Mansfield Transport Study

Stage 1: Baseline and Reference Case

Project Number: 60627945

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Quality information

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Table of Contents

Executive Summary

Overview

Mansfield District Council is currently preparing a new local development plan to be known as the Mansfield District Local Plan. It will comprise two main parts. Part 1 will provide the overall planning strategy for the area through strategic policies dealing with the overall scale, broad distribution and timing of new development. Part 2 will take forward the strategy with policies that allocate land for development and designate specific areas for protection.

All development plan documents will be subject to 'Examination in Public'. As such, a wide-ranging evidence base is being prepared to support the new Mansfield District Local Plan. This report has been prepared as part of this evidence base, and considers the transport context within which the potential development plan-related development would be brought forward. It considers how the transport network was observed to operate in 2016, and how it is likely to operate in future (2033) without the potential development plan-related proposals.

This report will be followed by a Stage 2 report which will consider how the transport network is likely to operate in future with the potential development plan-related proposals in place.

The evidence base examines AM and PM peak periods only and does not take into account other busy periods such as shopping trips on Saturday mornings.

Journey Patterns and Sustainable Transport

Similar to other towns in Nottinghamshire, there has been a long term reduction in traffic entering Mansfield town centre in recent years (Table 1). The towns have been selected for comparison purposes given that are similar in size to Mansfield and in relatively close proximity.

Table 1: Changes in Daily Traffic Entering Market Towns

Market Town	Year								
	2005	2006	2007	2008	2009	2010	2012	2014	2016
Worksop	0%	-5%	-8%	-8%	-12%	-9%	-14%	-15%	-13%
Retford	0%	0%	-2%	-5%	-2%	-7%	-7%	-15%	-9%
Newark	0%	0%	0%	-3%	-6%	-4%	-10%	-7%	-1%
Mansfield	0%	-2%	-3%	-4%	-8%	-7%	-10%	-9%	-8%
All Towns	0%	-2%	-3%	-5%	-7%	-7%	-10%	-10%	-7%

There has been a slight increase in daily traffic entering Mansfield since 2014.

This pattern can also be seen in long-term traffic count sites across Mansfield District (Table 2).

Table 2: Nottinghamshire County Council Long-term Daily Traffic Trend Data – Mansfield District (Indexed to 2005)

Market Town	Year										
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Mansfield / Sutton-in-Ashfield	100.0	99.3	99.9	98.6	98.1	95.3	93.9	92.5	93.0	93.9	94.9
	Numbers are indices: 2005 = 100.0										

In terms of public transport, 2013 saw a major improvement in the provision of public transport within Mansfield via the opening of a new interchange within the town. The new bus station provides 16 bays each fitted with Real Time information displays. In addition, a further 14 Real Time information displays were installed on key streets within the town centre and a Statutory Quality Bus Partnership adopted. In the 2 years since the opening of the interchange, bus passenger numbers have grown by 5%, which equates to approximately 3 million passengers journeys per annum.

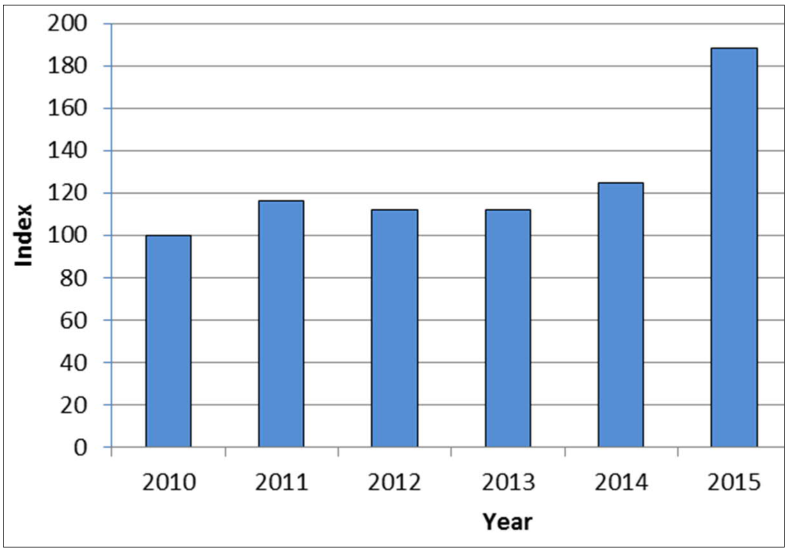
The most recent statistics published by the Office of Rail and Road (ORR) and identify that the period of declining rail patronage associated with the national economic climate has begun to lift, with growth figures turning positive for both Mansfield stations in 2015/16.

Table 3: Annual Station Usage (Source: Office of Rail Regulation, 2016)

Station	11 - 12	12 - 13	13 - 14	14 - 15	15 - 16
Mansfield Town	367,258	349,810 -4.8%	313,826 -14.5%	366,858 -0.1%	394,640 7.5%
Mansfield Woodhouse	160,340	155,792 -2.8%	139,582 -12.9%	158,692 -1.0%	169,506 5.7%

In terms of non-motorised travel, the Nottinghamshire Cycle Strategy Delivery Plan indicates that cycling has seen an increasing in the years following the 2011 census, particularly following a scheme of Personal Travel Planning (PTP) delivered in 2013.

Figure 1: Cycle Usage in Mansfield – 2010 - 2015



Note: Annual growth factors provided by Nottinghamshire County Council. Indices are based on a 2010 base value (i.e. 2010 = 100).

Although the district of Mansfield compares well with the rest of Nottinghamshire in terms of overall journey patterns (proportion of those driving to work, accessibility to services and facilities) there are variations between wards at a local level. For example, there is a higher proportion of residents in the Hornby ward for whom the main mode of travel to work is by car than in the Portland ward. Outside of Mansfield, the settlement of Church Warsop, Meden Vale and Warsop Vale are not as well served, in terms of sustainable transport modes, compared to Market Warsop.

Highway Network Modelling

Mansfield benefits from a SATURN traffic model of its highway network which has been developed over a number of years by Nottinghamshire County Council. To inform this report, this model has been updated to a 2016 base year. This has shown the following junctions are approaching capacity:

- Chesterfield Road / Debdale Lane;
- A60 Nottingham Road / Berry Hill Lane;
- Carter Lane / Southwell Road / Windsor Road;
- A617 MARR / A6191 Southwell Road;
- A60 Leeming Lane / Peafield Lane;
- A60 Leeming Lane / A6075 Warsop Road;
- Kings Mill Road / Beck Lane / B6014 Skegby Lane / Mansfield Road;
- A6191 Ratcliffe Gate / A60 St. Peters Way;
- A6117 Old Mill Lane / B6030 Clipstone Road West; and
- A38 Sutton Road / B6014 Skegby Lane / Sheepbridge Lane.

A 2033 Reference Case demand model has been built using planning assumptions provided by Mansfield District Council. The Reference Case includes all committed developments, land use assumptions and committed transport infrastructure projects; and therefore shows how the transport network could be expected to operate in 2033 without any further development plan-related proposals. The Reference Case will provide a future Baseline for comparative purposes against the Local Plan scenario. In the 2033 Reference Case scenario, the following junctions are likely to approach or exceed capacity:

- Chesterfield Road / Debdale Lane;
- A60 Nottingham Road / Berry Hill Lane;
- Carter Lane / Southwell Road / Windsor Road;
- A617 MARR / A6191 Southwell Road;
- A60 Leeming Lane / Peafield Lane;
- A60 Leeming Lane / A6075 Warsop Road;
- Kings Mill Road / Beck Lane / B6014 Skegby Lane / Mansfield Road;
- A6191 Ratcliffe Gate / A60 St. Peters Way;
- A6117 Old Mill Lane / B6030 Clipstone Road West;
- A38 Sutton Road / B6014 Skegby Lane / Sheepbridge Lane;
- A60 / Old Mill Lane / Butt Lane;
- A6191 Adams Way / Oak Tree Lane; and
- A60 / New Mill Lane.

The above locations are therefore sensitive to further increases in traffic flows which may be associated with development-plan related proposals. However, a further update of the traffic model to include such developments, and identify any other locations which may be impacted by the cumulative traffic impacts of the Local Plan. This analysis will be presented as part of the Stage 2 study and report.

1. Introduction

1.1 Overview

1.1.1 Mansfield District Council is currently preparing a new local development plan to be known as the Mansfield District Local Plan. The Local Plan will provide the overall planning strategy for the district by setting out policies and allocating land for development and designating specific sites for protection.

1.1.2 The new Local Plan will be subject to 'Examination in Public'. As such, a wide-ranging evidence base is being prepared to support the new Mansfield District Local Plan. This report has been prepared as part of this evidence base, and considers the transport context within which the potential development plan-related development would be brought forward. Although written as a stand-alone report, it should be read alongside the other documents comprising the evidence base as transport is only one consideration informing the new Local Plan and associated development allocations.

1.2 Reporting Structure

1.2.1 The transport assessment work has been undertaken via a 'stepped' approach. Broadly, these steps are:

Step 1:	How does the current transport network operate now?	Stage 1
Step 2:	How is the transport network likely to operate in future, with committed infrastructure schemes and land-use developments, but without the development identified in the development plan?	
Step 3:	How is the transport network likely to operate in future, with committed infrastructure schemes and land-use developments, and with development identified in the development plan?	Stage 2

1.2.2 From the above, comparison of the outputs from Stage 1 and Stage 2 will allow the impact of the proposed development identified in the development plan to be judged and appropriate mitigation identified.

1.3 Purpose of this Report

1.3.1 This report comprises Steps 1 and 2. It considers the transport network conditions in 2016 and how the transport network is likely to operate in future without the identified development sites in the development plan. A future year of 2033 has been considered as this represents the end of the development plan period.

1.3.2 Although the focus of the assessment work relates to the operation of roads and junctions, this report does consider all modes of transport within the district of Mansfield.

1.3.3 This Stage 1 report precedes the Stage 2 report, which considers how the transport network would be likely to operate in future with the development sites identified in the development plan in place.

1.3.4 This report provides an update to an earlier version of the 'Stage 1: Baseline and Reference Case', Issue 5, dated October 2014. A 'Stage 2: Local Plan Growth' report was also undertaken at this time, Issue 3, being dated January 2015. Updates to the committed development and the development plan assumptions have been made. The Base model network and matrix has also been updated and validated using 2016 counts.

1.4 Study Area

1.4.1 The Study Area is shown in Figure 1.1 (at the end of this section) and covers Mansfield, Market Warsop and the surrounding area.

1.5 Methodology

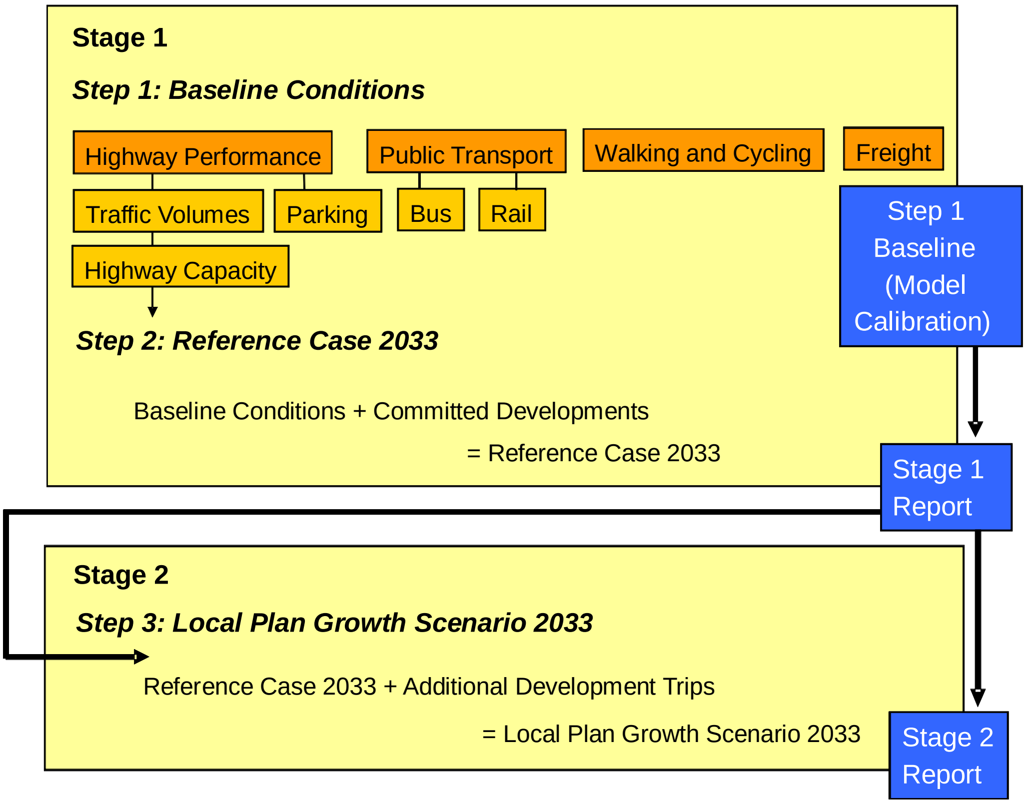
1.5.1 Figure 1.2 summarises the methodology employed for this study. Essentially there are three steps:

Step 1 collates data about the existing transport conditions and identifies a 'Baseline'.

Step 2 examines future conditions given the most likely projections of growth and committed developments (both transport infrastructure and land-use developments) that are likely to be implemented by 2033. This is a 'Reference Case' against which potential additional development can be judged.

Step 3 then examines the likely future conditions given the introduction of potential development plan-related proposals, and reviews this against the 'Reference Case'.

Figure 1.2: Study Methodology (Steps 1 – 3)



1.5.2 Data to inform the above steps have been obtained from both Mansfield District Council's planning department, and Nottinghamshire County Council (the local highway authority). In particular, the following information and data has been collated:

- Details of committed land-use developments to 2033;
- Details of committed transport-infrastructure improvements to 2033;
- Historic traffic count data from Nottinghamshire County Council including, 47 count locations in total, comprising:
  - Manual Classified Counts at junctions;
  - Permanent Automatic Traffic Counts;
  - Temporary Automatic Traffic Counts;
- New traffic count data has been commissioned for the following junctions during October 2016;
  - A60 / Baums Lane / Park Lane;
  - New Mill Lane / Sandlands Way;
  - Sandlands Way / A6117 / Heatherley Drive;
  - A60 / Church Street / Wood Street;
  - A60 / Askew Lane / Vale Avenue;
- Car parking patronage from MDC;
- Cycle count data from Nottinghamshire County Council;
- Road Safety statistics from Nottinghamshire County Council;
- Census data from National Statistics; and
- Mansfield SATURN traffic model.

1.5.3 As noted in the last bullet point, Mansfield benefits from a SATURN model of its highway network which has been developed over a number of years by Nottinghamshire County Council. Although made available to Mansfield District Council for this work, it is noted that this model does not cover the full Study Area (as shown in Figure 1.1). As such, the Step 1 and 2 assessments of the highway network have been undertaken via a composite of baseline data from the SATURN traffic model and traffic count data in Market Warsop. Figure 1.3 shows the coverage of the SATURN traffic model. As can be seen from this figure, the model represents the main routes within the town (i.e. the model does not include minor roads and routes).

1.5.4 An introduction relating to how a SATURN model operates is also provided at the end of this section.

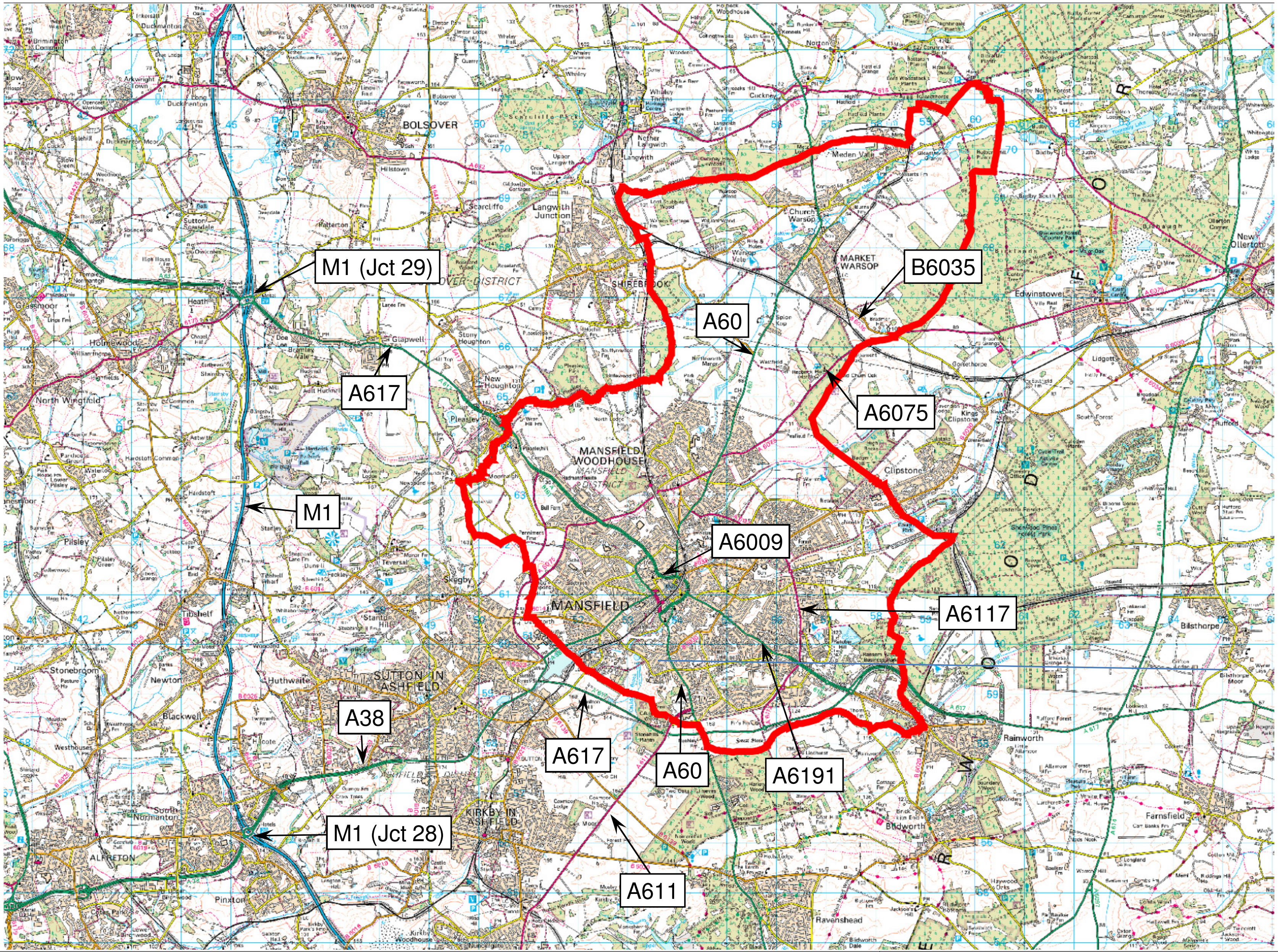
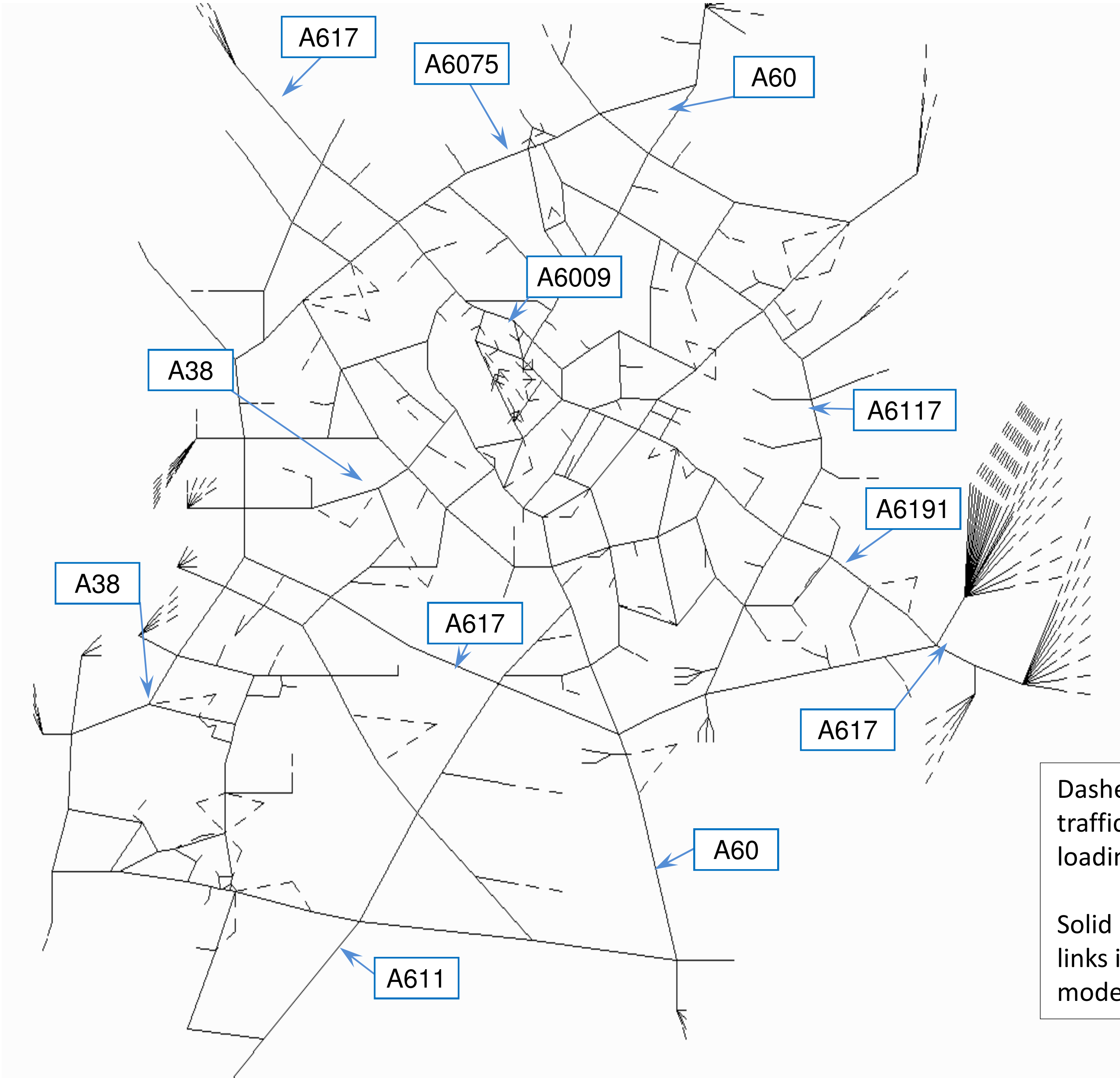


Figure 1.1: Study Area



Dashed lines represent traffic model zones' loading points.

Solid lines are highway links in the traffic model.

Figure 1.3: SATURN Model Coverage

What is a SATURN model?

SATURN (*Simulation and Assignment of Traffic in Urban Road Networks*) is a computer software package used to forecast changes in traffic associated with development or road schemes. It has been used to support many large infrastructure schemes, and is a DfT approved tool.

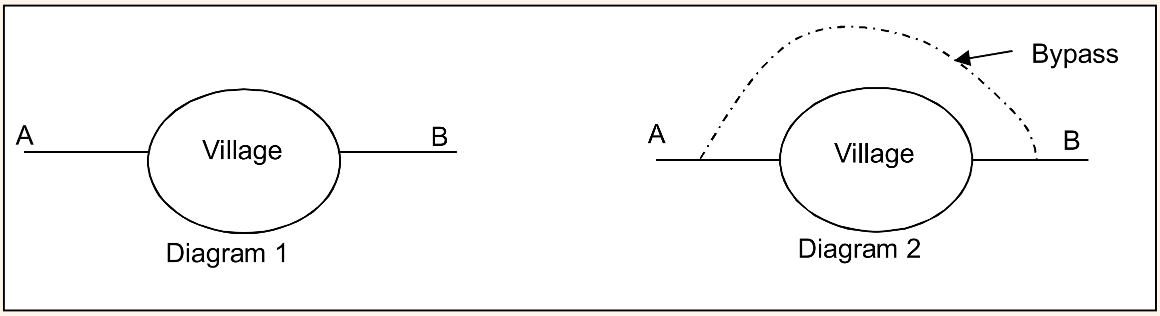
A SATURN model has two components:

- A **Supply Network;** which is a representation of the highway network including its roads and junctions; and
- A **Demand Matrix;** which is a representation of the individual vehicles which would seek to route through the network.

The purpose of the SATURN model is to predict which specific route vehicles will choose to travel from their respective origins to their respective destinations given:

- Changes to the Supply Network (i.e. as new roads are opened, or junctions improved); and
- Changes to the Demand Matrix, i.e. as traffic levels increase (or decrease) in future.

For example:



In Diagram 1, traffic from A to B would route through the village centre as it is their only choice.

In Diagram 2, the choice of route has increased. Vehicles could either use the bypass, or continue to route through the village centre. Importantly, as more traffic uses the bypass, congestion in the village centre would decrease and this may make it a faster route for some traffic given the shorter distance.

SATURN solves the problem of '*how much traffic would use each route available*'. It bases these choices on journey cost and distance.

1.6 Relevant Terminology

1.6.1 To assist those reading this report that may not be familiar with transport planning terminology, a brief overview of some of the terms used within this document is given in a Glossary at the end of this report.

2. Policy Background

2.1 Overview

2.1.1 The development of the Local Plan will provide the planning framework against which future developments will be judged at the local level. However, these documents are being formulated against the context of existing national planning policy and the Third Nottinghamshire Local Transport Plan (LTP3). The purpose of this section is to identify the relevant policy context in transport terms, and how this specifically relates to the district of Mansfield.

2.2 National Planning Policy Framework (NPPF)

2.2.1 The NPPF sets out the Government's planning policies for England and provides a framework to develop localised planning strategies. The document identifies three key components which the planning system has to balance:

an economic role	contributing to building a strong, responsive and competitive economy, by ensuring that sufficient land of the right type is available in the right places and at the right time to support growth and innovation; and by identifying and coordinating development requirements, including the provision of infrastructure;
a social role	supporting strong, vibrant and healthy communities, by providing the supply of housing required to meet the needs of present and future generations; and by creating a high quality built environment, with accessible local services that reflect the community's needs and support its health, social and cultural well-being; and
an environmental role	contributing to protecting and enhancing our natural, built and historic environment; and, as part of this, helping to improve biodiversity, use natural resources prudently, minimise waste and pollution, and mitigate and adapt to climate change including moving to a low carbon economy.

2.2.2 With regard to transport, the document focuses on, and emphasises, the promotion of sustainable transport. For instance, the NPPF states that:

> *"Transport policies have an important role to play in facilitating sustainable development but also in contributing to wider sustainability and health objectives. Smarter use of technologies can reduce the need to travel. The transport system needs to be balanced in favour of sustainable transport modes, giving people a real choice about how they travel. However, the Government recognises that different policies and measures will be required in different communities and opportunities to maximise sustainable transport solutions will vary from urban to rural areas."*

2.2.3 The NPPF also states that plans and decisions should take account of whether:

- the opportunities for sustainable transport modes have been taken up depending on the nature and location of the site, to reduce the need for major transport infrastructure;
- safe and suitable access to the site can be achieved for all people; and
- improvements can be undertaken within the transport network that would limit the significant impacts of the development cost effectively. Development should only be prevented or refused on transport grounds where the residual cumulative impacts of development are severe.

2.2.4 The key test in the NPPF, therefore, is that transport impacts are not “severe”. This is confirmed by the Planning Policy Guidance (PPG) portal which states that:

> *“Transport Assessments and Statements can be used to establish whether the residual transport impacts of a proposed development are likely to be “severe”, which may be a reason for refusal, in accordance with the National Planning Policy Framework.”*

2.2.5 The NPPF also notes that plans should protect and exploit opportunities for the use of sustainable transport modes for the movement of goods or people. Therefore, developments should be located and designed where practical to:

- accommodate the efficient delivery of goods and supplies; and
- give priority to pedestrian and cycle movements, and have access to high quality public transport facilities.

2.2.6 Importantly, the NPPF confirms that all developments generating significant volumes of traffic should be supported by a Transport Assessment, and those trips resulting from such developments should be managed via the Travel Plan process. With regards this latter point, it is noted that Nottinghamshire County Council published its revised guidance on the preparation of Travel Plans for new development in September 2010, and that this document includes standard conditions pertaining to Travel Plans in order to secure such documents for varying types and levels of development.

2.3 Nottinghamshire Local Transport Plan 3 (LTP3)

2.3.1 LTP3 was published in April 2011. It has been prepared to provide both a strategy and implementation plan for improvements to the local highway network up to March 2026. The objectives of the Nottinghamshire LTP3 are to:

- provide a reliable, resilient transport system which supports a thriving economy and growth;
- encourage sustainable and healthy travel;
- improve access to key services, particularly enabling employment and training opportunities;
- minimise the impacts of transport on people’s lives; and
- maximise opportunities to improve the environment and help tackle carbon emissions.

2.3.2 The above policy objectives broadly align with the aspirations set by central government in the NPPF. The LTP3 document has been reviewed to identify schemes which could impact on this project, as described later in this report.

2.4 Summary

2.4.1 Policy at a national level stresses the importance of transport sustainability in both siting and assessing new development locations. The Travel Plan process is seen as key to managing trips to / from new developments in future.

3. Baseline Conditions – Travel Patterns and Sustainable Transport modes

3.1 Overview

3.1.1 The purpose of this section is to describe the current transport conditions in the district of Mansfield. This section makes use of available traffic data described in Section 1, site visit observations, and also outputs from the Mansfield SATURN model.

3.2 Travel Patterns

The Mansfield Travel to Work Area (TTWA)

3.2.1 A TTWA is defined as an area where 75% of that area's resident workforce work in the area and at least 75% of the people who work in the area also live in the area. The area must have a working population of at least 3,500.

3.2.2 The Nottinghamshire LTP3 identifies that the Mansfield TTWA includes all of Mansfield District, the majority of Ashfield and Newark & Sherwood districts, as well as the south western tip of Bassetlaw and the north of Gedling district. It also includes parts of eastern Derbyshire. This area is shown in Figure 3.1.

3.2.3 The 2011 census recorded home and work postcodes. From this information, comprehensive data relating to journeys to work are available.

3.2.4 For Mansfield, analysis of 2011 Census 'Journey To Work' data shows the key origins (Inflow) of those who travel into Mansfield for work by all modes, car driver and bus / coach.

3.2.5 Data is also available showing the key destinations (Outflow) of those travelling to work from home addresses in Mansfield by all modes, car driver and bus / coach.

3.2.6 Figure 3.2 shows the top 10 origin locations (Inflow) of workers, as well as the top 10 worker destinations (Outflow) by all modes of travel. Similarly, Figure 3.3 this travel as a car driver, whilst Figure 3.4 shows this travel by bus / coach.

3.2.7 For the avoidance of doubt, the information in Figures 3.2 – 3.4 does not include those people who choose to work from home.

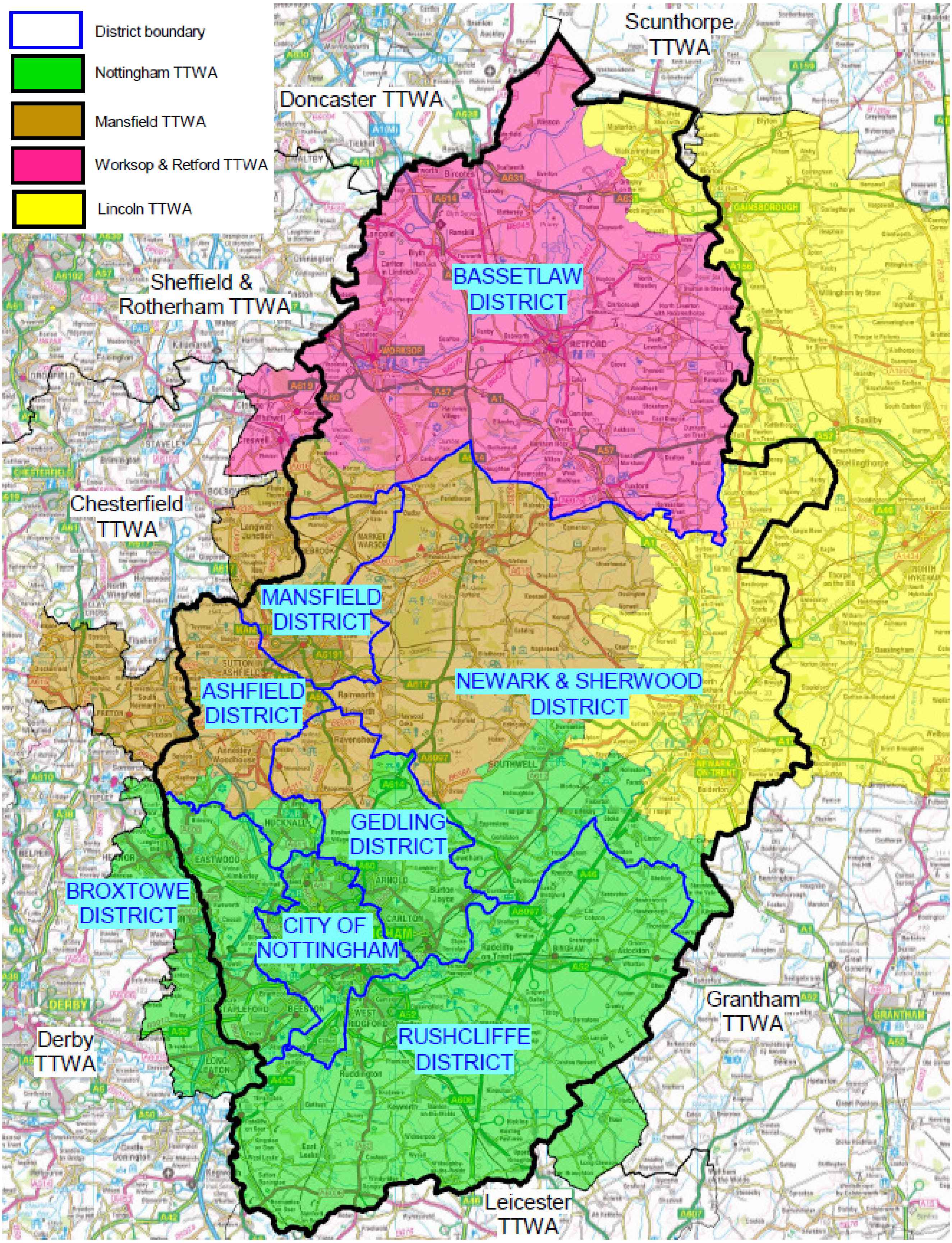


Figure 3.1: Mansfield Travel To Work Area (TTWA)

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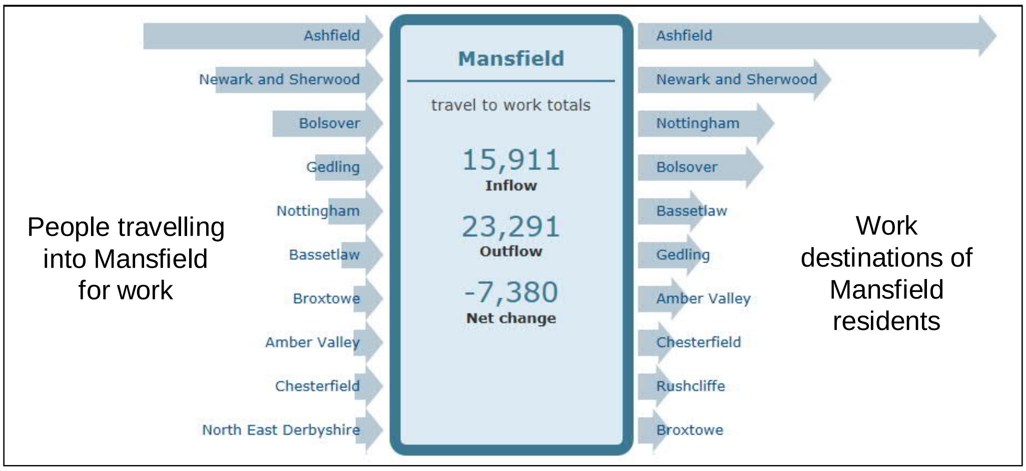
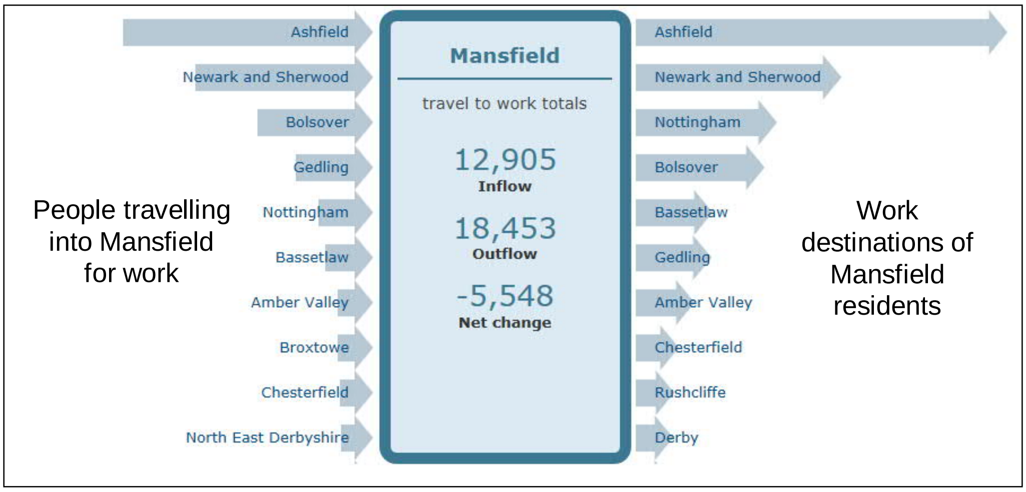
Figure 3.2: Mansfield travel to work top 10 inflows and outflows (All transport modes)



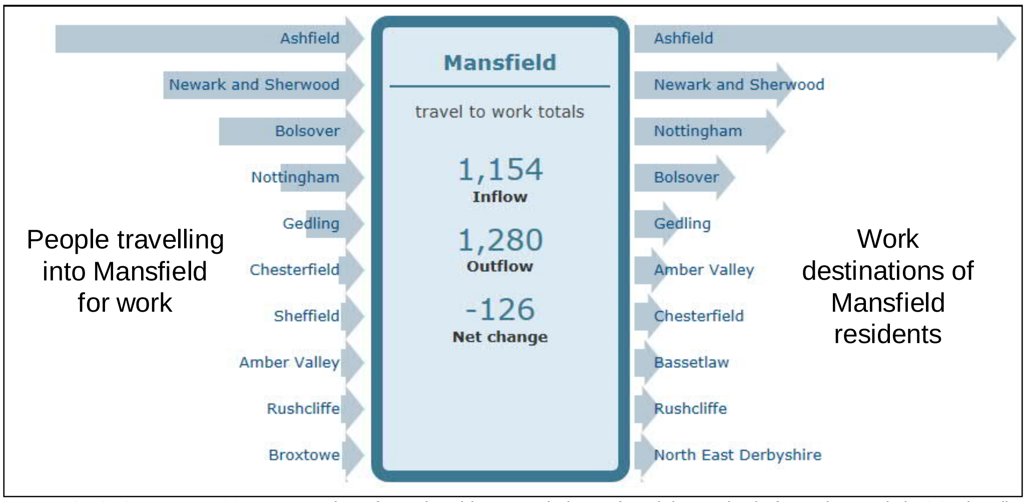
Source: ONS, Census WU03EW - Location of usual residence and place of work by method of travel to work (MSOA level). Visualisations by Nomis

Figure 3.3: Mansfield travel to work inflows and outflows (Car driver)



Source: ONS, Census WU03EW - Location of usual residence and place of work by method of travel to work (MSOA level). Visualisations by Nomis

Figure 3.4: Mansfield travel to work inflows and outflows (Bus/coach)



Source: ONS, Census WU03EW - Location of usual residence and place of work by method of travel to work (MSOA level). Visualisations by Nomis

3.2.8 From the above figures, it can be seen that the majority of travel is from and towards Ashfield, with the majority of trips undertaken by car, even though total journey distances are relatively short. Also, Derby appears as a ‘Top 10’ destination for car drivers but not for public transport users. It should be noted, however, that bus services are available to Derby as is described later in this report.

Transport Mode Choice

3.2.9 Table 3.1 identifies the usual mode choice of those travelling to work that live in Mansfield.

Table 3.1: Usual Main Mode of Travel to Work (excluding those who 'work from home')

Place of Residence (Mansfield Wards)	Train	Bus	Taxi	Car Driver	Car Psngr	Motor Cycle	Bicycle	Foot
Berry Hill	1.1%	2.2%	0.6%	83.5%	5.4%	0.5%	1.5%	5.2%
Manor	1.3%	3.9%	0%	81.5%	6.7%	0.4%	1.2%	4.9%
Oakham	1.6%	2.1%	0.2%	79.3%	5.6%	0.5%	2.2%	8.5%
Lindhurst	1.2%	2.6%	0.2%	82.3%	6.2%	0.8%	1.6%	5.1%
Ransom Wood	0.9%	6.8%	0.6%	71.8%	8.6%	0.9%	1.4%	9.0%
Kings Walk	0.9%	2.5%	0.3%	84.6%	4.9%	0.4%	0.7%	5.6%
Sandhurst	1.4%	6.6%	0.6%	66.8%	9.0%	0.9%	1.8%	12.9%
Eakring	0.6%	4.6%	0.1%	80.7%	5.8%	0.5%	1.2%	6.5%
Ling Forest	0.5%	4.4%	0.2%	80.8%	6.7%	0.7%	1.3%	5.4%
Oak Tree	0.8%	10.2%	1.1%	64.6%	9.3%	1.0%	0.8%	12.2%
Racecourse	1.1%	6.2%	0.8%	69.0%	9.3%	0.9%	2.2%	10.5%
Newgate	1.5%	8.6%	1.9%	59.3%	11.2%	0.6%	2.1%	14.8%
Portland	1.2%	9.8%	0.5%	50.3%	12.8%	0.5%	1.4%	23.5%
Grange Farm	0.7%	5.0%	0.6%	70.7%	6.6%	0.4%	1.6%	14.4%
Brick Kiln	0.6%	5.2%	0.9%	67.5%	9.4%	0.8%	1.9%	13.7%
Ladybrook	1.3%	9.1%	1.3%	54.5%	13.1%	0.7%	2.2%	17.8%
Woodlands	1.2%	5.6%	0.4%	63.6%	10.3%	0.4%	1.9%	16.6%
Carr Bank	1.1%	7.5%	1.5%	63.8%	9.2%	0.8%	2.1%	14.0%
Kingsway	1.6%	5.4%	0.3%	75.4%	7.4%	1.2%	0.9%	7.8%
Newlands	0.4%	7.4%	0.9%	74.8%	8.1%	0.9%	1.3%	6.3%
Holly	1.1%	4.3%	0.2%	83.0%	5.4%	0.9%	0.9%	4.5%
Maun Valley	1.3%	4.7%	0.7%	77.9%	7.3%	1.1%	1.0%	5.9%
Penniment	0.5%	7.5%	1.7%	63.6%	9.8%	1.7%	2.3%	13.0%
Broomhill	0.9%	6.5%	0.8%	55.9%	13.5%	0.9%	2.5%	18.9%
Yeoman Hill	1.2%	5.9%	0.5%	72.2%	8.6%	0.5%	1.8%	9.2%
Peafields	0.8%	6.6%	0.7%	77.8%	6.9%	0.6%	1.2%	5.4%
Hornby	1.2%	4.1%	0.3%	83.9%	5.8%	0.6%	0.8%	3.2%
Park Hall	1.3%	7.6%	0.7%	71.3%	7.4%	0.7%	1.1%	10.0%
Woodhouse	1.3%	10.5%	0.7%	65.3%	9.3%	1.1%	1.2%	10.5%
Sherwood	1.5%	5.2%	0.7%	73.0%	7.3%	0.3%	1.7%	10.3%
Abbott	0.5%	6.3%	1.1%	73.2%	7.1%	0.4%	1.6%	9.9%
Bull Farm and Pleasley Hill	0.8%	8.5%	0.8%	70.9%	9.1%	1.1%	1.9%	6.9%
Market Warsop	0.5%	9.0%	0.2%	70.5%	8.4%	0.8%	0.7%	10.0%
Warsop Carrs	0.5%	7.2%	0.3%	73.3%	8.5%	1.1%	0.8%	8.3%
Meden	0.5%	6.4%	0.5%	73.0%	7.4%	1.3%	1.3%	9.6%
Netherfield	0.8%	8.8%	0.4%	74.2%	8.5%	1.6%	1.0%	4.7%
England	10.0%	8.0%	0.6%	60.7%	5.3%	0.9%	3.1%	11.4%
East Midlands	1.7%	6.6%	0.4%	69.5%	6.4%	0.8%	2.9%	11.7%
Mansfield (Average)	**1.0%**	**6.2%**	**0.6%**	**72.1%**	**8.2%**	**0.8%**	**1.5%**	**9.7%**
Standard Deviation	***0.36%***	***2.2%***	***0.43%***	***8.49%***	***2.12%***	***0.33%***	***0.51%***	***4.59%***

Source: 2011 Census Data

Note: ward boundaries and names have changed since the 2011 Census

3.2.10 The lower four rows show the average (mean) mode choices of those living in, England, the East Midlands, Mansfield District and the 'standard deviation'[1] around the mean of mode choice in Mansfield based on the individual ward results.

3.2.11 The above table shows that there are wide variances in the use of car, and on-foot modes for the various wards within the Mansfield District. For example, for private car[2] modes, Portland ward generated the least car use (63.6% comprising 0.5% taxi, 50.3% car driver and 12.8% car passenger) for trips to work; and Hornby ward the most (90.0% comprising 0.3% taxi, 83.9% car driver and 5.8% car passenger). Hornby is also the ward that reports the least use of walking as the primary mode of travel to work (3.2%) with the largest being reported in Portland ward (23.5%).

3.2.12 The highest variance in mode choice relates to car driver, pedestrians and public transport (bus). This would indicate that where people choose not to drive, or are unable to drive, they make a greater proportion of trips on foot or public transport. Where walking modes are high, these trips are likely to be shorter (given the smaller range of walking as a mode of transport).

3.2.13 Overall, trips in Mansfield appear largely similar to the rest of the East Midlands region, with slightly more travelling to work as a car driver and car passenger, and slightly fewer choosing to cycle and walk.

3.2.14 Table 3.2 shows the change in travel to work modal split between the 2001 and 2011 census for the Mansfield District. Of note is the increase in car usage by 3.8% (including taxi, car driver and car passenger), caused by a large increase of those who travel to work as a car driver (5.5% increase). Walking and cycling to work has seen a decrease between 2001 and 2011 (1.5% and 0.4% respectively).

Table 3.2: Change in travel to work modal split in Mansfield.

District of Residence	Train	Bus	Taxi	Car Driver	Car Psngr	Motor Cycle	Bicycle	Foot
Mansfield (2001)	1.1%	7.6%	0.6%	66.6%	9.9%	1.1%	1.9%	11.2%
Mansfield (2011)	1.0%	6.2%	0.6%	72.1%	8.2%	0.8%	1.5%	9.7%

Car Ownership

3.2.15 Table 3.3 identifies the level of car ownership across Nottinghamshire in the 2011 census.

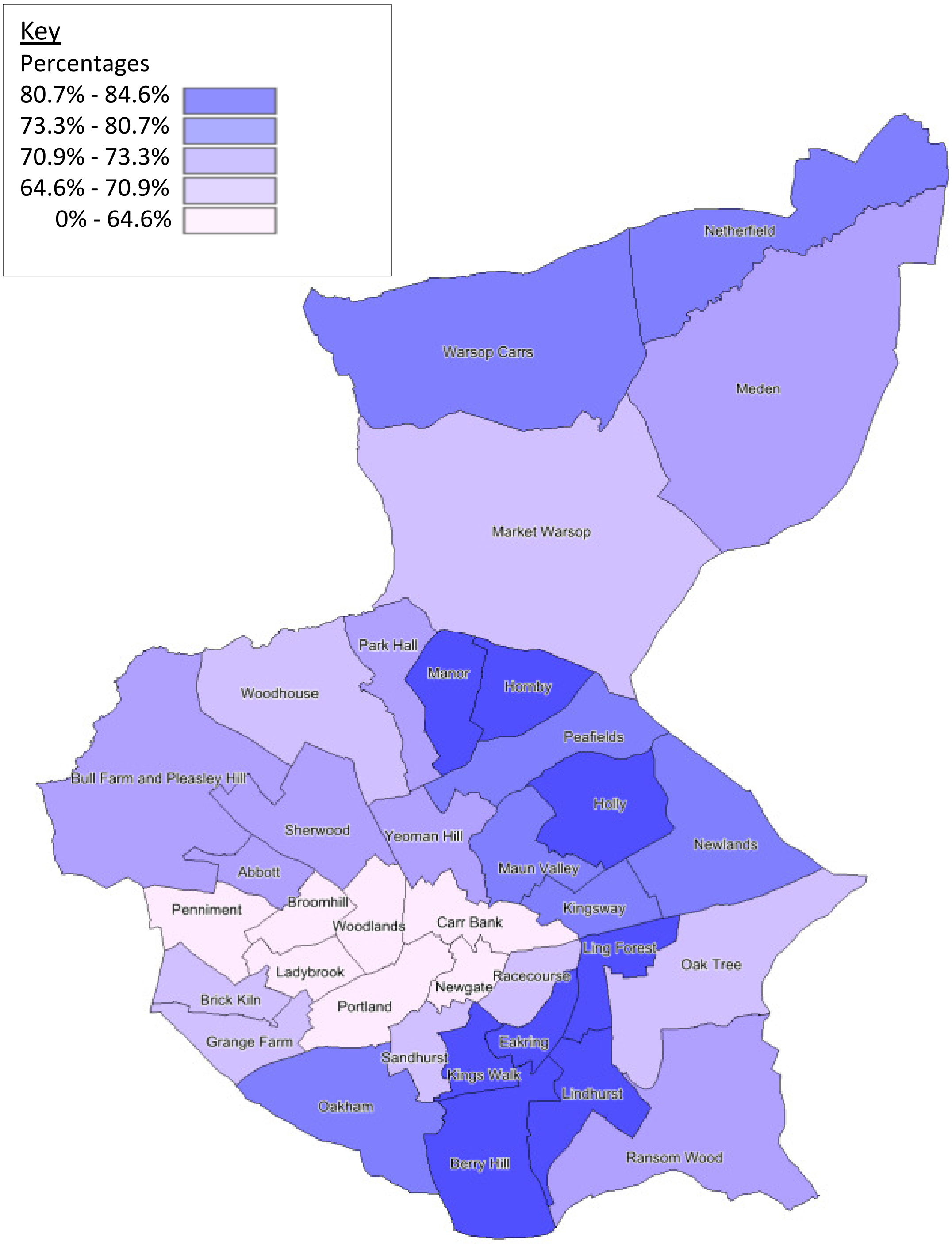
Table 3.3: Car/Van Ownership in Nottingham

District of Residence	No. of Households	Percentage of households with no car	Percentage of households with two or more cars
Ashfield	50,931	23.7%	32.0%
Bassetlaw	47,667	20.1%	36.8%
Broxtowe	46,820	21.6%	33.7%
Gedling	49,349	21.5%	33.5%
Mansfield	44,928	25.2%	31.7%
Newark and Sherwood	48,773	18.6%	39.0%
Rushcliffe	45,935	15.1%	44.1%
Nottinghamshire	334,403	20.8%	35.8%
England	22,063,268	25.8%	32.0%

[1] Standard Deviation shows how much variation or "dispersion" exists from the average (mean, or expected value). A low standard deviation indicates that the data points tend to be very close to the mean, whereas high standard deviation indicates that the data points are spread out over a large range of values.
[2] Travel by Private car is the sum of Car Driver, Car Passenger and Taxi Modes.

3.2.16 Within Nottinghamshire, Mansfield is the district with the highest proportion of households with no car. The proportion (25.2%) is largely similar to the national average (25.8%). Mansfield has the lowest proportion of households in Nottinghamshire with two or more cars (31.7%), the next lowest proportion being Ashfield (32.0%). This is similar to the national average (32.0%).

3.2.17 Figure 3.5 shows a density plot of the Mansfield District, which indicates those wards where residents make the most trips to work as car drivers. The wards of Kings Walk, Hornby and Berry Hill have the highest percentage of those who drive a car to work (84.6%, 83.9% and 83.5% respectively).



Source: 2011 Census data and wards

Figure 3.5: Percentage of Car Drivers (main mode of travel to work) by Ward

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Traffic Growth

3.2.18 Within the transport-industry trade press, there has been debate regarding the issue of ‘peak traffic’ and whether or not traffic volumes will continue to grow. The DfT’s long-term travel growth forecasts indicate that the majority of the predicted increase in trip growth will be driven, inter-alia, by two distinct factors:

- A predicted increase in the overall population, which would lead to an increase in the number of trips being made; and
- Traffic, measured as vehicle-kilometres, will increase as a result of longer trips being made in response to an increase in wealth relative to the future costs of travel.

3.2.19 This issue of traffic growth has been somewhat clouded by the recession, and higher fuel prices, which has had the effect of reducing traffic levels after 2008. Traffic growth in the Mansfield and Sutton-in-Ashfield urban areas between 2005 and 2015 (Latest data set available) has been identified from Nottinghamshire County Council’s long term traffic counters (site locations shown in Figure 3.6) and is shown in Table 3.4, below.

3.2.20 There has been a reduction in daily traffic flows between 2007 and 2012, followed by a slight increase in daily traffic flows between 2012 and 2015.

Table 3.4: Nottinghamshire County Council Long Term Daily Traffic Trend Data – Mansfield District

	Year										
Market Town	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Mansfield / Sutton-in-Ashfield	100.0	99.3	99.9	98.6	98.1	95.3	93.9	92.5	93.0	93.9	94.9
	Numbers are indices: 2005 = 100.0										

3.2.21 Town centre cordon monitoring, undertaken by Nottinghamshire County Council records the total number of vehicles entering a town over a whole year. The data set confirms there has also been a reduction in traffic volumes entering Mansfield town centre since 2005 (see Table 3.5). This table also shows other large Nottinghamshire towns, for comparison. For the avoidance of doubt, Nottinghamshire County Council now collect cordon data every two years (no data was collected in 2011, 2013 or 2015); the latest 2016 counts were obtained in the autumn.

3.2.22 It is noted that there has been a slight increase in traffic entering Mansfield between 2012 and 2016.

Table 3.5: Changes in Daily Traffic Flows Entering Market Towns, Compared with 2005 levels

	Year								
Market Town	2005	2006	2007	2008	2009	2010	2012	2014	2016
Worksop	0%	-5%	-8%	-8%	-12%	-9%	-14%	-15%	-13%
Retford	0%	0%	-2%	-5%	-2%	-7%	-7%	-15%	-9%
Newark	0%	0%	0%	-3%	-6%	-4%	-10%	-7%	-1%
Mansfield	0%	-2%	-3%	-4%	-8%	-7%	-10%	-9%	-8%
All Towns	0%	-2%	-3%	-5%	-7%	-7%	-10%	-10%	-7%

3.2.23 The locations of the traffic monitoring sites on a cordon around Mansfield town centre are indicated in Figure 3.7.

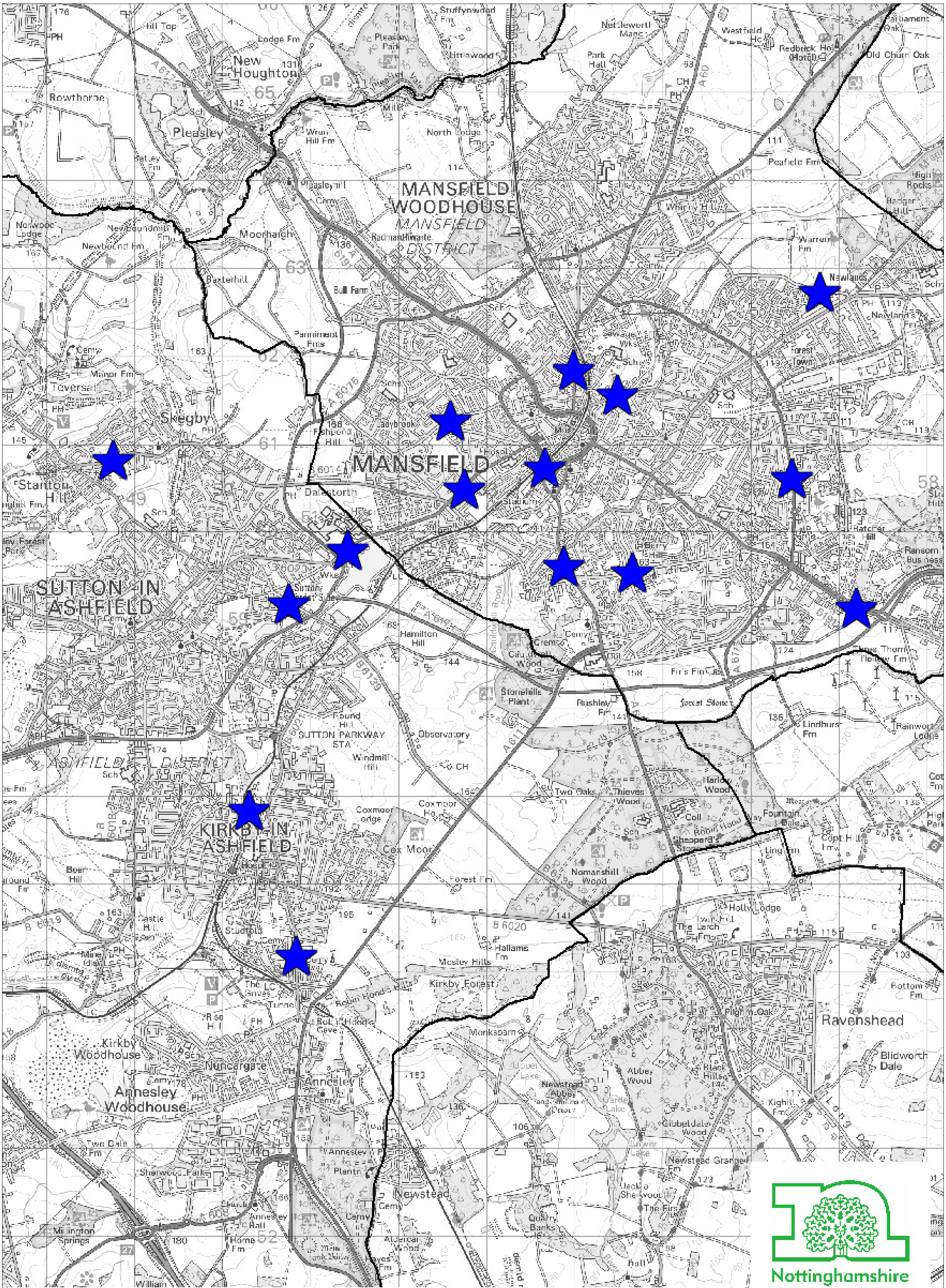

Figure 3.6: Traffic Monitoring Sites in the Mansfield and in Ashfield urban areas

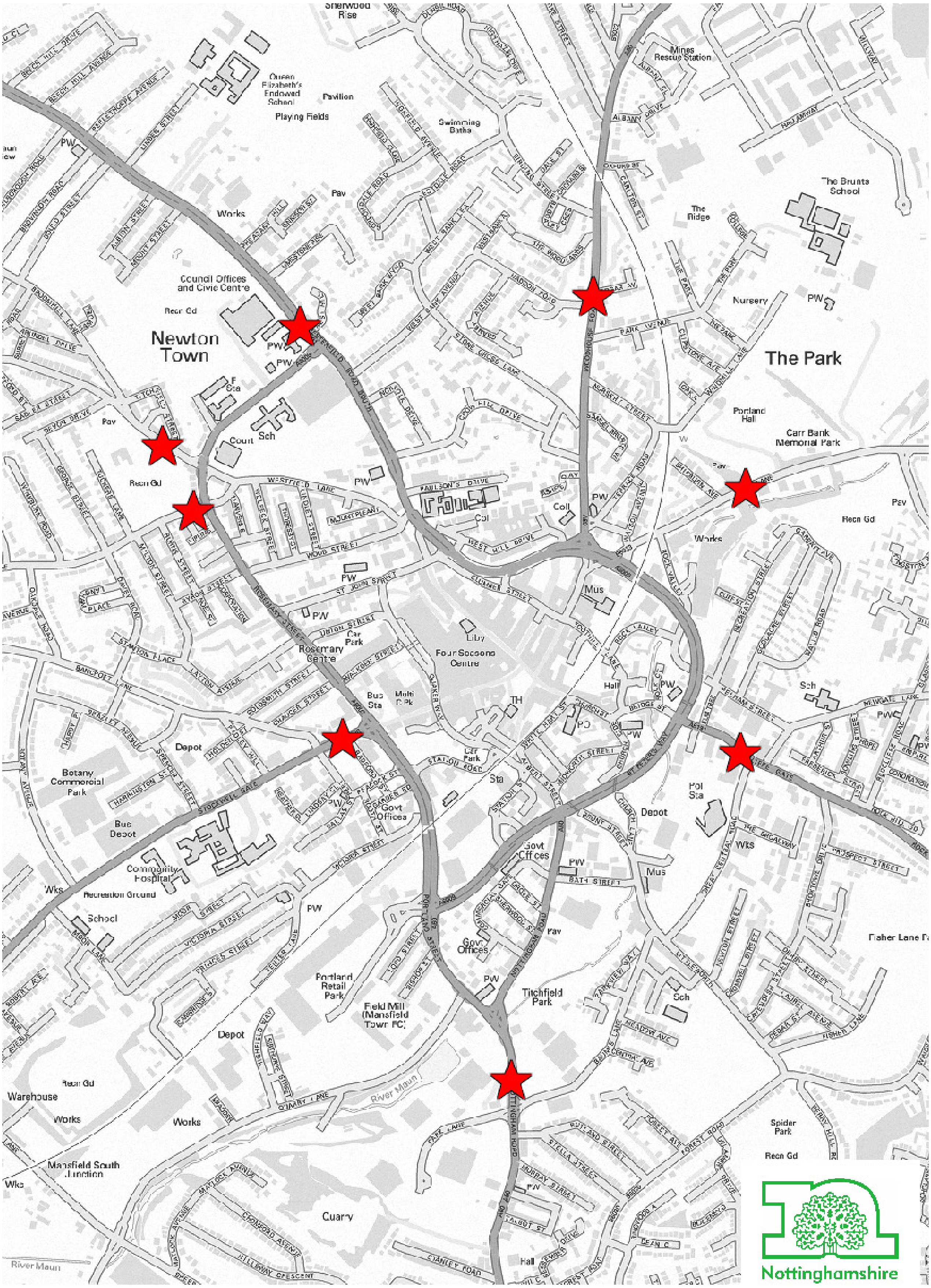

Figure 3.7: Locations of Traffic Monitoring Sites around Mansfield Town Centre

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3.3 Walking and Cycling

3.3.1 Figure 3.8, shows the existing cycle infrastructure within Mansfield, focusing on Mansfield town centre. This is taken from the document, *Cycling in Mansfield and Ashfield* (Nottinghamshire County Council, 2007). As can be seen from Figure 3.8, the existing cycling infrastructure is better developed to the south of the town than in the north.

3.3.2 In terms of longer distance routes, Mansfield is linked to Sutton-in-Ashfield town centre via the Timberland, and Teversal & Skegby Trails. These are multi-user routes, although there are several locations which require the crossing of busy roads. The routes run east-west, along the southern boundary of the town as shown in Figure 3.9 (This provides more specific detail to that shown in Figure 3.8).

3.3.3 Figure 3.10 is also taken from the document *Cycling in Mansfield and Ashfield*, but focuses on the Market Warsop area. It identifies east-west linkages with the District of Bolsover (Shirebrook) and Sherwood Forest Country Park. Indeed, the Interim Planning Guidance Note 11 (Green Infrastructure, published by Mansfield District Council in April 2009) identifies that trails between Church Warsop and Market Warsop act as important recreation and commuting routes between the two areas and also ensure additional recreational access linkages from Warsop Vale to the National Cycle Network and Pleasley Vale to Meden Vale. Notwithstanding this, it is noted that, as recreational routes, these don't necessarily follow a direct route. They are mostly surfaced with un-bonded aggregate (stone chips etc) and are un-lit. While this doesn't prohibit their use as a commuter route, it can make them less attractive to commuters and result in lower or more seasonal demand.

3.3.4 Figure 3.11 shows cycle paths through the Meden Trail / Pleasley Vale, and Figure 3.12 shows routes from Mansfield Woodhouse to Shirebrook / Market Warsop.

