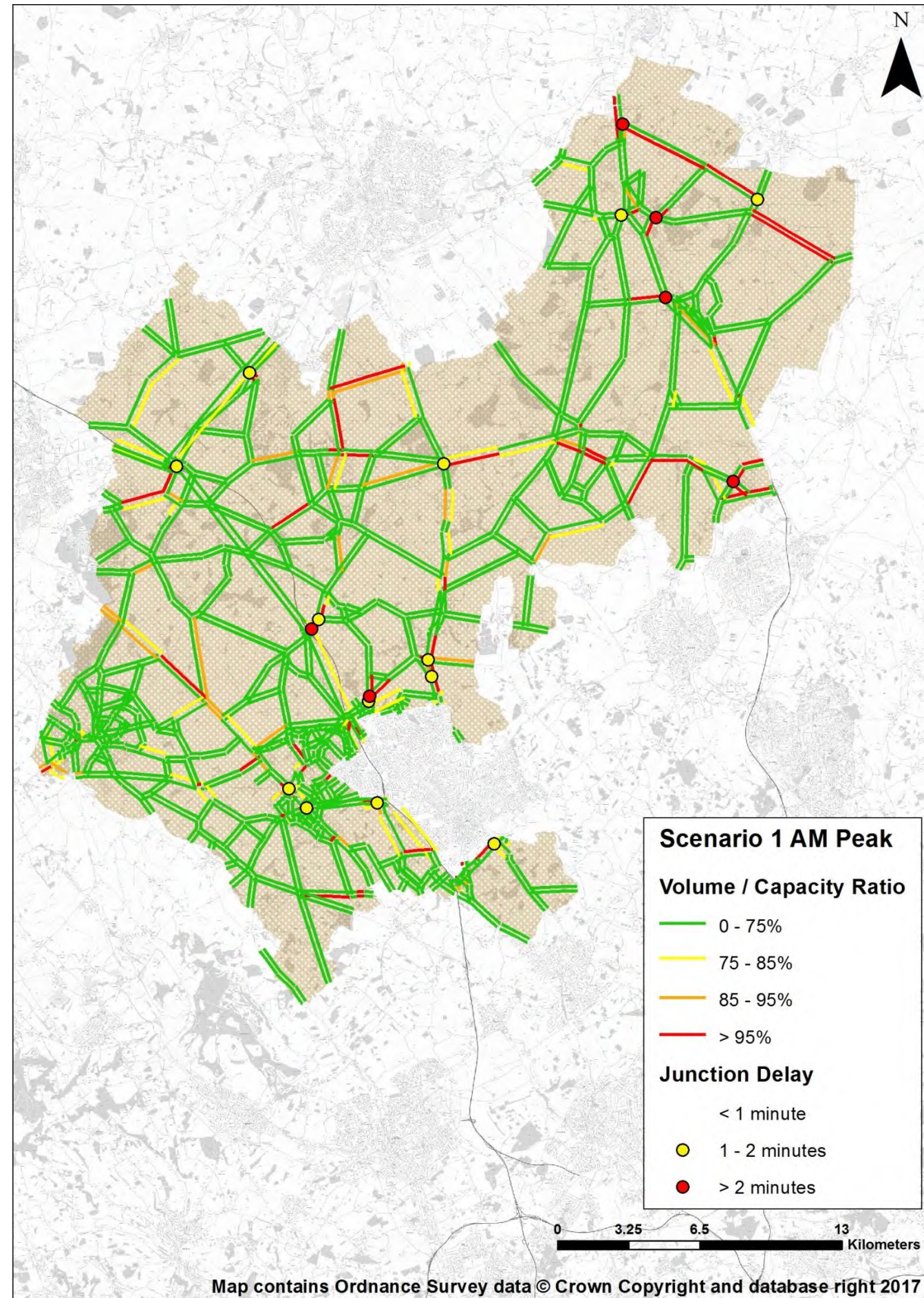


Figure 19: Link stress and Junction delays, Scenario 1, AM (Stage 1b)

