M3 Junction 9 Improvement

Scheme Number: TR010055

7.10 Combined Modelling and Appraisal Report (Rev 1) Clean

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Glossary

AADT: Annual Average Daily Traffic

ATC: Automatic Traffic Count

BCR: Benefit Cost Ratio

Buffer: Buffer network is a simplified version of the simulation network for locations away from area of interest

COBALT: Cost Benefit Analysis Light Touch (Accident Software)

Convergence: The seek for network stability (Wardrop's First Principle of Traffic Equilibrium or User Equilibrium)

CTM: Construction Traffic Management

DCO: Development Consent Order

Delta statistic or % gap: The difference between the costs along the chosen routes and those along the minimum cost routes, summed across the whole network, and expressed as a percentage of the minimum costs, usually known as 'Delta' or the '%GAP.

DM: Do-Minimum

DMRB: Design Manual for Roads and Bridges

DS: Do-Something

GEH: Geoffrey E. Havers statistic formula

HGV: Heavy Goods Vehicle

LGV: Light Goods Vehicle

Link Flow: Number of PCU/hr

LMVR: Local Model Validation Report

Matrix estimation: Refine estimates of movements which have been synthesised

MCC: Manual Classified Count

MCTC: Manual Classified Turning Count

ME: Matrix Estimation

NPV: Net Present Value

NTEM: National Trip End Model

OD: Origin / Destination,

OGV: Ordinary Goods Vehicle

PCF: Project Control Framework

PCU: Passenger Car Unit

PPK: Pence Per Kilometre

PPM: Pence Per Minute

PVB: Present Value of Benefits

PVC: Present Value of Costs

RTF: Road Traffic Forecasts

SATURN: Strategic Transport Modelling software

SERTM: South East Regional Transport Model

TAG: Transport Analysis Guidance

TEE: Transport Economic Efficiency

TUBA: Transport Users Benefit Appraisal software

UL: Uncertainty Log

VDM: Variable Demand Model

VISSIM: Micro-Simulation Transport Modelling software

VOC: Vehicle Operating Costs

WITA: Wider Impacts in Transport Appraisal software

Executive summary

Purpose

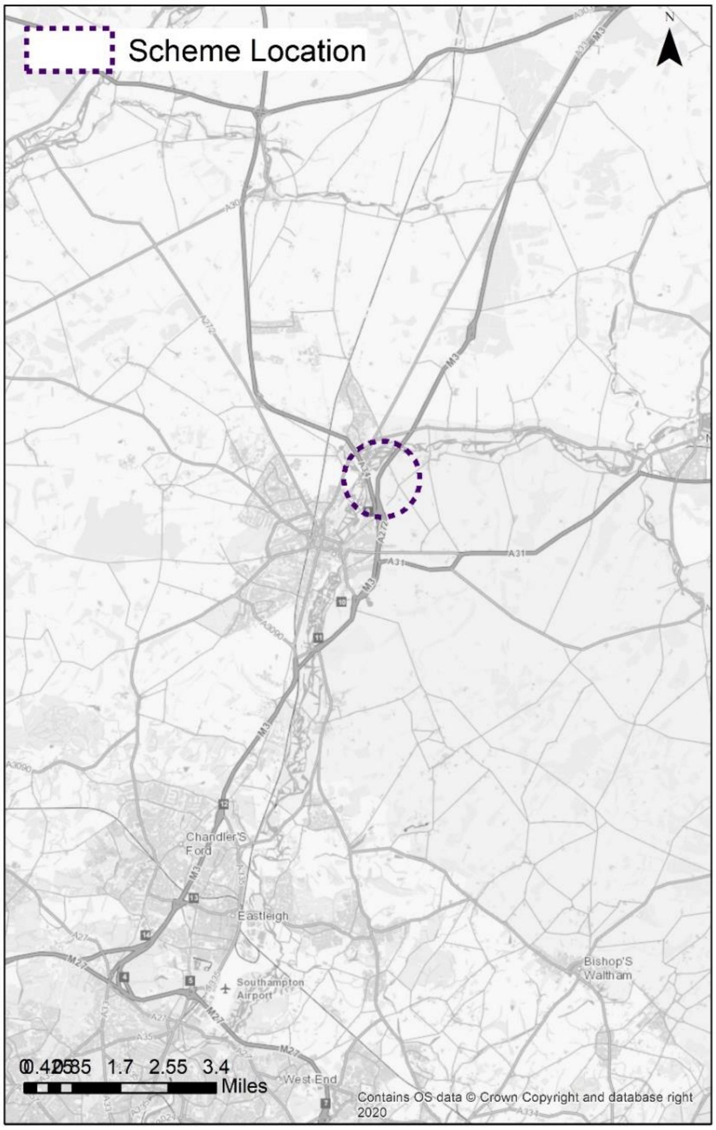
The M3 Junction 9 Improvement Scheme (the Scheme) is a Nationally Significant Infrastructure Project (NSIP). The Scheme therefore requires an application for a Development Consent Order (DCO) to be submitted to the Planning Inspectorate, acting on behalf of the Secretary of State (SoS).

The Combined Modelling and Appraisal (ComMA) report forms part of Volume 7 of the application for a DCO authorising National Highways (the Applicant) to construct and operate the Scheme. The ComMA is intended to inform decision makers and stakeholders on the evidence underpinning the business case: notably how it has been developed from the initial identification of the underlying transport problems; then covering the data used in the development of the Scheme traffic models, development of traffic forecasts, assessment of the impact of the Scheme on traffic and the environment, and subsequently the economic appraisal of the Scheme.

The Scheme

The M3 Junction 9 is located to the east of the City of Winchester which is in the county of Hampshire. M3 Junction 9 is a key transport interchange connecting South Hampshire (facilitating an intensive freight-generating industry) and the wider sub-region, with London via the M3 and with the Midlands and the North of England via the A34 (which also links to the principal east-west A303 and M4 corridors).

Figure 0-1: Location of the Scheme



The improvements proposed as part of the Scheme both maintain existing connectivity on the road network, whilst providing enhanced capacity, simplified routing and improved facilities for walking, cycling and horse-riding routes and landscaping enhancements. The Scheme would provide new free flow links between the M3 and A34, as well as a dedicated new A33 alignment.

A design review of the Scheme was undertaken to address key issues that were raised during the 2019 statutory consultation. Two further design solutions to those proposed at the 2019 statutory consultation were assessed against a set of multi-disciplinary criteria including economic impacts and value for money. After completion of the PCF Stage 3a, further design work was undertaken in PCF Stage 3b. A statutory consultation was undertaken as Part of Stage 3b, and the Applicant has subsequently further developed the Scheme and the DCO application documents following statutory consultation.

Further Stage 3b value engineering amendments of the Stage 3a design proposed a reduction of the southern section overpass of the M3 from 3 to 2 lanes. In addition, amendments were proposed to reduce the M3 northbound off-slip approach to the junction from 3 to 2 lanes and the M3 southbound approach from a 3-lane approach with dedicated left turn lane to a standard 3 lane approach.

A further statutory consultation was undertaken in 2021 for the Scheme.

Following a ministerial statement on 12 January 2022, the roll out of all lane running (ALR) schemes not yet constructed was paused. As the M3 Junction 9 to Junction 14 Scheme tied into the Scheme on the south facing slips of the gyratory roundabout, some minor design development was undertaken.

The design changes did not result in any change to the Application Boundary. The Applicant provided a Scheme update in September 2022 to provide further information about the minor design amendments and proposed timescales following the ALR pause. The Applicant also used the Scheme update to notify stakeholders about the design changes following the responses received from the 2021 statutory consultation.

Model development

The PCF Stage 3 (Preliminary Design) Scheme assessment adopted the M3M27 SMI model, which was based on the Applicant's South East Regional Traffic Model (SERTM).

As part of the Scheme PCF Stage 3 (Preliminary Design) programme, the M3M27 SMI model underwent several enhancements. Calibration and validation focussed on the area of Winchester to strengthen the model and make it suitable for the analysis of impacts of the Scheme. These enhancements included improvements to the local network detail and additional calibration of the traffic model, including amendments to the trip matrix in the area local to the junction.

The enhanced model is referred to as the M3 Junction 9 Model.

There are two primary modelling components to the M3 Junction 9 Model as follows:

- Highway Assignment Model (HAM); and
- Variable Demand Model (VDM).

Overall, the network and matrix calibration improved the performance of the model. High standards were achieved in the focal area of the Scheme around Junction 9 and Winchester, which met DfT's TAG criteria for the calibration and validation of transport models. The standard of calibration and validation achieved across the wider Hampshire area in the donor model (M3M27 SMI) was also retained.

In PCF Stage 2 (Options Selection) an operational assessment model was developed using PTV-VISSIM micro-simulation software (version 11). Referred to as the operational model, this was used to test the updated Scheme in Preliminary Design.

Forecast future flows

The forecasting process followed the guidance set out in TAG Unit M4 related to forecasting and uncertainty. To demonstrate the long-term benefits of the Scheme, three forecast years were modelled:

- **2027**: assumed to be the opening year of the Scheme at the time of the development of the forecasts;
- **2042**: assumed to be the design year 15 years after the assumed opening year; and
- **2047**: a horizon year for modelling that is three years on from that in the Stage 3a assessment.

Strategic model forecast outputs

Overall the pattern of impacts on the highway network is similar between the three modelled years. The scale of change is generally greatest in 2047, given that this scenario has the highest level of travel demand.

The Scheme is predicted to increase the traffic flow on Easton Lane. The diversion of A34 traffic from M3 Junction 9 increases the attractiveness of A272 Spitfire Link as an access route to the M3 and Winchester City while traffic flows on several local roads within Winchester are predicted to decrease.

Several analysed routes show journey time improvements with the introduction of the Scheme. The A34 route between M3 J10 and A34/A272 junction is predicted to have journey time savings in both directions in all time periods in 2042 and 2047 where the Scheme provides a direct connection between the M3 and A34.

Operational model forecast outputs

With the Scheme in place, most routes show a predicted decrease in journey time. The largest reductions are between the A31 Easton Lane where southbound (Route 10) journey times reduce by almost 4 minutes in the AM peak and northbound (Route 9) journey times reduce by around 3.5 minutes in the PM peak. This is due to the significant congestion in the Do-Minimum scenario being alleviated.

The Scheme is predicted to reduce queuing and delay at Junction 9. Most significantly at the A33 (old A34 approach), where average queuing in the Do-Minimum 2047 forecast is over 0.8 kilometres in the PM peak, which is removed with the introduction of proposed junction improvements.

Summary of economic appraisal

Scheme costs were prepared by the Applicant, including construction and operating and maintenance, which were rebased to 2010 market prices with a total Present Value Cost (PVC) of £112.7M.

The results of the transport economic analysis indicated that the Scheme is predicted to generate user benefits in the order of £152.7M. The greatest benefit relates to travel time savings, amounting to £155.5M, which are predominantly due to the provision of the free-flow movement between the A34 and the M3.

The construction traffic management impacts are predicted at -£2.7M.

The accident assessment was modelled using COBALT which indicated a predicted reduction in accidents with a corresponding benefit of £22.9M.

Environmental impacts appraisal indicated minor negative impacts for Noise (£-1.3M), moderate positive impacts for Local Air Quality (£4.7M) and moderate negative impacts for Greenhouse Gases (£-24.1M).

Journey time reliability was qualitatively assessed and does not form part of the monetised benefits. The Scheme is expected to improve journey time reliability where it provides capacity which reduces congestion and reduces journey time delays.

The total Present Value of Benefits (PVB) (Level 1) is £152.3M, with a Net Present Value (NPV) of £39.5M, and an Initial BCR of 1.35.

Inclusion of (Level 2) wider economic impacts, estimated at £41.8M, increased the PVB to £194.1M, with an adjusted NPV of £81.4M, and an Adjusted BCR of 1.72.

Consideration of results against scheme objectives

The objectives of the Scheme are:

- To reduce delays at M3 Junction 9 on all links M3, A33 and A34
- Smooth the flow of traffic by improving journey time reliability and reducing delays (time lost per vehicle per mile) at M3 Junction 9 and the exit and entry roads for the A33 and A34
- Improve the safety for all road users and reduce the annual collision frequency and severity ratio on the M3 Junction 9
- Support economic growth and ensure the junction can accommodate additional traffic
- Improvements for walkers and cyclists, including connecting the National Cycle Network Route 23 which is severed by the current junction layout

The Scheme is predicted to meet the objectives by:

- **Reducing delays** at key areas that are presently congested. The Scheme also reduces journey times from the M3 South to the A34 and the A34 to the M3 South in the AM and PM peak period. Furthermore, there are reductions in journey times between Easton Lane and the A31 and A33
- **Reducing journey times** on key approaches to the M3 Junction 9. There are reductions in delays on the M3 Southbound off-slip/A34 and A272 approach in the AM and PM peak periods
- **Providing safety benefits** of £23M and will save in the order of 537 collisions over the appraisal period with a predicted reduction in slight, serious, and fatal casualties
- **Providing Wider Economic Benefits** of £42M – which is expected to stimulate local development sites and economic activity
- **Providing improvements to walking and cycling** in terms of new, improved, and upgraded crossings for the M3

1 Introduction

1.1 Purpose of this report

1.1.1 The M3 Junction 9 Improvement Scheme (the Scheme) is a Nationally Significant Infrastructure Project (NSIP). The Scheme therefore requires an application for a Development Consent Order (DCO) to be submitted to the Planning Inspectorate, acting on behalf of the Secretary of State (SoS).

1.1.2 The Combined Modelling and Appraisal (ComMA) report forms part of Volume 7 of the application for a DCO authorising National Highways (the Applicant) to construct and operate the Scheme. The ComMA is intended to inform decision makers and stakeholders on the evidence underpinning the business case: notably how it has been developed from the initial identification of the underlying transport problems; then covering the data used in the development of the Scheme traffic models, development of traffic forecasts, assessment of the impact of the Scheme on traffic and the environment, and subsequently the economic appraisal of the Scheme. In undertaking the assessment of the Scheme, the 'without scheme', Do-Minimum (DM), is compared with the 'with scheme', Do-Something (DS), to forecast the impact the Scheme would have on journey times, traffic flows, accidents, air quality, greenhouse gases and noise.

1.1.3 The ComMA is essentially intended to be an 'end of stage' report, detailing what has occurred through the Applicant's Project Control Framework (PCF) Stage 3 and indicating where analysis has been refined or updated from a previous stage.

1.1.4 The Applicant updated and brought forward the Stage 3a post consultation design solution fix. This included updating the forecast to a revised opening year (2027), design year (2042) and horizon year (2047 - change by the addition of 3 years). Whilst this current stage is referred to as Stage 3b, it essentially comprises the work that has been undertaken since the 2019 statutory consultation up to the submission of the DCO.

1.2 The Applicant

1.2.1 National Highways is the Applicant and the strategic highways company as defined in the Infrastructure Act 2015, and is charged with operating, maintaining and improving England's motorways and major A roads on behalf of the Department for Transport (DfT).

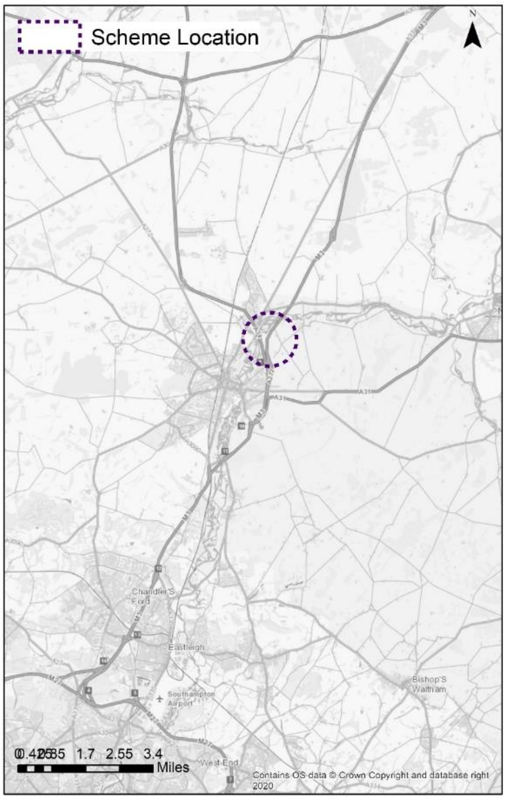
1.2.2 National Highways' Road network totals over 4,300 miles (6,920 kilometres). Whilst this represents only 2% of all roads in England by length, these roads carry a third of all traffic by milage and two-thirds of all heavy goods traffic.

1.2.3 In summer 2021 Highways England rebranded to National Highways, therefore all references to 'the Applicant' prior to summer 2021 will be to Highways England and all references post summer 2021 will be to National Highways.

1.3 Background

1.3.1 M3 Junction 9 is a key transport interchange connecting South Hampshire (facilitating an intensive freight-generating industry) and the wider sub-region, with London via the M3 and with the Midlands and the North of England via the A34 (which also links to the principal east-west A303 and M4 corridors). The M3 is also a key strategic route for freight traffic accessing the Port of Southampton. In addition, Junction 9 is one of the access points to the City of Winchester from the M3 motorway. As a result, the Scheme (location shown in **Figure 1-1**) will have an impact not only on the Strategic Road Network (SRN), but also to some extent on the local traffic to and from Winchester.

Figure 1-1: Location of the Scheme



Scheme description

1.3.2 The improvements proposed as part of the Scheme both maintain existing connectivity on the road network, whilst providing enhanced capacity, simplified routing and improved facilities for walking, cycling and horse-riding routes and landscaping enhancements. The Scheme would provide new free flow links between the M3 and A34, as well as a dedicated new A33 alignment. The Scheme elements are as follows:

- Widening of the M3 from a dual two-lane motorway (two-lane motorway with hard shoulders) to a four-lane motorway (with hard shoulders) between the proposed M3 Junction 9 gyratory north and south slip roads.

- A new smaller grade separated gyratory roundabout arrangement within the footprint of the existing roundabout, incorporating new connections over the M3 with improved walking, cycling and horse-riding routes.
- Connector roads from and to the new gyratory roundabout.
- Improved slip roads to/from the M3.
- New structures (in the form of gyratory bridges, underpasses, retaining walls, subway and a new cycle and footbridge over the River Itchen).
- A new surface water runoff system with associated drainage and infiltration features.
- New signage and gantries.
- Utility diversions.
- New lighting (subways, underpasses and gantries).
- Modifications to topography through cuttings and false cuttings as well as re-profiling of existing landform.
- New walking, cycling and horse-riding provision.
- Creation of new areas of chalk grassland, woodland, scrub planting and species rich grassland.

1.3.3 The Application Boundary covers an area of approximately 109 hectares (ha). This includes the proposed land required for gantries, signage, temporary construction compound areas, areas for environmental mitigation, areas for drainage requirements (some of which would be temporary) and traffic management.

1.3.4 The Scheme includes a package of environmental mitigation and enhancement measures to reduce the impacts from the Scheme to the environment where possible. Consideration has also been given to the enhancement of the South Downs National Park where reasonably practicable.

1.3.5 Bridleways, footpaths and cycleways have been designed to allow all gradients to be less than 1:20 to comply with Department for Transport's (DfT) inclusive mobility impaired users. Also, the walking, cycling and horse-riding routes are designed for cyclists, and therefore all horizontal radii are suited for cyclists. They are also considered acceptable for mobility impaired users. The range of opportunities and barriers to all forms of movements have been given due consideration in the design of the Scheme.

1.3.6 A number of new structures are required to be both constructed and demolished to facilitate the Scheme. Some of the main structures are as follows:

- The existing bridges at the M3 Junction 9 gyratory roundabout are proposed to be demolished and replaced by the two new bridge structures carrying the new gyratory.

- A new underpass is proposed to carry the A34 southbound under the new A33 link road and the existing M3. The A34 northbound underpass would carry the new A34 northbound over the new A33 link.

- The existing subways (Winnall Subway East and Winnall Subway West) located under the existing gyratory are proposed to be demolished to facilitate the construction of the reconfigured roundabout. New subways are proposed along the proposed footpath and cycle path route.

- A new bridge to accommodate the footpath and cycle path over the River Itchen is proposed between the existing Itchen Bridge, (which carries the A34 northbound carriageway), and the existing Kings Worthy Bridge would carry the A33 north and southbound carriageways and the A34 southbound carriageway, respectively.

1.3.7 The walking, cycling and horse-riding facilities around and within the Scheme are to be upgraded. This includes an improvement to the National Cycle Network (NCN) Route 23. An additional footpath, cyclepath and bridleway is proposed on the eastern side of the Scheme to link Easton Lane with Long Walk. Such a route would provide a circular leisure path for those using the South Downs National Park with a link to the other paths around Long Walk with their links to local villages. A new combined footpath and cyclepath for the western side of the Scheme is proposed to link the A33 / B3047 Junction to Winnall Industrial Estate situated on Easton Lane.

1.3.8 A detailed description of the Scheme is provided in **Chapter 1 (Introduction)** and **Chapter 2 (The Scheme and its Surroundings)** of the **Environmental Statement (ES) (Document Reference 6.1)**.