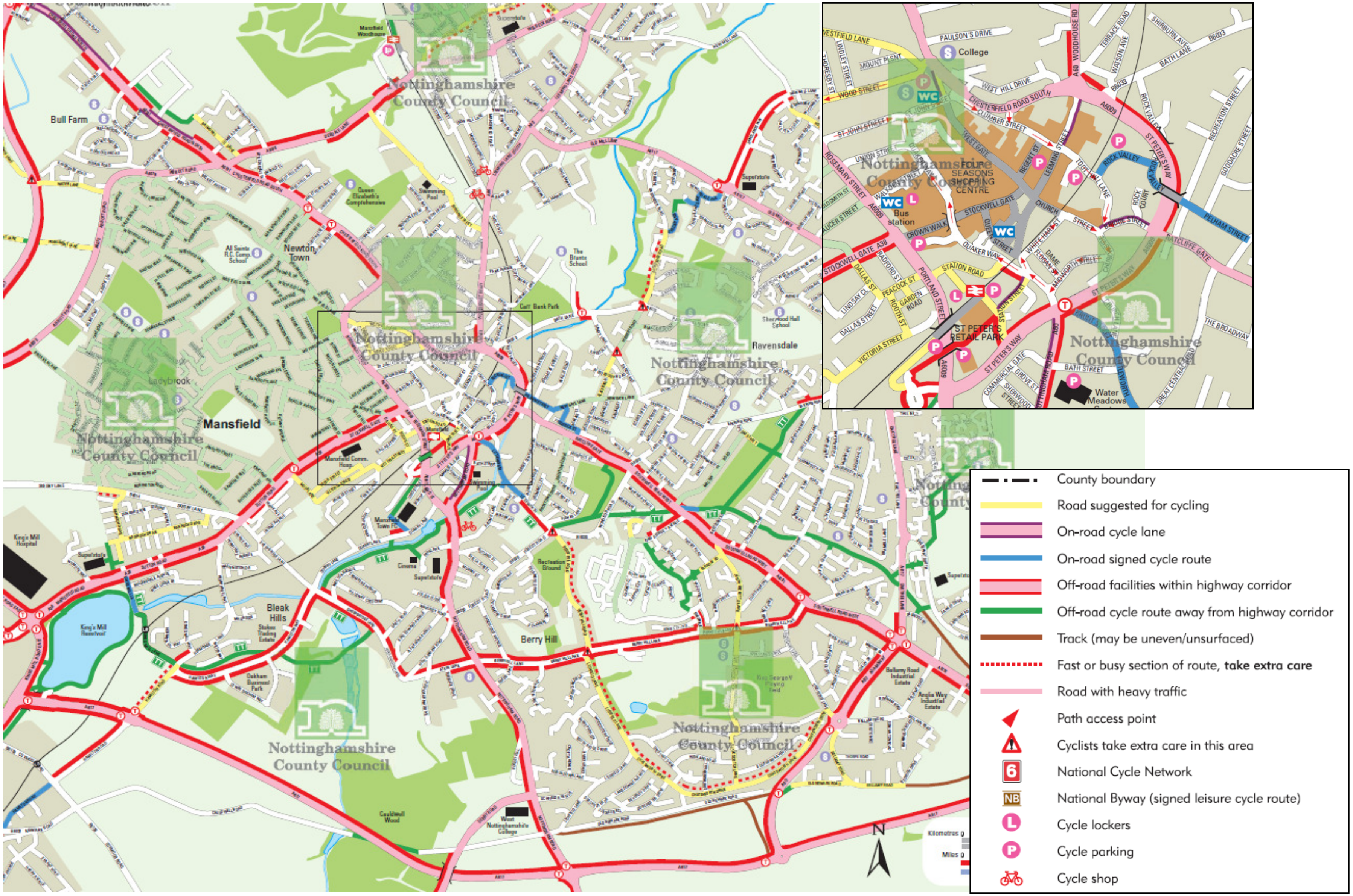

Figure 3.8: Mansfield Cycle Map

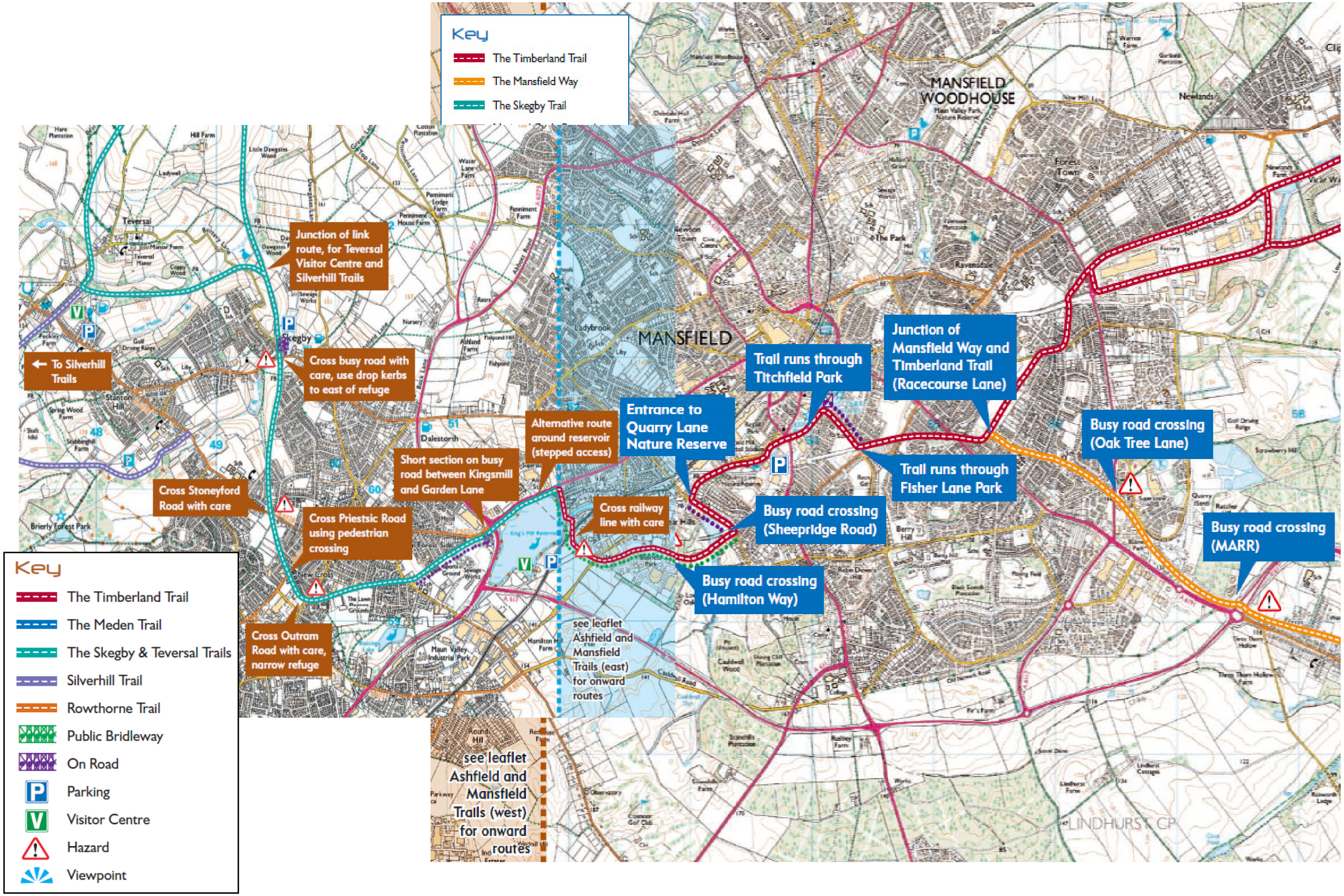

Figure 3.9: Ashfield and Mansfield Cycle Trails

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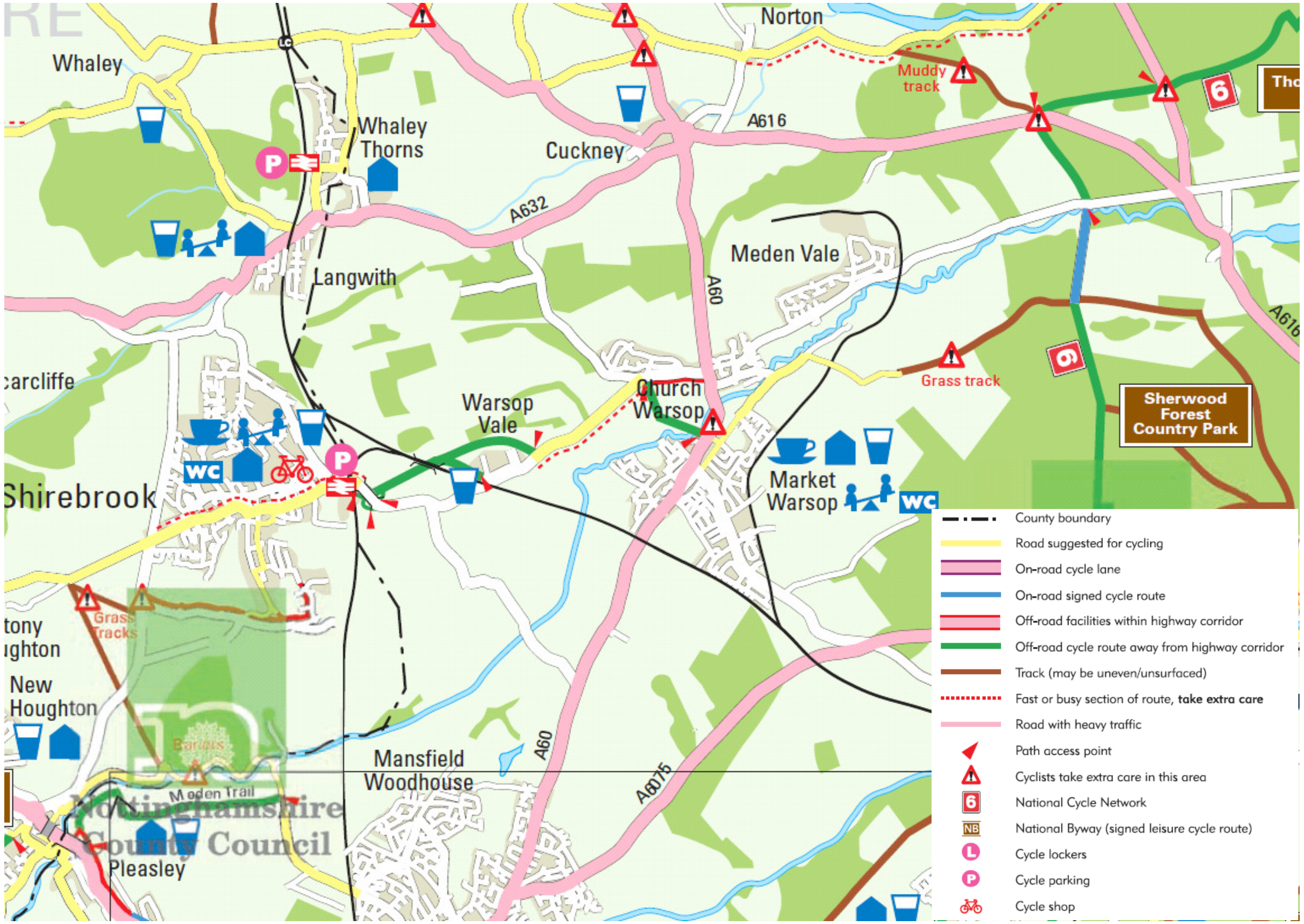


Figure 3.10: Mansfield Cycle Map – Market Warsop

AECOM

Figure 3.11: Cycle Paths Through the Meden Trail / Pleasley Vale

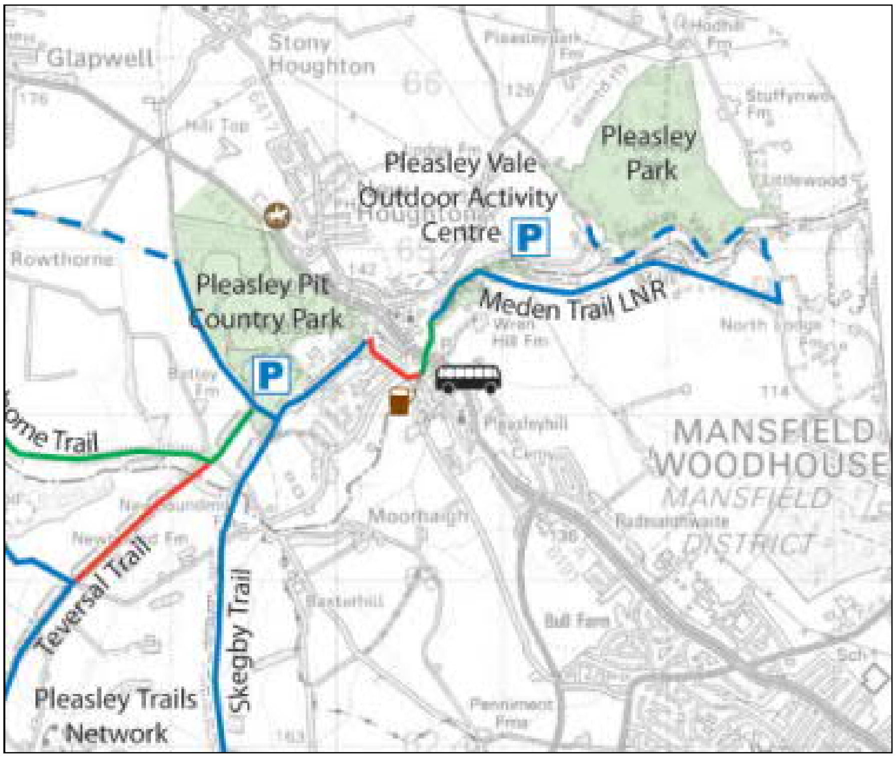
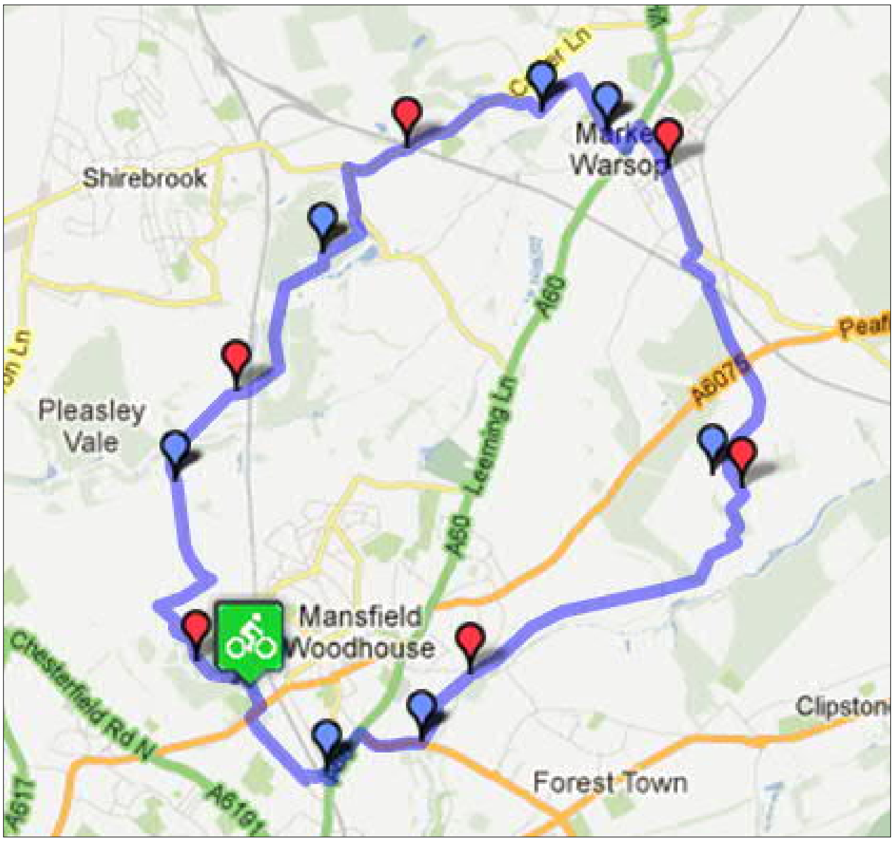


Figure 3.12: Cycle Paths Through the Meden Trail / Pleasley Vale (Reproduced from: Cycle-Route.com)



3.3.5 Cycle linkages across the district are therefore available, although these have developed along specific corridors such that, for instance, there is sparse network development between the north and south of the district. In terms of usage, the Nottinghamshire Cycle Strategy Delivery Plan (Nottinghamshire County Council, 2016) notes that levels of cycling in Mansfield remain low, with 1.5% of 16-74 year olds cycling to work compared to Nottinghamshire's average of 3.0%. This correlates to the census data shown in Table 3.4, whereby the number of Mansfield residents travelling to work by bicycle (1.5%) is significantly lower than the East Midlands's average (2.9%) and national average (3.1%).

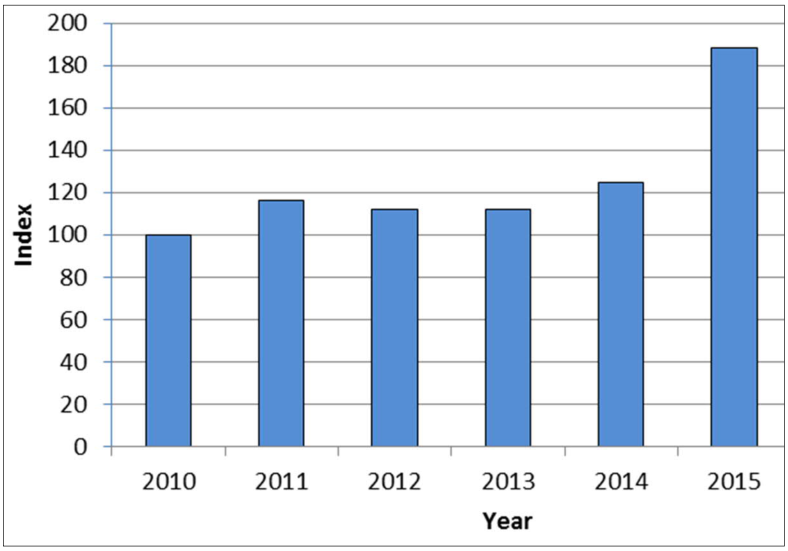
3.3.6 The Nottinghamshire Cycle Strategy Delivery Plan states that recent Personal Travel Planning (PTP) initiatives in Mansfield, Worksop and Sutton in Ashfield have however encouraged the growth of cycling, seeing an overall increase of cycling trips to work of 3% (compared to a survey completed before the PTP delivery).

Table 3.6: Changes in levels of cycling when compared to 2010 levels

Area	2011	2012	2013	2014	2015	2016
Ashfield	+13%	+9%	+11%	+17%	+60%	+58%
Bassetlaw	+10%	+4%	+3%	+11%	+4%	8%
Broxtowe	+10%	+8%	+14%	+30%	+9%	-1%
Gedling	+8%	+0%	+6%	+11%	+8%	+7%
Mansfield	+16%	+12%	+12%	+25%	+88%	-
Newark & Sherwood	+10%	+5%	+9%	+14%	+15%	+14%
Rushcliffe	+5%	+1%	+0%	+14%	+13%	+16%
Nottinghamshire	**+9%**	**+4%**	**+8%**	**+16%**	**+18%**	**+12%**

3.3.7 The County Council monitors cycle usage at several sites, and undertook annual counts between 2010 and 2015. The change in the level of cycling compared to a 2010 base year is shown in Table 3.6. The increase in cycling within Mansfield is well above the Nottinghamshire average, with 2014 (the year after PTP delivery) seeing a 25% increase compared to the 2010 base year. The graph at Figure 3.13 indicates that cycle usage has increased over the period 2010-2015 compared to the 2010 base year. Despite a plateau in 2012/13, cycle usage has begun to increase once more. It should be noted that the number of cycle counters in the area is however limited.

Figure 3.13: Cycle Usage in Mansfield (2010 – 2015)



Note: Annual growth factors provided by Nottinghamshire County Council. Indices are based on a 2010 base value (i.e. 2010 = 100).

3.3.8 Notwithstanding the above changes in recorded cycle volumes, the Nottinghamshire Cycle Strategy identified some of the problems which may deter cycling:

- High traffic levels;
- Poor maintenance of routes;
- Danger of cycle theft / not enough secure cycle parking in the most convenient places;
- Real or perceived risk of injury;
- General ease and attractiveness, and perceived low cost of car use;
- Geography of certain areas – e.g. hills, spacing between facilities;
- Length of journey – may require interaction with public transport over longer commuting journeys;
- Severance of direct and attractive routes;
- Lack of rural links – resulting from the cost (due to length) verses lower benefits through smaller populations;
- Lack of designated facilities in smaller towns to main towns – resulting from cost versus benefits issue;
- Air and noise pollution; and
- Poor weather.

3.3.9 Many of the above issues are being addressed by Nottinghamshire County Council through both school and adult cycle training, and securing new cycling infrastructure via LTP funds or from developer contributions. The latter is the most important with respect to new sites coming forward via the Mansfield District Local Plan.

3.3.10 NCC has recently been awarded funding to install 4.3km of off-road segregated cycle track and 3km of signed on-road non-segregated cycle lanes. This will link the Lindhurst development to Mansfield's improved cycle network; providing access to local services, employment, and housing sites. This also provides links to LGF (Local Growth Fund) funded Vision West Nottinghamshire College University Centre.

3.3.11 In addition to the above, it is understood that NCC are considering the development of a number of additional cycle routes and infrastructure within Mansfield to improve the cycle network. It is likely any proposals will be consulted upon throughout 2017.

3.4 Public Transport

3.4.1 In 2015 Nottinghamshire County Council published the Nottinghamshire Integrated Passenger Transport Strategy, a document outlining strategies for its future passenger transport priorities with the aim to deliver local and national transport objectives for an improved transport service.

3.4.2 The key priorities outlined throughout the document include the aims to produce a network and service that:

- Has good network coverage, operating periods, service frequency and fully accessible vehicles and waiting facilities network;
- Is affordable so that costs are competitive with the use of the private car and don't deter people from using the available services; with good use of ticketing options, concessionary fares, smartcard technology and integrated ticketing;
- Is understood by everyone and is easy to use so that people know about services and how to use them by providing clear information in a variety of media; operators being in partnership and through effective marketing of passenger transport; and
- Provides high quality services that are reliable, punctual, don't take too long and require minimum changes; as well as providing high quality infrastructure that is fully accessible, modern, clean (both in appearance and emissions), quiet, safe and informative; and provides a high quality customer service provision by drivers and other staff.

3.4.3 To meet passenger transport priorities, a new £11m public transport interchange was built and opened in March 2013, as well as a Quality Bus Partnership introduced. The bus station, maintained by Nottinghamshire County Council, has 16 bays each fitted with Real Time Information (RTI) displays, with a further 14 RTI displays at key bus stops within Mansfield town centre.

3.4.4 Additional highways work, which included the installation of bus lanes and the relocation of the bus station, has led to an increase in punctuality across the network. In 2016, 93% of services operating in Mansfield have adhered to the Traffic Commissioners window of tolerance, which states that a bus can be up to 1 minute early and 5 minutes late.

3.4.5 In the past 2 years (2013-2015) since the opening of the public transport interchange (PTI), passenger numbers have grown by 5%. Although there was a reported loss of bus patronage in 2015, in line with national trends, the number of passengers has stabilised at 4% or more above the levels reported before the development. This equates to approximately 3 million more passenger journeys per annum.

3.4.6 In addition to the initial investment, the development of the bus interchange encouraged the following further investment from bus operators and NCC:

- Bus operators have invested £4.9m upgrading strategic services within Mansfield town as well as the Mansfield to Derby Nines service. In addition, all Mansfield to Nottingham services now provide WiFi as standard;
- The Nottingham County and Nottinghamshire City councils have funded an upgrade to enable the Threes service buses (Mansfield to Nottingham via Sutton in Ashfield and Hucknall) to seek priority at intelligent traffic signals. This aims to improve punctuality and reduce journey times between Mansfield and Nottingham; and
- The County Council are working with all operators to introduce integrated ticketing across the Mansfield / Ashfield area. NCC is also working with Stagecoach to display Real Time bus information at the bus station.

3.4.7 In addition to the introduction of the Integrated Passenger Transport Strategy, Nottinghamshire County Council are also currently exploring the following as part of their strategic bus strategy:

- The development of a County-wide Public Transport Infrastructure Investment Delivery plan, to encourage economic growth and job creation. Work will centre on a number of improvements to key transport corridors, in order to improve service punctuality and reliability. Feasibility scoping has already begun on a number of key corridors including the A38, A60 and A6191.

3.4.8 The local public transport services covering the Mansfield and Market Warsop area are shown in Figure 3.14.

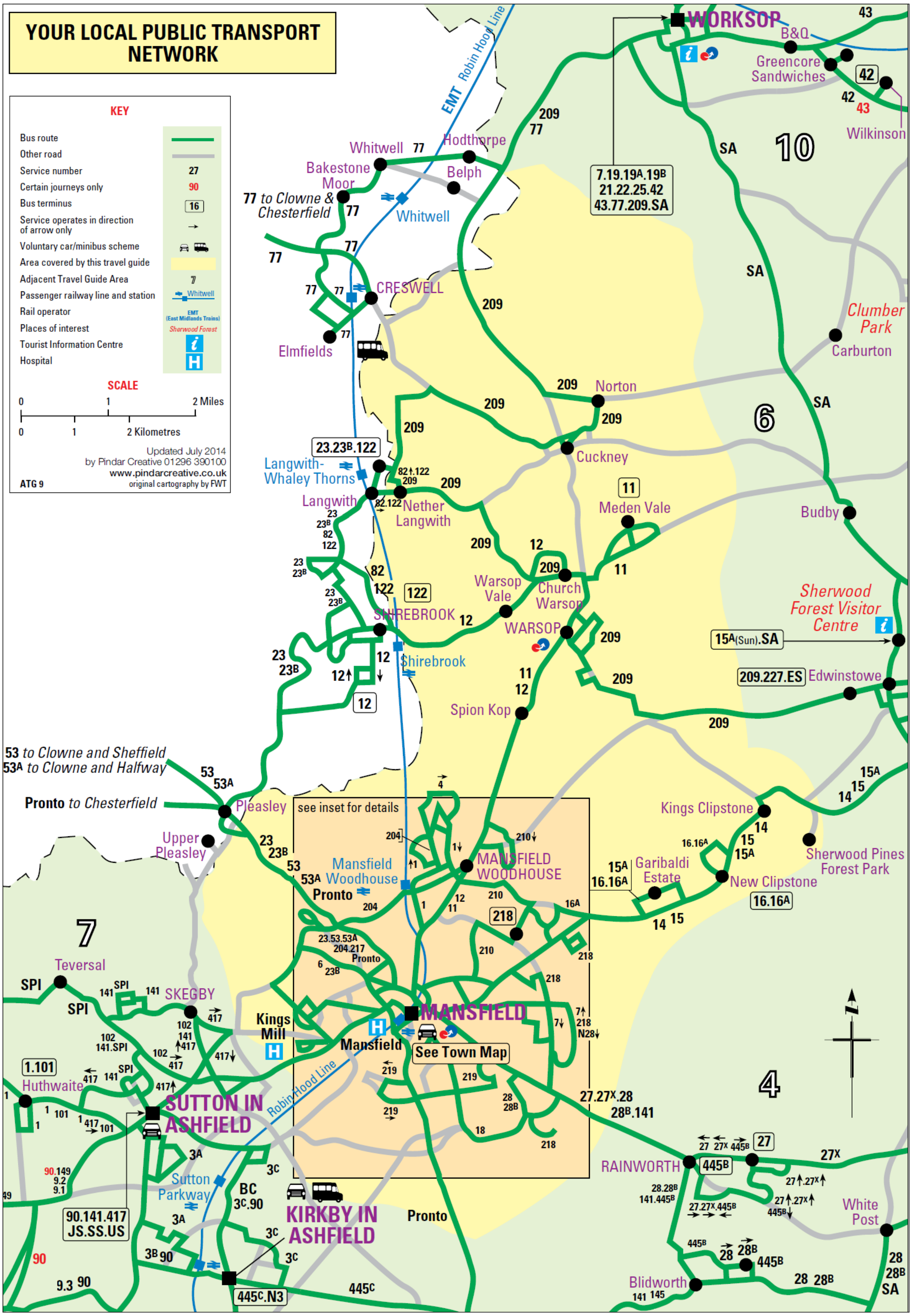
3.4.9 In terms of specific services, these are subject to periodic changes based on the requirements of the individual operators (e.g. Trent Barton, Stagecoach East Midlands, McEwen and TM Travel). Figure 3.15 shows the Mansfield bus map and generally shows a good coverage of services across the urban area, which link together via a town centre interchange.

3.4.10 The routes of the bus services in and around the Mansfield Town Centre are indicated in Figure 3.16. These routes relate to services in 2016.

3.4.11 Of the commercial services, the key connections to Derby, Nottingham, Chesterfield and Sutton-in-Ashfield are available via the 'Nines', Rainbow, Black Cat and Pronto services which run at least every 60 minutes during the daytime.

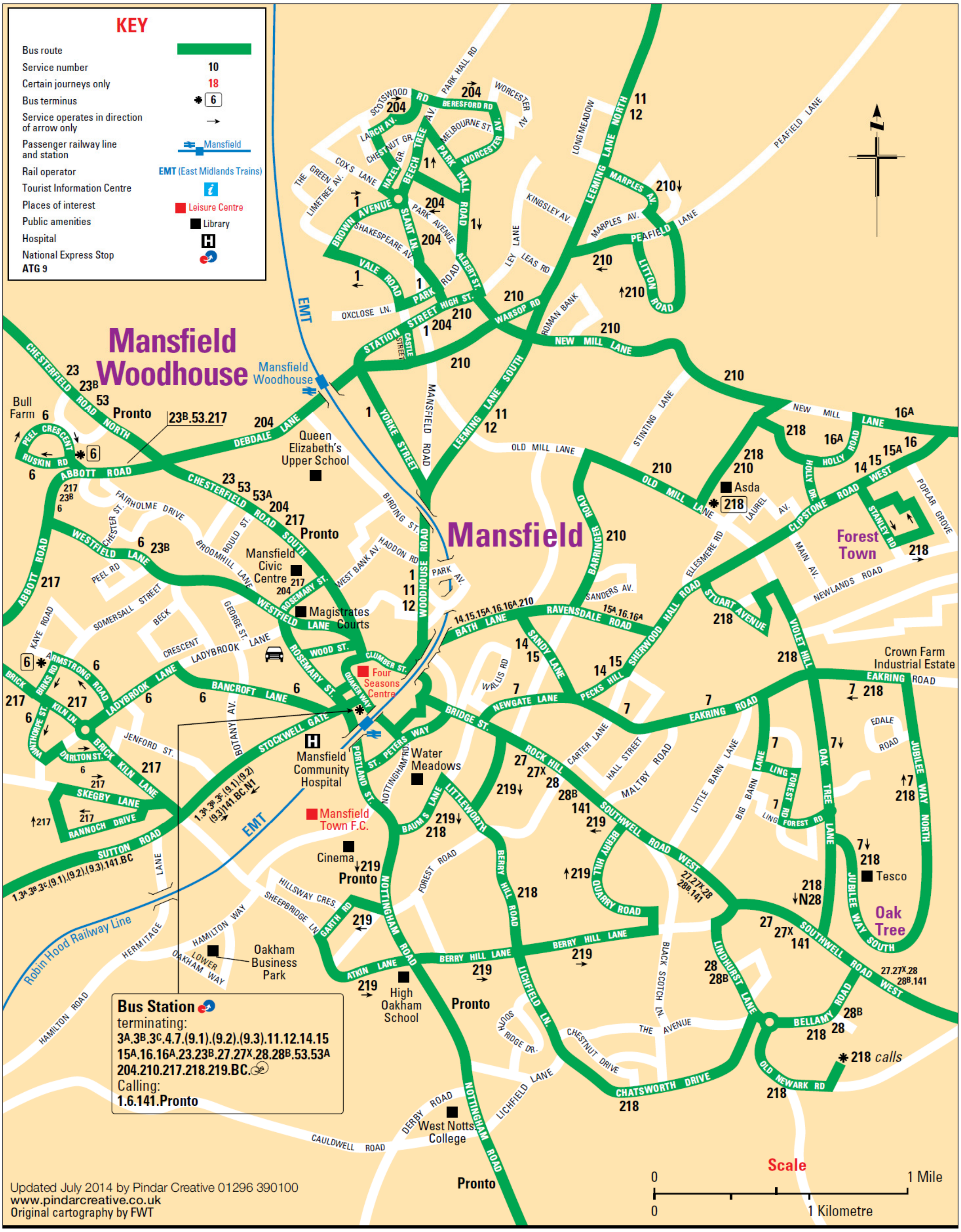
3.4.12 In addition to the commercial operators, Nottinghamshire County Council also supports a range of services within Mansfield including the following services:

- 204 (Mansfield to Mansfield Woodhouse);
- 217 (Mansfield – Ladybrook- Rannoch Drive- Mansfield);
- 218 (Mansfield – Oak Tree – Forest Town);and
- 219 (Mansfield – Berry Hill – Mansfield).



Extract from Nottinghamshire County Council's Area 9 local bus travel guide for Mansfield and Warsop area, dated July 2014.

Figure 3.14: Bus Services Map of district



Extract from Nottinghamshire County Council's Area 9 local bus travel guide for Mansfield and Warsop area, dated July 2014.

Figure 3.15: Bus Services Map of Mansfield

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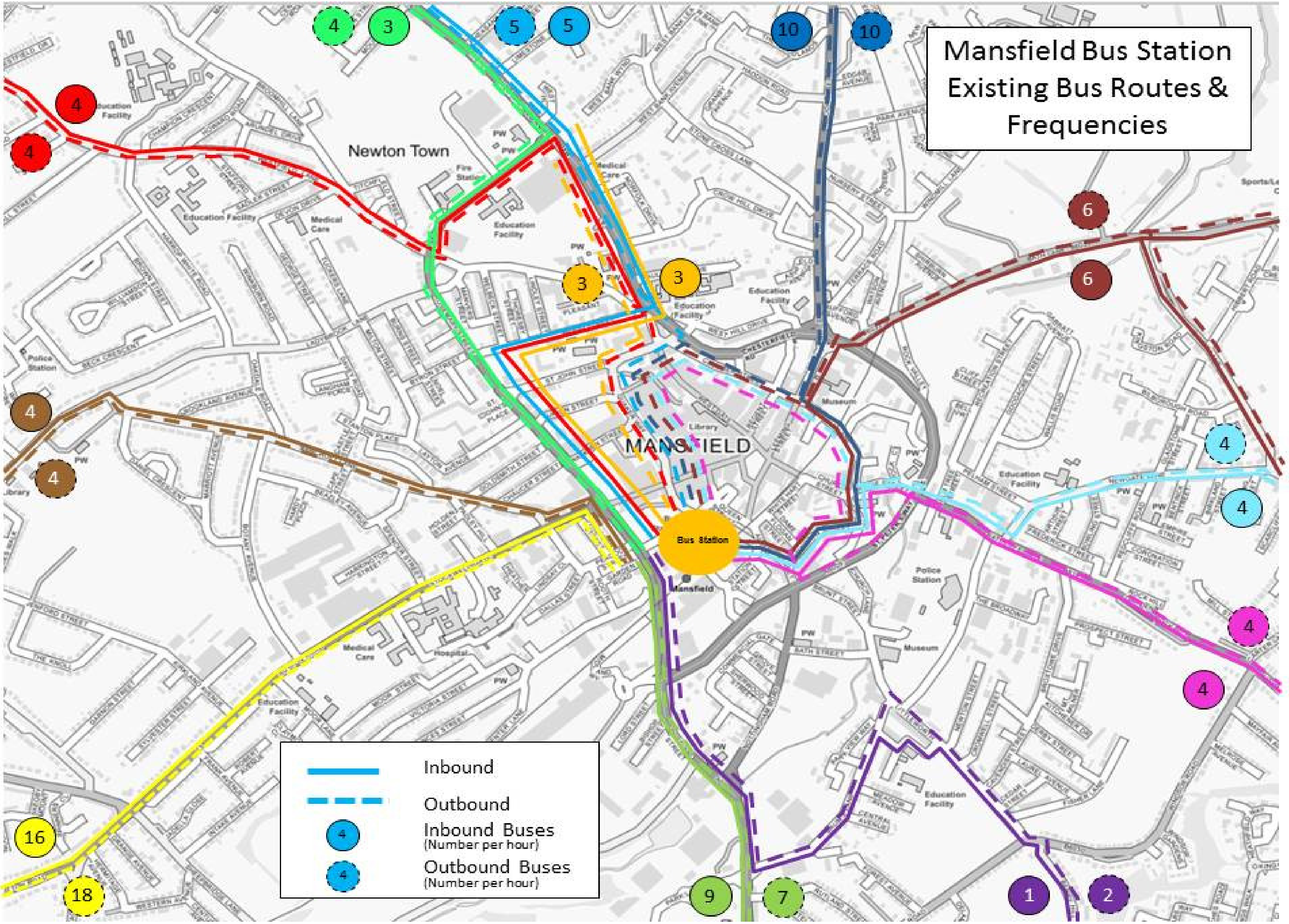

Information supplied by Nottinghamshire County Council for 2016.

Figure 3.16: Bus Routes and frequencies servicing Mansfield PTI

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3.4.13 As at December 2016, the frequencies of the main bus services in the district of Mansfield are provided in Table 3.7:

Table 3.7: Frequencies of the main Bus Services

Service Number	Operator	Service Description		Frequency (mins)						
				Monday to Friday			Saturday		Sun day	
			First Dep. Time	Peak	Daytime	Evening	Daytime	Evening		Last Dep. Time
1	Stagecoach	Mansfield Woodhouse - Huthwaite - Alfreton	0450	10	10	15/30	10	15/30	15/30	2330
6	Stagecoach	Ladybrook - Mansfield - Bull Farm	0550	20	15	2jnys	15	2jnys	60	1917
7	Stagecoach	Mansfield - Oak Tree - Mansfield	0530	15	15		15		60	1815
11	Stagecoach	Mansfield – Warsop - Meden Vale	0545	30	30	60	30	30	60	2245
12/12B	Stagecoach	Mansfield - Shirebrook	0625	30	30	2jnys	30	2jnys	60	2005
14/15/15A	Stagecoach	Mansfield - Ollerton - Kirton/Walesby	0545	30	30	60	30	60	60	2220
16/16A	Stagecoach	Mansfield - Clipstone	0510	15	15		15		60	1753
23/23B	Stagecoach	Mansfield - Shirebrook - Langwith	0545	30		120	30		120	2215
27	Stagecoach/ Trent Barton	Mansfield – Rainworth-Mansfield	0605	60	60		60			1630
27X/28/ 28B/29	Stagecoach	Mansfield – Rainworth - Blidworth - Southwell - Newark	0515	30	30	1jny	30	1jny	60	1905
53/53A	Stagecoach	Mansfield - Sheffield	0640	120	120	2jnys	120	2jnys	120	2157
141	Trent Barton	Sutton-in-Ashfield - Mansfield - Hucknall - Nottingham	0600	60	60		60			1800
204	Nottsbus/ Stagecoach	Mansfield - Mansfield woodhouse - Mansfield	0920		60		60			1420
210	Stagecoach	Mansfield - Mansfield woodhouse - Mansfield	0838	60	60		60			1838
217	Nottsbus/ Stagecoach	Mansfield – Ladybrook – Rannoch Drive - Mansfield	1105		60		60			1405
218	Nottsbus/ Stagecoach	Mansfield – Oak Tree – Forest Town	0645	60	60		60			1745
219	Nottsbus/ Stagecoach	Mansfield – Berry Hill - Mansfield	1005		60		60			1405
N12	Trent Burton	Mansfield – Warsop – Shirebrook – Pleasley – Mansfield	2359				1jny			2359
Black Cat	Trent Barton	Mansfield - Heanor - Ilkeston - Derby	0620	60	60		60			1830
nines	Trent Barton	Mansfield – Sutton-in-Ashfield - Alfreton - Ripley - Derby	0530	10/20	15	30	15	30	30	2300
pronto	Stagecoach/ Trent Barton	Mansfield - Chesterfield	0535	30	10	60	10	60	30/60	2315
threes	Trent Barton	Mansfield -Sutton-in-Ashfield - Kikby-Hucknall-Nottingham.	0445	10/15	10	30	10	30	60	2306

3.4.14 Bus operators were contacted during the development of this study, to ascertain the perception of the performance of the highway network in Mansfield and Warsop and to identify common issues. Frequent comments included:

- Traffic conditions during peak periods along the main arterial corridors into Mansfield (A38 and A60) continue to cause delays to services. This reduces the attractiveness of bus travel, especially since these corridors are core bus routes with high frequency services run by multiple bus operators;
- Outdated vertical traffic calming across Mansfield causes problems for buses especially as road surfaces around the bus cushions have deteriorated and the structures have become loose and unstable. Vertical traffic calming damages the suspension of buses as well as creates potential health hazards for passengers and staff. This undermines the comfort of bus travel and;
- Any future housing and commercial developments should be accompanied by further quality improvements to bus services, in order to encourage modal shift and ensure traffic levels remain manageable and air quality is maintained.
- There are a number of road surface issues across Mansfield. These include:
  - A60 Nottingham Road / Berry Hill Lane Junction. Two red brick crossings at this junction are very rough, and cause major bangs/rattles as the buses pass over them;
  - A60 between Caulwell Road and Derby Road junctions. Has a poor road surface;
  - B6020 (Southwell Road East) in Rainworth between A617 and Kirklington Road. High speed ramps are uncomfortable for buses passing over them;
  - Chesterfield Road South between Debdale Lane and Rosemary Street. The cracking road surface has led to a number of sunken grates and pot holes and;
  - Sutton Road (A38) between Kings Mill and Hermitage Lane. There are at least 4 sunken grates and a ‘groove’ which runs along this section of road.
- Along Leeming Street night buses often have issues with taxis who block the road. Nottinghamshire police have been moving taxis on for causing an obstruction;
- Pronto buses leaving Mansfield Bus Station (to Nottingham) are taking an average of 5 minutes and 8 seconds to get to Stella Street (a journey of only 0.6 miles) due to delays at 5 sets of traffic lights. Priority for buses or improved traffic light flow to favour vehicles leaving the bus station here would be beneficial. A peak time bus lane would also help in this situation;
- The A617 from Pleasley towards Mansfield has two locations that would benefit from a peak hour bus lane. A bus lane sensor fitted to the traffic light junctions would speed up transitions through these busy junctions and;
- Mansfield Bus Station would benefit from a sensor fitted to each bus bay which detects when a bus is moving, and subsequently informs drivers in other lanes. This should help reduce the number of vehicle movement related incidents that have occurred here. This issue is particularly prominent when a large number of buses depart at a similar time.

3.4.15 For those unable to use their own transport, or access public transport, Nottinghamshire County Council also allows users to search for community and social transport schemes via its website[3].

[3] Refer to web site: http://www.nottinghamshire.gov.uk/travelling/travel/communitytransport/

Public Transport – Rail

3.4.16 Mansfield benefits from two rail stations: Mansfield and Mansfield Woodhouse. The locations of these stations are shown in Figure 3.17.

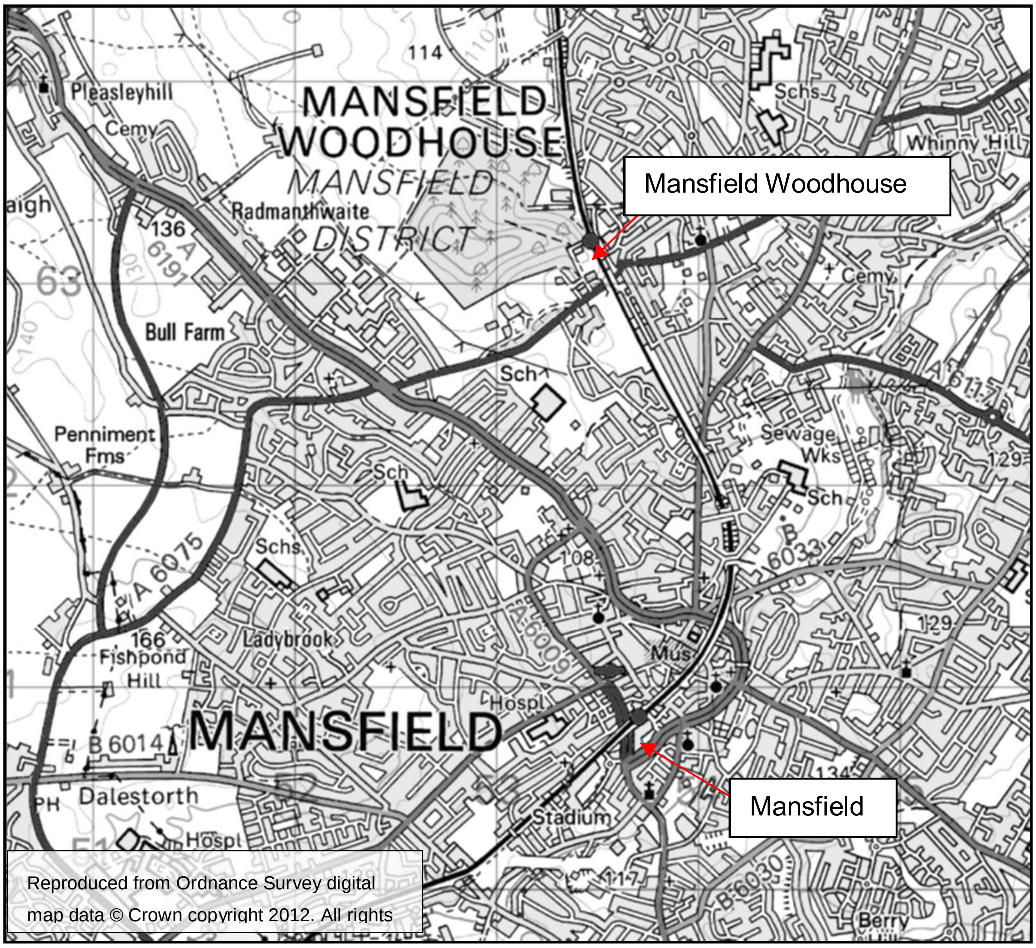
3.4.17 Mansfield station has a 103 space car park, and three uncovered cycle stands (which can accommodate up to six cycles).

3.4.18 Mansfield Woodhouse has a 40 space car park, and five uncovered cycle stands (which can accommodate up to ten cycles).

3.4.19 Although no information is available for this study with regards to the arrival mode of those using the station, it is likely that both stations could benefit from the provision of enhanced cycle facilities such as covered parking facilities.

3.4.20 Both stations offer step free access to all platforms for less able users.

Figure 3.17: Mansfield District Rail Stations



3.4.21 In terms of services, Mansfield is served by the Robin Hood line. The towns and villages served by the route are listed below:

- Nottingham;
- Bulwell;
- Hucknall;
- Newstead;
- Kirkby-in-Ashfield;
- Sutton-in-Ashfield;
- Mansfield;
- Mansfield Woodhouse;
- Shirebrook;
- Langwith, Nether Langwith and Whaley Thorns;
- Creswell;
- Whitwell; and
- Worksop.

3.4.22 During the daytime between Monday and Saturday there is a half-hourly service from Mansfield Woodhouse, through to Nottingham (southbound) and an hourly northbound service onwards to Worksop. There is an hourly service during the evenings between Nottingham and Worksop. There is also a reduced service on Sundays; every two hours in each direction towards Nottingham and Worksop.

3.4.23 The most recent statistics published by the Office of Rail and Road (ORR) provide detail on rail patronage. These show usage growth for both Mansfield stations in 2015/16 (Table 3.8). For comparison, data for Chesterfield Railway Station is also shown, due to the similarity in the towns' sizes although Chesterfield station is on the Midland Mainline with links to London hence greater passenger numbers. The values presented in Table 3.8 shows the number of entries and exits from the stations, and as such represent the total number of passengers passing through.

Table 3.8: Annual Station Usage (Source: Office of Rail Regulation, 2016)

Station	11-12	12-13	13-14	14-15	15-16
Mansfield Town	367,258	349,810 (-4.8%)	313,826 (-14.5%)	366,858 (-0.1%)	394,640 (7.5%)
Mansfield Woodhouse	160,340	155,792 (-2.8%)	139,582 (-12.9%)	158,692 (-1.0%)	169,506 (5.7%)
Chesterfield	1,490,616	1,498,814 (0.5%)	1,564,882 (5.0%)	1,640,288 (10.0%)	1,731,432 (16.2%)

3.5 Accessibility

3.5.1 The above sections demonstrate that the pattern of travel varies across the district of Mansfield and that the availability of sustainable transport infrastructure is also unevenly distributed.

3.5.2 These issues can be explored in further detail with reference to the Core Accessibility Indicators (CAI) published by the Government. The CAI provide a local-level measure of the accessibility for key services (covering food stores, education, health care, town centres and employment centres) for the populations who use them. They estimate the proportion of the local population who can access key services within reasonable time limits by sustainable transport modes. They are widely used in accessibility planning by local authorities.

3.5.3 Accessibility indicators are published by the Department for Transport (DfT) and Office for National Statistics for persons aged between 16 to 74 year-old. In terms of access to employment, the accessibility indicators identify the percentage of 16 to 74 year olds with access to employment by a composite mode of transport (i.e. a combination of one or more of walking, cycling or public transport). Table 3.9 summarises these results for Mansfield and the wider area and shows that Mansfield performs slightly higher than the Nottinghamshire average, but below that of Nottingham City (which is to be expected given Nottingham's size and status as a large employment destination).

Table 3.9: Percentage (%) of 16 to 74 Year Olds with Access to Employment by Composite Mode of Transport

Area	2010	2011	2013
Mansfield	83%	85%	85%
Nottingham City	85%	87%	86%
Nottinghamshire	82%	83%	83%

3.5.4 In previous versions of this report, composite 'Core Accessibility Indicators' (CAIs) for 'at-risk' users have been utilised as an additional measure of accessibility. These statistics are no longer produced by the Department for Transport and as such have been constructed by AECOM from a basket of similar parameters to generate a composite score. The following journey time statistics were used to estimate composite accessibility scores to services and facilities. Indictors have also been published by the Department for Transport based on the following criteria, which have then been combined into an overall composite score:

- % of users (16-74 year olds) within 15 minutes/30 minutes/ 45 minutes/ 60 minutes (results averaged) of **employment centres** (varying sizes) by walking/public transport;
- % of users (16-74 year olds) within 15 minutes/30 minutes/ 45 minutes/ 60 minutes (results averaged) of **primary schools** by walking/public transport;
- % of users (16-74 year olds) within 15 minutes/30 minutes/ 45 minutes/ 60 minutes (results averaged) of **secondary schools** by walking/public transport;
- % of users (16-74 year olds) within 15 minutes/30 minutes/ 45 minutes/ 60 minutes (results averaged) of **further education** by walking/public transport;
- % of users (16-74 year olds) within 15 minutes/30 minutes/ 45 minutes/ 60 minutes (results averaged) of a **GP surgery** by walking/public transport;
- % of users (16-74 year olds) within 15 minutes/30 minutes/ 45 minutes/ 60 minutes (results averaged) of a **hospital** by walking/public transport;and
- % of users (16-74 year olds) within 15 minutes/30 minutes/ 45 minutes/ 60 minutes (results averaged) of a **food store** by walking/public transport.

3.5.5 The criteria above were averaged to generate an overall composite score for accessibility. The statistics provide the percentage of users (16-74 year olds) who are able to access certain facilities within: a) 15 minutes b) 30 minutes c) 45 minutes and d) 60 minutes through either walking or using public transport. For consistency, and to provide a better representation of accessibility, all journey times have been averaged to create one score for each facility/service.

3.5.6 Although we are unable to show change over time, due to the government's discontinuation of composite CAI, the data can be used to show the geographical variation of accessibility.

3.5.7 Table 3.10 compares the local composite score data for Mansfield and the wider area. For the composite data, higher scores generally indicate an area that is more accessible (i.e. a higher percentage of 16-74 year olds are able to access core services). This table again shows that Mansfield compares well with Nottinghamshire and the wider East Midlands. As before, Mansfield is less accessible than Nottingham City, which is to be expected given more compact nature of Nottingham as well as more comprehensive public transport services.

Table 3.10: Composite Accessibility Scores

Area	Composite Score (% of users who have access to key facilities/services)
Mansfield	84.5
Nottingham	88.8
Nottinghamshire	82.7
East Midlands	81.7
England	84.0

3.5.8 Figure 3.18 provides a density plot for Mansfield at the Lower Super Output Area (LSOA) level. The darker colours on this figure identify where the most accessible LSOA areas are located. Here the most accessible LSOA cluster around the market town of Mansfield itself, as well as along major transport corridors (such as along Chesterfield Road South).

3.5.9 The least accessible areas are located in the rural areas to the North of Mansfield, as well as towards the South East of Mansfield

3.6 Freight

3.6.1 Nottinghamshire County Council has confirmed that no specific issues relating to freight in Mansfield were highlighted during the development of the LTP3 (by either stakeholders or as part of the evidence base analysis).

3.6.2 A map showing those routes carrying the greatest number of HGV movements in the District is shown as Figure 3.19 and more detail for the Mansfield urban area is shown in Figure 3.20.

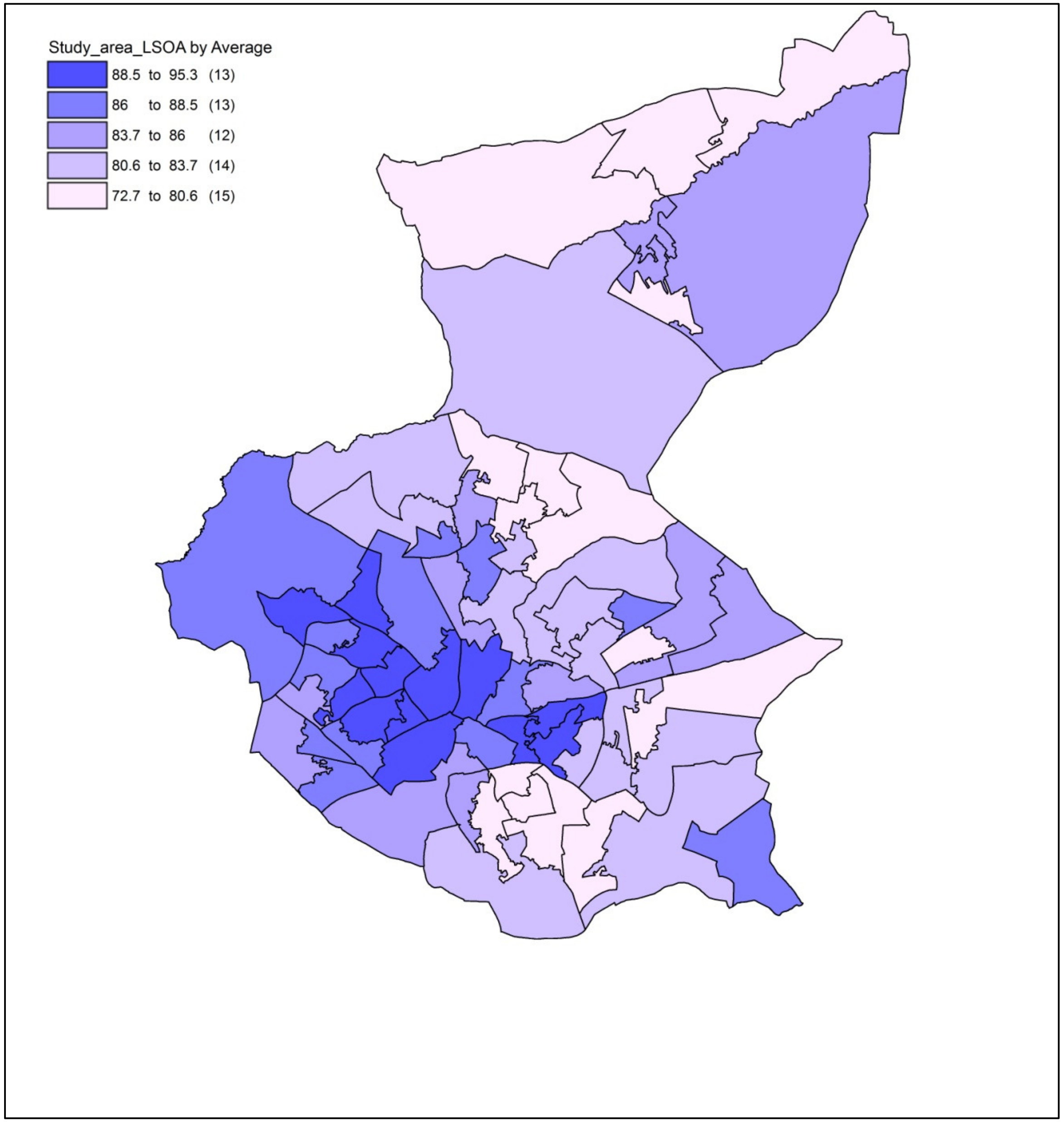


Figure 3.18: Composite Accessibility scores by LSOA

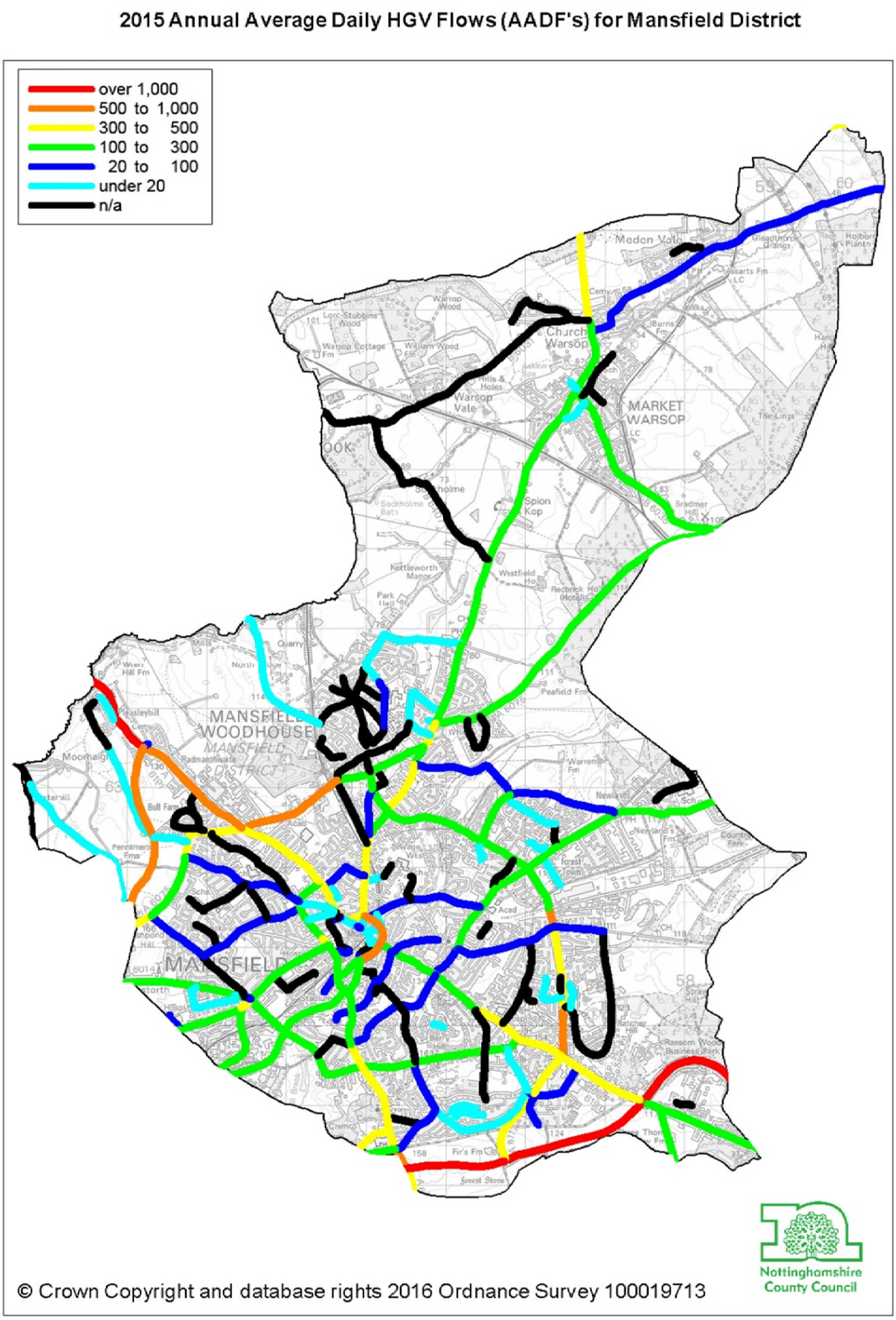


Figure 3.19: 2015 Annual Average Daily HGV Flows in District

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2015 Annual Average Daily HGV Flows (AADF's) for Mansfield

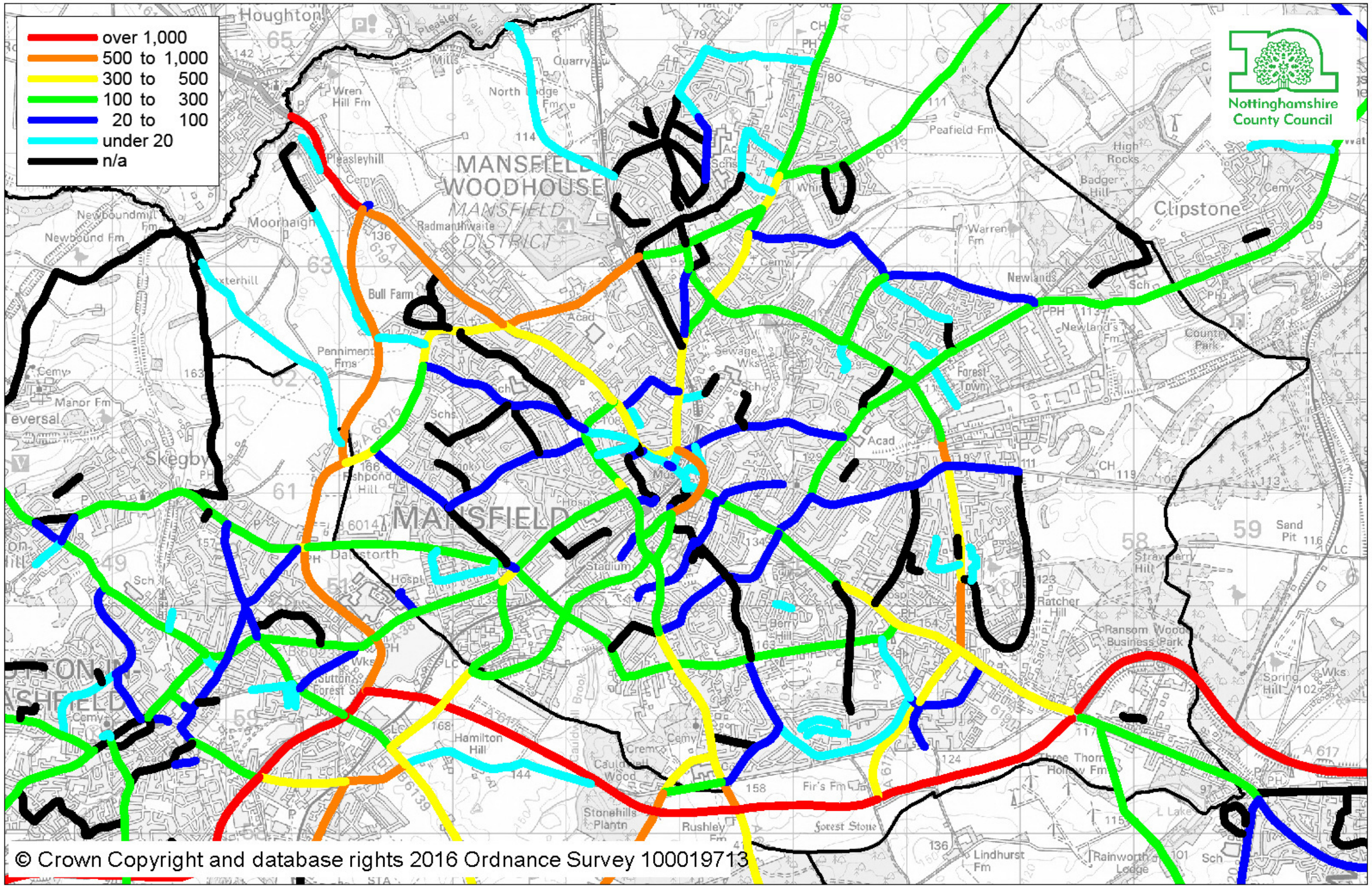


Figure 3.20: 2015 Annual Average Daily HGV Movements

3.7 Summary

3.7.1 Similar to other towns in Nottinghamshire, there has been a reduction in traffic entering Mansfield town centre since 2005. There has been a slight increase in traffic entering Mansfield between 2014 and 2016.

3.7.2 In terms of non-motorised travel, pedal cycle usage has seen a decrease compared to the 2001 census data (1.9% to 1.5% of all methods of travel to work). However the Nottinghamshire Cycle Strategy Delivery Plan indicates that cycling has seen an increase in the years following the 2011 census, particularly following a scheme of Personal Travel Planning (PTP) delivered in 2013.

3.7.3 2013 saw a major improvement in the provision of public transport within Mansfield via the opening of a new interchange within the town. The new bus station provides 16 bays each fitted with Real Time information displays. In addition, a further 14 Real Time information displays were installed on key streets within the town centre and a Statutory Quality Bus Partnership adopted.

3.7.4 Although the district of Mansfield compares well with the rest of Nottinghamshire in terms of overall journey patterns (proportion of those driving to work, accessibility to services and facilities) there are variations between wards at a local level. There are variations in the use of the car, as a main mode of travel to work, between wards. There is a higher proportion of residents in the Hornby ward for whom the main mode of travel to work is by car than in the Portland ward. These variations reflect the availability of sustainable transport infrastructure and access to employment, services and facilities by sustainable transport modes.

3.7.5 The sustainable transport choices of the district's main settlements may be linked to the frequency of public transport services and, more importantly, the range of services and destinations that may be accessed by public transport.

3.7.6 In terms of local transport and access to services, Mansfield town centre has more sustainable transport choices than some of its sub-urban areas to the south and east. The residential areas of Mansfield Woodhouse and Market Warsop have slightly better than average sustainable transport choices. However, the small communities in the north east, for example Church Warsop, Meden Vale and Warsop Vale have relatively less access to services by public transport modes.

3.7.7 The Mansfield urban area is served by two railway stations that provide access to other settlements in Nottinghamshire. There are also long-distance commercial bus services between Mansfield town centre and Derby, Chesterfield and Nottingham. In this respect the Mansfield urban area has more sustainable transport choices than other settlements within the district of Mansfield.

4. Baseline Conditions – Highway Network

4.1 Overview

4.1.1 The preceding sections have identified the current position with regards to overall travel patterns within Mansfield, and the availability of sustainable transport modes. The highway network carries a high proportion of trips in the Mansfield District whether by car, bus or as part of longer trips by train.

4.1.2 The purpose of this section is to identify the current operation of the highway network in terms of capacity and road safety.

4.1.3 In addition, information is presented regarding parking opportunities in Mansfield.

Description of the Highway Network

4.1.4 The main routes connecting Mansfield to the wider locality are:

- A38 – Sutton-in-Ashfield, M1 (Junction 28), Derby;
- A60 – Worksop, Nottingham;
- A617 – M1 (Junction 29), Chesterfield, Newark; and
- A611 – M1 (Junction 27).

4.1.5 In recent years, Mansfield has benefited from a major improvement to its highway network via the construction of the Mansfield Ashfield Regeneration Route (MARR). This connects the western end of the A617 Rainworth bypass and the A617 at Pleasley, passing by the south and west of Mansfield. Its purpose is to regenerate the area and essentially forms a bypass for Mansfield on the northwest to southeast axis.

4.1.6 Within Mansfield town centre itself, the A6009 forms an inner ring road which contains the key retail and civic centre of the district. The A60 is the key route through the Mansfield Woodhouse and Market Warsop areas of the Mansfield District and carries high proportions of through traffic.

4.2 Highway Network Performance

Daily Traffic Flows

4.2.1 Annual Average Daily Traffic (AADT) flows on roads at 2015 levels were calculated from traffic counting sites and data held by Nottinghamshire County Council. These count sites included: permanent and temporary automatic traffic counters, manual classified passing counts and junction turning counts. Traffic flows will vary along each link and it is not feasible to undertake traffic counts at every location where the traffic flows change, therefore an AADT is calculated from data at a specific location but is used to represent the flow along the whole length of the road. AADT data is only available for those roads where traffic counts have been undertaken. The most recent traffic counts for each road were used to calculate the AADT for the road. Various adjustment factors (short period, daily, seasonal, etc.) were applied to the count data where no 2015 traffic counts have been undertaken and where counts cover only short durations. The margin of error will increase with time, particularly where adjustment factors have to account for short-period and aged counts. Traffic count locations are shown in Appendix A (page A11).

4.2.2 Figures 4.1 shows AADT flows across the whole district and Figure 4.2 shows AADT flows in the Mansfield urban area.

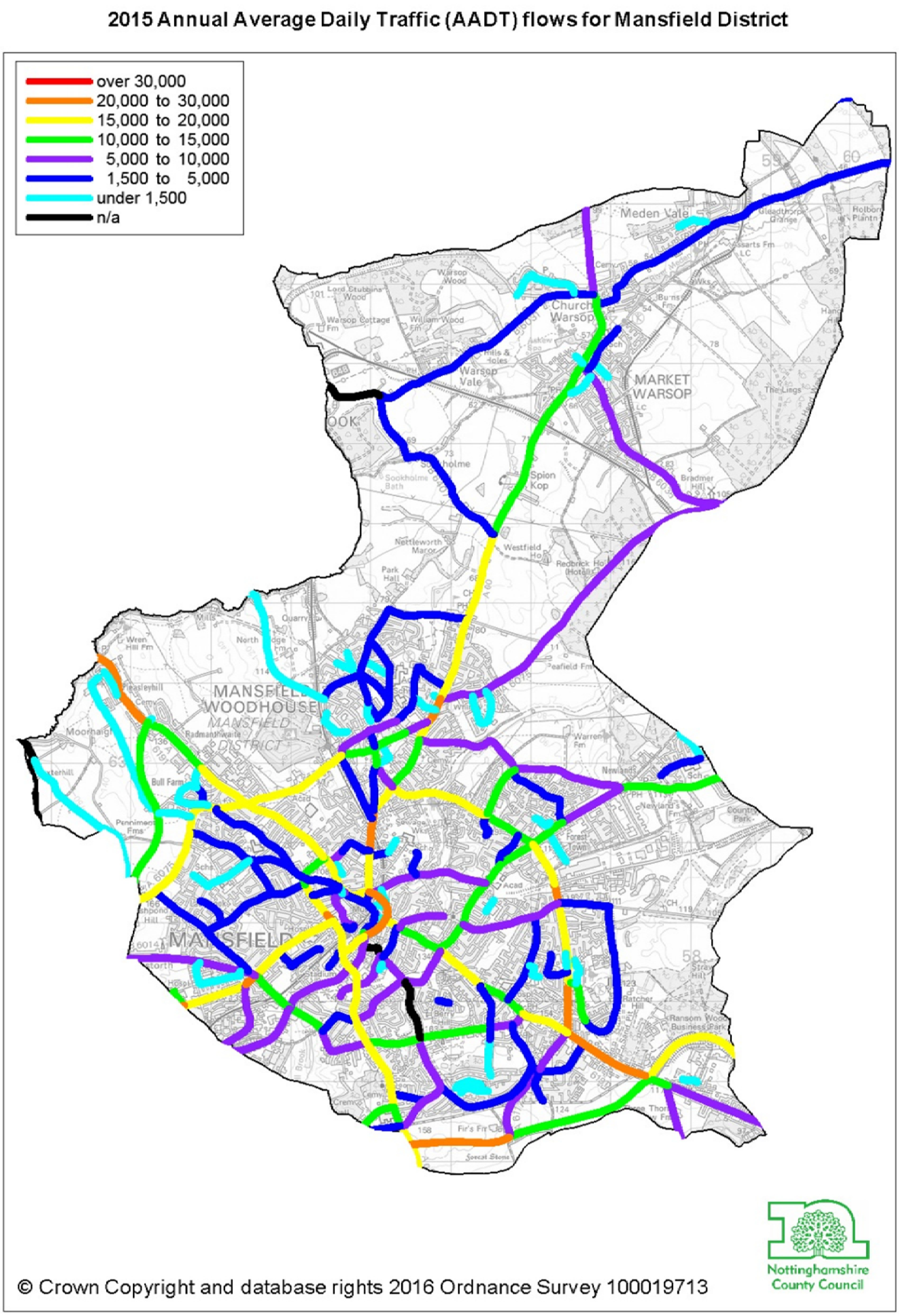


Figure 4.1: 2015 Annual Average Daily Flows in the District

2015 Annual Average Daily Traffic (AADT) flows for Mansfield

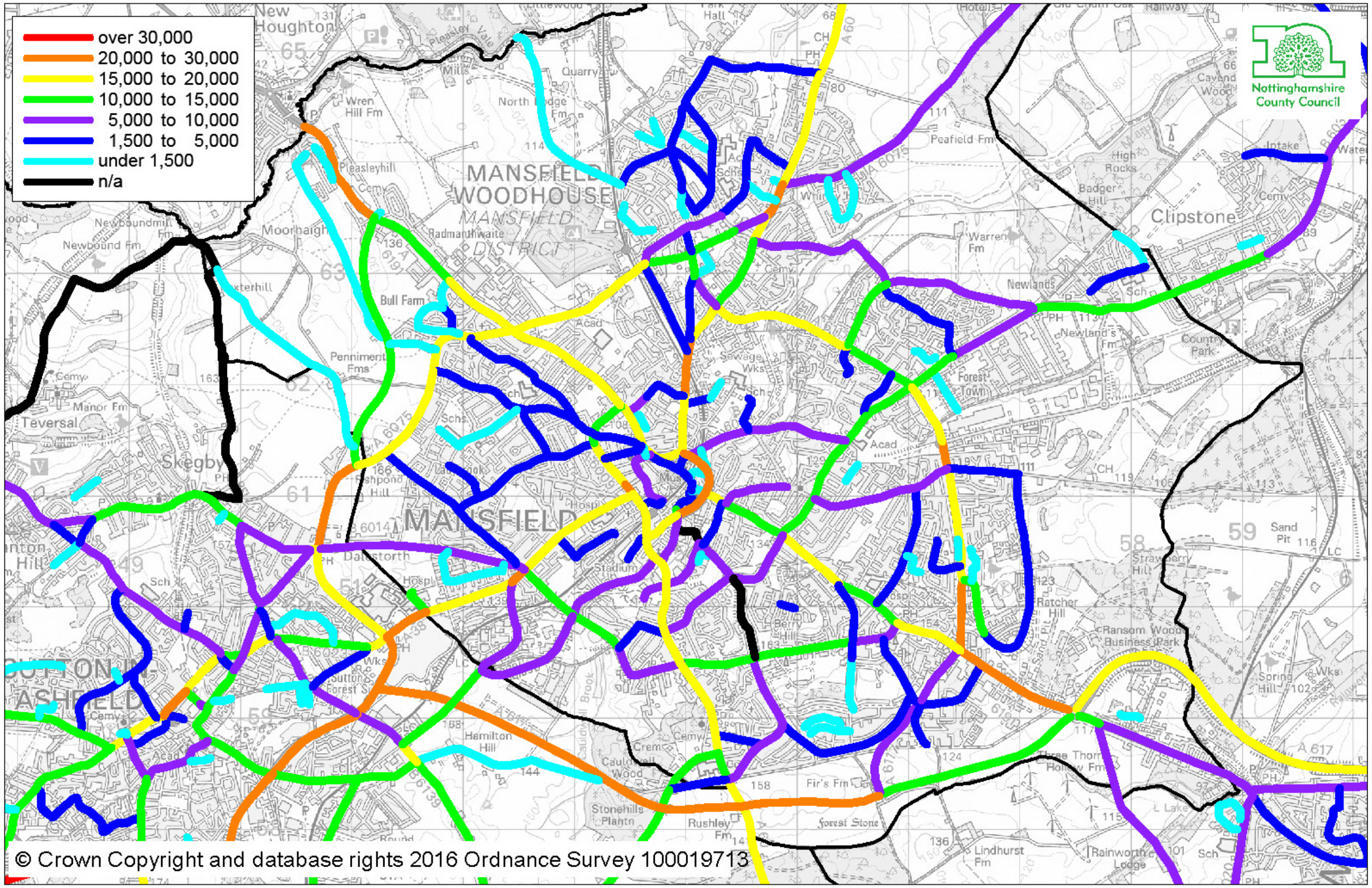


Figure 4.2: 2015 Annual Average Daily Flows in Mansfield

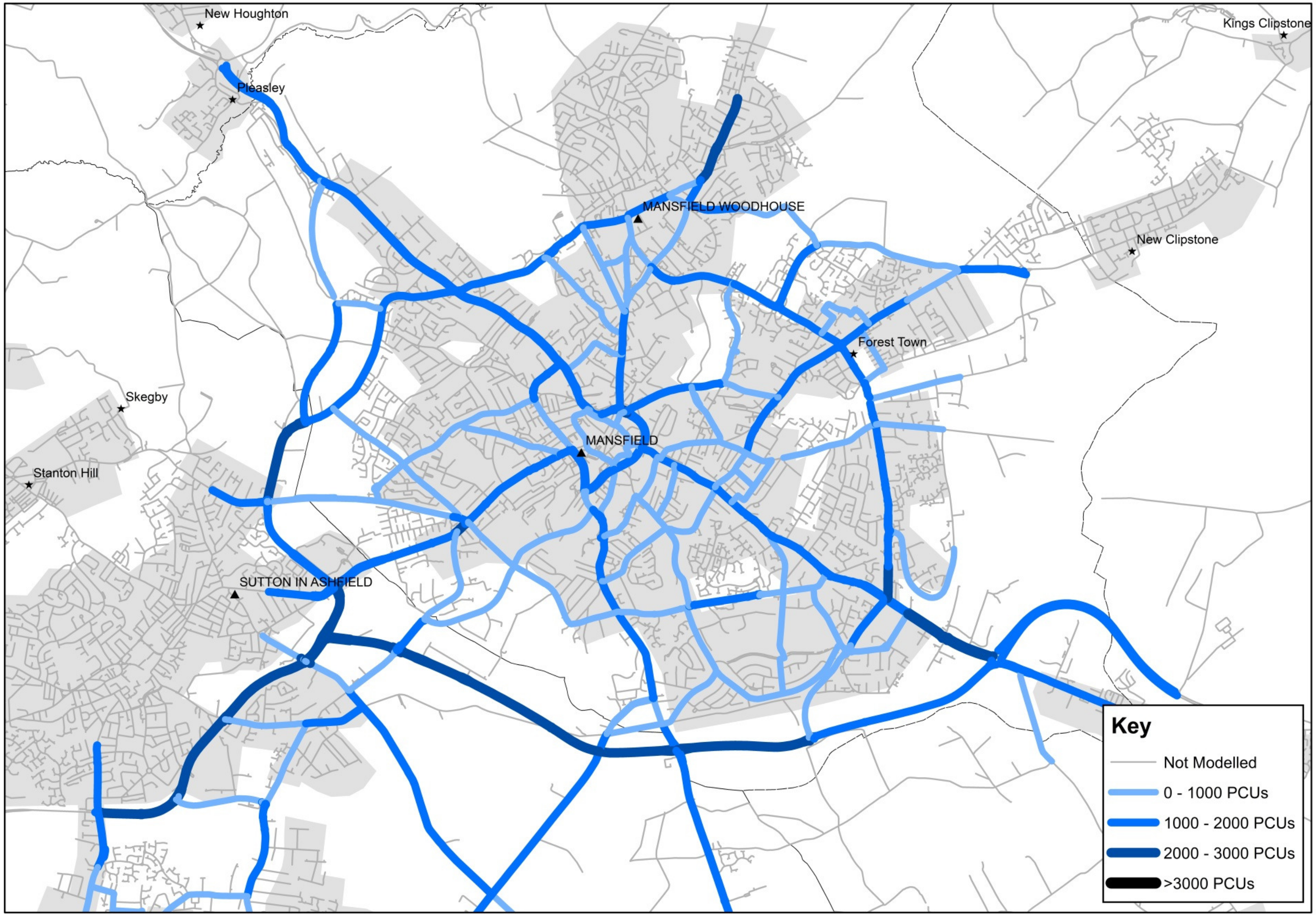
Peak Hour Traffic in the Mansfield Urban Area

4.2.3 As noted earlier in this report, the Mansfield urban area benefits from a SATURN traffic model. This model represents traffic conditions in both an AM (08:00 to 09:00) and PM (17:00 to 18:00) peak hour. To inform this report, this SATURN model has been updated to a 2016 base year using traffic count data provided by Nottinghamshire County Council and new counts commissioned at those junctions listed in Section 1.5.2. The detail of this updating work is described in the Mansfield Transport Study; Local Model Validation Report contained in Appendix A.