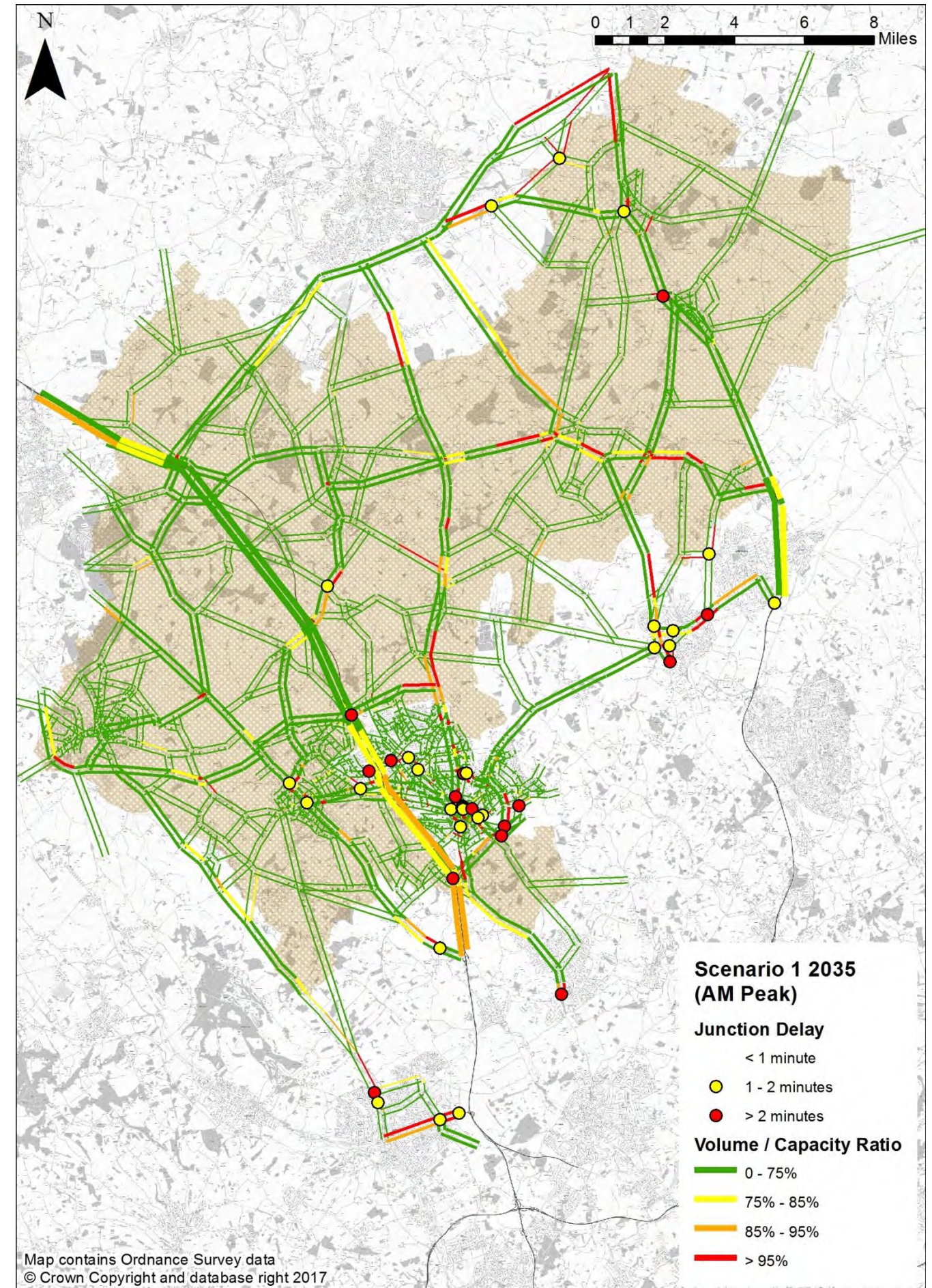




Figure 20: Link stress and Junction delays, Scenario 1, PM (Stage 1a)