Evolution of the Scheme design

1.3.9 Following the statutory consultation in 2019, the Applicant undertook a further design review of the Scheme presented at the consultation (PCF Stage 3 (Preliminary Design) Design Fix 2), addressing key issues that were raised during the consultation.

1.3.10 As such, two further design solutions to that proposed at the 2019 statutory consultation were assessed against a set of multi-disciplinary criteria including economic impacts and value for money. This information allowed the Applicant to make an informed decision and conclude a preferred design solution to take forward.

1.3.11 The preferred solution at Stage 3a incorporated the following revisions to the consultation design:

- Removal of the A33 Merge/Diverge from the A34, Junction 9 link to the A33 now provided through the Stage 3 Design Fix 2 M3 northbound on-slip with new roundabout north of A34 underpass and contraflow arrangement up to the roundabout.
- Dumbbell gyratory arrangement proposed at Consultation Design revised to oval shaped 2 lane gyratory accompanied with a provision of flares and free flowing turns to increase capacity.

1.3.12 After completion of the PCF Stage 3a, work was developed further in PCF Stage 3b. Further Stage 3b value engineering amendments to the Stage 3a design proposed a reduction of the southern section overpass of the M3 from 3 to 2 lanes. In addition, amendments were proposed to reduce the M3 northbound off-slip approach to the junction from 3 to 2 lanes.

1.3.13 A further statutory consultation was undertaken in 2021 for the Scheme.

1.3.14 Following a ministerial statement on 12 January 2022, the roll out of all lane running (ALR) schemes not yet constructed was paused. As the M3 Junction 9 to Junction 14 Scheme tied into the Scheme on the south facing slips of the gyratory roundabout, some minor design development was undertaken.

1.3.15 The design changes did not result in any change to the Application Boundary. The Applicant provided a Scheme update in September 2022 to provide further information about the minor design amendments and proposed timescales following the ALR pause. The Applicant also used the Scheme update to notify stakeholders about the design changes following the responses received from the 2021 statutory consultation.

1.3.16 The update was disseminated to stakeholders through various methods, including public information events, an online information portal and stakeholder briefings.

1.3.17 During the period of the Scheme update, engagement with prescribed bodies, relevant local authorities and landowners, as detailed in **Chapter 14** of the **Consultation Report (Document Reference 5.1)** was ongoing.

1.4 Scheme objectives

1.4.1 The objectives of the Scheme are:

- To reduce delays at M3 Junction 9 on all links M3, A33 and A34
- Smooth the flow of traffic by improving journey time reliability and reducing delays (time lost per vehicle per mile) at M3 Junction 9 and the exit and entry roads for the A33 and A34

- Improve the safety for all road users and reduce the annual collision frequency and severity ratio on the M3 Junction 9
- Support economic growth and ensure the junction can accommodate additional traffic
- Improvements for walkers and cyclists, including connecting the National Cycle Network Route 23 which is severed by the current junction layout

1.5 Report structure

1.5.1 The structure of this Report is as follows:

1. Background and Scheme Objectives;
2. Local Transport Summary including current transport conditions and data sources;
3. Model Development including model development, calibration, and validation.
4. Forecasting including the forecast scenarios and forecast model outputs;
5. Economic Appraisal including the Scheme costs and Scheme benefits; and
6. Summary.

2 Local transport summary

2.1 Overview

2.1.1 The M3 Junction 9 is located to the east of the City of Winchester which is the county town of Hampshire. As per the 2011 Census, the Winchester District including Alresford and Bishop's Waltham had a population of 116,800.

2.1.2 M3 Junction 9 is located adjacent to the settlement of Winnall (to the east of Winchester). The surrounding area is urban to the west and northwest of the junction and primarily rural in all other directions with the South Downs National Park (SDNP) located to the east and north of the junction.

2.1.3 The land immediately to the west of the junction is predominantly commercial/industrial with Wykeham Trade Park and a National Highways maintenance depot located to the north-west of the junction. Developments to the south-west include Sun Valley Business Park, Tesco Extra Superstore, Winnall Industrial Estate and Scylla Industrial Estate.

2.1.4 The land to the east is generally greenfield, primarily forming part of the SDNP, with the River Itchen and its associated floodplain to the north of the Scheme. The River Itchen Special Area of Conservation and Site of Special Scientific Interest (SSS) also extend to the north-east and south-west of the existing junction.

2.2 Description of the local transport system

2.2.1 The M3 Junction 9 is a key strategic route interchange which connects South Hampshire and the ports of Southampton and Portsmouth with the wider sub region. It also connects the region to London and the north-west via the M3, and the Midlands and the North via the A34. The A34 also provides a connection to the principal east-west corridor of the A303. The junction acts as a bottleneck on the local and strategic highways network and causes significant delay, especially during peak hours.

2.2.2 The existing junction forms a grade-separated, partially signal controlled roundabout arrangement between:

- M3 (which forms the principal route between Southampton and London) à A34 (which forms the principal route between Winchester and Oxford; this also links with the A33 to Basingstoke);
- A272 Spitfire Link (non-signalised link, this forms the principal route between Winchester and Petersfield, this route also links to the A31); and
- Easton Lane (which provides the local access route between Winchester and the Strategic Road Network via M3 Junction 9).

2.2.3 The northbound carriageway of the M3 approaching Junction 9 from the south is formed of a standard dual 3 lane motorway with hard shoulder. The Junction 9 northbound diverge is a DMRB10 TD22/06 Layout of Grade Separated Junctions Type 'D' (Option 2) Lane Drop with Parallel diverge. Diverge lanes from the motorway are marked for the A34, with two lanes proceeding northbound through the junction for the M3 as a standard dual 2 lane motorway. A northbound slip road from Junction 9 joins the M3 mainline north of the junction via a TD22/06 Type 'A' Taper merge.

2.2.4 North of the junction the southbound carriageway of the M3 forms part of the standard dual 2 lane motorway. A TD22/06 Type 'A' Taper diverge provides access to the Junction 9 roundabout via the southbound off-slip road. The M3 continues through the junction as a standard dual 2 lane motorway with hard shoulder. South of the junction a TD22/06 Type 'F' Lane Gain with Ghost Island Merge is provided after which the junction the M3 becomes a standard dual 3 lane motorway with hard shoulder.

2.2.5 The A34 is a dual 2 lane all-purpose road. Approximately one kilometre north of the M3 Junction 9, the 2-lane northbound carriageway bifurcates. The nearside lane continues north-west as the A34, widening to two lanes just beyond the bifurcation. The offside lane continues to the north to become the A33. The existing A34 / A33 arrangement creates a bottleneck for the A34 traffic by effectively narrowing the A34 from two lanes to one prior to the diverge, before returning to two lanes after the diverge.

2.2.6 In the southbound direction the A33 southbound carriageway merges with the southbound A34 with a TD22/06 Type 'C' ghost island merge. Beyond the merge the A34 is 2 lanes until just before the M3 Junction 9 roundabout where it widens to three lanes on the approach to the Junction 9 traffic signals. On the A34 southbound approach to Junction 9 there is also an access to and egress from the National Highways maintenance depot.

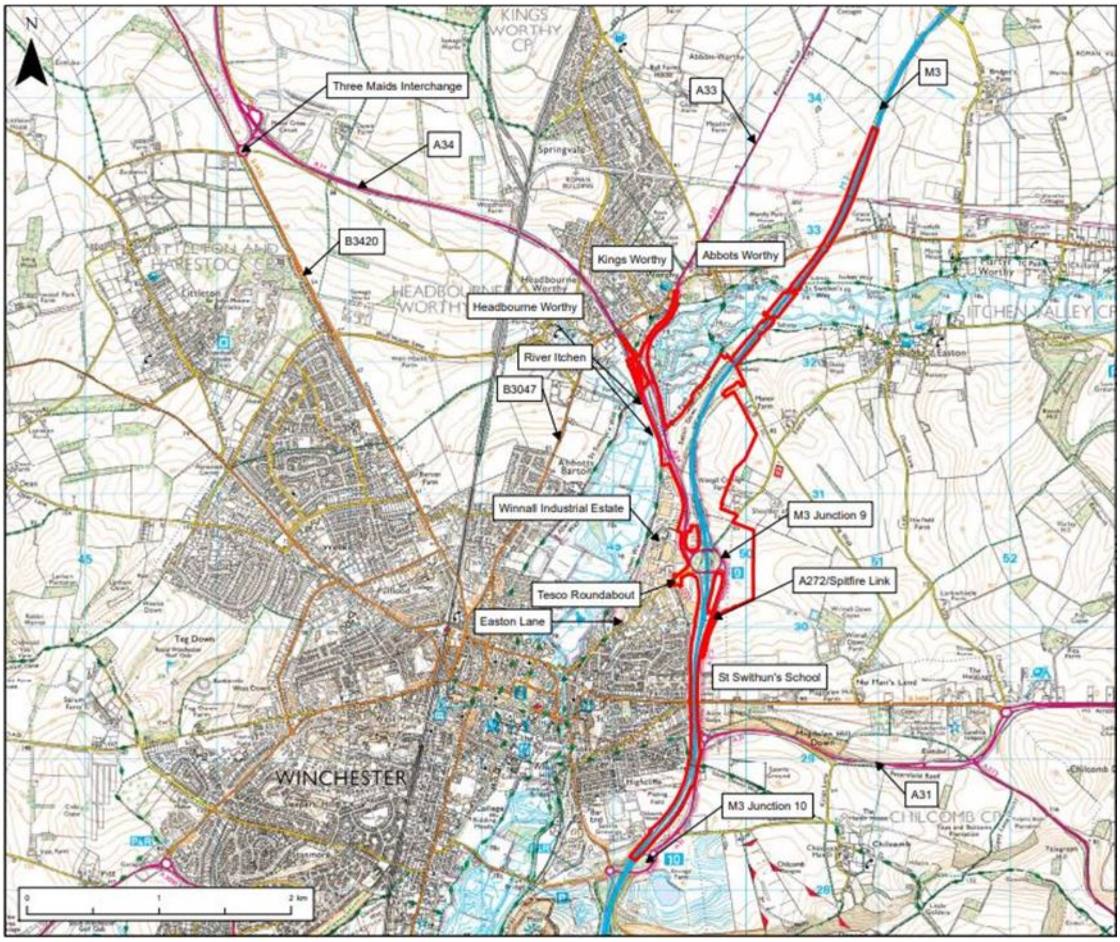
2.3 Current transport and traffic issues

2.3.1 The northbound and southbound movements between the M3 to the south of the M3 Junction 9 and the A34 to the north, are particularly significant. Queues on the northbound diverge (off-slip) of the M3 regularly back onto the mainline carriageway, resulting in delays and safety concerns for both M3 northbound through traffic and traffic seeking to leave the motorway. Such issues are particularly prevalent during peak periods. There are further potential safety concerns on the A34 southbound due to significant queuing which also results in rat running traffic through the residential suburbs of Winchester.

2.3.2 To overcome queuing on the M3 Junction 9 northbound diverge (off-slip), additional traffic signal green time has been allocated at the Junction 9 signalised roundabout, through a recent pinch point project, which has resulted in the development of lengthy queues on the A272 Spitfire Link and Easton Lane during the morning and evening peak periods respectively.

2.3.3 As the primary congestion and safety issues are associated with traffic travelling between the M3 south of Junction 9 and the A34, there is no identified need to provide free flowing links between the M3 north of Junction 9 and the A34. Traffic would continue to use Junction 9 for this movement.

Figure 2-1: Application Boundary and Key Links (Source: Case for the Scheme Document Ref: 7.1)

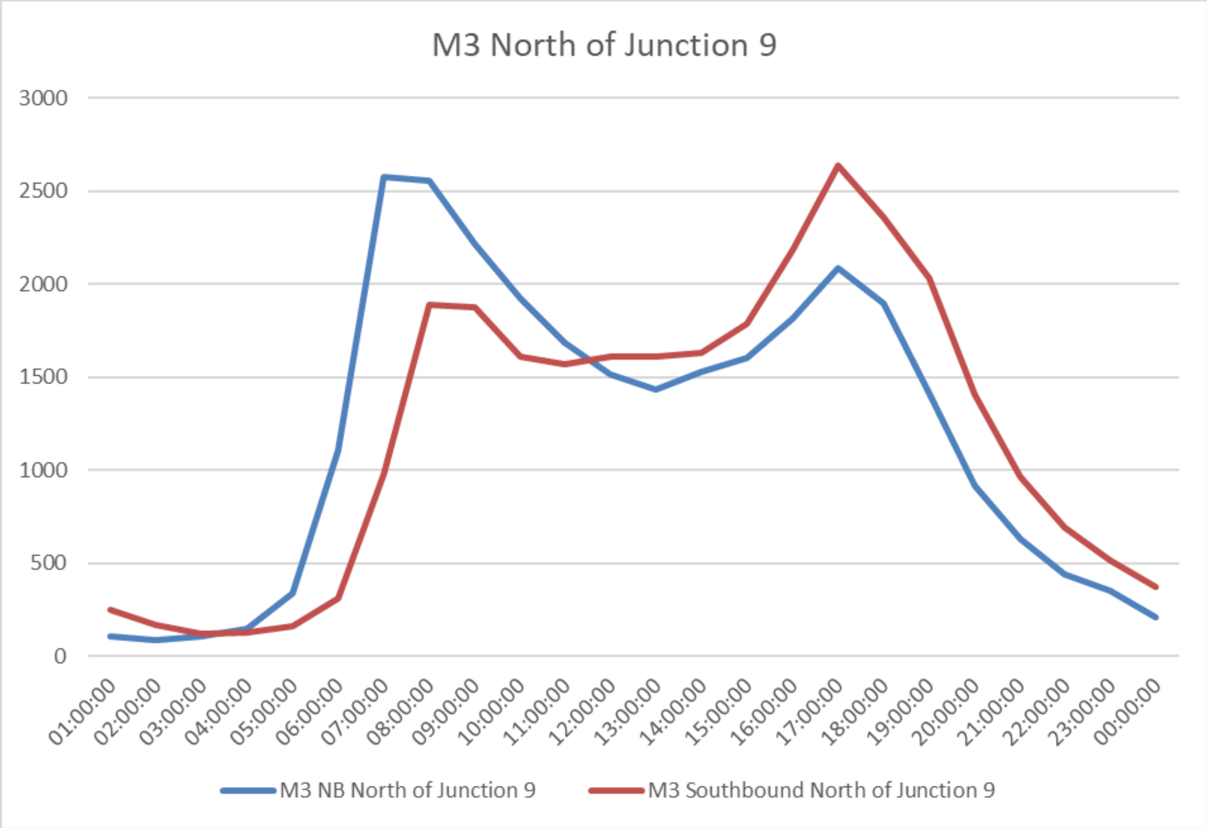


2.4 Current traffic flows

2.4.1 Data collected by the Applicant[1] indicates that the annual average daily traffic flows along the A34 in 2019 (pre-COVID-19) were around 32,900 vehicles in the northbound direction and 30,800 vehicles in the southbound direction, of which 26,000 were from the A34 and 4,800 from the A33. The annual average daily traffic (AADT) flow along the M3 (North of Junction 9) was approximately 30,000 vehicles in each direction. The Junction 9 slip roads have around 26,600 vehicles on the northbound off-slip and 25,300 on the southbound on-slip.

[1] National Highways network traffic flow data

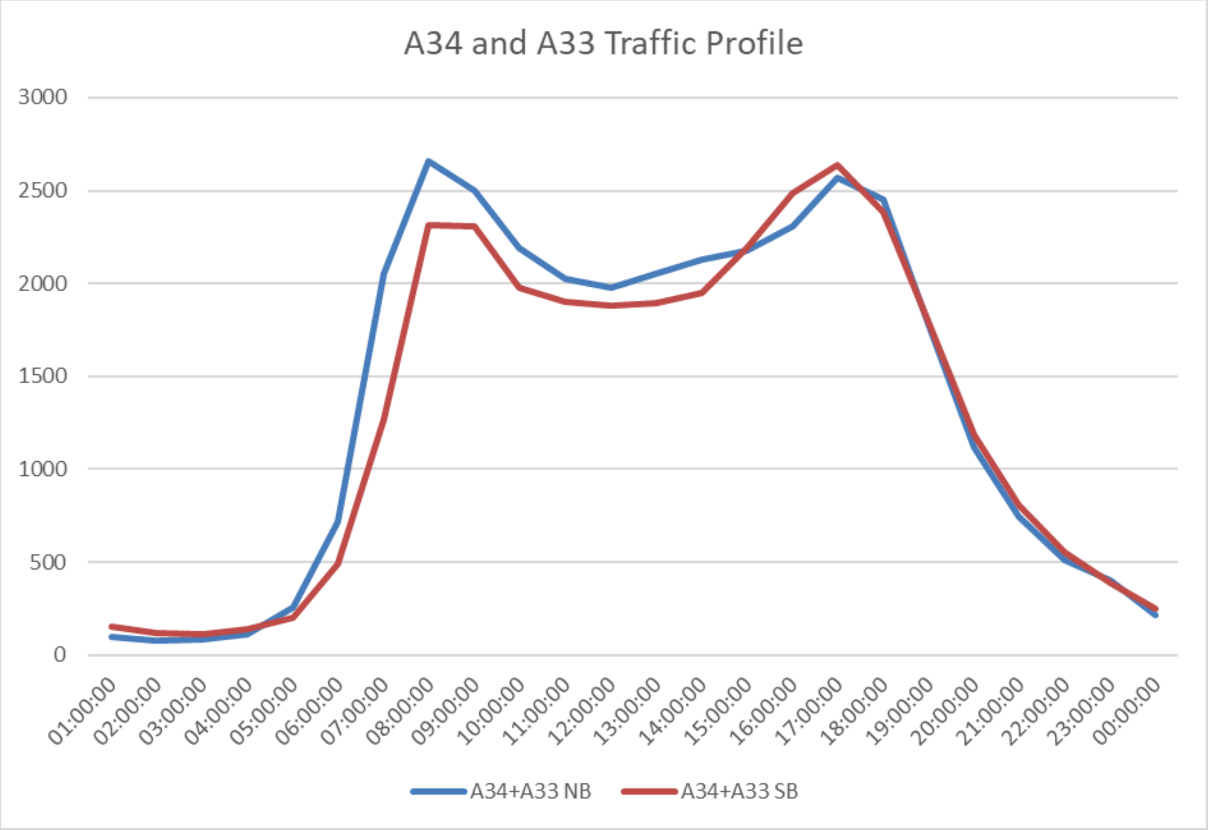
Figure 2-2: Daily Flow Profile of the M3 Junction 9



2.4.2 **Figure 2-2** shows that there are clear morning and evening peaks in both the northbound and southbound traffic (flows from WebTRIS in February 2020). There is a higher peak in the AM for the northbound traffic (which could be associated with people travelling to London) between 07:00 and 09:00. In the southbound direction the peak is an hour later. The PM peak is more pronounced in the southbound direction at approximately 17:00 to 18:00.

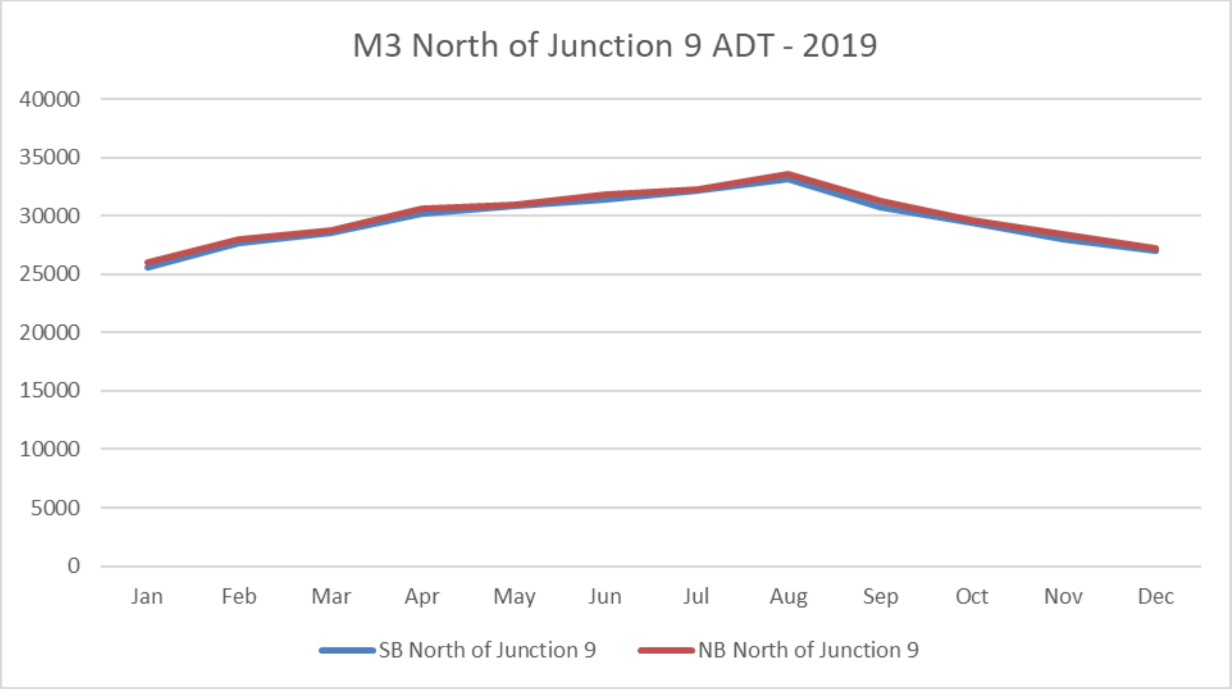
2.4.3 The profile for the A34 and A33 combined Average Daily Traffic for February 2020 (**Figure 2-3**) shows that the northbound direction has higher traffic flow at peak times and has generally more traffic throughout the day. For both the AM and PM peaks the northbound and southbound direction happen between 08:00 and 09:00, and 17:00 and 18:00.