4.2.4 SATURN has the facility to report various indicators to identify how the highway network is performing. For the purpose of this report, the following outputs have been compiled and plotted:

- Total vehicular flow (Figure 4.3 & 4.4);
- Delay (Figure 4.5 & 4.6); and
- Volume / Capacity Ratios (Figure 4.7 & 4.8).

4.2.5 The Volume / Capacity (V/C) ratio of a road or junction is a measure of the traffic at the junction in relation to its ability to accommodate such flow. The V/C ratio is calculated by summing all the approach flows into a junction and dividing by the total available capacity on all approaches to the junction. A V/C value above 0.85 (or 85%) is likely to produce queues on some occasions during the peak hours. Above a V/C value of 1.0 (or 100%), a junction is more than likely to be at capacity (with resulting larger increases in queue length) during the peak hours. In Figures 4.7 and 4.8 the V/C values are grouped into coloured bands for plotting; junctions that are modelled to have over 50% V/C loading are shown yellow, junctions that are over 75% loading are plotted orange and junctions that are over 85% V/C loading are red or dark-red.



PCUs = Passenger Car Units. 1 Car = 1 PCU / 1 Bus = 2 PCUs etc.

Figure 4.3: Baseline (2016) AM Peak Hour Traffic Flows

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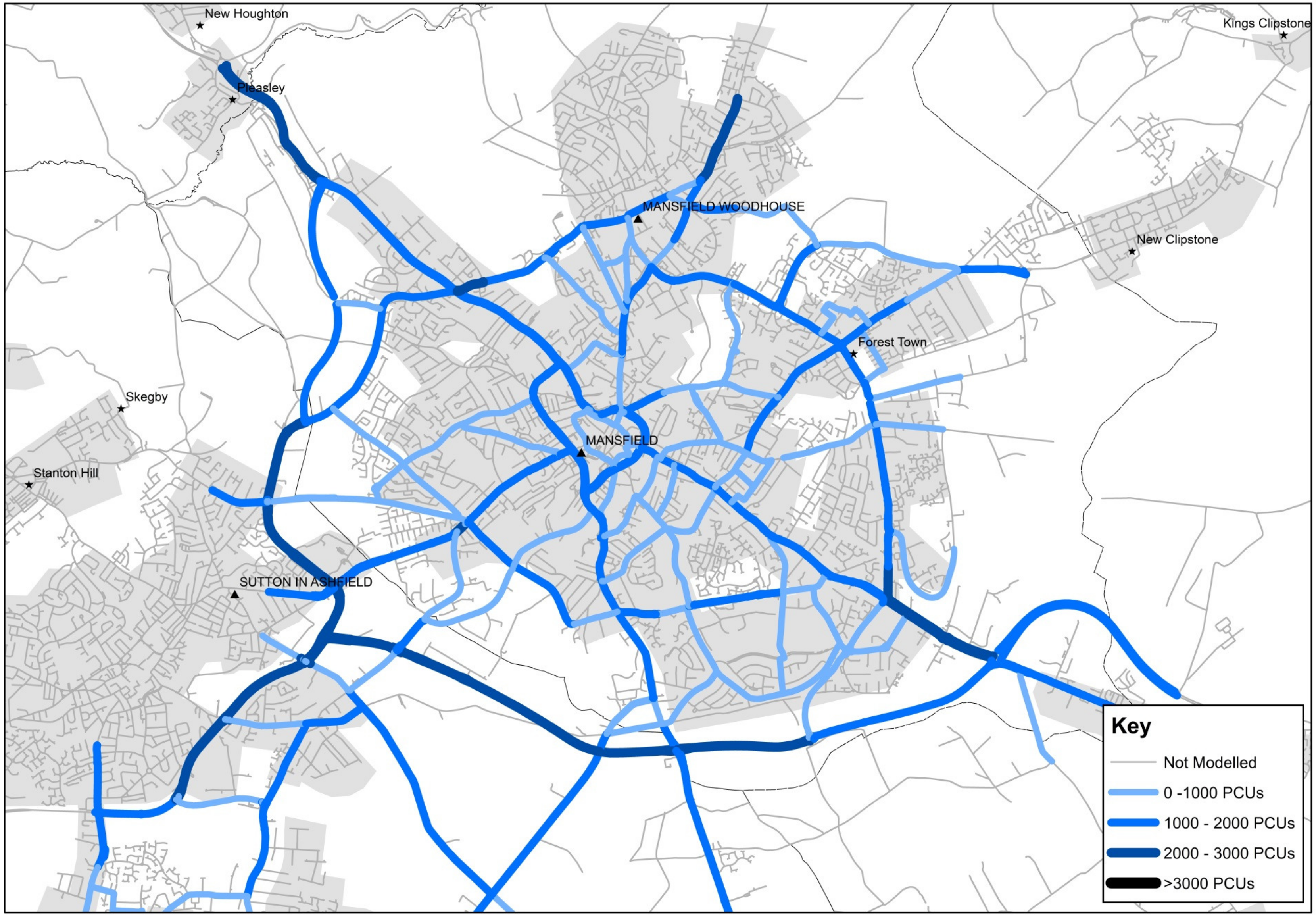

PCUs = Passenger Car Units. 1 Car = 1 PCU / 1 Bus = 2 PCUs etc.

Figure 4.4: Baseline (2016) PM Peak Hour Traffic Flows

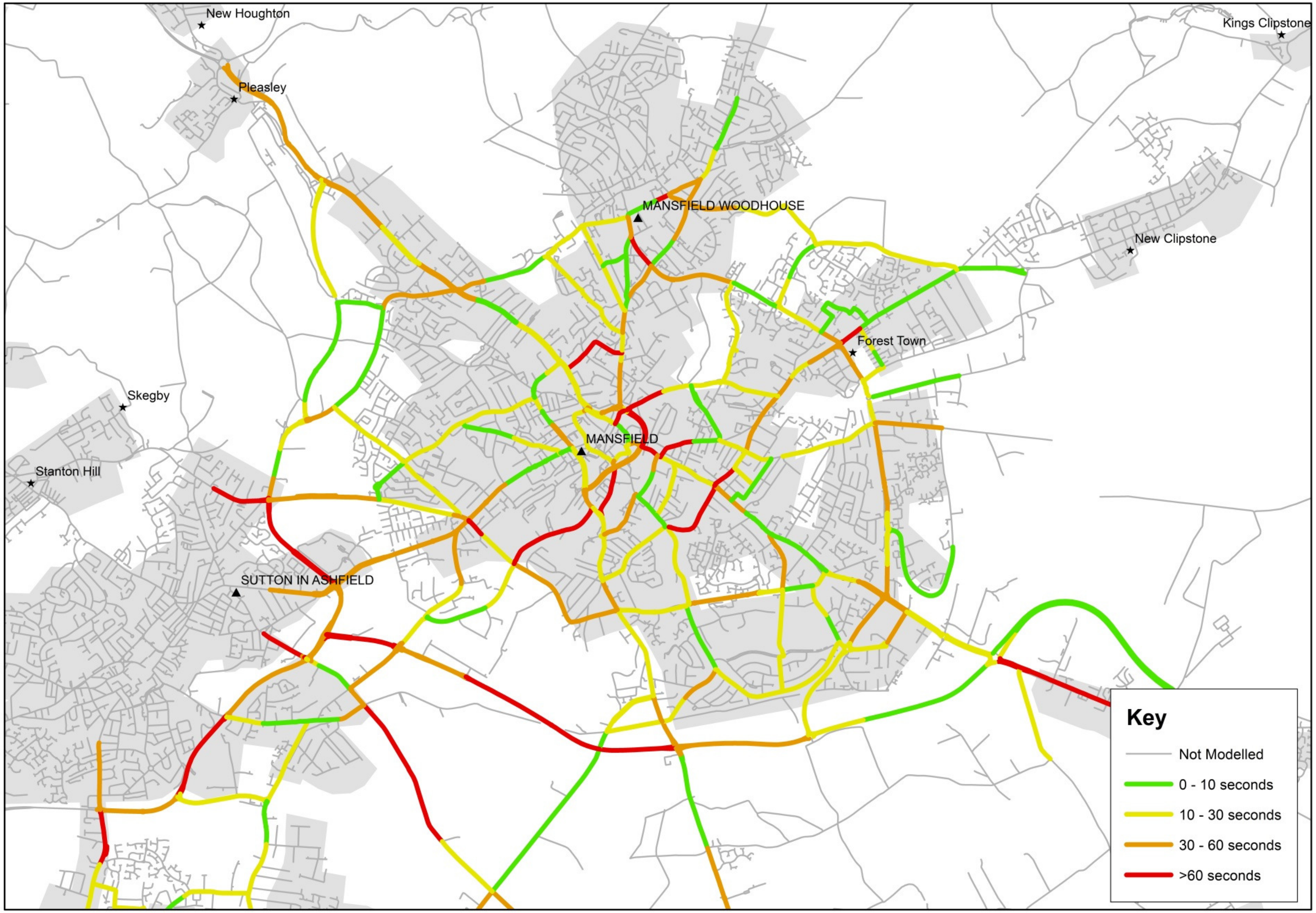

Figure 4.5: Baseline (2016) AM Peak Hour Delay

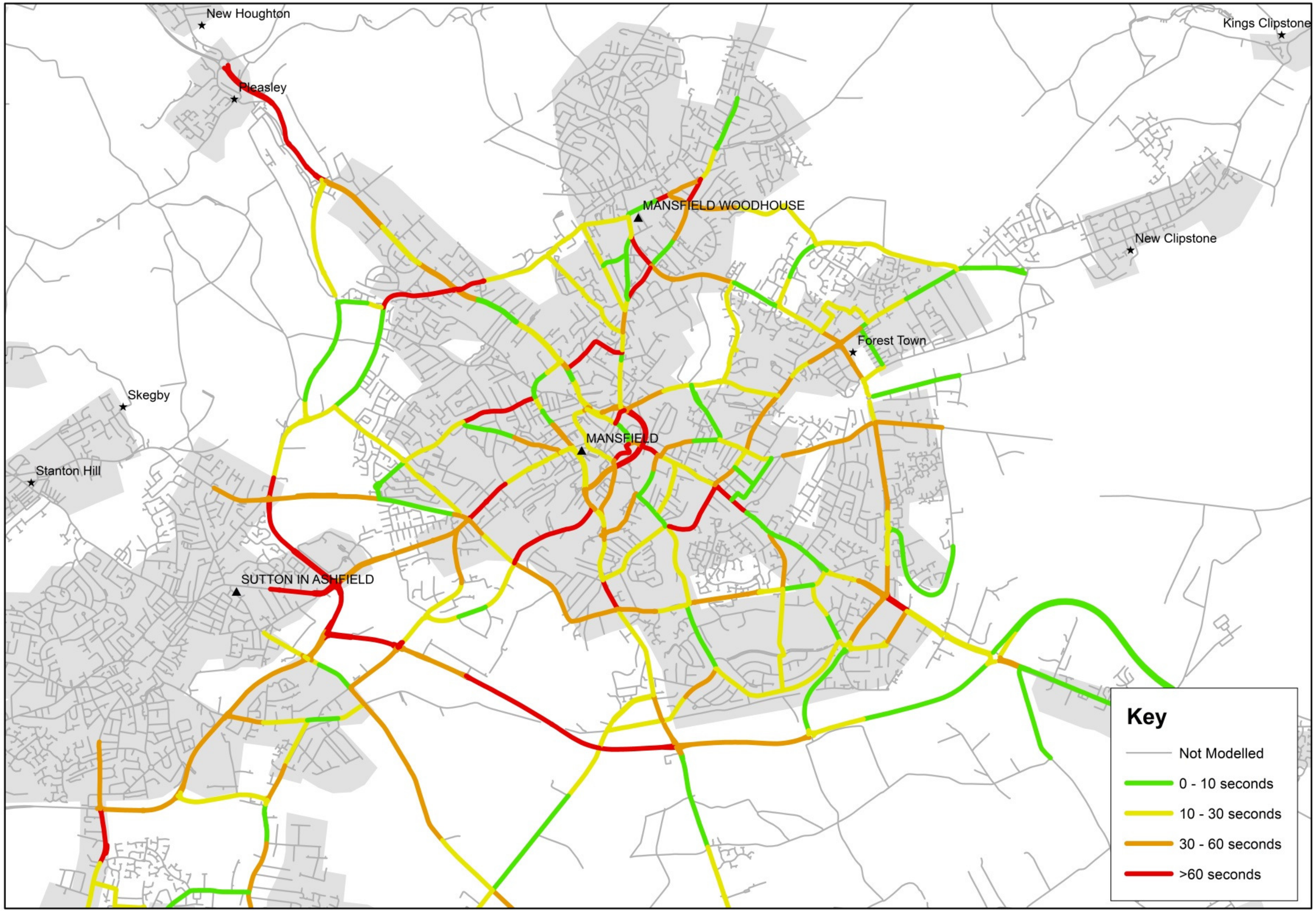

Figure 4.6: Baseline (2016) PM Peak Hour Delay

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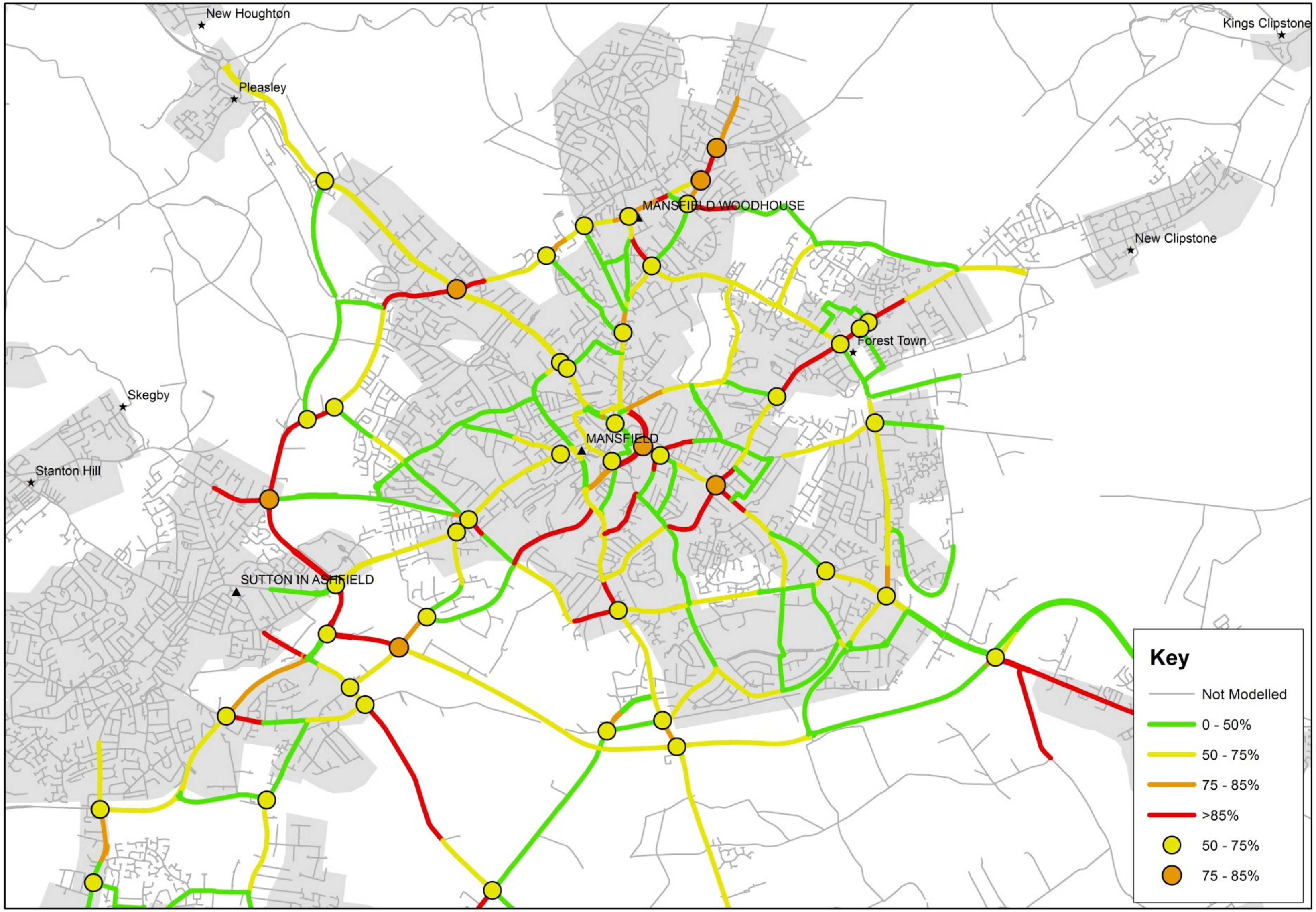

Figure 4.7: Baseline (2016) AM Peak Hour Volume / Capacity Ratio

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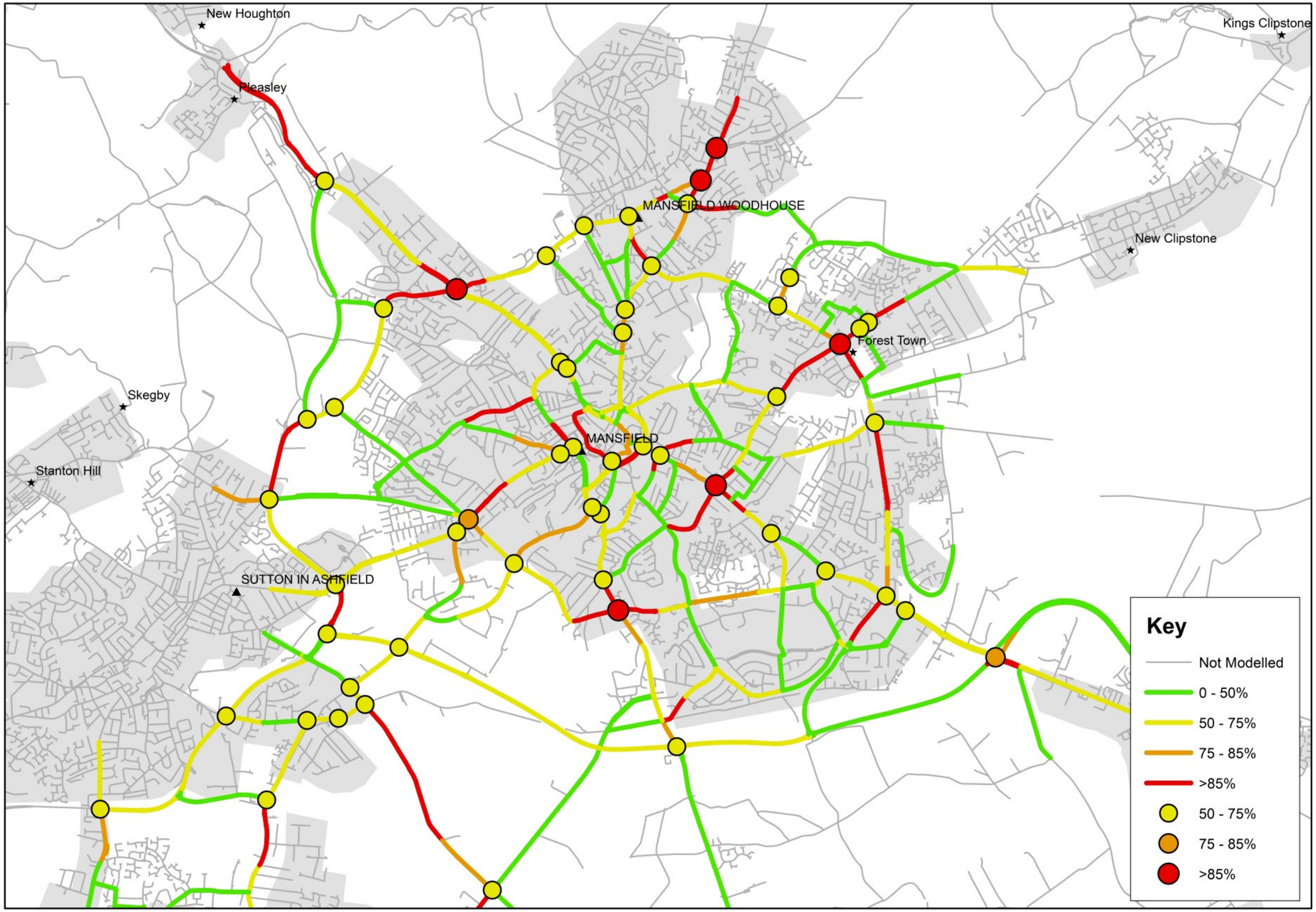

Figure 4.8: Baseline (2016) PM Peak Hour Volume / Capacity Ratio

AECOM

4.2.6 The AM and PM peak models were analysed to identify which junctions are approaching capacity in the Base Year. Those junctions with V/C threshold of 0.75 (or 75%) or greater were selected for analysis in the future years. This threshold was used to identify all junctions likely to be approaching capacity, as well as those junctions operating at capacity, in order to ensure that all the main junctions were captured and monitored for potential adverse traffic impacts in the future year analysis. This process highlighted the following ten junctions within the Mansfield urban area covered by the traffic model:

- Chesterfield Road / Debdale Lane;
- A60 Nottingham Road / Berry Hill Lane;
- Carter Lane / Southwell Road / Windsor Road;
- A617 MARR / A6191 Southwell Road;
- A60 Leeming Lane / Peafield Lane;
- A60 Leeming Lane / A6075 Warsop Road;
- Kings Mill Road / Beck Lane / B6014 Skegby Lane / Mansfield Road;
- A6191 Ratcliffe Gate / A60 St. Peters Way;
- A6117 Old Mill Lane / B6030 Clipstone Road West; and
- A38 Sutton Road / B6014 Skegby Lane / Sheepbridge Lane.

4.2.7 It is noted that the A60 / Baums Lane / Mansfield Leisure Park junction has vehicle queues in the peak shopping hours; e.g. on Saturday morning. These busier periods are outside the average weekday AM and PM peak hours used in this assessment. The locations of future developments will be reviewed at stage 2 to determine whether they are likely to impact on this junction within the modelled time periods.

Peak Hour Traffic in the Market Warsop Area

4.2.8 Site observations of the district’s highway network by AECOM traffic engineers indicated that only one junction outside of the Mansfield urban area was likely to be operating near to capacity such that queues and delays were occurring in the peak hours. This junction was at the A60 Church Street / Wood Street in Market Warsop.

4.2.9 The A6075 Peafield Lane/B6035 Forest Road junction, to the east of Market Warsop, and the junction of A60 Mansfield Road / Askew Lane / Vale Avenue are of interest in terms of the volume of traffic using this junction. The flows at these three junctions were measured via turning movement surveys in April 2016.

4.2.10 The location of the three traffic count surveys are shown in Figure 4.9. The traffic flows on those highways adjacent to the surveyed junctions are indicated in Table 4.1.

Table 4.1: Flows Observed on Highways Outside of the Mansfield Urban Area

Road	Two Way Observed Flow (Vehicles per hour)	
	AM	PM
A60 North of B6035	1,300	1,350
A60 South of B6035	1,150	1,250
B6035 Church Street	500	650
Wood Street	100	50
B6035 Forest Road (North of A6075)	450	550
A6075 Peafield Lane (East of B6035)	750	800
B6035 (South of A6075)	400	450
A6075 Peafield Lane (West of B6035)	750	750
A60 North of Vale Avenue	1,250	1,350
A60 South of Vale Avenue	1,200	1,300
Askew Lane	<50	<50
Vale Avenue	200	250

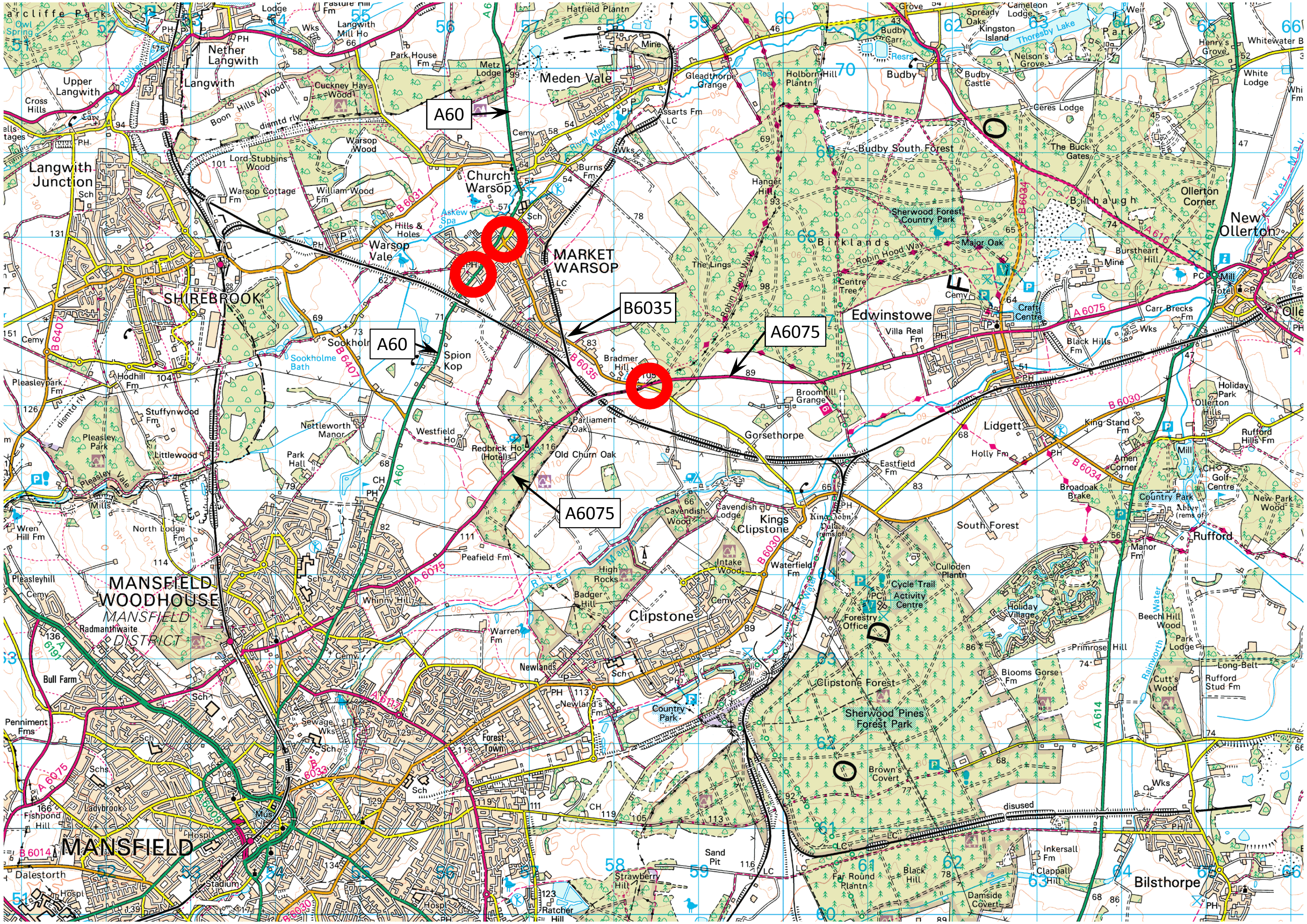

Figure 4.9: Traffic Count Locations in the Market Warsop area

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4.3 Detailed Junction Assessment

4.3.1 Being a network-wide model, the representation of junctions in SATURN is more limited than for junction specific software. As such, the above junctions, identified as operating above 0.75 (or 75%) in the Base Year, were next assessed in more detail using industry standard software for measuring the performance of isolated junctions. Specifically, the following software has been used:

- LINSIG3 – to identify the performance of signalised junctions;
- *Assessment of Roundabout Capacity and Delay* (ARCADY) – to identify the performance of roundabout junctions; and
- *Priority Capacity and Delay* (PICADY) – to identify the performance of priority junctions.

4.3.2 In general terms, the key inputs to the above models are geometrical parameters, signal stages/times and traffic flows. Geometrical parameters (e.g. road width etc.) have been taken from OS mapping. For the signalised junctions, stage sequences and timings have been obtained from Nottinghamshire County Council's traffic signals team. Traffic flows were extracted from the validated 2016 Base Year SATURN model.

4.3.3 As previously noted, the SATURN model does not cover the Market Warsop area. As such, traffic flows at the A60 Church Street / Wood Street junction were obtained from Manual Classified Count (MCC) surveys and assessed using LINSIG3.

4.3.4 Table 4.2 summarises the results of the junction assessments, with full details provided in Appendix B.

Table 4.2: Junction Capacity Assessments – Base Year (2016)

Junction	AM Peak Hour	PM Peak Hour
Chesterfield Road / Debdale Lane	Over Capacity	Over Capacity
A60 Nottingham Road / Berry Hill Lane	Near to or At Capacity	✓
Carter Lane / Southwell Road / Windsor Road	✓	✓
A617 MARR / A6191 Southwell Road	✓	✓
A60 Leeming Lane / Peafield Lane	✓	✓
A60 Leeming Lane / A6075 Warsop Road	Over Capacity	Over Capacity
Kings Mill Road / Beck Lane / B6014 Skegby Lane / Mansfield Road	Over Capacity	Over Capacity
A6191 Ratcliffe Gate / A60 St. Peters Way	Near to or At Capacity	Near to or At Capacity
A6117 Old Mill Lane / B6030 Clipstone Road West;	Near to or At Capacity	Over Capacity
A38 Sutton Road / B6014 Skegby Lane / Sheepbridge Lane	Near to or At Capacity	Over Capacity
✓Indicates that the operational performance of the junction is acceptable; i.e. ratio of flow to capacity (RFC) < 0.85 for a roundabout or Degree of Saturation less than 0.9 for a traffic signal junction.		

4.3.5 Table 4.2 shows that, of the junctions identified by the SATURN model outputs and operation observed on site, the Chesterfield Road / Debdale Lane junction is a key location of both AM and PM peak congestion. The PM peak has higher flows on Chesterfield Road than the AM peak, which may be a reflection of its proximity to Mansfield town centre. Such locations often contain a proportion of shopping and leisure trips that are not present in the morning peak.

4.3.6 The A60 Leeming Lane / A6075 Warsop Road junction is also a key location of both AM and PM congestion. The A60 is a known congested corridor. The junction is recognised by Nottinghamshire County Council as a busy junction and they are currently working on the feasibility of introducing a scheme to improve this junction.

4.3.7 The Kings Mill Road / Beck Lane / B6014 Skegby Lane / Mansfield Road junction is over capacity in the AM and PM peaks. The junction sits on the Mansfield and Ashfield boundary and intersects large North/South movements on the MARR with East/West movements between Sutton/Skegby and Mansfield.

4.4 Car Parking

4.4.1 Table 4.3 identifies the total number of parking spaces within Mansfield. Figure 4.10 shows the location of these carparks.

Table 4.3: Mansfield Car Park Capacity

Carpark Name	Total Spaces
Public Carpark	
Four Seasons Shopping Centre multi storey Car Park	472
Walkden Street Car Park, Mansfield	307
Old Town Hall Car Park	19
Civic Centre	92
Water Meadows Leisure Centre Car Park	188
Clumber Street	118
Toothill Lane	97
Stockwell Gate North	118
Robin Hood Line Station Car Park	102
Service Area D Car Park	16
Grove Street	82
Church Lane	65
Handley Arcade	23
Victoria Street	43
Garden Road Car Park	15
Newgate Lane	12
Newgate Lane (opposite Mansfield Academy Primary School)	34
Mansfield Woodhouse railway station	110
Prince Charles Car Park	35
Kingsway Hall Car Park	31
Sub total	**1,979**
Private Carpark	
Portland Retail Park	600
Rosemary Centre	117
St Peters Retail Park	338
Swan Public House	58
Tesco	581
Belvedere	120
Portland Hotel Car Park	20
Nottingham Road	238
Sub Total	**2,072**
Total	**4,051**

4.4.2 In terms of usage, ticketing data provided by Mansfield District Council has identified an increase in sales of 10.9% between 2012/13 and 2016/17.

4.4.3 It is noted that there have been several periods of free car parking around Christmas and New Year over the last few years to assist retailers. This would appear consistent within the findings of the Portas Review (2011) which supported the view that car parking was a key element of a vital town centre.

4.4.4 Table 4.4 identifies the overall ranking of the car parks in terms of their intensity of use (i.e. Annual number of tickets divided by spaces) for 2016/17. This indicates the number of times that each space is used throughout the year. The smaller car parks near to the town centre tend to rank the highest, although pricing will also have an influence.

Table 4.4: Mansfield Public Parking Intensity

Car Park	Spaces	Intensity of use	
Old Town Hall	19	3,787	Most Intensely Used
Service Area D	16	2,987	
Clumber Street	118	1,906	
Handley Arcade	23	1,880	
Stockwell Gate	118	1,567	
Garden Road	15	934	
Toothill Road	114	691	
Civic Centre	92	679	
Four Season	472	620	
Water Meadows	188	551	
Toothill Lane	97	516	
Walkden Street	307	350	
Church Lane	65	332	
Grove Street	82	180	Least Intensely Used
Robin Hood Line	102	56	
Victoria Street	43	52	

4.4.5 In terms of future potential changes, the Mansfield District Council Regeneration team is currently promoting a site known as “Belvedere Street Strategic Development Site”. The information supporting this scheme notes that the project aims to provide a temporary 250 space car park to meet a shortfall in parking spaces within the town centre. The options include a surface car park, or more attractive option which would include a new commercial development fronting Portland Street and a new multi storey car park to the rear of this site.

4.4.6 The 2006 Mansfield Parking Study also identified a development which would require the removal of the Walkden Street car park (though any future development is likely to require the provision of replacement parking).

Figure 4.10 Location of car parks

4.5 Road Safety

4.5.1 According to the Nottinghamshire LTP3, between 2005 and 2009, the number of car driver and passengers killed and serious injury (KSI) casualties decreased in each of the districts except Mansfield, where the number of casualties increased in each of the last two years. The number of car driver and passenger KSI casualties in Mansfield (21 in 2009), however, remained low when compared to other districts.

4.5.2 For this study, road safety collision statistics have been obtained from Nottinghamshire County Council. The data obtained relates to those collisions that resulted in a personal injury and which were reported to the police. This data (known as STATS19 statistics) are generally recognised to be the most complete record of road collisions occurring on the local highway network. For the avoidance of doubt, and as is normal practice, they do not include statistics from collisions resulting in "damage-only" to vehicles.

4.5.3 Each collision resulting in a personal injury is classed as either 'Slight', 'Serious' or 'Fatal' by the police depending on the most serious injury resulting from the collision (i.e. a collision resulting in two 'Slight' injuries and one 'Serious' injury would be classed as a 'Serious' collision).

4.5.4 Tables 4.5 to 4.7 summarise the collisions and casualties which have occurred from 1st January 2013 to 31st December 2015 in the Mansfield area, and also in Nottinghamshire and across the UK for comparison. This is the latest full three years of collision statistics available.

Table 4.5: Road Collisions and Casualty Data for Mansfield District Area (Source: Nottinghamshire County Council)

Year	Collisions				Casualties			
	Fatal	Serious	Slight	Total	Fatal	Serious	Slight	Total
2013	2	36	183	221	4	42	256	302
2014	3	28	240	271	3	30	313	346
2015	2	36	215	253	2	43	279	324

Table 4.6: Road Collisions and Casualty Data for Nottinghamshire County (Source: Nottinghamshire County Council)

Year	Collisions				Casualties			
	Fatal	Serious	Slight	Total	Fatal	Serious	Slight	Total
2013	24	284	1,467	1,775	28	317	2,116	2,461
2014	26	277	1,601	1,904	30	313	2,191	2,534
2015	22	266	1,507	1,795	23	297	2,050	2,370

Table 4.7: Road Collisions and Casualty Data for United Kingdom (Source: Department for Transport, RAS 10001 & 30001)

Year	Collisions				Casualties			
	Fatal	Serious	Slight	Total	Fatal	Serious	Slight	Total
2013	1,608	19,624	117,428	138,660	1,713	21,657	160,300	183,670
2014	1,658	20,676	123,988	146,322	1,775	22,807	169,895	194,477
2015	1,616	20,038	118,402	140,056	1,732	22,137	162,340	186,209

4.5.5 The above tables show that overall the number of collisions (and associated casualties) appear to be stable within Mansfield, Nottinghamshire and across the UK. Across all three geographical areas there was a reduction in collisions and casualties between 2014 and 2015, although 2015 levels were higher than those recorded in 2013.

4.5.6 In terms of specific road safety interventions planned by the local highway authority, it is understood that schemes are to be progressed at the following locations:

- Debdale Lane / Sherwood Street / Priory Square – signal modifications;
- Butt Lane / Church Lane – signing & lining;
- Rosemary Street – speed management;
- St Peters Way / Albert Road – signal modifications;
- St Peters Way / Ratcliffe Gate – signing;
- Wood Street – kerbline amendments and lining;
- A60 Nottingham Road / A617 MARR – signal modifications;
- Southwell Road West / Big Barn Lane – signing, and;
- A6075 Welbeck Road / Morrisons entrance – signing & lining.

4.5.7 The above locations are shown in Figure 4.11.

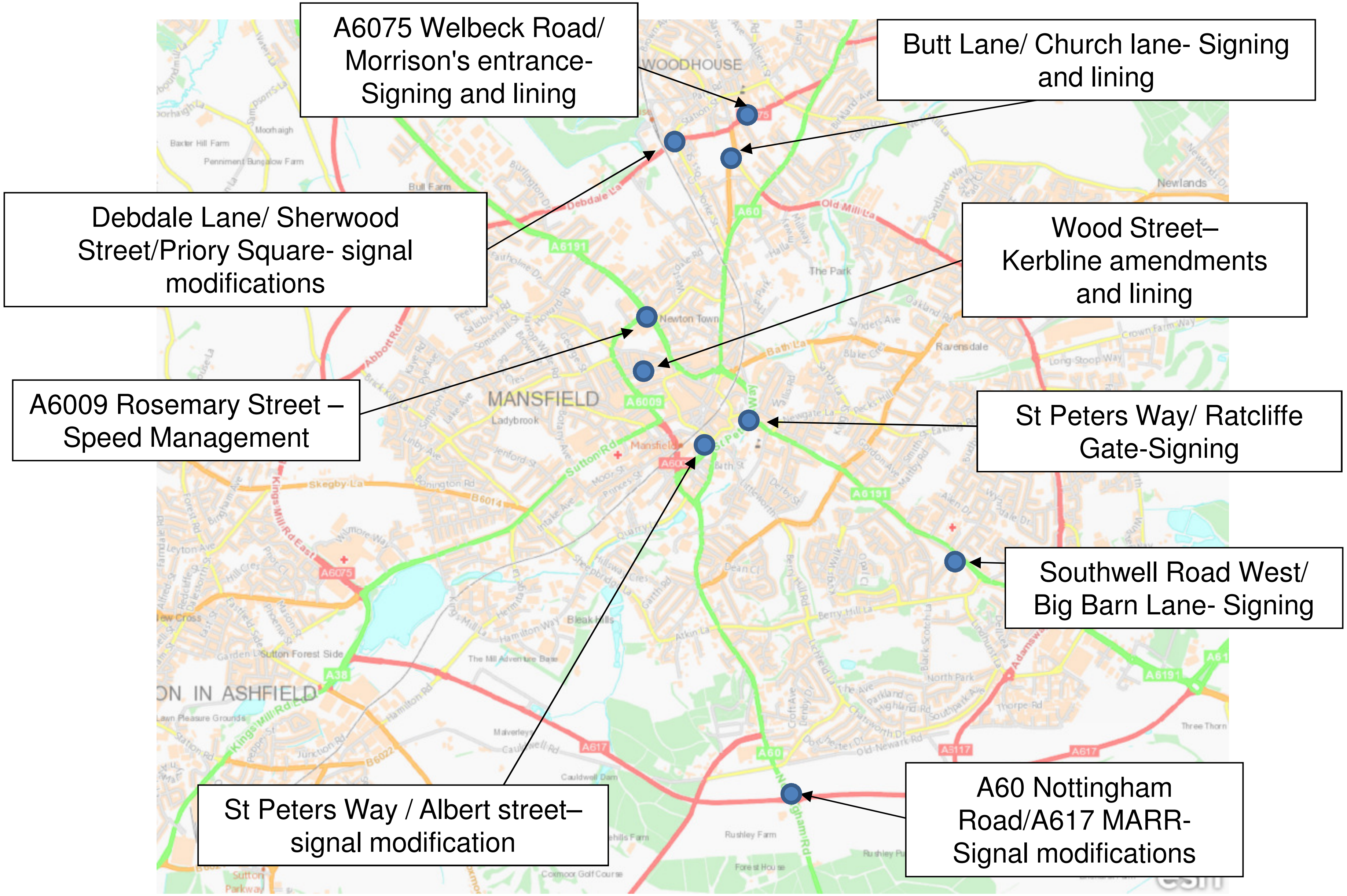


Figure 4.11: Programmed Nottinghamshire County Council Road Safety Schemes

5. Reference Case Conditions – Highway Network

5.1 Overview

5.1.1 Having examined the Base Year conditions, Step 2 of the study examines the likely future conditions within Mansfield and Market Warsop, given the most likely projections of growth and committed developments (both transport infrastructure and land-use developments) that are likely to be implemented to 2033. This is a ‘Reference Case’ against which potential additional development sites within the development plan can be judged.

5.1.2 This section of the report will document the committed developments used to create a 2033 Reference Case forecast and, using the SATURN model, identifies any junctions that are likely to be approaching or exceeding capacity in 2033.

5.2 Committed Developments to 2033

5.2.1 The 2016 updated traffic model described above in Section 4 and in Appendix A was used as a basis to calculate likely 2033 forecast conditions. This required information about both known interventions to the highway network and known development sites (as of January 2017), which generate trips to be added to the demand traffic flows.

5.2.2 Developments considered to be ‘committed’ by Mansfield District Council were included in the forecasts. For the purposes of the Study, committed developments are defined as either housing or commercial developments with planning consent, or with planning consent likely to be issued imminently, but not yet fully developed. Details of these sites are included in Appendix C.

5.2.3 Four additional developments located in Ashfield district were included in the Reference Case forecasts due to their scale and proximity to Mansfield. These developments were located at:

- Beck Lane, Skegby;
- Land north of Kings Mill Hospital;
- Land south of West Nottinghamshire College; and
- Summit Park (Previously Prologis Park)

5.2.4 Committed Developments to 2033 were identified by type and size. Residential and commercial developments are shown below on a map base in Figure 5.1 for Mansfield and Figure 5.2 for Market Warsop.

5.2.5 Major development sites incorporated in the Reference Case forecasts include:

- Sandlands Way (Housing);
- Clipstone Road East (Housing);
- Penniment Farm (Mixed Use); and
- Lindhurst (Mixed Use).

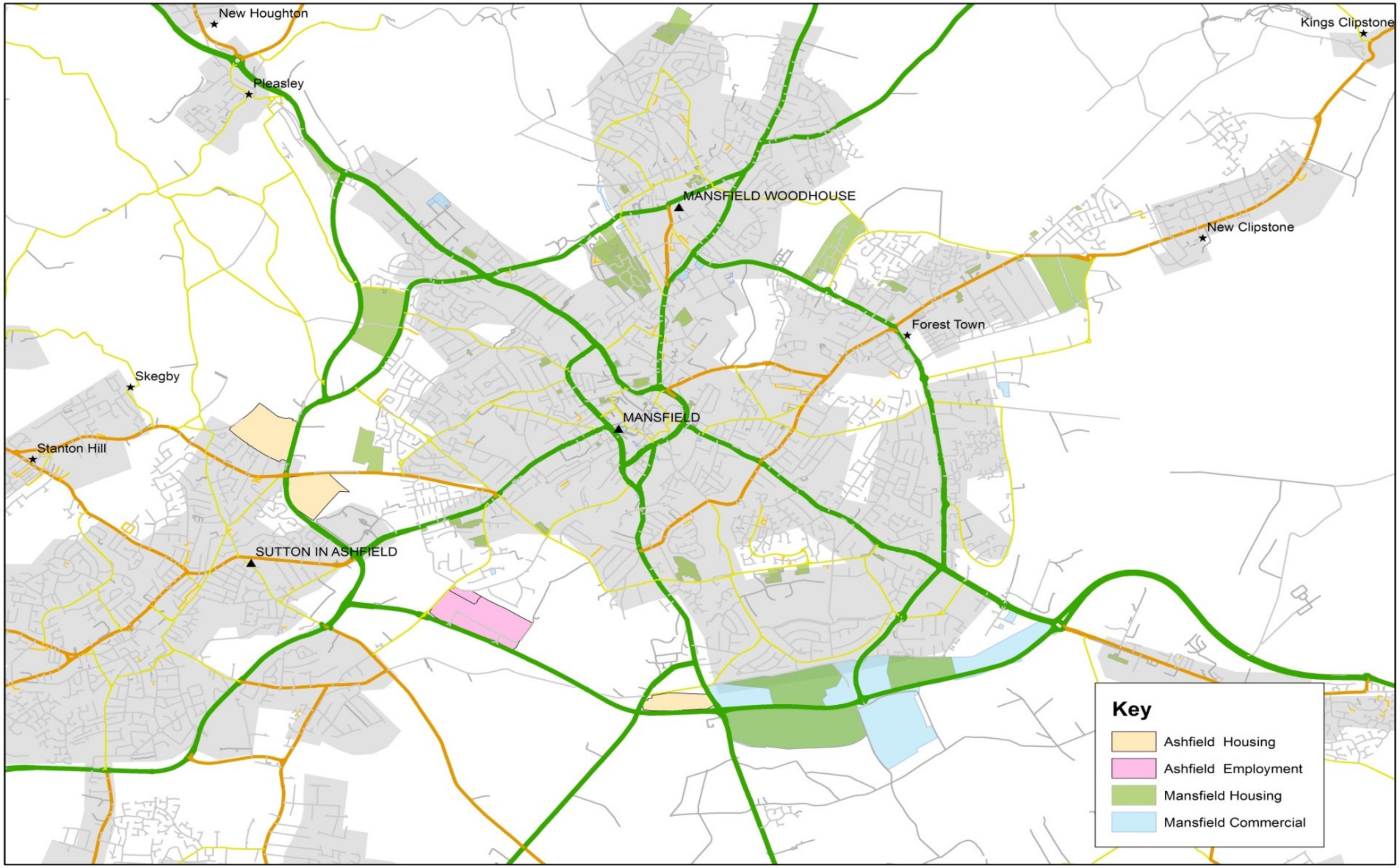


Figure 5.1: Committed Residential and Commercial Developments: Mansfield

AECOM

Figure 5.2: Committed Residential and Commercial Developments: Market Warsop

AECOM

5.2.6 The development of the 2033 Reference Case SATURN model is detailed in Appendix D. However, Table 5.1 below details the hourly trip total represented in the Base Year (2016) SATURN model. Also shown are the 2033 trip totals calculated using the DfT's National Trip End Model (NTEM) growth forecast and the trip totals for the Reference Case (based on committed developments in Mansfield District).

Table 5.1: Matrix Totals

Trip demand scenario	Total Trips	
	AM	PM
Base 2016	29,565	31,678
NTEM 2033	33,376	35,571
Reference Case 2033	39,452	40,890

5.2.7 This shows that the 2033 Reference Case forecasts represent an increase compared to the 2016 Baseline traffic conditions of 9,857 trips per hour in the AM peak and 9,212 trips per hour in the PM peak.

5.2.8 It is noted that the growth in trip demand in the Reference Case exceed that forecast from NTEM. This shows that the overall level of growth contained in Mansfield District Council's list of committed development and Local Plan is greater than the forecasts derived from national planning projections of jobs, employment, population and household numbers.

5.3 Transport Infrastructure

5.3.1 No future year highway schemes were identified which would impact upon the existing network capacity. Some of the committed development sites had associated highway infrastructure associated with them. These included:

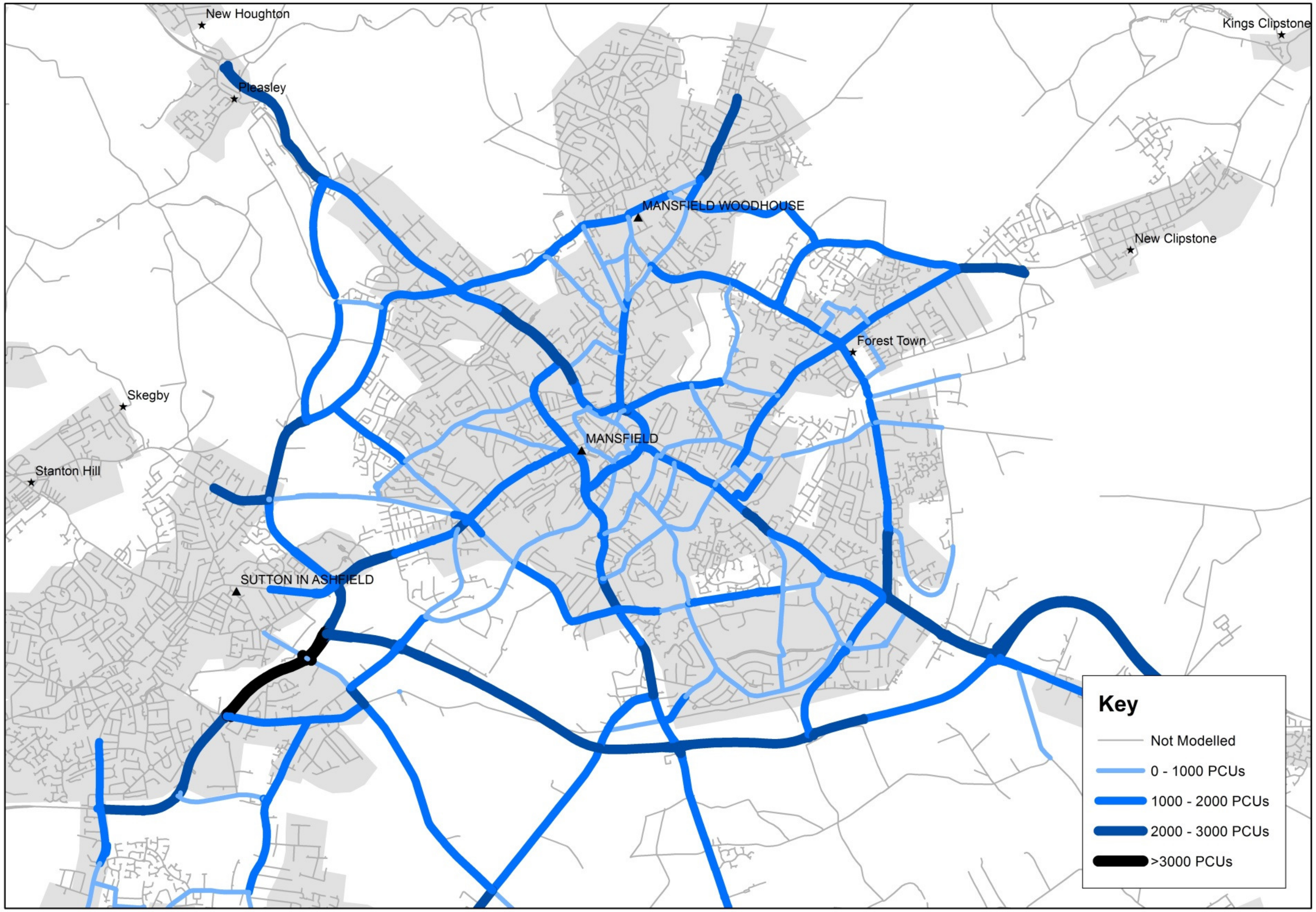
- Lindhurst (internal link roads and access points);
- Penniment Farm (access points); and
- Prologis Park (access points).

5.3.2 These highway improvements have been included within the 2033 Reference Case highway networks.

5.4 Operating Conditions

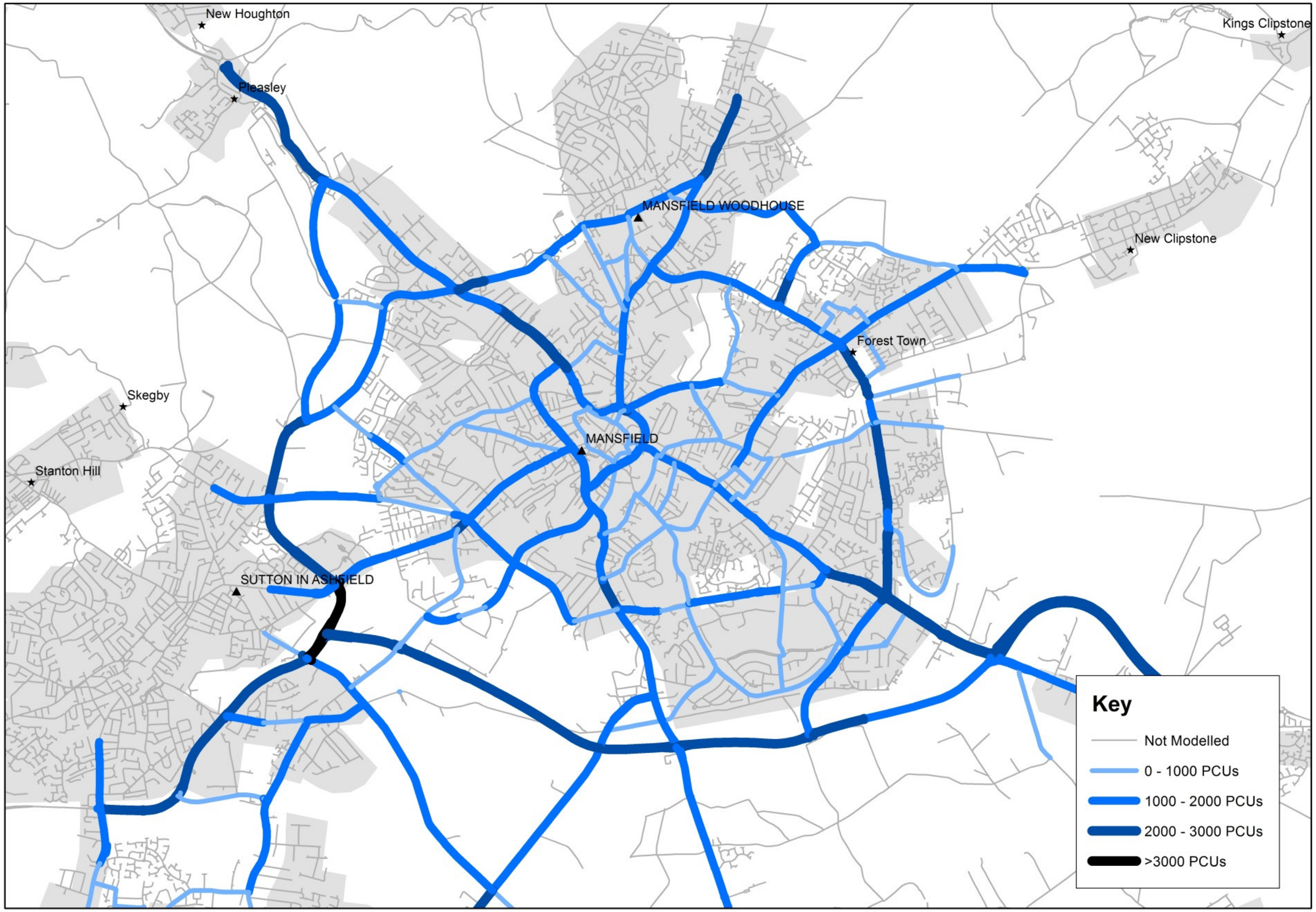
5.4.1 As for the Baseline (2016) analysis, the following indicators for the Reference Case (2033) highway network have been extracted from the SATURN model:

- Total vehicular flow (Figure 5.3 & 5.4);
- Delay (Figure 5.5 & 5.6); and
- Volume / Capacity Ratios (Figure 5.7 & 5.8).



PCUs = Passenger Car Units. 1 Car = 1 PCU / 1 Bus = 2 PCUs etc.

Figure 5.3:Reference Case (2033) AM Peak Hour Traffic Flows



PCUs = Passenger Car Units. 1 Car = 1 PCU / 1 Bus = 2 PCUs etc.

Figure 5.4:Reference Case (2033) PM Peak Hour Traffic Flows

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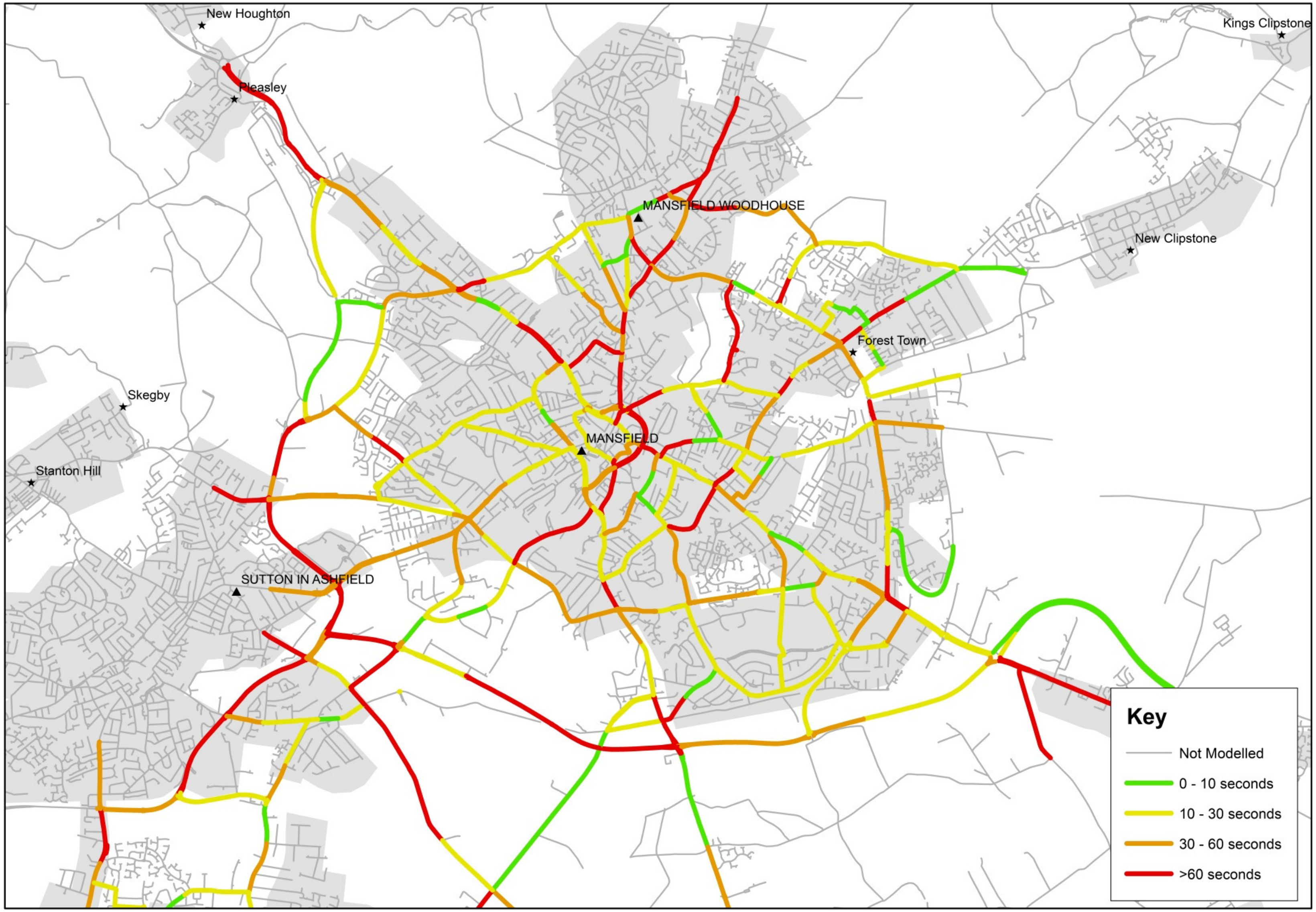

Figure 5.5:Reference Case (2033) AM Peak Hour Delays

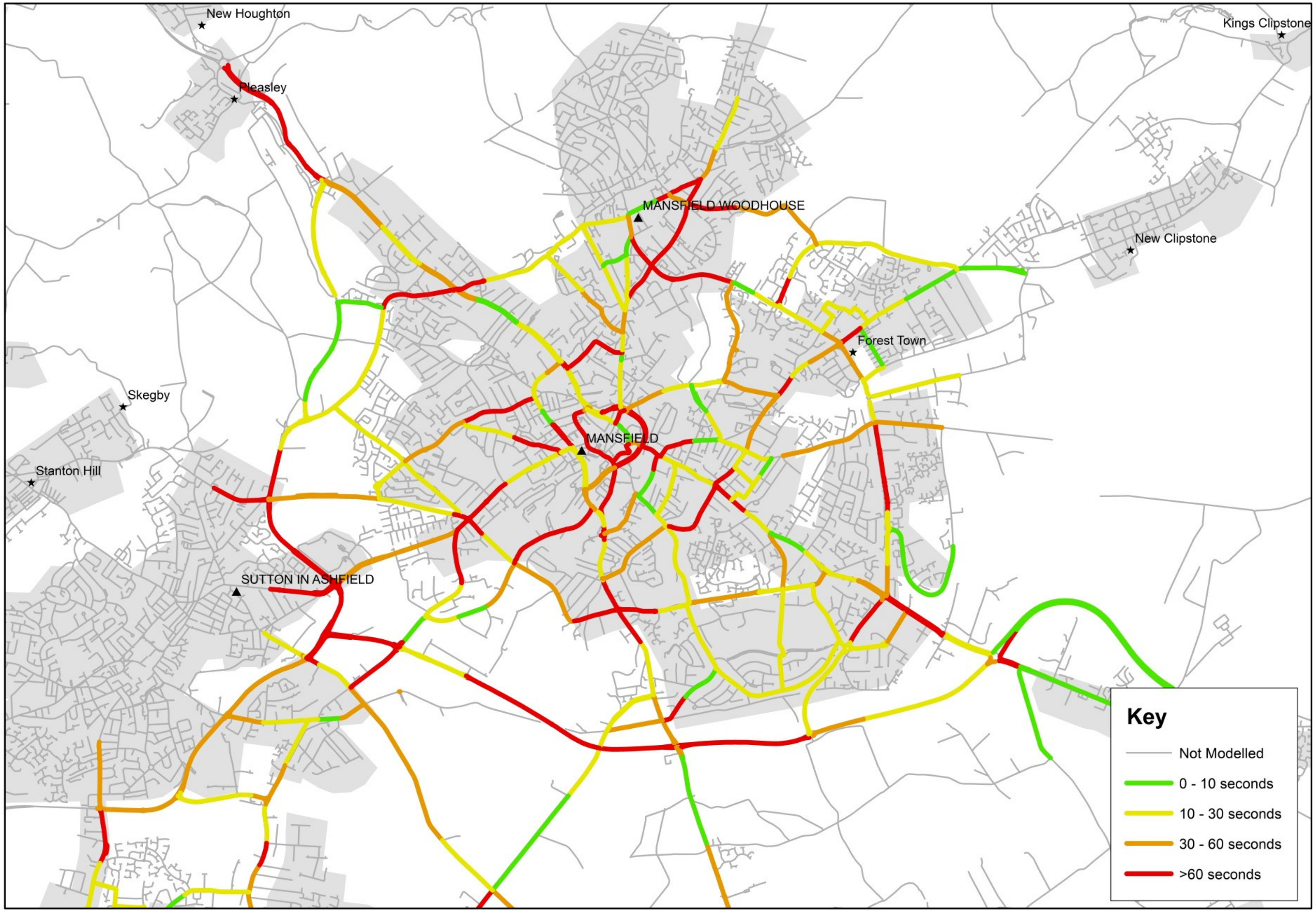

Figure 5.6:Reference Case (2033) PM Peak Hour Delays

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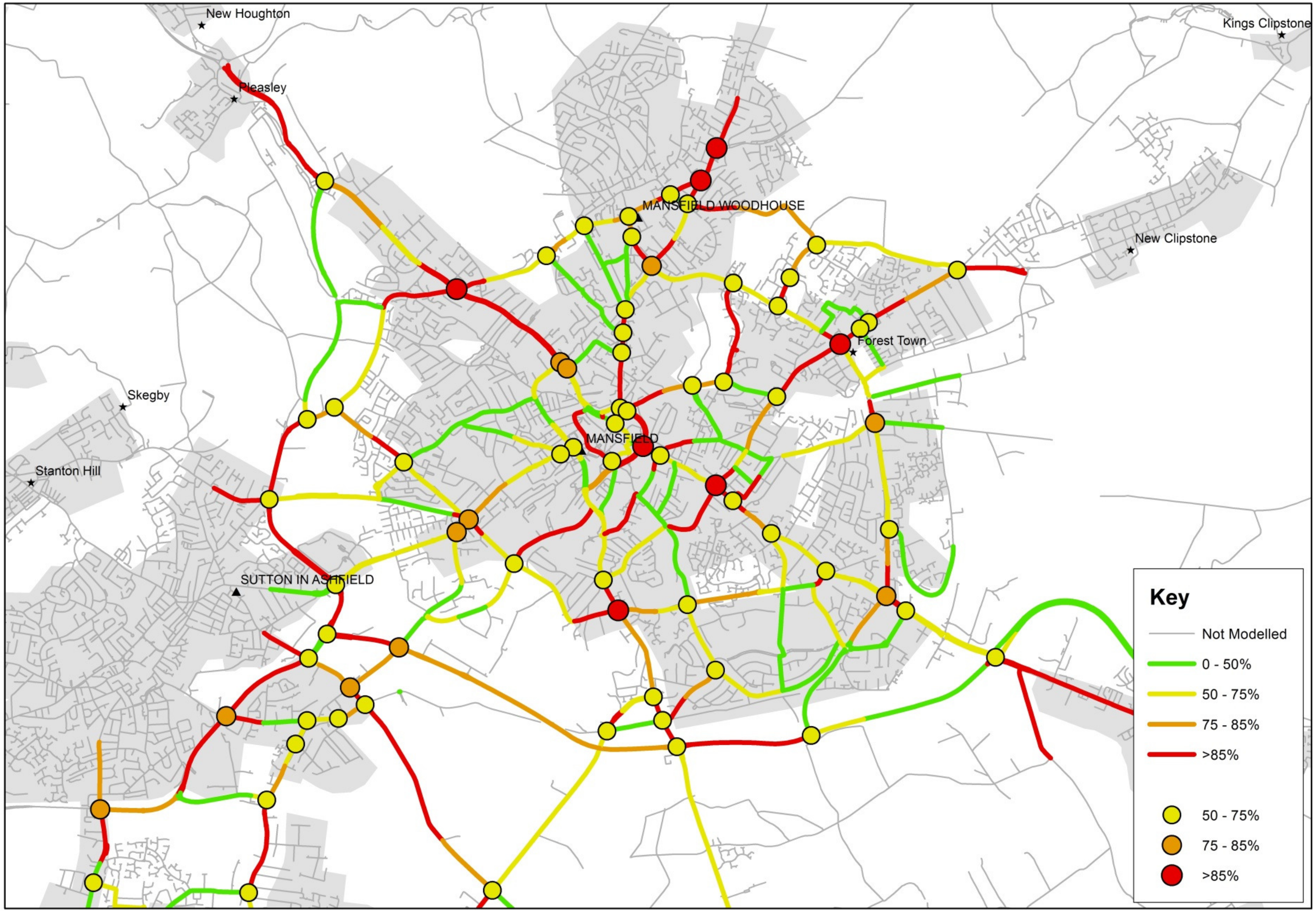


Figure 5.7:Reference Case (2033) AM Peak Hour Volume / Capacity Ratio

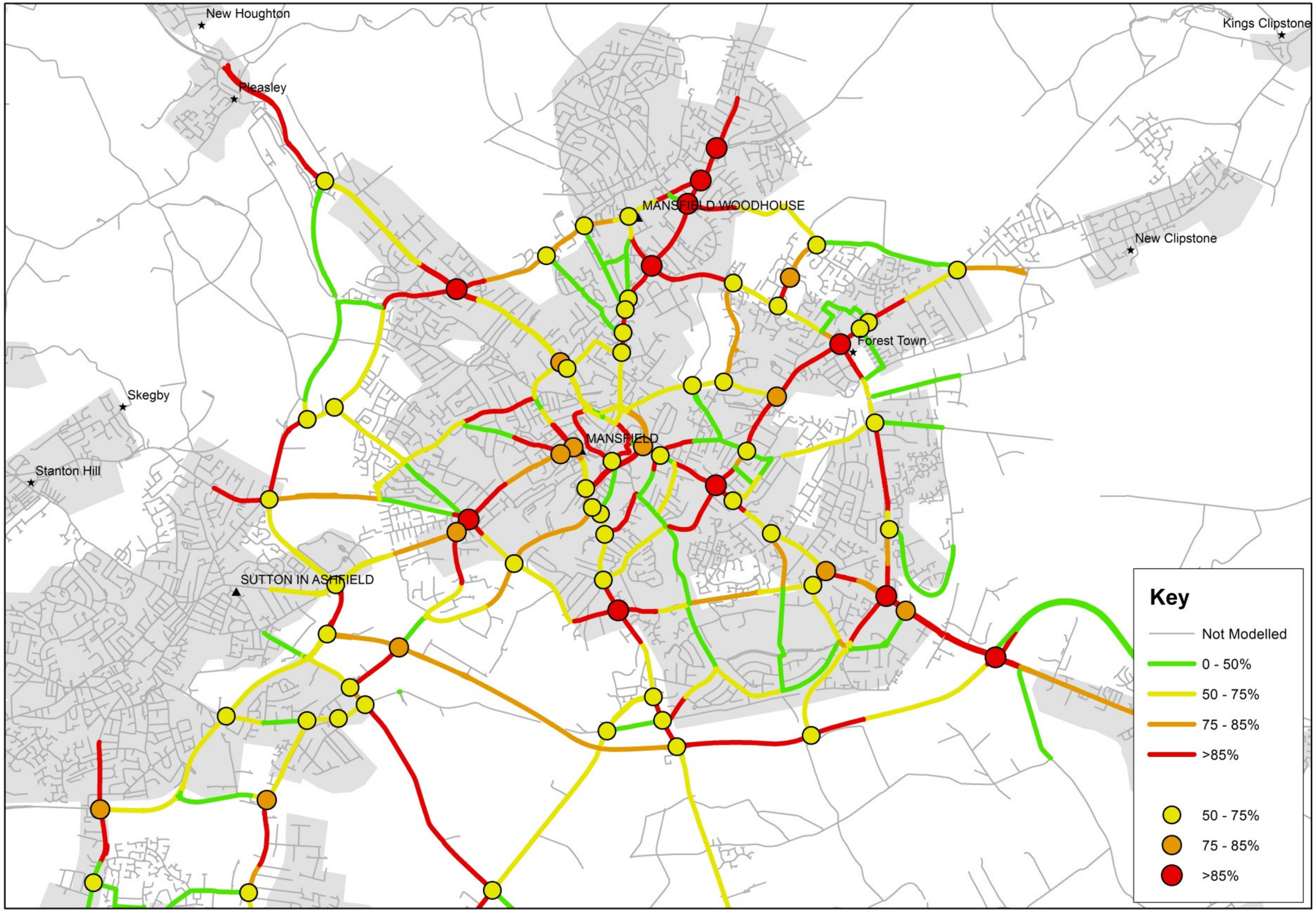


Figure 5.8:Reference Case (2033) PM Peak Hour Volume / Capacity Ratio

AECOM

5.4.2 The SATURN traffic model has been used to identify those junctions that are likely to be operating at, or over capacity in the forecast year of 2033. Given that traffic growth is expected from the Baseline year of 2016 to the forecast 2033 Reference Case, it is expected that junctions across the highway network will be more heavily loaded in future years. The traffic model was interrogated to determine those junctions with a traffic V/C ratio of more than 0.85 (85%) in the 2033 traffic model. Detailed junction modelling has been undertaken on the junctions identified from the base year analysis (in Section 4.3 of this report) plus any additional junctions that were identified from the forecast year 2033 analysis.