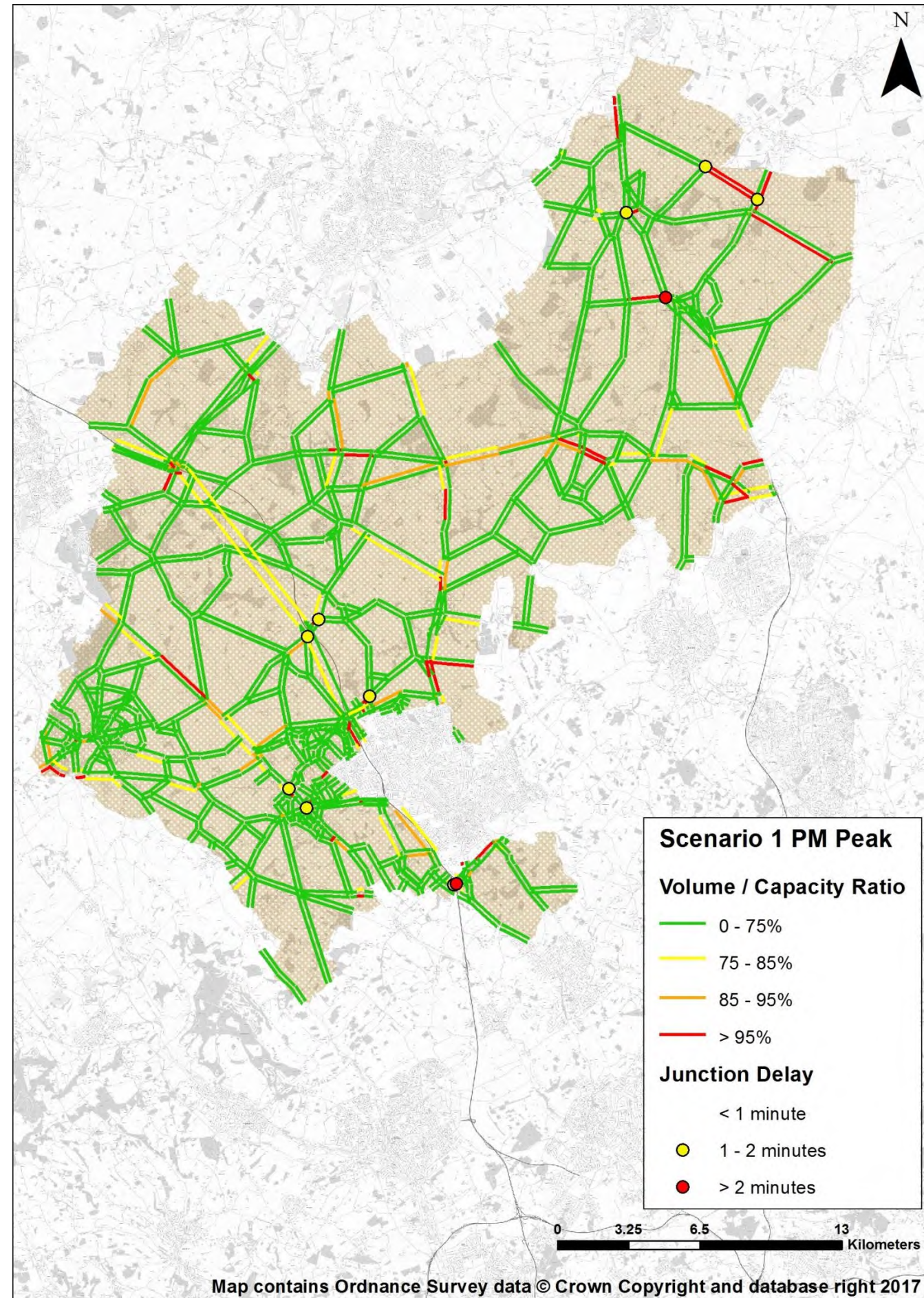


Figure 21: Link stress and Junction delays, Scenario 1, PM (Stage 1b)