Figure 2-3: A34 and A33 Daily Traffic Flow Profile



2.4.4 **Figure 2-4** shows the Average Daily Traffic (ADT) for the year of 2019 on the M3 just north of Junction 9 from WebTRIS. The flows across the year indicate that there is a stable flow along the M3. There is a steady rise in flow into the summer months with a peak in August and then a fall in flow between August and September. The northbound and southbound direction have very similar ADT.

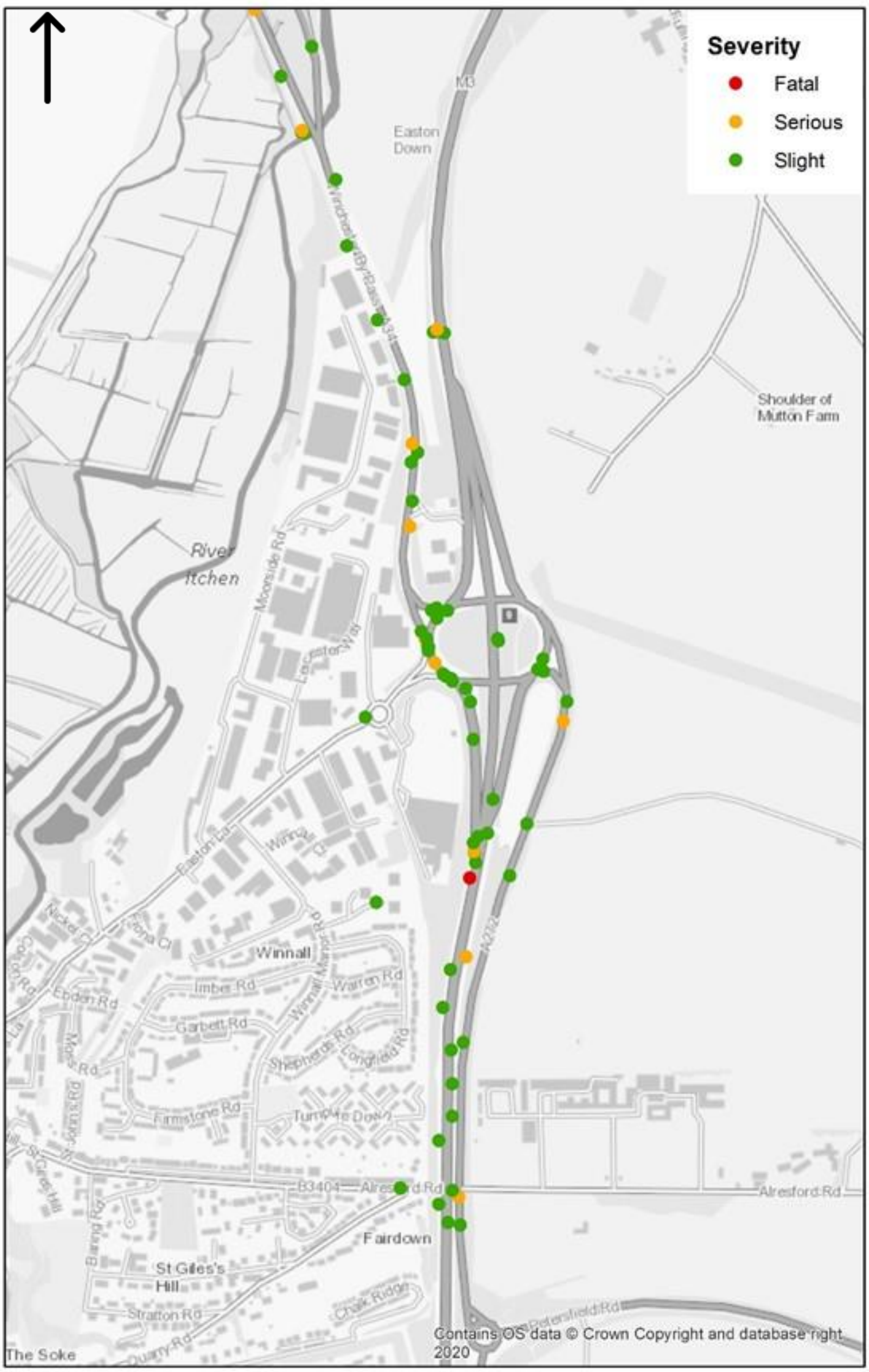
Figure 2-4: Monthly Flow Profile M3 North of Junction 9



2.5 Road safety

2.5.1 The location of accidents recorded within the vicinity of the A34, A33 and M3 Junction 9 between 2015 and 2019 are illustrated in **Figure 2-5**.

Figure 2-5: Historical Collision Data around the M3 Junction 9 (2015-2019)



2.5.2 Most accidents were located around the circulatory of the M3 grade separated roundabout or the merge/diverge locations on the M3.

2.5.3 **Table 2-1** presents the number of collisions in each year by severity classification.

Table 2-1: Collision Data by Year (2015-2019)

Severity	2015	2016	2017	2018	2019	Total	Total %
Slight	18	13	14	16	6	67	84%
Serious	2	4	2	1	3	12	15%
Fatal	0	0	1	0	0	1	1%

2.5.4 Out of the 80 collisions (67 slight, 12 serious and 1 fatal) there were 106 casualties involved. 87 of these casualties were involved in slight collisions, 15 serious collisions and 4 casualties involved in the fatal collision.

2.6 Data sources

2.6.1 The PCF Stage 3 (Preliminary Design) Scheme assessment adopted the M3M27 SMI model, which was based on the Applicant's South East Regional Traffic Model (SERTM).

2.6.2 The data collected for the M3M27 SMI is documented in the Traffic Data Collation report for the M3 J9-J14 and M27 J4-J11 Motorway Upgrade projects and the SERTM Data Collection Report.

2.6.3 In addition, a small amount of data from PCF Stage 2 (Options Selection) assessment was reused in PCF Stage 3 (Preliminary Design) assessment. This related primarily to the Automatic Number Plate Recognition (ANPR) and Manual Classified Count (MCC) data collected for the development of the operational model developed as part of PCF Stage 2 (Options Selection). The existing data sources are summarised below:

Group 1 (M3M27 SMI model):

- Count data (Automatic Traffic Count and Manual Classified Count (ATC and MCC)) collected for the SERTM model and used in M3M27 SMI model.
- Journey time data collected and processed for SERTM and used in M3M27 SMI model.

2.6.4 The above data was the primary source of existing data used in the calibration and validation of the M3 Junction 9 Model.

Group 2 (M3 Junction 9 Stage 2 assessment):

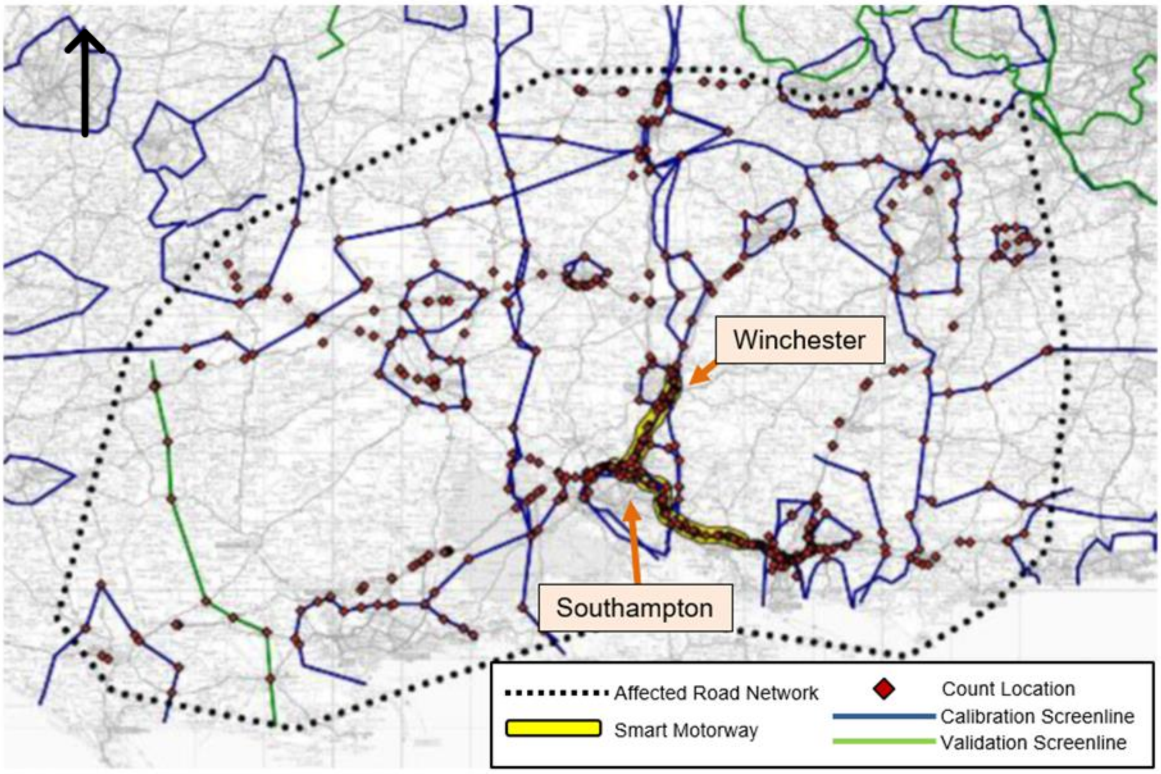
- ANPR data used in the development of the PCF Stage 2 (Options Selection) operational model.

- MCC data used to calibrate the PCF Stage 2 (Options Selection) operational model.

2.6.5 The above sources were treated as supporting data only and used to inform a limited number of elements of M3 Junction 9 Model development.

2.6.6 During M3M27 SMI model development, data was collated around the M3 and M27. Existing SERTM screenlines and their associated data were used, and this included TRADS and ATC data collated for March 2015 from the Applicant's and local authority databases, supplemented by traffic counts undertaken as part of the development of the Regional Traffic Models. Additional screenlines were created for the SMI study making use of Hampshire County Council traffic counts. **Figure 2-6** shows the location of counts and screenlines in the SMI study area, which covers a large part of South Hampshire.

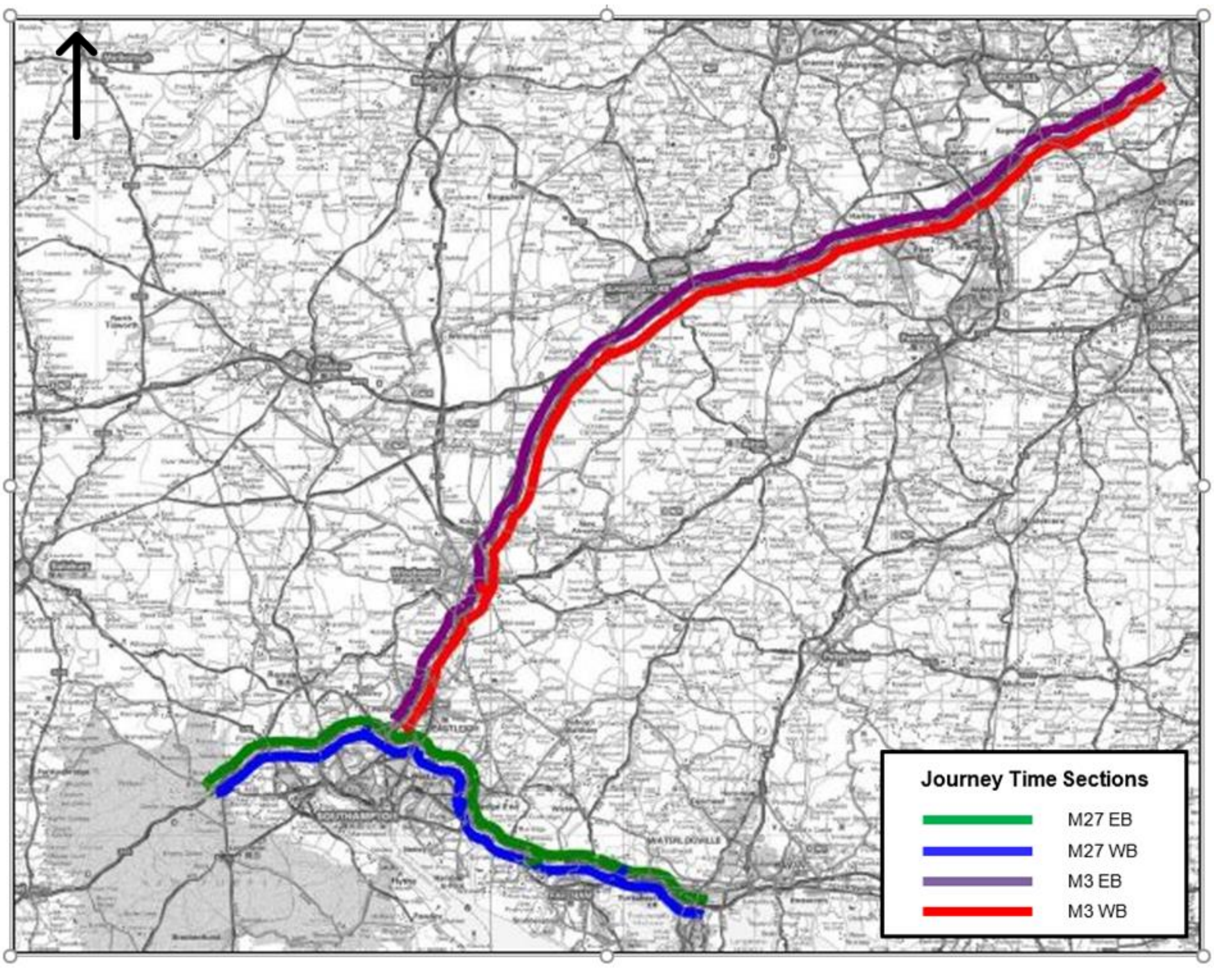
Figure 2-6: Location of the SMI Model Counts and Screenlines (Source: M3M27 SMI Data Collection Report; scheme location in figure refers to M3M27 SMI scheme)



2.6.7 Data collected for sites presented in **Figure 2-6** was used in the M3M27 SMI model dashboard and was adopted in the M3 Junction 9 Model calibration in its entirety. The dashboard was subsequently expanded with the addition of data collected as part of the M3 Junction 9 Model development described later in this report.

2.6.8 Journey time data used in the M3M27 SMI model was taken from the June 2015 Traffic Master dataset extracted for selected road links along the M3 and M27 corridors. The journey time data for the M27 and M3 corridors were reused as part of this study and these routes are depicted in **Figure 2-7**.

Figure 2-7: M3M27 SMI Journey Time Routes (Source: PCF Stage 3 (Preliminary Design) Transport Model Package, Highways England, 2020)



2.6.9 **Table 2-2** illustrates the end-to-end journey times along the M3 and M27 which were observed as part of the M3M27 model.

Table 2-2: M3M27 SMI Journey Time Routes

Route Name	Direction	Route Description	AM Mean Observed Journey Time (Min)	IP Mean Observed Journey Time (Min)	PM Mean Observed Journey Time (Min)
M27	eastbound	J1-J12	27:39	25:02	25:29
M27	westbound	J12-J1	27:40	25:09	25:42
M3	eastbound	J14-M25	53:49	50:35	49:47
M3	westbound	M25-M27	51:29	51:52	56:26

M3 Junction 9 PCF Stage 2 (Options Selection) data

2.6.10 The data collected as part of PCF Stage 2 (Options Selection) and used in PCF Stage 3 (Preliminary Design) included ANPR data and MCC data collected in 2017. This data was used in the development of the PCF Stage 2 (Options Selection) operational model and its collection is described in detail in the **PCF Stage 2 (Options Selection) Operational Model Traffic Data Collection Report**.

2.6.11 Elements from these datasets were used in the development of the PCF Stage 3 (Preliminary Design) M3 Junction 9 Model. These are:

- ANPR count on A34 northbound between the A33 diverge and A272; and
- turning counts at the Tesco roundabout on Easton Lane near Junction 9.

2.6.12 The location of these counts is shown in **Figure 2-8** and **Figure 2-9**.

Figure 2-8: Location of ANPR Count Site 17 on A34 (Source: PCF Stage 3 (Preliminary Design) Transport Data Package, Highways England, 2020)

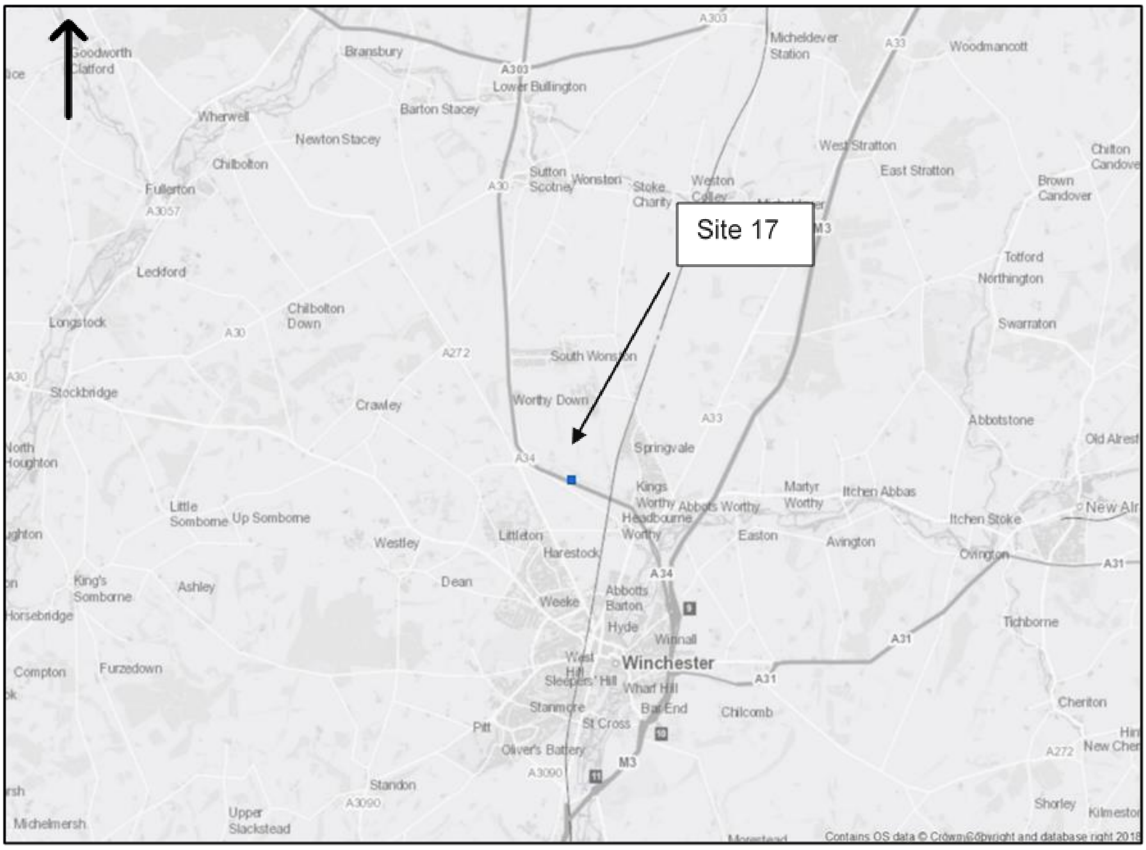
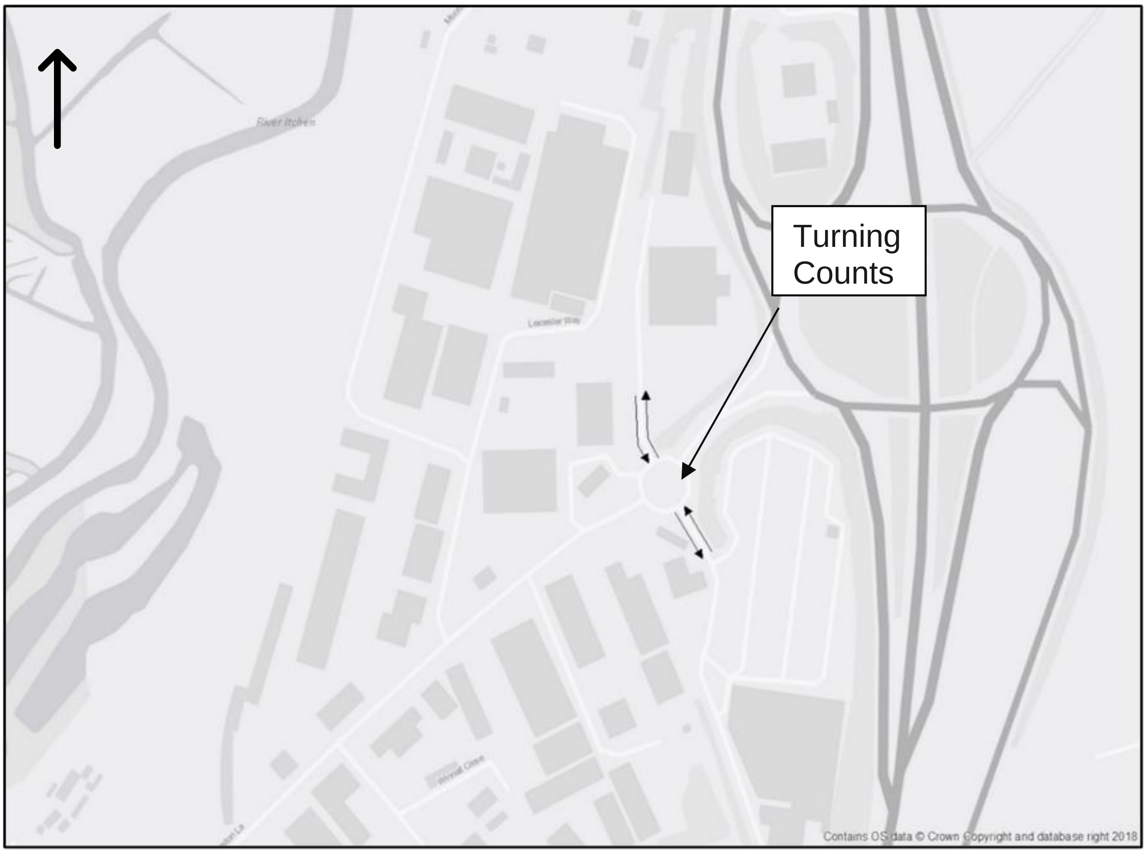


Figure 2-9: Location of Turning Counts at Easton Lane Roundabout (Source: PCF Stage 2 (Options Selection) Transport Data Package, Highways England, 2020)



Other data sources

2.6.13 Apart from the data on the SRN around Junction 9 and adjacent links, it was also necessary to obtain counts that would form model calibration screenlines covering the City of Winchester. Hampshire County Council collects a range of traffic counts on its network, including the main roads in Winchester. The study team requested access to counts covering Winchester between 2015 and 2018. However, the data does not cover the city sufficiently and does not allow formulation of watertight screenlines across the city. Data was also not collected consistently – the locations vary, and the different years include a different mix of ATC and MCC data.