5.4.3 This process highlighted the following thirteen junctions within the Mansfield urban area:

- Chesterfield Road / Debdale Lane;
- A60 Nottingham Road / Berry Hill Lane;
- Carter Lane / Southwell Road / Windsor Road;
- A617 MARR / A6191 Southwell Road;
- A60 Leeming Lane / Peafield Lane;
- A60 Leeming Lane / A6075 Warsop Road;
- Kings Mill Road / Beck Lane / B6014 Skegby Lane / Mansfield Road;
- A6191 Ratcliffe Gate / A60 St. Peters Way;
- A6117 Old Mill Lane / B6030 Clipstone Road West;
- A38 Sutton Road / B6014 Skegby Lane / Sheepbridge Lane;
- A60 / Old Mill Lane / Butt Lane;
- A6191 Adams Way / Oak Tree Lane; and
- A60 / New Mill Lane.

5.4.4 Of the twelve junctions identified above, the last three were not highlighted from the SATURN model outputs as approaching or at capacity in the Baseline analysis (2016). The other nine junction models updated with the Reference Case junction turning movements to assess operational performance in 2033. Additionally the junction at Kings Mill Road / Beck Lane / B6014 Skegby Lane / Mansfield Road was highlighted in the 2016 Baseline, but not in the 2033 Reference Case as having a V/C greater than 0.85. Given that detailed modelling found that this junction was operating over capacity in the Baseline analysis, the junction was analysed with 2033 Reference Case flows assigned.

5.4.5 The 2016 baseline assessments identified one junction in Market Warsop that was approaching capacity, which was the A60 Church Street / Wood Street traffic signalled junction. This junction was included within the Reference Case detailed junction analysis. Traffic Growth in Market Warsop has been taken from the DfT's NTEM assumptions for rural Nottinghamshire.

5.4.6 The detailed junction assessment results for all twelve of these junctions are summarised in Table 5.2. Appendix E provides further detail with regard to these junction assessments.

5.4.7 The detailed junction modelling results, presented in Table 5.2, confirm that most of the identified junctions are predicted to operate near to capacity or at capacity (Degree of saturation >85%) or overcapacity in 2033. The only exception is A60 / Old Mill Lane / Butt Lane which is predicted operate within capacity.

Table 5.2: Junction Capacity Assessments – Base and Reference Case

Junction	Base Year (2016)		Reference Case (2033)	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Chesterfield Road / Debdale Lane	Over Capacity	Over Capacity	Over Capacity	Over Capacity
A60 Nottingham Road / Berry Hill Lane	Near to or At Capacity	✓	Over Capacity	Over Capacity
Carter Lane / Southwell Road / Windsor Road	✓	✓	✓	Near to or At Capacity
A617 MARR / A6191 Southwell Road	✓	✓	✓	Near to or At Capacity
A60 Leeming Lane / Peafield Lane	✓	✓	Over Capacity	Near to or At Capacity
A60 Leeming Lane / A6075 Warsop Road	Over Capacity	Over Capacity	Over Capacity	Over Capacity
Kings Mill Road / Beck Lane / B6014 Skegby Lane / Mansfield Road	Over Capacity	Over Capacity	Over Capacity	Over Capacity
A6191 Ratcliffe Gate / A60 St. Peters Way	Near to or At Capacity	Near to or At Capacity	Over Capacity	Over Capacity
A6117 Old Mill Lane / B6030 Clipstone Road West	Near to or At Capacity	Over Capacity	Over Capacity	Over Capacity
A38 Sutton Road / B6014 Skegby Lane / Sheepbridge Lane	Near to or At Capacity	Over Capacity	Over Capacity	Over Capacity
A60 / Old Mill Lane / Butt Lane	Not Assessed	Not Assessed	✓	✓
A6191 Adams Way / Oak Tree Lane	Not Assessed	Not Assessed	Over Capacity	Over Capacity
A60 / New Mill Lane	Not Assessed	Not Assessed	Over Capacity	Over Capacity
✓Indicates that the operational performance of the junction would be acceptable; i.e. RFC less than 0.85 for a roundabout or Degree of Saturation less than 0.9 for a traffic signal junction.				

5.4.8 It is noted that the A60 / Baums Lane / Mansfield Leisure Park junction has vehicle queues in the peak shopping hours; e.g. on Saturday morning. These busier periods are outside the average weekday AM and PM peak hours used in this assessment. The locations of future developments will be reviewed at stage 2 to determine whether they are likely to impact on this junction within the modelled time periods. It is unlikely that trips from Reference Case developments would route through this junction.

5.5 Other Junctions Outside Of Mansfield District

5.5.1 An assessment of the Reference Case (2033) traffic entering the Strategic Road Network (SRN) was required as part of the Mansfield Transport Study. There are no Strategic (Trunk) Roads within Mansfield District and the nearest one is the M1 motorway to the west. As the M1 is not included in the Mansfield traffic model, the percentage increase in flows on the A38 approaching Junction 28 and the A617 approaching Junction 29 is presented in Table 5.3 below. The A611 leaves the traffic modelled area on the south side of Mansfield and the A608 branches-off this route to access the M1 at Junction 27.

Table 5.3: Changes in Traffic on Roads Approaching the M1 between the Baseline and Reference Case

		Base AM (PCU's)	Base PM (PCU's)	Ref Case AM (PCU's)	Ref Case PM (PCU's)	Absolute Change (PCU's)		Change in traffic flows (%)	
						AM	PM	AM	PM
A38	Eastbound	896	665	1,199	867	+303	+202	34%	30%
	Westbound	920	699	1,109	872	+189	+173	21%	25%
A617	Eastbound	410	521	730	594	+320	+73	78%	14%
	Westbound	471	483	511	624	+40	+141	8%	29%
A611	Northbound	1,047	1,091	1,486	1,336	+439	+245	42%	22%
	Southbound	694	978	873	1,414	+179	+436	26%	45%

5.5.2 Any restrictions to the flows on these routes, due to capacity limitations of junctions along these routes, would limit the volume of traffic reaching the M1 motorway. It should also be noted that the Reference Case includes future developments in Ashfield and therefore, not all the increases on the routes approaching the M1 are a direct result of development within the district of Mansfield.

5.5.3 Further to the above, there are other junctions identified by the SATURN modelling which may experience capacity issues in the 2033 Reference Case (but which are located outside of the Study Area). These junctions fall within the A38, A611 and the A617 corridors. As noted, on paragraph 5.5.2, given the inclusion of Ashfield developments in the Reference Case, not all the increases at the junctions identified are a direct result of developments within the district of Mansfield. Table 5.4 provides a qualitative assessment of these junctions:

Table 5.4: Changes in Traffic outside of Mansfield District

Junction	Qualitative Assessment
A617 MARR / Hamilton Road	The traffic model indicates that the V/C indicator would increase from 75% in 2016 to 84% in 2033 in the AM Peak and 66% to 81% in the PM Peak. This indicates that potential need for improvement is marginal.
Hamilton Road / Coxmoor Road	The traffic model indicates that the V/C indicator would increase from 59% in 2016 to 82% in 2033 in the AM Peak and 54% to 67% in the PM Peak. This indicates the potential need for improvement.
A38 / Station Road	The traffic model indicates that the V/C indicator would increase from 72% in 2016 to 84% in 2033 in the AM Peak and 53% to 67% in the PM Peak. This indicates that potential need for improvement is marginal.
A38 / Sutton Road	The traffic model indicates that the V/C indicator would increase from 71% in 2016 to 82% in 2033 in the AM Peak and

	62% to 75% in the PM Peak. This indicates that potential need for improvement is marginal.
Low Moor Road / Penny Emma Way	The traffic model indicates that the V/C indicator would increase from 53% in 2016 to 72% in 2033 in the AM Peak and 69% to 76% in the PM Peak. This indicates that potential need for improvement is marginal.
Diamond Avenue / Derby Road	The traffic model indicates that the V/C indicator would increase from 62% in 2016 to 84% in 2033 in the AM Peak and 61% to 84% in the PM Peak. This indicates the potential need for improvement.

5.6 Impact on Public Transport Services

5.6.1 The changes in journey time may impact on public transport services. Table 5.5, below summarises the modelled journey times (excluding delays associated with buses stopping) extracted from the SATURN model for vehicles travelling along on key routes (as identified in Figure 5.9) in the Baseline (2016) and Reference Case (2033).

Table 5.5: Changes in Journey Time (seconds) on Key Routes (shown on Figure 5.9)

Bus Route		AM Peak Journey Time				PM Peak Journey Time			
		2016 (Sec)	2033 (Sec)	Time Increase (Sec)	% change	2016 (Sec)	2033 (Sec)	Time Increase (Sec)	% change
Route 1	Inbound	579	845	266	45.9	382	551	169	44.2
	Outbound	353	419	66	18.7	533	736	203	38.1
Route 2	Inbound	542	798	256	47.2	411	464	53	12.9
	Outbound	361	363	2	0.6	414	530	116	28.0
Route 3	Inbound	443	469	26	5.9	446	519	73	16.4
	Outbound	335	411	76	22.7	336	356	20	6.0
Route 4	Inbound	261	271	10	3.8	275	325	50	18.2
	Outbound	259	295	36	13.9	277	305	28	10.1
Route 5	Inbound	404	461	57	14.1	421	421	0	0.0
	Outbound	415	432	17	4.1	435	499	64	14.7
Route 6	Inbound	365	508	143	39.2	391	469	78	19.9
	Outbound	356	462	106	29.8	399	475	76	19.0
Journey times are in seconds (s)									

5.6.2 Journey time graphs for the above routes are provided in Appendix E.

5.6.3 To accommodate longer travel times, bus operators would either have to adjust their timetables or add extra buses to the service to in order to compensate for the extra time that buses spend in travelling.

5.6.4 The travelling journey time for bus services, excluding waiting time at stops, would increase by between 3 minutes and 6 minutes for buses on a round trip along the radial Routes 1 (the A60 corridor) and 2 (serving Forest Town). On radial routes 3, 4 and 5 the increase in round-trip journey times would be no greater than 2 minutes. On radial route 6 the increase in round trip journey times would be between 2 minutes 30 seconds and 4 minutes (see charts at Appendix E).

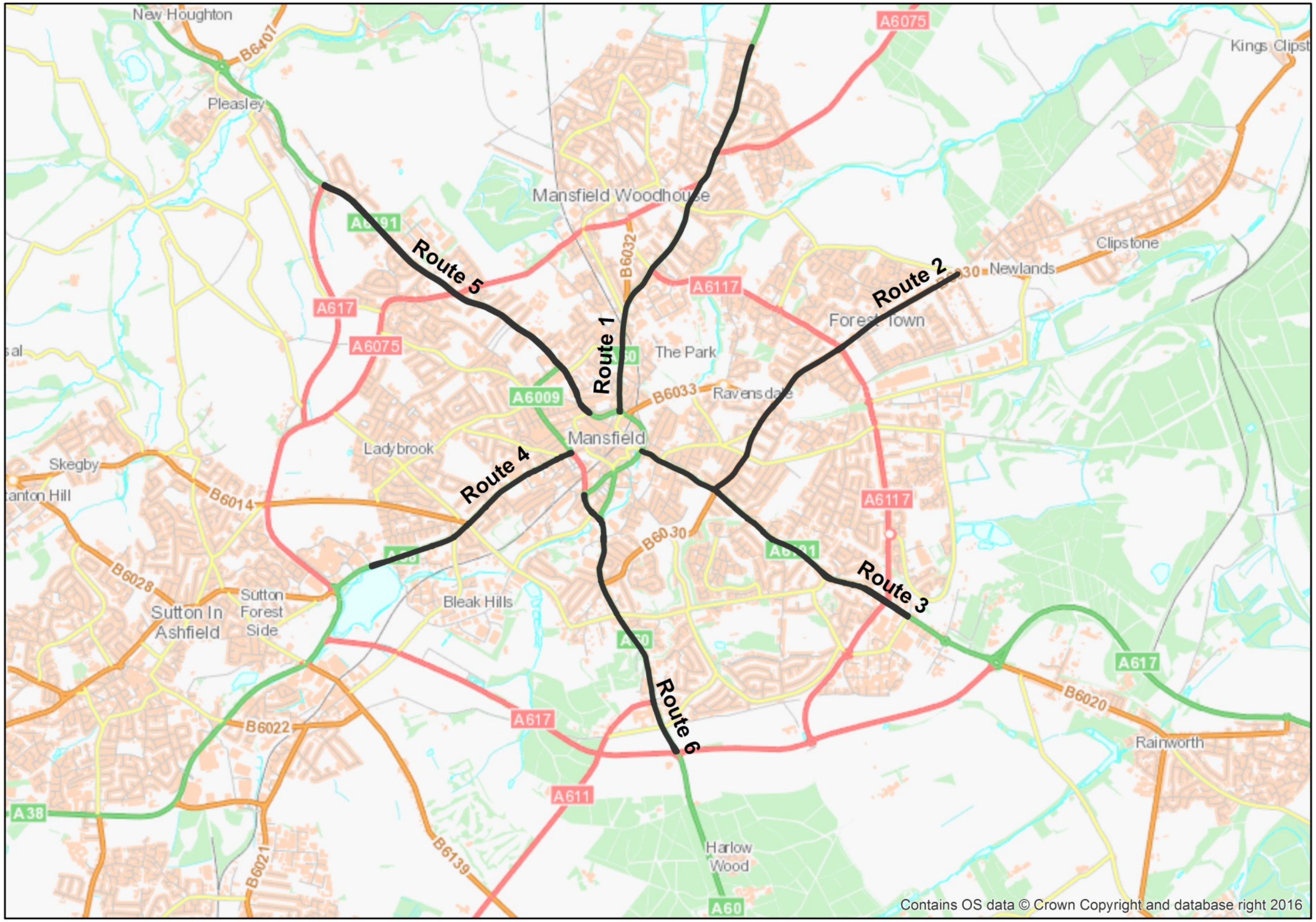


Figure 5.9: Public Transport Journey Times (relating to Table 5.5)

6. Securing Sustainable Transport

6.1 Overview

6.1.1 As a precursor to the Stage 2 Report, this section sets out an approach to securing sustainable transport in relation to development plans.

6.1.2 In the last ten years, there has been a much greater focus on securing transport sustainability. This has now been fully articulated in both the DfT's Guidance on Transport Assessment and the Delivering a Sustainable Transport System strategy.

6.1.3 The most widely quoted definition of sustainability and sustainable development was developed by the Brundtland Commission of the United Nations which stated that;

"sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

6.1.4 In transport terms, sustainability is often taken as being the ability to access development without the use of a private car - with a particular focus on reducing single-occupancy car trips[4]. As such, it is focused on providing opportunities to make cycling, walking and public transport the modes of choice. In order for this to be successful, these modes must be made more convenient than the private car for the majority of trips.

6.1.5 The more trips that can be accommodated by sustainable means, the less private car traffic a development would generate. This section identifies how sustainable transport choices could be secured and locked-in to the developments via the planning process (i.e. how sites could enhance their sustainable transport-mode shares).

6.1.6 This approach is consistent with the Guidance on Transport Assessment, which seeks to maximise transport sustainability prior to the identification of measures to accommodate residual trips.

6.2 Development Location and Mix

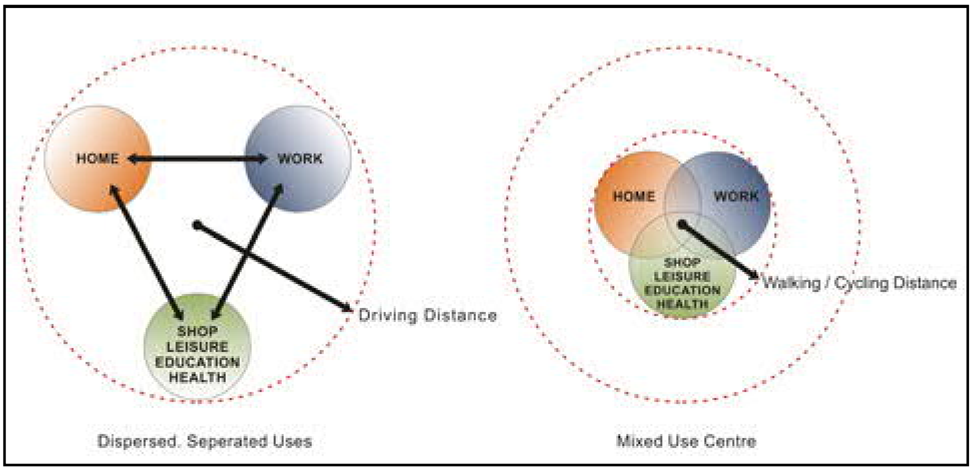
6.2.1 It is recognised that the requirement to interchange during a particular trip is an important dissuasive factor when selecting overall mode choice. Following from this, it is important to note that the most "door-to-door" trips over medium to long distances are provided only by the private car.

6.2.2 Walking and cycling modes are "door-to-door" over short distances (normally taken to be up to 2km and 5km respectively) and public transport has traditionally been effective at moving people within defined corridors of movement.

6.2.3 As such, ensuring that different land-uses (including key services and facilities) are contained within a geographic area (either the development itself or the proximate neighbourhood) is often taken as being a key enabler of sustainable-mode trips such that real mode choice is available to those wishing to travel. This is illustrated within Figure 6.1, below.

[4] Transport Sustainability is often mistaken for "anti-car" policies; though Travel Planning often encourages car sharing schemes that seek to minimise single-occupancy trips by replacing these with multi-occupant car journeys.

Figure 6.1: Mixed Use Development (taken from www.plan4sustainabletravel.org)



6.2.4 From the above figure, it can be seen that having several land uses within a defined area is to allow multiple activities to occur from one trip, to shorten trip lengths and to encourage non-motorised trips by making common destinations available within walking / cycling distance.

6.2.5 Table 6.1 indicates how various land-use design features are estimated to reduce per capita vehicle trip generation compared with conventional development that lacks these features.

Table 6.1: Travel Impacts of Land Use Design Features (Source: Victoria Transport Policy Institute, 2001, from DISTILLATE - Design and Implementation Support Tools for Integrated Local Land use, Transport and the Environment, April 2006)

Design Feature	Reduced Vehicle Travel
Residential development around public transport nodes	10%
Commercial development around public transport nodes	15%
Residential development along public transport corridor	5%
Commercial development along public transport corridor	7%
Residential mixed-use development around public transport nodes	15%
Commercial mixed-use development around public transport nodes	20%
Residential mixed-use development around public transport corridor	7%
Commercial mixed-use development around public transport corridor	10%
Residential mixed-use development	5%
Commercial mixed-use development	7%

Notes (1) In this table, "residential mixed-use development" would indicate a residential development with our land-use integrated into the development form, whereas residential development indicates a wholly residential development
(2) public transport node = bus or train station

6.2.6 Table 6.1 shows the relative importance of mixed-use development, public transport corridors and public transport nodes; with the latter (i.e. bus and train stations) having the greatest impact.

6.2.7 Research into the impacts of providing a mix of land-use types within a neighbourhood has found that;

- The presence of local facilities has a positive effect on mode choice (i.e. more non-car trips) but more so on car ownership, particularly multiple car ownership (Dargay and Hanly, 2004).
- Diversity of services and facilities in close proximity to households reduces distance travelled (Banister, 1996; Farthing et al, 1995, 1997; Hickman and Banister, 2007a)
- Work trip distances and times are shorter in areas of higher population density, higher employment density and greater land use mix (Frank and Pivo, 1994).
- Trip lengths are shorter in 'traditional urban settings'. Walking and, to a lesser degree, public transport mode share is also higher in 'traditional urban settings' (Ewing and Cervero, 2001).
- The use of public transport and walk / bike modes is more likely where commercial and non-residential uses are nearby (within 300 feet of residence). Also, walking, cycling and public transport mode shares are greater in locations where shops are located close to office buildings (Cervero, 1989).

(taken from www.plan4sustainabletravel.org)

6.2.8 Given the above, according to the Commission for Integrated Transport (CFIT), an initial basis for securing sustainable development in transport terms is the selection of a good site location where:

- Good accessibility is available, or can be developed, by sustainable modes to:
  - employment and other main facilities in the main towns or immediate vicinities;
  - a rail station or other public transport interchange where good services are available to other (larger) centres within the sub-region; and
  - community facilities within the development or the surrounding neighbourhood.
- Opportunities exist to:
  - promote the use of walking, cycling and public transport;
  - provide an attractive level of public transport service which does not depend on (additional) subsidy over the longer term; and
  - utilise and support existing public transport services and community facilities in the locality.

6.2.9 According to Inclusive Mobility (DfT, 2002) bus services should be within 400m of a development in order to be considered accessible - though without specific development sites, this level of analysis is not available at this stage. However, this section does give indication of public transport density and therefore potential for servicing.

6.3 On-Site Development Infrastructure

6.3.1 According to the Government publication, Building Sustainable Transport into New Developments (DfT, April 2008), “the layout of a development has a significant impact on how people choose to travel.”

6.3.2 Indeed, a year before this document was issued, the benefits of good design on mode choice was recognised in the DfT publication Manual for Streets which sought to directly influence the layout of new residential development.

6.3.3 The Manual for Streets replaced the previous guidance (DB32 and the accompanying Places, Streets and Movement) that was focused on providing for the car. By comparison, Manual for Streets provided a new hierarchy for the provision of infrastructure within the development envelope (as summarised in Figure 6.2 below) which placed the needs of pedestrians and cyclists at the forefront of design.

Figure 6.2: Development-Envelope Design Hierarchy (Source; Manual for Streets)

Consider first	Pedestrians
	Cyclists
↓	Public transport use
	Specialist service vehicles (e.g. emergency service vehicles, waste etc)
Consider last	Other motor traffic

6.3.4 In the above, it is acknowledged that the attractiveness of walking and cycling is not only influenced by distance but also the quality of the walking and cycling environment.

6.4 Assessment of the Sustainability of New Development

6.4.1 The preceding sections have identified that opportunities to serve new development by sustainable modes vary across the district of Mansfield. Once the development plan-related proposals are known, they can be compared with the sustainable-transport context identified in this baseline report.

6.4.2 Where developments co-incide with opportunities for sustainable travel, it is likely that the proportion of those travelling to / from employment (and other services and facilities) by car will be naturally lower than where such opportunities do not exist. However, this is not meant to imply that developments in other areas should not proceed. Rather it identifies which developments would need additional support through development specific measures such as bus services, cycle routes and / or the wider Travel Planning process.

7. Summary and Conclusions

7.1.1 Mansfield District Council is currently preparing a new Local Plan. This report has been prepared to support the traffic analysis and impacts of the developments in the Local Plan and considers the transport context within which the development sites identified within the Local Plan would be brought forward.

7.1.2 Baseline (2016) conditions in terms of existing travel patterns, mode choice, car ownership, public transport patronage, walking and cycling and accessibility in Mansfield and Market Warsop have been examined.

7.1.3 Although the district of Mansfield compares well with the rest of Nottinghamshire in terms of overall journey patterns (proportion of those driving to work, accessibility to services and facilities) there are variations between wards at a local level. There are variations in the use of the car, as a main mode of travel to work, between wards. For example, there is a higher proportion of residents in the Kings Walk ward for whom the main mode of travel to work is by car and motorcycle than in the Portland ward. Similar variations in accessibility to services between wards were noted. These variations reflect the availability of sustainable transport infrastructure and access to employment, services and facilities by sustainable transport modes.

7.1.4 Similar to other towns in Nottinghamshire, there has been a long term reduction in traffic entering Mansfield town centre in recent years. There has been a slight increase in traffic entering Mansfield between 2014 and 2016. In 2013, there was an improvement to public transport facilities within Mansfield via the opening of a new public transport interchange within the town.

7.1.5 There is an existing SATURN traffic model of Mansfield, which has been utilised in this study. The model has been updated to 2016 flow levels using existing and new traffic count data in order to represent a baseline of trip patterns and traffic volumes in Mansfield.

7.1.6 The 2016 Baseline model was used to examine the performance of the highway network and identify any junctions that were approaching capacity and thus causing delays and congestion. This process identified the following ten junctions:

- Chesterfield Road / Debdale Lane;
- A60 Nottingham Road / Berry Hill Lane;
- Carter Lane / Southwell Road / Windsor Road;
- A617 MARR / A6191 Southwell Road;
- A60 Leeming Lane / Peafield Lane;
- A60 Leeming Lane / A6075 Warsop Road;
- Kings Mill Road / Beck Lane / B6014 Skegby Lane / Mansfield Road;
- A6191 Ratcliffe Gate / A60 St. Peters Way;
- A6117 Old Mill Lane / B6030 Clipstone Road West; and
- A38 Sutton Road / B6014 Skegby Lane / Sheepbridge Lane.

7.1.7 Detailed models of the above junctions were built to examine their performance in the Base Year. Where junctions were found to be operating close to or above capacity the scale of the potential mitigation measures have been suggested (the descriptive text is provided in Appendix B for each junction).

7.1.8 Having examined the Base Year conditions, the project examined the future conditions within Mansfield and Market Warsop, given the most likely projections of growth and committed developments (both transport infrastructure and land-use developments) that are likely to be implemented before 2033. This is a ‘Reference Case’ against which potential local plan developments can be judged.

7.1.9 As with the Baseline analysis, the Reference Case traffic model was used to identify those junctions within the highway network that were likely to be approaching capacity in 2033. This process identified the following thirteen junctions for more detailed analysis:

- Chesterfield Road / Debdale Lane;
- A60 Nottingham Road / Berry Hill Lane;
- Carter Lane / Southwell Road / Windsor Road;
- A617 MARR / A6191 Southwell Road;
- A60 Leeming Lane / Peafield Lane;
- A60 Leeming Lane / A6075 Warsop Road;
- Kings Mill Road / Beck Lane / B6014 Skegby Lane / Mansfield Road;
- A6191 Ratcliffe Gate / A60 St. Peters Way;
- A6117 Old Mill Lane/ B6030 Clipstone Road West;
- A38 Sutton Road / B6014 Skegby Lane / Sheepbridge Lane;
- A60 / Old Mill Lane / Butt Lane;
- A6191 Adams Way / Oak Tree Lane; and
- A60 / New Mill Lane.

7.1.10 Ten of these thirteen junctions identified for analysis in the Reference Case were identified as approaching capacity in the Base Year. Detailed junction modelling of the remaining three junctions using the 2033 Reference Case forecast traffic flows identified that one junction would perform adequately;

- A60/ Old Mill Lane/ Butt Lane.

The other two junctions perform near to or at capacity;

- Carter Lane / Southwell Road / Windsor Road; and
- A617 MARR / A6191 Southwell Road.

The remaining ten junctions are likely to operate above capacity in 2033 in at least one of the peak periods, with queueing expected to occur on one or more approach arms.

7.1.11 The junctions which were identified as operating over capacity in the Reference Case may require improvements for them to operate without excessive queuing and delays. Some junctions may require modest improvements to the operation of the signals whilst others are likely to require a more complete solution to reduce queuing and delays.

7.1.12 The Baseline and Reference Case analysis has highlighted key areas where possible future local plan growth may be sensitive. A forecast using the traffic model to include the development plan related proposals would confirm this, and identify any other locations which may be impacted by the cumulative traffic impacts of the Local Plan. This analysis should be part of the Stage 2 study and report.

7.1.13 The travelling journey time for bus services, excluding waiting time at stops, would increase by between 3 minutes and 6 minutes for buses on a round trip along the radial Routes 1 (the A60 corridor) and 2 (serving Forest Town). On radial routes 3, 4 and 5 the increase in round-trip journey times would be no greater than 2 minutes. On radial route 6 the increase in round trip journey times would be between 2 minutes 30 seconds and 4 minutes (see charts at Appendix E).

Glossary

ARCADY	*Assessment of Roundabout Capacity and DelaY*. A software tool used to assess the capacity of roundabouts under differing traffic scenarios.
Design Manual for Roads and Bridges	The UK highway design guide, commonly used for analysis and design of the trunk road network but also used for local roads, where appropriate.
Degree of Saturation (DoS)	A measure of the operational performance of a signalled junction, with measures 100% or above indicating that a junction is operating above capacity.
Guidance on Transport Assessment (GTA)	A guidance document prepared by the DfT setting out how a Transport Assessment should be prepared.
Junction Capacity	The number of vehicles which can be accommodated by a junction within a given period. Normally calculated using software such as ARCADY, PICADY or LINSIG. Where a junction is operating “at capacity”, queues are likely to form since the number of vehicles approaching the junction is more than that which can pass through it.
LINSIG	A computer programme used for modelling traffic at traffic signal junctions. LINSIG allows engineers to model junctions in a way which closely follows the behaviour of on-site signal control equipment.
Local Highway Authority	The body responsible for the local road network in a particular area, in particular with regards network improvements and the control of development that could affect the local highway.
Local Plan	A document produced by Local Authorities containing the development plans and policy documents for the local area.
Local Transport Plan	The Transport Act 2000 required Local Highway Authorities to produce and maintain an LTP. The LTP sets out transport strategies and policies for a given area and how these will be implemented. The plans cover a defined period and are used by the DfT to make decisions on capital funding, and for Local Authorities to monitor the delivery of key objectives and targets. The current LTP document covers the period 2011- 2026.
Manual Classified Count (MCC)	A count of traffic on a particular road, or at a junction, which is usually undertaken by a team of enumerators, usually over a 12-hour period. Traffic is classified by vehicle type.
MOVA	*Microprocessor Optimised Vehicle Actuation* is an adaptive signal control system. It uses advanced

	traffic control algorithms to increase capacity and minimise delay at traffic signals. It is used at a range of junctions from high speed to smaller suburban and urban sites.
NTEM	The *National Trip End Model* is a transport planning tool that was developed by the DfT, which produces projections of trip numbers across England and Wales. The forecasts are derived from local and regional planning projections of jobs, employment, population and household numbers in combination with travel growth factors from the national transport model.
PCU	Passenger Car Units are used to measure the capacity of roads and junctions whereby vehicle flows are converted to a standard unit using factors, e.g. car = 1 PCU, bus = 2 PCUs.
PICADY	*Priority Intersection Capacity and Delay.* A software tool that predicts capacities, queue lengths and delays at non-signalised major/minor priority junctions.
Ratio of Flow to Capacity (RFC)	A measure of the performance of a junction, with a measure of 1.0 or above indicating that a junction is operating above capacity.
SATURN	A software tool used to model traffic flows on a highway network that is responsive to congestion and reassignment issues.
Transport Analysis Guidance (TAG)	A set of documents (or Units) published by the Department for Transport which sets out how a particular transport scheme should be assessed, principally in terms of economic analysis and calculating a Benefit:Cost ratio. Guidance on the assessment of environmental impacts of highway schemes are also contained in the guidance. Sometimes referred to as WebTAG.
Transport Assessment (TA)	A document submitted in support of a planning application which sets out the likely impact of a proposed development on the transport network. Guidance on the content of a Transport Assessment is provided in the GTA.
Travel Plan	A document submitted in support of a planning application which sets out how trips to / from a development would be managed on opening. Its objective is usually to reduce single occupancy car trips by promoting sustainable travel options.
Trip Rate Information Computer System (TRICS)	A software tool which contains traffic survey data classified by land-use type and size. It is used to estimate the number of trips that could be generated by a proposed development based on experience elsewhere in the UK, and is recommended for this purpose in the GTA.

Trip Assignment	A stage in the estimation of future traffic conditions. The process of “assigning” traffic flows to particular links and junctions to and from a particular destination. It is preceded by Trip Distribution.
Trip Distribution	A stage in the estimation of future traffic conditions. The process of determining the likely origins and destinations of traffic to and from a proposed development. This stage does not make any assumptions about routeing, and is followed by Trip Assignment.
Trip End Model Program (TEMPRO)	The TEMPRO database contains information relating to land-use developments across the United Kingdom. It is used to forecast traffic growth in / from specific areas.
Trip Generation	A stage in the estimation of future traffic conditions. Trip Generation is an estimate of the total arrivals and departures that could be generated by a development within a specific time period. The software tool TRICS is commonly used to inform this stage. This stage is followed by Trip Distribution and Trip Assignment.
WebTAG	See TAG.

Appendix A Technical Note on Model Updating

Mansfield Transport Study 2017

Local Model Validation Report

Project Number: 60527945

1 February 2017

Quality information

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Revision History

Revision	Revision date	Details	Authorized	Name	Position
1	3/2/17	NCC comments (2/2/17) addressed		Adam Hall	Principal Transport Planner

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Table of Contents

Figures

Tables

1. Introduction

1.1.1 Mansfield District Council (MDC) is currently preparing a new development plan to be known as the Mansfield District Local Plan. AECOM (previously URS) began work in 2012 to develop a transport evidence base to support the Local Plan culminating in two study reports published in October 2014. These reports are:

Mansfield District Transport Study – Stage 1: Baseline and Reference Case; and

Mansfield District Transport Study – Stage 2: Local Plan Growth

1.1.2 The proposed Local Plan was subject to a public consultation in January 2015, during which Mansfield District Council received comments from stakeholders and the public. Subsequently, Mansfield District Council has updated the development plan's employment and housing allocations. Updates include the inclusion of new sites locations, change of use, and change of development density. Mansfield District Council has requested that AECOM update the Stage 1 and Stage 2 Mansfield District Transport Study reports to reflect the latest local plan position.

1.1.3 The 2014 Stage 1 and Stage 2 Transport Study reports were based upon outputs from a SATURN traffic model of Mansfield. Prior to updating the Mansfield Study, the SATURN model needs to be shown to represent current traffic conditions.

1.1.4 Activity 1 reviewed the Mansfield SATURN 2012 Base Year model to see if it was representative of 2016 traffic conditions. This process is described in a Technical Note (TN01). This concluded that the 2012 Base Year model, as carried forward from the previous study, does not meet the Transport Analysis Guidance Validation criteria when compared against 2016 count data. TAG guidance is the Department for Transport (DfT) guidance on transport modelling and scheme appraisal. Further work was therefore required to update the 2012 Base Year model to a 2016 Base year model as set out in Activity 1A of AECOMs proposal document.

1.1.5 This report summaries the validation of the Mansfield SATURN 2016 Base Year model against 2016 Trafficmaster data and 2016 traffic count data for use in the updated Mansfield District Transport Study.

2. Mansfield SATURN 2016 Base year model overview

2.1.1 The Mansfield SATURN 2016 Base Year model is a SATURN highway assignment model. The model was built using SATURN version 11.3.07K. The geographical extent of the Mansfield SATURN traffic model is shown in Figure 1.

2.1.2 The trip demand model groups trip purposes into six separate user classes by utilising two vehicle classes: lights and heavies. Trips are then assigned to the highway network as six user classes to allow the different trip purposes and vehicle classes to be routed through the network along suitable paths. Modelling different user classes also provides the ability to ban heavy vehicles from travelling along certain routes where there may be a weight limit or obstacles such as low bridges. The user classes in the Mansfield traffic model are defined as:

Vehicle class 1

User Class 1 – Car (Work)

User Class 2 – Car (Commute)

User Class 3 – Car (Other)

User Class 4 – LGV (All)

Vehicle class 2

User Class 5 – HGV1 (other goods vehicle: rigid chassis or up to three axles)

User Class 6 – HGV2 (other goods vehicle: articulated with four axles plus)

2.1.3 The model was built to assess two time periods; AM peak (0800-0900) and PM peak (1700-1800).

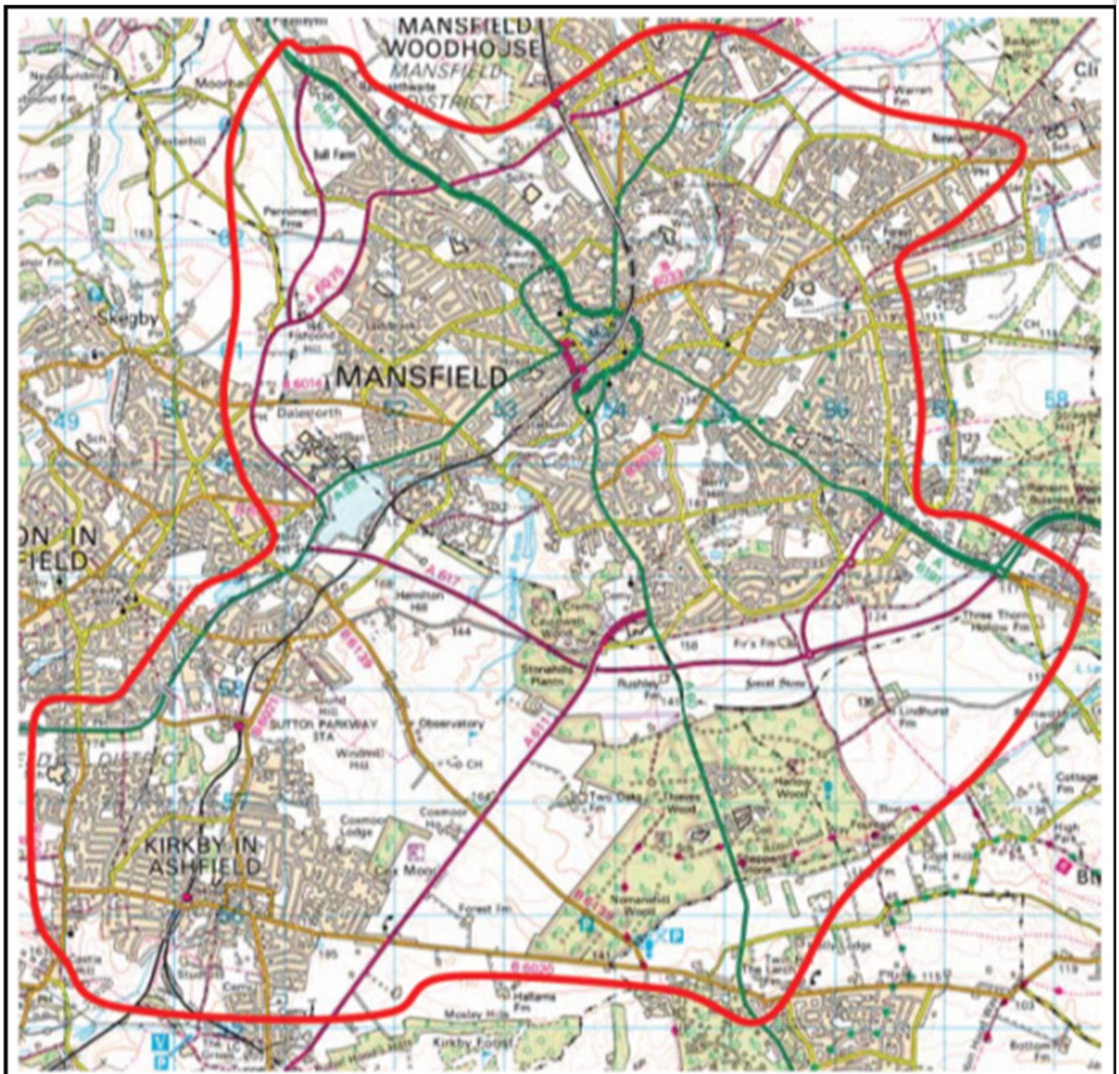


Figure 1. Geographical extent of the Mansfield SATURN Traffic Model.

3. 2016 Network Building

3.1 Transport infrastructure and development changes

3.1.1 The highway network was reviewed to identify any changes to the road network made since 2012. Changes may be due to developments modifying access arrangements, roads being added or removed and alterations to traffic signal junction's phase timings and lane allocations. Information relating to possible highway network changes were collected and included to form a 2016 base year network. The following updates were made:

1. The Sandlands development in Forest Town is a large housing development that has been built out since 2012. The development is not represented in the 2012 Base Year SATURN model. The development zone was moved to a more suitable location to better represent the development in the 2016 network.

2. The Mansfield Leisure Park was represented as a large zone in the 2012 Base Year Model. This zone connector was moved to a more suitable location to improve the level of fit at the A60 Nottingham Road/ Baums Lane/Park Lane Junction in the 2016 network.

3. Mansfield Civic Centre and the Tesco Superstore were represented as one zone in the 2012 Base Year Model. The Zone was spilt with the Tesco zone connector moved to a more suitable location to improve the level of fit at the Rosemary Street/ Chesterfield Road South Junction in the 2016 network.

4. West Bank Avenue, Yorke Street, Sherwood Street and Crow Hill Lane were all added to the 2016 network.

3.2 Generalised costs

3.2.1 The traffic model uses generalised costs to calculate the minimum cost route through the highway network. Generalised cost is a function of the value of time (pence per minute - PPM) and the perceived vehicle operating cost of distance travelled (pence per kilometre – PPK). The parameters used in the calculation of generalised cost were updated by the Department for Transport in the DfT's TAG data book of Spring 2016 (Latest TAG data book at time of base year update). These values were used to update the generalised costs for the 2016 Base model. The new parameters have been updated to better represent driver's behaviours.

3.2.2 Using different values for PPM and PPK may encourage different route patterns through the model and therefore differences in traffic volumes on certain links. The PPM and PPK parameters used in both the 2012 and 2016 base models are presented below in Table 1 and Table 2 for the AM and PM peak time period.

Table 1. AM Peak generalised cost parameters

User Class	PPM (2012)	PPM (2016)	PPK (2012)	PPK (2016)
UC1	54.59	28.48	14.32	14.78
UC2	12.35	8.40	7.67	6.66
UC3	15.75	10.67	7.67	6.66
UC4	20.67	12.31	16.14	13.92
UC5	18.2	13.00	33.17	39.57
UC6	18.2	13.00	62.56	73.31

Source: Tag Databook, Spring 2016

Table 2. PM Peak generalised cost parameters

User Class	PPM (2012)	PPM (2016)	PPK (2012)	PPK (2016)
UC1	54.59	27.38	14.37	15.20
UC2	12.35	8.22	7.69	6.83
UC3	15.75	11.42	7.69	6.83
UC4	20.67	12.31	16.16	14.19
UC5	18.2	13.00	33.32	40.83
UC6	18.2	13.00	62.85	75.66

Source: Tag Databook, Spring 2016

4. New Data

4.1 Counts collected for 2016 calibration/validation

4.1.1 An updated set of counts was collected to assist with updating the Mansfield SATURN 2016 Base Year Model. Data was collected at 47 different count sites, with 3 different types of count being collected as shown in Figure 2.

4.1.2 Count data has been sourced from:

- 5 new counts commissioned as part of the Mansfield Transport Study:
  - A60 / Baums Lane / Park Lane;
  - New Mill Lane / Sandlands Way;
  - Sandlands Way / A6117 / Heatherley Drive;
  - A60 / Church Street / Wood Street;
  - A60 / Askew Lane / Vale Avenue
- Counts held by Nottinghamshire County Council on the C2 Web count database; and
- Ad-hoc counts used to support planning applications.

4.1.3 The 47 sites consist:

- 12 Manual Classified Junction Counts. These sites provide a count of individual turning movements at a junction and are collected on a single day;
- 32 Permanent Automatic Traffic Counts (ATC). These sites are maintained by Nottinghamshire County Council and are used to monitor traffic volumes across the district. These sites record traffic volumes by hour all year round; and
- 3 Temporary ATCs. These sites record traffic volumes by hour, generally over a two week period.

4.1.4 Where available the data has been collected in June 2016 to coincide with the new MCC junction counts. In some cases, where there was a notable gap in the count data set, older count data has been obtained.

4.1.5 Figure 3 shows the year of the counts collected. Count data was rebased to a June 2016 level, using a factor derived from a nearby long term count site, which contained data from both June 2016 and the date of the survey. This approach ensured consistency throughout the data set.

4.1.6 The count data set was split into Calibration and Validation sets. Counts used in the Calibration process will be used to improve the model (via matrix estimation). Counts in the Validation set were kept as an independent data set and used to check the outputs of the calibration process.

4.1.7 Figure 3 shows the count sites that were used within either the Calibration or the Validation process. There were 47 count sites which when split into their individual turning movements and link counts resulted in 129 calibration counts and 118 validation counts.

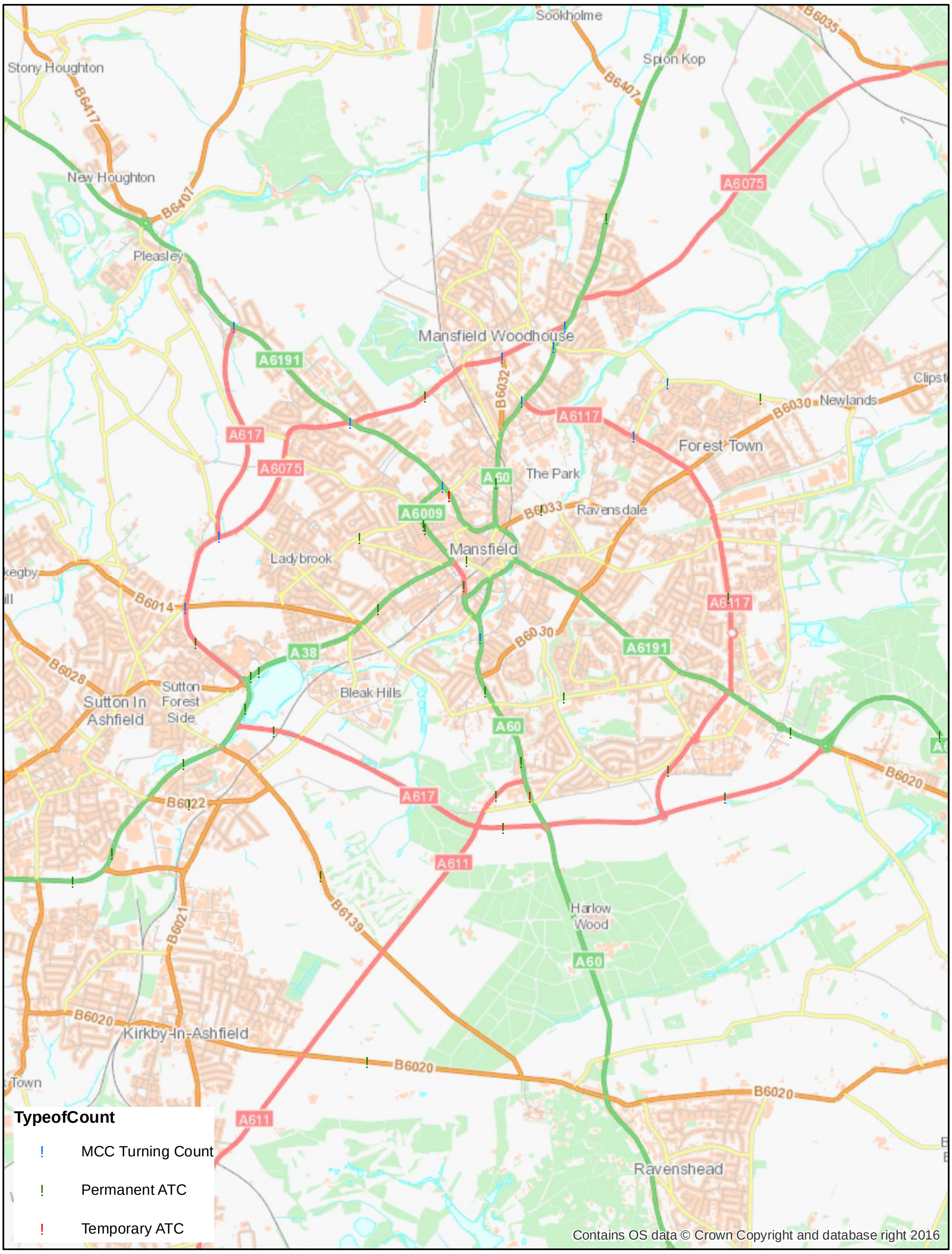


Figure 2. Count Type

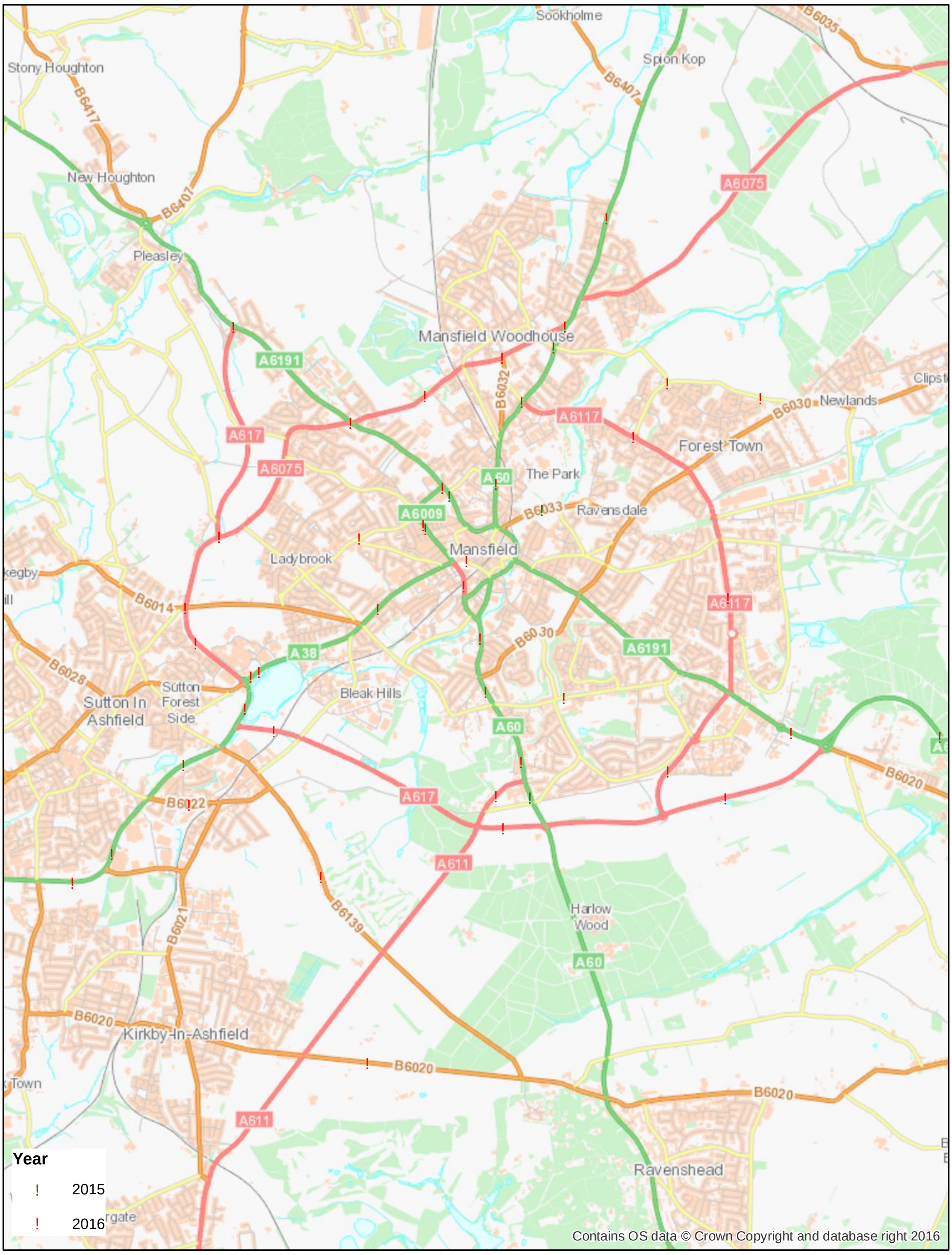


Figure 3. Date of Count

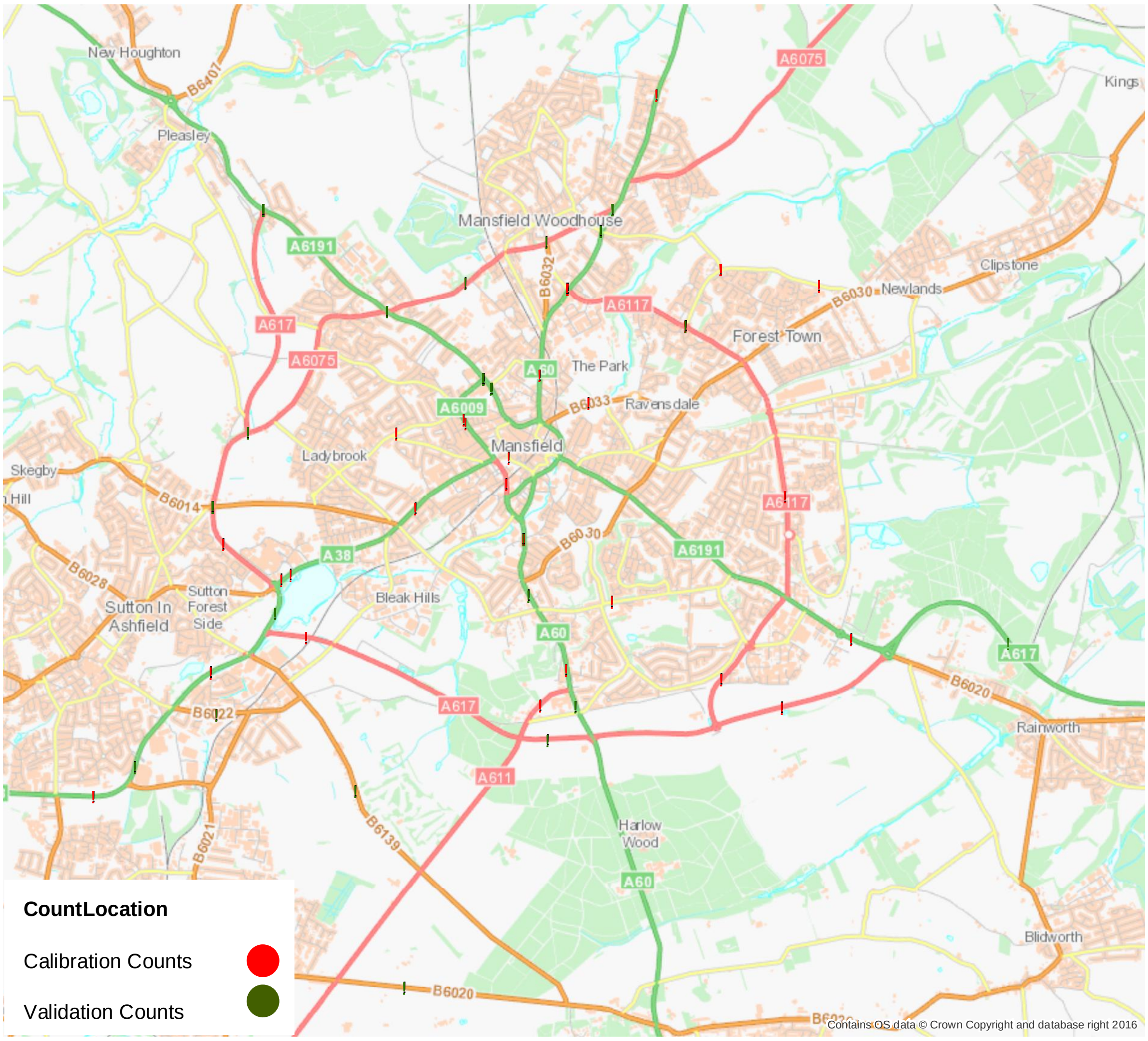


Figure 4. Count Locations

4.2 2016 Journey Time Routes

4.2.1 Journey time data were obtained for the Mansfield area from the Trafficmaster GPS database, for the period October 2015 to September 2016 inclusive.

4.2.2 The Trafficmaster data were aggregated to give a mean journey time and standard deviation of journey times for each ITN link, in each modelled time period, across all neutral months and all weekdays during the data collection period.

4.2.3 Observations (i.e. the group of observations relating to; each day, time period and ITN link in question) with mean journey times above the maximum threshold were identified as 'outliers' and those observations were excluded from the Journey Time data set. The resulting 'cleaned' data set was then used to recalculate each ITN link's mean and its variance for each time period. The mean journey time (post-cleaning) was used to calculate each period's mean journey time of the whole Journey Time Route.

4.2.4 Seven journey time routes in each direction were used to validate the 2016 Mansfield SATURN 2016 Base Year Model. These are described in Table 3 and are shown in Figure 5.

Table 3. Journey Time Routes

Route Number	Origin	Destination
1	A60/ Peafield Lane Junction	A60/St Peters Way Junction
2	A60/St Peters Way Junction	A60/ Peafield Lane junction
3	B6030-Clipstone Road West/New Mill Lane Junction	B6030-Carter Lane/ A6191 Rock Hill
4	B6030-Carter Lane/ A6191 Rock Hill	B6030-Clipstone Road West/New Mill Lane Junction
5	A6191 Southwell Road/A617 Sherwood Way East Junction	A60 St Peters Way/ A6191 Ratcliffe Gate Junction
6	A60 St Peters Way/ A6191 Ratcliffe Gate Junction	A6191 Southwell Road/A617 Sherwood Way East Junction
7	A617 Kings Mill Road East/ A38 Sutton Road Junction	A38 Stockwell Gate/ Rosemary Street Junction
8	A38 Stockwell Gate/ Rosemary Street Junction	A617 Kings Mill Road East/ A38 Sutton Road Junction
9	A617/Chesterfield Road North Junction	A6009 St Peters Way/ St John Street Junction
10	A6009 St Peters Way/ St John Street Junction	A617/Chesterfield Road North Junction
11	A617 Sherwood Way South/ A60 Nottingham Road Junction	A60 Portland Street/A60 St Peters Way Junction
12	A60 Portland Street/A60 St Peters Way Junction	A617 Sherwood Way South/ A60 Nottingham Road Junction
13	A6191 Southwell Road/A617 Sherwood Way East Junction	A617/Chesterfield Road North Junction
14	A617/Chesterfield Road North Junction	A6191 Southwell Road/A617 Sherwood Way East Junction

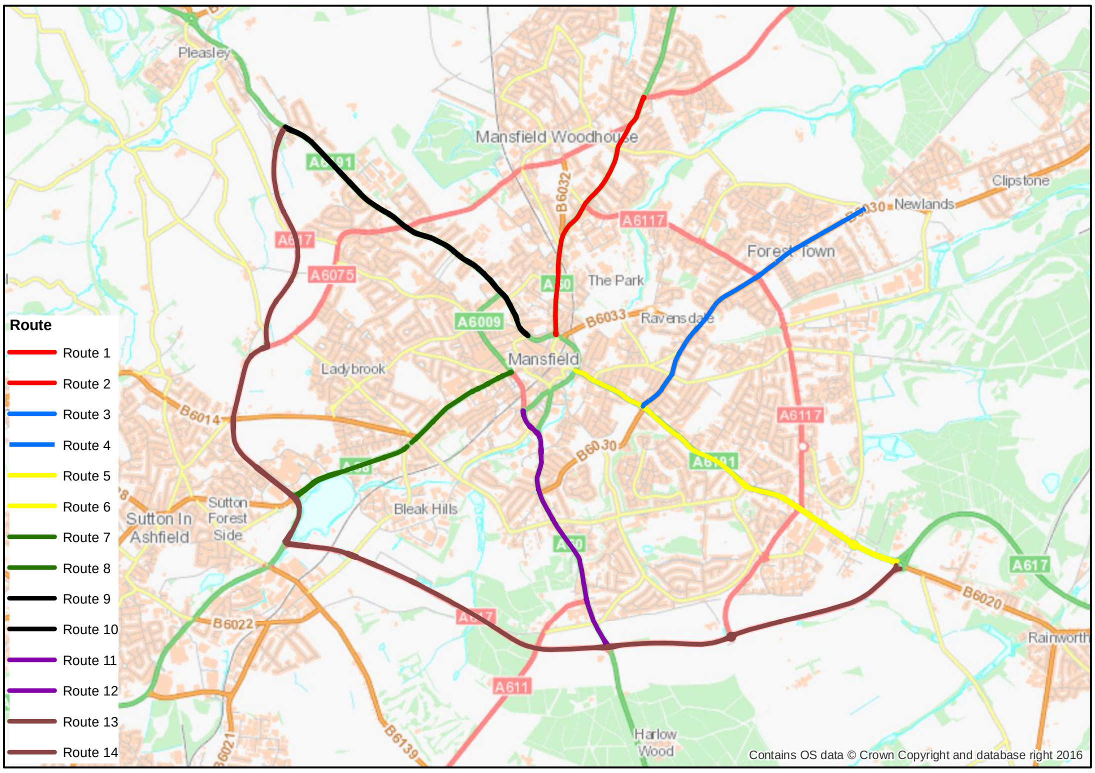


Figure 5. Journey Time Routes

5. Journey Time Validation

5.1.1 The criterion for journey time validation is stated in the TAG unit M3.1, paragraph 3.2.10 (Table 3). The criteria against which validation is judged is that modelled times along the journey time routes should be within 15% of surveyed times (or 1 minute, if higher than 15%). The acceptability guideline is that these criteria should be satisfied on more than 85% of journey time routes.

5.1.2 Table 4 shows the comparison of the end to end journey times for each of the seven routes, in each direction and time period (Mean observed time verses modelled time), with the colours indicating whether the route fits with the TAG journey time validation criteria.

5.1.3 If a cell is coloured green, the observed and modelled journey times are within the validation criteria, if a cell is coloured blue it means the observed and modelled journey times are outside of the validation criteria and the model is running slower than observed.

5.1.4 Journey time plots are shown in Appendix A. These plots show the modelled time and upper and lower bounds of the validation criteria.

5.1.5 The number of routes fulfilling the TAG criteria is 93% in the AM peak and 100% in the PM peak, fulfilling the TAG criteria, which satisfies the acceptability guideline. The single Journey time route outside of the 15% range is in the AM peak and the model is +16% slower than the observed journey time; this is the A60 Leeming Lane outbound. This amounts to two seconds outside the 15% criteria.

Table 4. Comparison of Total Modelled and Observed Journey Time by route

Route Number	AM Observed Journey Time (seconds)	AM Modelled Journey Time (seconds)	PM Observed Journey Time (seconds)	PM Modelled Journey Time (seconds)
1	670	599	437	402
2	318	368	491	552
3	500	546	412	402
4	376	361	366	412
5	546	530	487	549
6	421	413	448	423
7	322	304	334	317
8	294	296	307	330
9	437	404	402	421
10	384	415	414	435
11	383	363	426	391
12	413	356	437	397
13	987	991	982	989
14	1,096	1017	1,114	949

5.1.6 The nature of the journey time route data, is that it is collected from a series of samples of travel time data along each link within the given time period.

5.1.7 This data can vary naturally in the form of journeys taking a different length of time as each vehicle encounters different conditions such as pedestrians crossing, other vehicles egressing, right turners into driveways delaying ahead movements etc or the limit of the vehicles' acceleration and speed.

5.1.8 It should be noted that, whilst the average journey times on a series of links can be combined together using an ITN highway shapefile, an individual vehicle's time cannot be summed along several links. By using the TrafficMaster data in this way, the travel time along the route is not dependent upon the conditions or delays experienced along the previous upstream link.

5.1.9 The TrafficMaster data is supplied with a standard deviation from the average of the data record group. This has been used to identify and remove any outlier data groups which are not within ±2 standard deviations of the reported mean. The purpose of removing the outliers data groups is to eliminate any exceptional traffic incidents from the average travel times.

5.1.10 The standard deviation has also been used, along each of the journey time routes, to assess the accuracy of the observed times along the route in whole. The accuracy of the observations along each route are given below in Table 5. Routes with a low accuracy score are likely to have a poorer reliability record; that is to say drivers will notice a larger variation in journey times from day to day.

Table 5. Observed Mean Journey Times by Time Period & Accuracy

	Time period:	**AM**		**PM**	
JT **Route**	**Description**	**Observed Mean time**	**Accuracy**	**Observed Mean time**	**Accuracy**
Route 1 Inbound	A60 Leeming Lane	00:11:10	88%	00:07:17	87%
Route 2 Outbound	A60 Leeming Lane	00:05:18	92%	00:08:11	89%
Route 3 Inbound	B6030 Forest Town	00:08:20	87%	00:06:52	89%
Route 4 Outbound	B6030 Forest Town	00:06:16	91%	00:06:06	93%
Route 5 Inbound	A6191 Southwell Road West	00:09:06	92%	00:08:07	91%
Route 6 Outbound	A6191 Southwell Road West	00:07:01	93%	00:07:28	92%
Route 7 Inbound	A38 Sutton Road	00:05:22	92%	00:05:34	91%
Route 8 Outbound	A38 Sutton Road	00:04:54	92%	00:05:07	90%
Route 9 Inbound	A6191 Chesterfield Road Sth	00:07:17	94%	00:06:42	95%
Route 10 Outbound	A6191 Chesterfield Road Sth	00:06:24	94%	00:06:54	93%
Route 11 Inbound	A60 Nottingham Road	00:06:23	91%	00:07:06	90%
Route 12 Outbound	A60 Nottingham Road	00:06:53	92%	00:07:17	90%
Route 13 Clockwise	A617 MARR	00:16:27	95%	00:16:22	95%
Route 14 Anticlockwise	A617 MARR	00:18:16	94%	00:18:34	94%

5.1.11 Routes 1, 2 and 3; A60 Leeming Lane Inbound and Outbound and B6030 Forest Town Inbound are the most variable routes in the AM and PM Peaks with accuracies reported as being under 90%. The least variable routes are those along the A617 MARR both clockwise and anticlockwise (Route 13 & 14) and the A6191 Chesterfield Road south route in both directions (Route 9 & 10); these routes typically have accuracies of 93% or more

5.1.12 The variability around routes 1, 2 and 3 can be seen from the journey time plots presented in Appendix A. Whilst the plots show the modelled journey times do not fit within the range over the whole journey time route, the journey time uncertainty, as indicated by the accuracy of the TrafficMaster data suggests that the actual measured mean may lie closer to the modelled times than actually presented. Likewise the routes which are most accurate; 9, 10, 13 and 14 are all modelled within the range suggested by the TrafficMaster data suggesting that both the data and the model are accurately representing average travel times along these routes.

6. Calibration

6.1 Prior Matrix

6.1.1 The 2012 Base Year matrix was used as the initial demand 2016 (Prior) matrix. Two updates were made to the 2012 Base Year matrix before matrix estimation was undertaken:

1. The Sandlands development in Forest Town is a large housing development that has been built out since 2012. The development is not represented in the 2012 Base Year SATURN model. The development was included in the 2012 model's Reference Case scenario. Trip demands from the 2012 Reference Case model were added to the 2016 Prior matrix.

2. Mansfield Civic Centre and the Tesco Superstore were represented as one zone in the 2012 Base Year Model. The zone was spilt to improve the level of fit at the Rosemary Street / Chesterfield Road South Junction in the 2016 prior matrix.

6.2 Matrix Estimation

6.2.1 Within the SATURN suite of software, there is a facility to improve a trip demand matrix using the method of matrix estimation. This process requires count data as an input and adjusts the prior matrix to match the specified link counts by selectively factoring the appropriate origin-destination movements. Matrix estimation is considered the most appropriate way forward to provide an improved Base Year trip demand model.

6.2.2 The matrix estimation technique relies upon a calibrated highway network and therefore the network was updated with changes as described in section 3.1. The 2012 Base Year matrix was used as the initial demand (Prior) matrix within the matrix estimation process with changes as described in section 6.1.

6.2.3 All the 2016 calibration counts were entered into the matrix estimation procedure and to limit the amount of adjustment made to the prior matrix the maximum balancing factor was limited to 3. At each pass any cell can only be factored in the range of ⅓ to 3. This was to ensure that cell values do not change by an excessive amount when attempting to match to a count. An independent set of counts were retained and were not used within the matrix estimation process. These counts were used to validate the Mansfield SATURN 2016 Base Year model.

6.3 Calibration Criteria

6.3.1 Two criteria have been considered for each count, the GEH criteria and the Flow pass criteria.

6.3.2 The flow-pass criteria is stated in the TAG unit M3.1, paragraph 3.2.8 (Table 2). The criteria against which validation is judged is that of:

- Individual flows to be within 15% for links with flows in the range 700-2700 vehicles per hour
- Individual flows within 100 vehicles per hour for links with flows less than 700 vehicles per hour
- Individual flows within 400 vehicles per hour for links with flows greater than 2700 vehicles per hour

6.3.3 The GEH statistic for individual flows is to be less than 5. The GEH statistic is calculated by comparing the assigned and observed flows with the following formula:

$$\sqrt{\frac{(assigned - observed)^2}{0.5 * (assigned + observed)}}$$

6.3.4 A model flow which meets either the GEH statistic criteria or the flow-pass criteria is considered to have reached a suitable acceptable level. TAG acceptability guidelines are that these criteria should be met on at least 85% of the observed links.

6.3.5 TAG acceptability guidelines apply only to link flows. Traffic models are not expected to calibrate on turning movements flows to the TAG guidelines. Where turning movement flows are calibrated this is better than required by TAG guidance.

6.3.6 Turning counts were used in the calibration set. Whilst not a requirement in TAG terms, the better the models representation of turning movement the more the risk of using modelled flows in detailed junction assessments is reduced.

6.4 2016 Calibration results

6.4.1 The modelled level of fit against the calibration set of observed link and turn counts after the matrix estimation process are presented below in Table 6 by time period, with both links flows and turning movement flows at junctions being combined. The full set of calibration results is presented in Appendix B.

Table 6. Calibration counts, GEH or Flow Pass (% of combined links/turns that pass)

	AM Peak	PM Peak
Combined link flows and turning movement flows at junctions.	92%	91%

6.4.2 Table 6 shows that TAG calibration criterion was achieved because more than 85% of modelled link and turn flows matched the calibration count set.

6.5 Validation Criteria

6.5.1 Two criteria have been considered for each count, the GEH criteria and the Flow pass criteria.

6.5.2 The flow-pass criteria is stated in the TAG unit M3.1, paragraph 3.2.8 (Table 2). The criteria against which validation is judged is that of:

- Individual flows to be within 15% for links with flows in the range 700-2700 vehicles per hour

- Individual flows within 100 vehicles per hour for links with flows less than 700 vehicles per hour
- Individual flows within 400 vehicles per hour for links with flows greater than 2700 vehicles per hour

6.5.3 The GEH statistic for individual flows is to be less than 5. The GEH statistic is calculated by comparing the assigned and observed flows with the following formula:

$$\sqrt{\frac{(assigned - observed)^2}{0.5*(assigned + observed)}}$$

6.5.4 A model flow which meets either the GEH statistic criteria or the flow-pass criteria is considered to have reached a suitable acceptable level. TAG acceptability guidelines are that these criteria should be met on at least 85% of the observed links.

6.5.5 TAG acceptability guidelines apply only to link flows. Traffic models are not expected to validate on turning movements flows to the TAG guidelines. Where turning movement flows are validated this is better than required by TAG guidance.

6.5.6 As with the calibration count set, turning counts were used in the validation set. Whilst it is not a requirement in TAG terms, the better the models representation of turning movement the more the risk of using modelled flows in detailed junction assessment is reduced.

6.6 2016 Validation Results

6.6.1 The modelled level of fit against the validation set of observed link and turn counts after the matrix estimation process are presented below in Table 7 by time period, with both links flows and turning movement flows at junctions being combined. The full set of validation results is presented in Appendix C.

Table 7. Validation counts, GEH or Flow Pass (% of combined links/turns that pass)

	AM Peak	PM Peak
Combined link flows and turning movement flows at junctions.	86%	87%

6.6.2 Table 7 shows that TAG validation criterion was achieved because more than 85% of modelled link and turn flows matched the validation count set. This indicates that the Mansfield SATURN 2016 Base Year model is suitable from which to assess the impacts of the Mansfield District Local Plan.

6.7 ME2 Checks

6.7.1 Both the 2016 AM and PM models meet both the count and journey time TAG validation criteria. To ensure that the matrix estimation process has not distorted the origin-destination matrix several checks have been undertaken. The pre and post matrix estimation totals are shown in Table 8.

Table 8. 2016 Pre and Post ME2 matrix totals (PCU)

User Class	AM Pre ME2	AM Post ME2	PM Pre ME2	PM Post ME2
Light's	27,595	28,635	30,324	31,347
Heavy's (PCU)	1,618	1,860	552	660
Total	**29,213**	**30,495**	**30,876**	**32,007**

6.7.2 Comparing the Pre and Post ME2 matrix totals, the post matrix estimation totals show small increases in the overall size of the matrices, +4.38% in the AM peak and +3.66% in the PM peak overall.

6.7.3 Each matrix cell can be analysed to identify changes between pre and post matrix estimation. An estimation of the number of matrix cells changed indicates whether the changes are widespread. To identify the significance of the cells' changes, it is necessary to identify the number of trips changed. There could be changes to a large number of cells but these cells might only contain a small, or even fractional, number of trips. Matrix changes for the AM Peak period are given in Figure 6 and Figure 7 below. PM Peak period matrix changes are presented in Figure 8 and Figure 9.