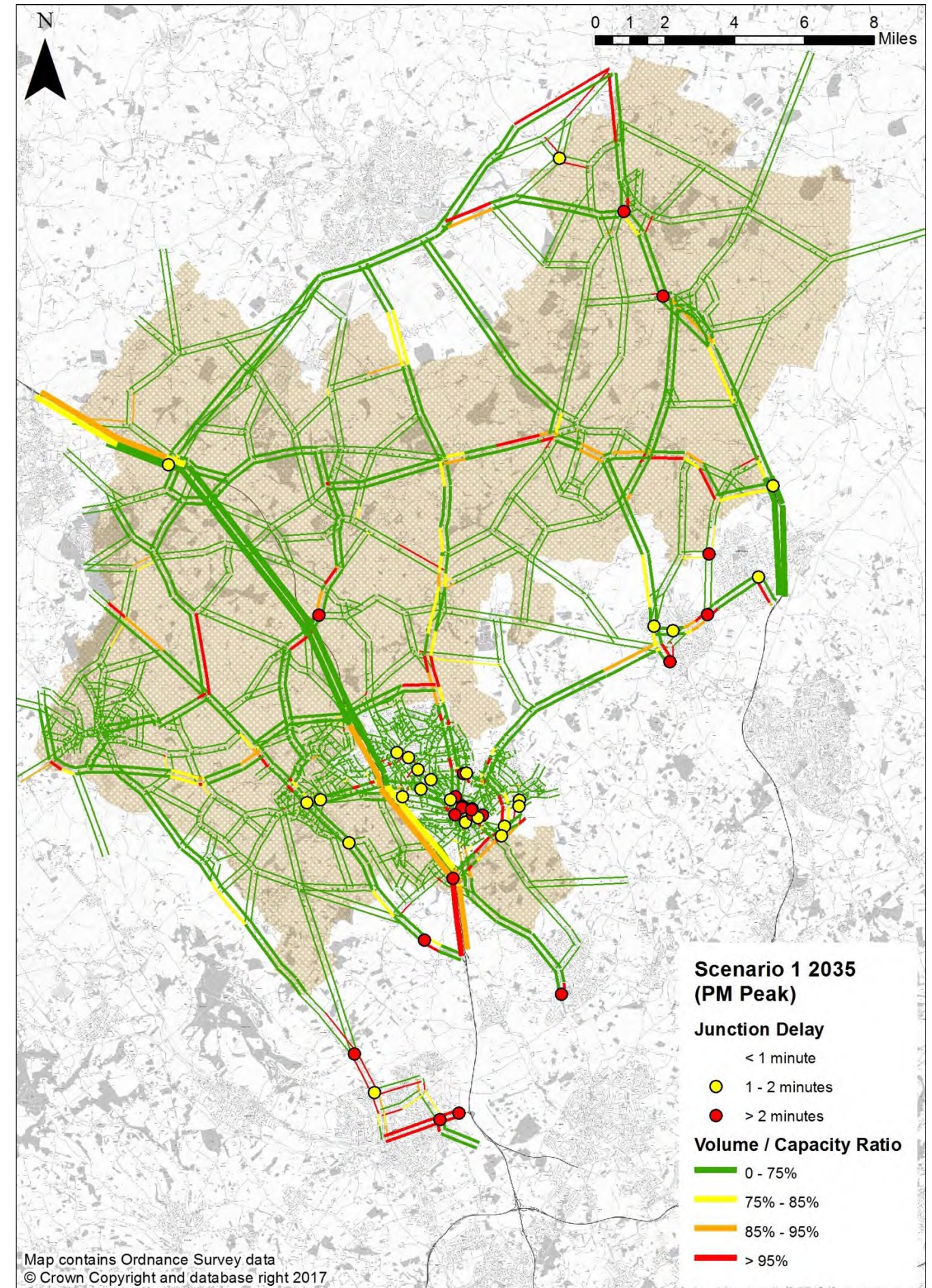




Figure 22: Link stress and Junction delays, Scenario 1\*, AM (Stage 1a)