2.6.14 To obtain a consistent dataset with sufficient coverage the study team agreed that additional data had to be collected. This is described below.

Additional data collection

2.6.15 The review of existing data sources described in the previous section identified the need for additional data collection. This included:

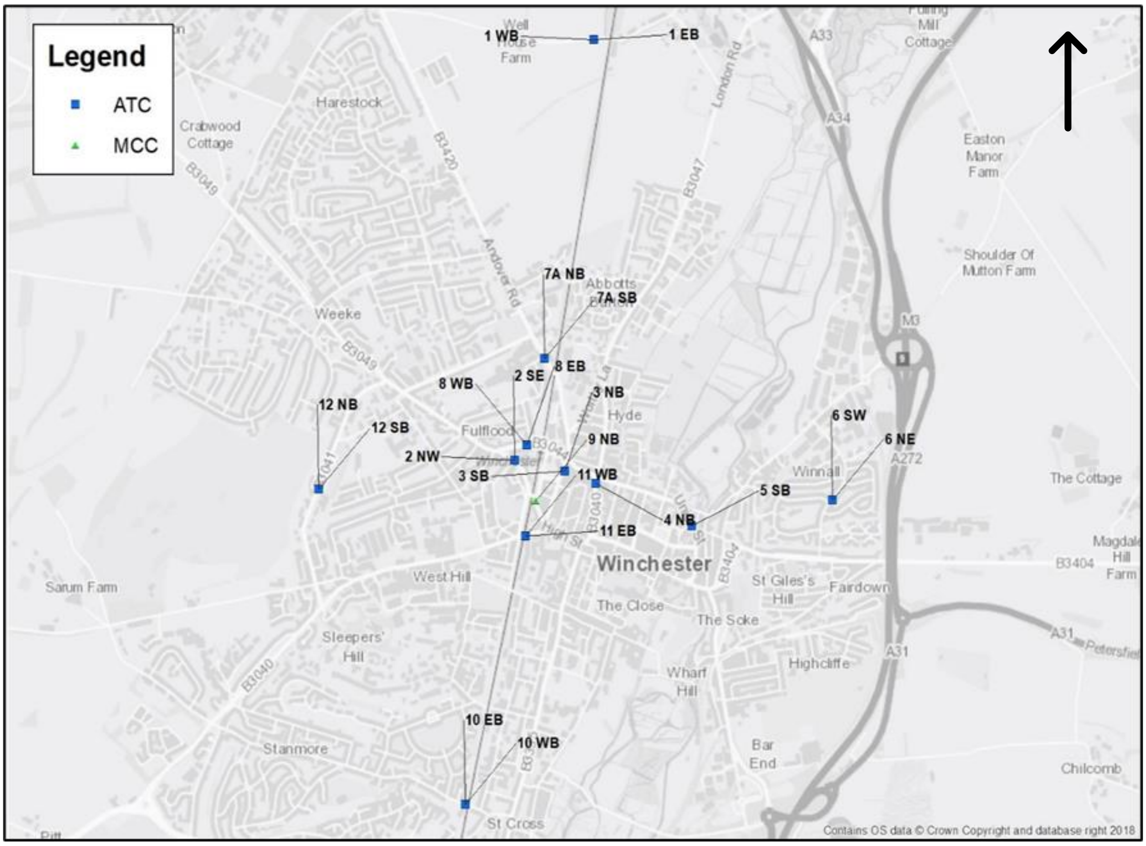
- Additional traffic counts covering the City of Winchester; and
- Additional journey time data covering routes across the City of Winchester.

2.6.16 Additional traffic counts were collected in the neutral traffic periods of June and early July 2018, during the school term and before the summer holidays, consistent with the spirit of the Transport Analysis Guidance (TAG)[2]. The focus of the survey was ATC data collected within the period from Monday 18th June to Sunday 22nd July. All sites were covered fully for a continuous period of three weeks, which is a relatively long duration, improving the reliability of the data.

2.6.17 The ATC and MCC data described above was collected in 2018. However, the base year of the model is 2015. It was necessary to convert the count data to a common base year for use in model calibration. This is a standard practice in cases where count data originates from a range of years around the study base year. DfT's Road Traffic Forecasts 2018 (RTF18) were used to estimate the change in traffic levels between 2015 and 2018 for the relevant road types in the South East of England. TAG recommends that national statistics should be benchmarked against local data where possible. Local TEMPro 7.2 data for Winchester was used to derive a rate of growth in car trips between 2015 and 2018.

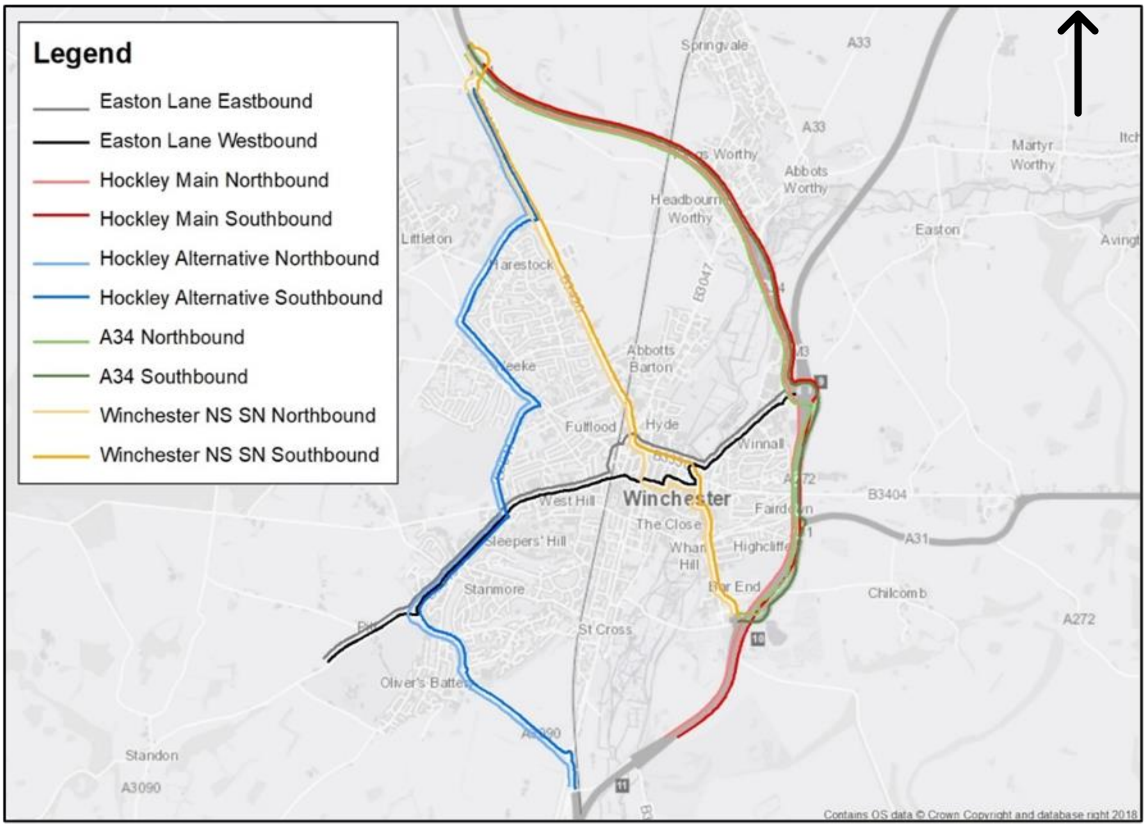
[2] https://www.gov.uk/government/publications/webtag-tag-unit-m1-2-data-sources-and-surveys

Figure 2-10: Location of 2018 ATC and MCC Sites (Source: PCF Stage 3 (Preliminary Design) Transport Data Package, Highways England, 2020)



2.6.18 The development of M3 Junction 9 Model required additional journey time data for model validation purposes. The additional routes focused on Winchester and are depicted in **Figure 2-11**.

Figure 2-11: Additional M3 Junction 9 Model Journey Time Routes (Source: PCF Stage 3 (Preliminary Design) Transport Data Package, Highways England, 2020)



2.6.19 The review of the TrafficMaster database and the associated ITN[3] network used in M3M27 SMI model revealed that not all routes in Winchester were covered. To obtain the data for the missing routes, it was necessary to obtain re-extracted TrafficMaster data from DfT. The data was obtained in August 2018 and covered the full extract for Hampshire (all ITN links) covering the whole of 2015.

[3] Integrated Transport Network – GIS database used to map journey time data recorded in TrafficMaster

3 Model development

3.1 Introduction

3.1.1 The model used for PCF Stage 3 (Preliminary Design) and subsequently Stage 3b is a derivation of the Applicant's South East Regional Transport Model (SERTM), including updates for this stage. This model is referred to as the M3 Junction 9 Model.

M3 Junction 9 PCF Stage 1 and Stage 2 traffic forecasts

3.1.2 The PCF Stage 1 (Options Identification) made use of a strategic traffic model developed by Hampshire County Council, called the Solent Regional Traffic Model (SRTM) referred to as the "Solent Model" throughout this report. This was the only model for this area available at the time.

3.1.3 The Solent Model is a multi-modal model, with the highway assignment component developed in SATURN software and a bespoke variable demand model component. The model used in the assessment had a base year of 2009. The outputs of this work are provided in the PCF Stage 1 (Options Identification) documentation for the Scheme. This model was used for early option sifting and was superseded with a newer version updated for the purposes of PCF Stage 2 (Options Selection).

3.1.4 The model used in PCF Stage 1 (Options Identification) the Solent model was subsequently enhanced by Hampshire County Council. The key enhancement was to update the base year to 2015 and subsequently calibrate and validate the model. This model formed the basis of the PCF Stage 2 (Options Selection) assessment of the options and provided traffic growth estimates for input into a more detailed operational assessment of the junction tested in a micro-simulation model.

3.1.5 The enhanced Solent model provided a tool sufficient for use in PCF Stage 2 (Options Selection), and its use was proportionate to inform option testing. The PCF Stage 2 (Options Selection) identified a preferred scheme, known as Option 14, which formed the basis of the PCF Stage 3 (Preliminary Design) design described in the previous section.

3.2 Overview of the strategic model

3.2.1 PCF Stage 3 (Preliminary Design) required a full assessment of the preferred scheme and required a robust and up-to-date modelling tool. The Applicant identified limitations of the Solent model associated with its coverage and the details of its validation. To support the full scheme assessment in PCF Stage 3 (Preliminary Design) a new modelling tool was therefore required.

3.2.2 In parallel to the Scheme, the Applicant developed the M3M27 SMI Model, which was based on SERTM (which was developed to assist in the assessment of schemes in the Road Investment Strategy (RIS1)). The Applicant judged the M3M27 SMI Model to be fit for modelling SRN schemes and requested that this model should be adopted and enhanced further for use in the M3 Junction 9 Improvement Scheme assessment.

3.3 Strategic model development

3.3.1 As part of the PCF Stage 3 (Preliminary Design) programme, the M3M27 SMI model was subject to further enhancements for the purpose of the assessment at Stage 3b. Calibration and validation focussed on the area of Winchester to strengthen the model and make it suitable for the analysis of impacts of the M3 Junction 9 Improvement Scheme. These enhancements included:

- Improvements to the local network detail;
- Additional calibration of the traffic model in Winchester, including the amendments to the trip matrix in the local area; and
- Updated calibration of the Variable Demand Model (VDM).

3.3.2 The enhanced model is referred to as the M3 Junction 9 Model throughout this report and other related PCF products.

3.4 Model features and data

3.4.1 There are two primary modelling components to the M3 Junction 9 Model as follows:

- Highway Assignment Model (HAM). The HAM was used to predict traffic flows, speeds, delays, routes, and travel costs on the highway network. SATURN was identified as the most appropriate tool for building the Regional Transport Models by the Applicant. SATURN operates as a static equilibrium highway assignment model which incorporates both simulation and assignment loops. It can deal with local, large conurbation, regional or even national models thus making it appropriate for the modelling of traffic in the South East of England. SATURN Software Version 11.4.06D was used for the M3 Junction 9 Model.
- Variable Demand Model (VDM). The VDM was used to predict the future changes in demand for private vehicle travel with and without the Scheme. For consistency with the Regional Traffic Models (RTMs), it was agreed that DfT's DIADEM[4] (Dynamic Integrated Assignment and Demand Modelling) software v7.0 (64bit) would be used.

3.4.2 The SERTM base year model (from which the M3 Junction 9 Model was derived, and key features retained) was defined as an average weekday model

[4] https://www.gov.uk/government/publications/diadem-software

representing March 2015. March is classified as a “neutral” month in Transport Analysis Guidance (TAG) Unit M1.2 paragraph 3.3.6. This was specified for the following number of reasons:

- Mobile Network Data (MND). MND was the primary source for use in developing base year travel demand matrices. The dataset used was representative of March 2015 from the Highways England Trip Information System (TIS) Interim Database;
- Additional traffic count and journey time data were collected for use in this study and converted to March 2015, supplemented by other local data collected in 2015; and
- A TRADS journey time dataset for March 2015 was provided by the Applicant.

3.4.3 The SERTM model is representative of an average hour model within the following time periods:

- AM Peak (07:00 to 10:00);
- Inter-peak (10.00 to 16.00); and
- PM Peak (16.00 to 19.00).

3.4.4 The SERTM model was developed for the following user classes:

- User Class 1 – Car Business;
- User Class 2 – Car Commuting;
- User Class 3 – Car Other;
- User Class 4 – Light Goods Vehicles (LGVs); and
- User Class 5 – Heavy Goods Vehicles (HGVs).

3.4.5 The M3M27 SMI model developed from SERTM, and consequently the M3 Junction 9 Model which was developed from it, retain these key features of the SERTM model.

3.5 Calibration and validation

3.5.1 Overall, the network and matrix calibration improved the performance of the model. High standards were achieved in the focal area of the Scheme around Junction 9 and Winchester, which met DfT’s TAG criteria for the calibration and validation of transport models. The standard of calibration and validation achieved across the wider Hampshire area in the donor model (M3M27 SMI) was also retained.

3.5.2 **Table 3-1**, **Table 3-2** and **Table 3-3** present the Stage 3b calibration screenline results following the base year model network amendments and using the Stage 3a post Matrix Estimation travel demand matrices, for the AM, Inter and PM Peaks respectively. The screenlines were the same as those reported in the Stage 3a model calibration.

Table 3-1: Calibration Results on Key Local Screenlines, AM Peak

Screenline	Direction	Total Count Sites	Observed Flow	Modelled Flow	% Diff
Winchester	Inbound	11	4,549	4,406	-3.2%
Winchester	Outbound	11	3,633	3,655	0.6%
Winchester NS	Eastbound	5	1,319	1,299	-1.5%
Winchester NS	Westbound	5	1,178	1,161	-1.4%
Winchester WE	Northbound	5	1,785	1,841	3.2%
Winchester WE	Southbound	5	1,927	1,908	-1.0%

Table 3-2: Calibration Results on Key Local Screenlines, Inter Peak

Screenline	Direction	Total Count Sites	Observed Flow	Modelled Flow	% Diff
Winchester	Inbound	11	3,257	3,221	-1.1%
Winchester	Outbound	11	3,484	3,239	-7.0%
Winchester NS	Eastbound	5	1,080	1,067	-1.2%
Winchester NS	Westbound	5	1,184	1,094	-7.6%
Winchester WE	Northbound	5	1,634	1,502	-8.1%
Winchester WE	Southbound	5	1,867	1,795	-3.8%

Table 3-3: Calibration Results on Key Local Screenlines, PM Peak

Screenline	Direction	Total Count Sites	Observed Flow	Modelled Flow	% Diff
Winchester	Inbound	11	3,876	3,809	-1.7%
Winchester	Outbound	11	4,859	4,750	-2.2%
Winchester NS	Eastbound	5	1,265	1,210	-4.4%
Winchester NS	Westbound	5	1,491	1,364	-8.5%
Winchester WE	Northbound	5	1,911	1,817	-4.9%
Winchester WE	Southbound	5	2,202	2,148	-2.5%

3.5.3 As the scope of the base model and subsequent application of the model was to underpin the appraisal of a Road Improvement Scheme (RIS) in Stage 3b and the DCO application, validation criteria were required to align with TAG guidance. As a consequence, the validation criteria for Stage 3b were revised from the bespoke Stage 3a criteria, to align with TAG guidance.

3.5.4 Two sets of validation criteria were used in the Stage 3a PCF Model Package report to define individual link flow criteria dependant on the screen line definition.

- “Core” screenlines defined with the standard TAG criteria; and
- “Non-Core” screenlines defined with a bespoke link flow passing criteria.

3.5.5 The variance in the “Core” (TAG criteria) and bespoke “Non-Core” is summarised within **Table 3-4** and **Table 3-5**.

Table 3-4: "Core" Calibration and Validation Criteria (Standard TAG Criteria)

Element	Criteria	Acceptability Guideline	Vehicle Type
Screenline Flows			
Total	Within 5%	All or nearly all screenlines	All vehicle class separately
Individual Link Flows			
Roads with flows >2700	+/- 400 veh/hr	>85% of cases	Car and Total Flow
Roads between 2700 & 700	+/- 15%	>85% of cases	Car and Total Flow
Roads < 700	+/- 100 veh/hr	>85% of cases	Car and Total Flow
GEH <5		>85% of cases	Car and Total Flow

Table 3-5: "Non-Core" Calibration and Validation Criteria (Adjusted TAG Criteria used in Stage 3a)

Element	Criteria	Acceptability Guideline	Vehicle Type
Screenline Flows			
Total	Within 5%	All or nearly all screenlines	All vehicle class separately
Individual Link Flows			
Roads with flows >2700	+/- 400 veh/hr	>85% of cases	Car and Total Flow
Roads between 2700 & 2000	+/- 15%	>85% of cases	Car and Total Flow
Roads < 2000	+/- 300 veh/hr	>85% of cases	Car and Total Flow
GEH <5		>85% of cases	Car and Total Flow

3.5.6 **Table 3-6** and **Table 3-7** present the proportion of links which meet the TAG highway assignment criteria in each modelled time period for the key screenlines, as well as the overall model area for Stage 3a (using the bespoke criteria) and Stage 3b (using the standard TAG criteria) respectively.