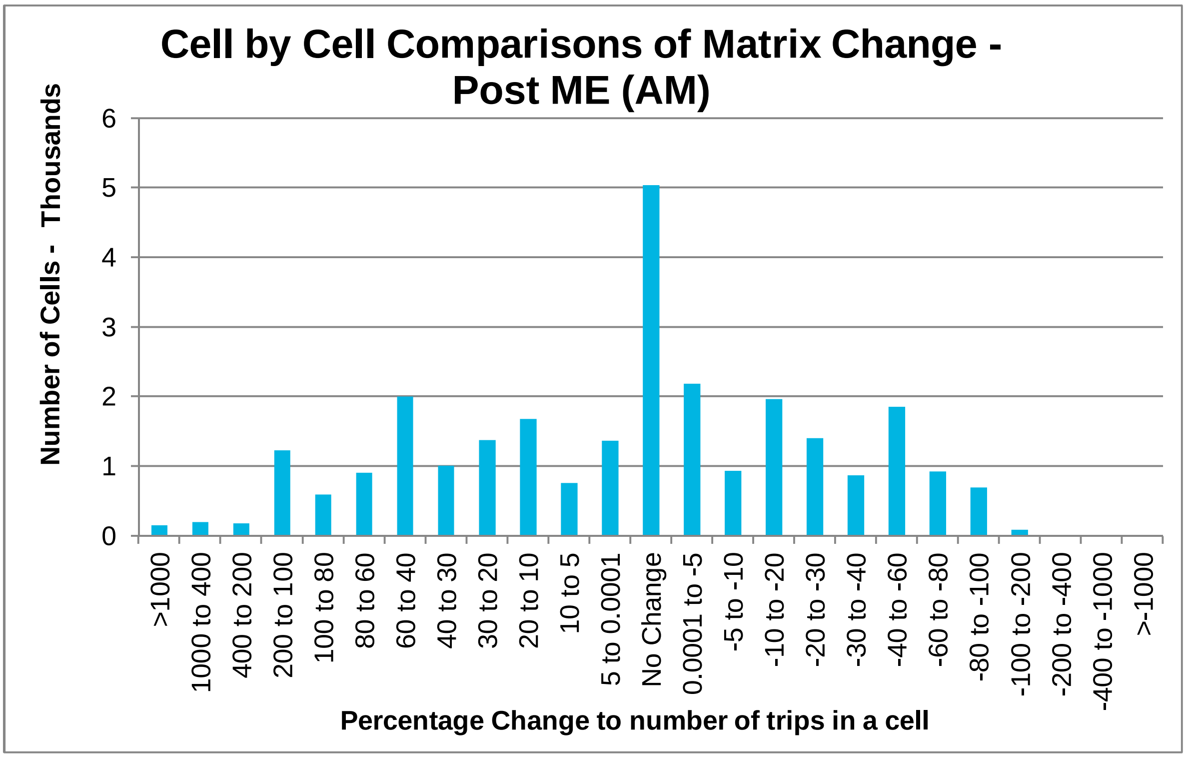


Figure 6. Matrix changes, cell by cell, AM Peak Period

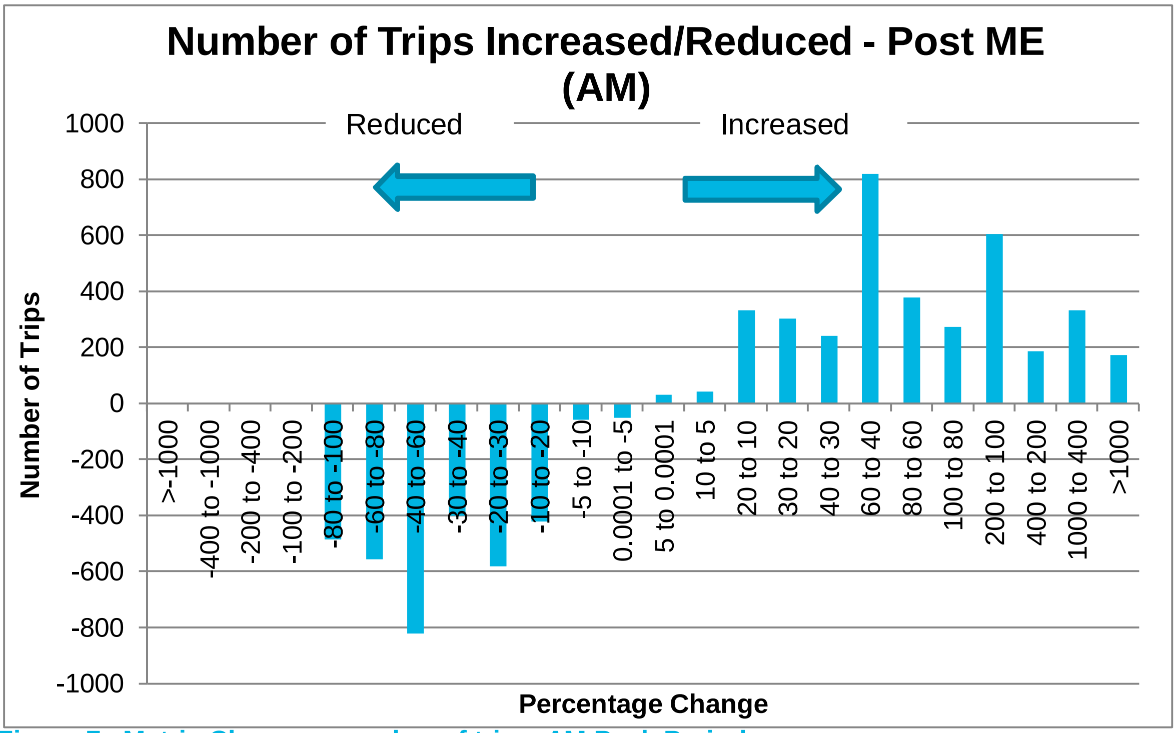


Figure 7. Matrix Changes, number of trips, AM Peak Period

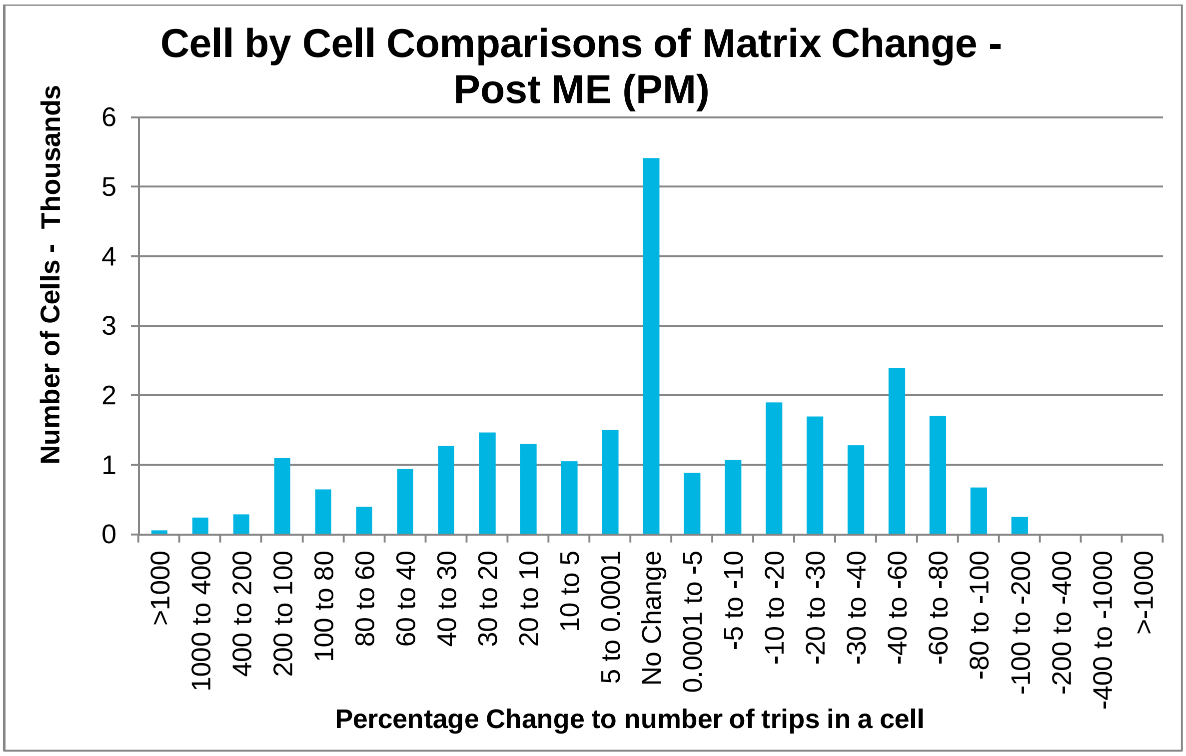


Figure 8. Matrix changes, cell by cell , PM Peak Period

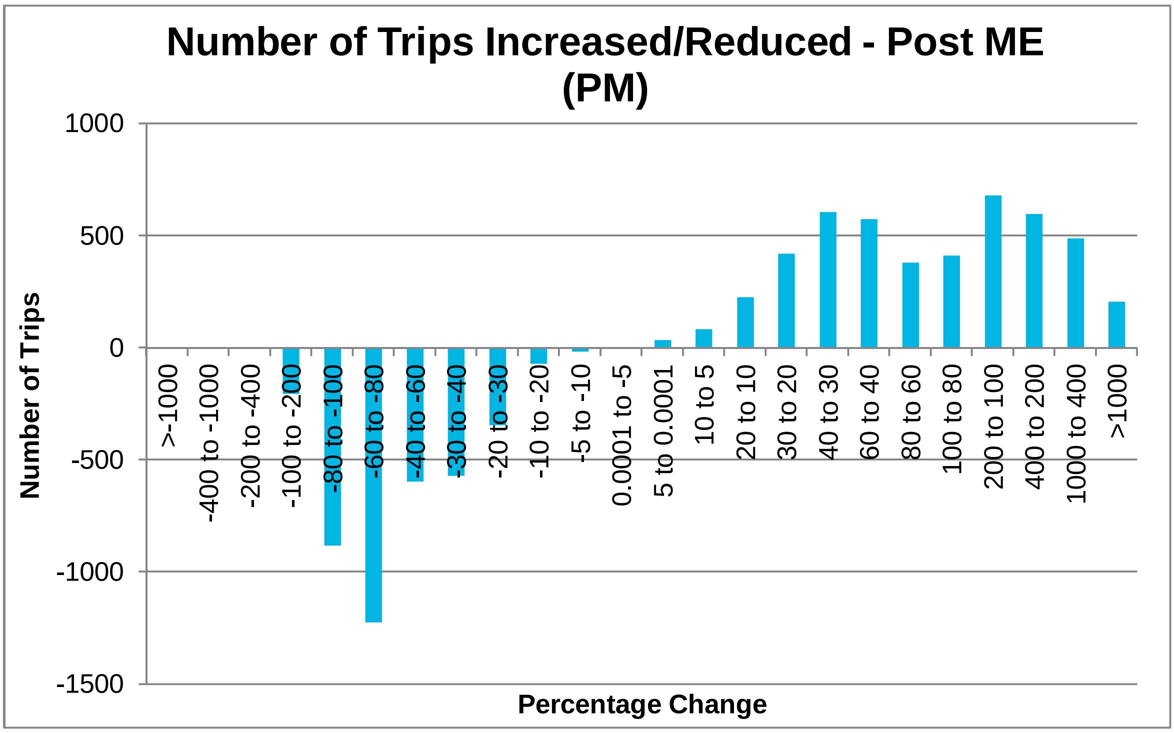


Figure 9. Matrix Changes, number of trips, PM Peak Period

6.7.4 In both the AM and PM peaks the individual matrix cell changes are generally less than +100% of trips, with the majority of cells having no change. There are some cells that change in excess of 100%. Figure 6 indicates that there are 1,860 cells of 27,744 non-zero cells which have changed by more than ±100% in the AM peak and Figure 8 indicates that there are 1,958 cells of 27,629 non-zero cells which have changed by more than ±100% in the PM peak.

6.7.5 Figure 7 and Figure 9 show the impact on trip volumes by percentage change band. Figure 7 shows that in the AM Peak, the number of trips in cells that change by more than 100% is 1,350 trips. This equates to 4.5% of the AM Post matrix estimation matrix.

6.7.6 Figure 9 show that in the PM Peak, the number of trips in cells that change by more than 100% is 2,100 trips. This equates to 6.5% of the PM post Matrix Estimation matrix.

6.7.7 Ideally, the post matrix estimation impacts would be limited to small changes across the matrix as shown in Figure 6 and Figure 8.

6.7.8 Figure 7 and Figure 9 show that most of the increase in trip numbers are associated with a 6,973 cells in the AM peak and 6,791 cells in the PM peak for which there is a 40% to 100% change in trips numbers in those cells.

6.7.9 The majority of the matrices are subject to small incremental adjustments. Given the trip patterns in the Prior Matrix were last updated in 2008, it is expected that some larger changes in the matrix will be required to reflect these observed local changes. Given that the majority of the matrices are subject to no change or small incremental changes it can be concluded that the changes to the matrices resulting from the matrix estimation process are reasonable.

6.7.10 However, it is recommended that for future applications of the traffic model (post 2017) consideration should be given to updating the trip matrices with up to date origin-destination trip patterns.

6.7.11 The Trip Length Distribution was analysed for differences between the pre and post matrix estimation in both the AM and PM Peaks. These comparisons are shown in Figure 10 and Figure 11.

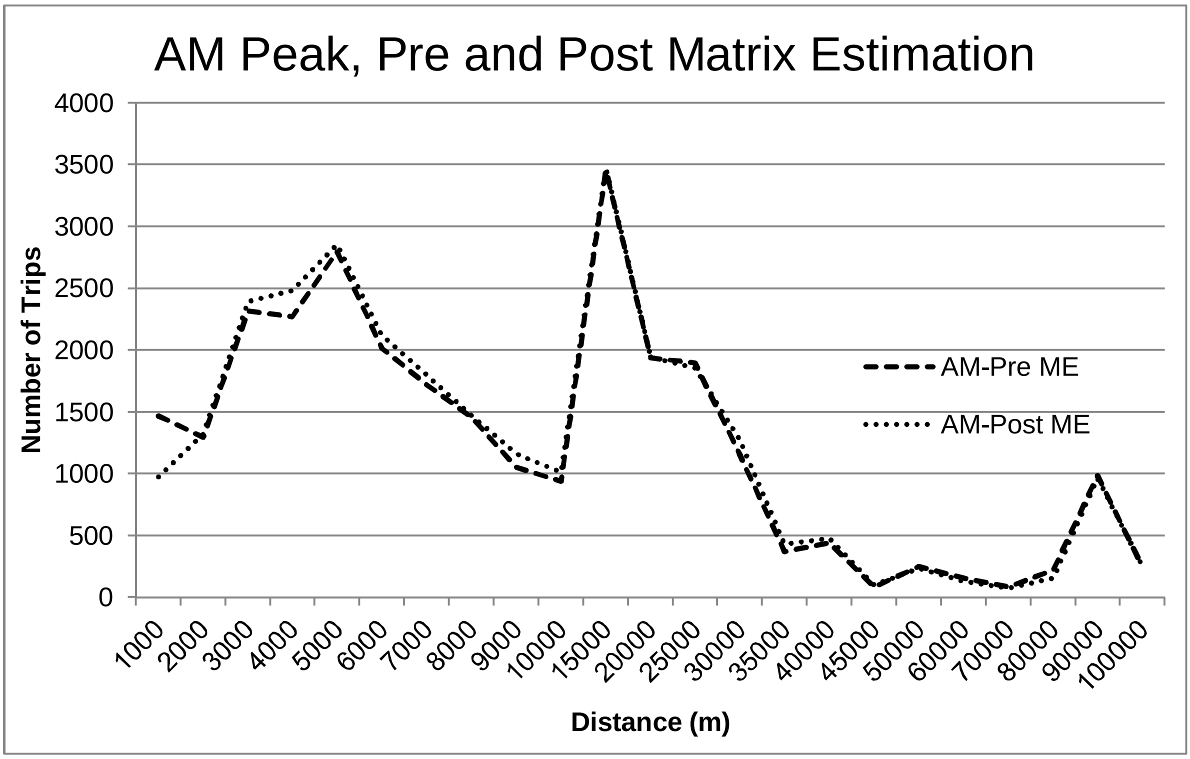


Figure 10. AM Peak Trip Length Distribution Comparison

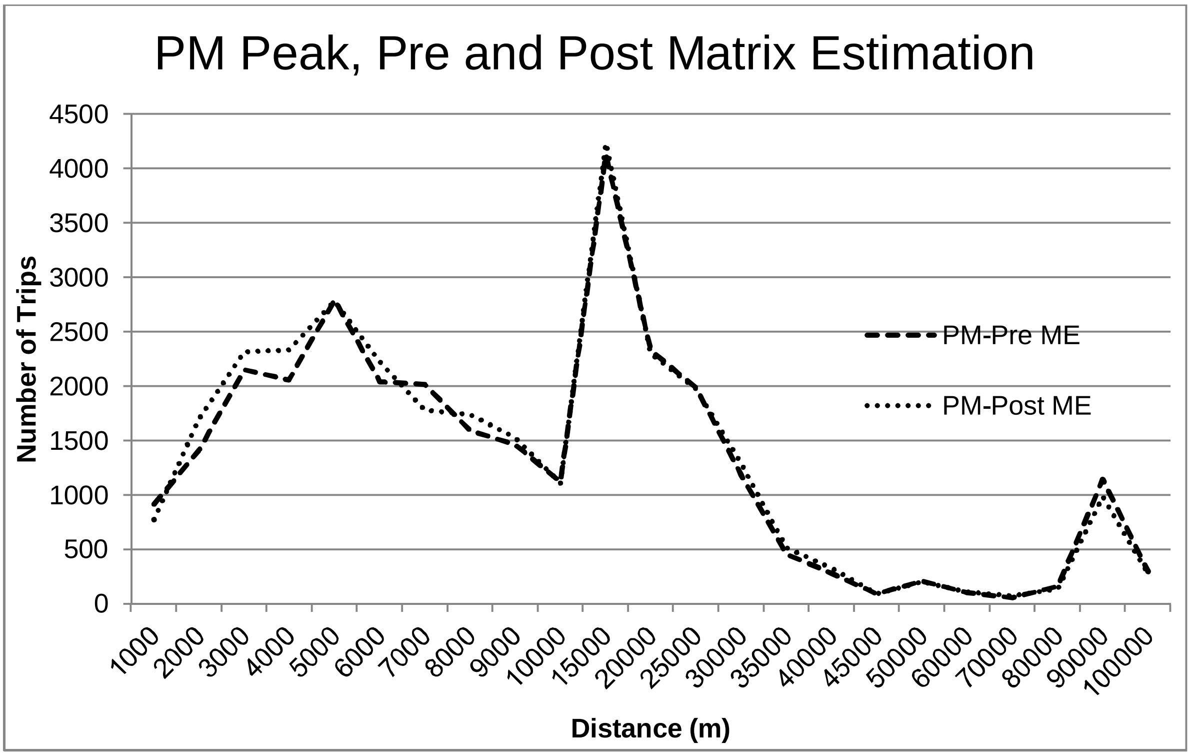


Figure 11. PM Peak Trip Length Distribution Comparison

6.7.12 The AM and PM Peak trip length distributions show that the matrices have not been distorted towards either shorter or longer distance trips by the matrix estimation process. Overall trip length distribution patterns are similar across all distance bands.

6.7.13 Following the checks on the post matrix estimation outputs, the matrix estimation process has created matrices which are reasonable and it is concluded that the post matrix estimation 2016 Base Year matrices are suitable to be used as a basis to take forward to the traffic forecasting and highway impact assessment of the Mansfield Local Plan.

7. Conclusion

7.1.1 Mansfield District Council (MDC) is currently preparing a new development plan to be known as the Mansfield District Local Plan. AECOM (previously URS) began work in 2012.

7.1.2 The 2012 Base Year model, as carried forward from the previous study, does not meet the TAG Validation criteria when compared against 2016 count data. Further work was therefore required to update the 2012 Base Year model to a 2016 Base year model.

7.1.3 The highway network was reviewed to identify any changes to the road network made since 2012. Information relating to possible highway network changes were collected and included to form a 2016 base year network.

7.1.4 Generalised cost were updated by the Department for Transport in the DfT's TAG data book of Spring 2016 (Latest TAG data book at time of base year update).

7.1.5 An updated set of counts was collected to assist with updating the Mansfield SATURN 2016 Base Year Model. Data was collected at 47 different count sites.

7.1.6 Count data has been sourced from:

- 5 new counts commissioned as part of the Mansfield Transport Study:
  - A60 / Baums Lane / Park Lane;
  - New Mill Lane / Sandlands Way;
  - Sandlands Way / A6117 / Heatherley Drive;
  - A60 / Church Street / Wood Street;
  - A60 / Askew Lane / Vale Avenue
- Counts held by Nottinghamshire County Council on the C2 Web count database; and
- Ad-hoc counts used to support planning applications.

7.1.7 Journey time data were obtained for the Nottinghamshire area from the Trafficmaster GPS database, for the period October 2015 to September 2016 inclusive.

7.1.8 The Trafficmaster data were aggregated to give a mean journey time and standard deviation of journey times for each ITN link, in each modelled time period, across all neutral months and all weekdays during the data collection period.

7.1.9 Seven journey time routes in each direction were used to validate the 2016 Mansfield SATURN 2016 Base Year Model.

7.1.10 The number of routes fulfilling the TAG criteria is 93% in the AM peak and 100% in the PM peak, fulfilling the TAG criteria, which requires more than 85% of routes to be within the Journey time validation limits. The Journey time route outside of the 15% range is at +16%, this is the A60 Leeming Lane outbound.

7.1.11 Matrix estimation was used to improve the trip demand matrix. Count data from 2016 was input to adjust the prior matrix to match the specified link counts by selectively factoring the appropriate origin-destination movements.

7.1.12 TAG calibration criterion was achieved because more than 85% of modelled link and turn flows matched the calibration count set.

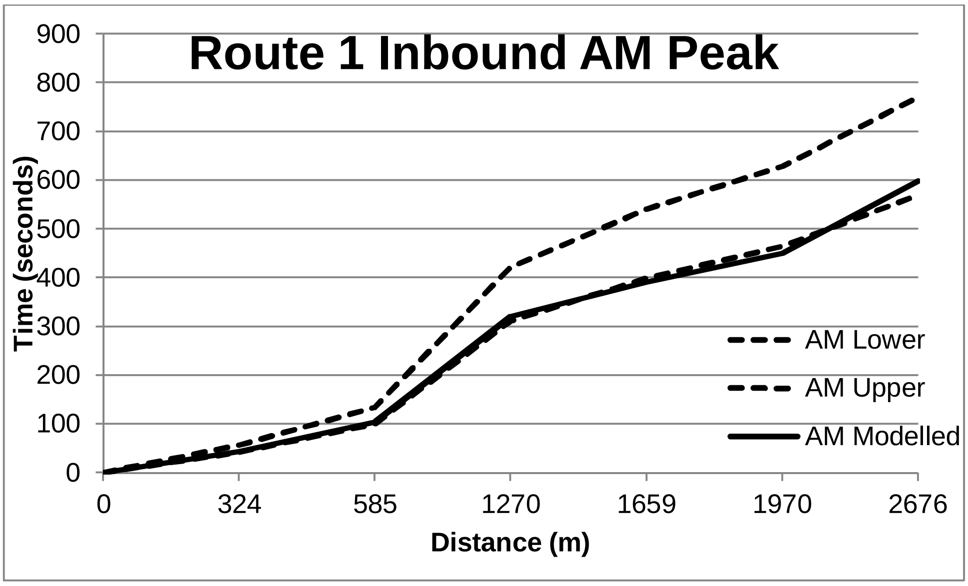
7.1.13 TAG validation criterion was achieved because more than 85% of modelled link and turn flows matched the validation count set. This indicates that the Mansfield SATURN 2016 Base Year model is suitable from which to assess the impacts of the Mansfield District Local Plan.

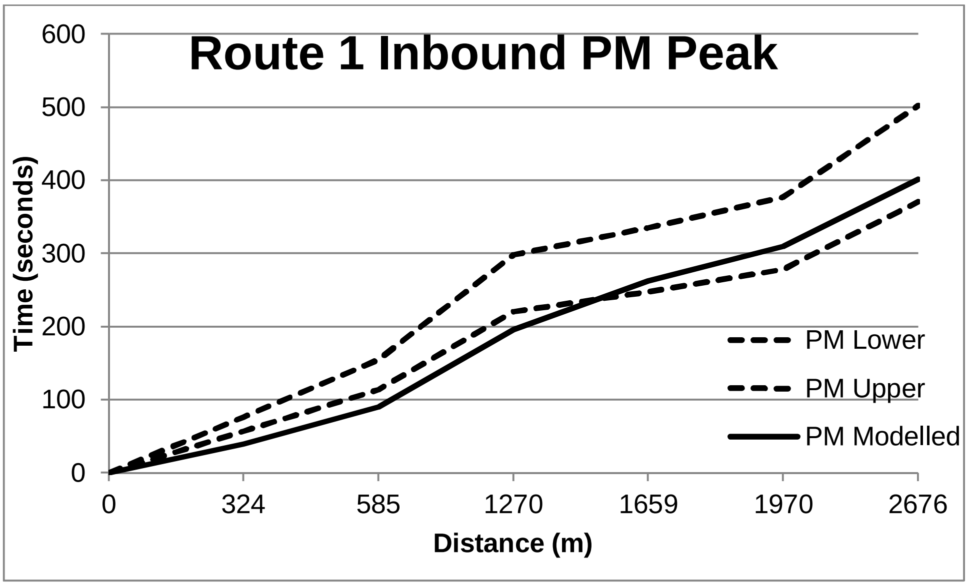
7.1.14 Both the 2016 AM and PM models meet both the count and journey time TAG validation criteria. To ensure that the outputs of the matrix estimation process has not distorted the matrix unacceptably several checks have been undertaken.

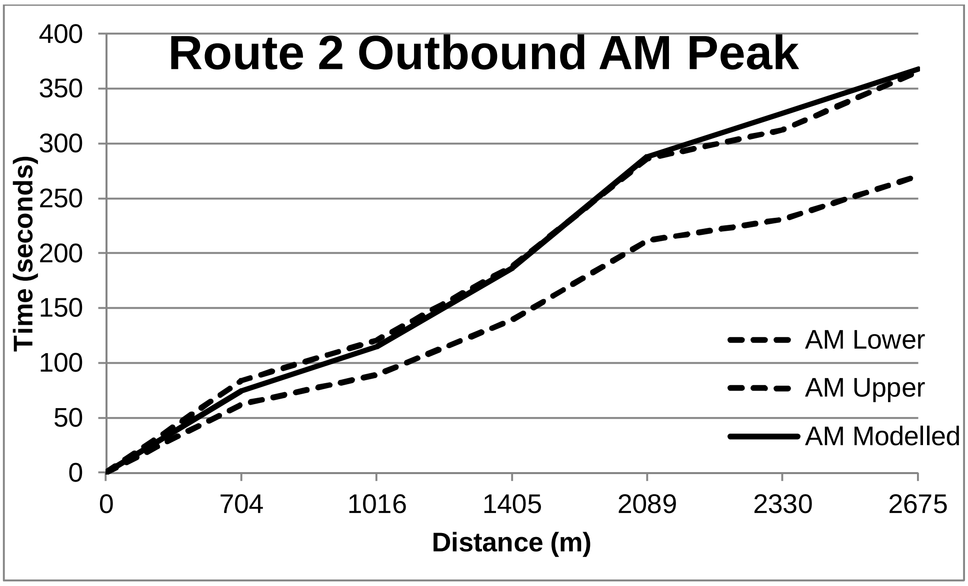
7.1.15 The majority of the matrices are subject to no change or small incremental changes, it can be concluded that the changes to the matrices resulting from the matrix estimation process are reasonable.

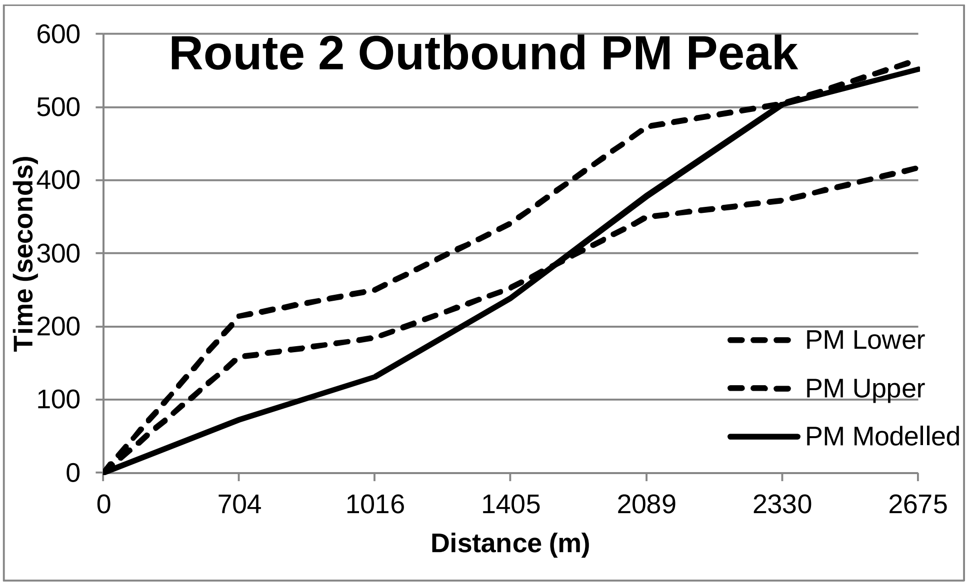
7.1.16 It is concluded that the post matrix estimation 2016 Base Year matrices are suitable to be used as a basis to take forward to the Traffic Forecasting and highway impact assessment of the Mansfield Local Plan.

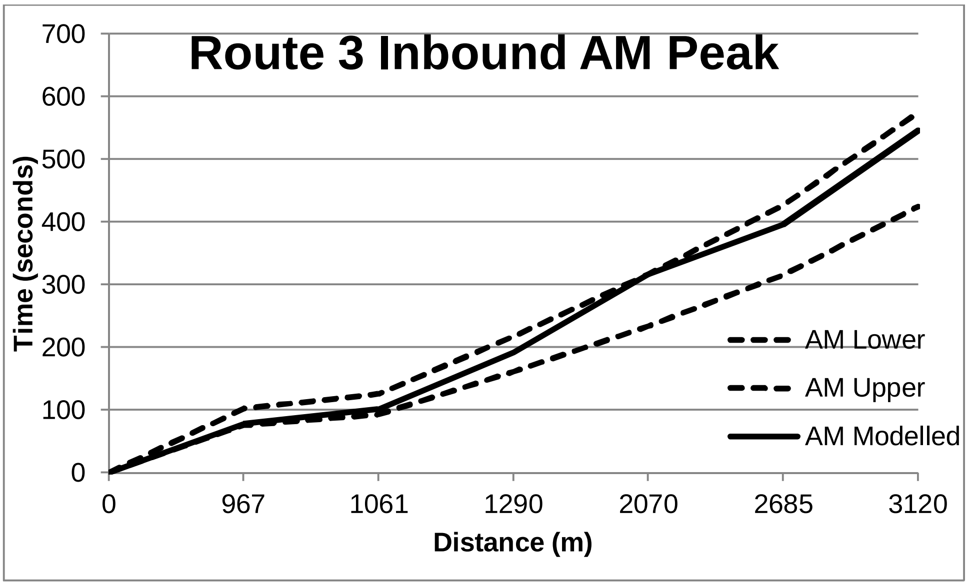
Appendix A Journey Time Plots

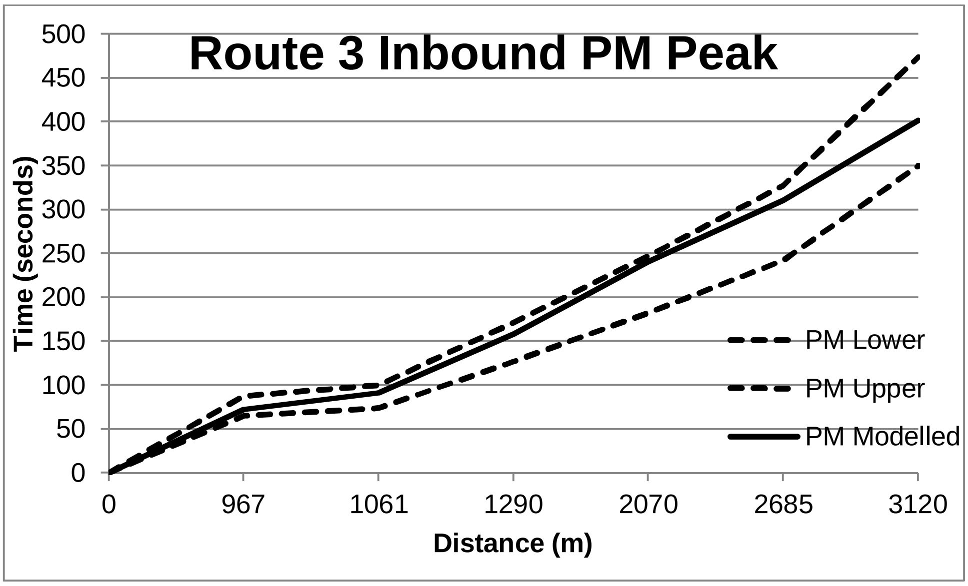

Route 1 Inbound AM Peak
900
800
700
600
500
400
300
200
100
0
Time (seconds)
0
324
585
1270
1659
1970
2676
Distance (m)
AM Lower
AM Upper
AM Modelled

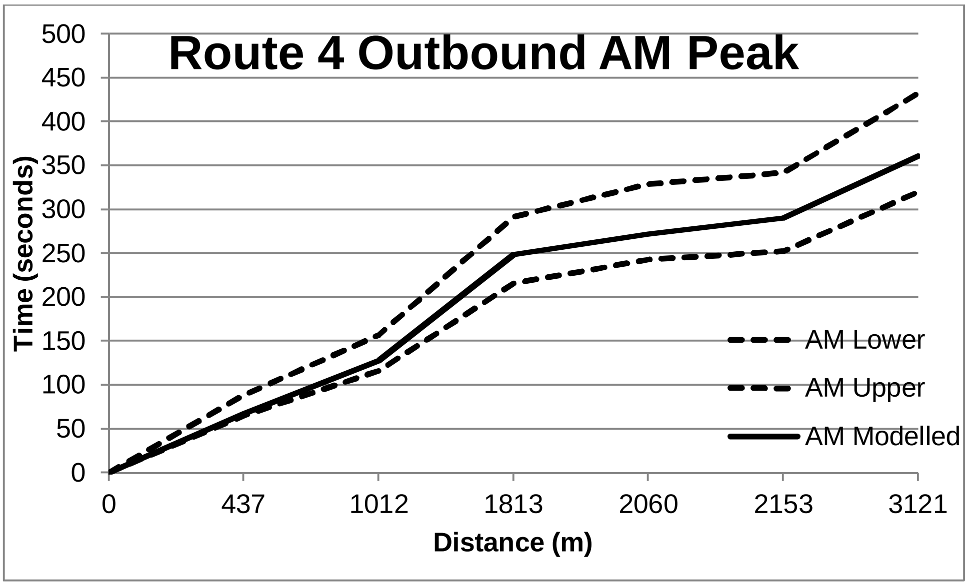

Route 1 Inbound PM Peak
600
500
400
300
200
100
0
Time (seconds)
0
324
585
1270
1659
1970
2676
Distance (m)
PM Lower
PM Upper
PM Modelled

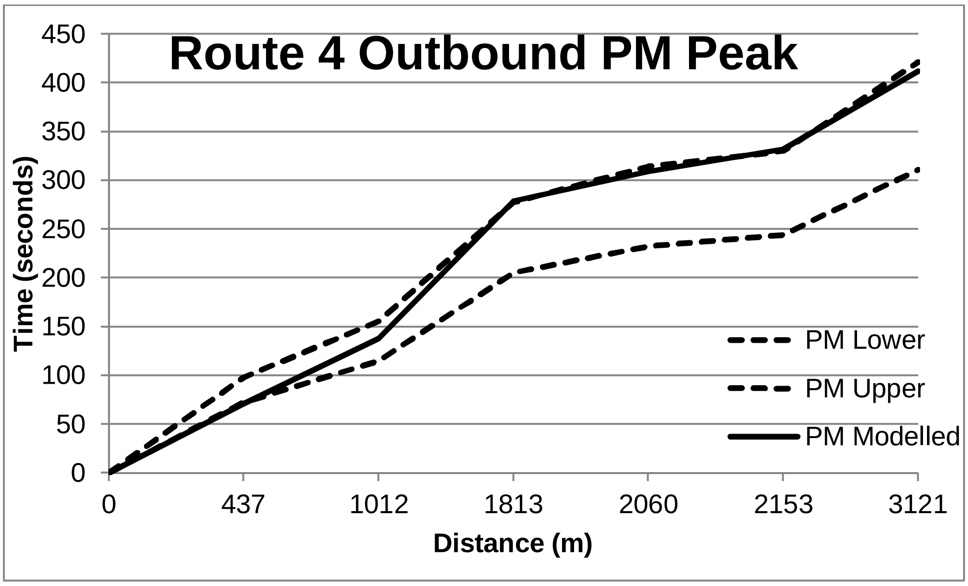

Route 2 Outbound AM Peak
Time (seconds)
400
350
300
250
200
150
100
50
0
0
704
1016
1405
2089
2330
2675
Distance (m)
AM Lower
AM Upper
AM Modelled

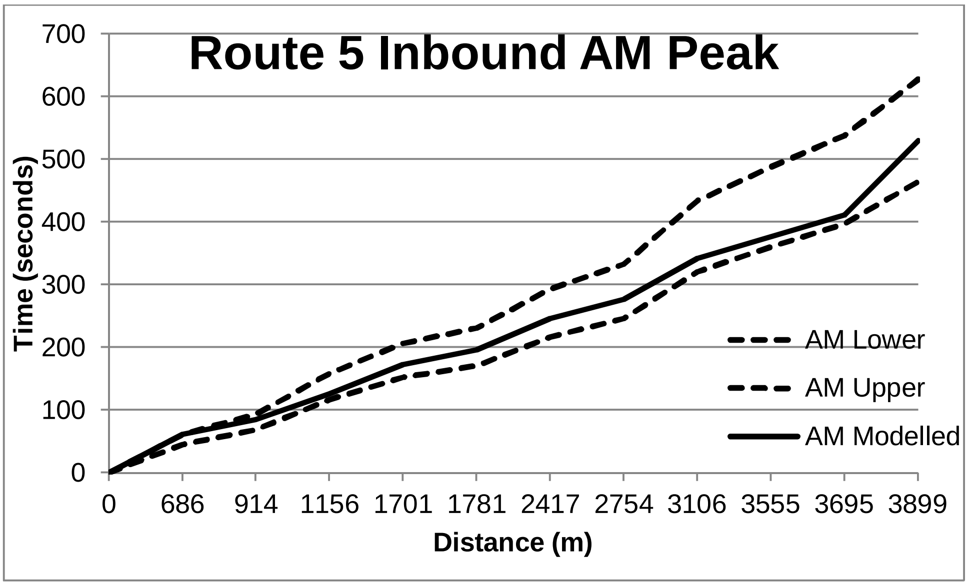

Route 2 Outbound PM Peak
Time (seconds)
600
500
400
300
200
100
0
0
704
1016
1405
2089
2330
2675
Distance (m)
PM Lower
PM Upper
PM Modelled

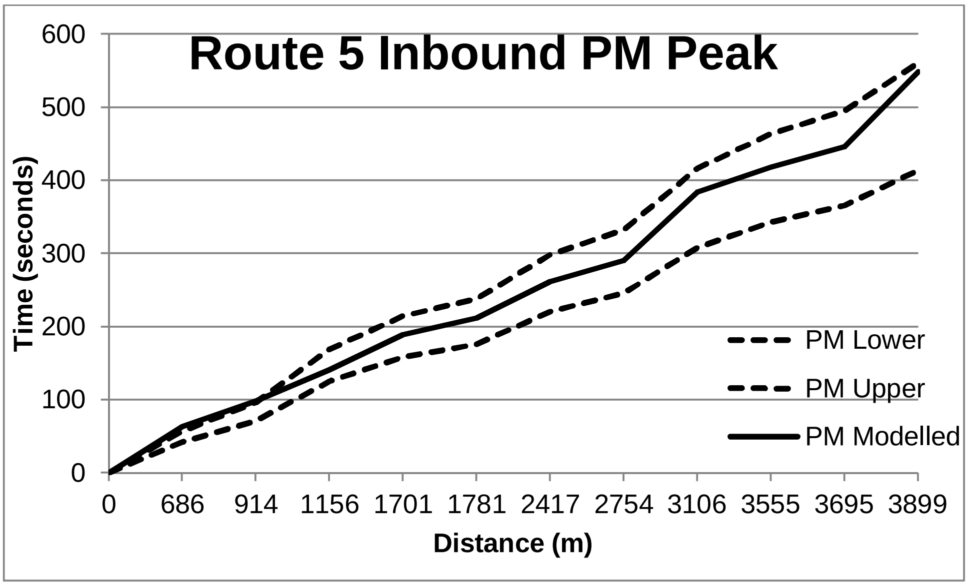

Route 3 Inbound AM Peak
Time (seconds)
700
600
500
400
300
200
100
0
0
967
1061
1290
2070
2685
3120
Distance (m)
AM Lower
AM Upper
AM Modelled

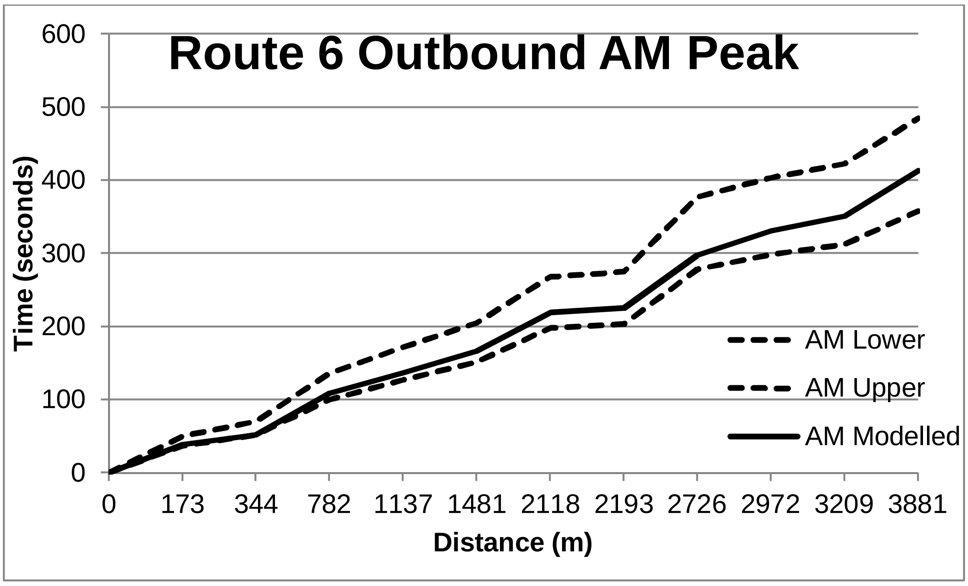

Route 3 Inbound PM Peak
Time (seconds)
500
450
400
350
300
250
200
150
100
50
0
0
967
1061
1290
2070
2685
3120
Distance (m)
PM Lower
PM Upper
PM Modelled

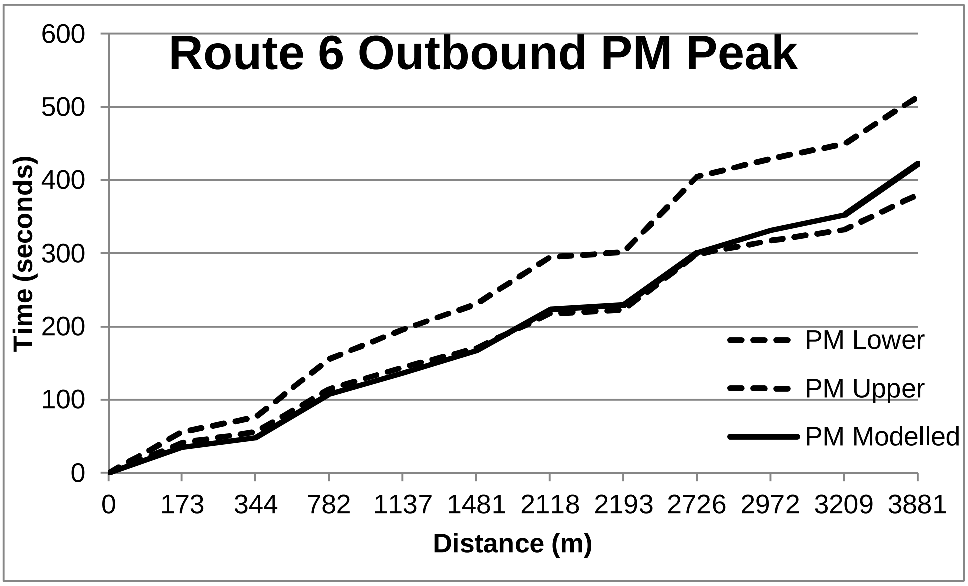

Route 4 Outbound AM Peak
Time (seconds)
500
450
400
350
300
250
200
150
100
50
0
0
437
1012
1813
2060
2153
3121
Distance (m)
AM Lower
AM Upper
AM Modelled

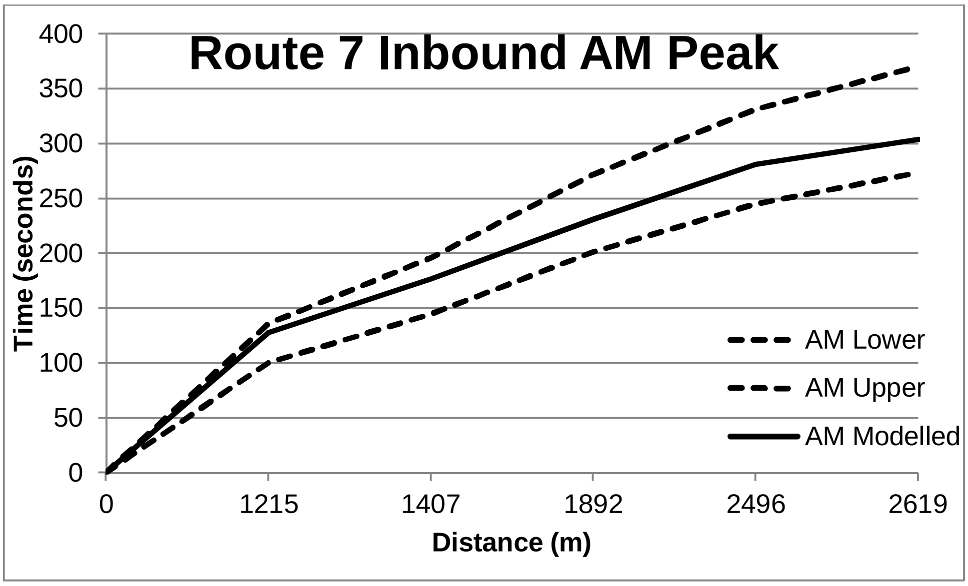

Route 4 Outbound PM Peak
Time (seconds)
450
400
350
300
250
200
150
100
50
0
0
437
1012
1813
2060
2153
3121
Distance (m)
PM Lower
PM Upper
PM Modelled

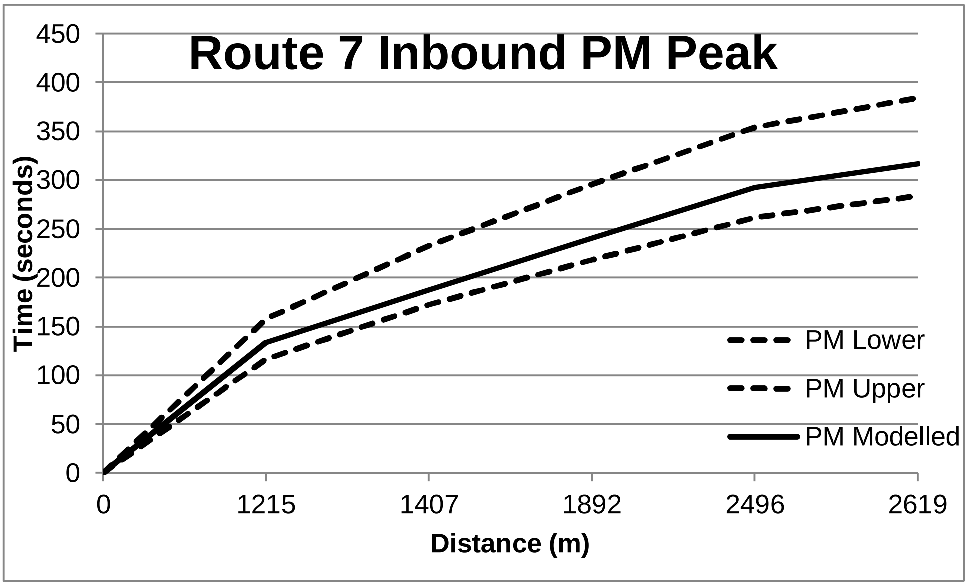

Route 5 Inbound AM Peak
700
600
500
400
300
200
100
0
Time (seconds)
0
686
914
1156
1701
1781
2417
2754
3106
3555
3695
3899
Distance (m)
AM Lower
AM Upper
AM Modelled

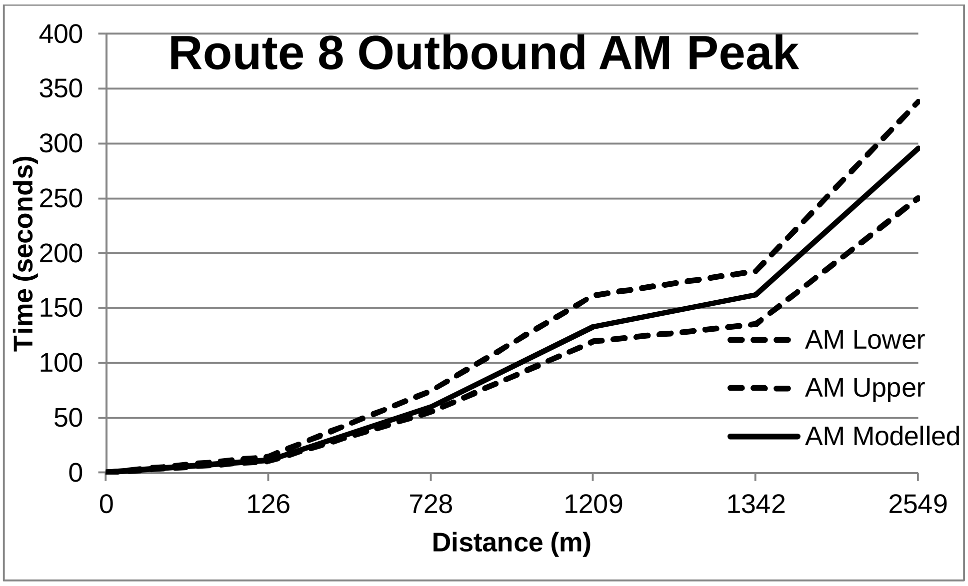

Route 5 Inbound PM Peak
600
500
400
300
200
100
0
Time (seconds)
0
686
914
1156
1701
1781
2417
2754
3106
3555
3695
3899
Distance (m)
PM Lower
PM Upper
PM Modelled

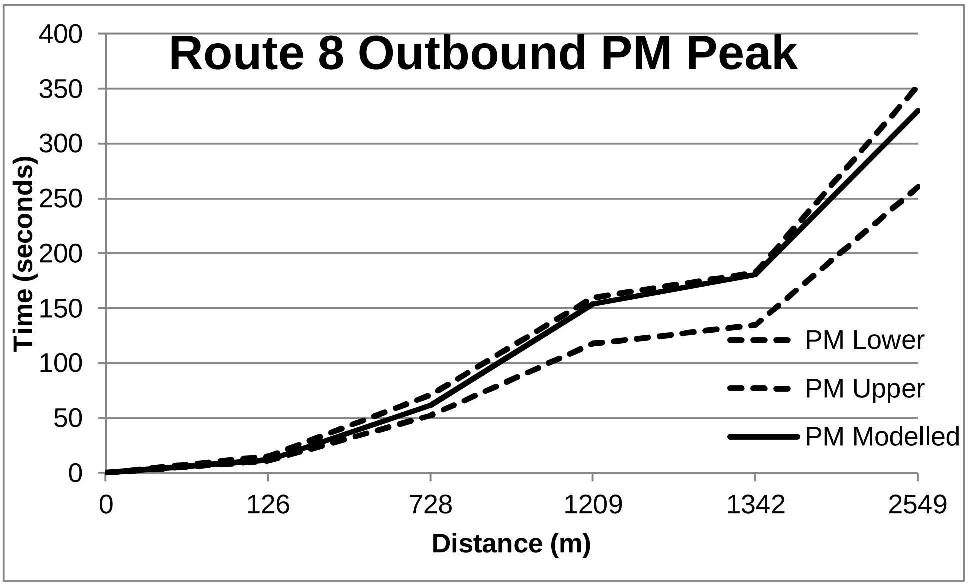

Route 6 Outbound AM Peak
Time (seconds)
600
500
400
300
200
100
0
0
173
344
782
1137
1481
2118
2193
2726
2972
3209
3881
Distance (m)
AM Lower
AM Upper
AM Modelled

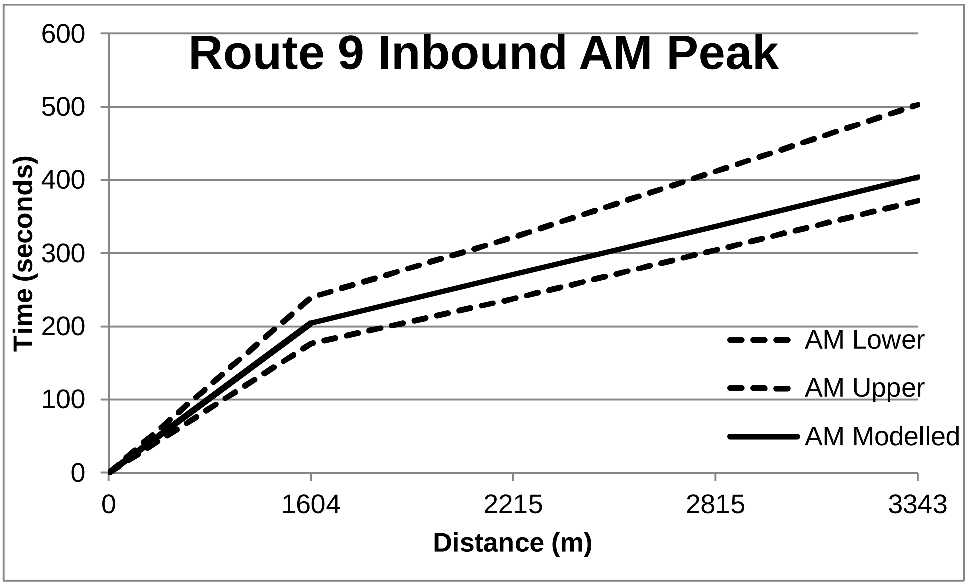

Route 6 Outbound PM Peak
Time (seconds)
600
500
400
300
200
100
0
0
173
344
782
1137
1481
2118
2193
2726
2972
3209
3881
Distance (m)
PM Lower
PM Upper
PM Modelled

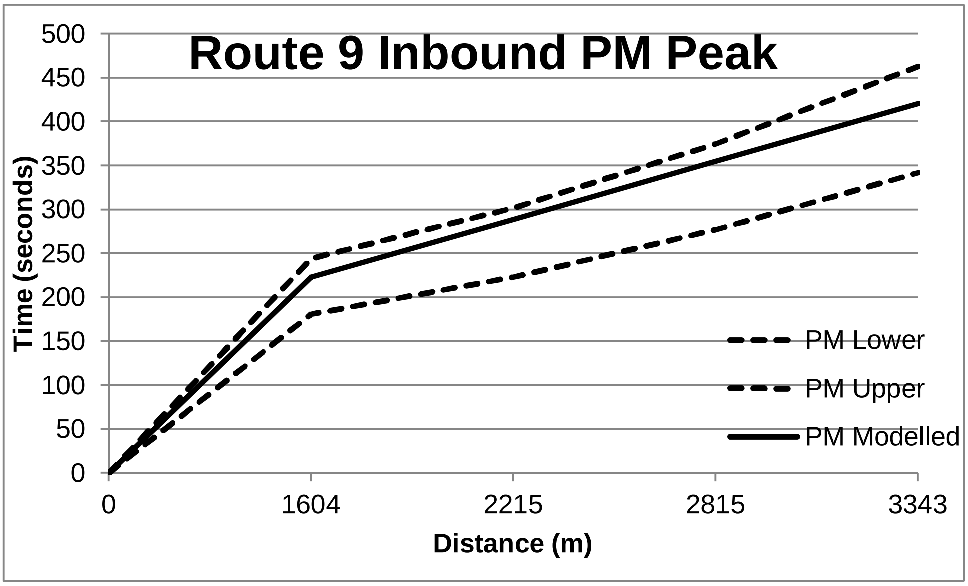

Route 7 Inbound AM Peak
400
350
300
250
200
150
100
50
0
Time (seconds)
0
1215
1407
1892
2496
2619
Distance (m)
AM Lower
AM Upper
AM Modelled

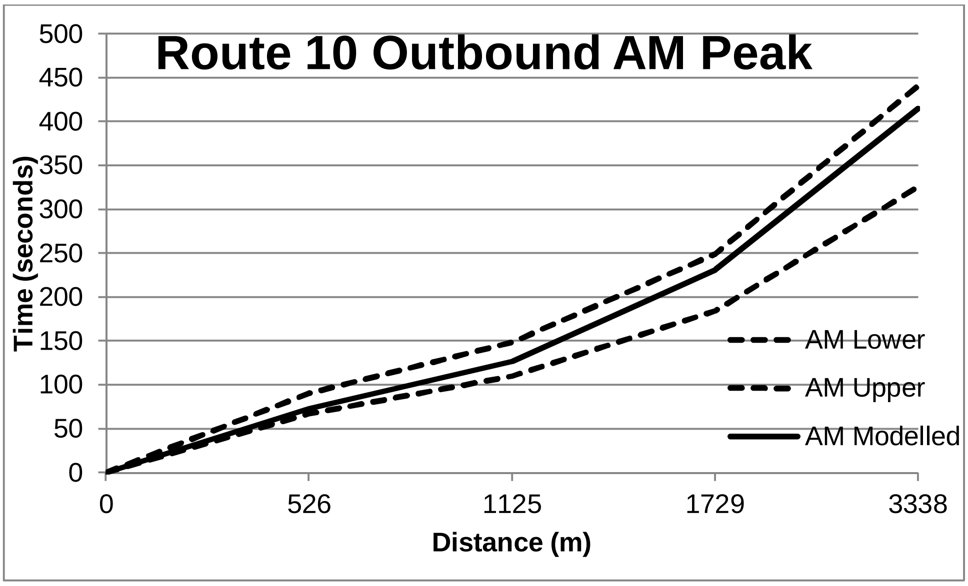

Route 7 Inbound PM Peak
450
400
350
300
250
200
150
100
50
0
Time (seconds)
0
1215
1407
1892
2496
2619
Distance (m)
PM Lower
PM Upper
PM Modelled

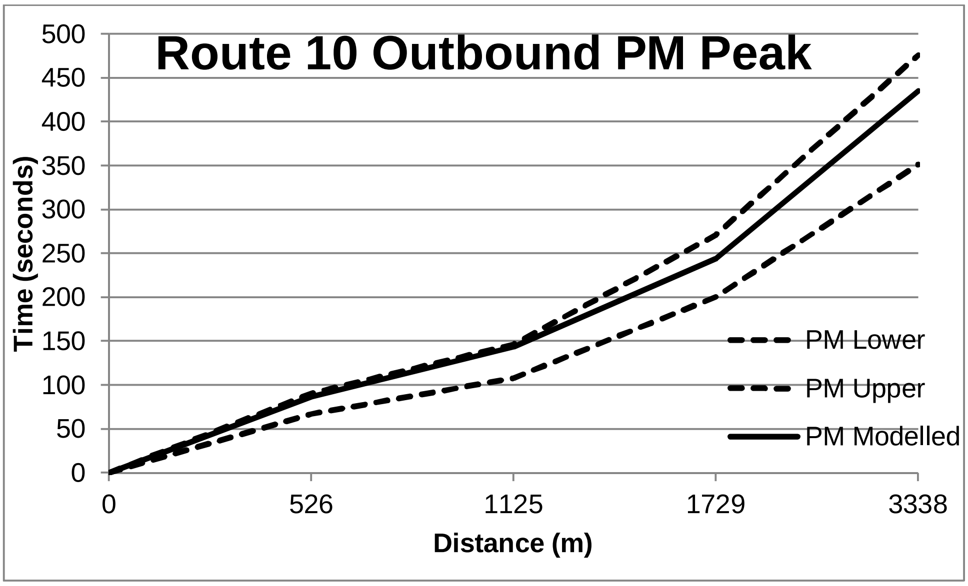

Route 8 Outbound AM Peak
400
350
300
250
200
150
100
50
0
Time (seconds)
0
126
728
1209
1342
2549
Distance (m)
AM Lower
AM Upper
AM Modelled

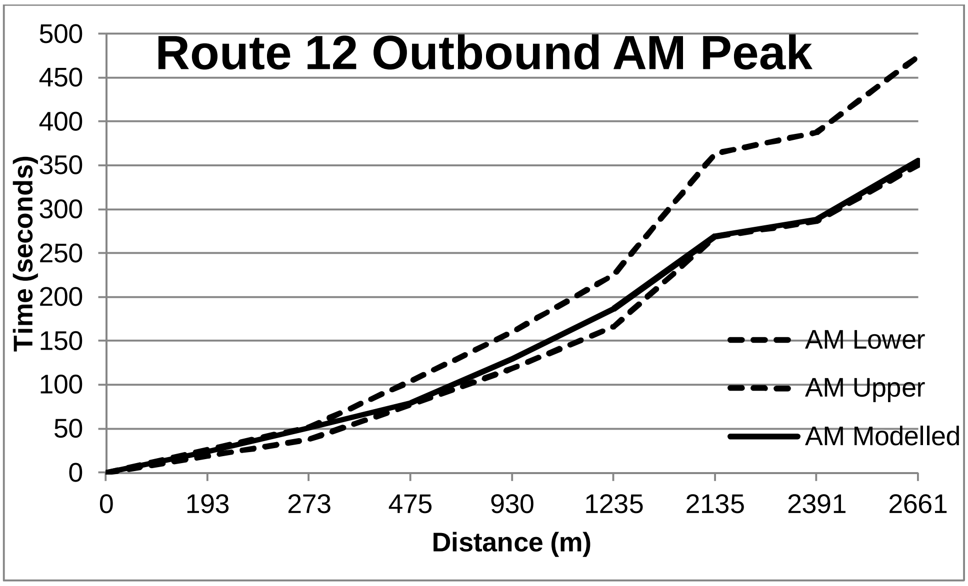

Route 8 Outbound PM Peak
400
350
300
250
200
150
100
50
0
Time (seconds)
0
126
728
1209
1342
2549
Distance (m)
PM Lower
PM Upper
PM Modelled

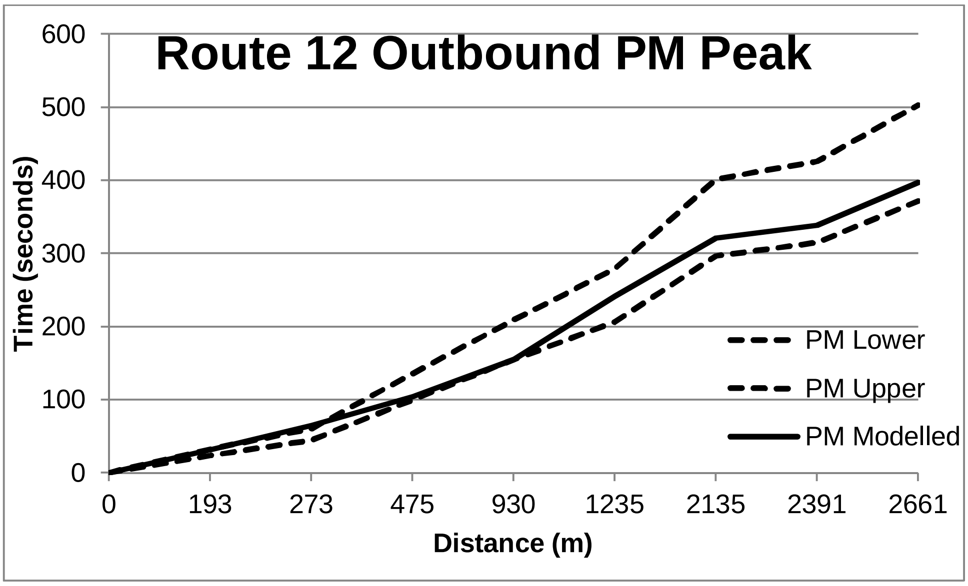

Route 9 Inbound AM Peak
Time (seconds)
600
500
400
300
200
100
0
0
1604
2215
2815
3343
Distance (m)
AM Lower
AM Upper
AM Modelled

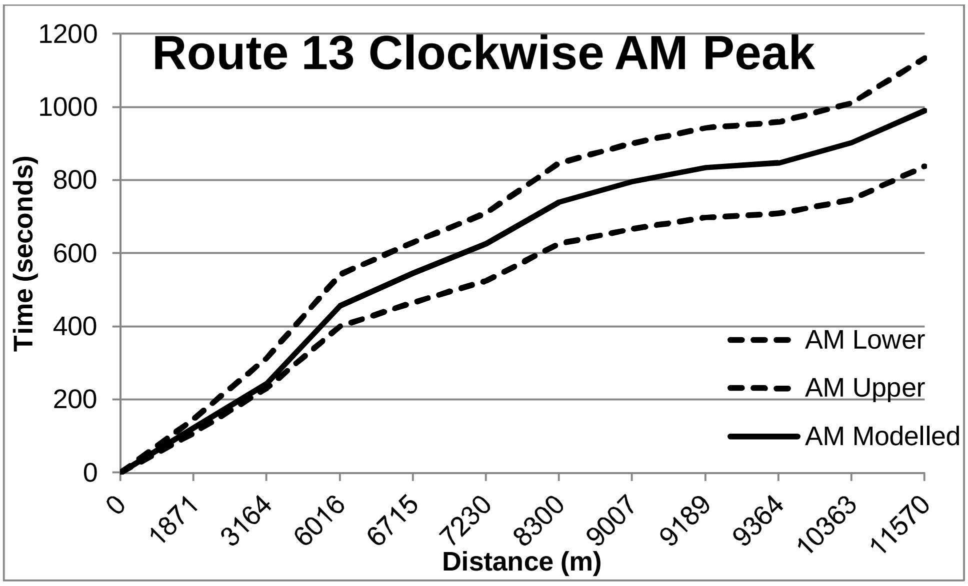

Route 9 Inbound PM Peak
Time (seconds)
500
450
400
350
300
250
200
150
100
50
0
0
1604
2215
2815
3343
Distance (m)
PM Lower
PM Upper
PM Modelled

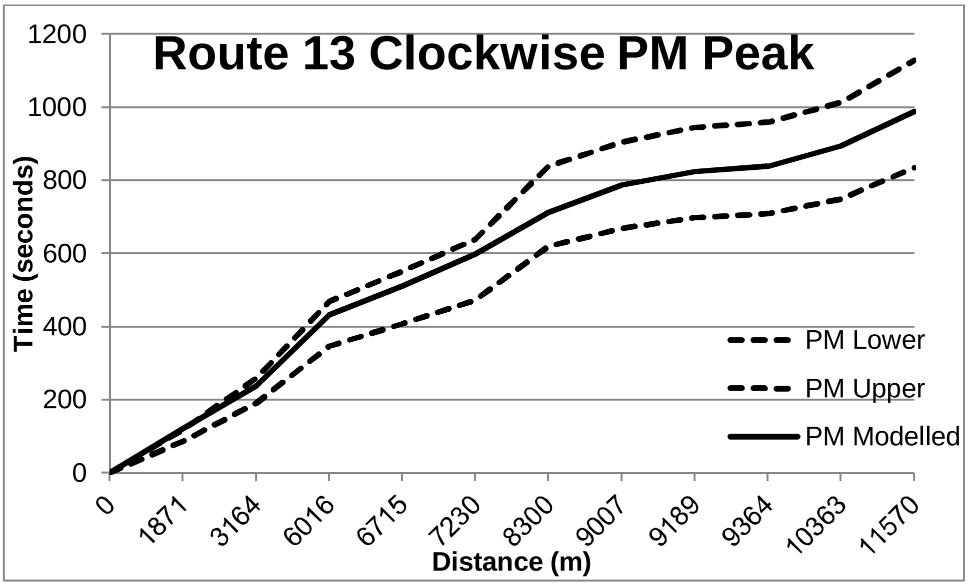

Route 10 Outbound AM Peak
Time (seconds)
500
450
400
350
300
250
200
150
100
50
0
0
526
1125
1729
3338
Distance (m)
AM Lower
AM Upper
AM Modelled

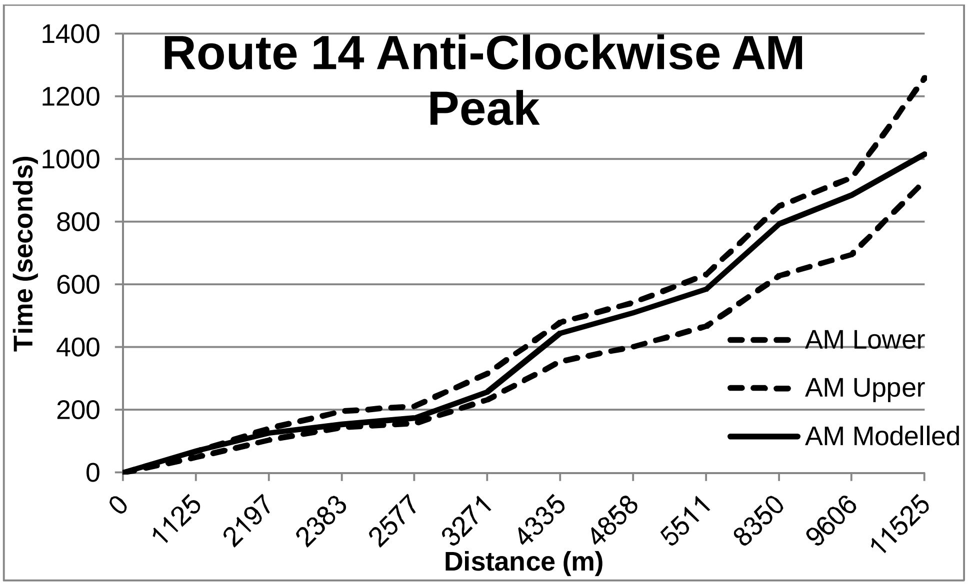

Route 10 Outbound PM Peak
Time (seconds)
500
450
400
350
300
250
200
150
100
50
0
0
526
1125
1729
3338
Distance (m)
PM Lower
PM Upper
PM Modelled

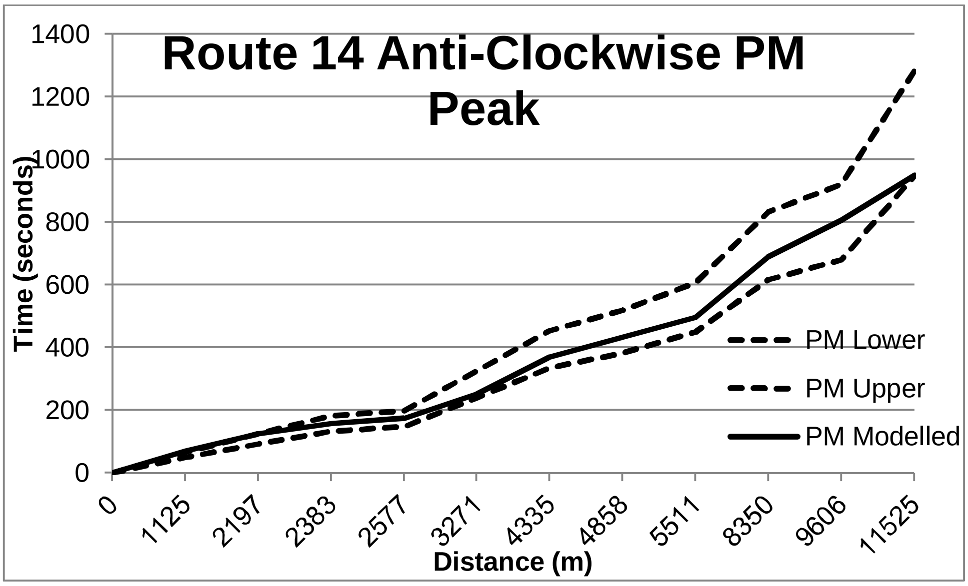

Route 12 Outbound AM Peak
500
450
400
350
300
250
200
150
100
50
0
Time (seconds)
0
193
273
475
930
1235
2135
2391
2661
Distance (m)
AM Lower
AM Upper
AM Modelled