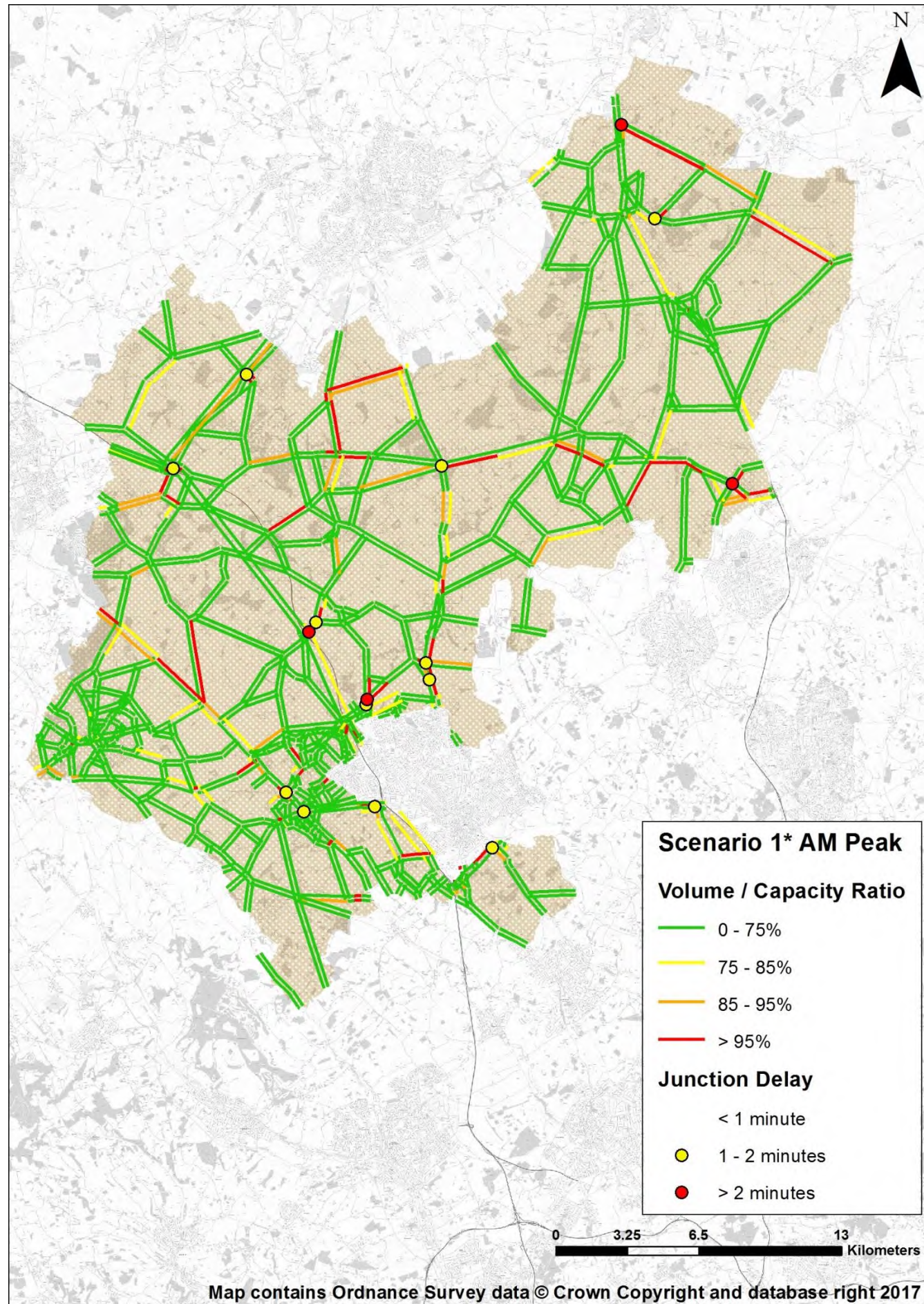


Figure 23: Link stress and Junction delays, Scenario 1\*, AM (Stage 1b)