Table 3-6: % Core Screenlines Meeting Stage 3a Criteria (Adjusted TAG Criteria)

Screenline	Direction	Total Count Sites	AM Peak	Inter-Peak	PM Peak
Winchester	Inbound	11	100%	100%	91%
Winchester	Outbound	11	91%	91%	91%
Winchester NS	Eastbound	5	100%	100%	100%
Winchester NS	Westbound	6	83%	100%	100%
Winchester WE	Northbound	5	100%	80%	80%
Winchester WE	Southbound	5	100%	100%	100%
All Screenline Links			**83.7%**	**87.5%**	**82.8%**

Table 3-7: % Core Screenlines Meeting Stage 3b Criteria (Standard TAG Criteria)

Screenline	Direction	Total Count Sites	AM Peak	Inter-Peak	PM Peak
Winchester	Inbound	11	91%	100%	100%
Winchester	Outbound	11	100%	82%	100%
Winchester NS	Eastbound	5	100%	100%	100%
Winchester NS	Westbound	6	83%	100%	100%
Winchester WE	Northbound	5	100%	80%	80%
Winchester WE	Southbound	5	100%	100%	100%
All Screenline Links			**70.1%**	**73.7%**	**68.7%**

3.5.7 The screenline results around Winchester demonstrated a negligible difference between Stage 3a and Stage 3b demonstrating that the level of validation within close proximity to the Scheme around Winchester was maintained with a very high proportion of links meeting TAG criteria in the key screenlines. However, in the wider modelled area, a greater number of screenline links did not pass the criteria. Of these, a significant proportion of the links failing were in the South Coast area, on the periphery of the model and therefore distant from the direct sphere of influence of the Scheme.

3.5.8 The journey time validation compared the modelled journey times with observed data derived from TrafficMaster. The journey time routes prepared for comparison (of modelled vs observed) are the same as those reported in the Stage 3a Model Package and as illustrated in **Figure 3-1** and **Figure 3-2**.

Figure 3-1: M3 Junction 9 Model Local Journey Time Routes (Source: PCF Stage 3 (Preliminary Design) Transport Data Package, Highways England, 2020)

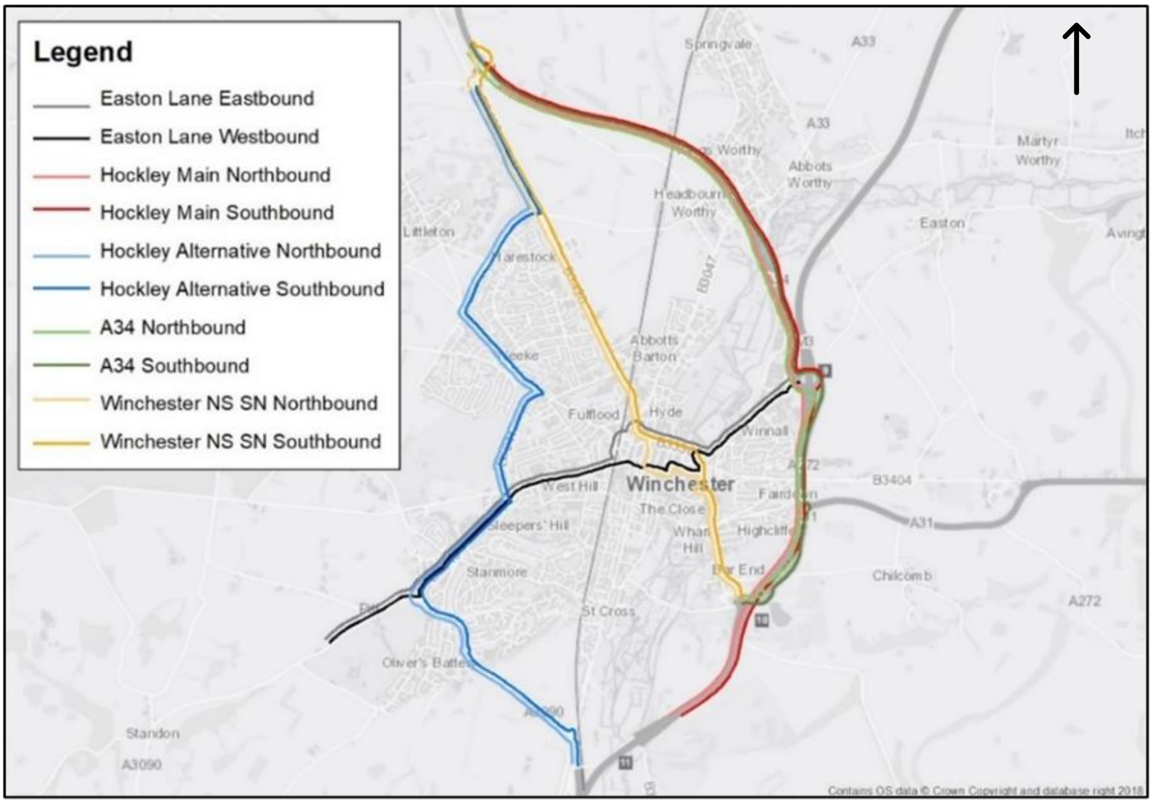
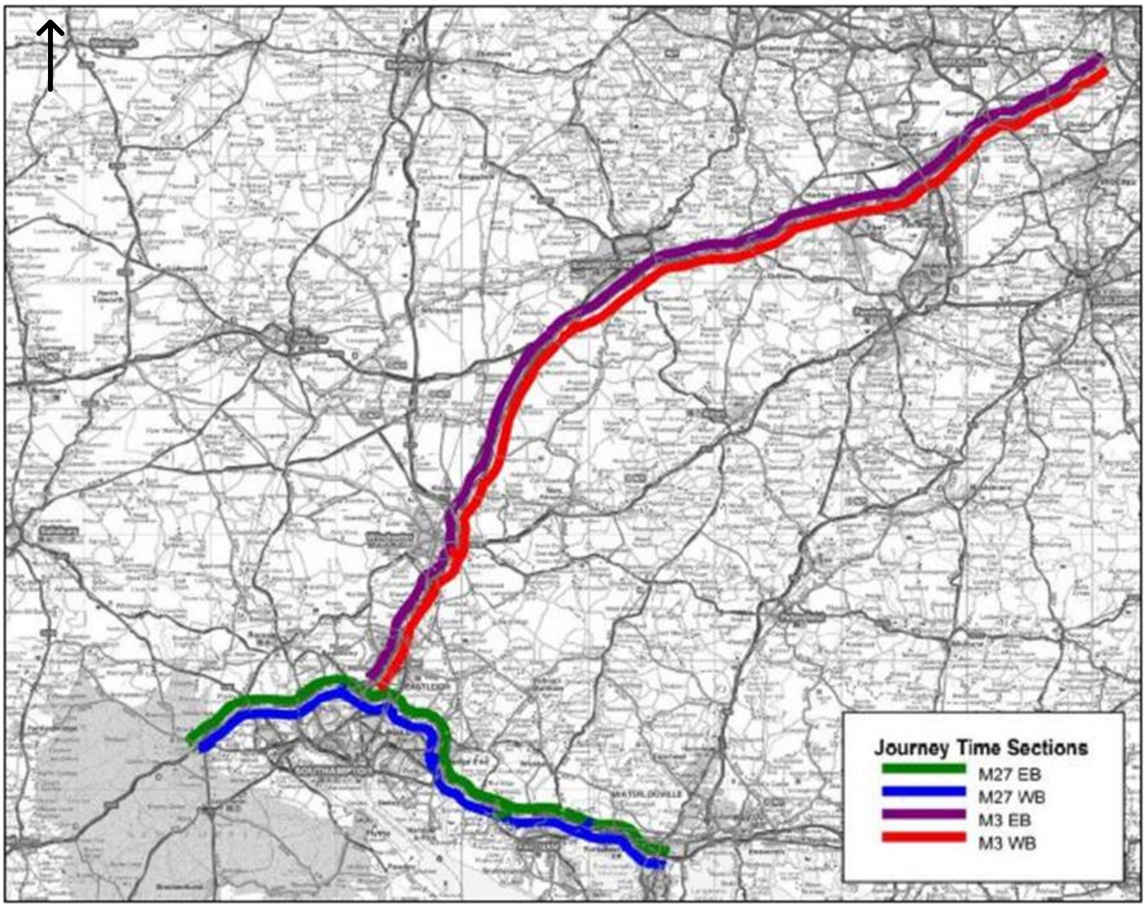


Figure 3-2: M3 Junction 9 Model Strategic Journey Time Routes (Source: PCF Stage 3 (Preliminary Design) Transport Model Package, Highways England, 2020)



3.5.9 The Stage 3b journey time validation compares well with that reported in Stage 3a. Differences between modelled and observed data sit within 15% for all routes in the AM Peak and most routes in the Inter and PM Peak modelled hours. The validation results for the routes shown in **Figure 3-1** and **Figure 3-2** are shown in **Table 3-8**.

Table 3-8: Journey Time Validation Results (minutes)

		AM Peak			Inter Peak			PM Peak		
Route ID	**Route Description**	**Obs.**	**Mod.**	**% Diff**	**Obs.**	**Mod.**	**% Diff**	**Obs.**	**Mod.**	**% Diff**
A34 (NB)	M3 J10 <> A34/A272 via Spitfire Link	10:54	09:54	-9%	08:24	07:54	-6%	09:18	08:36	-8%
A34 (SB)	A34/A272 <> M3 J10 via Spitfire Link	07:36	07:30	-1%	07:12	07:18	1%	08:48	07:30	-15%
Easton Lane (EB)	South Winchester Golf Club <> Easton Lane Roundabout	16:18	14:54	-9%	14:18	14:24	1%	14:42	13:24	-9%
Easton Lane (WB)	South Winchester Golf Club <> Easton Lane Roundabout	13:48	14:24	4%	14:30	12:06	-17%	15:18	13:30	-12%
Hockley Alternative (NB)	M3 J11 <> A34 A272 through west Winchester	16:42	14:12	-15%	12:48	13:06	2%	14:00	13:48	-1%
Hockley Alternative (SB)	M3 J11 <> A34 A272 through west Winchester	15:24	14:00	-9%	14:06	13:06	-7%	14:54	14:18	-4%
Hockley Main (NB)	M3 J11 <> A34 / A272	06:30	07:30	15%	06:18	06:12	-2%	06:12	06:30	5%
Hockley Main (SB)	M3 J11 <> A34 / A272	07:06	07:24	4%	07:00	06:48	-3%	09:18	08:00	-14%
M27 (EB)	J1 <> J12	27:42	29:42	7%	25:00	26:00	4%	25:30	29:54	17%
M27 (WB)	J12 <> J1	27:42	29:42	7%	25:12	25:54	3%	25:42	31:54	24%

		AM Peak			Inter Peak			PM Peak		
Route ID	Route Description	Obs.	Mod.	% Diff	Obs.	Mod.	% Diff	Obs.	Mod.	% Diff
M3 (EB)	J14 <> M25	53:48	58:24	9%	50:36	52:18	3%	49:48	52:36	6%
M3 (WB)	M25 <> J14	51:30	55:36	8%	51:54	54:18	5%	56:24	60:36	7%
Winchester N<>S (NB)	M3 J10 <> A34 A272 through town centre	14:36	13:30	-8%	14:00	12:54	-8%	14:18	14:24	1%
Winchester N<>S (SB)	M3 J10 <> A34 A272 through town centre	12:36	12:00	-5%	11:54	12:42	7%	13:12	12:00	-9%

Key: NB-northbound, SB-southbound, EB-eastbound, WB-westbound

3.5.10 It should be noted that the Stage 3b network amendments made on the A34 approach within the model did not have a significant impact on the modelled journey time on the A34 southbound (SB) and Hockley Main southbound (SB) routes, with a relatively slight increase (~5 seconds) relative to Stage 3a. The coding refinements in the base year were, however, considered to better represent capacity restraint in the base and forecast scenarios.

3.5.11 The convergence results of the amended post matrix estimation base year model are summarised in **Table 3-9**. This indicates that the Stage 3b base model convergence is broadly the same as that reported at Stage 3a. The model converges within criteria outlined in TAG.

Table 3-9: M3 Junction 9 Model Assignment Convergence Statistics

Time Period	Final Iteration Number	% GAP	% Flows	% Delays
AM Peak	16	0.0084	98.4	98.6
Inter-Peak	14	0.0044	98.9	99.2
PM Peak	15	0.012	98.4	97.7

3.6 Variable demand model

3.6.1 The VDM was prepared using DIADEM software (version 7.0). DIADEM software is designed to enable practitioners to set up (using user-friendly methods) a multi-stage transport demand model and finding equilibrium between demand and supply, using the SATURN package as the supply model. The process iterates between demand calculations and highway assignments until a converged solution is reached.

3.6.2 DIADEM is consistent with TAG with respect to model form, model hierarchy and incremental nature of the model. The approach makes use of cost changes from incremental differences between base and test scenarios operated using a pivot point approach.

3.6.3 The logit model parameters calibrated during Stage 3a were adopted for Stage 3b. The models were calibrated in a way that the same set of parameters were used by all time periods. Realism tests were undertaken to confirm the same level of VDM calibration was maintained for the Stage 3b version of the M3 Junction 9 model

3.6.4 A representation of PT demand and supply data was required for VDM. The PT demand data was taken from the M3M27 SMI model, which was in turn based on data used in SERTM. With SERTM focussing on inter-urban travel with rail being the main competitor to car. It was therefore proportionate to retain rail as the representation of public transport in the choice model where bus or coach choice did not require to be modelled.

3.6.5 A representation of the UK rail network (including Scotland, England, and Wales, but excluding Northern Ireland) in RTMs was derived from timetable and network data obtained from the Traveline National Dataset, a detailed database of UK rail timetables as well as data from the Association of Train Operating Companies (ATOC). In addition, the National Public Transport Access Nodes (NaPTAN) provided data on the locations of UK railway stations. The development of the PT travel costs is described in the SERTM Model Development Report. Rail fare information was taken from the M3M27 SMI model, which was also based on the SERTM model data. The sources for these data included MOIRA data and the National Rail Travel Survey, as described in the M3M27 SMI and SERTM Model Development Reports.

Realism testing

3.6.6 In the M3 Junction 9 Model, car fuel cost elasticity was tested. The car fuel cost elasticity required is the percentage change in car vehicle-kms with respect to the percentage change in fuel cost. The calculations were carried out for 10% fuel cost increase, which was applied to all vehicle types.

3.6.7 TAG suggests that the overall fuel cost elasticity should lie between -0.25 and -0.35. The Stage 3b results, presented in **Table 3-10**, showed that the annual average fuel cost elasticity was -0.32, which lies within the TAG range.

Table 3-10: Summary of Fuel Cost Elasticities

User Class	AM Peak	Inter-peak	PM Peak	12-hour period
Business	-0.144	-0.180	-0.138	-0.157
Commute	-0.093	-0.111	-0.094	-0.098
Other	-0.474	-0.500	-0.437	-0.477
Overall	**-0.274**	**-0.376**	**-0.268**	**-0.315**

3.6.8 Journey time elasticity was also tested, the overall journey time elasticity was -0.88 (**Table 3-11**), which is within the range of between 0 and -2.0 recommended in TAG.

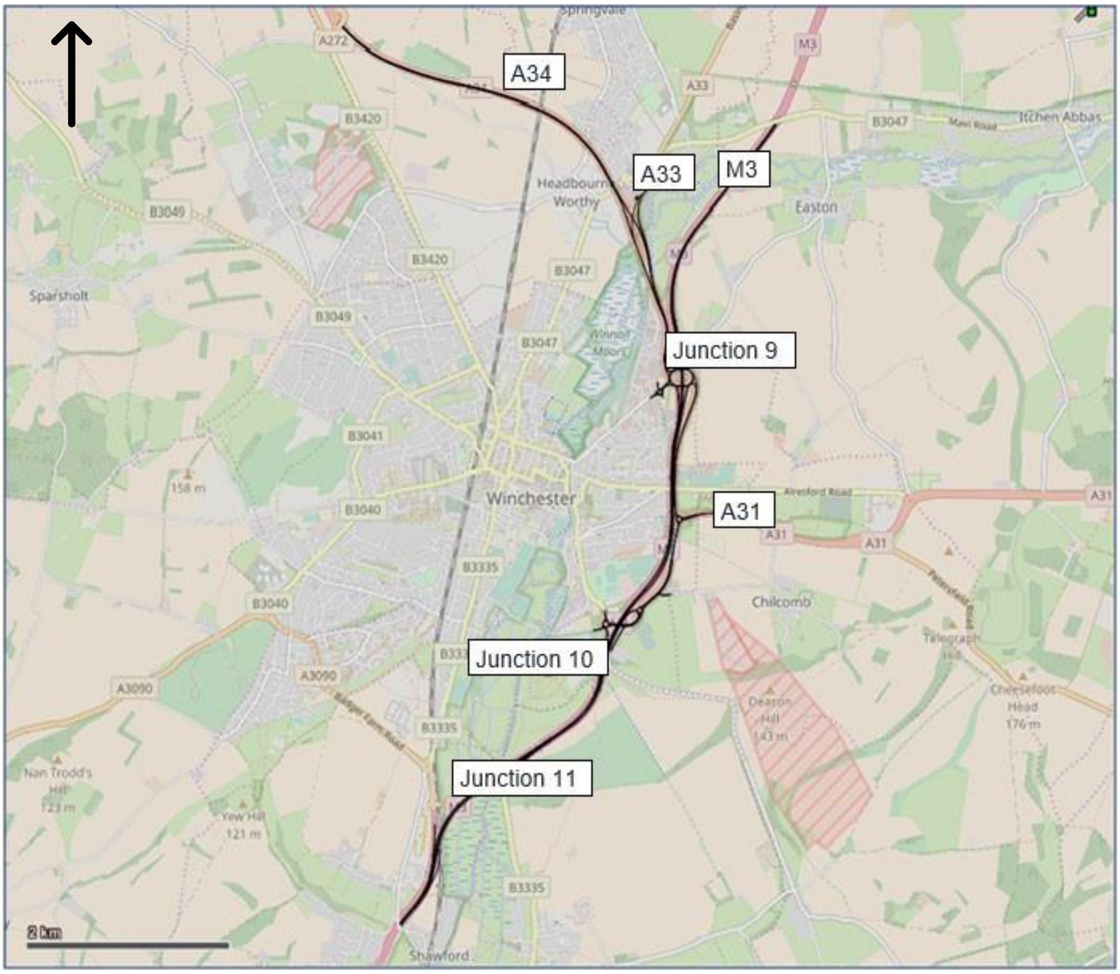
Table 3-11: Summary of Journey Time Elasticities

User Class	AM Peak	Inter-peak	PM Peak	12-hour period
Business	-0.335	-0.402	-0.346	-0.366
Commute	-0.343	-0.370	-0.347	-0.353
Other	-1.184	-1.229	-1.209	-1.217
Overall	-0.779	-0.970	-0.812	-0.879

3.7 Operational model

3.7.1 In PCF Stage 2 (Options Selection) an operational model was developed using PTV-VISSIM software version 11. The operational model was used to test the updated Scheme for PCF Stage 3b. The extent of the operational model is illustrated in **Figure 3-3**.

Figure 3-3: Operational Model Extent (Source: PCF Stage 2 Operational Model LMVR, Highways England, 2017)



3.7.2 The base year of the operational model is 2017. The travel demand matrices covering the movements within the operational model network were developed from Automatic Number Plate Recognition (ANPR) data, along with turning counts at key junctions.

3.7.3 The model was prepared for both the AM peak hour (07:15 – 08:15) and PM peak hour (16:00 – 17:00) with the travel demand matrices divided into 15-minute intervals.

Calibration and validation

3.7.4 Criteria for calibration and validation were taken from TAG Unit 3.1. For flows, numerical and percentage difference and GEH were assessed. The criteria were applied to both link flows and turning flows. For journey times, numerical and percentage difference were assessed.

3.7.5 Traffic flows on model links were used to calibrate the model. The overall performance of the model is shown in **Table 3-12**. The table shows the percentage of all movements that pass both the flow and GEH criteria, and the percentage that passes either flow or GEH criteria. This indicates that the model fulfilled the acceptability criteria at all locations.