Route 12 Outbound PM Peak
600
500
400
300
200
100
0
Time (seconds)
0
193
273
475
930
1235
2135
2391
2661
Distance (m)
PM Lower
PM Upper
PM Modelled


Route 13 Clockwise AM Peak
Time (seconds)
1200
1000
800
600
400
200
0
0
1871
3164
6016
6715
7230
8300
9007
9189
9364
10363
11570
Distance (m)
AM Lower
AM Upper
AM Modelled


Route 13 Clockwise PM Peak
Time (seconds)
1200
1000
800
600
400
200
0
0
1871
3164
6016
6715
7230
8300
9007
9189
9364
10363
11570
Distance (m)
PM Lower
PM Upper
PM Modelled


Route 14 Anti-Clockwise AM Peak
Time (seconds)
1400
1200
1000
800
600
400
200
0
0
1125
2197
2383
2577
3271
4335
4858
5511
8350
9606
11525
Distance (m)
AM Lower
AM Upper
AM Modelled


Route 14 Anti-Clockwise PM Peak
Time (seconds)
1400
1200
1000
800
600
400
200
0
0
1125
2197
2383
2577
3271
4335
4858
5511
8350
9606
11525
Distance (m)
PM Lower
PM Upper
PM Modelled

Appendix B Calibration Counts

Count Location/Direction/Turning Movement	Count Type	2016 Count AM	2016 Count PM	2016 Base Model AM	2016 Base Model PM	2016 Combined criteria AM	2016 Combined criteria PM
A611 Derby Road, Mansfield (SW)	Link	366	366	354	349	Pass	Pass
A611 Derby Road, Mansfield (NE)	Link	516	575	481	534	Pass	Pass
A617 Kings Mill Road East (NW)	Link	666	1111	703	1355	Pass	Fail
A617 Kings Mill Road East (SE)	Link	1137	631	1114	755	Pass	Pass
A38 Kingsmill (WB)	Link	613	1114	660	1033	Pass	Pass
A38 Kingsmill (EB)	Link	1147	935	1207	868	Pass	Pass
A617 Marr SE of A38 (NW)	Link	1138	1018	1192	1091	Pass	Pass
A617 Marr SE of A38 (SE)	Link	991	1086	1152	1170	Pass	Pass
A38 near Sheepwash Lane (SW)	Link	1087	1067	1318	1126	Fail	Pass
A38 near Sheepwash Lane (NE)	Link	966	909	1368	1060	Fail	Pass
A38 Kings Mill Rd east of B6018 (WB)	Link	994	875	1223	932	Fail	Pass
A38 Kings Mill Rd east of B6018 (EB)	Link	1014	1041	1185	1010	Fail	Pass
A60 Leeming Lane North, Mansfield Woodhouse (SW)	Link	1137	1000	1113	980	Pass	Pass
A60 Leeming Lane North, Mansfield Woodhouse (NE)	Link	981	1301	959	1333	Pass	Pass
A6009 Rosemary Street, Mansfield (SB)	Link	481	488	374	549	Fail	Pass
A6009 Rosemary Street, Mansfield (NB)	Link	487	706	501	715	Pass	Pass
A6009 Mansfield (NB)	Link	781	834	768	775	Pass	Pass
A6009 Mansfield (SB)	Link	555	776	521	761	Pass	Pass
A38 Sutton Road (WB)	Link	663	832	689	856	Pass	Pass
A38 Sutton Road (EB)	Link	848	945	830	951	Pass	Pass
A6191 Mansfield (EB)	Link	898	1176	894	1166	Pass	Pass
A6191 Mansfield (WB)	Link	1054	947	942	941	Pass	Pass
A617 Marr (WB)	Link	777	692	739	707	Pass	Pass
A617 Marr (EB)	Link	538	588	558	611	Pass	Pass

Count Location/Direction/Turning Movement	Count Type	2016 Count AM	2016 Count PM	2016 Base Model AM	2016 Base Model PM	2016 Combined criteria AM	2016 Combined criteria PM
A6117 Adams Way (SB)	Link	452	343	444	357	Pass	Pass
A6117 Adams Way (NB)	Link	446	451	441	464	Pass	Pass
A60 Nottingham Road, Mansfield (SB)	Link	714	769	663	705	Pass	Pass
A60 Nottingham Road, Mansfield (NB)	Link	730	829	753	801	Pass	Pass
C141 Berry Hill Lane (EB)	Link	348	806	389	754	Pass	Pass
C141 Berry Hill Lane (WB)	Link	731	408	679	380	Pass	Pass
A6117 Mansfield (SB)	Link	920	731	919	742	Pass	Pass
A6117 Mansfield (NB)	Link	622	914	625	938	Pass	Pass
New Mill Lane Forest Town (WB)	Link	244	304	196	344	Pass	Pass
New Mill Lane Forest Town (EB)	Link	308	321	350	334	Pass	Pass
Ladybrook Lane Mansfield (WB)	Link	214	229	188	151	Pass	Pass
Ladybrook Lane Mansfield (EB)	Link	143	133	138	136	Pass	Pass
Quaker Way Mansfield (WB)	Link	220	453	228	244	Pass	Fail
MCC1-A60 (North) to Baums Lane	Turn	80	102	95	139	Pass	Pass
MCC1-A60 (North) to A60 (South)	Turn	459	593	402	608	Pass	Pass
MCC1-A60 (North) to Park Lane	Turn	106	323	112	180	Pass	Fail
MCC1-Baums lane to A60 (South)	Turn	40	73	16	51	Pass	Pass
MCC1-Baums lane to Park Lane	Turn	87	134	70	237	Pass	Fail
MCC1-Baums lane to A60 (North)	Turn	95	121	74	107	Pass	Pass
MCC1-A60 (South) to Baums Lane	Turn	58	45	68	38	Pass	Pass
MCC1-A60 (South) to A60 (North)	Turn	602	420	575	440	Pass	Pass
MCC1-A60 (South) to Park Lane	Turn	95	173	111	208	Pass	Pass
MCC1-Park Lane to A60 (North)	Turn	122	208	121	229	Pass	Pass
MCC1-Park Lane to Baums Lane	Turn	36	126	47	99	Pass	Pass
MCC1-Park Lane to A60 (South)	Turn	70	237	42	239	Pass	Pass
MCC1-Park Lane (EB)	Link	228	571	211	568	Pass	Pass

Count Location/Direction/Turning Movement	Count Type	2016 Count AM	2016 Count PM	2016 Base Model AM	2016 Base Model PM	2016 Combined criteria AM	2016 Combined criteria PM
MCC1-Park Lane (WB)	Link	288	630	287	595	Pass	Pass
MCC1-A60 North (SB)	Link	645	1018	609	926	Pass	Pass
MCC1-A60 North (NB)	Link	819	749	764	776	Pass	Pass
MCC1-Baums Lane (EB)	Link	174	273	211	277	Pass	Pass
MCC1-Baums Lane (WB)	Link	222	328	160	394	Pass	Pass
MCC2-New Mills Lane (North) to New Mills Lane (East)	Turn	73	110	105	117	Pass	Pass
MCC2-New Mills Lane (North) to Sandlands Way	Turn	392	322	400	307	Pass	Pass
MCC2-New Mills Lane (East) to New Mills Lane (North)	Turn	93	101	117	140	Pass	Pass
MCC2-New Mills Lane (East) to Sandlands Way	Turn	258	210	233	194	Pass	Pass
MCC2- Sandlands Way to New Mills Road (North)	Turn	283	412	344	393	Pass	Pass
MCC2- Sandlands Way to New Mills Road (East)	Turn	140	246	91	227	Pass	Pass
MCC2-New Mills Lane (NB)	Link	376	513	462	533	Pass	Pass
MCC2-New Mills Lane (SB)	Link	465	432	505	424	Pass	Pass
MCC2-Sandlands Way (EB)	Link	423	658	435	620	Pass	Pass
MCC2-Sandlands Way (WB)	Link	650	532	633	501	Pass	Pass
MCC3-Sandlands Way to A6117 (East)	Turn	447	381	464	374	Pass	Pass
MCC3-Sandlands Way to Heatherly Drive	Turn	63	49	44	48	Pass	Pass
MCC3-Sandlands Way to A6117 (West)	Turn	443	288	422	258	Pass	Pass
MCC3-A6117 (East) to Heatherly Drive	Turn	55	74	52	73	Pass	Pass
MCC3-A6117 (East) to A6117 (West)	Turn	332	377	261	365	Pass	Pass
MCC3-A6117 (East) to Sandlands Way	Turn	314	584	370	582	Pass	Pass
MCC3-Heatherly Drive to A6117 (West)	Turn	92	31	85	31	Pass	Pass
MCC3-Heatherly Drive to Sandlands Way	Turn	64	38	49	38	Pass	Pass
MCC3-Heatherly Drive to A6117 (East)	Turn	72	36	59	35	Pass	Pass
MCC3-A6117 (West) to Sandlands Way	Turn	152	362	94	324	Pass	Pass

Count Location/Direction/Turning Movement	Count Type	2016 Count AM	2016 Count PM	2016 Base Model AM	2016 Base Model PM	2016 Combined criteria AM	2016 Combined criteria PM
MCC3-A6117 (West) to A6117 (East)	Turn	265	296	258	217	Pass	Pass
MCC3-A6117 (West) to Heatherly Drive	Turn	27	17	25	17	Pass	Pass
MCC3-Old Mill Lane (EB) (East)	Link	784	713	781	626	Pass	Pass
MCC3-Old Mill Lane (WB) (East)	Link	701	1035	683	1018	Pass	Pass
MCC3-Heatherly Drive (NB)	Link	228	105	193	104	Pass	Pass
MCC3-Heatherly Drive (SB)	Link	145	140	121	138	Pass	Pass
MCC3-Old Mill Lane (EB) (West)	Link	444	675	377	557	Pass	Pass
MCC3-Old Mill Lane (WB) (West)	Link	867	696	767	654	Pass	Pass
A6075 Debdale Lane NorthEastbound	Link	650	1035	611	1065	Pass	Pass
B6022 STation Road Westbound	Link	378	401	483	404	Fail	Pass
B6033_BathLane NorthEastbound	Link	397	624	459	636	Pass	Pass
B6033_BathLane SouthWestbound	Link	596	253	632	264	Pass	Pass
A60,WarsopRd Warsop Road-A60 (W-N)	Turn	340	376	345	441	Pass	Pass
A60,NewMillLn New Mill Lane-New Mill Lane (W-E)	Turn	161	216	192	212	Pass	Pass
A60 South Southbound	Link	426	442	380	348	Pass	Pass
Skegby Lane Westbound	Link	354	352	386	393	Pass	Pass
Skegby Lane Eastbound	Link	421	322	284	379	Fail	Pass
A617 Southbound	Link	644	496	630	481	Pass	Pass
A617 Northbound	Link	524	634	381	547	Fail	Pass
Abbott Road Southwest bound	Link	886	568	841	573	Pass	Pass
Abbott Road Northeast bound	Link	600	829	620	969	Pass	Pass
Chesterfield Road South (North) Southbound	Link	898	729	963	894	Pass	Fail
Chesterfield Road South (North) Northbound	Link	669	890	651	883	Pass	Pass
Chesterfield Road North Southeast bound	Link	691	778	681	762	Pass	Pass
Chesterfield Road North Northwest bound	Link	696	722	684	776	Pass	Pass
Abbott Road Eastbound	Link	671	743	691	978	Pass	Fail

Count Location/Direction/Turning Movement	Count Type	2016 Count AM	2016 Count PM	2016 Base Model AM	2016 Base Model PM	2016 Combined criteria AM	2016 Combined criteria PM
Abbott Road Westbound	Link	767	648	791	752	Pass	Pass
Chesterfield Road (West) Southeast bound	Link	1003	940	985	929	Pass	Pass
Chesterfield Road (West) Northwest bound	Link	942	1235	926	1316	Pass	Pass
Mansfield Road - Beck Lane (W-N)	Turn	346	373	415	382	Pass	Pass
Mansfield Road - Skegby Lane (W-E)	Turn	267	189	247	257	Pass	Pass
Mansfield Road - Kings Mill Road East (W-S)	Turn	192	69	196	85	Pass	Pass
A60,OldMillLn,ButtLn A60-Butt Lane (S-W)	Turn	5	9	0	0	Pass	Pass
A60,OldMillLn,ButtLn A60-A60 (S-N)	Turn	291	586	244	509	Pass	Pass
A60,OldMillLn,ButtLn A60-Old Mill Lane (S-E)	Turn	159	222	104	155	Pass	Pass
A60,OldMillLn,ButtLn Butt Lane-A60 (W-N)	Turn	17	52	14	45	Pass	Pass
A60,OldMillLn,ButtLn Butt Lane-Old Mill Lane (W-E)	Turn	293	289	280	278	Pass	Pass
A60,OldMillLn,ButtLn Butt Lane-A60 (W-S)	Turn	44	57	0	0	Pass	Pass
A60,OldMillLn,ButtLn A60-Old Mill Lane (N-E)	Turn	103	102	110	107	Pass	Pass
A60,OldMillLn,ButtLn A60-A60 (N-S)	Turn	375	349	330	240	Pass	Fail
A60,OldMillLn,ButtLn A60-Butt Lane (N-W)	Turn	14	8	6	5	Pass	Pass
A60,OldMillLn,ButtLn Old Mill Lane-A60 (E-S)	Turn	227	222	194	219	Pass	Pass
A60,OldMillLn,ButtLn Old Mill Lane-Butt Lane (E-W)	Turn	298	308	265	293	Pass	Pass
A60,OldMillLn,ButtLn Old Mill Lane-A60 (E-N)	Turn	154	213	108	234	Pass	Pass
A60 South Northbound	Link	450	825	348	665	Fail	Fail
A60 South Southbound	Link	653	623	491	458	Fail	Fail
Butt Lane West Eastbound	Link	354	398	293	323	Pass	Pass
Butt Lane West Westbound	Link	317	325	270	298	Pass	Pass
A60 North Southbound	Link	498	454	445	352	Pass	Fail
A60 North Northbound	Link	456	858	365	781	Pass	Pass
Old Mill Lane East Westbound	Link	679	743	566	745	Pass	Pass
Old Mill Lane East Eastbound	Link	555	613	477	515	Pass	Pass

Count Location/Direction/Turning Movement	Count Type	2016 Count AM	2016 Count PM	2016 Base Model AM	2016 Base Model PM	2016 Combined criteria AM	2016 Combined criteria PM
A60 Woodhouse Road (NB)	Link	424	673	419	547	Pass	Fail
A60 Woodhouse Road (SB)	Link	795	552	684	416	Pass	Fail

Appendix C Validation Counts

Count Location/Direction/Turning Movement	Count Type	2016 Count AM	2016 Count PM	2016 Base Model AM	2016 Base Model PM	2016 Combined criteria AM	2016 Combined criteria PM
A38 S of Kingsmill (SW)	Link	978	1191	1148	1287	Fail	Pass
A38 S of Kingsmill (NE)	Link	1286	1200	1275	1319	Pass	Pass
A38 Kings Mill Road East SIA (SW)	Link	1075	1069	1333	976	Fail	Pass
A38 Kings Mill Road East SIA (NE)	Link	1109	1206	1183	1132	Pass	Pass
A617 Marr (WB)	Link	1197	903	1252	982	Pass	Pass
A617 Marr (EB)	Link	947	1182	986	1210	Pass	Pass
A60 Nottingham Road (SB)	Link	568	751	722	714	Fail	Pass
A60 Nottingham Road (NB)	Link	755	777	757	878	Pass	Pass
MCC1-A60 South (SB)	Link	569	903	458	898	Pass	Pass
MCC1-A60 South (NB)	Link	755	638	754	686	Pass	Pass
MCC3-Sandlands Way (NB)	Link	530	984	512	944	Pass	Pass
MCC3-Sandlands Way (SB)	Link	953	718	929	681	Pass	Pass
A60_NottinghamRoad Northbound	Link	552	497	491	466	Pass	Pass
A60_NottinghamRoad Southbound	Link	555	635	453	463	Pass	Fail
A6009_ChesterfieldRoadSouth NorthWestbound	Link	549	844	609	746	Pass	Pass
A6009_ChesterfieldRoadSouth SouthEastbound	Link	961	827	994	791	Pass	Pass
A6075 Debdale Lane SouthWestbound	Link	991	777	998	744	Pass	Pass
B6020_BlidworthRoad Westbound	Link	288	336	392	318	Fail	Pass
B6020_BlidworthRoad Eastbound	Link	289	319	289	335	Pass	Pass
B6022 STation Road Eastbound	Link	437	383	331	348	Fail	Pass
B6139_CoxmoorRoad Northbound	Link	458	380	579	644	Fail	Fail
B6139_CoxmoorRoad Southbound	Link	408	536	571	645	Fail	Pass
A617 Rainworth Bypass West of Colliery Road (Eastbound)	Link	737	967	773	980	Pass	Pass
A617 Rainworth Bypass West of Colliery Road (Westbound)	Link	1047	834	1105	928	Pass	Pass
A60,WarsopRd A60-Warsop Road (S-W)	Turn	5	9	0	0	Pass	Pass

Count Location/Direction/Turning Movement	Count Type	2016 Count AM	2016 Count PM	2016 Base Model AM	2016 Base Model PM	2016 Combined criteria AM	2016 Combined criteria PM
A60,WarsopRd A60-A60 (S-N)	Turn	663	924	714	1038	Pass	Pass
A60,WarsopRd Warsop Road-A60 (W-S)	Turn	1	1	0	0	Pass	Pass
A60,WarsopRd A60-A60 (N-S)	Turn	613	617	670	622	Pass	Pass
A60,WarsopRd A60-Warsop Road (N-W)	Turn	515	373	562	442	Pass	Pass
A60,NewMillLn A60-New Mill Lane (S-W)	Turn	88	51	32	21	Pass	Pass
A60,NewMillLn A60-A60 (S-N)	Turn	410	581	336	654	Pass	Pass
A60,NewMillLn A60-New Mill Lane (S-E)	Turn	37	32	17	86	Pass	Pass
A60,NewMillLn New Mill Lane-A60 (W-N)	Turn	10	35	0	0	Pass	Pass
A60,NewMillLn New Mill Lane-A60 (W-S)	Turn	33	64	8	4	Pass	Pass
A60,NewMillLn A60-New Mill Lane (N-E)	Turn	270	238	334	309	Pass	Pass
A60,NewMillLn A60-A60 (N-S)	Turn	358	356	335	311	Pass	Pass
A60,NewMillLn A60-New Mill Lane (N-W)	Turn	2	9	1	2	Pass	Pass
A60,NewMillLn New Mill Lane-A60 (E-S)	Turn	28	26	37	33	Pass	Pass
A60,NewMillLn New Mill Lane-New Mill Lane (E-W)	Turn	221	168	173	176	Pass	Pass
A60,NewMillLn New Mill Lane-A60 (E-N)	Turn	236	309	378	385	Fail	Pass
ChurchHill,PrioryRd Church Hill Northbound	Link	381	426	313	254	Pass	Fail
ChurchHill,PrioryRd Church Hill Southbound	Link	599	495	416	354	Fail	Fail
A60 North Northbound	Link	990	1311	1036	1373	Pass	Pass
A60 North Southbound	Link	1138	981	1207	1043	Pass	Pass
Warsop Road Eastbound	Link	341	377	345	441	Pass	Pass
Warsop Road Westbound	Link	520	382	562	442	Pass	Pass
A60 South Northbound	Link	526	671	385	761	Fail	Pass
New Mill Lane West Eastbound	Link	205	316	200	216	Pass	Fail
New Mill Lane West Westbound	Link	311	229	206	200	Fail	Pass
A60 North Southbound	Link	625	609	670	622	Pass	Pass
A60 North Northbound	Link	655	944	714	1038	Pass	Pass

Count Location/Direction/Turning Movement	Count Type	2016 Count AM	2016 Count PM	2016 Base Model AM	2016 Base Model PM	2016 Combined criteria AM	2016 Combined criteria PM
New Mill Lane East Westbound	Link	485	503	589	594	Pass	Pass
New Mill Lane East Eastbound	Link	468	486	544	606	Pass	Fail
Beck Lane - Skegby Lane (N-E)	Turn	134	89	0	2	Fail	Pass
Beck Lane - Kings Mill Road East (N-S)	Turn	903	541	864	648	Pass	Pass
Beck Lane - Mansfield Road (N-W)	Turn	414	418	452	273	Pass	Fail
Skegby Lane - Kings Mill Road East (E-S)	Turn	42	21	97	23	Pass	Pass
Skegby Lane - Mansfield Road (E-W)	Turn	197	240	288	370	Pass	Fail
Skegby Lane - Beck Lane (E-N)	Turn	115	91	1	0	Fail	Pass
Kings Mill Road East - Mansfield Road (S-W)	Turn	82	175	127	250	Pass	Pass
Kings Mill Road East - Beck Lane (S-N)	Turn	563	891	485	985	Pass	Pass
Kings Mill Road East - Skegby Lane (S-E)	Turn	21	44	91	120	Pass	Pass
Beck Lane Southbound	Link	1451	1048	1316	923	Pass	Pass
Beck Lane Northbound	Link	1025	1355	838	1366	Fail	Pass
Mansfield Road Eastbound	Link	805	632	858	723	Pass	Pass
Mansfield Road Westbound	Link	693	834	866	848	Fail	Pass
A617 - Abbott Road (N-NE)	Turn	47	55	97	94	Pass	Pass
A617 - Beck Lane (N-SW)	Turn	596	441	533	386	Pass	Pass
Abbott Road - Beck Lane (NE-SW)	Turn	840	517	823	565	Pass	Pass
Abbott Road - A617 (NE-N)	Turn	45	50	18	8	Pass	Pass
Beck Lane - A617 (SW-N)	Turn	479	583	363	538	Fail	Pass
Beck Lane - Abbott Road (SW-NE)	Turn	553	773	523	874	Pass	Pass
Beck Lane Northeast bound	Link	1031	1357	885	1413	Pass	Pass
Beck Lane Southwest bound	Link	1437	958	1327	951	Pass	Pass
Chesterfield Road South (North) - Chesterfield Road South (South) (N-S)	Turn	619	550	679	545	Pass	Pass
Chesterfield Road South (North) - Rosemary Street (N-W)	Turn	278	179	285	349	Pass	Fail

Count Location/Direction/Turning Movement	Count Type	2016 Count AM	2016 Count PM	2016 Base Model AM	2016 Base Model PM	2016 Combined criteria AM	2016 Combined criteria PM
Chesterfield Road South (South) - Rosemary Street (S-W)	Turn	265	155	220	276	Pass	Fail
Chesterfield Road South (South) - Chesterfield Road South (North) (S-N)	Turn	449	597	408	498	Pass	Pass
Rosemary Street - Chesterfield Road South (North) (W-N)	Turn	220	293	244	386	Pass	Pass
Rosemary Street - Chesterfield Road South (South) (W-S)	Turn	314	542	401	465	Pass	Pass
Chesterfield Road South (South) Northbound	Link	715	752	628	774	Pass	Pass
Chesterfield Road South (South) Southbound	Link	934	1092	1080	1010	Pass	Pass
Rosemary Street Eastbound	Link	534	835	645	851	Pass	Pass
Rosemary Street Westbound	Link	543	334	505	615	Pass	Fail
Chesterfield Road North - Debdale Lane (NW-E)	Turn	180	266	132	278	Pass	Pass
Chesterfield Road North - Chesterfield Road South (NW-SE)	Turn	495	476	523	469	Pass	Pass
Chesterfield Road North - Abbott Road (NW-W)	Turn	16	36	26	16	Pass	Pass
Debdale Lane - Chesterfield Road South (E-SE)	Turn	137	103	137	157	Pass	Pass
Debdale Lane - Abbott Road (E-W)	Turn	635	437	688	641	Pass	Fail
Debdale Lane - Chesterfield Road North (E-NW)	Turn	273	206	182	143	Pass	Pass
Chesterfield Road South - Abbott Road (SE-W)	Turn	116	174	88	155	Pass	Pass
Chesterfield Road South - Chesterfield Road North (SE-NW)	Turn	386	490	455	570	Pass	Pass
Chesterfield Road South - Debdale Lane (SE-E)	Turn	77	109	51	141	Pass	Pass
Abbott Road - Chesterfield Road North (W-NW)	Turn	37	26	47	74	Pass	Pass
Abbott Road - Debdale Lane (W-E)	Turn	456	612	430	705	Pass	Pass
Abbott Road - Chesterfield Road South (W-SE)	Turn	178	105	227	211	Pass	Fail
Debdale Lane Westbound	Link	1045	747	1008	941	Pass	Fail
Debdale Lane Eastbound	Link	713	987	613	1110	Pass	Pass
Chesterfield Road North Northwest bound	Link	579	774	595	866	Pass	Pass
Chesterfield Road North Southeast bound	Link	809	685	887	817	Pass	Pass
Woburn Road - Chesterfield Road (East) (NE-SE)	Turn	33	2	20	40	Pass	Pass

Count Location/Direction/Turning Movement	Count Type	2016 Count AM	2016 Count PM	2016 Base Model AM	2016 Base Model PM	2016 Combined criteria AM	2016 Combined criteria PM
Woburn Road - A617 (NE-SW)	Turn	73	19	95	12	Pass	Pass
Woburn Road - Chesterfield Road (West) (NE-NW)	Turn	39	17	39	9	Pass	Pass
Chesterfield Road (East) - A617 (SE-SW)	Turn	49	79	27	42	Pass	Pass
Chesterfield Road (East) - Chesterfield Road (West) (SE-NW)	Turn	450	683	515	828	Pass	Fail
Chesterfield Road (East) - Woburn Road (SE-NE)	Turn	36	5	32	6	Pass	Pass
A617 - Chesterfield Road (West) (SW-NW)	Turn	452	535	372	479	Pass	Pass
A617 - Woburn Road (SW-NE)	Turn	35	21	18	34	Pass	Pass
A617 - Chesterfield Road (East) (SW-NE)	Turn	107	34	42	12	Pass	Pass
Chesterfield Road (West) - Woburn Road (NW-NE)	Turn	33	16	6	6	Pass	Pass
Chesterfield Road (West) - Chesterfield Road (East) (NW-SE)	Turn	574	553	577	480	Pass	Pass
Chesterfield Road (West) - A617 (NW-SW)	Turn	397	371	401	443	Pass	Pass
Woburn Road Southwest bound	Link	145	37	154	61	Pass	Pass
Woburn Road Northeast bound	Link	104	41	57	46	Pass	Pass
Chesterfield Road (East) Northwest bound	Link	536	767	573	877	Pass	Pass
Chesterfield Road (East) Southeast bound	Link	713	589	640	532	Pass	Pass
A617 Northeast bound	Link	594	590	432	525	Fail	Pass
A617 Southwest bound	Link	519	469	523	497	Pass	Pass

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Appendix B Junction Operational Capacity Assessments

Appendix B Junction Operational Capacity Assessments

<u>Introduction</u>

This Appendix summarises the detailed Baseline (2016) and Reference Case (2033) junction assessments described in the main body of the report.

LINSIG3 has been used to assess signalised junctions. LINSIG3 (3.2.28) software provides outputs for both individual approaches and for the junction as a whole. For the individual approaches, the outputs are Degree of Saturation (DoS) and Mean Maximum Queue Length (MMQ). A total-junction statistic known as the Practical Reserve Capacity (PRC) is also reported, which shows the percentage of "spare" capacity left at the junction.

LINSIG works on the basis that a junction is considered to be near to or at capacity when the DoS value on an individual junction approach exceeds 90%. Below this threshold, queues begin to increase slowly as the DoS increases. Above this threshold, queues begin to elongate rapidly. As the DoS on any approach increases, the PRC remaining at the junction decreases.

ARCADY has been used to assess roundabout junctions. The ARCADY software has been run using a synthesised profile and provides outputs in the form of *Ratio of Flow to Capacity* (RFC) and *queue length* (Q). A synthesised profile includes a 12.5% mid-peak increase in traffic demand to robustly test the performance of the junction. For a new roundabout, a target RFC value of 0.85 on the worst-approach during a single time segment is preferred as this minimises the chance that queuing will occur at a new junction on opening. For existing junctions, RFC values above 0.85 are likely to produce queues which increase slowly. Above an RFC value of 1.0, a junction is more than likely to be at capacity (with resulting larger increases in queue length).

PICADY has been used to assess priority junctions.PICADY software has been run using a synthesised profile and provides outputs in the form of Ratios of Flow to Capacity (RFC) and queue length (Q). A synthesised profile includes a 12.5% mid-peak 'surge' to robustly test the performance of the junction. For a junction, a worst-arm target RFC value of 0.85 (or 0.75 in a rural location) during a single time segment is preferred as this minimises the chance that queuing will occur at a new junction on opening. For existing junctions, RFC values above 0.85 are likely to produce queues which increase slowly. Above an RFC value of 1.0, a junction is more than likely to be at capacity (with resulting larger increases in queue length).

Chesterfield Road / Debdale Lane

This is a MOVA controlled signalised junction and, as such, has been assessed using LINSIG3. Chesterfield Road is a key route between the M1 and Mansfield town centre. Abbott Road leads to local housing estates and links into MARR providing routes to Sutton in Ashfield and the A38. Debdale Lane provides routes to Mansfield Woodhouse.

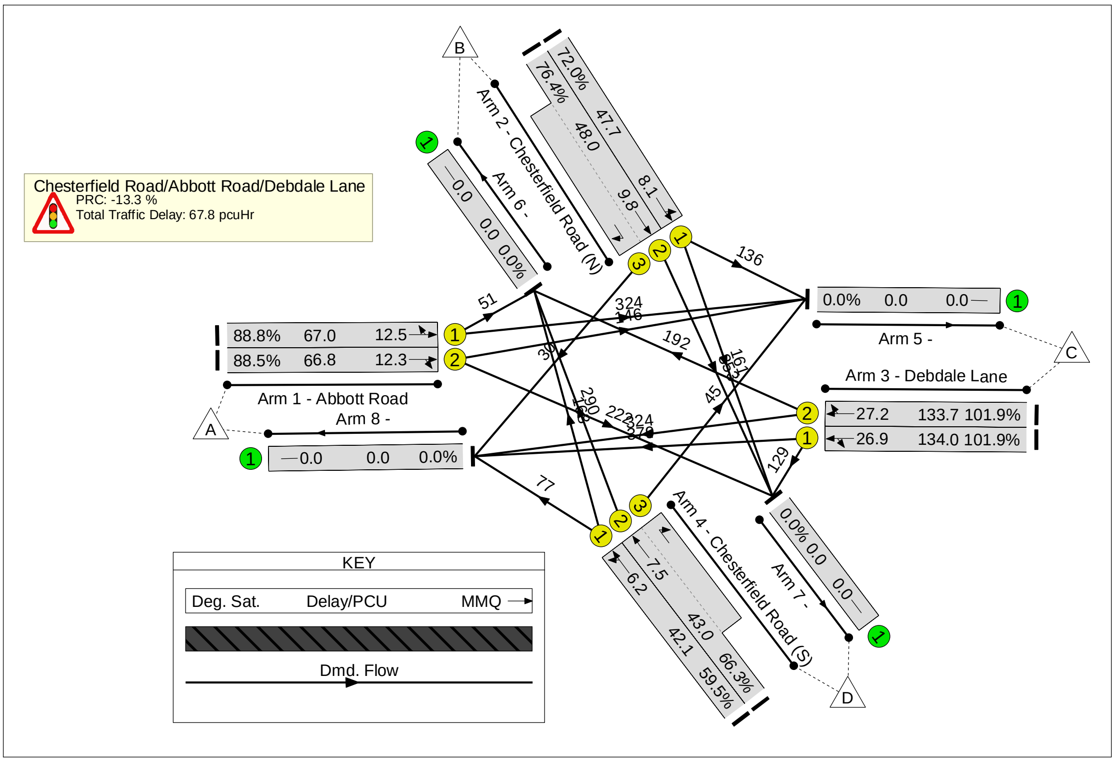


Table 1A: Performance of Chesterfield Road / Debdale Lane (Base Year)

Approach Lane (and flare)	AM (0800 – 0900hrs)		PM (1700 – 1800hrs)	
	DoS	MMQ	DoS	MMQ
Abbott Road Left Ahead	88.8%	12.5	103.4%	29.0
Abbott Road Ahead Right	88.5%	12.3	103.3%	28.8
Chesterfield Road (N) Left Ahead	72.0%	8.1	111.0%	38.3
Chesterfield Road (N) Ahead Right	76.4%	9.8	111.4%	47.0
Debdale Lane Left Ahead	101.9%	26.9	111.0%	41.2
Debdale Lane Ahead Right	101.9%	27.2	111.1%	42.5
Chesterfield Road (S) Left Ahead	59.5%	6.2	83.7%	10.4
Chesterfield Road (S) Ahead Right	66.3%	7.5	88.9%	12.9
Junction Summary	PRC	-13.3	PRC	-23.8
	Veh Delay (PCU Hrs)	67.79	Veh Delay (PCU Hrs)	198.49

Notes: DoS = Degree of Saturation, is the percentage of the traffic demand on a traffic lane compared to the capacity of that traffic lane with the allocated green time.
MMQ = Mean Maximum Queue is the estimated mean of the back of the predicted traffic queue (which is exceeded for 50% of the time).
PCU = Passenger Car Unit. 1 car = 1 PCU / 1 bus = 2 PCU etc.
PRC = Practical Reserve Capacity is the percentage difference between the estimated Degree of Saturation (DoS) and the normal maximum acceptable degree of saturation of 90%.
Delay = Vehicle Delay in PCU-hours per hour.overall percentage "spare" capacity at a junction.
Delay = Vehicle Delay in PCU-hours per hour.

Table 1A indicates that the signal controlled junction at Chesterfield Road / Debdale Lane operates over capacity in both the AM Peak and PM Peak under current conditions. In the AM Peak, the LINSIG analysis indicates that issues are most likely to occur on the Debdale Lane approach however in the PM Peak all arms except the Chesterfield Road arm from the south are over capacity. In the PM Peak the largest queues are likely to form on the Chesterfield Road (N) approach and Debdale Lane approach.

It should also be noted that the junction is operating under Microprocessor Optimised Vehicle Actuation (MOVA) control. This is an advanced form of signal control and, as such, there is unlikely to be any room for improvement in terms of amending the junction timing, other than that some minor improvement might be obtainable from the conversion of pedestrian facilities (which are present on all arms) to puffin-style operation.

In conclusion, a substantial improvement will be required if the junction is to operate with minimal delays and queues in the PM peak hour. It is likely that additional highway areas would need to be acquired from adjacent land holdings if a substantial capacity improvement is to be implemented at the junction.

Alternative solutions might seek to remove some of the traffic movements from the junction, by banning turning movements and providing alternative diversion routes, or to encourage modal shift by introducing selective bus detection at this junction and others along the A6191 and Debdale Lane – Abbott Road corridors. A CCTV based system could also be implemented to enable the urban traffic control centre to intervene with signal settings to respond to incidents and events as they occur.

Table 1B: Performance of Chesterfield Road / Debdale Lane (2033 Reference Case)

Approach Lane (and flare)	AM (0800 – 0900hrs)		PM (1700 – 1800hrs)	
	DoS	MMQ	DoS	MMQ
Abbott Road Left Ahead	123.0%	69.0	126.8%	85.7
Abbott Road Ahead Right	123.1%	67.9	126.7%	84.2
Chesterfield Road (N) Left Ahead	117.7%	59.2	124.8%	70.1
Chesterfield Road (N) Ahead Right	118.0%	69.8	124.9%	84.9
Debdale Lane Left Ahead	122.4%	69.5	122.8%	67.8
Debdale Lane Ahead Right	122.3%	70.9	122.8%	69.1
Chesterfield Road (S) Left Ahead	79.3%	10.2	102.2%	24.4
Chesterfield Road (S) Ahead Right	82.8%	11.7	105.4%	35.5
Junction Summary	PRC	-36.8	PRC	-40.9
	Veh Delay (PCU Hrs)	372.13	Veh Delay (PCU Hrs)	464.16

Notes: DoS = Degree of Saturation, is the percentage of the traffic demand on a traffic lane compared to the capacity of that traffic lane with the allocated green time.
MMQ = Mean Maximum Queue is the estimated mean of the back of the predicted traffic queue (which is exceeded for 50% of the time).
PCU = Passenger Car Unit. 1 car = 1 PCU / 1 bus = 2 PCU etc.
PRC = Practical Reserve Capacity is the percentage difference between the estimated Degree of Saturation (DoS) and the normal maximum acceptable degree of saturation of 90%.
Delay = Vehicle Delay in PCU-hours per hour.overall percentage "spare" capacity at a junction.
Delay = Vehicle Delay in PCU-hours per hour.

Table 1B indicates that the signal controlled junction at Chesterfield Road / Debdale Lane operates over capacity in both the AM Peak and PM Peak in the Reference Case, the measure of DoS are worse (higher) for all arms than in the Base year. The arm with least queueing would be expected to be Chesterfield Road (S) in both the AM and PM Peak.

Localised widening could be undertaken, although any expansion is restrained by the petrol filling station, the public house and local businesses on three corners of the junction. Further capacity improvement will be difficult and/or expensive as it would require land take. A detailed design of junction options would need to be developed in order to assess the feasibility of any potential junction improvements and the impact upon adjacent land owners. Given that a substantial improvement is likely to be required by the forecast year, a localised widening scheme may need to be considered at this junction. Further modelling would be required to establish the benefits of any potential widening scheme.

A60 Nottingham Road / Berry Hill Lane

This is a MOVA controlled signalised junction and, as such, has been assessed using LINSIG3. The A60 Nottingham Road is a key arterial route between Mansfield and Nottingham. Berry Hill Lane leads to local housing and provides a route for east-west movements across Mansfield. Atkin Lane links to local housing and business parks. There is a school located on the corner of Atkin Lane which leads to localised parking/capacity issues at peak times.

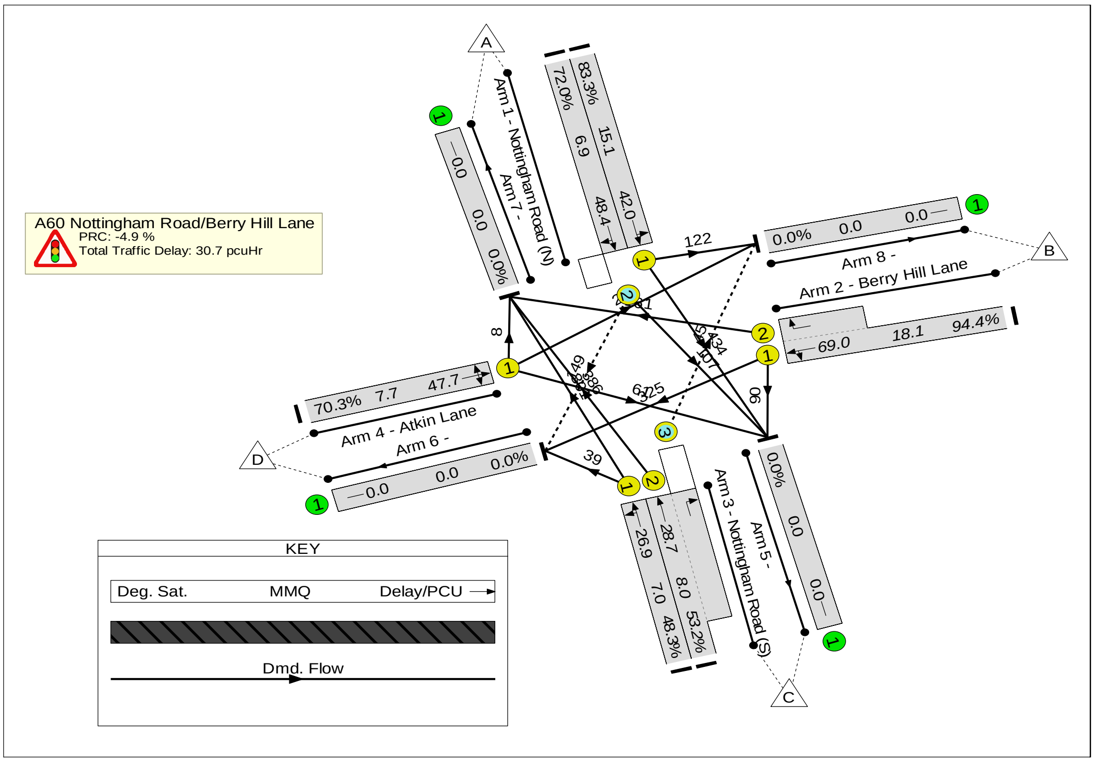


Table 2A: Performance of A60 Nottingham Road / Berry Hill Lane (Base Year)

Approach Lane (and flare)	AM (0800 – 0900hrs)		PM (1700 – 1800hrs)	
	DoS	MMQ	DoS	MMQ
Nottingham Road (N) Left Ahead	83.3%	15.1	86.6%	13.8
Nottingham Road (N) Ahead Right	72.0%	6.9	89.3%	16.0
Berry Hill Lane Left Ahead Right	94.4%	18.1	86.9%	11.3
Nottingham Road (S) Left Ahead	48.3%	7.0	56.5%	7.6
Nottingham Road (S) Ahead Right	53.2%	8.0	63.0%	8.8
Atkin Lane Left Ahead Right	70.3%	7.7	89.5%	15.9
Junction Summary	PRC	-4.9	PRC	0.5
	Veh Delay (PCU Hrs)	30.67	Veh Delay (PCU Hrs)	38.28

Notes: DoS = Degree of Saturation, is the percentage of the traffic demand on a traffic lane compared to the capacity of that traffic lane with the allocated green time.
MMQ = Mean Maximum Queue is the estimated mean of the back of the predicted traffic queue (which is exceeded for 50% of the time).
PCU = Passenger Car Unit. 1 car = 1 PCU / 1 bus = 2 PCU etc.
PRC = Practical Reserve Capacity is the percentage difference between the estimated Degree of Saturation (DoS) and the normal maximum acceptable degree of saturation of 90%.
Delay = Vehicle Delay in PCU-hours per hour.overall percentage "spare" capacity at a junction.
Delay = Vehicle Delay in PCU-hours per hour.

Table 2A indicates that this junction operates near to or at capacity in the AM Peak and operates just within capacity in the PM Peak. The worst performing arm in the AM Peak is the Berry Hill Lane approach. The LINSIG assessment predicts a MMQ of approximately 18 vehicle along this arm.

Table 2B: Performance of A60 Nottingham Road / Berry Hill Lane (2033 Reference Case)

Approach Lane (and flare)	AM (0800 – 0900hrs)		PM (1700 – 1800hrs)	
	DoS	MMQ	DoS	MMQ
Nottingham Road (N) Left Ahead	128.3%	143.8	100.5%	25.8
Nottingham Road (N) Ahead Right	132.5%	28.2	100.8%	28.2
Berry Hill Lane Left Ahead Right	132.1%	109.4	104.1%	32.3
Nottingham Road (S) Left Ahead	67.5%	11.9	76.2%	11.7
Nottingham Road (S) Ahead Right	74.1%	11.0	81.3%	11.6
Atkin Lane Left Ahead Right	128.3%	72.1	102.7%	31.1
Junction Summary	PRC	-47.2	PRC	-15.6
	Veh Delay (PCU Hrs)	334.92	Veh Delay (PCU Hrs)	97.00

Notes: DoS = Degree of Saturation, is the percentage of the traffic demand on a traffic lane compared to the capacity of that traffic lane with the allocated green time.
MMQ = Mean Maximum Queue is the estimated mean of the back of the predicted traffic queue (which is exceeded for 50% of the time).
PCU = Passenger Car Unit. 1 car = 1 PCU / 1 bus = 2 PCU etc.
PRC = Practical Reserve Capacity is the percentage difference between the estimated Degree of Saturation (DoS) and the normal maximum acceptable degree of saturation of 90%.
Delay = Vehicle Delay in PCU-hours per hour.overall percentage "spare" capacity at a junction.
Delay = Vehicle Delay in PCU-hours per hour.

Table 2B, in the 2033 Reference Case, indicates that the performance of this junction worsens from that of the Base Year, which is to be expected. In both AM Peak and PM Peak, this junction is expected to operate over capacity. In both peak periods, all arms except for Nottingham Road (S) approach are over capacity with MMQs of 72 to 144 PCUs in the AM Peak and 25 to 32 PCUs in the PM Peak.

Given the need to maintain the viability of the pedestrian crossings around this junction due to the adjoining school, extending signal timings would not be a reasonable approach for traffic capacity gains. Localised widening could achieve capacity gains but would require third party land and the associated costs. Along the two minor arms, Berry Hill Lane and Atkin Lane, a possible option could be to provide an additional lane at the stop line. This could be achieved by removing the central pedestrian island and altering the operation of the signals so that pedestrians cross straight across the road. This would also benefit pedestrians as there would be less waiting in the middle of the road with just one crossing movement.

Adding an additional lane at the stop line would increase capacity on the widened arms, but in order to facilitate the crossing of pedestrians in one movement, an ‘all red’ stage would need to be added to the signal timings which would increase delays on other arms.

This solution would be subject to a detailed junction design, which would need to quantify whether the increase in capacity obtained by widening would outweigh the reduction in capacity from an ‘all red’ stage. Even if such a scheme provided net increases in capacity, it might not be sufficient to address all delays in the AM Peak in the Reference Case.

Subject to agreement with the bus companies, the current level of bus priority on Nottingham Road could be upgraded to a GPS system and extended to the north approach. The cost of a GPS system is typically £4000-£5000 per junction. A CCTV based system could also be implemented to enable the urban traffic control centre to intervene with signal settings to respond to incidents and events as they occur.

Carter Lane / Southwell Road / Windsor Road

This is a MOVA controlled signalised junction and, as such, has been assessed using LINSIG3. Southwell Road is an arterial route to/from Mansfield town centre. Carter Lane accesses local housing but also provides routes to Forest Town and Clipstone to the east of Mansfield.

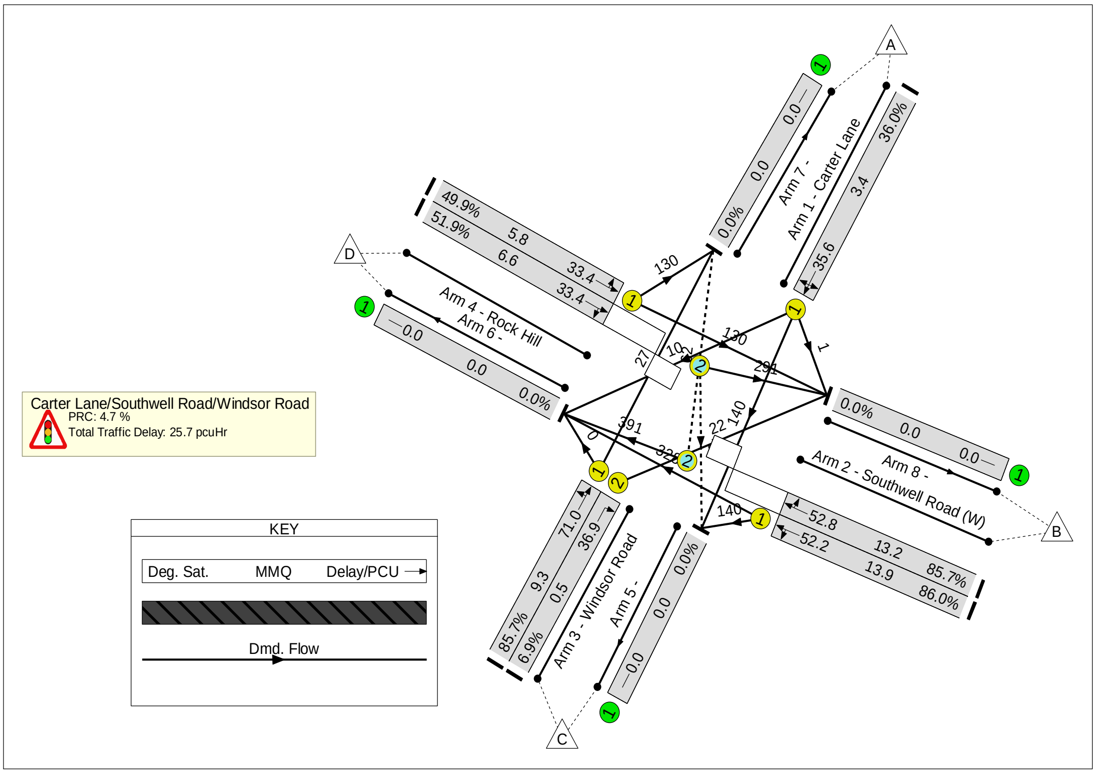


Table 3A: Performance of Carter Lane / Southwell Road / Windsor Road (Base Year)

Approach Lane (and flare)	AM (0800 – 0900hrs)		PM (1700 – 1800hrs)	
	DoS	MMQ	DoS	MMQ
Carter Lane Left Ahead Right	68.6%	4.7	81.1%	5.3
Southwell Road (W) Left Ahead	69.9%	11.2	56.0%	9.0
Southwell Road (W) Ahead Right	66.9%	10.4	81.6%	4.6
Windsor Road Left Ahead	68.6%	7.3	77.7%	7.9
Windsor Road Right	5.5%	0.5	20.8%	1.6
Rock Hill Left Ahead	40.5%	5.2	50.5%	7.5
Rock Hill Ahead Right	42.2%	5.9	51.4%	8.2
Junction Summary	PRC	28.8	PRC	10.3
	Veh Delay (PCU Hrs)	18.97	Veh Delay (PCU Hrs)	20.46

Notes: DoS = Degree of Saturation, is the percentage of the traffic demand on a traffic lane compared to the capacity of that traffic lane with the allocated green time.
MMQ = Mean Maximum Queue is the estimated mean of the back of the predicted traffic queue (which is exceeded for 50% of the time).
PCU = Passenger Car Unit. 1 car = 1 PCU / 1 bus = 2 PCU etc.
PRC = Practical Reserve Capacity is the percentage difference between the estimated Degree of Saturation (DoS) and the normal maximum acceptable degree of saturation of 90%.
Delay = Vehicle Delay in PCU-hours per hour.overall percentage “spare” capacity at a junction.
Delay = Vehicle Delay in PCU-hours per hour.

Table 3A indicates that the Carter Lane / Southwell Road / Windsor Road junction operates within capacity in the AM and PM Peaks in the Base Year. Minimal queues are expected to from with the worst arm being the Southwell Road (W) approach to the junction.

Table 3B: Performance of Carter Lane / Southwell Road / Windsor Road (2033 Reference Case)

Approach Lane (and flare)	AM (0800 – 0900hrs)		PM (1700 – 1800hrs)	
	DoS	MMQ	DoS	MMQ
Carter Lane Left Ahead Right	75.3%	6.1	51.9%	2.4
Southwell Road (W) Left Ahead	81.0%	13.9	38.5%	5.8
Southwell Road (W) Ahead Right	78.9%	13.7	93.6%	10.6
Windsor Road Left Ahead	78.5%	8.8	94.7%	12.4
Windsor Road Right	13.6%	1.1	45.2%	3.5
Rock Hill Left Ahead	70.9%	11.0	61.5%	10.3
Rock Hill Ahead Right	67.5%	10.5	58.3%	10.1
Junction Summary	PRC	11.1	PRC	-5.3
	Veh Delay (PCU Hrs)	28.82	Veh Delay (PCU Hrs)	27.46

Notes: DoS = Degree of Saturation, is the percentage of the traffic demand on a traffic lane compared to the capacity of that traffic lane with the allocated green time.
MMQ = Mean Maximum Queue is the estimated mean of the back of the predicted traffic queue (which is exceeded for 50% of the time).
PCU = Passenger Car Unit. 1 car = 1 PCU / 1 bus = 2 PCU etc.
PRC = Practical Reserve Capacity is the percentage difference between the estimated Degree of Saturation (DoS) and the normal maximum acceptable degree of saturation of 90%.
Delay = Vehicle Delay in PCU-hours per hour.overall percentage “spare” capacity at a junction.
Delay = Vehicle Delay in PCU-hours per hour.

Table 3B indicates that whilst the operation of the Carter Lane / Southwell Road / Windsor Road junction worsens in the 2033 Reference Case, in the AM Peak the junction is still expected to operate within capacity. In the PM Peak the junction operates near to or at capacity with the Southwell Road (W) and Windsor Road arms performing the worst, however queues do not extend to unacceptable levels, typically around 10 PCUs.

The issue for this junction appears to be the level of demand flow making the ahead movement from Windsor Road to Carter Lane. It would be difficult to implement widening for this movement as there is not sufficient room available on either the approach or exit to improve the operation.

An approach to allow queuing on the non-strategic routes (Carter Lane and Windsor Road) in order to give additional capacity to the strategic traffic to/from Mansfield (Southwell Road) was discounted by the highway authority. A detailed review at this traffic signal junction might show that fine tuning of the signal timings would resolve some of the capacity issues associated with the Reference Case traffic without physical works at the junction. However, VIA have pointed out that biasing green times is contrary to the principles of MOVA control, under which this junction operates.

The introduction of selective bus detection at this junction and others along the A6191 corridor could contribute to modal shift. A CCTV based system could also be implemented to enable the urban traffic control centre to intervene with signal settings to respond to incidents and events as they occur.

A60 Leeming Lane / Peafield Lane

This is a MOVA controlled signalised junction and, as such, has been assessed using LINSIG3. The A60 provides a link between Mansfield and Market Warsop. Peafield Lane provides a route to Edwinstowe.

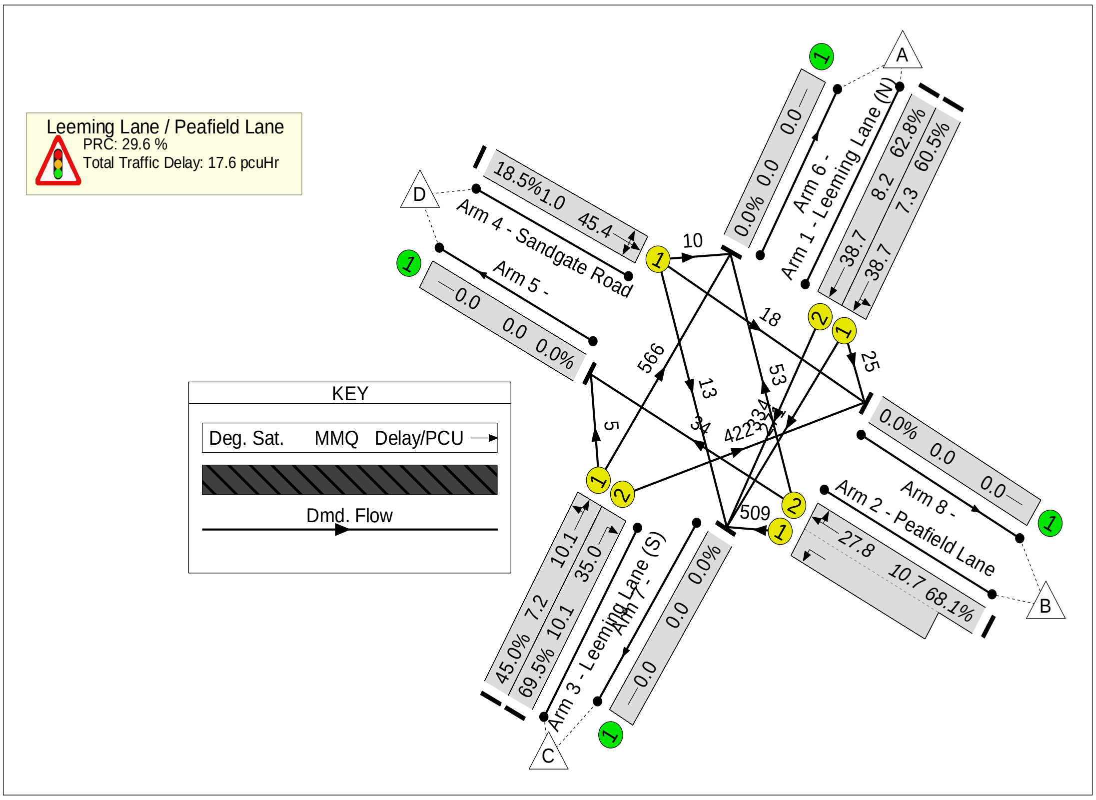


Table 4A: Performance of A60 Leeming Lane / Peafield Lane (Base Year)

Approach Lane (and flare)	AM (0800 – 0900hrs)		PM (1700 – 1800hrs)	
	DoS	MMQ	DoS	MMQ
Leeming Lane (N) Left Ahead	70.0%	7.9	75.4%	7.9
Leeming Lane (N) Ahead	71.8%	8.9	77.4%	8.8
Peafield Lane Left Ahead Right	72.8%	11.6	56.2%	8.0
Leeming Lane (S) Left Ahead	50.1%	8.7	72.8%	16.1
Leeming Lane (S) Right	79.7%	11.5	75.5%	11.4
Sandgate Road Left Ahead Right	25.4%	1.1	25.7%	1.2
Junction Summary	PRC	12.9	PRC	16.3
	Veh Delay (PCU Hrs)	21.37	Veh Delay (PCU Hrs)	21.90

Notes: DoS = Degree of Saturation, is the percentage of the traffic demand on a traffic lane compared to the capacity of that traffic lane with the allocated green time.
MMQ = Mean Maximum Queue is the estimated mean of the back of the predicted traffic queue (which is exceeded for 50% of the time).
PCU = Passenger Car Unit. 1 car = 1 PCU / 1 bus = 2 PCU etc.
PRC = Practical Reserve Capacity is the percentage difference between the estimated Degree of Saturation (DoS) and the normal maximum acceptable degree of saturation of 90%.
Delay = Vehicle Delay in PCU-hours per hour.overall percentage "spare" capacity at a junction.
Delay = Vehicle Delay in PCU-hours per hour.

Table 4A indicates that the junction of A60 Leeming Lane / Peafield Lane operates within capacity in the Base Year in both the AM Peak and PM Peak time periods. All arms operate with a DoS below 80% and therefore queueing would not typically be expected to occur at this location.

Table 4B: Performance of A60 Leeming Lane / Peafield Lane (2033 Reference Case)

Approach Lane (and flare)	AM (0800 – 0900hrs)		PM (1700 – 1800hrs)	
	DoS	MMQ	DoS	MMQ
Leeming Lane (N) Left Ahead	88.0%	17.0	53.7%	10.1
Leeming Lane (N) Ahead	86.1%	16.7	52.5%	10.1
Peafield Lane Left Ahead Right	105.0%	55.9	102.7%	37.2
Leeming Lane (S) Left Ahead	105.9%	54.1	118.5%	126.9
Leeming Lane (S) Right	84.6%	19.4	117.6%	68.1
Sandgate Road Left Ahead Right	7.9%	1.2	10.8%	1.4
Junction Summary	PRC	-17.7	PRC	-31.7
	Veh Delay (PCU Hrs)	99.89	Veh Delay (PCU Hrs)	194.61

Notes: DoS = Degree of Saturation, is the percentage of the traffic demand on a traffic lane compared to the capacity of that traffic lane with the allocated green time.
MMQ = Mean Maximum Queue is the estimated mean of the back of the predicted traffic queue (which is exceeded for 50% of the time).
PCU = Passenger Car Unit. 1 car = 1 PCU / 1 bus = 2 PCU etc.
PRC = Practical Reserve Capacity is the percentage difference between the estimated Degree of Saturation (DoS) and the normal maximum acceptable degree of saturation of 90%.
Delay = Vehicle Delay in PCU-hours per hour.overall percentage "spare" capacity at a junction.
Delay = Vehicle Delay in PCU-hours per hour.

Table 4B indicates that the junction of A60 Leeming Lane / Peafield Lane operates over capacity in the Reference Case in the AM Peak and PM Peak time period. The worst performing arm in both time periods is the Leeming Lane (S) approach.

The heavy right turn movement from Leeming Lane (S) to Peafield Lane and the conflicting Leeming Lane (N) to Leeming Lane (S) movement appear to be causing the restriction in operating capacity at this junction in the Reference Case.

There is a wide verge and footway to the west of the A60 north of the junction: it might be feasible to widen and realign the A60 north of the junction in order to provide three lanes southbound at the stopline (Lane 1 left, Lane 2 ahead, Lane 3 ahead), in place of the current two lanes (Lane 1 left and ahead, Lane 2 ahead). The capacity of the A60 southbound flow would be restricted by the merge from two lanes down to one on the A60 southbound exit from the junction: modelling would be required to quantify the benefits of any potential widening.

There are pedestrian crossing facilities on three of the four arms of the junction (Peafield Lane (East), Leeming Lane (South) and Sandgate Road (West)). Conversion of these facilities to puffin-style operation might release some green time, providing capacity benefits.

Introduction of selective bus detection at this junction and others on the A60 corridor could contribute to modal shift.

Sutton Road / Skegby Lane / Sheepbridge Lane

This is a SCOOT controlled signalised junction and, as such, has been assessed using LINSIG3. The A38 forms the south west radial route into Mansfield town centre. Skegby Lane on the west side of the junction provides a link to the northern part of Sutton in Ashfield. Sheepbridge Lane to the south east of the junction provides a route to the Berry Hill area of Mansfield. The results of the operational analysis are presented in Table 5A and 5B.

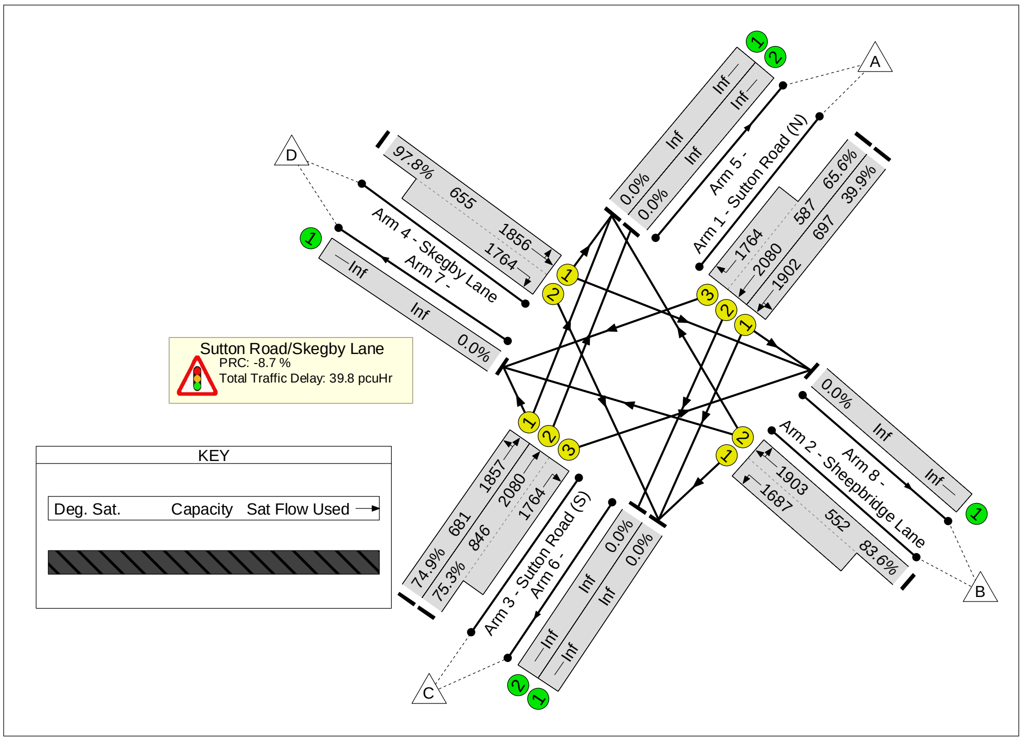


Table 5A: Performance of Sutton Road / Skegby Lane / Sheepbridge Lane (Base Year)

Approach Lane (and flare)	AM (0800 – 0900hrs)		PM (1700 – 1800hrs)	
	DoS	MMQ	DoS	MMQ
Sutton Road (N) Left Ahead	78.8%	14.1	67.1%	8.6
Sutton Road (N) Ahead Right	68.9%	3.7	72.1%	9.8
Sheepbridge Lane Left Ahead Right	83.6%	8.8	100.7%	21.0
Sutton Road (S) Left Ahead	71.5%	11.6	102.3%	39.2
Sutton Road (S) Ahead Right	77.9%	13.1	77.5%	9.1
Skegby Lane Left Ahead Right	97.8%	18.1	100.8%	18.2
Junction Summary	PRC	-8.7	PRC	-13.6
	Veh Delay (PCU Hrs)	42.08	Veh Delay (PCU Hrs)	73.82

Notes: DoS = Degree of Saturation, is the percentage of the traffic demand on a traffic lane compared to the capacity of that traffic lane with the allocated green time.
MMQ = Mean Maximum Queue is the estimated mean of the back of the predicted traffic queue (which is exceeded for 50% of the time).
PCU = Passenger Car Unit. 1 car = 1 PCU / 1 bus = 2 PCU etc.
PRC = Practical Reserve Capacity is the percentage difference between the estimated Degree of Saturation (DoS) and the normal maximum acceptable degree of saturation of 90%.
Delay = Vehicle Delay in PCU-hours per hour.overall percentage "spare" capacity at a junction.
Delay = Vehicle Delay in PCU-hours per hour.

Table 5A indicates that the Sutton Road / Skegby Lane / Sheepbridge Lane junction operates near to or at capacity in the Base Year in the AM Peak and just over capacity in the PM Peak. In the AM Peak the worst performing arm is Skegby Lane with queues of up to 18 PCUs. In the PM Peak the worst performing arm is Sutton Road (S) with queues up to 39 PCUs.

Table 5B: Performance of Sutton Road / Skegby Lane / Sheepbridge Lane (2033 Reference Case)

Approach Lane (and flare)	AM (0800 – 0900hrs)		PM (1700 – 1800hrs)	
	DoS	MMQ	DoS	MMQ
Sutton Road (N) Left Ahead	72.7%	10.5	79.3%	11.9
Sutton Road (N) Ahead Right	78.2%	12.2	82.1%	13.3
Sheepbridge Lane Left Ahead Right	106.5%	32.4	114.5%	52.6
Sutton Road (S) Left Ahead	107.8%	42.7	111.3%	55.3
Sutton Road (S) Ahead Right	106.6%	50.2	112.5%	78.2
Skegby Lane Left Ahead Right	105.4%	48.8	113.6%	58.3
Junction Summary	PRC	-19.7	PRC	-27.2
	Veh Delay (PCU Hrs)	157.17	Veh Delay (PCU Hrs)	223.05

Notes: DoS = Degree of Saturation, is the percentage of the traffic demand on a traffic lane compared to the capacity of that traffic lane with the allocated green time.
MMQ = Mean Maximum Queue is the estimated mean of the back of the predicted traffic queue (which is exceeded for 50% of the time).
PCU = Passenger Car Unit. 1 car = 1 PCU / 1 bus = 2 PCU etc.
PRC = Practical Reserve Capacity is the percentage difference between the estimated Degree of Saturation (DoS) and the normal maximum acceptable degree of saturation of 90%.
Delay = Vehicle Delay in PCU-hours per hour.overall percentage "spare" capacity at a junction.
Delay = Vehicle Delay in PCU-hours per hour.

Table 5B indicates that the operation of the Sutton Road / Skegby Lane / Sheepbridge Lane worsens in the Reference Case when compared to the Base Year. Both the AM and PM Peak periods operate over capacity.

The junction has residential, business and public house premises on the four corners so localised widening of the approaches would be likely to require the acquisition of property. Cycle times at the junction could be extended to increase vehicle capacity but this would come with a disbenefit to pedestrian wait times.

Modal change may be encouraged by the introduction of selective bus detection at this junction (and others along the A38 corridor).

A CCTV based system could also be implemented to enable the urban traffic control centre to intervene with signal settings to respond to incidents and events as they occur.

Kings Mill Road / Beck Lane / B6014 Skegby Lane / Mansfield Road

This is a MOVA controlled signalised junction and, as such, has been assessed using LINSIG3. Kings Mill Road facilitates north-south movements and accommodates flows circulating around the town centre using the MARR. Mansfield Road leads to the residential areas around Skegby and Stanton Hill whilst Skegby Lane leads towards Mansfield via the A38.

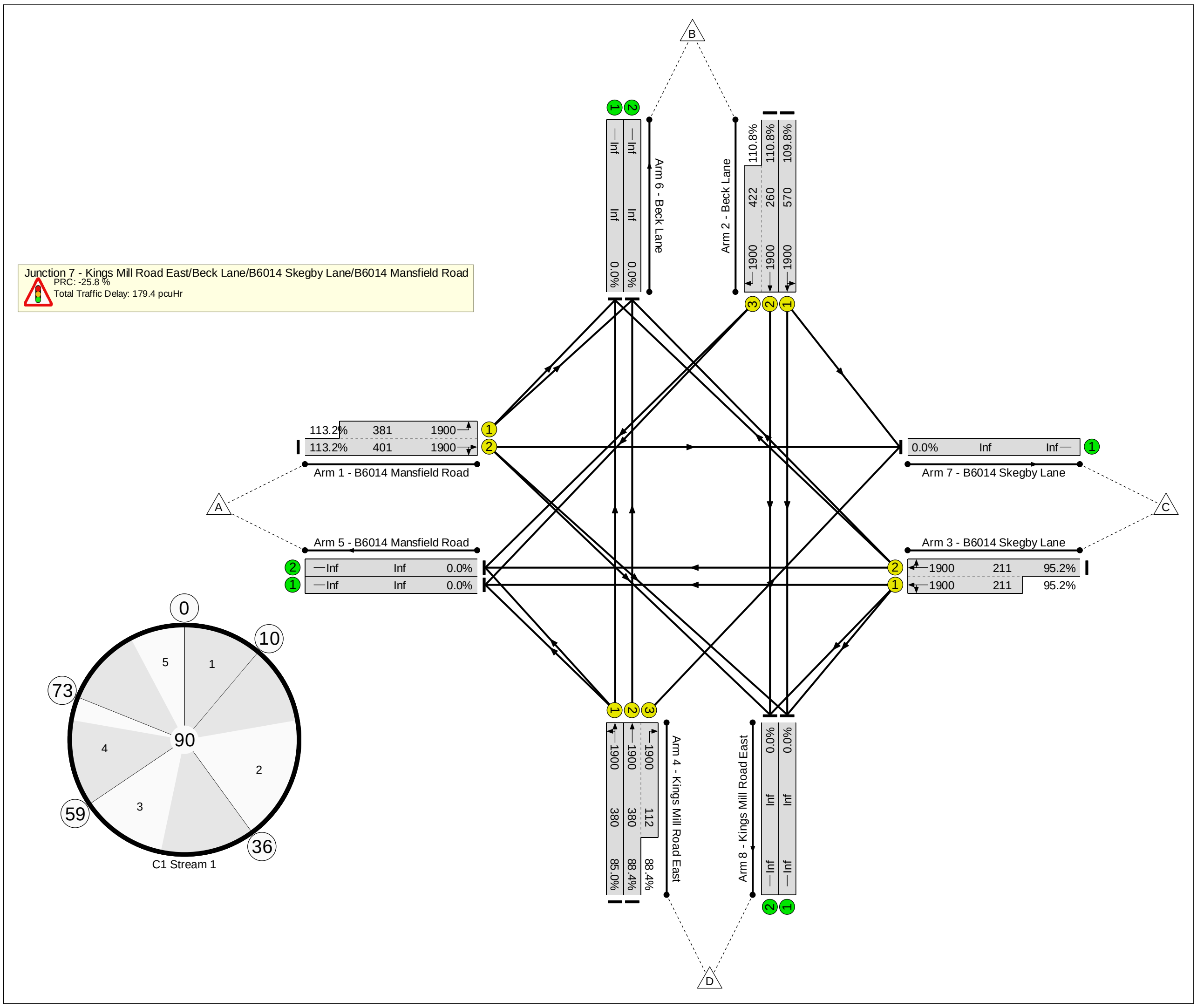


Table 6A: Performance of Kings Mill Road / Beck Lane / B6014 Skegby Lane / Mansfield Road (Base Year)

Approach Lane (and flare)	AM (0800 – 0900hrs)			PM (1700 – 1800hrs)		
	DoS		MMQ	DoS		MMQ
Mansfield Road Left Ahead Right	113.2%		68.2	103.3%		29.7
Beck Lane Left Ahead	109.8%		49.8	106.4%		44.5
Beck Lane Ahead Right	110.8%		57.8	105.7%		21.4
Skegby Lane Left Ahead Right	95.2%		11.1	95.7%		11.7
Kings Mill Road East Left Ahead	85.0%		10.3	110.0%		51.9
Kings Mill Road East Ahead Right	88.4%		11.5	110.2%		59.0
Junction Summary	PRC	-25.8		PRC	-22.5	
	Veh Delay (PCU Hrs)	179.39		Veh Delay (PCU Hrs)	181.29	

Notes: DoS = Degree of Saturation, is the percentage of the traffic demand on a traffic lane compared to the capacity of that traffic lane with the allocated green time.
MMQ = Mean Maximum Queue is the estimated mean of the back of the predicted traffic queue (which is exceeded for 50% of the time).
PCU = Passenger Car Unit. 1 car = 1 PCU / 1 bus = 2 PCU etc.
PRC = Practical Reserve Capacity is the percentage difference between the estimated Degree of Saturation (DoS) and the normal maximum acceptable degree of saturation of 90%.
Delay = Vehicle Delay in PCU-hours per hour.overall percentage “spare” capacity at a junction.
Delay = Vehicle Delay in PCU-hours per hour.