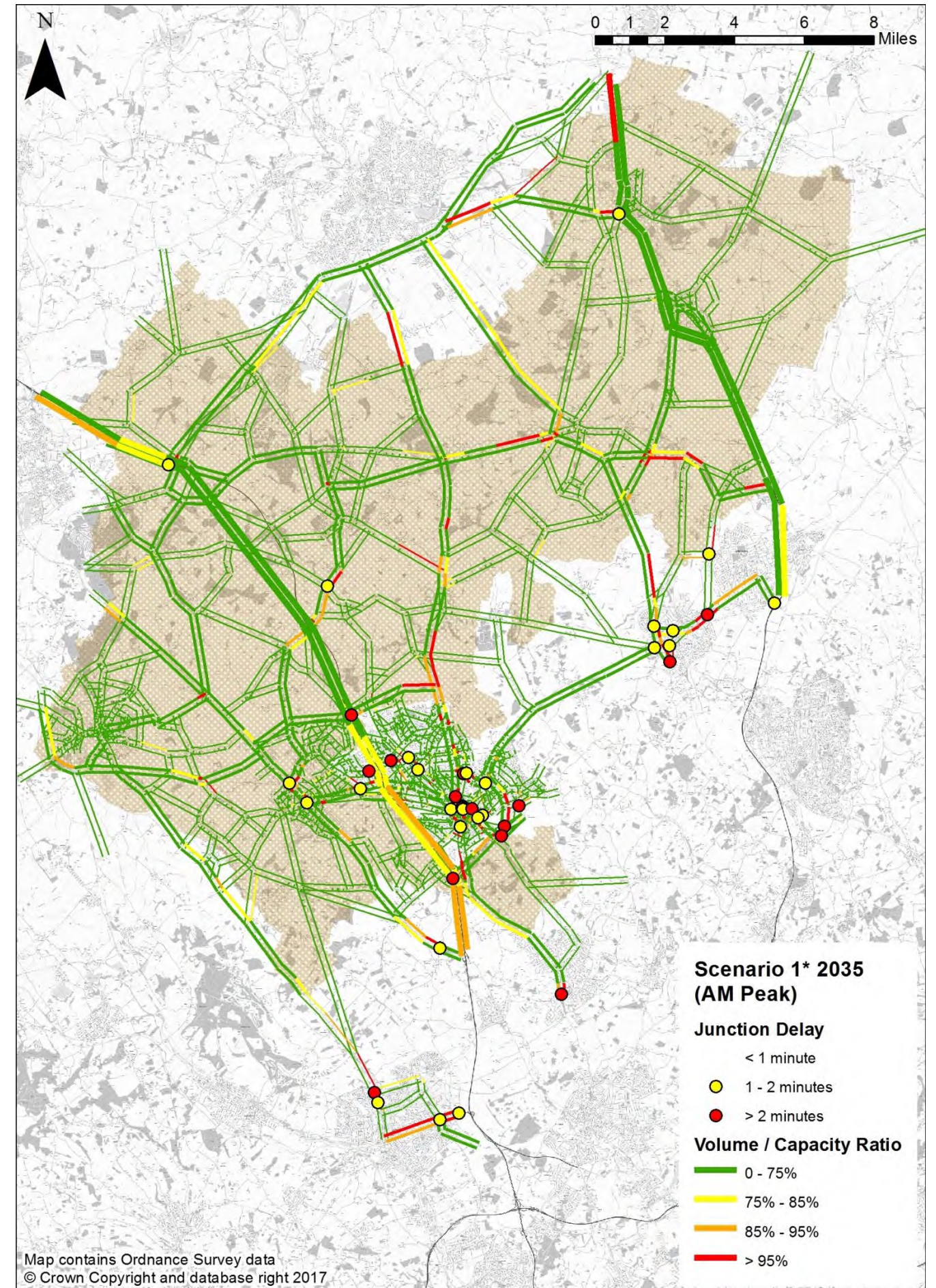




Figure 24: Link stress and Junction delays, Scenario 1\*, PM (Stage 1a)