Table 3-12: Operational Model Link Flow Calibration Results

Time Period	Links	Cars	LGV	HGV
AM	GEH Criteria Pass	100%	100%	100%
	Flow Criteria Pass	100%	100%	100%
PM	GEH Criteria Pass	100%	100%	100%
	Flow Criteria Pass	100%	100%	100%

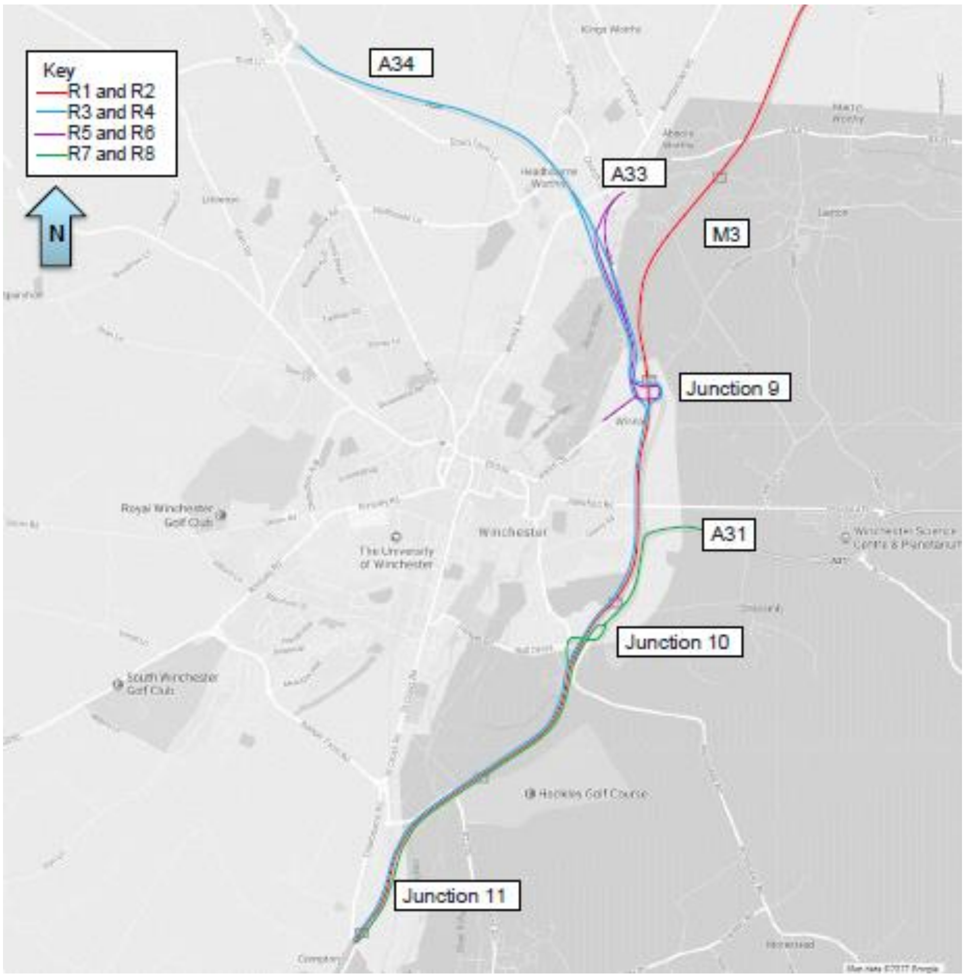
3.7.6 Turning flows were used to validate the model. The overall performance of the model is shown in **Table 3-13**, which indicates that the model had a good level of validation.

Table 3-13: Operational Model Turning Flow Validation Results

Time Period	Links	Cars	LGV	HGV
AM	GEH Criteria Pass	95%	100%	98%
	Flow Criteria Pass	98%	100%	100%
PM	GEH Criteria Pass	98%	100%	100%
	Flow Criteria Pass	100%	100%	100%

3.7.7 Journey time validation was undertaken for eight routes, as illustrated in **Figure 3-4**, using ANPR data collected in April 2017.

Figure 3-4: Operational Model Journey Time Validation Routes (Source: PCF Stage 2 Operational Model LMVR, Highways England, 2017)



3.7.8 The model showed an excellent level of journey time validation in the AM and PM peak, with all eight routes passing the TAG criteria of being within 15% of journey time (or 1 minute if higher than 15%). It was therefore considered that both the AM and PM base models provided a robust representation of the current situation.

4 Forecasting

4.1 Introduction

4.1.1 This chapter describes the development of the traffic forecasts within the models to assess the Scheme. Traffic forecasts for this study were developed in accordance with TAG.

4.1.2 In particular, the forecasting process followed the guidance set out in TAG Unit M4 related to forecasting and uncertainty. This chapter provides an overview of the process and defines the forecast scenarios. The process takes account of the following:

- Definition of the scenarios
- Trip rate assumptions and trip end forecasting
- User classes
- Description of trip matrices
- Development of forecast year network assumptions

4.2 Assumptions and uncertainty log

4.2.1 TAG Unit M-4 recommends the production of an Uncertainty Log to summarise the local planning assumptions in relation to the nature, likelihood, timing, size, and other details of the future developments. The Uncertainty Log was based on information provided by Hampshire County Council who maintain a log of planned developments in their area. Consistent with the predecessor model and the area of interest of the Scheme, the information was provided for the districts of; Winchester, Basingstoke & Deane, Test Valley, Eastleigh, Southampton, New Forest, Fareham, Gosport, Portsmouth, and Havant.

4.2.2 The data provided by Hampshire County Council formed a starting point. Additional confirmation of sites and phasing was also required to robustly estimate the trips generated by these developments. Local Authorities (LA) in Hampshire were consulted to verify the information provided by Hampshire County Council and ensure the data is up to date. The following LA were consulted: Eastleigh Borough Council, Fareham Borough Council, Gosport Borough Council, Havant Borough Council, New Forest District Council, Portsmouth City Council, Winchester City Council, Test Valley Borough Council, and Southampton City Council. The status of all schemes (development schemes and network supply schemes) was classified according to the TAG classification presented in **Table 4-1**.

Table 4-1: Classification Status of Future Developments

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

4.2.3 The criteria to select the developments to be included in each forecast scenario are presented in **Table 4-2**. In line with guidance, only those development sites which can be categorised as ‘Near Certain’ or ‘More than Likely’ were included in the Core Scenario, which represents the most likely outcome and forms the basis for the Scheme appraisal. The Core and Optimistic Scenarios were constrained to growth assumptions from NTEM at the borough level.

Table 4-2: Classification Criteria of Future Developments

Scenario	Supply	Demand
Core	Near Certain, and More than Likely schemes	Near Certain, and More than Likely developments
High	Near Certain, and More than Likely	Near Certain and More than Likely developments
Optimistic	Near Certain, More than Likely, and Reasonably Foreseeable schemes	Near Certain, More than Likely, and Reasonably Foreseeable developments
Low	Near Certain, and More than Likely schemes	Near Certain, and More than Likely developments

Developments

4.2.4 In line with TAG Unit M-4, future developments in the vicinity of the Scheme should be modelled explicitly rather than as part of growth factors extracted from NTEM[5]. For each development the modelling process involved estimating the trip generation and trip distribution of the development when fully completed for each time period.

4.2.5 Each development was assigned a model zone (or zones) with similar land use characteristics, and the trip distribution from those zones used. This provides a development trip matrix which is then added to the forecast matrix derived from applying TEMPro[6] growth to the base year matrix.

4.2.6 **Table 4-3** summarises development totals from the Uncertainty Log, for each Local Authority.

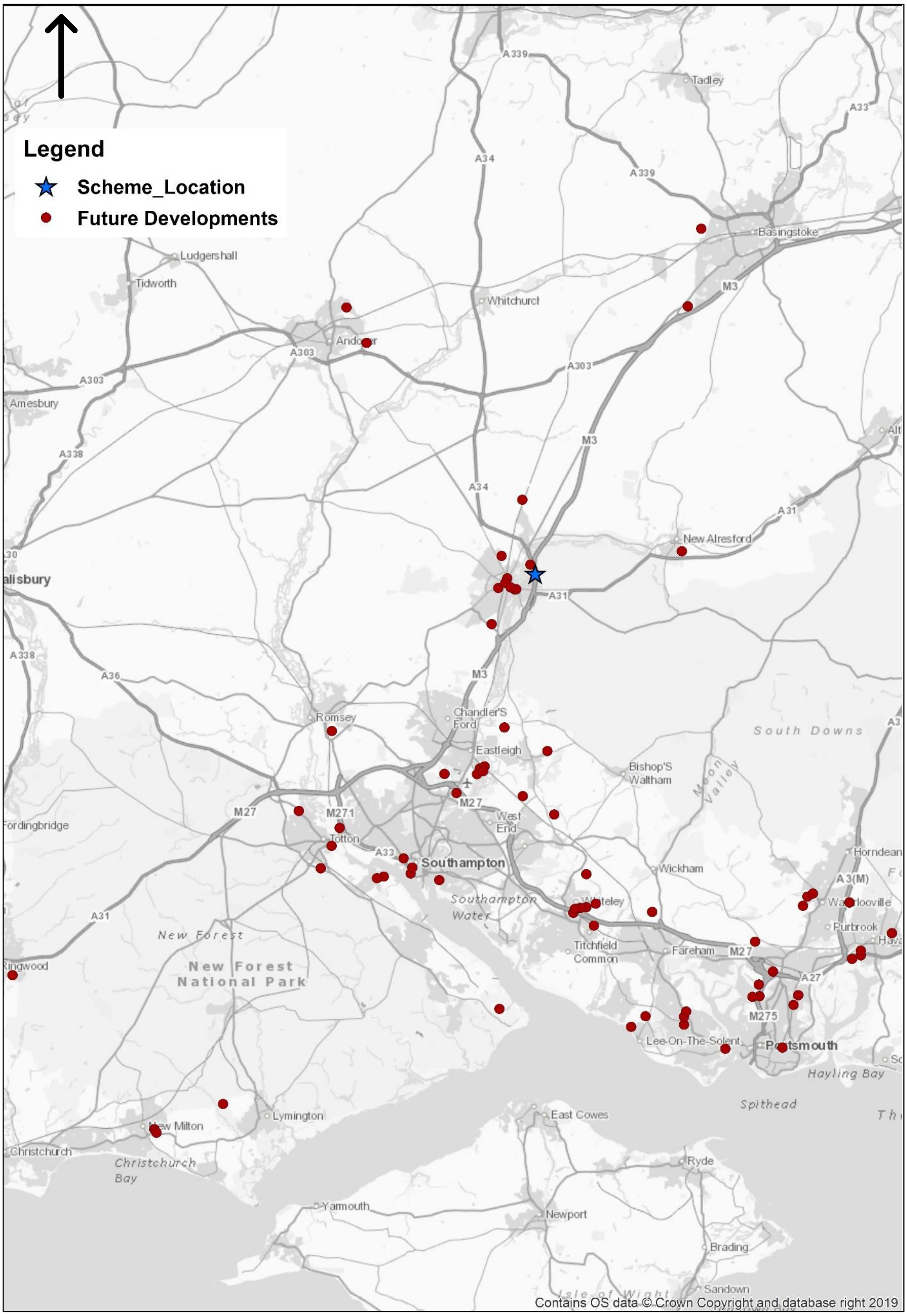
4.2.7 The locations of proposed developments included in the Uncertainty Log are illustrated in **Figure 4-1**. Assumptions were made for those developments for which either sufficient data were not provided or at a very initial stage. The final Uncertainty Log, for which assumptions were finalised in July 2020 is provided in **Appendix A**.

[5] National Trip End Model (NTEM) - data.gov.uk
[6] Trip End Model Presentation Program (TEMPro) download - GOV.UK (www.gov.uk)

Table 4-3: Uncertainty Log Development Summary

Local Authority	Dwellings			Jobs		
	2027	2042	2047	2027	2042	2047
Basingstoke and Deane Borough Council	3,172	5,460	5,460	1,443	1,443	1,443
Test Valley Borough Council	5,159	5,906	5,906	4,905	6,363	6,363
Winchester City Council	5,339	8,854	8,854	6,259	11,110	11,110
Eastleigh Borough Council	4,735	8,358	8,358	6,132	12,614	12,713
Southampton City Council	1,799	1,799	1,799	7,541	9,002	9,002
Fareham Borough Council	1,147	6,000	6,000	6,409	6,409	6,409
Gosport Borough Council	1,079	1,198	1,198	5,034	5,610	5,610
Havant Borough Council	-	-	-	5,994	5,994	5,994
New Forest District Council	40	400	400	5,475	12,105	12,105
Portsmouth City Council	657	2,376	2,376	8,744	9,248	9,248

Figure 4-1: Location of Developments



4.3 Forecast scenarios

4.3.1 To demonstrate the long-term benefits of the Scheme, three forecast years were modelled:

- **2027**: assumed to be the opening year of the Scheme at the time of the development of the forecasts;
- **2042**: assumed to be the design year 15 years after the assumed opening year; and
- **2047**: a horizon year for modelling that is three years on from that in the Stage 3a assessment.

4.3.2 Three further sensitivity tests, referred to as the Low, High, and Optimistic growth scenarios were also run as part of this study. The High and Low growth scenarios were prepared in accordance with TAG Unit M4 to reflect uncertainties in travel demand forecasts. The Optimistic scenario was prepared to assess the impact of additional development and related demand.

4.3.3 Following the completion of the Uncertainty Log for housing and commercial developments, the highway schemes to be included in the 2027, 2042 and 2047 DM networks were determined. These are summarised in **Table 4-4**, which specifies whether the scheme was included in the core\high\low scenarios or the optimistic scenario (see **Section 4.6**).

Table 4-4: Forecast Highway Schemes

Scheme	2027 Core, High and Low	2042 & 2047 Core, High and Low	2047 Optimistic
A31 Ringwood Widening	✓	✓	✓
M271 Redbridge	✓	✓	✓
M3 Junction 2-4a	✓	✓	✓
A27 Arundel Bypass		✓	✓
M4 Junctions 3-12	✓	✓	✓
A27 Segensworth Dualling	✓	✓	✓
Stubbington Bypass	✓	✓	✓
M27 Junction 9 and Parkway South Roundabout	✓	✓	✓
Whitehill and Bordon Relief Road	✓	✓	✓
M27 Junction 4-11 J4 S3	✓	✓	✓
A3024 Eastern Corridor improvements	✓	✓	✓
A3024 / Kingfisher Grange Access	✓	✓	✓
M27 J8	✓	✓	✓
Botley Bypass			✓
M27 Junction 10 Welborne			✓

4.4 Methodology

Car trip rates

4.4.1 TAG Unit M4 “Forecasting and Uncertainty” refers to determining trip rates for local developments using Trip Rate Information Computer System (TRICS) as a possible choice for the trip rate information (version 7.2.3 was considered). TRICS is a database that provides trip rates for typical developments across the UK based on a given land-use type. However, the choice of trip rates from the TRICS database is subjective and based on a relatively modest sample of developments. A generic application of subjectively selected trip rates over a large area may introduce biases and adds uncertainty to the forecasting process. Another limitation of TRICS trip rates is that they represent past observations and do not reflect any future changes in car ownership over time, which is an important determinant of trip rates, and which is considered within the NTEM trip end forecasts.

4.4.2 The car trip ends for the base year and each forecast year, for AM, Inter and PM Peak periods for each origin and destination NTEM zone (consistently with the OD-based structure of the demand model) were extracted from TEMPro 7.2. These were then mapped to the M3 Junction 9 Model zones, to provide standard growth in trips based on housing and employment assumptions included in NTEM 7.2.

4.4.3 Based on the housing and commercial developments listed in the Uncertainty Log (**Appendix A**), new local assumptions about the location and quantum of housing and commercial developments were prepared and mapped to the relevant NTEM zones. With regards to residential developments, the number of additional households to be used in forecasting was taken from the number of houses expected to be delivered in the relevant NTEM zones. With regards to the commercial developments, floor space was converted into the number of jobs, based on the job density assumptions derived from Government's "Employment Densities Guide: 3rd Edition".

4.4.4 The M3 Junction 9 Model covers a large area (Hampshire), and the network extends to the rest of the South East and wider UK. To ensure a greater consistency with TEMPro forecasts, it was therefore preferable to use trip rates implied by the data encapsulated in the TEMPro software and derive the forecasts of trip ends using the software's Alternative Planning Assumptions (APA) functionality. There are two further benefits of using the APA approach:

- Trip ends are generated at a Production-Attraction (PA) level and converted into OD trip ends using factors embedded in TEMPro; and
- Trip rates implied by TEMPro (taken as trip productions over population and trip attractions over jobs) are more consistent with the predictions of CTripEnd and NATCOP8 models, which are part of NTEM and are embedded in the Applicant's demand forecasting interface developed for RTMs.

4.4.5 Based on these assumptions, the number of new households and jobs defined for the relevant NTEM zones were entered into the Alternative Planning Assumptions (APA) tool in TEMPro to derive alternative trip ends for each relevant NTEM zone. These alternative trip end forecasts were then mapped to the M3 Junction 9 Model zones in the same way as the standard, background TEMPro 7.2 growth forecasts.

4.4.6 The forecasts were subsequently constrained to TEMPro 7.2 trip end projections. This process retained the trip end projections associated with the new developments in the zones where the developments are located. In the remaining model zones, it reduced the background NTEM growth to meet the overall TEMPro trip end projections over the local authorities for which the detailed development assumptions were specified. In the areas outside of these authorities, the original TEMPro 7.2 trip end assumptions were used without any further adjustment.

4.4.7 The adjusted trip end forecasts were used to calculate growth factors between the base year and each forecast year and for each origin and destination. These factors were then applied to the base year matrix through furnessing (balancing between origins and destinations) to produce forecast year reference case travel demand matrices.

Rail growth

4.4.8 To facilitate the operation of the variable demand procedure, the M3 Junction 9 Model requires forecast rail demand and supply (time and fare) inputs. These were based on the M3M27 SMI model (which in turn were derived from SERTM) by interpolating and extrapolating M3M27 SMI data for available years.

LGV and HGV growth

4.4.9 LGV and HGV growth was derived from Road Traffic Forecasts (RTF) 2018, published by the DfT. The RTF growth forecast are published for five-year intervals for each region and road type. For the purposes of this study, average regional growth factors for the South East reference case scenario were used. LGV\HGV factors for the M3 Junction 9 Model forecast years of 2027, 2042 and 2047 were determined via linear interpolation across the forecasted years published in RTF. Growth factors were obtained as the ratio of vehicle kilometres travelled, in the respective forecast years, to the vehicle kilometres travelled in the base year of 2015.

Forecast matrices

4.4.10 **Table 4-5** provides the overall growth factors for the Core scenario for the reference case matrices with respect to the base year (2015).

Table 4-5: Growth Rates – Core Scenario

Period / Year	Matrix Totals (PCUs/Hr)					
	Car Business	Car Commuting	Car Other	LGV	HGV	Total
AM						
2027	11%	8%	13%	19%	4%	**11%**
2042	20%	17%	27%	43%	15%	**24%**
2047	24%	21%	32%	49%	18%	**28%**
IP						
2027	10%	7%	13%	19%	4%	**12%**
2042	19%	15%	28%	43%	15%	**26%**
2047	23%	18%	32%	49%	18%	**30%**
PM						
2027	10%	7%	12%	19%	5%	**10%**
2042	19%	16%	25%	43%	15%	**22%**
2047	23%	19%	29%	49%	18%	**26%**

VDM process and results

4.4.11 The reference case and post-VDM matrix totals were compared to understand the impact of VDM on highway trips. The comparison of pre and post VDM results indicated that there was induced traffic for all demand segments as a result of VDM. The comparisons for all scenarios, years and time periods are provided in **Appendix B**.

Operational model forecasting methodology

4.4.12 The forecast demand matrices were prepared using growth rates derived from the M3 Junction 9 Model. To obtain strategic traffic forecasts from the M3 Junction 9 Model, the highway assignment model was cordoned in a manner consistent with the coverage of the operational model network. The cordoned demand for each scenario was prepared based on this network for each user class and forecast year, as well as the base year. This ensured that zonal demand from M3 Junction 9 Model was compatible with the operational model zone structure.

4.4.13 The demand from the M3 Junction 9 Model was prepared for the following user classes:

- User class 1: car employer's business;
- User class 2: car commute;
- User class 3: car other;
- User class 4: Light Goods Vehicles (LGV); and
- User class 5: Other Goods Vehicles (OGV).

4.4.14 These user classes were combined to limit the opportunities for large changes in the low absolute number of vehicles in individual user classes to influence the results. The combined flows were subsequently used to calculate growth factors for each origin-destination pair (entry-exit pair) of the operational model network. These growth rates were cross-checked and constrained to represent the overall total amount of growth on this section of the network between the M3 Junction 9 Model base and the forecast years.

4.4.15 Since the M3 Junction 9 Model has a base year of 2015 and the operational model has a base year of 2017, adjustment was necessary to reflect the proportion of growth that would have taken place between these two years. This was undertaken by generating an estimate of 2017 demand through linear interpolation between the 2015 base demand, 2047 Do-Minimum and Do-Something forecast demand (**Table 4-6**).

Table 4-6: Operational Model Years

M3 Junction 9 Model	Operational Model
2015	-
-	2017
2047	2047

4.4.16 The following amendments were made to the Do-Something scenario in the operational model for the PCF Stage 3b (Preliminary Design):

- M3 northbound off-slip approach reduced from 3 lanes to 2
- Junction 9 circulatory reduced from 3 lanes to 2
- A33 exit from circulatory reduced from 2 lanes to 1
- M3 southbound off-slip dedicated left lane filter altered to give-way arrangement instead of merge.

4.5 Traffic forecasting outcomes

Strategic model traffic flows

4.5.1 Overall the impact of the Scheme on the road network was similar in the three modelled years. The scale of change was generally greatest in 2047, given that this has the highest level of travel demand and related traffic flows. As expected, there were large increases in flow predicted along the A34 and M3 between Junction 9 and Junction 11 in the northbound direction in the AM and PM peak. The Scheme reduces predicted delays for A34 traffic by providing a direct connection between the M3 and A34. There were increases in flow in all time periods (up to 860 vehicles in the PM period in 2047) due to the provision of direct slip roads between the M3 and A34.

4.5.2 The Scheme also resulted in predicted increased traffic flows on Easton Lane in all periods in all years. The diversion of A34 traffic from M3 Junction 9 increased the attractiveness of A272 Spitfire Link as an access route to the M3 and Winchester City.