Table 6A indicates that the Kings Mill Road /Beck Lane / B6014 Skegby Lane / Mansfield Road junction operates over capacity in the Base Year in both the AM Peak and PM Peak. In the AM Peak the worst performing arm is Mansfield Road with queues of up to 68 PCUs. In the PM Peak the worst performing arm is Kings Mill Road with queues up to 59 PCUs.

Table 6B: Performance of Kings Mill Road / Beck Lane / B6014 Skegby Lane / Mansfield Road (2033 Reference Case)

Approach Lane (and flare)	AM (0800 – 0900hrs)			PM (1700 – 1800hrs)		
	DoS		MMQ	DoS		MMQ
Mansfield Road Left Ahead Right	112.9%		58.6	130.9%		116.0
Beck Lane Left Ahead	108.7%		37.3	113.0%		58.9
Beck Lane Ahead Right	106.1%		51.7	127.9%		43.6
Skegby Lane Left Ahead Right	115.1%		73.1	124.1%		94.3
Kings Mill Road East Left Ahead	110.8%		36.3	132.1%		116.9
Kings Mill Road East Ahead Right	111.3%		45.9	130.5%		135.2
Junction Summary	PRC	-27.9		PRC	-46.8	
	Veh Delay (PCU Hrs)	267.78		Veh Delay (PCU Hrs)	532.58	

Notes: DoS = Degree of Saturation, is the percentage of the traffic demand on a traffic lane compared to the capacity of that traffic lane with the allocated green time.
MMQ = Mean Maximum Queue is the estimated mean of the back of the predicted traffic queue (which is exceeded for 50% of the time).
PCU = Passenger Car Unit. 1 car = 1 PCU / 1 bus = 2 PCU etc.
PRC = Practical Reserve Capacity is the percentage difference between the estimated Degree of Saturation (DoS) and the normal maximum acceptable degree of saturation of 90%.
Delay = Vehicle Delay in PCU-hours per hour.overall percentage “spare” capacity at a junction.
Delay = Vehicle Delay in PCU-hours per hour.

Table 6B indicates that the Kings Mill Road /Beck Lane / B6014 Skegby Lane / Mansfield Road junction operates over capacity in the Reference Case in both the AM Peak and PM Peak. In the AM Peak the worst performing arm is Skegby Lane with queues of up to 73 PCUs. In the PM Peak the worst performing arm is Kings Mill Road with queues up to 135 PCUs.

There may be some potential to provide some localised widening at this junction, particularly to the south. Any localised widening would need to be fully modelled and assessed to understand the impacts on the highway network. A potential junction improvement scheme was identified as part of the Penniment Farm planning application.

A617 MARR / A6191 Southwell Road

The A617 MARR route provides links to Mansfield, the M1 and Nottingham to the west and Newark to the east. The A6191 provides links to Mansfield to the north and Rainworth to the south. This is a roundabout junction and, as such, has been assessed using ARCADY.

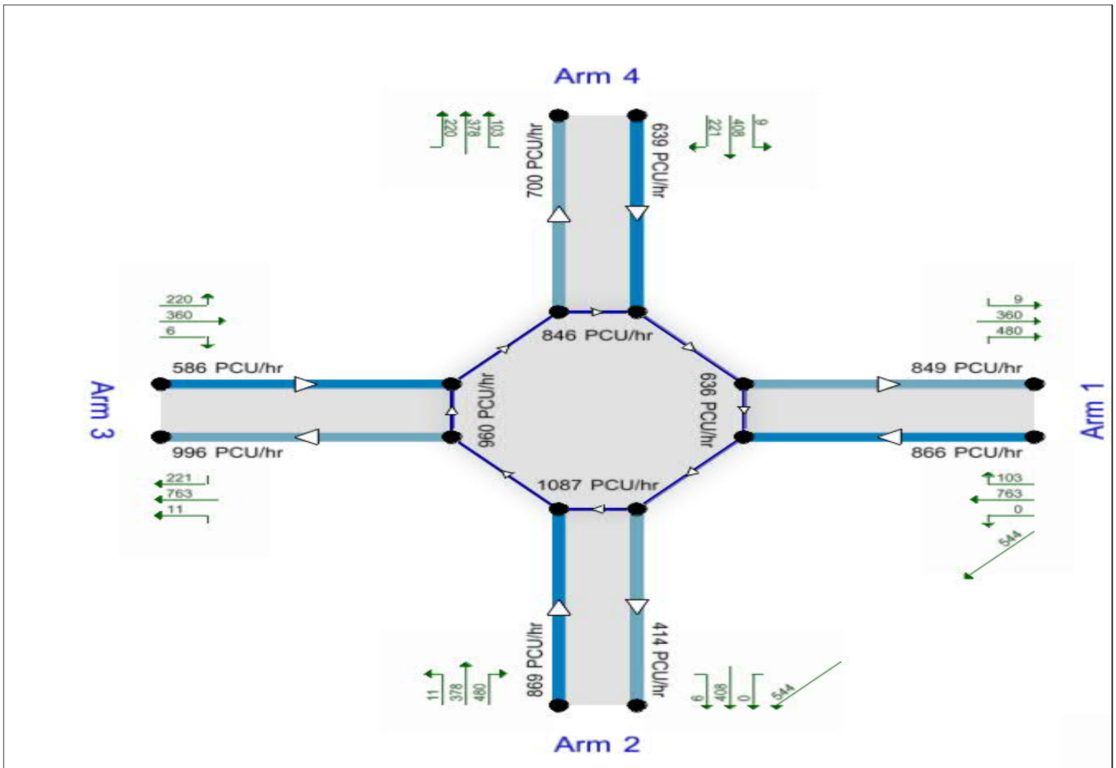


Table 7A: A617 MARR / A6191 Southwell Road (Base Year)

Approach	AM (0800 – 0900hrs)		PM (1700 – 1800hrs)	
	RFC	Q	RFC	Q
A6191 Southwell Road	0.30	0.42	0.57	1.30
A617 Rainworth Bypass	0.63	1.72	0.61	1.55
B6020	0.55	1.21	0.35	0.54
A617 MARR	0.42	0.72	0.42	0.71

Notes: RFC = Ratio of Flow to Capacity. A measure of the trafficking at the junction in relation to its ability to accommodate such flow, reported on a worst-arm basis. Q = Mean Maximum Vehicle Queue, reported on a worst arm basis. It is measured in PCUs.
PCU = Passenger Car Unit. 1 car = 1 PCU; 1 bus = 2 PCU etc.

In both the AM peak and PM peak hour the junction works within capacity. In the AM peak, the maximum RFC of 0.63 occurs on A617 Rainworth Bypass resulting in a minimal queue. In the PM peak hour the maximum RFC of 0.61 is produced on the A617 Rainworth Bypass approach. It is noted that the queue disperses within the modelled hour. The operational performance of the roundabout is considered to be acceptable in both peak hours.

Table 7B: A617 MARR / A6191 Southwell Road (Reference Case)

Approach	AM (0800 – 0900hrs)		PM (1700 – 1800hrs)	
	RFC	Q	RFC	Q
A6191 Southwell Road	0.40	0.67	0.76	3.04
A617 Rainworth Bypass	0.84	5.13	0.85	5.36
B6020	0.81	4.04	0.50	0.98
A617 MARR	0.69	2.22	0.58	1.38

Notes: RFC = Ratio of Flow to Capacity. A measure of the trafficking at the junction in relation to its ability to accommodate such flow, reported on a worst-arm basis. Q = Mean Maximum Vehicle Queue, reported on a worst arm basis. It is measured in PCUs.
PCU = Passenger Car Unit. 1 car = 1 PCU; 1 bus = 2 PCU etc.

In the AM peak the junction operates within capacity, in the PM peak the junction operates just within the band of 'near to or at capacity'. In the both the AM and PM peak hours the A617 Rainworth Bypass operates with the highest RFC values, and queues of approximately 5 PCUs are likely to form on this approach. All remaining approaches are less than the target RFC value of 0.85. The operational performance of the junction is largely considered to be acceptable in both peak hour periods, the small amount of queueing suggests that mitigation may not be required in the Reference Case scenario.

A6191 Ratcliffe Gate / A60 St Peters Way

This is a MOVA controlled signalised junction and, as such, has been assessed using LINSIG3. The A60 St Peters Way forms part of a ring road around Mansfield's commercial centre. Bridge Street allows access towards the town centre but only Public Service Vehicles are allowed out at the junction. A6191 Ratcliffe Gate is the main arterial route towards the south east of the town centre and joins with the A617 Rainworth bypass and MARR.

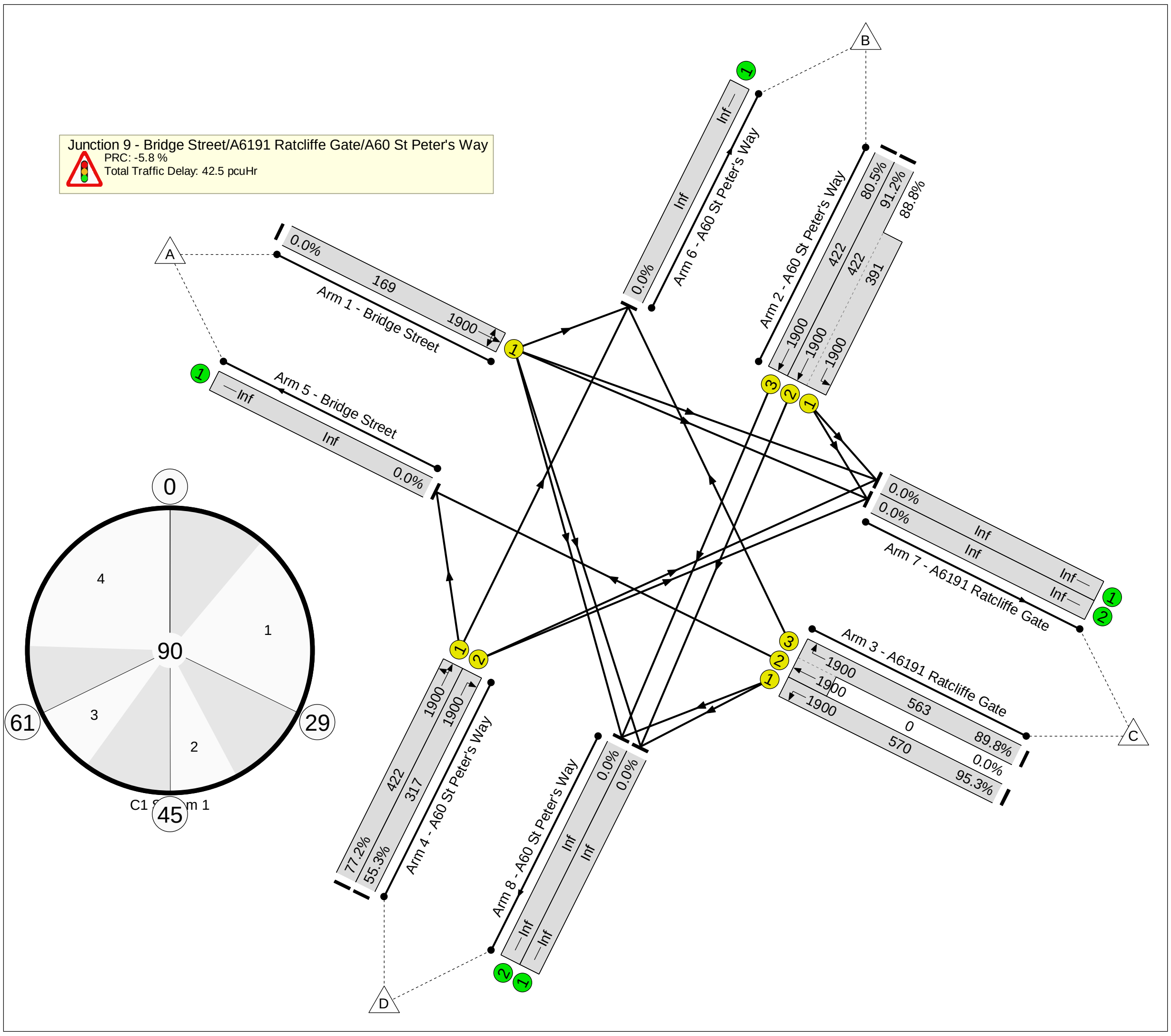


Table 8A: Performance of A6191 Ratcliffe Gate / A60 St Peters Way (Base Year)

Approach Lane (and flare)	AM (0800 – 0900hrs)		PM (1700 – 1800hrs)	
	DoS	MMQ	DoS	MMQ
Bridge Street Left Ahead Right	0.0%	0.0	0.0%	0.0
A60 St Peters Way Left Ahead	91.2%	13.4	88.2%	13.9
A60 St Peters Way Ahead	80.5%	10.0	61.6%	7.6
A6191 Ratcliffe Gate Left	95.3%	20.0	43.1%	4.4
A6191 Ratcliffe Gate Ahead Right	89.8%	16.0	86.8%	12.0
A60 St Peters Way Left Ahead	77.2%	9.2	90.4%	15.0
A60 St Peters Way Right	55.3%	4.6	90.0%	11.5
Junction Summary	PRC	-5.8	PRC	-0.4
	Veh Delay (PCU Hrs)	42.48	Veh Delay (PCU Hrs)	33.97

Notes: DoS = Degree of Saturation, is the percentage of the traffic demand on a traffic lane compared to the capacity of that traffic lane with the allocated green time.
MMQ = Mean Maximum Queue is the estimated mean of the back of the predicted traffic queue (which is exceeded for 50% of the time).
PCU = Passenger Car Unit. 1 car = 1 PCU / 1 bus = 2 PCU etc.
PRC = Practical Reserve Capacity is the percentage difference between the estimated Degree of Saturation (DoS) and the normal maximum acceptable degree of saturation of 90%.
Delay = Vehicle Delay in PCU-hours per hour.overall percentage "spare" capacity at a junction.
Delay = Vehicle Delay in PCU-hours per hour.

Table 8A indicates that the A6191 Ratcliffe Gate / A60 St Peters Way junction operates near to or at capacity in the Base Year in both the AM Peak and PM Peak. In the AM Peak the worst performing arm is A6191 Ratcliffe Gate with queues of up to 20 PCUs. In the PM Peak the worst performing arm is A60 St Peters Way with queues up to 15 PCUs.

Table 8B: Performance of A6191 Ratcliffe Gate / A60 St Peters Way (2033 Reference Case)

Approach Lane (and flare)	AM (0800 – 0900hrs)		PM (1700 – 1800hrs)	
	DoS	MMQ	DoS	MMQ
Bridge Street Left Ahead Right	0.0%	0.0	0.0%	0.0
A60 St Peters Way Left Ahead	113.2%	71.2	101.8%	29.4
A60 St Peters Way Ahead	108.0%	34.3	100.3%	24.3
A6191 Ratcliffe Gate Left	115.4%	67.0	76.9%	9.6
A6191 Ratcliffe Gate Ahead Right	109.5%	49.0	100.3%	21.8
A60 St Peters Way Left Ahead	99.2%	19.8	103.8%	30.9
A60 St Peters Way Right	74.5%	7.0	101.7%	20.5
Junction Summary	PRC	-28.3	PRC	-15.4
	Veh Delay (PCU Hrs)	210.13	Veh Delay (PCU Hrs)	96.31

Notes: DoS = Degree of Saturation, is the percentage of the traffic demand on a traffic lane compared to the capacity of that traffic lane with the allocated green time.
MMQ = Mean Maximum Queue is the estimated mean of the back of the predicted traffic queue (which is exceeded for 50% of the time).
PCU = Passenger Car Unit. 1 car = 1 PCU / 1 bus = 2 PCU etc.
PRC = Practical Reserve Capacity is the percentage difference between the estimated Degree of Saturation (DoS) and the normal maximum acceptable degree of saturation of 90%.
Delay = Vehicle Delay in PCU-hours per hour.overall percentage "spare" capacity at a junction.
Delay = Vehicle Delay in PCU-hours per hour.

Table 8B indicates that the A6191 Ratcliffe Gate / A60 St Peters Way junction operates over capacity in the Reference Case in both the AM Peak and PM Peak. In the AM Peak the worst performing arm is A6191 Ratcliffe Gate with queues of up to 67 PCUs. In the PM Peak the worst performing arm is A60 St Peters Way with queues up to 31 PCUs.

This junction is constrained along Ratcliffe Gate by several properties, so widening along this arm would be unlikely or high cost. The Bridge Street arm provides a bus lane into the junction and is also constrained. Potentially both the A60 St Peters Way arms could be widened locally to provide additional capacity at the junction. However this is likely to be a high cost solution, particularly given it is likely that major engineering work would be required, and the benefits delivered by any widening may be outweighed by the scheme costs. Any potential scheme would need detailed junction design to understand the feasibility of this type of layout and modelling to assess its business case.

Modal change could be encouraged by the introduction of selective bus detection at this junction (and others along the A60). A CCTV based system could also be implemented to enable the urban traffic control centre to intervene with signal settings to respond to incidents and events as they occur.

A6117 Old Mill Lane / B6030 Clipstone Road West

This is a MOVA controlled signalised junction and, as such, has been assessed using LINSIG3. The junction is to the east of Mansfield town centre. Clipstone Road is aligned NE-SW and provides access to the residential areas of Forest Town and Clipstone. A6117 Old Mill Lane is in a NW-SE alignment and provides a route around the town centre on the eastern side of Mansfield.

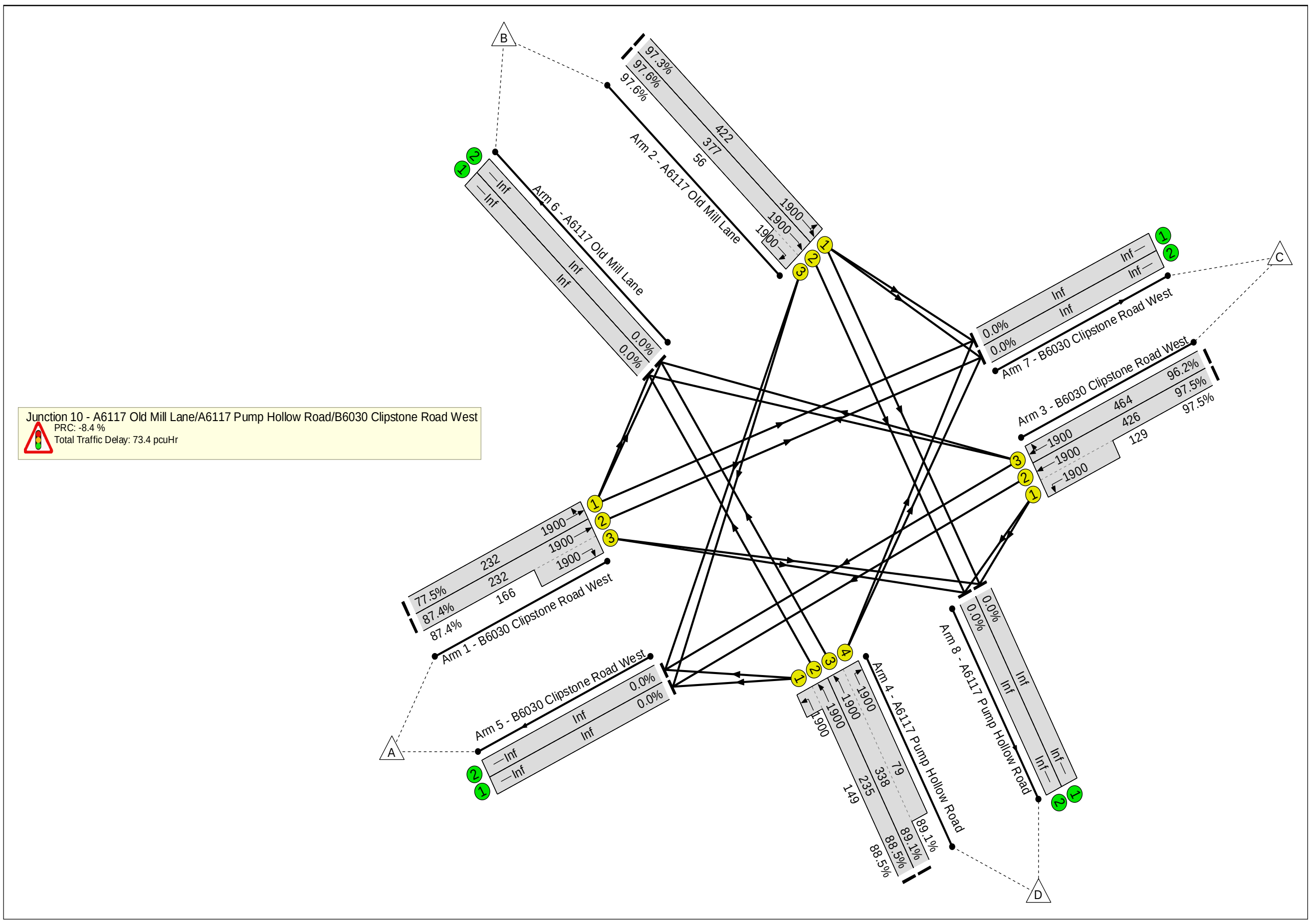


Table 9A: Performance of A6117 Old Mill Lane / B6030 Clipstone Road West (Base Year)

Approach Lane (and flare)	AM (0800 – 0900hrs)		PM (1700 – 1800hrs)	
	DoS	MMQ	DoS	MMQ
Clipstone Road West Left Ahead	77.5%	6.0	108.1%	30.0
Clipstone Road West Ahead Right	87.4%	8.1	108.7%	37.3
Old Mill Lane Left Ahead	97.3%	17.9	61.0%	7.8
Old Mill Lane Ahead Right	97.6%	18.0	63.6%	7.7
Clipstone Road West Left Ahead	97.5%	19.9	108.1%	24.3
Clipstone Road West Ahead Right	96.2%	18.0	106.8%	19.3
Pump Hollow Road Left Ahead	88.5%	10.3	111.5%	43.7
Pump Hollow Road Ahead Right	89.1%	10.8	111.7%	46.9
Junction Summary	PRC	-8.4	PRC	-24.1
	Veh Delay (PCU Hrs)	73.41	Veh Delay (PCU Hrs)	179.70

Notes: DoS = Degree of Saturation, is the percentage of the traffic demand on a traffic lane compared to the capacity of that traffic lane with the allocated green time.
MMQ = Mean Maximum Queue is the estimated mean of the back of the predicted traffic queue (which is exceeded for 50% of the time).
PCU = Passenger Car Unit. 1 car = 1 PCU / 1 bus = 2 PCU etc.
PRC = Practical Reserve Capacity is the percentage difference between the estimated Degree of Saturation (DoS) and the normal maximum acceptable degree of saturation of 90%.
Delay = Vehicle Delay in PCU-hours per hour.overall percentage “spare” capacity at a junction.
Delay = Vehicle Delay in PCU-hours per hour.

Table 9A indicates that the A6117 Old Mill Lane / B6030 Clipstone Road West junction operates near to or at capacity in the Base Year in the AM Peak and overcapacity in the PM Peak.

Table 9B: Performance of A6117 Old Mill Lane / B6030 Clipstone Road West (2033 Reference Case)

Approach Lane (and flare)	AM (0800 – 0900hrs)		PM (1700 – 1800hrs)	
	DoS	MMQ	DoS	MMQ
Clipstone Road West Left Ahead	96.0%	11.0	136.8%	83.4
Clipstone Road West Ahead Right	98.2%	13.0	135.6%	103.2
Old Mill Lane Left Ahead	122.7%	72.2	70.5%	9.4
Old Mill Lane Ahead Right	122.6%	74.3	72.3%	9.4
Clipstone Road West Left Ahead	120.8%	71.8	132.6%	67.4
Clipstone Road West Ahead Right	119.1%	58.0	131.8%	49.0
Pump Hollow Road Left Ahead	101.0%	20.9	136.3%	102.5
Pump Hollow Road Ahead Right	102.4%	24.2	136.7%	139.0
Junction Summary	PRC	-36.4	PRC	-52.0
	Veh Delay (PCU Hrs)	302.95	Veh Delay (PCU Hrs)	520.56

Notes: DoS = Degree of Saturation, is the percentage of the traffic demand on a traffic lane compared to the capacity of that traffic lane with the allocated green time.
MMQ = Mean Maximum Queue is the estimated mean of the back of the predicted traffic queue (which is exceeded for 50% of the time).
PCU = Passenger Car Unit. 1 car = 1 PCU / 1 bus = 2 PCU etc.
PRC = Practical Reserve Capacity is the percentage difference between the estimated Degree of Saturation (DoS) and the normal maximum acceptable degree of saturation of 90%.
Delay = Vehicle Delay in PCU-hours per hour.overall percentage “spare” capacity at a junction.
Delay = Vehicle Delay in PCU-hours per hour.

Table 9B indicates that the A6117 Old Mill Lane / B6030 Clipstone Road West junction operates over capacity in the Reference Case in both the AM Peak and the PM Peak. The worst performing arm in the AM Peak is Old Mill Lane with queues up to 74 PCUs. The worst performing arm in the PM Peak is Pump Hollow Road with queues up to 139 PCUs.

The junction is mostly constrained to all sides with localised widening having already been undertaken. Relatively high flows of movements across the junction between Clipstone Road and Clipstone Road and between Old Mill Lane and Pump Hollow Road prevent the signals from being optimised to any particular one or two arms.

To improve this junction to operate with a reasonable level of service would require land take and widening of the approaches: further modelling and assessment would be required to quantify the benefits of any potential widening and identify whether it offered value for money.

A CCTV based system could also be implemented to enable the urban traffic control centre to intervene with signal settings to respond to incidents and events as they occur.

A60 Church Street / Wood Street

This is a signalised junction and, as such, has been assessed using LINSIG3. The A60 Church Street provides links to Mansfield to the south and Worksop to the north. B6035 Church Street to the east provides local access to Market Warsop town centre and car parking. Signal timings and phasing for this junction have been based on on-site observations and timings.

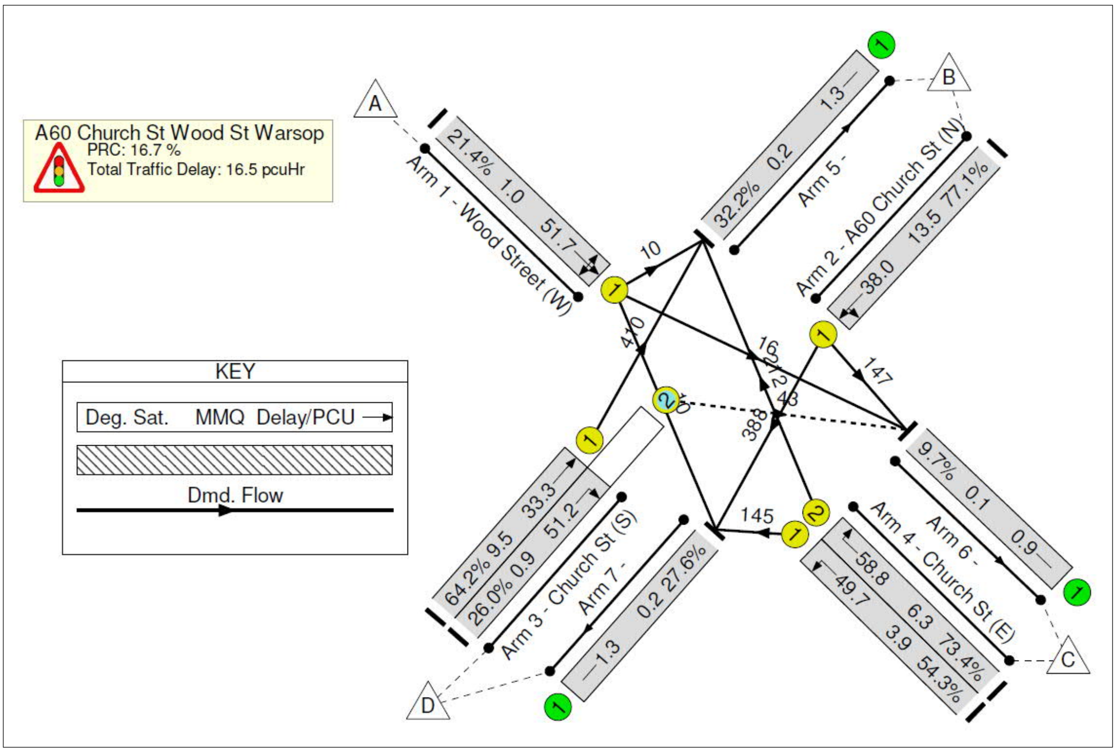


Table 10A: Performance of A60 Church Street / Wood Street (Base Year)

Approach Lane	AM (0800 – 0900hrs)		PM (1700 – 1800hrs)	
	DoS	MMQ	DoS	MMQ
Wood Street (W) Left Ahead Right	47.0%	2.3	18.4%	0.8
A60 Church St (N) Left Ahead	74.0%	13.1	88.3%	18.3
Church St (S) Ahead	71.3%	11.4	56.4%	8.2
Church St (S) Right	21.0%	0.8	39.5%	1.1
Church St (E) Left	62.9%	4.5	73.4%	5.7
Church St (E) Right	71.9%	5.8	83.5%	7.7
Junction Summary	PRC	21.6	PRC	1.9
	Veh Delay (PCU Hrs)	17.21	Veh Delay (PCU Hrs)	20.61

Notes: DoS = Degree of Saturation, is the percentage of the traffic demand on a traffic lane compared to the capacity of that traffic lane with the allocated green time.
MMQ = Mean Maximum Queue is the estimated mean of the back of the predicted traffic queue (which is exceeded for 50% of the time).
PCU = Passenger Car Unit. 1 car = 1 PCU / 1 bus = 2 PCU etc.
PRC = Practical Reserve Capacity is the percentage difference between the estimated Degree of Saturation (DoS) and the normal maximum acceptable degree of saturation of 90%.
Delay = Vehicle Delay in PCU-hours per hour.overall percentage "spare" capacity at a junction.
Delay = Vehicle Delay in PCU-hours per hour.

Table 10A indicates that the A60 Church Street / Wood Street junction operates within capacity in the Base Year in the AM Peak and PM Peak. The worst performing arm is the A60 Church Street (N) with queues of upto 13 PCUs in the AM Peak and 18 PCUs in the PM Peak.

Table 10B: Performance of A60 Church Street / Wood Street (2033 Reference Case)

Approach Lane	AM (0800 – 0900hrs)		PM (1700 – 1800hrs)	
	DoS	MMQ	DoS	MMQ
Wood Street (W) Left Ahead Right	64.5%	3.4	23.8%	1.1
A60 Church St (N) Left Ahead	101.2%	34.2	112.9%	73.0
Church St (S) Ahead	97.2%	24.5	72.0%	11.6
Church St (S) Right	65.0%	1.7	76.3%	2.4
Church St (E) Left	85.9%	7.8	93.9%	10.5
Church St (E) Right	98.0%	13.4	106.6%	21.5
Junction Summary	PRC	-12.4	PRC	-25.5
	Veh Delay (PCU Hrs)	54.23	Veh Delay (PCU Hrs)	93.29

Notes: DoS = Degree of Saturation, is the percentage of the traffic demand on a traffic lane compared to the capacity of that traffic lane with the allocated green time.
MMQ = Mean Maximum Queue is the estimated mean of the back of the predicted traffic queue (which is exceeded for 50% of the time).
PCU = Passenger Car Unit. 1 car = 1 PCU / 1 bus = 2 PCU etc.
PRC = Practical Reserve Capacity is the percentage difference between the estimated Degree of Saturation (DoS) and the normal maximum acceptable degree of saturation of 90%.
Delay = Vehicle Delay in PCU-hours per hour.overall percentage "spare" capacity at a junction.
Delay = Vehicle Delay in PCU-hours per hour.

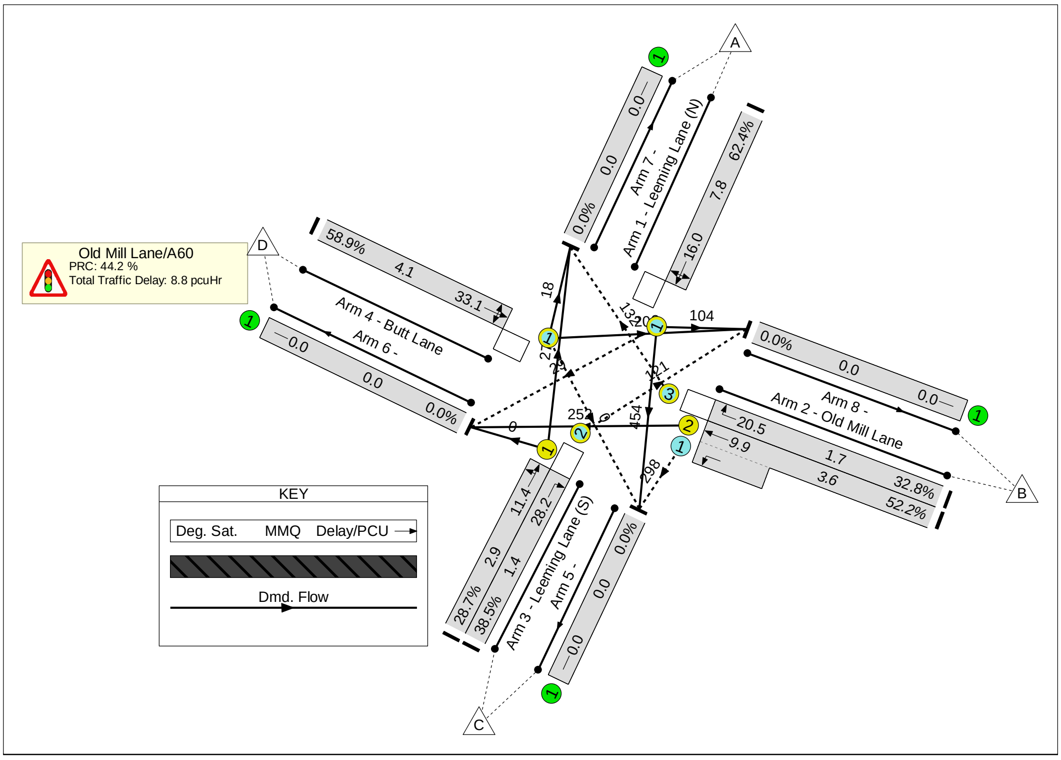
Table 10B indicates that the A60 Church Street / Wood Street junction operates over capacity in the Reference Case in the AM Peak and PM Peak. The worst performing arm is the A60 Church Street (N) with queues of up to 34 PCUs in the AM Peak and 73 PCUs in the PM Peak.

There is very little room to provide localised widening around the junction. The option of biasing green times to the A60 strategic corridor has been discounted by the highway authority.

This junction currently does not operate under MOVA control. MOVA may provide some benefits in managing the incoming traffic demands. The installation of MOVA typically costs in the range of £40,000 to £100,000 dependent upon existing conditions and equipment.

A60 Leeming Lane / Old Mill Lane / Butt Lane

This is a MOVA controlled signalised junction and, as such, has been assessed using LINSIG3. A60 Leeming Lane provides access between Mansfield and Warsop with Worksop beyond. Old Mill Lane provides access towards Forest Town and Butt Lane provides access towards Mansfield Woodhouse.



This junction was not highlighted as approaching capacity in the Base Year and has therefore not been assessed with 2016 traffic flows and turning movements.

Table 11B: Performance of A60 Leeming Lane / Old Mill Lane / Butt Lane (2033 Reference Case)

Approach Lane (and flare)	AM (0800 – 0900hrs)		PM (1700 – 1800hrs)	
	DoS	MMQ	DoS	MMQ
Leeming Lane (N) Left Ahead Right	87.4%	14.1	89.4%	17.5
Od Mill Lane Left Ahead	81.6%	10.7	84.8%	15.1
Old Mill Lane Right	81.3%	7.4	88.7%	10.1
Leeming Lane (S) Left Ahead	33.9%	4.2	69.6%	14.1
Leeming Lane (S) Right	72.6%	5.7	89.4%	10.9
Butt Lane Left Ahead Right	86.1%	9.9	80.5%	11.6
Junction Summary	PRC	3.0	PRC	0.6
	Veh Delay (PCU Hrs)	26.69	Veh Delay (PCU Hrs)	38.20

Notes: DoS = Degree of Saturation, is the percentage of the traffic demand on a traffic lane compared to the capacity of that traffic lane with the allocated green time.

MMQ = Mean Maximum Queue is the estimated mean of the back of the predicted traffic queue (which is exceeded for 50% of the time).

PCU = Passenger Car Unit. 1 car = 1 PCU / 1 bus = 2 PCU etc.

PRC = Practical Reserve Capacity is the percentage difference between the estimated Degree of Saturation (DoS) and the normal maximum acceptable degree of saturation of 90%.

Delay = Vehicle Delay in PCU-hours per hour.overall percentage "spare" capacity at a junction.

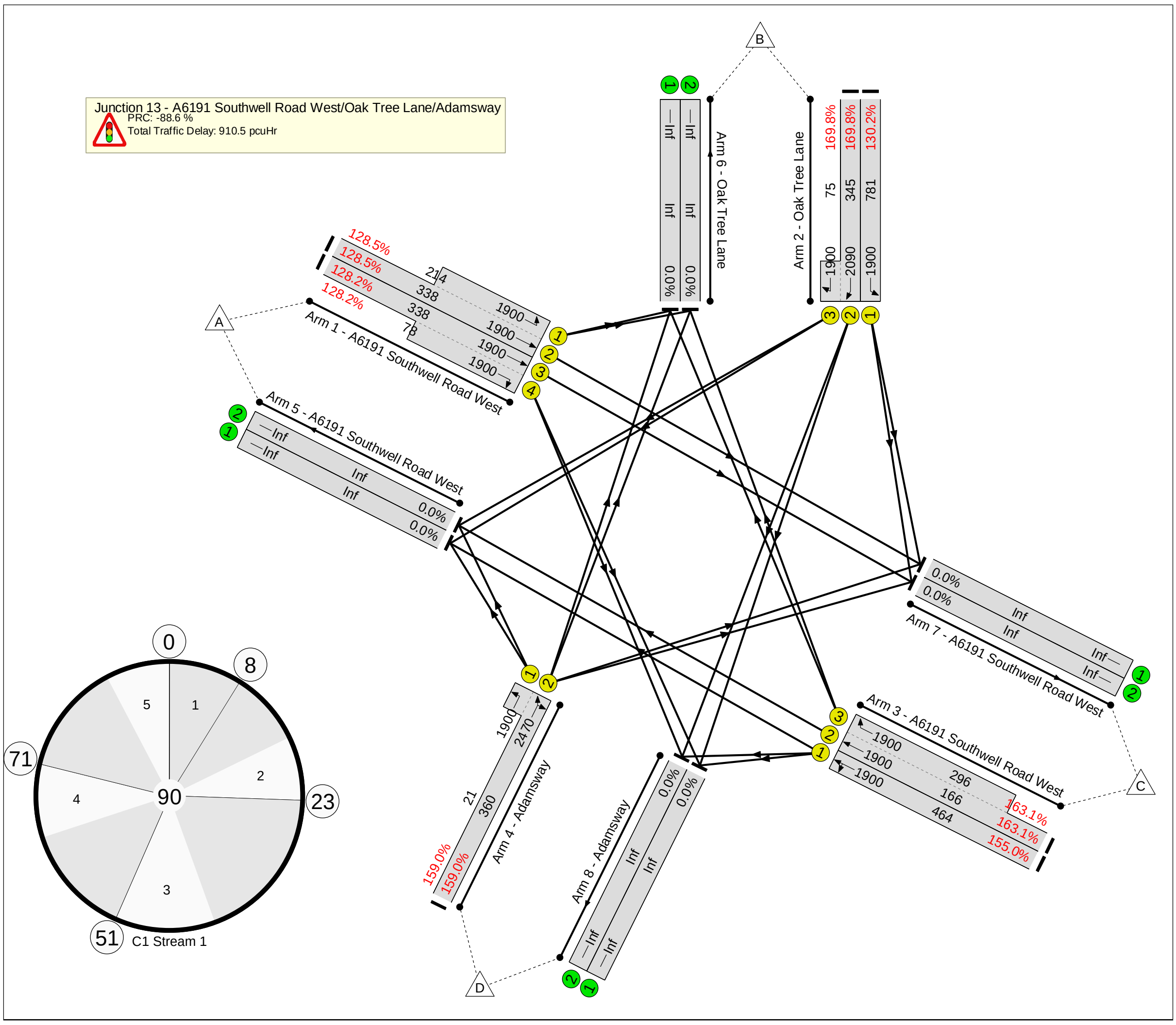
Delay = Vehicle Delay in PCU-hours per hour.

Table 11B indicates that the A60 Leeming Lane / Old Mill Lane / Butt Lane junction operates within capacity in the Reference Case in the AM Peak and PM Peak. The worst performing arm is Leeming Lane (N) with queues of up to 14 PCUs in the AM Peak and 18 PCUs in the PM Peak.

In the Reference Case, no mitigation measures are required with the predicted levels of traffic flows.

A6191 Southwell Road / Oak Tree Lane / Adamsway

This is a SCOOT controlled signalised junction and, as such, has been assessed using LINSIG3. The A6191 provides a link between Mansfield and the A617 to the south east. Oak Tree Lane / Adamsway provides a north south route.



This junction was not highlighted as approaching capacity in the Base Year and has therefore not been assessed with 2016 traffic flows and turning movements.

Table 12B: Performance of A6191 Southwell Road / Oak Tree Lane / Adamsway (2033 Reference Case)

Approach Lane (and flare)	AM (0800 – 0900hrs)		PM (1700 – 1800hrs)	
	DoS	MMQ	DoS	MMQ
A6191 Southwell Road Left Ahead	128.5%	98.5	103.7%	30.7
A6191 Southwell Road Ahead Right	128.2%	76.3	102.8%	23.5
Oak Tree Lane Left	126.8%	140.5	73.5%	13.3
Oak Tree Lane Right Ahead	40.3%	1.9	69.7%	3.9
A6191 Southwell Road Ahead Left	97.3%	24.6	137.1%	151.6
A6191 Southwell Road Ahead Right	99.3%	24.9	132.4%	129.3
Adamsway Left Ahead	34.9%	1.0	57.0%	1.8
Adamsway Ahead Right	9.5%	0.8	5.0	0.4
Junction Summary	PRC	-42.8	PRC	-52.3
	Veh Delay (PCU Hrs)	328.70	Veh Delay (PCU Hrs)	315.70

Notes: DoS = Degree of Saturation, is the percentage of the traffic demand on a traffic lane compared to the capacity of that traffic lane with the allocated green time.
MMQ = Mean Maximum Queue is the estimated mean of the back of the predicted traffic queue (which is exceeded for 50% of the time).
PCU = Passenger Car Unit. 1 car = 1 PCU / 1 bus = 2 PCU etc.
PRC = Practical Reserve Capacity is the percentage difference between the estimated Degree of Saturation (DoS) and the normal maximum acceptable degree of saturation of 90%.
Delay = Vehicle Delay in PCU-hours per hour.overall percentage "spare" capacity at a junction.
Delay = Vehicle Delay in PCU-hours per hour.

Table 12B indicates that the A6191 Southwell Road / Oak Tree Lane / Adamsway junction operates over capacity in the Reference Case in the AM Peak and PM Peak. Large queues are predicted to form on both A6191 Southwell Road approaches and Oak Tree Lane in the AM Peak.

The junction already provides the capacity of two lanes for each arms' straight ahead movement, further junction improvements would require additional widening at the stop lines.

Options for capacity improvements at this junction include:

- Given a high predicted left turning movement from Oak Tree Lane in both peak periods, provision of two left turn lanes from Oak Tree Lane to A6191 Southwell Road West (Eastern arm) could allow more traffic to make this move. An associated extension of the flare NE wards would allow better utilisation of the left turn lanes. An extra left turn lane could be achieved by utilising land take from the western side of the arm and moving the remaining existing lanes slightly westwards.
- Left turn dedicated lane from A6191 Southwell Road West (Eastern arm) to A6117 Adamsway. There may be land available to the south of the highway to develop a flare along this arm. Whilst this is fairly small movement it would allow an incremental increase to the capacity for the heavier ahead movement.
- Provision of three ahead lanes from A6191 Southwell Road West (Eastern arm) to A6191 Southwell Road West (Western arm). This would require land take from both A6191 arms which could be gained from the southern side of the arm and subsequently developed using the central grassed divider on the western arm. A three lane exit length could be provided for approximately 230m before providing a merge back down to two lanes. The west bound movement along the A6191 is greater than the east bound movement in both peak periods.
- The three improvements above would allow the signals to be retimed and would allow more capacity at each of the stop lines.

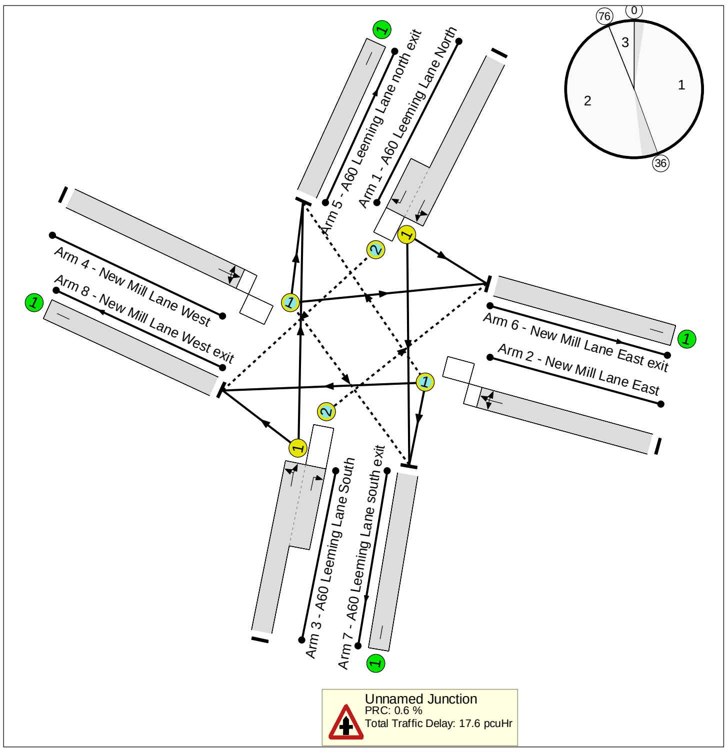
Each of the options will require land take, in some cases third party land outside the existing highway boundary. Given the major works required and the potential land costs of any scheme, the costs might outweigh any potential benefits accruing to decreased journey times. Any potential scheme would need detailed junction design to understand the feasibility of this type of layout.

A CCTV based system could also be implemented to enable the urban traffic control centre to intervene with signal settings to respond to incidents and events as they occur.

Modal change may be encouraged by the introduction of selective bus detection at this junction (and others along the A6191 Southwell Road corridor).

A60 Leeming Lane / New Mill Lane

This is a MOVA controlled signalised junction and, as such, has been assessed using LINSIG3. The A60 Leeming Lane is an arterial route linking Mansfield and Market Warsop. New Mill Lane links Mansfield Woodhouse to the west and Forest Town to the east.



This junction was not highlighted as approaching capacity in the Base Year and has therefore not been assessed with 2016 traffic flows and turning movements.

Table 13B: Performance of A60 Leeming Lane / New Mill Lane (2033 Reference Case)

Approach Lane (and flare)	AM (0800 – 0900hrs)		PM (1700 – 1800hrs)	
	DoS	MMQ	DoS	MMQ
A60 Leeming Lane (N) Left Ahead Right	126.5%	130.2	120.5%	94.5
New Mill Lane (E) Left Ahead Right	195.6%	189.4	161.9%	174.7
A60 Leeming Lane (S) Left Ahead Right	72.8%	9.0	110.7%	65.2
New Mill Lane (W) Left Ahead Right	56.5%	4.6	41.8%	3.4
Junction Summary	PRC	-117.3	PRC	-79.9
	Veh Delay (PCU Hrs)	309.96	Veh Delay (PCU Hrs)	311.17

Notes: DoS = Degree of Saturation. A measure of the trafficking of an approach to the junction in relation to its ability to accommodate such flow.
MMQ = Mean Maximum Queue reported on a per arm basis and measured in PCUs.
PCU = Passenger Car Unit. 1 car = 1 PCU / 1 bus = 2 PCU etc.
PRC = Practical Reserve Capacity. A measure of the overall percentage "spare" capacity at a junction.
Delay = Vehicle Delay in PCU-hours per hour

Table 13B indicates that the A60 Leeming Lane / New Mill Lane junction operates over capacity in the Reference Case in the AM Peak and PM Peak. Large queues are predicted to form on A60 Leeming Lane (N) and New Mill Lane (E) in the AM Peak and PM Peak.

To improve the operational performance of this junction, it may be possible to provide three lanes at the stop line from the A60 Leeming Lane (N) arm. To the east there is a very wide footpath area extending back to a length of approximately 30m which is currently used as informal parking, if a third lane was developed back from this point extra capacity could be achieved on this arm. Given that the left and ahead turning movements are heaviest from this arm the ahead move should develop the left turn flare from a suitable distance with the right turn flare developing towards the stop line. It is noted that as there is limited space to build a flare lane, the potential increase in capacity may not address all the issues at this junction.

From the New Mill Lane (E) arm the major movements are ahead to New Mill Lane (W) and right to A60 Leeming Lane (N). It may be possible to develop two lanes towards the stop line along this arm. Potentially a flare could begin from approximately 20m back utilising land to the south of the arm. There is an area of widened access to three properties which could still be maintained if a flare was to used. There may need to be a small amount of land take on the corner to maintain a footpath. Given the turning movements, the lanes should be marked left and ahead in the left lane and right turn in the right lane. Nottinghamshire County Council have aspirations to deliver an A60 bus priority scheme so any improvements should make allowance for future schemes. Modal change could be encouraged by the introduction of selective bus detection at this junction and others along the A60 corridor.

A CCTV based system could also be implemented to enable the urban traffic control centre to intervene with signal settings to respond to incidents and events as they occur.

Any potential scheme would need detailed junction design to understand the feasibility of this type of layout.

A60 Leeming Lane / A6075 Warsop Road

This is a priority junction and, as such, has been assessed using PICADY. The A60 Leeming Lane forms a major north east route between Mansfield town centre and Market Warsop. The A6075 Warsop Road provides access to Mansfield Woodhouse.

Nottinghamshire County Council are aware of queues forming at this junction and have developed a preliminary traffic signal design for this junction to address some of the issues. Currently, no funding source has been identified for this scheme and therefore it is likely that contributions from nearby developments would be required. As such, this junction cannot be considered as having 'Do-Minimum' improvements as there is no commitment. It is therefore assessed as a priority junction in these capacity assessments.

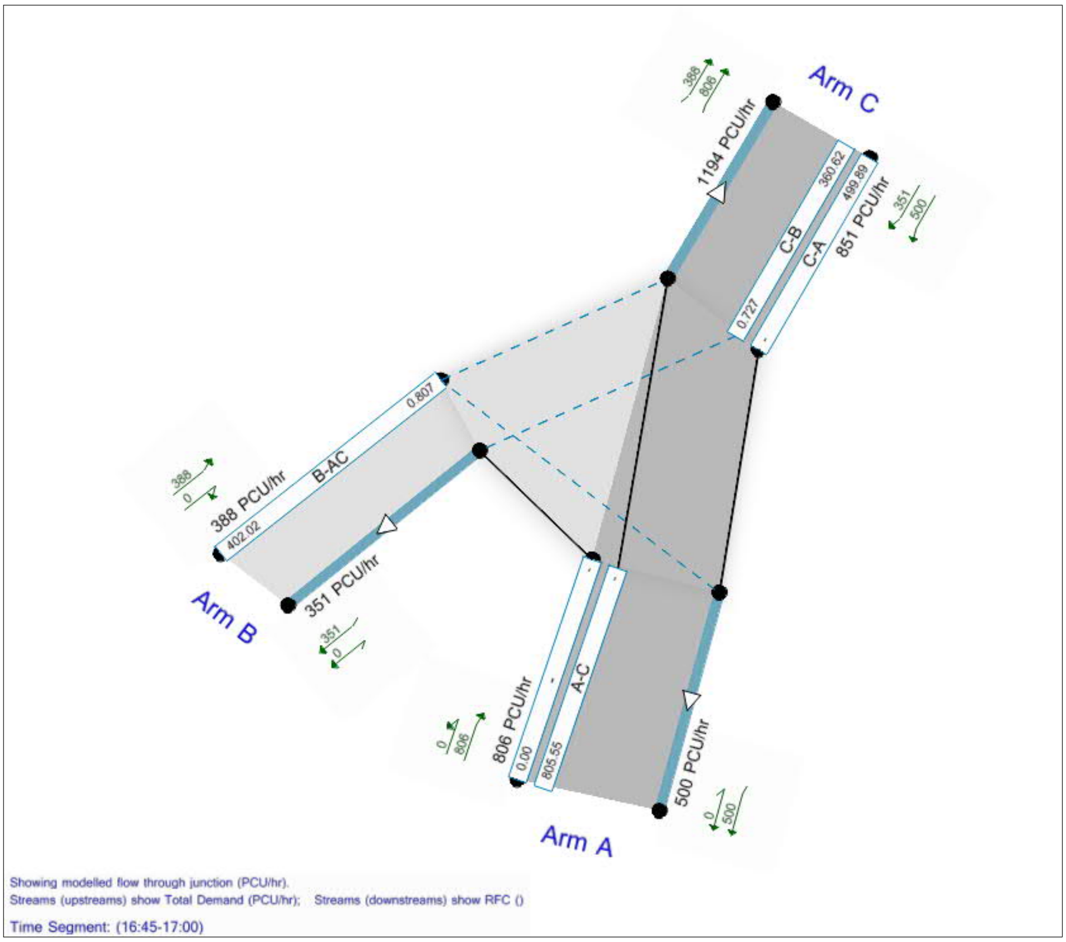


Table 14A: Performance of A60 Leeming Lane / A6075 Warsop Road (Base Year)

Approach Lane (and flare)	AM (0800 – 0900hrs)		PM (1700 – 1800hrs)	
	RFC	Q	RFC	Q
A60 Leeming Lane (S) Left Ahead	-	-	-	-
A6075 Warsop Road Left Right	0.67	1.98	1.24	64.16
A60 Leeming Lane (N) Ahead Right	1.07	31.42	1.11	35.25
Junction Summary	Junction Delay (Seconds)	115.89	Junction Delay (Seconds)	317.86

Notes: RFC = Ratio of Flow to Capacity. A measure of the trafficking at the junction in relation to its ability to accommodate such flow, reported on a worst-arm basis. Q = Mean Maximum Vehicle Queue, reported on a worst arm basis. It is measured in PCUs.
PCU = Passenger Car Unit. 1 car = 1 PCU; 1 bus = 2 PCU etc.
Junction Delay= Demand weighted averages

Table 14A shows the results from the PICADY analysis and identifies that the junction would not operate within capacity in the Base Year in either the AM or PM peak hours. The worst performing arm in the AM peak is the A60 Leeming Lane (N) with queues of up to 31 PCUs. In the PM peak the worst performing arm is A6075 Warsop Road with queues of up to 64 PCUs.

Table 14B: Performance of A60 Leeming Lane / A6075 Warsop Road (Reference Case)

Approach Lane (and flare)	AM (0800 – 0900hrs)		PM (1700 – 1800hrs)	
	RFC	Q	RFC	Q
A60 Leeming Lane (S) Left Ahead	-	-	-	-
A6075 Warsop Road Left Right	0.98	12.62	1.98	301.84
A60 Leeming Lane (N) Ahead Right	1.45	139.38	1.56	140.17
Junction Summary	Junction Delay (Seconds)	554.14	Junction Delay (Seconds)	1614.48

Notes: RFC = Ratio of Flow to Capacity. A measure of the trafficking at the junction in relation to its ability to accommodate such flow, reported on a worst-arm basis. Q = Mean Maximum Vehicle Queue, reported on a worst arm basis. It is measured in PCUs.
PCU = Passenger Car Unit. 1 car = 1 PCU; 1 bus = 2 PCU etc.
Junction Delay= Demand weighted averages

Table 14B shows the results from the PICADY analysis and identifies that the junction would not operate within capacity in the 2033 Reference Case in either the AM or PM peak hours. The worst performing arm in the AM peak is the A60 Leeming Lane (N) with queues of up to 139 PCUs. In the PM peak the worst performing arm is A6075 Warsop Road with queues of up to 301 PCUs.

Queues arise because drivers turning right from Leeming Lane into Warsop Road would block the vehicles behind attempting to go ahead. In addition, the increased flow on Leeming Lane is likely to cause delays on Warsop Road in the PM peak because vehicles at the stop line would be unable to find suitable gaps in traffic into which to pull out. The visibility to the right, from vehicles exiting Warsop Road, is limited by the presence of the bus shelter on Leeming Lane.

The potential to widen the carriageway is limited by the existing adjacent land use; however there may be benefits to assessing a signalled junction at this location. Changes at this junction may also require a review of the bus stop provision on Leeming Lane.

This junction could also be incorporated into a wider A60 bus priority scheme which would limit delays encountered by public transport.

Any potential scheme would need detailed junction design to understand the feasibility of this type of layout.

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Appendix C Committed Development Sites

Committed Development Sites-Housing

Planning Reference	Site Name	Planning Status	Easting	Northing	Proposal	Land use Classification
H-Ab003	20, Abbott Road, Mansfield.	Permitted	452263	362512	Housing Development	C3
H-Bf008	Chesterfield Road North Pleasley. (Pleasley Hill Regeneration Area)	Permitted	451016	363615	Housing Development	C3
H-Bh001	Berry Hill Hall	Permitted	454973	359535	Housing Development	C3
H-Bh008	Lindhurst. Land adjacent the MARR	Permitted	455553	358304	Housing Development	C3
H-Bh010	Former Miners Offices Berry Hill Lane Mansfield	Permitted	455238	359593	Housing Development	C3
H-Bk006	Skegby Lane	Permitted	451423	360752	Housing Development	C3
H-Br010	Former Bowls Club, Westfield Lane, Mansfield.	Permitted	452972	361637	Housing Development	C3
H-Cb007	The Ridge, The Park, Mansfield.	Permitted	454191	362073	Housing Development	C3
H-Gf002	167, Sutton Road, Mansfield. (Vauxhall Garage)	Permitted	452194	360059	Housing Development	C3
H-Gf005	Land at Hermitage Lane Mansfield	Permitted	452337	360047	Housing Development	C3
H-Gf007	Land off Sutton Road, Mansfield.	Permitted	451912	359993	Housing Development	C3
H-Hl004	Land to the rear of 183, Clipstone Road West, Forest Town.	Permitted	456739	362538	Housing Development	C3

Planning Reference	Site Name	Planning Status	Easting	Northing	Proposal	Land use Classification
H-Ki002	Land to the rear of 66-70, Clipstone Road West, Forest Town.	Permitted	456615	362276	Housing Development	C3
H-Li008	284, Berry Hill Lane, Mansfield.	Permitted	455912	359720	Housing Development	C3
H-Me003	Robin Hood Avenue, Warsop.	Permitted	457117	366814	Housing Development	C3
H-Mv004	Land off Sandlands Way, Forest Town.	Permitted	455525	362770	Housing Development	C3
H-Mv006	Birchlands/Old Mill Lane, Forest Town	Permitted	456012	362060	Housing Development	C3
H-Mv008	Land at Flint Avenue, Forest Town, Mansfield.	Permitted	456042	362387	Housing Development	C3
H-Mw007	Mansfield Road, Woodlands Way, Spion Kop. Site of former Wood B	Permitted	455971	366421	Housing Development	C3
H-Ng006	10A, Montague Street, Mansfield (Off Newgate Lane / Skerry Hill	Permitted	455063	360994	Housing Development	C3
H-Nl007	74, Clipstone Drive, Forest Town. (Former community centre)	Permitted	457661	363153	Housing Development	C3
H-Oa006	Quarry Lane	Permitted	452940	360019	Housing	C3

Planning Reference	Site Name	Planning Status	Easting	Northing	Proposal	Land use Classification
					Development	
H-Oa016	Land at the corner of Quarry Lane, Mansfield.	Permitted	452978	359972	Housing Development	C3
H-Oa019	Hermitage Mill, Hermitage Lane, Mansfield.	Permitted	452404	359873	Housing Development	C3
H-Pe006	Land at Penniment Farm, Abbott Road, Mansfield.	Permitted	451529	362059	Housing Development	C3
H-Pe010	Land adj 27, Redgate Street, Mansfield.	Permitted	452308	361731	Housing Development	C3
H-Pf003	32, Warsop Road, Mansfield Woodhouse.	Permitted	454623	363444	Housing Development	C3
H-Ph007	Land to the rear of 5, Welbeck Road, Mansfield Woodhouse.	Permitted	454241	363381	Housing Development	C3
H-Ph009	Land off Portland Street (West), Mansfield.	Permitted	454311	363428	Housing Development	C3
H-Ph015	Park Hall Farm, Park Hall Road, Mansfield Woodhouse.	Permitted	454122	364938	Housing Development	C3
H-Ph016	Park Hall Farm, Park Hall Road, Mansfield Woodhouse.	Permitted	454046	364899	Housing Development	C3
H-Ph020	75, High Street, Mansfield Woodhouse.	Permitted	454307	363548	Housing Development	C3

Planning Reference	Site Name	Planning Status	Easting	Northing	Proposal	Land use Classification
H-Po023	Dallas Street, Mansfield. (Mansfield Refrigeration & Air Condit	Permitted	453442	360828	Housing Development	C3
H-Po032	39, Stockwell Gate, Mansfield.	Permitted	453627	361018	Housing Development	C3
H-Po034	13 - 15, Albert Street, Mansfield.	Permitted	453876	360930	Housing Development	C3
H-Po039	Land at Recreation Street, old Metal Box site, car park.	Permitted	454255	361213	Housing Development	C3
H-Po041	Land off Pelham Street, Mansfield.	Permitted	454284	361018	Housing Development	C3
H-Rw008	Land to the rear of 82-110 Southwell Road East	Permitted	458010	358721	Housing Development	C3
H-Sa005	Former Mansfield Sand Co Sandhurst Avenue	Permitted	454218	359600	Housing Development	C3
H-Sh005	Sherwood Rise, Mansfield Woodhouse. (Former Sherwood Colliery)	Permitted	453636	362568	Housing Development	C3
H-Sh012	Development off Debdale Lane, known as Sherwood Rise,	Permitted	453555	362871	Housing Development	C3

Planning Reference	Site Name	Planning Status	Easting	Northing	Proposal	Land use Classification
	Mansfield					
H-Wc002	The Royal Estate, Land off King Road / Wood Street, Market Wars	Permitted	456433	368094	Housing Development	C3
H-Wc004	Land at West St and King St Warsop Vale inc. Greenshank Road.	Permitted	454776	368011	Housing Development	C3
H-Wc008	Land at Moorfield Farm, Bishops Walk, Church Warsop.	Permitted	456663	368946	Housing Development	C3
H-Wc012	Land off Birch Street, Church Warsop.	Permitted	456079	369191	Housing Development	C3
H-Wl001	Former Mansfield General Hospital, West Hill Drive	Permitted	453820	361436	Housing Development	C3
H-Wl018	Ashmead Chambers, 11-21, Regent Street, Mansfield.	Permitted	453855	361228	Housing Development	C3
H-Wl021	22, St John Street, Mansfield.	Permitted	453473	361272	Housing Development	C3
H-Wl024	Union Street, Mansfield.	Permitted	453481	361243	Housing Development	C3
H-Wl029	Innisdoon, 1, Crow Hill Drive, Mansfield.	Permitted	453602	361615	Housing Development	C3

Planning Reference	Site Name	Planning Status	Easting	Northing	Proposal	Land use Classification
H-Wl031	7-9, Leeming Street, Mansfield Woodhouse.	Permitted	453881	361156	Housing Development	C3
H-Yh003	Land to rear of Yorke St / Blake St	Permitted	453834	362545	Housing Development	C3
H-La009	18 Burns Street Mansfield	Resolution to permit	453101	361346	Housing Development	C3
H-Me005	Land at the rear of Cherry Paddocks	Resolution to permit	457197	367482	Housing Development	C3
H-Ne008	Welbeck Farm, Netherfield Lane, Meden Vale.	Resolution to permit	457938	369389	Housing Development	C3
H-Nl005	Land South of Clipstone Road East. Plot next to the Pub.	Resolution to permit	457455	362431	Housing Development	C3
H-Nl011	Land South of Clipstone Road East. Plot near Newlands roundabout	Resolution to permit	457642	362472	Housing Development	C3
H-Nl017	Land to the north east of Woodview Gardens off Clipstone Drive	Resolution to permit	457275	362895	Housing Development	C3
H-Nl023	122, Clipstone Road West, Forest Town, Mansfield.	Resolution to permit	457152	362651	Housing Development	C3
H-Sh014	Balmoral Drive, Mansfield.	Resolution to permit	452310	362711	Housing Development	C3
H-Wc013	Moorfield Farm /	Resolution to	456691	368945	Housing	C3

Planning Reference	Site Name	Planning Status	Easting	Northing	Proposal	Land use Classification
	Memorial Club Bishop Walk Church Warsop	permit			Development	
H-Wc015	Warsop Vale School, Carter Lane, Warsop Vale.	Resolution to permit	454981	367894	Housing Development	C3
H-Wh008	Land at 7, Oxclose Lane, Mansfield Woohouse.	Resolution to permit	453675	363339	Housing Development	C3
H-Wl025	Corner House, Union Street, Mansfield.	Resolution to permit	453524	361260	Housing Development	C3

Committed Development Sites-Commercial

Planning Reference	Site Name	Planning Status	Easting	Northing	Proposal	Land use Classification
2016/0375/NT	United Carpet Store Farmway, Old Mill Lane Mansfield Nottinghamshire	Permitted	454313	362604	CHANGE OF USE TO INDOOR TRAMPOLINE CENTRE (CLASS D2 ASSEMBLY)	D2
2016/0315/NT	Labour Hall The Labour Hall Priory Road Mansfield Woodhouse Nottinghamshire	Permitted	453797	363089	CHANGE OF USE FROM OFFICE USE TO AN INDOOR FITNESS STUDIO	D2
2016/0286/ST	St Peters Retail Park Station Street Mansfield Nottinghamshire	Permitted	453761	360838	ERECTION OF A SINGLE STOREY MIXED CLASS A3 / A1 BUILDING	A1/A3
2016/0278/NT	122 - 124 Chesterfield Road North Mansfield Nottinghamshire NG1	Permitted	452141	362726	CHANGE OF USE TO PROVIDE 8 BEDROOM HOUSE	SG
2016/0263/ST	4 Corporation Street Mansfield Nottinghamshire NG18 5NU	Permitted	453230	361301	CHANGE OF USE FROM RESIDENTIAL (USE CLASS C3)	SG
2016/0178/NT	Adjacent Unit 3 69 Woodhouse Road Mansfield Nottinghamshire	Permitted	453993	362145	ERECTION OF RETAIL UNIT (USE CLASS A1)	A1

Planning Reference	Site Name	Planning Status	Easting	Northing	Proposal	Land use Classification
	NG1					
2016/0177/ST	3 Acorn Way Oak Tree Business Park Mansfield Nottinghamshire	Permitted	456587	359635	CHANGE OF USE FROM LIGHT INDUSTRIAL (USE CLASS B1) TO GENERAL	B2
2016/0136/NT	Land Between Church Street And Burns Lane Warsop Nottinghamshire	Permitted	456756	368074	DEMOLITION OF THE FORMER STRAND CINEMA AND WALL	A1
2016/0092/NT	1A Oxford Street Mansfield Nottinghamshire NG18 2BE	Permitted	454038	362204	CHANGE OF USE FROM A1 RETAIL	A1
2016/0082/NT	Land Adjacent 6 Sherwood Street Mansfield Woodhouse Nottinghamshire	Permitted	453642	362974	PROPOSED WAREHOUSE AND OFFICES (USE CLASS B8)	B8
2016/0081/ST	Ace House Great Central Road Mansfield Nottinghamshire NG18 2RJ	Permitted	454325	360871	DEMOLITION OF EXISTING BUILDING AND ERECTION OF TWO STOREY	B1a
2015/0735/NT	Innisdoon 1 Crow Hill Drive Mansfield Nottinghamshire	Permitted	453609	361619	CHANGE OF USE FROM SURGERY TO 6 NO.	C3

Planning Reference	Site Name	Planning Status	Easting	Northing	Proposal	Land use Classification
	NG19 7AE				DWELLINGS	
2015/0733/ST	Adjacent Unit 3 St Peters Retail Park Station Street Mansfield	Permitted	453684	360747	ERECTION OF A SINGLE STOREY MIXED CLASS A3/A1 BUILDING	A1/A3
2014/0071/NT	P & P Clothing 12 Millway Mansfield Woodhouse Nottinghamshire	Permitted	454612	362413	FIRST & SECOND FLOOR EXTENSION	B1c
2014/0578/NT	Future Products Limited Future Products Enterprise Road Mansfield	Permitted	452039	363248	FACTORY EXTENSION FOR STORAGE	B8
2014/0620/ST	Wright Self Storage 17 Pecks Hill Mansfield Nottinghamshire NG1	Permitted	455119	361171	GROUND FLOOR REAR EXTENSION TO STORAGE FACILITY	B8
2015/0332/NT	Double A Kebabs Limited Double A Kebabs Enterprise Road Mansfield	Permitted	451971	363212	EXTENSION TO EXISTING FOOD PRODUCTION AND COLD STORE FACILITIES	B1a/B1c/B8
2015/0531/ST	Kingfisher Lighting Ltd Ratcher Way	Permitted	457017	361403	TWO STOREY EXTENSION TO REAR	B1a/B1c

Planning Reference	Site Name	Planning Status	Easting	Northing	Proposal	Land use Classification
	Forest Town Nottinghamshire					
2016/0002/ST	Land Off Kestral Road Mansfield Nottinghamshire NG18 5FT	Permitted	452511	359575	ERECTION OF 6 NO INDUSTRIAL UNITS (USE CLASSES B1, B2 and B8)	B2
2015/0502/ST	Land At Penniment Farm Abbott Road / Water Lane Mansfield Nottinghamshire	Permitted	451560	362355	APPLICATION FOR THE APPROVAL OF THE RESERVED MATTERS OF ACCESS	B1a/B2/B8
2013/0376/ST	Land Adjacent Unit 3 Sherwood Oaks Close Mansfield Nottinghamshire	Permitted	456989	359045	ERECT TWO STOREY, SELF-CONTAINED OFFICE BUILDING	B1a
2015/0045/ST	Land Adjacent To The A617 Mansfield Ashfield Regeneration Route	Permitted	455659	358078	APPLICATION FOR THE APPROVAL OF RESERVED MATTERS	B Mixed
2010/0784/NT	Land Adjacent Mansfield Woodhouse Train Station Debdale Lane Mansfield	Permitted	453485	363257	REGULATION 4 APPROVAL FOR THE CONSTRUCTIO N OF 1 NO. TWO STOREY	B1c
2014/0242/NT	11 Millway	Permitted	454613	362499	APPLICATION	B8

Planning Reference	Site Name	Planning Status	Easting	Northing	Proposal	Land use Classification
	Old Mill Lane Industrial Estate Mansfield Woodhouse				FOR THE APPROVAL OF THE RESERVED MATTERS OF ACCESS	
2015/0471/ST	St Peters Retail Park Station Street Mansfield Nottinghamshire	Permitted	453766	360830	ERECTION OF A SINGLE STOREY MIXED CLASS A3 / A1 BUILDING	A1/A3
2015/0273/ST	Land At Belvedere Street / Quaker Way Mansfield Nottinghamshire	Permitted	453633	360969	OUTLINE APPLICATION FOR MIXED USE TOWN CENTRE DEVELOPMEN T (A1)	A1/A2/A3/A4/A5/ B1a/D1/D2/C1
2015/0286/NT	28A Leeming Street (First & Second Floor) Mansfield Nottinghamshire	Permitted	453931	361186	CHANGE OF USE FROM A2 (FINANCIAL AND PROFESSIONA L SERVICES)	A3
2013/0154/ST	8-10 Queen Street Mansfield Nottinghamshire NG18 1JN	Permitted	453775	360985	EXTERNAL REFURBISHME NT AND EXTENSION TO EXISTING RETAIL	A1
2015/0380/ST	Oakleaf Close Mansfield Nottinghamshire NG18 4GH	Permitted	457021	359152	CONSTRUCTIO N OF A 1925SQ M FOODSTORE (USE CLASS	A1

Planning Reference	Site Name	Planning Status	Easting	Northing	Proposal	Land use Classification
					A1)	
2014/0621/NT	V L Pegg 30 Leeming Lane South Mansfield Woodhouse Nottinghamshire	Permitted	454185	362473	ERECTION OF NEW RETAIL FOOD STORE AND ASSOCIATED WORKS	A1
2014/0587/ST	Adjacent The Ladybrook 190 Ladybrook Lane Mansfield Nottinghamshire	Permitted	452277	361104	ERECTION OF LOCAL NEEDS FOOD RETAIL STORE AND ASSOCIATED WORKS	A1
2014/0169/ST	Nottingham Road Methodist Church Bath Street Mansfield Nottinghamshire	Permitted	453949	360701	CHANGE OF USE OF CHURCH TO RESTAURANT (USE CLASS A3)	A3
2013/0273/NT	Land At Sandlands Court Off Fulmar Close Forest Town Nottinghamshire	Permitted	455391	362537	APPLICATION FOR OUTLINE PLANNING PERMISSION	A1/D1
2013/0206/ST	Nottingham Road Retail Park Nottingham Road Mansfield Nottinghamshire	Permitted	453790	360330	ERECTION OF A CLASS A1/A3 DRIVE THROUGH RETAIL UNIT.	A1/A3

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Appendix D Technical Note on Reference Case Forecasting

Mansfield Transport Study 2017

Reference Case Forecasts

Project Number: 60527945

12 April 2017

Quality information

Prepared by	Checked by	Approved by
Sam Shearstone Graduate Transport Planner	Adam Hall Principal Transport Planner	David Elliott Associate

Revision History

Revision	Revision date	Details	Authorized	Name	Position
1	12/4/17	NCC comments	AH	Adam Hall	Principal Transport Planner

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UK

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Table of Contents

Figures

Tables

1. Reference Case Forecasts

1.1 Introduction

Mansfield District Council is currently preparing a new local development plan to be known as the Mansfield District Local Plan. The agreed methodology employed for this study is summarised in three key steps:

§ **Step 1** collates data about the existing transport conditions and identifies a 'Baseline'. This work has been documented in Technical Note 01 - Local Model Validation Report (LMVR), January 2017.