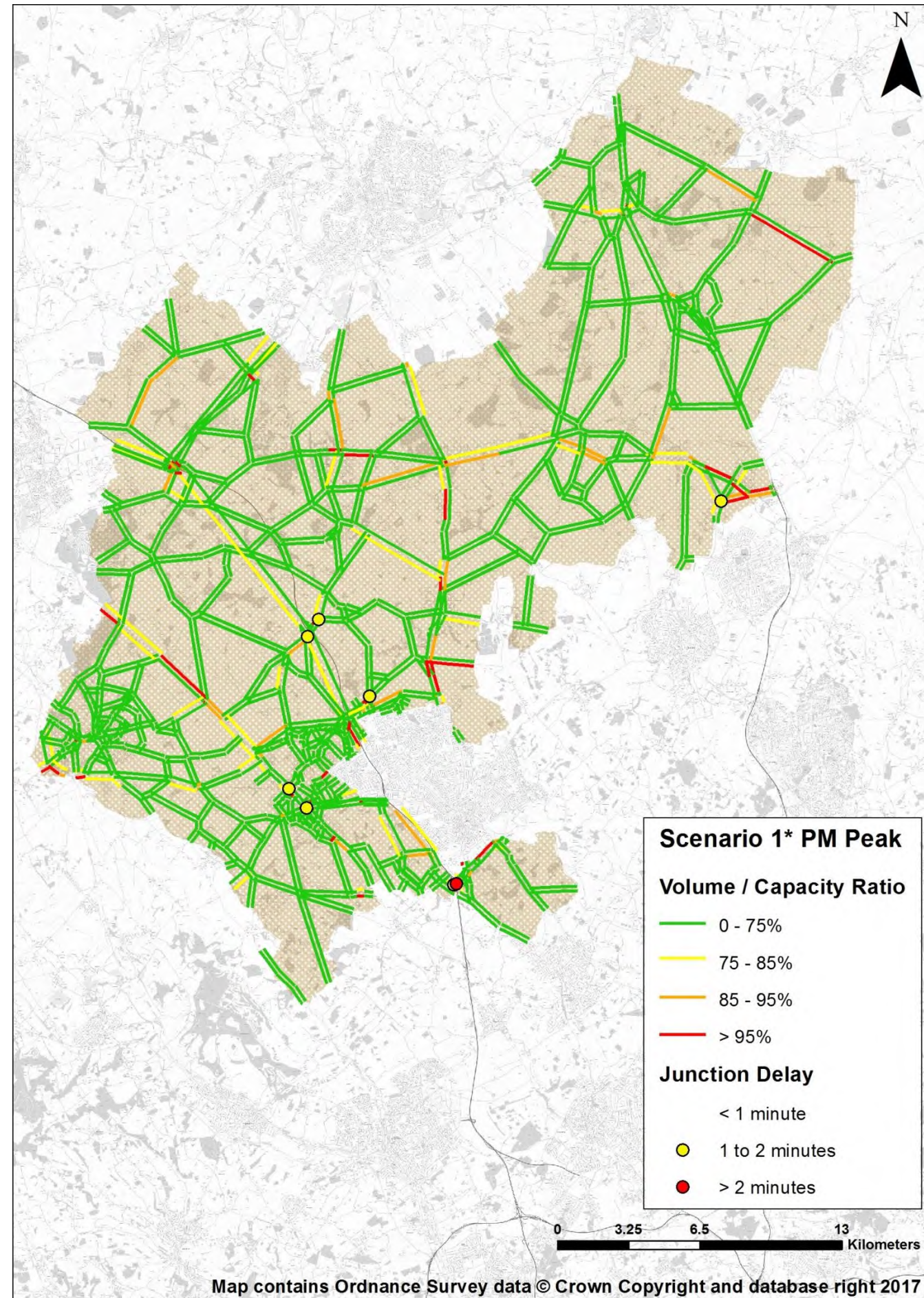


Figure 25: Link stress and Junction delays, Scenario 1\*, PM (Stage 1b)