4.5.3 The flows on a number of local roads within Winchester City were predicted to decrease. One reason is that, in the Do-Minimum scenario, traffic diverted through Winchester to avoid the delays at Junction 9. The introduction of the Scheme reduces the incentive to avoid the junction with a predicted reduction in traffic flows across the city.

4.5.4 The difference in flows for the Winchester Road Network (**Figure 4-2**) is presented in **Figure 4-3** to **Figure 4-11** (also full sized in **Appendix C**).

Figure 4-2: Winchester Modelled Road Network

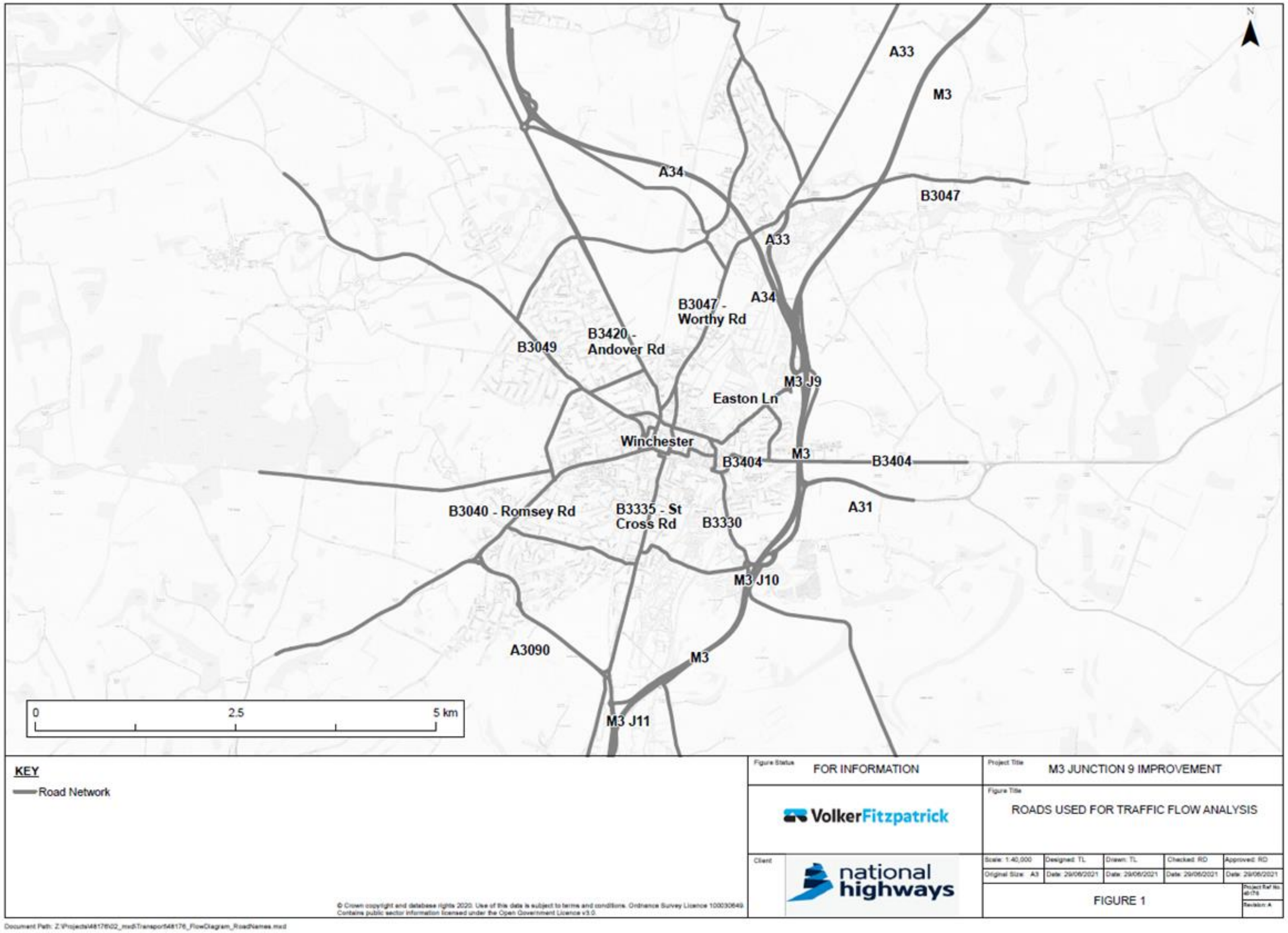


Figure 4-3: Core Scenario Flows, 2027 AM Peak, Do-Minimum and Do-Something Scenarios (NB-northbound, SB-southbound, EB-eastbound, WB-westbound)

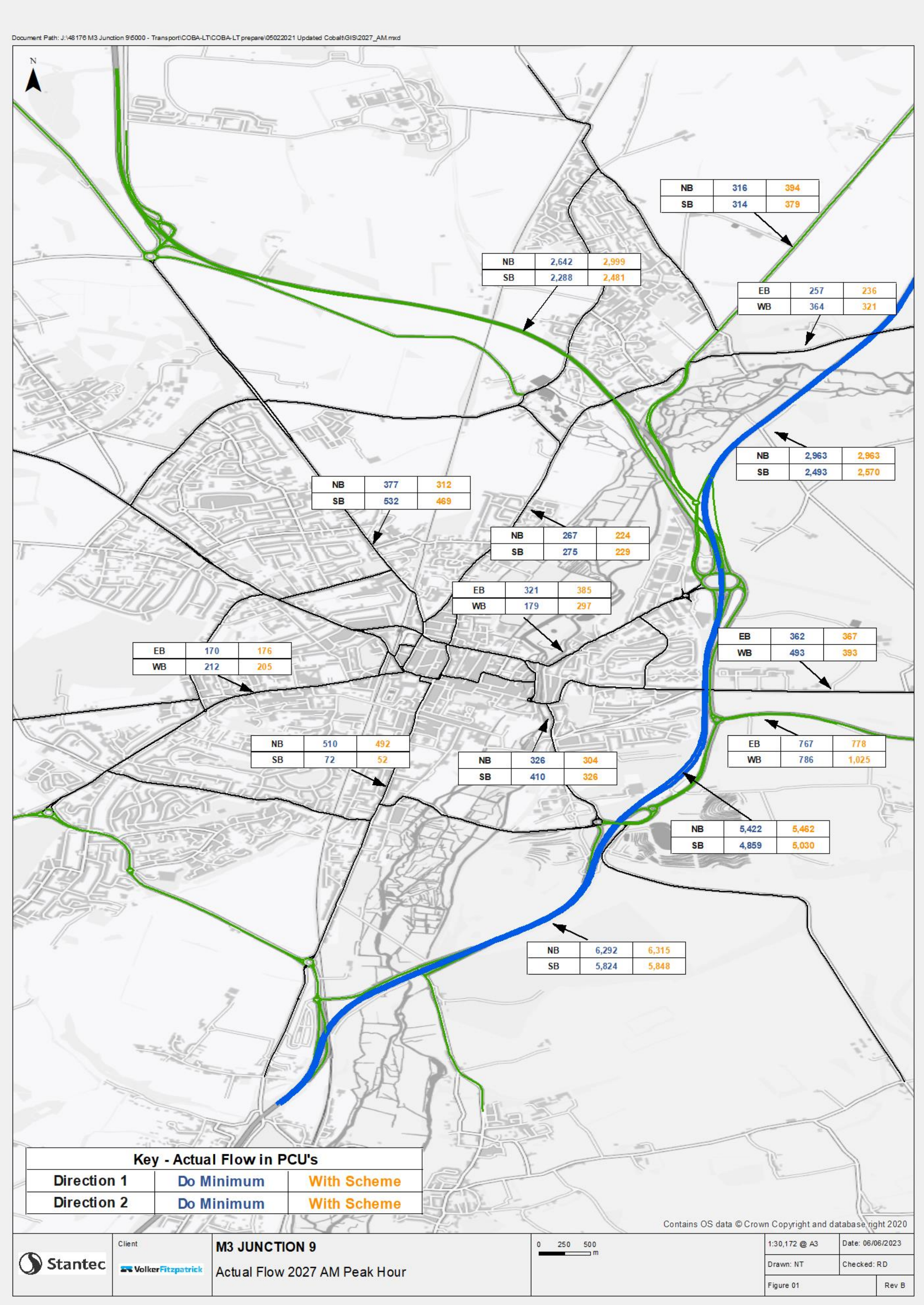


Figure 4-4: Core Scenario Flows, 2027 Inter Peak, Do-Minimum and Do-Something Scenarios (NB-northbound, SB-southbound, EB-eastbound, WB-westbound)

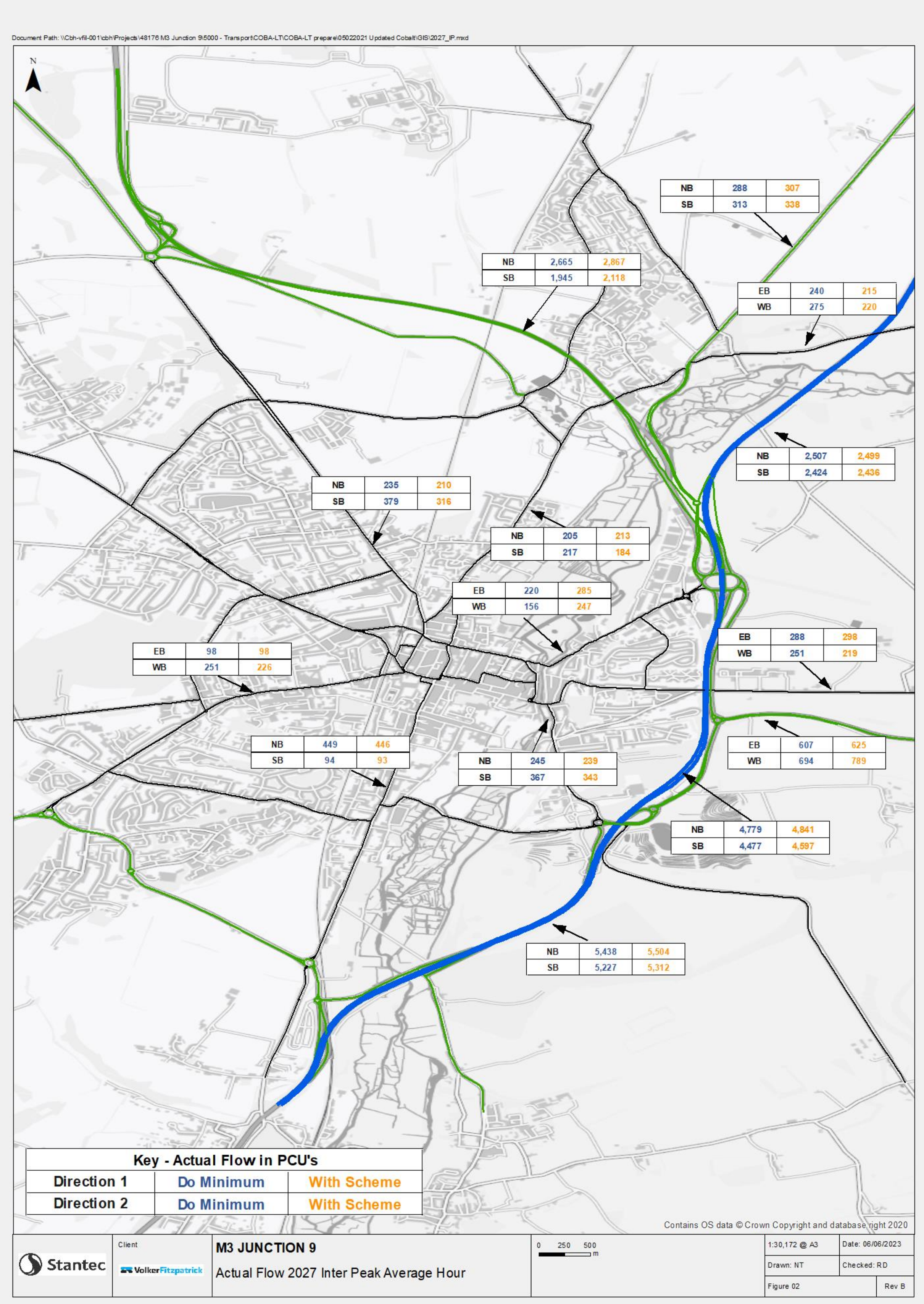


Figure 4-5: Core Scenario Flows, 2027 PM Peak, Do-Minimum and Do-Something Scenarios (NB-northbound, SB-southbound, EB-eastbound, WB-westbound)

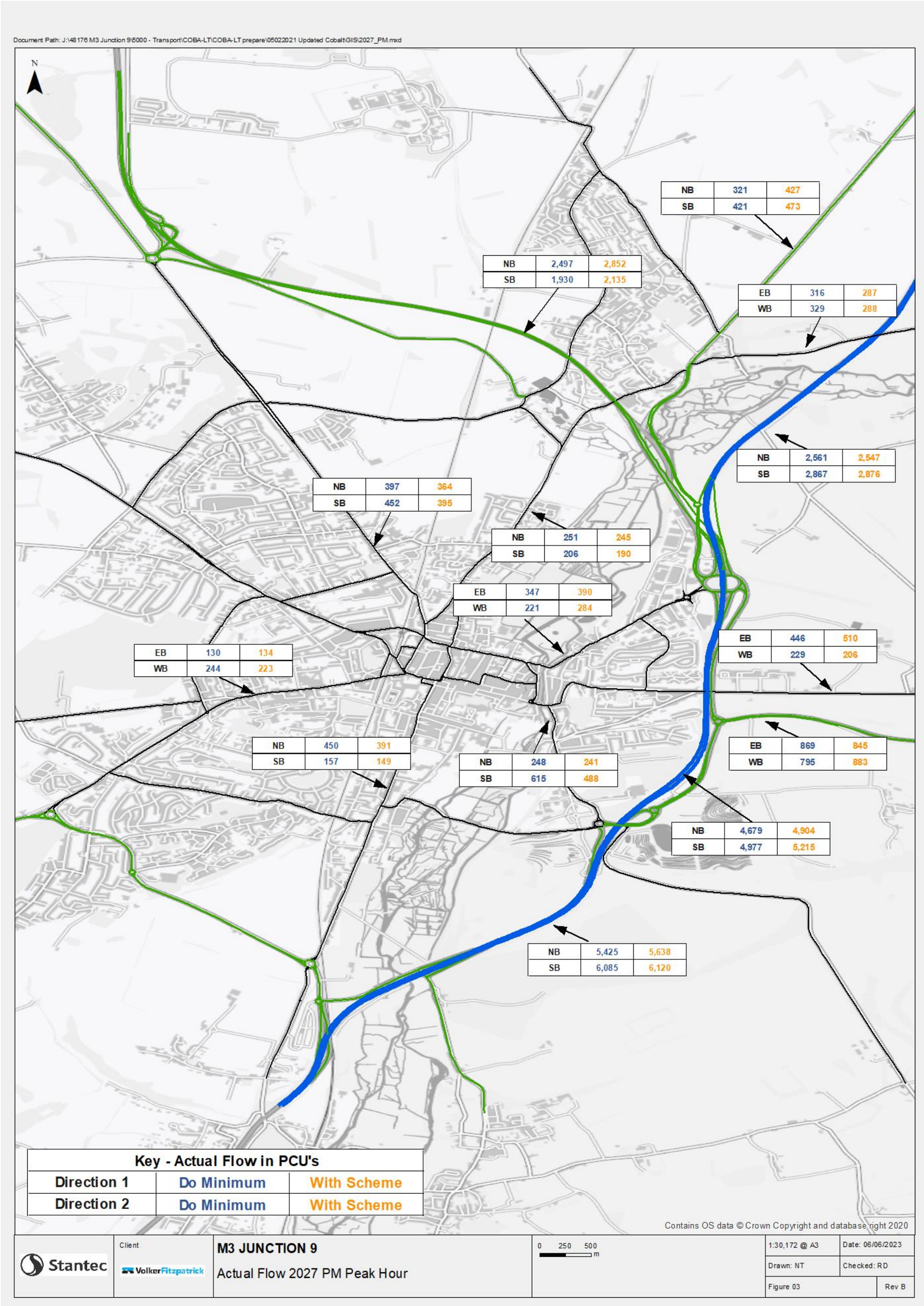


Figure 4-6: Core Scenario Flows, 2042 AM Peak, Do-Minimum and Do-Something Scenarios (NB-northbound, SB-southbound, EB-eastbound, WB-westbound)

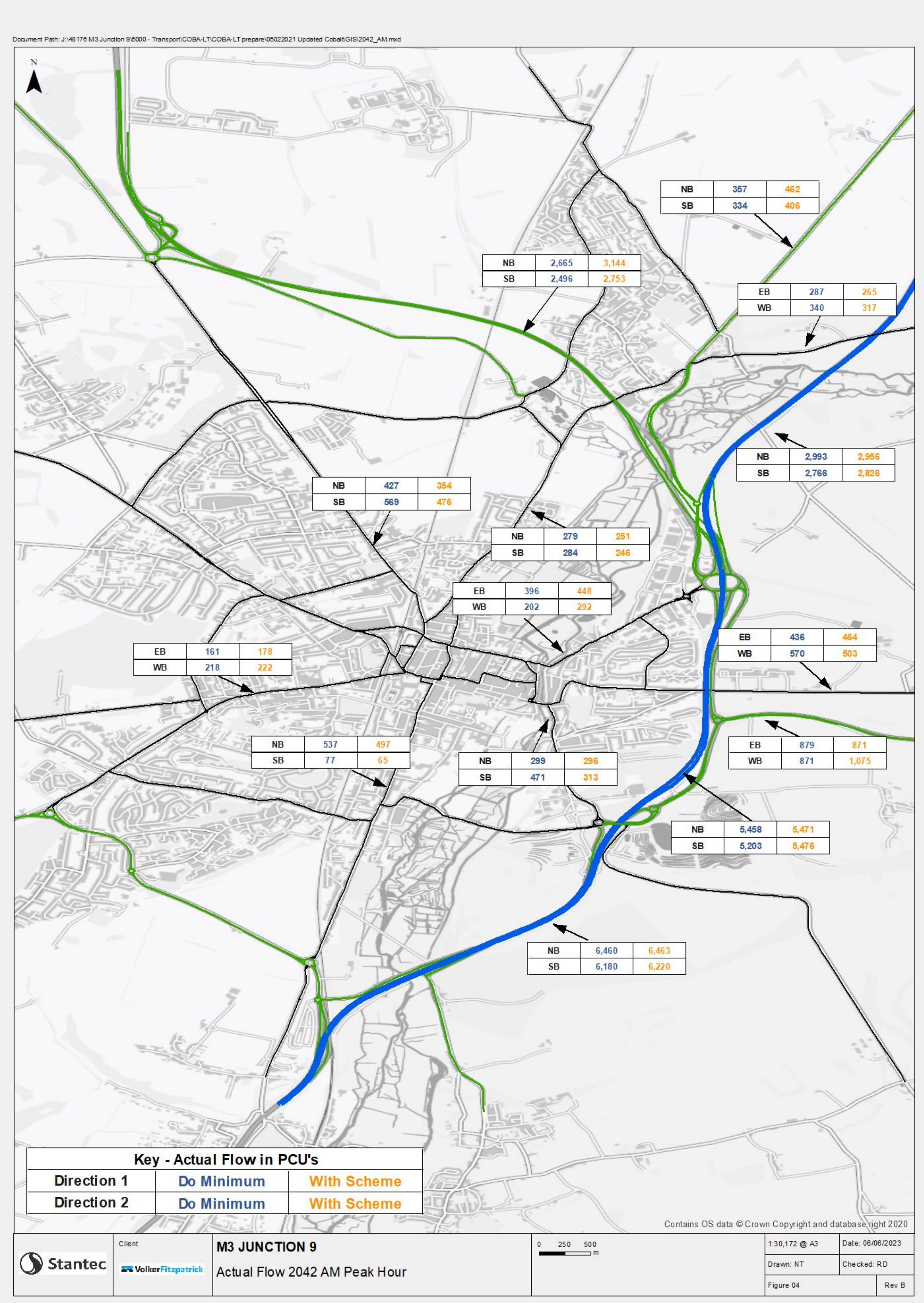


Figure 4-7: Core Scenario Flows, 2042 Inter Peak, Do-Minimum and Do-Something Scenarios (NB-northbound, SB-southbound, EB-eastbound, WB-westbound)