§ **Step 2** examines future conditions given the most likely projections of growth and committed developments (both transport infrastructure and land-use developments) that are likely to be implemented by 2033. This is a 'Reference Case' against which the traffic impacts of potential additional development can be judged.

§ **Step 3** will then examine the likely future conditions given the introduction of potential development plan-related proposals, and review this against the 'Reference Case'.

This report is part of Step 2 and summarises the committed developments and methodology used to create the 2033 Reference Case. The SATURN traffic model will then be used to examine the forecast traffic performance of the highway network in the 2033 Reference Case.

1.2 Base Model

The forecasting network and matrices are built upon the 2016 base model is network and trip demand matrices. The development of the 2016 base year traffic model is described in the Local Model Validation Report (TN01); the report concluded that the model provides a realistic representation of the modelled links in Mansfield.

The user classes in the 2016 base year trip demand matrices, in the Mansfield traffic model, are spilt between two vehicle matrix levels:

<u>Matrix level 1-Light Vehicles</u>

User Class 1 – Car (Work)

User Class 2 – Car (Commute)

User Class 3 – Car (Other)

User Class 4 – LGV (All)

<u>Matrix level 2-Heavy Vehicles</u>

User Class 5 – OGV1 (other goods vehicle: rigid chassis or up to three axles)

User Class 6 – OGV2 (other goods vehicle: articulated with four axles plus)

The base model was calibrated with 2016 journey time and traffic count data and is compliant of WebTAG criteria.

1.3 Committed Developments to 2033

To update the model to represent conditions in 2033, changes to the highway network and future growth and development trips are needed. Land-use changes considered to be ‘committed’ by Mansfield District Council were represented in the forecasting models as specific sites. Committed Developments in Mansfield up to 2033 were identified by the type and size.

Housing developments with fewer than five dwellings were not specifically represented in the Reference Case. However, forecasts of traffic growth include population growth and increased car ownership

Four additional developments located in Ashfield district were included in the Reference Case forecasts due to their scale and proximity to Mansfield. These developments were located at:

- Beck Lane, Skegby;
- Land north of Kings Mill Hospital;
- Land south of West of Notts College and
- Summit Park (Previously Prologis Park)

Figure 1, Figure 2 and Figure 3 shows the locations of the committed development sites included in the Reference Case forecasts.

No future highway schemes were identified that would change the capacity of the highway network.

Some of the larger committed development sites have associated highway infrastructure modifications included as part of their construction. These include:

- Lindhurst
  - Internal link road,
  - Access to South West plot via existing roundabout,
  - New Roundabout on Adams Way,
  - New Roundabout on MARR from North East plot,
  - New traffic signal controlled junction with Southwell Road, to include left-in, left-out and right-in.
- Land behind Kings Mill Hospital
  - Access Points

These proposed access points have been coded into the 2033 Reference Case highway networks.

Committed developments were allocated a model zone number based upon the location of the development. The total number of new committed dwellings (for housing developments) and total gross floor area (for commercial developments) was calculated for each model zone.

Trip Rate Information Computer Systems (TRICS) is a database of trip generations collected by regular surveys undertaken throughout the country of different types of development. TRICS is the industry standard method of calculating trip rates for new developments. TRICS 50th percentile rates represent the average trip rates generated by similar types of developments and are suitable for use in calculating new trip generations as part of this study. TRICS 50th percentile rates were applied by land-use type to these specifically modelled developments to give origin and destination trip ends for the AM and PM peaks.

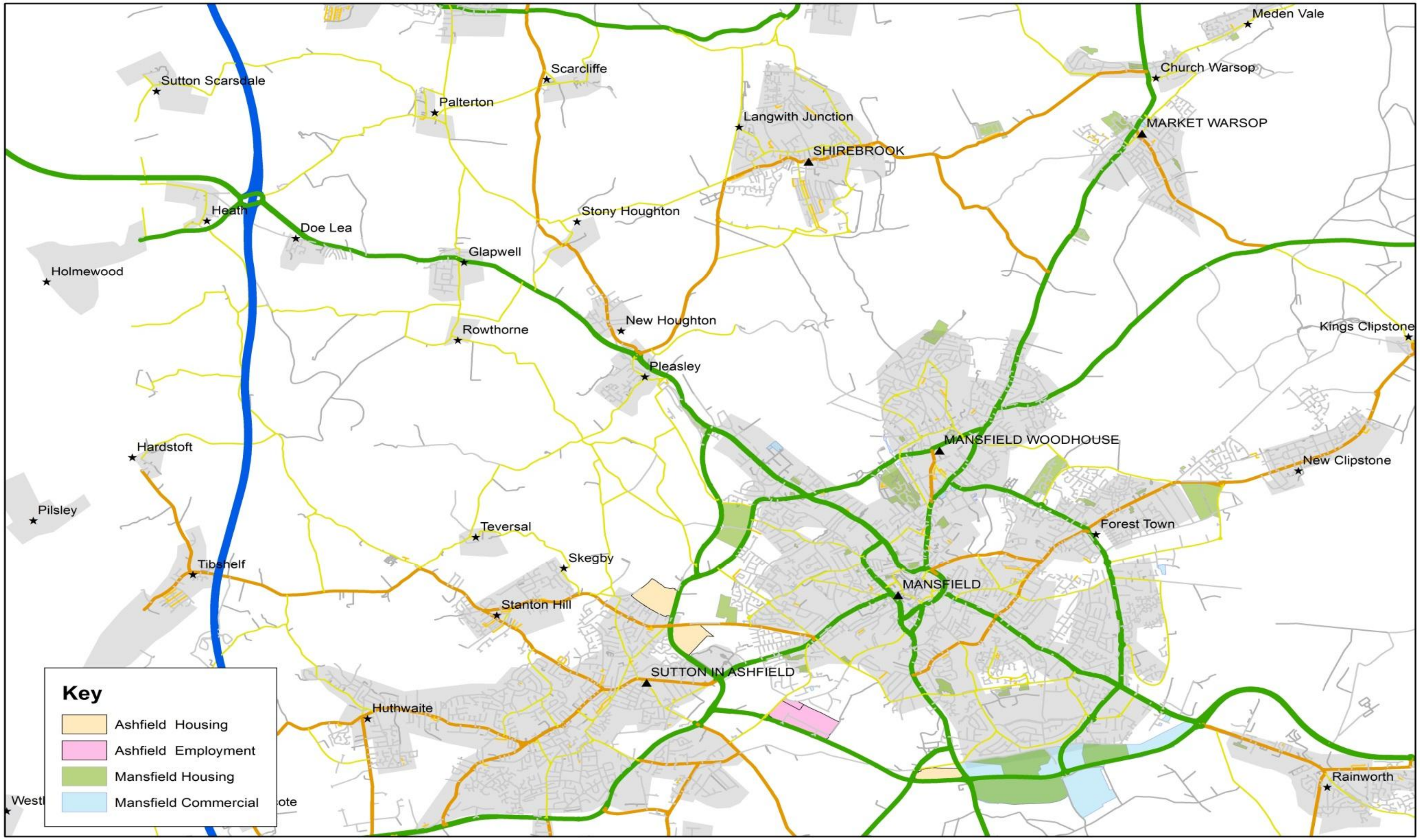

Figure 1. Overview of Committed Developments expected by 2033

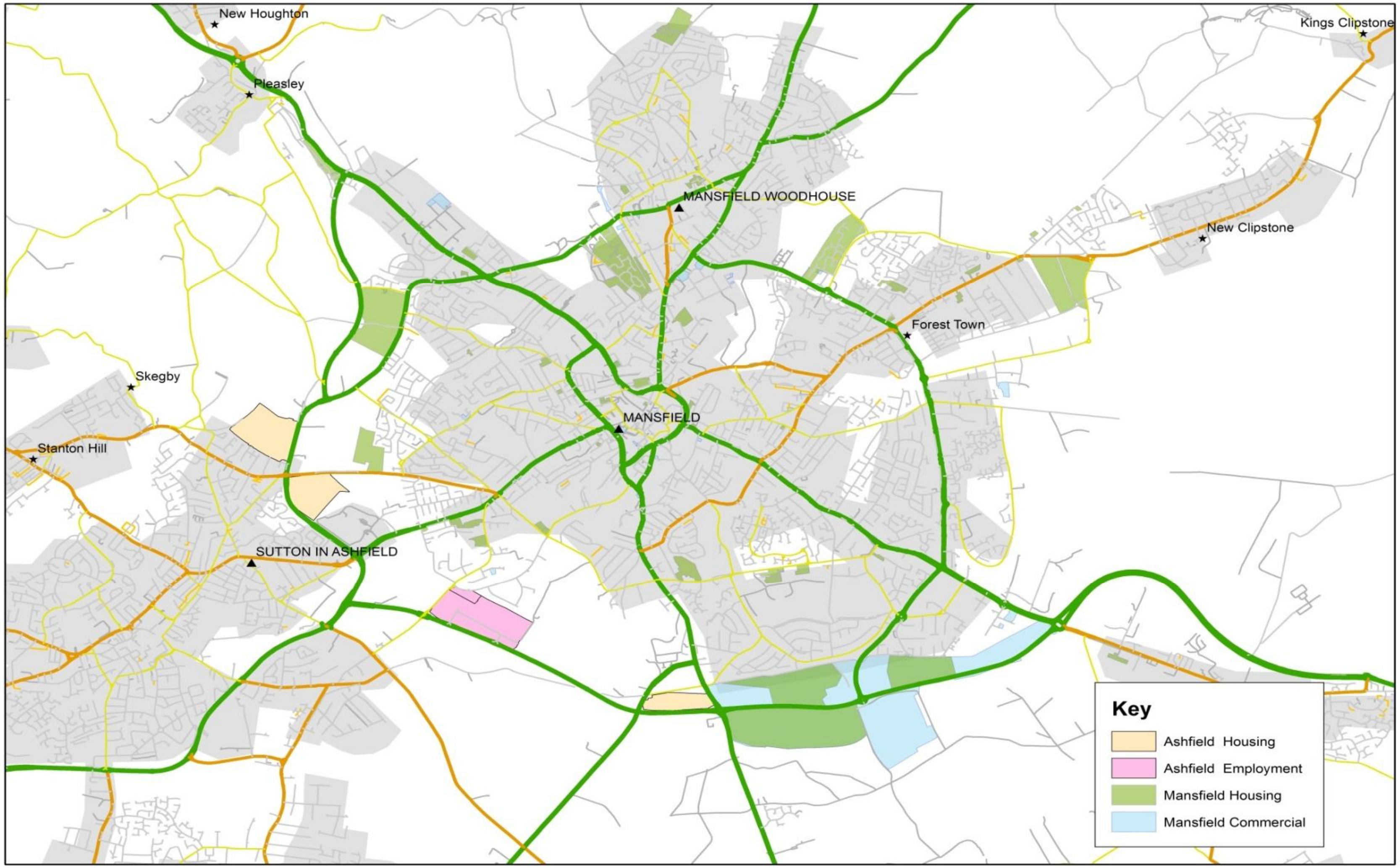

Figure 2. Mansfield Committed Developments expected by 2033

Figure 3. Market Warsop, Church Warsop and Meden Vale Committed Developments expected by 2033

Substantial traffic forecasting work had already been undertaken for the Lindhurst and Penniment Farm developments where trip numbers and distributions had been developed for their respective planning applications. Trip rates and distributions for Penniment Farm have been taken from the 2012 assessment. For the Lindhurst development the number of dwellings and gross floor area have been agreed with Mansfield District Council and only include the phases considered to be committed to be built by 2033.

Trip ends associated with development zones, were distributed using the trip distributions of the existing model zone they were allocated to. The locations of all committed developments were checked against the base model to ensure development types were similar land-use types, i.e. housing developments were in model zones that contained housing. Where developments were not similar; i.e. housing trips being allocated to a model zone previously dominated by commercial uses, the appropriate distribution was taken from a nearby zone with similar land use to the new development.

As the trip ends allocated to development zones were for all vehicle classes it was necessary to calculate the spilt of trips between level 1 (Light vehicles) and level 2 (Heavy vehicles) for all of the development zones, using the same vehicle proportions as the base year matrix.

The trip matrix totals for the committed developments are presented below in Table 1.

Table 1 Trip Matrix Totals – Committed Development from 2016-2033 (vehicles per hour)

	AM	PM
Lindhurst Development	3,752	3,114
Penniment Farm	1,286	977
Other Committed Development	814	908
Total Committed Development	**5,852**	**4,999**

1.4 (TEMPRO and NTM) Growth of Trip Ends

In addition to trips generated by new development sites, there will be traffic growth associated with trips already on the highway network (i.e. background trips). TEMPRO is a Department of Transport (DfT) published software programme and database that contains details on trip numbers, journey mileage, car ownership and population/workforce numbers from the National Trip End Model (NTEM). Data from NTEM is available at the Middle Super- Output Area (as defined by 2010 census) level and has been manipulated based on area to provide model zone factors. TEMPRO 7 was used to calculate background trip end growth factors to apply to the 2016 base matrix light vehicles (Level 1). This was the current version at the time of forecasting.

NTEM growth factors between 2016 and 2033 are presented in Table 2 below.

Table 2 NTEM growth factors 2016-2033

	AM Origin	AM Destination	PM Origin	PM Destination
GB	1.1278	1.1278	1.1279	1.1279
Mansfield	1.1322	1.1216	1.12	1.1267
Ashfield	1.1161	1.1189	1.1143	1.1122

The heavy vehicle trip matrix (Level 2) was subject to factoring according to the National Transport Model (NTM). NTM provides forecast factors for heavy vehicle traffic across regions of the UK. Factors for the East Midlands were used for this study. A default spilt of 45% Rigid (OGV1) and 55% Artic (OGV2) was used to produce a Table 3 combined factor.

NTM growth factors between 2016 and 2033 are presented in Table 3 below.

Table 3 NTM growth Factors 2016-2033

Region	**Factor**
East Midlands Rigid	1.09
East Midlands Artic	1.16
Combined	1.13

Applying the TEMPRO and NTM background growth factors, produced trip end totals (presented in Table 4 and Table 5) by district. This forecasting scenario would occur if no committed developments had been identified.

Table 4 Trip End Totals - Base and NTEM Growth (Light vehicles)

District	Model	Number of Trips (Vehicles per hour)			
		AM (Origin)	AM (Destination)	PM (Origin)	PM (Destination)
Mansfield	2016 Base	14,755	15,642	17,203	16,789
	2033 NTEM	16,651	17,637	19,295	18,832
	Forecast Growth	1,896	1,995	2,092	2,043
Ashfield	2016 Base	6,987	7,319	7,873	7,427
	2033 NTEM	7,904	8,282	8,833	8,346
	Forecast Growth	917	963	960	919
Other	2016 Base	6,893	5,675	6,272	7,131
	2033 NTEM	7,771	6,428	7,070	8,020
	Forecast Growth	878	753	798	889

Table 5 Trip End Totals - Base and NTM Growth (Heavy vehicles)

District	Model	Number of Trips (Vehicles per hour)			
		AM (Origin)	AM (Destination)	PM (Origin)	PM (Destination)
Mansfield	2016 Base	359	399	123	123
	2033 NTM	405	451	139	139
	Forecast Growth	46	52	16	16
Ashfield	2016 Base	315	244	118	111
	2033 NTM	355	275	133	126
	Forecast Growth	40	31	15	15
Other	2016 Base	256	287	89	96
	2033 NTM	289	324	101	109

	Forecast Growth	33	37	12	13

The trip matrix totals for the light and heavy vehicle combined are presented below in Table 6.

Table 6 Trip Matrix Totals - Base and NTEM/NTM (vehicles),

	AM	PM
Base Year 2016	29,565	31,678
NTEM 2033	33,376	35,571
Growth	3,811	3,893

It is noted that the additional trips forecast by applying NTEM/NTM growth in the Mansfield District is lower than the growth associated with the specifically modelled Committed Development, as presented in Table 1.

1.5 Alternative Assumptions

TEMPRO 7 allows the user to apply ‘alternative assumptions’ into the source planning data. This allows the user to define their own planning assumptions based upon housing or employment growth in the modelled area. Given the committed development is known in more detail for the Mansfield District than in the NTEM forecasts, alternative planning assumptions were calculated. Given the Committed Development growth exceeds NTEM growth, an alternative planning scenario was generated assuming no growth in housing or employment numbers within the Mansfield district zones with no specifically modelled developed sites, between 2016 and 2033. The trips identified in the Mansfield committed developments sites would then be treated as additional to that background growth for Level 1 (light vehicles) of the matrix.

Level 2 (HGV) trips for the Mansfield district were fixed at base level, with Level 2 trips identified in the Mansfield committed developments sites being treated as additional growth.

As four developments in Ashfield have been identified for inclusion in the Reference Case, the full TEMPRO (Level 1) and NTM (Level 2) growth factors for Ashfield were reduced to take into account the additional development trips of the four Ashfield developments. Therefore the Ashfield zones were constrained to TEMPRO and NTM growth but with the four specific developments and their associated trips were modelled in detail.

All other zones were constrained to the full TEMPRO (Level 1) and NTM (Level 2) growth.

It is noted that, despite assuming no growth in housing or in jobs, there is a small increase in the number of trips. These increases are a result of the expectation that car ownership will increase and housing developments already in the model are likely to make more trips in the future.

The matrix totals for the NTEM and NTM alternative planning scenario are presented below in Table 7.

Table 7 Trip Matrix Totals - Base and NTEM/NTM Alternative Planning (vehicles)

	AM	PM
Base Year 2016	29,565	31,678
NTEM Alternative Assumptions 2033	31,786	33,944
Growth	2,221	2,266

1.6 Change of Use

As some of the committed developments identified in the Mansfield district were classified as a change of use, it was necessary to remove trips from the relevant model zones if the new development would generate less trips then the previous use. These matrix totals are presented in Table 8. There were no zones that had less HGV trips in the Reference Case than the Base Year so the Level 2 matrix was not reduced.

Table 8 Light vehicles, Trips to be removed trips

	Number of Trips (Vehicles)			
	AM (Origin)	**AM (Destination)**	**PM (Origin)**	**PM (Destination)**
Trips to be removed	26	26	61	57

1.7 Fuel and Income Adjustment Factors

It is necessary to apply additional factors to the matrices to account for the effect of income growth and the changes to the affordability of personal vehicle travel. As travel becomes relatively cheaper compared to personal income, travel becomes more efficient and therefore travel distances per person will tend to increase. These effects are accounted for by applying the fuel and income adjustment factor. These are provided in the July 2016 WebTAG data book Table M 4.2.1 and the relevant factors for the Mansfield traffic model forecasting are presented below in Table 9.

Table 9. Fuel and Income Adjustment Factors

Period	Fuel Factor	Income Factor	Combined
2012-2031	1.0429	1.0226	1.0665

The combined factor is applied to the light vehicle matrix (Level 1) for both the AM and PM peaks in all districts. The factors were not applied to heavy vehicles (Level 2). Fuel and income adjustment factors were not applied to the Committed Developments trips as these were considered to be new trips to the network.

1.8 Reference Case Matrices

The trips associated with the Mansfield and Ashfield committed development sites identified in Figure 1 and trip generated displayed in Table 1 were combined, on a cell by cell basis, with the alternative planning growth forecast and the change of use and fuel and income adjustments to produce Reference Case forecasts. The final trip matrix totals are presented in Table 10.

Table 10 Trip Matrix Totals - Base and Reference Case (vehicles),

	AM	PM
Base Year 2016	29,565	31,678
Reference Case 2033	39,452	40,890
Growth to 2033	9,887 (+33%)	9,212 (+29%)

2. Conclusion

2.1 Introduction

This Reference Case Forecasts technical note details the methodology used to develop a Reference Case forecast for use in the Mansfield Transport Study. The resulting numbers of trips contained within the Reference Case trip matrices have been presented.

2.2 Summary

The Mansfield traffic model, with updates to 2016 baseline conditions applied, was the starting point for building the forecast models.

The forecast year is 2033 and the model has forecast of the AM and PM peak hours.

Highway improvements to the network were included in the forecast year models.

Alternative planning assumptions and fuel and income growth were applied to the non-development trips in the future year trip matrices.

Reference Case forecast trip matrices were updated based upon assumption about known committed development sites, as identified by Mansfield District Council. Large committed development sites in Ashfield, located close to the Mansfield/Ashfield border were also included in the Reference Case Forecast

The trips generated by Committed Development sites, plus the effects of background traffic growth are compatible with the growth forecast for Mansfield produced by the DfT's national travel models.

The forecast year trip matrices were assigned to the forecast networks to assess highway capacity impacts in the future year.

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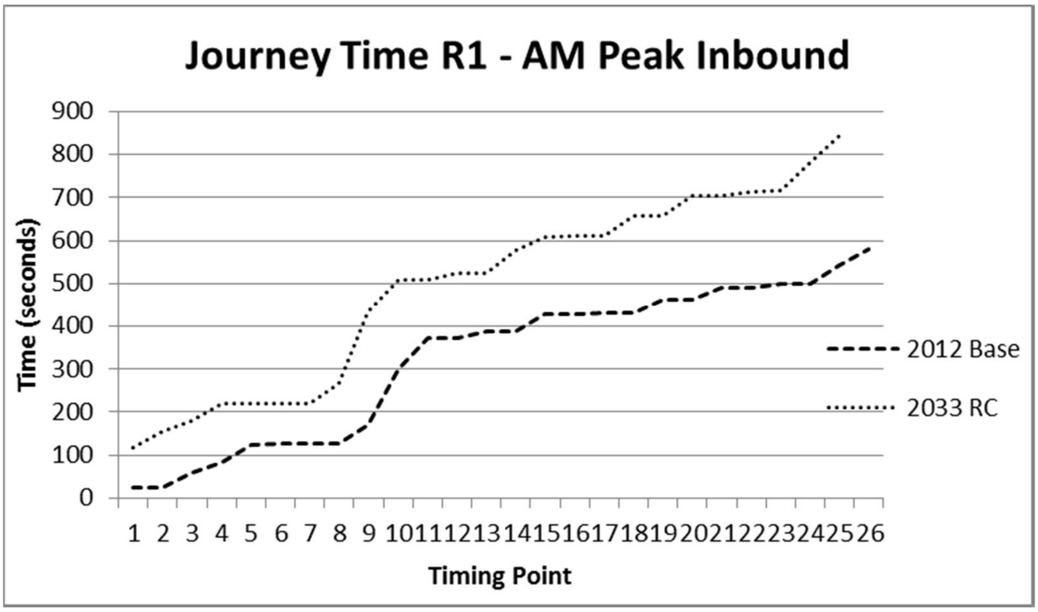
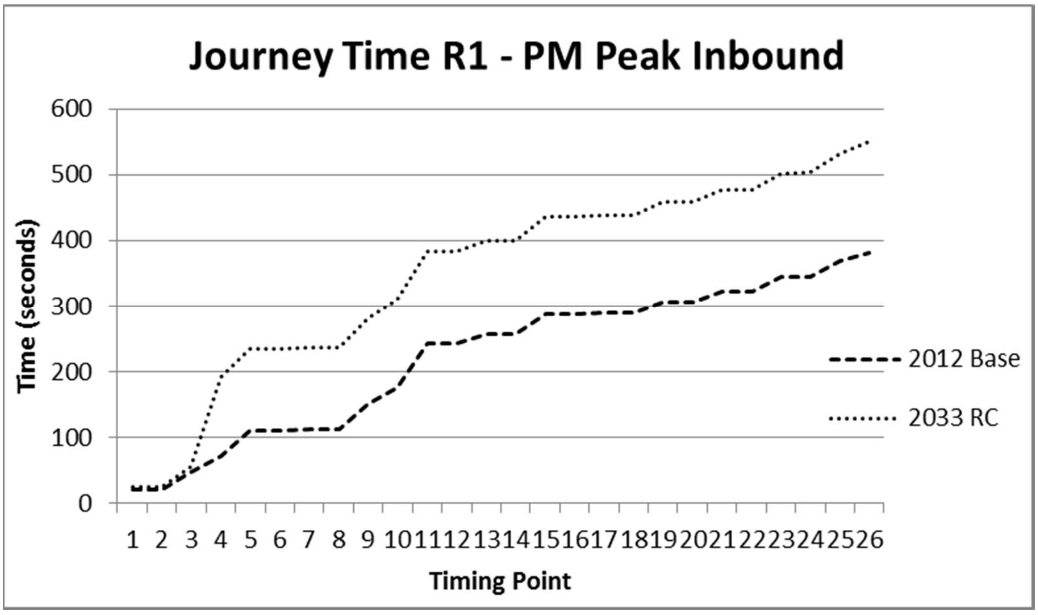
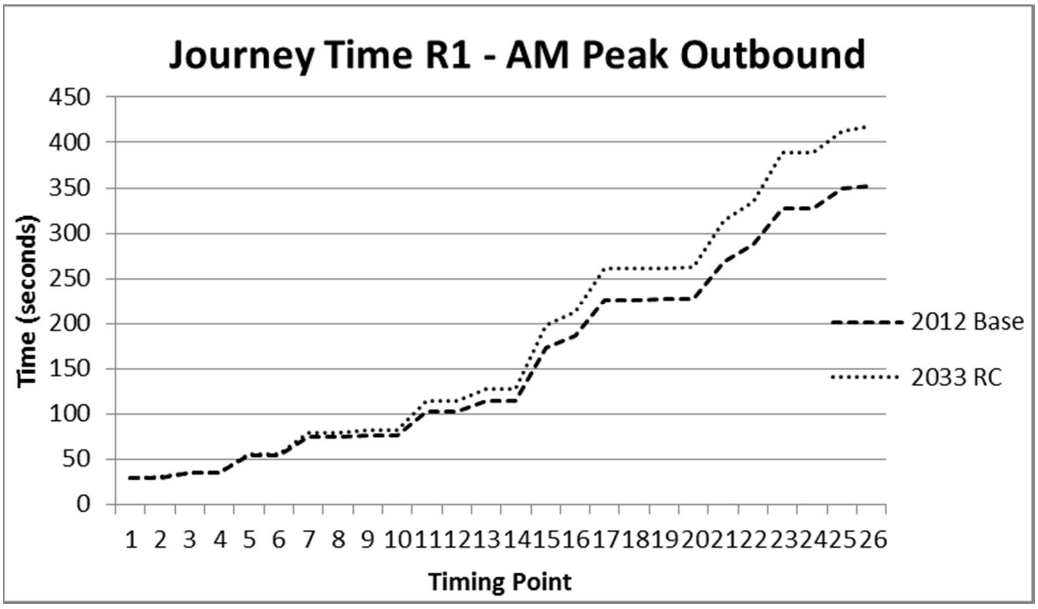
Appendix E Route Time-Distance Plots

Appendix E: Route Time Distance Plots



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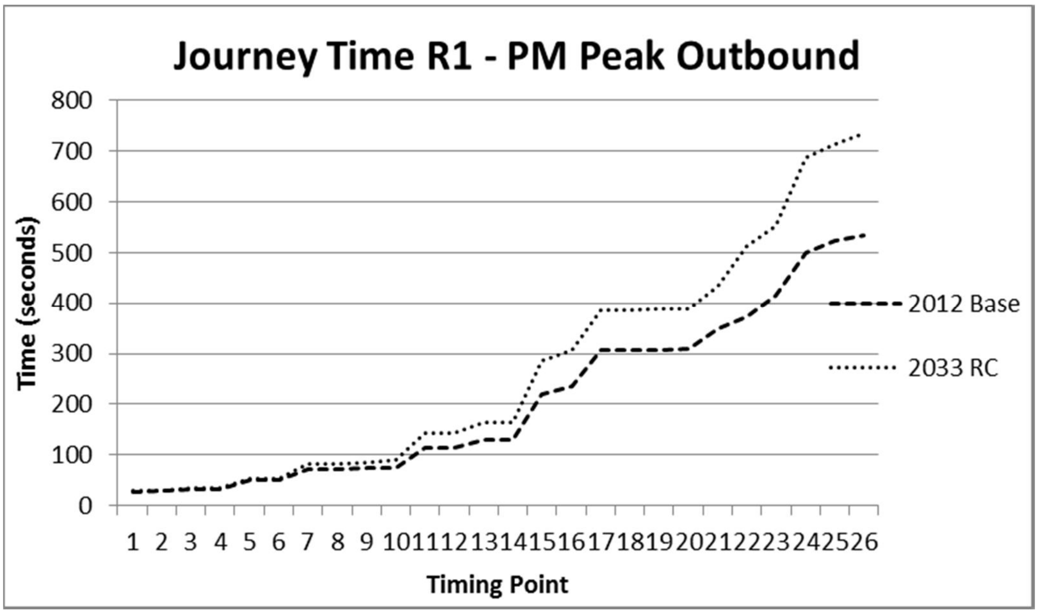
Timing Point
2012 Base
2033 RC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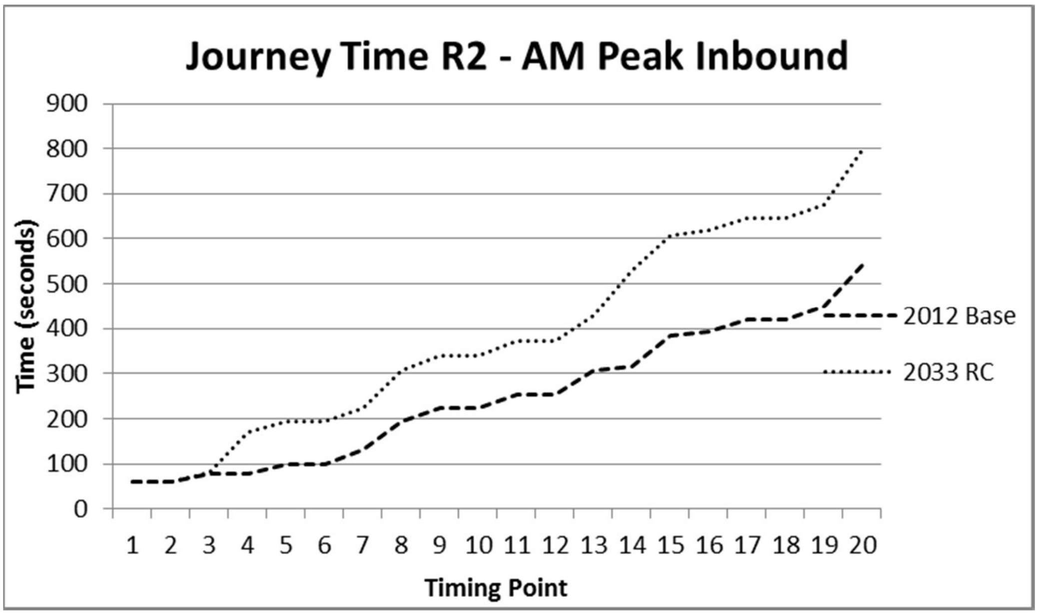
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Timing Point
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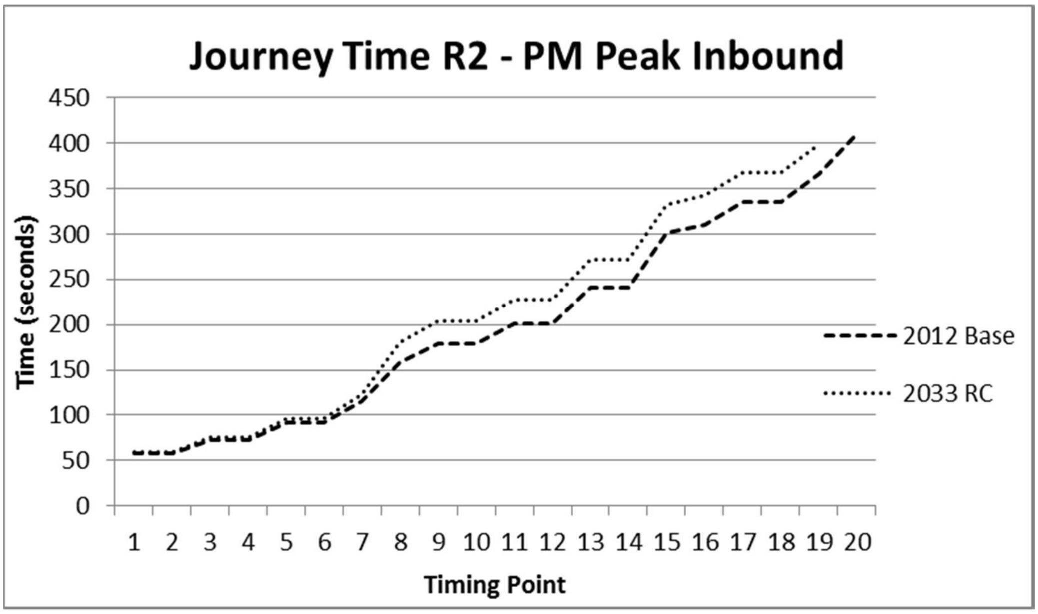
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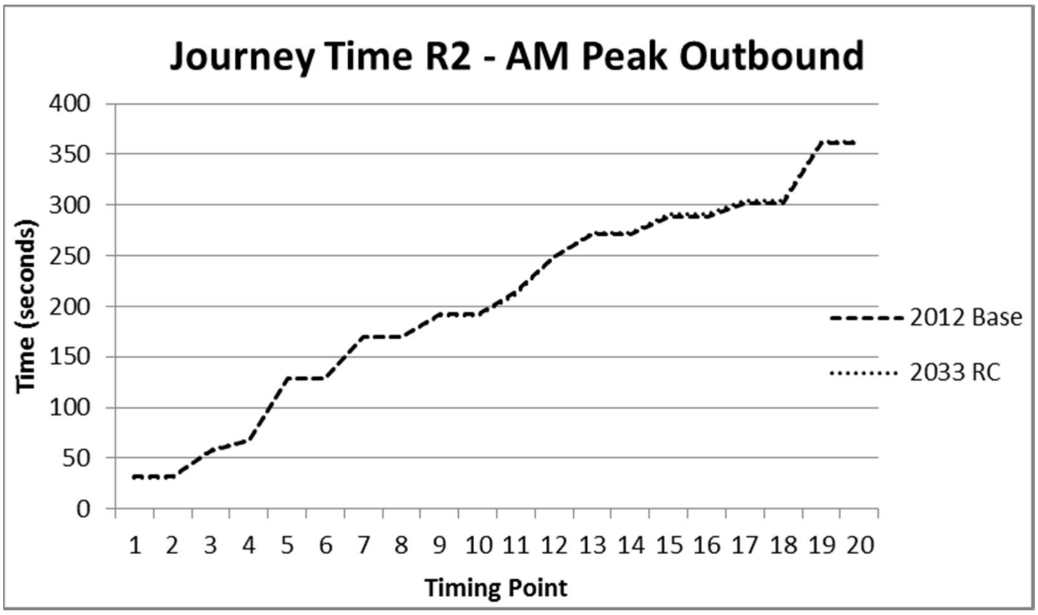
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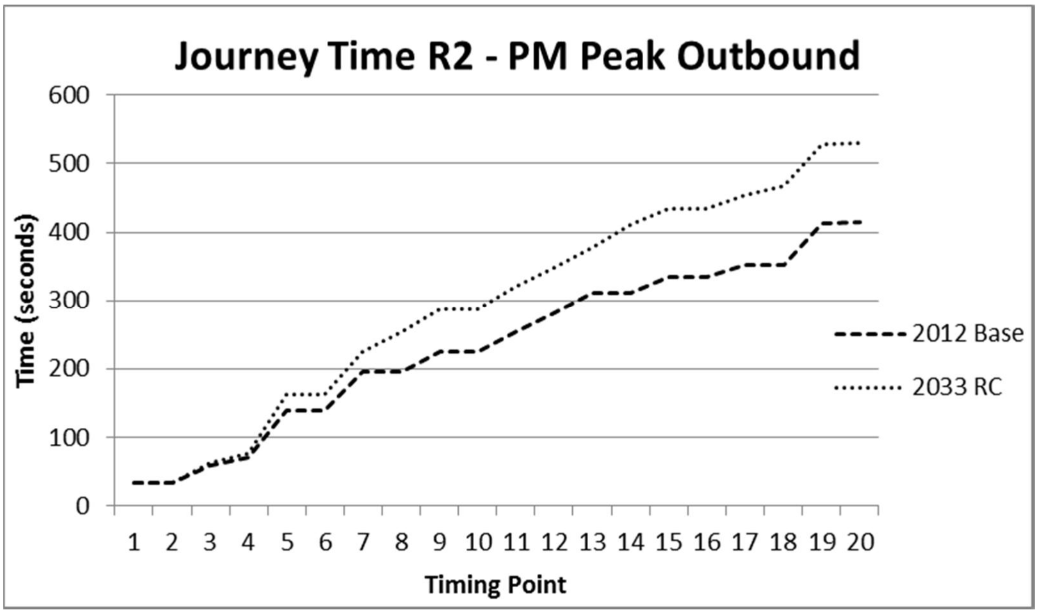
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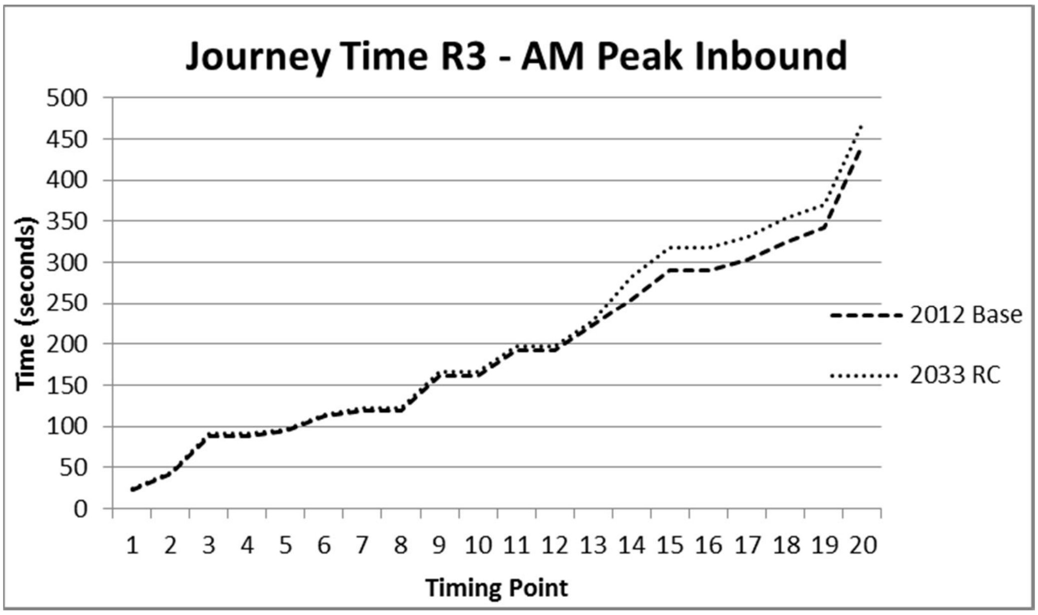
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Timing Point
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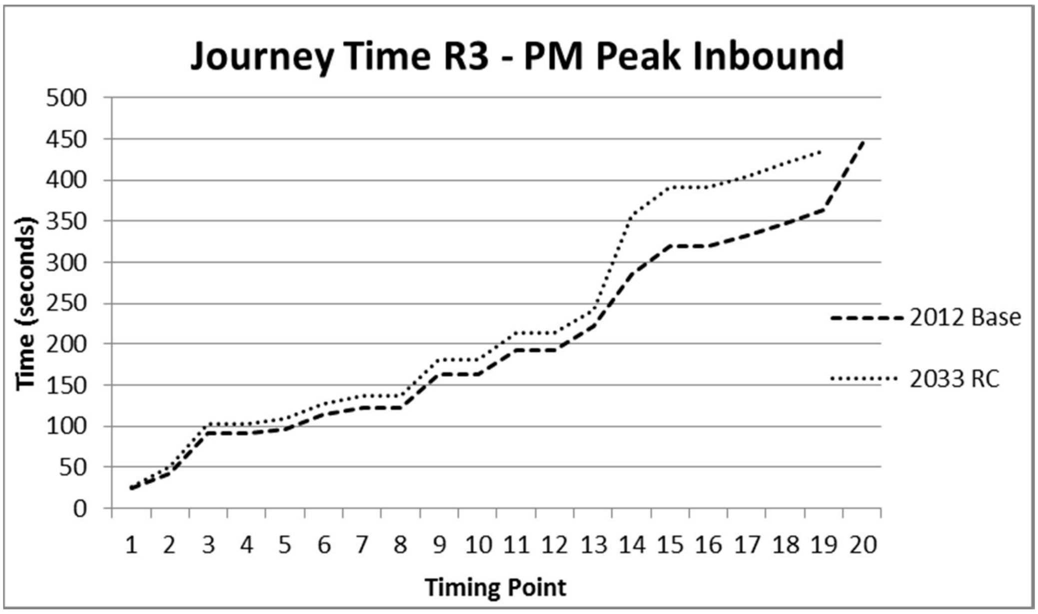
2033 RC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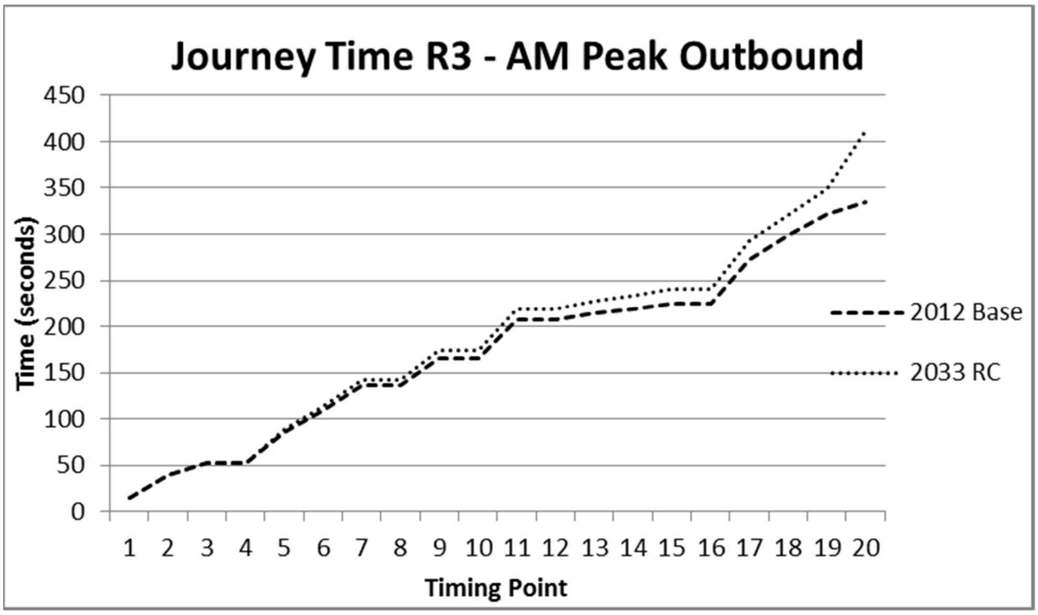
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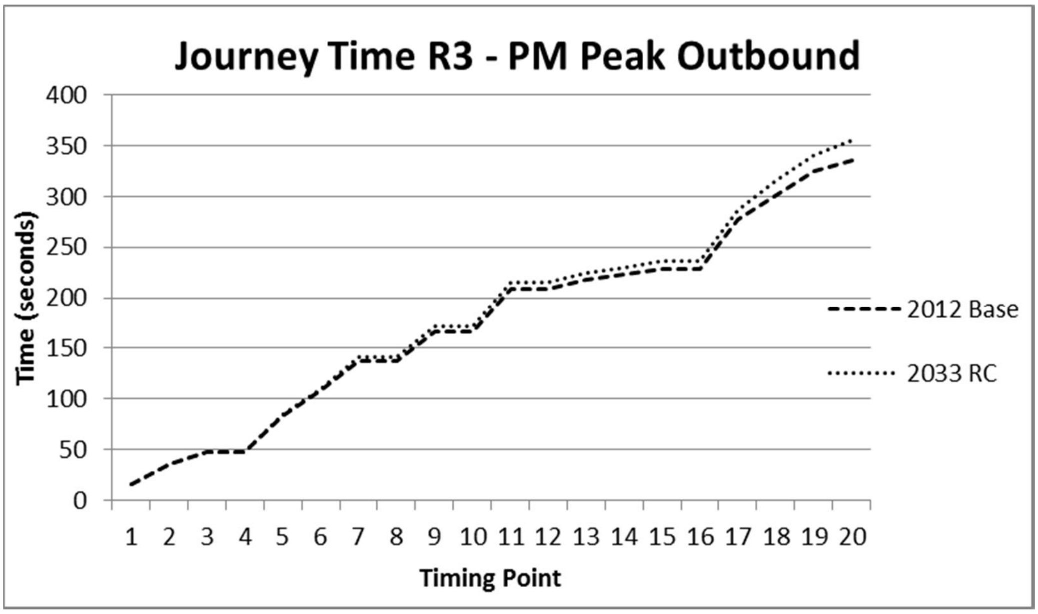
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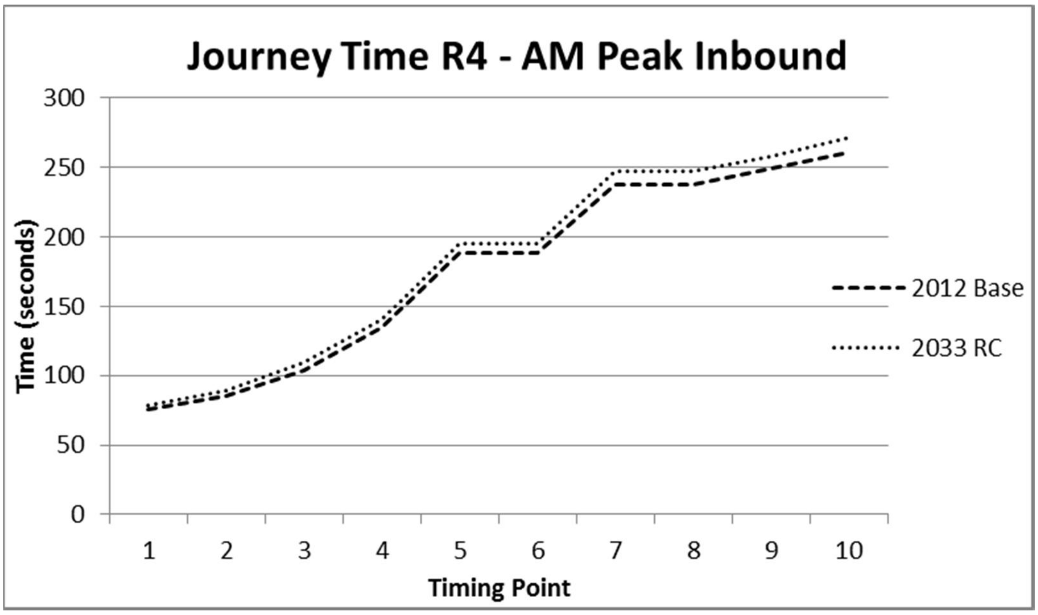
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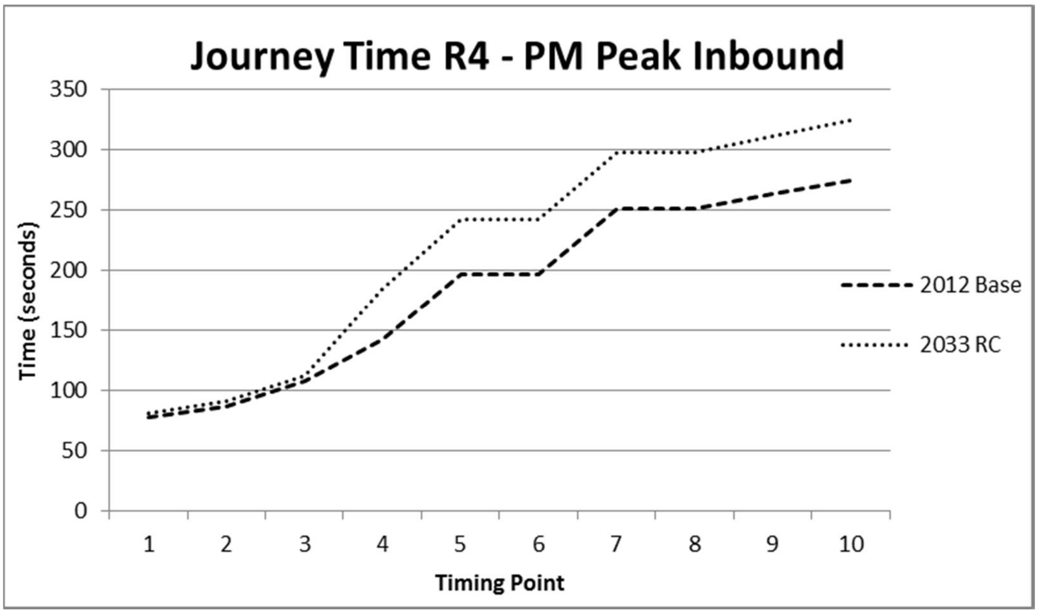
2012 Base
2033 RC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Timing Point
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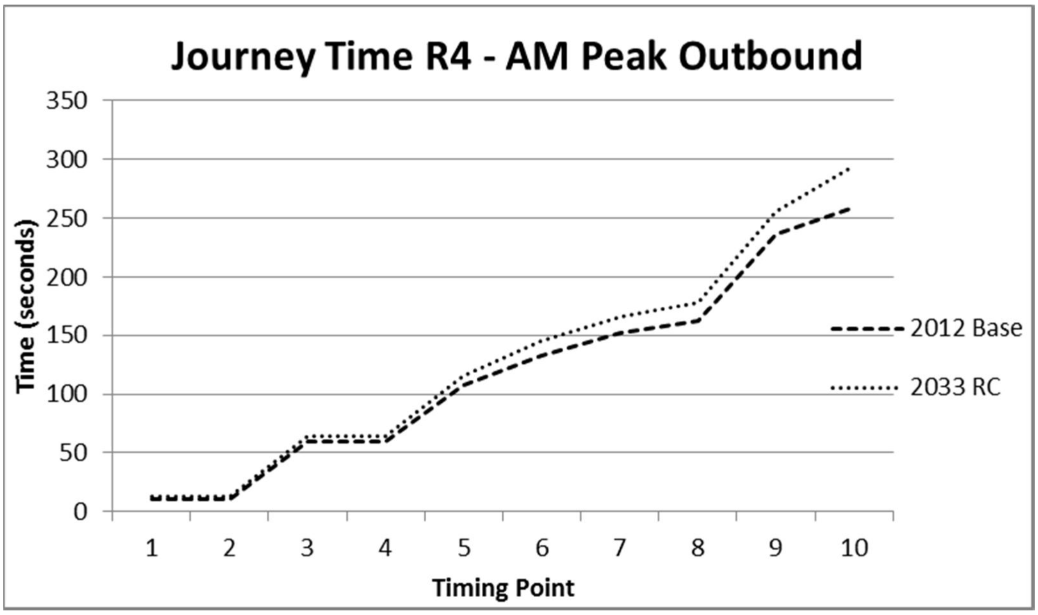
2033 RC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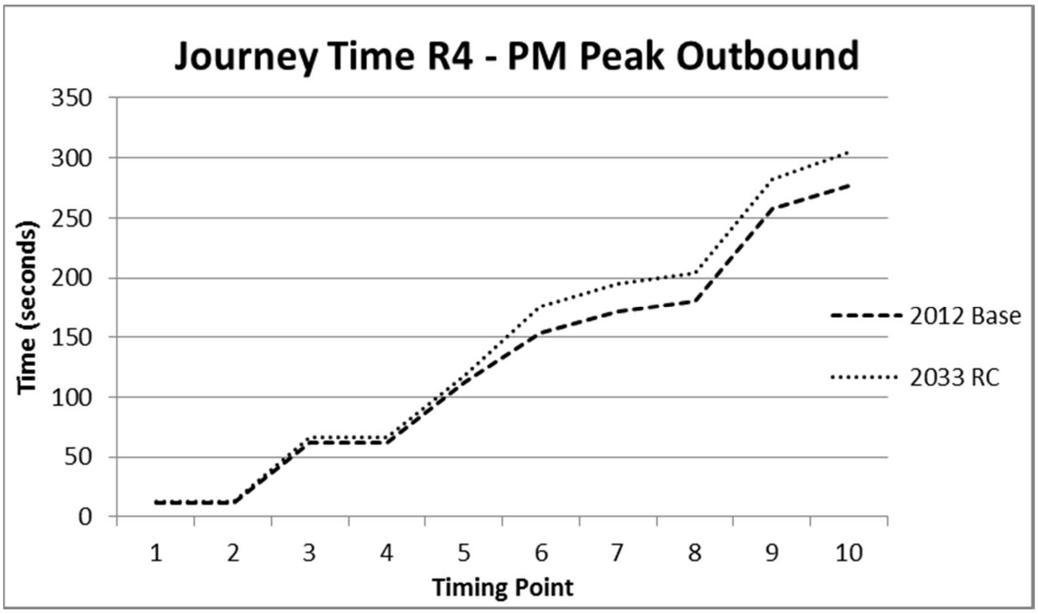
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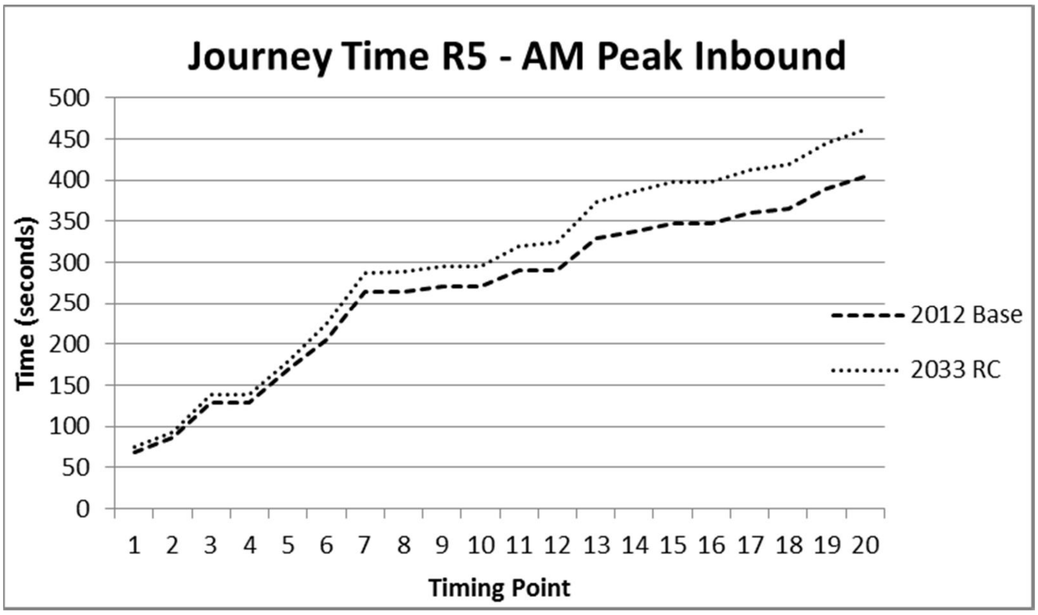
2033 RC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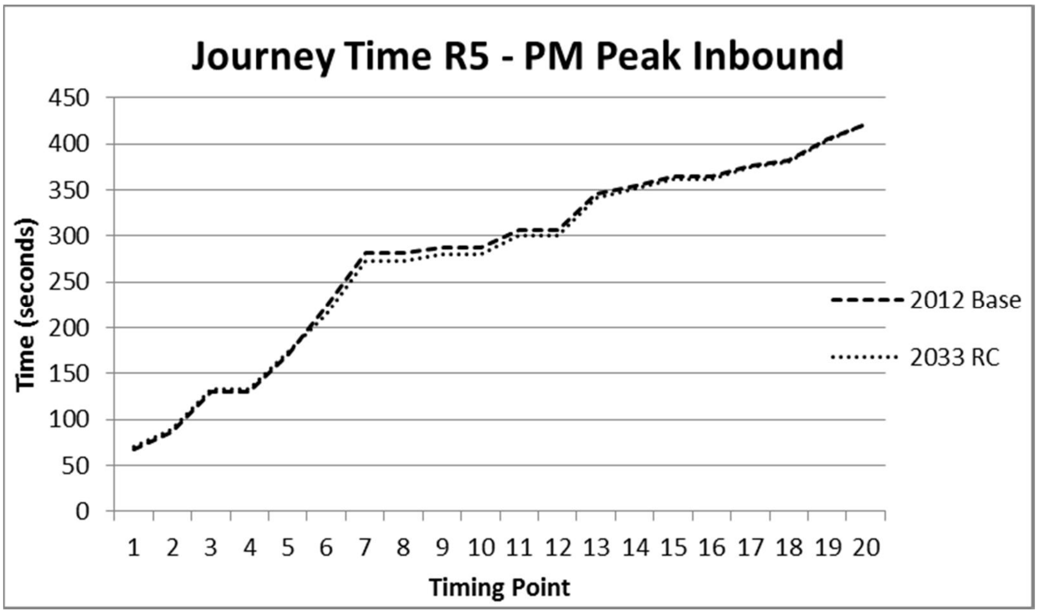
2033 RC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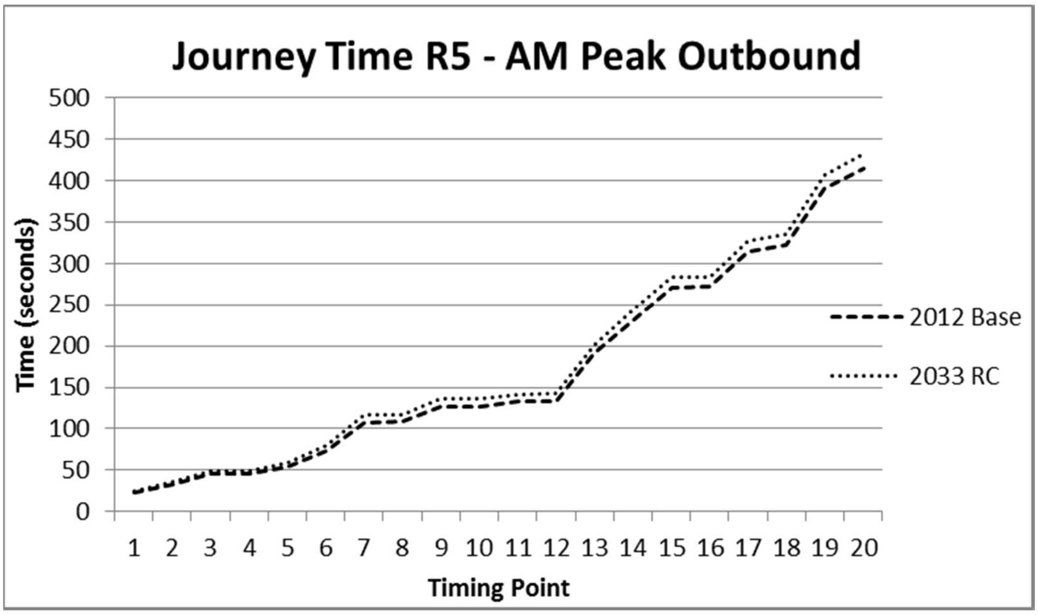
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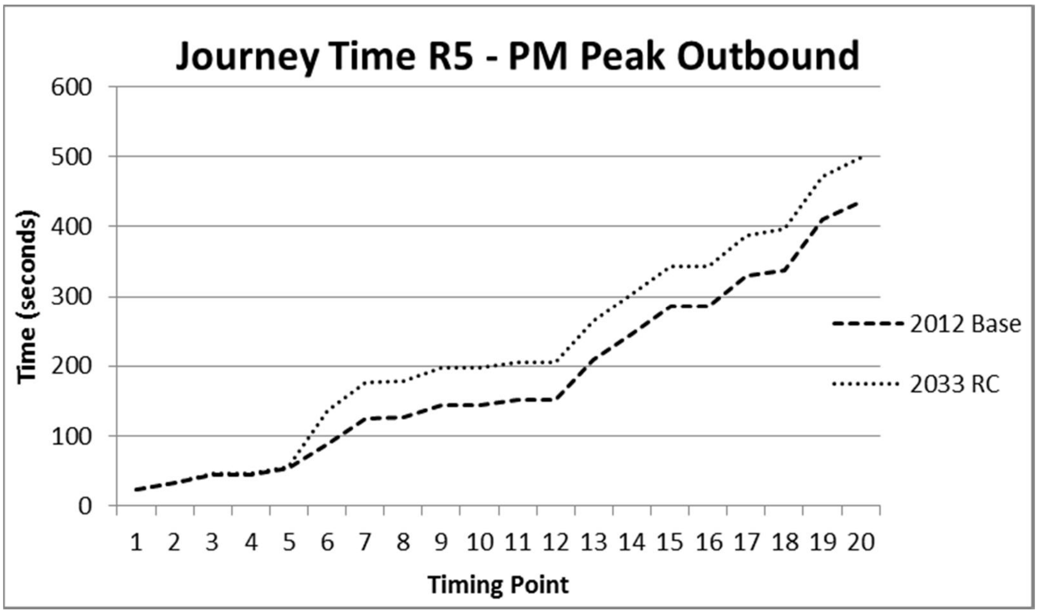
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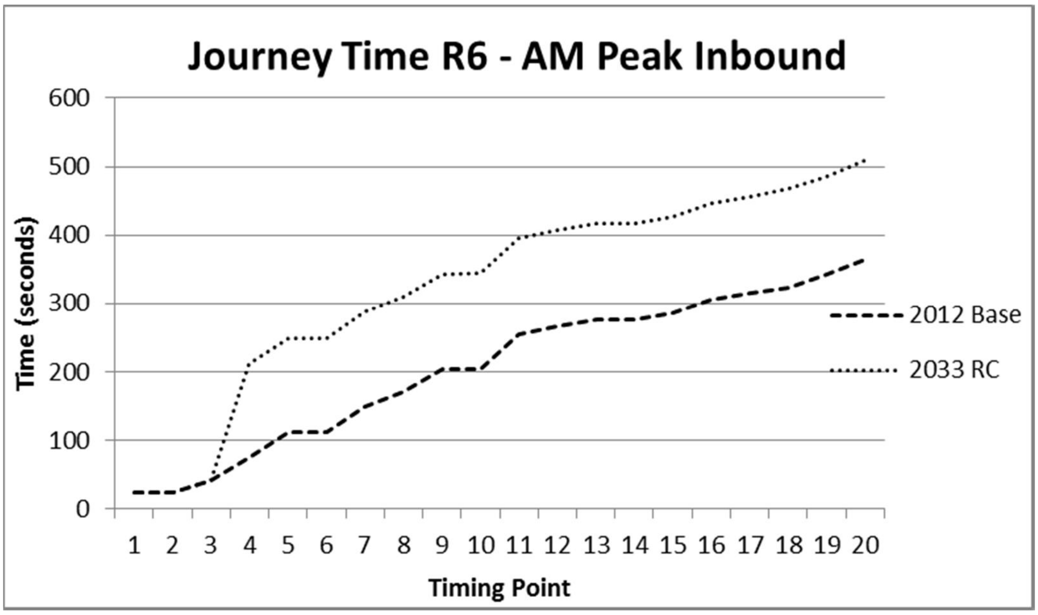
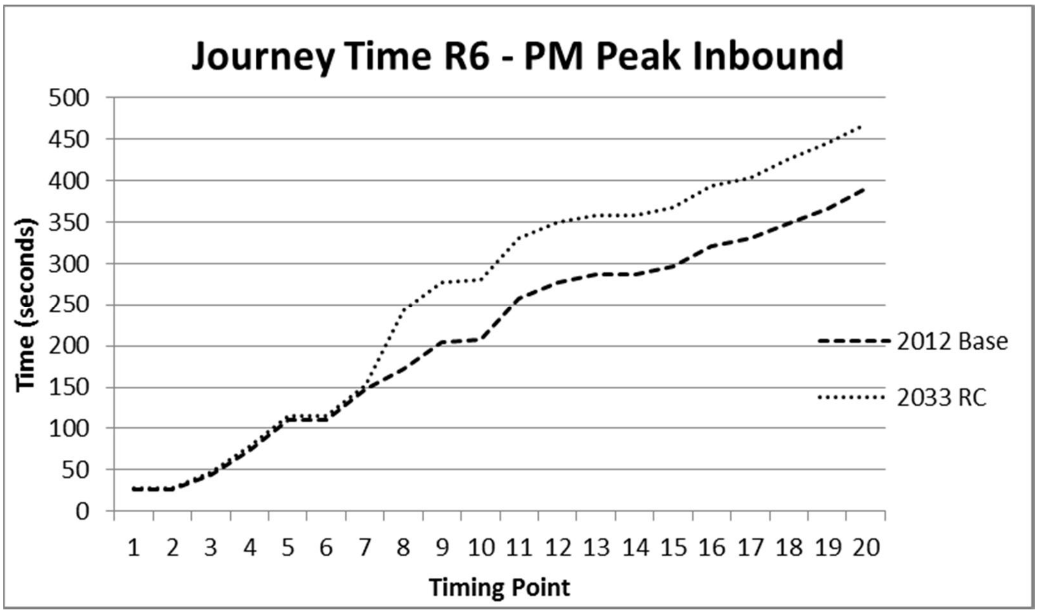
Time (seconds)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Timing Point
2012 Base
2033 RC


Journey Time R6 - AM Peak Inbound
600
500
400
300
200
100
0
Time (seconds)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Timing Point
2012 Base
2033 RC


Journey Time R6 - PM Peak Inbound
500
450
400
350
300
250
200
150
100
50
0
Time (seconds)
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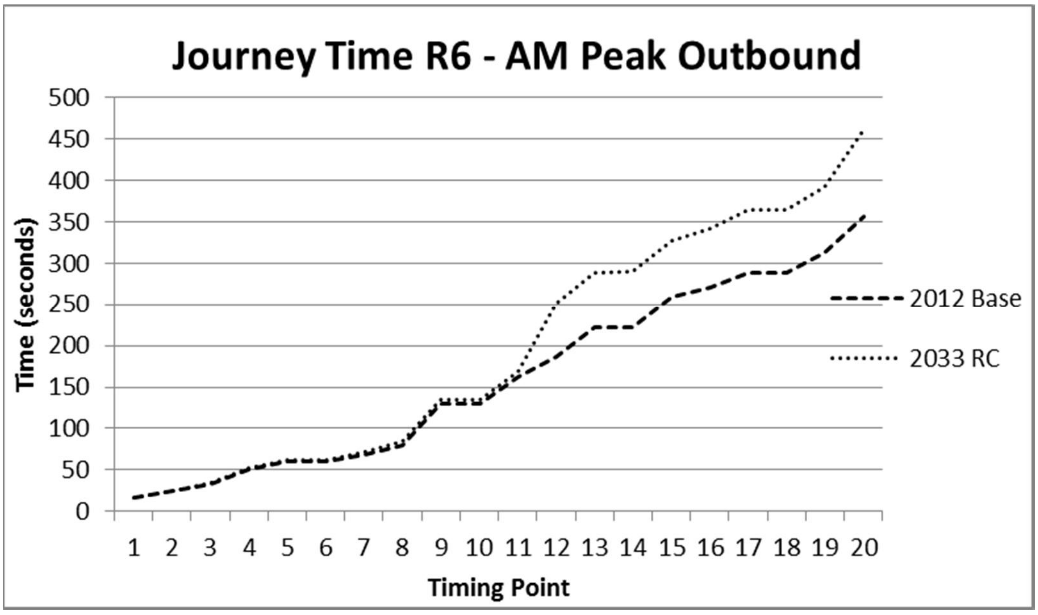
Timing Point
2012 Base
2033 RC


Journey Time R6 - AM Peak Outbound
Time (seconds)
500
450
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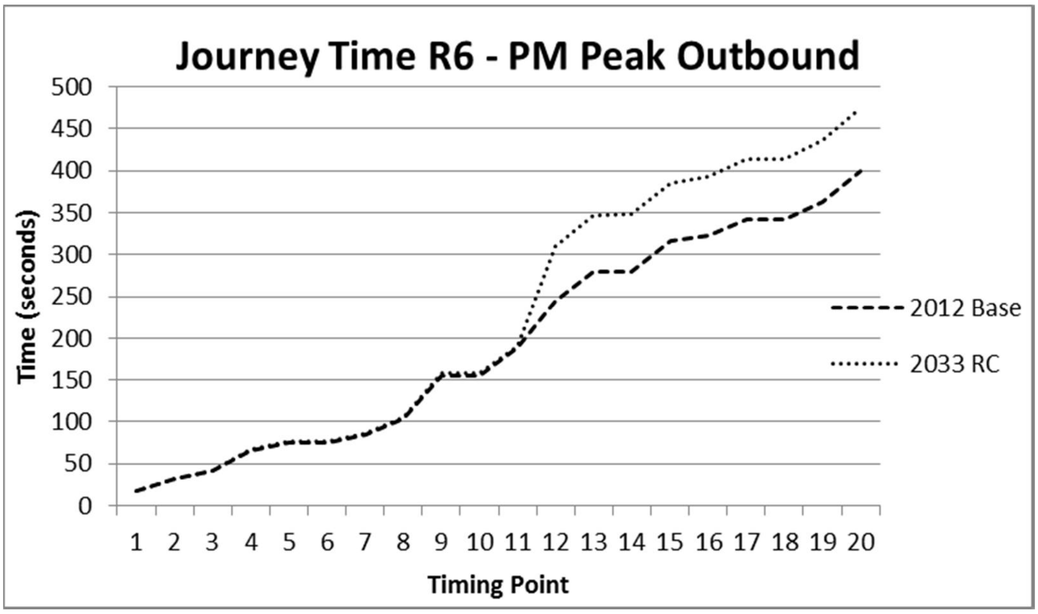
Timing Point
2012 Base
2033 RC


Journey Time R6 - PM Peak Outbound
Time (seconds)
500
450
400
350
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250
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150
100
50
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Timing Point
2012 Base
2033 RC

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