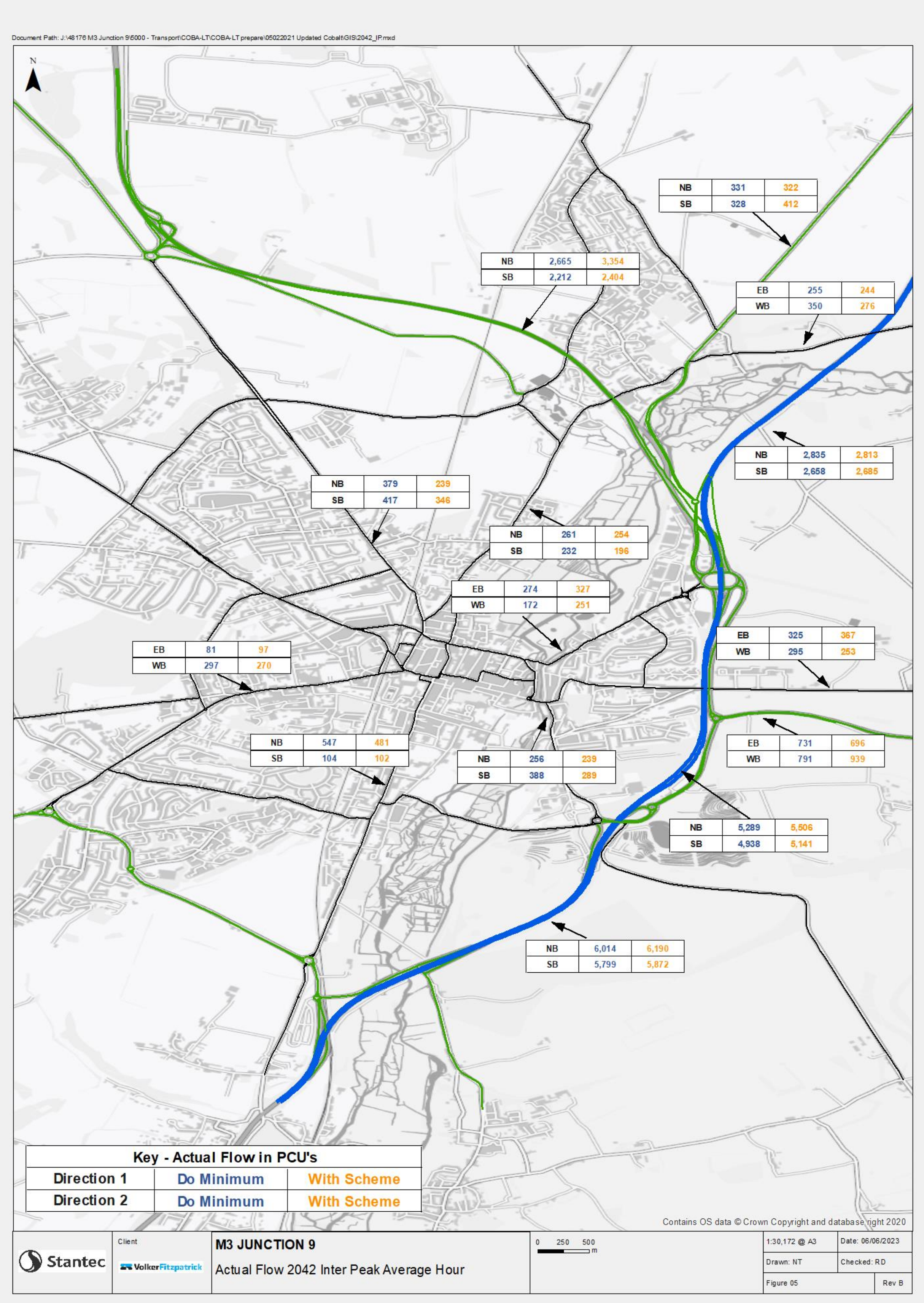


Figure 4-8: Core Scenario Flows, 2042 PM Peak, Do-Minimum and Do-Something Scenarios (NB-northbound, SB-southbound, EB-eastbound, WB-westbound)

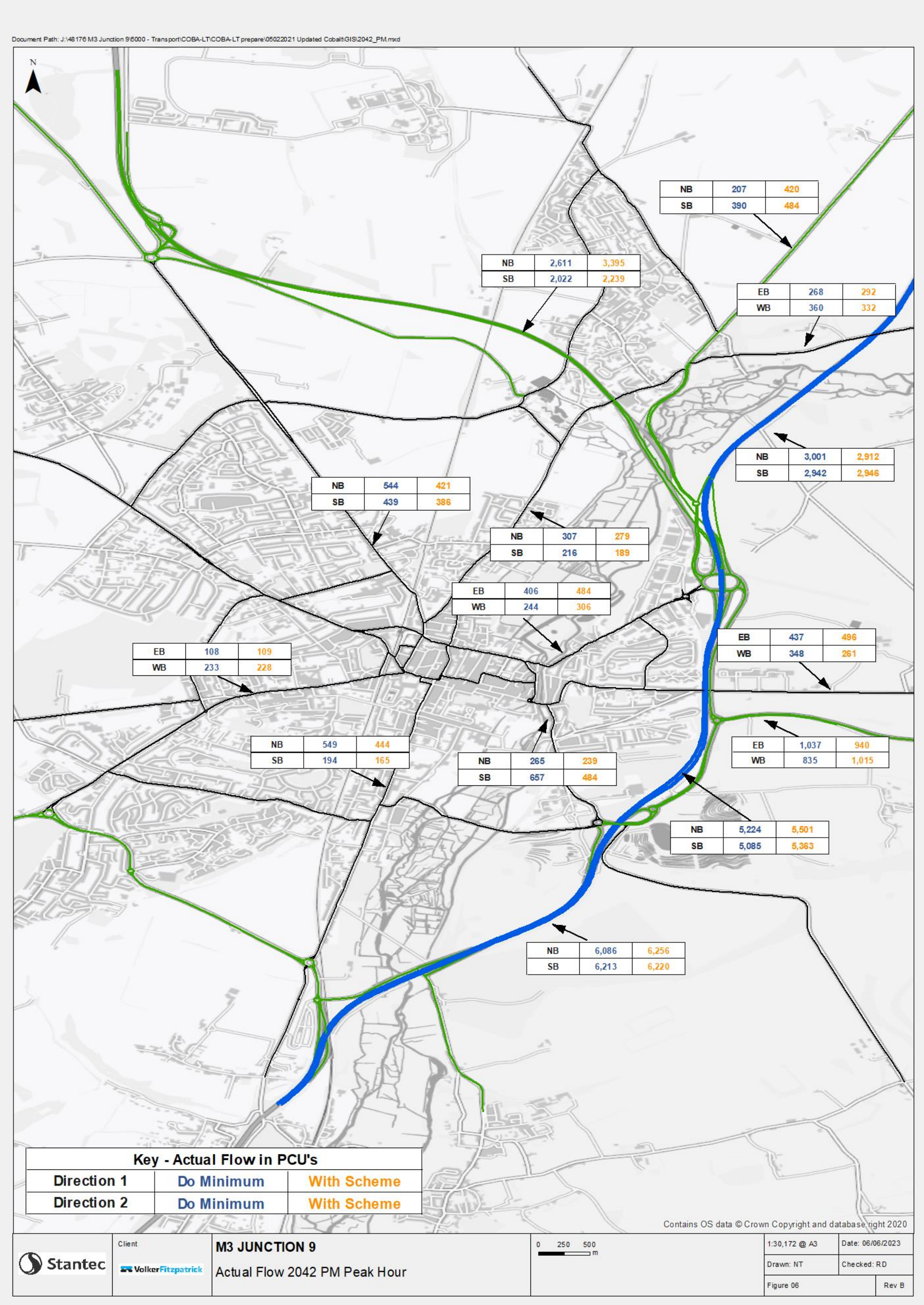


Figure 4-9: Core Scenario Flows, 2047 AM Peak, Do-Minimum and Do-Something Scenarios (NB-northbound, SB-southbound, EB-eastbound, WB-westbound)

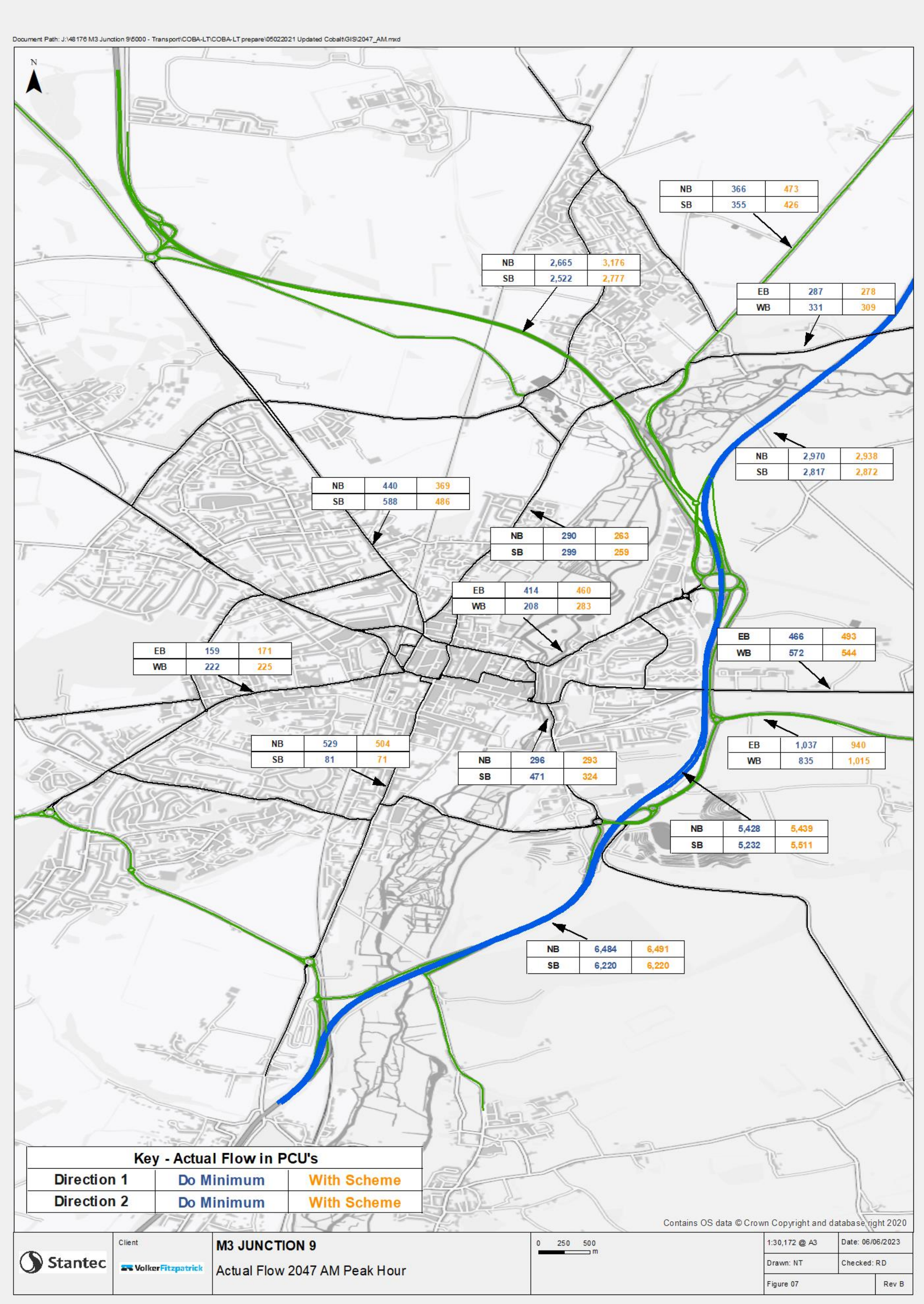


Figure 4-10: Core Scenario Flows, 2047 Inter Peak, Do-Minimum and Do-Something Scenarios (NB-northbound, SB-southbound, EB-eastbound, WB-westbound)

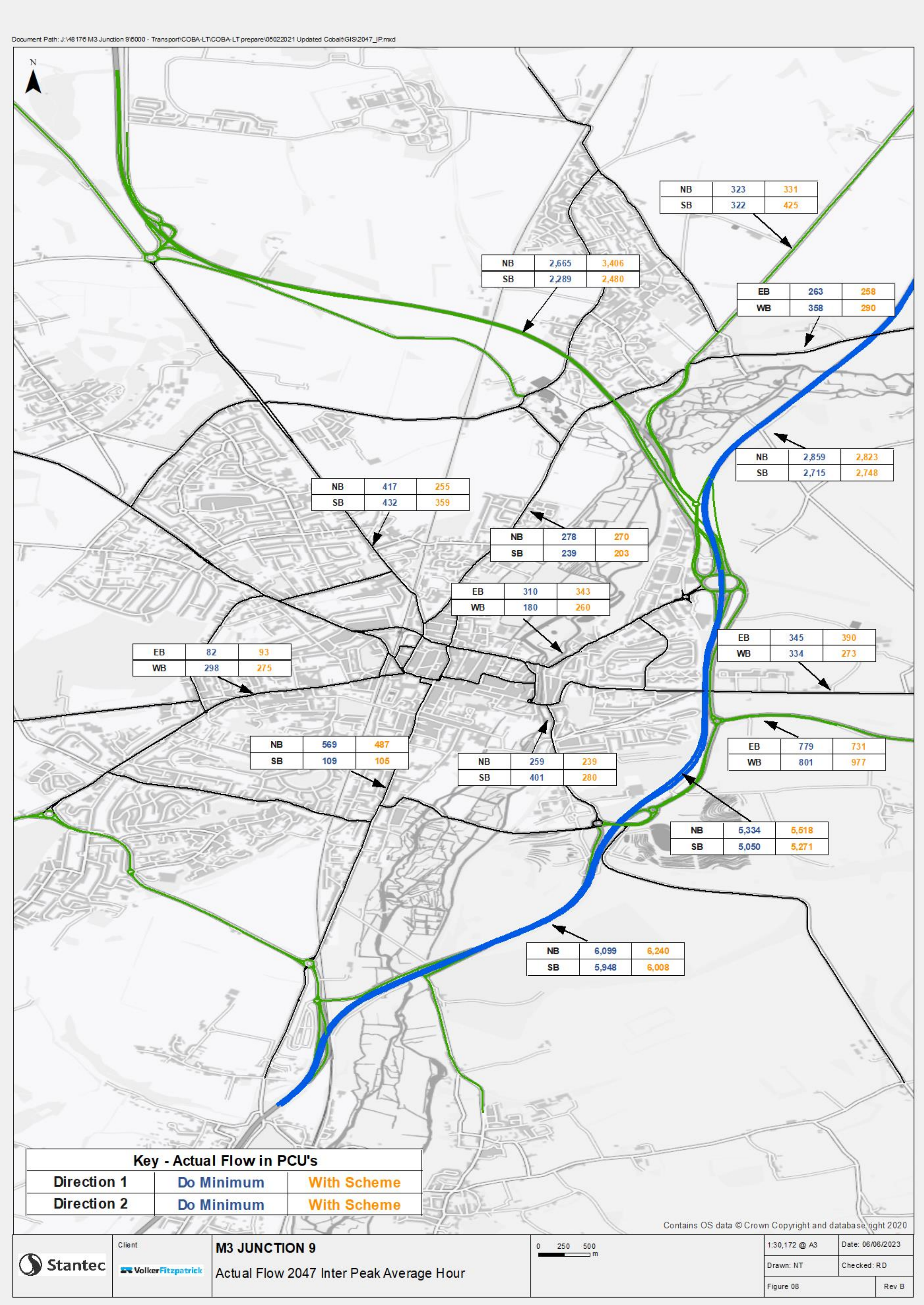
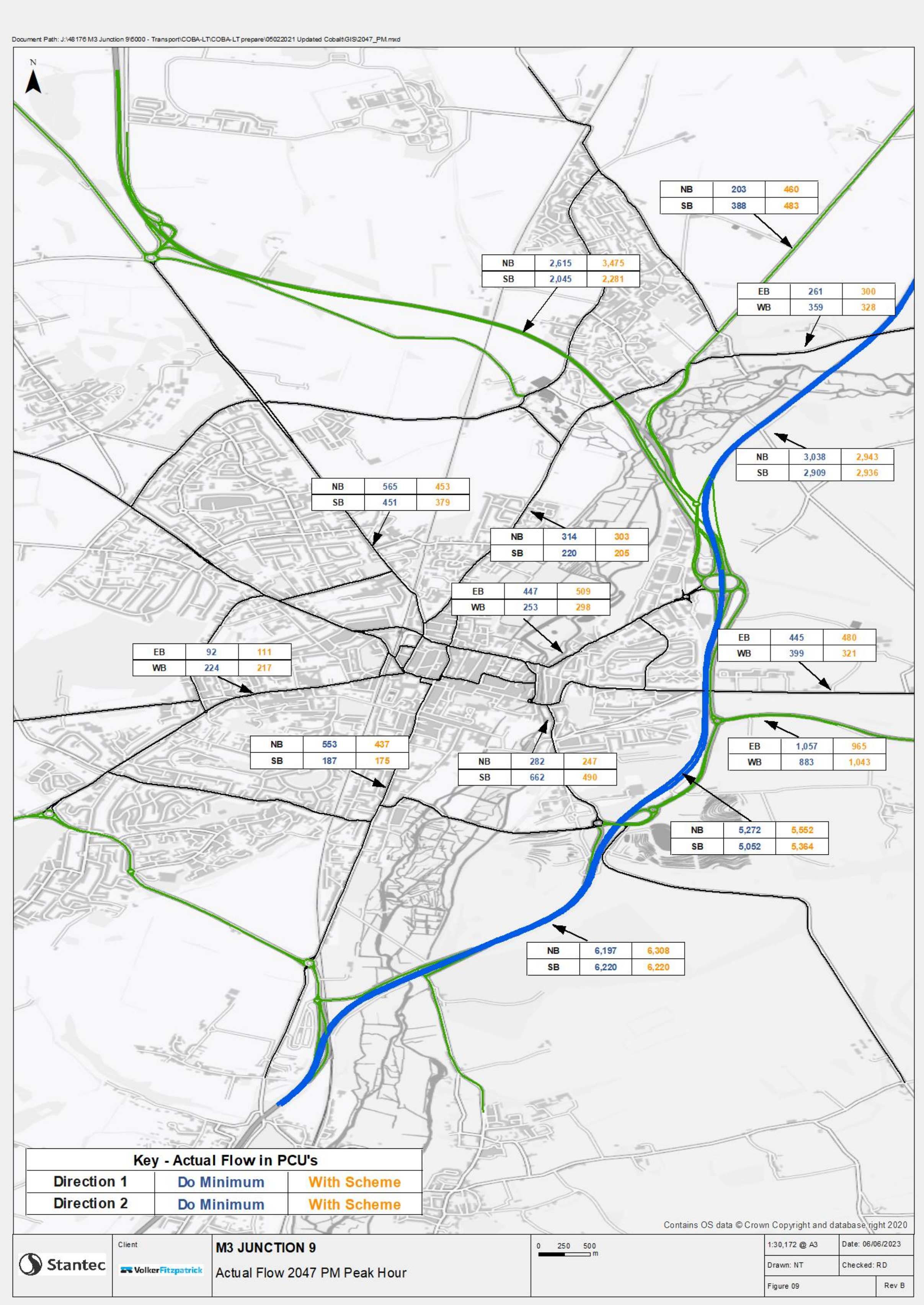


Figure 4-11: Core Scenario Flows, 2047 PM Peak, Do-Minimum and Do-Something Scenarios (NB-northbound, SB-southbound, EB-eastbound, WB-westbound)

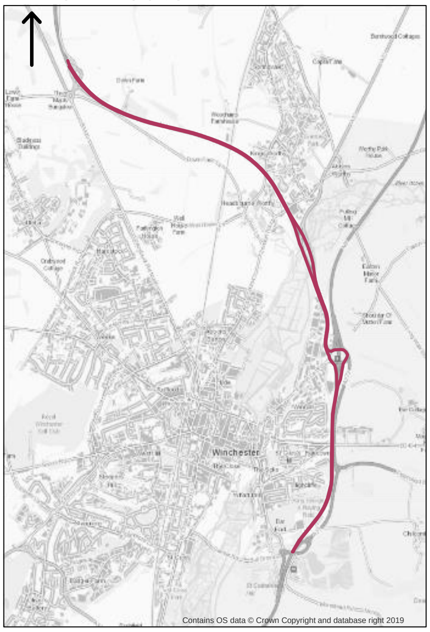


Strategic model journey time

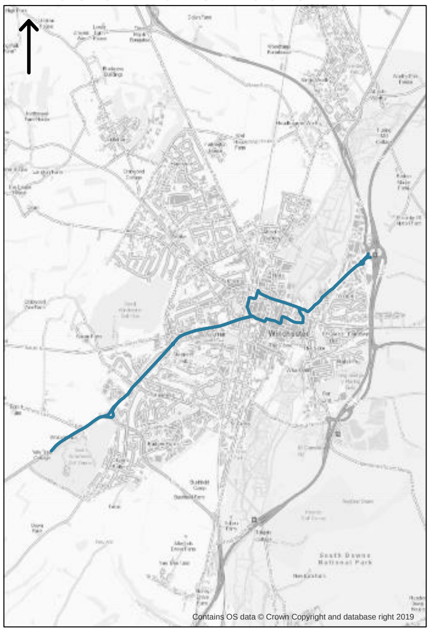
4.5.5 An analysis of M3 Junction 9 Model journey times on various routes through the Scheme was also undertaken to help understand the impact of the Scheme on journey times. The points between the potential combinations of routes were analysed and are illustrated in **Figure 4-12**. Tables in this section present the difference in journey time between the Do-Minimum and Do-Something scenarios for 2027, 2042 and 2047 for each of these routes.

Figure 4-12: Journey Time Routes (Source: PCF Stage 3 (Preliminary Design) Transport Forecasting Package Report, Highways England, 2020)

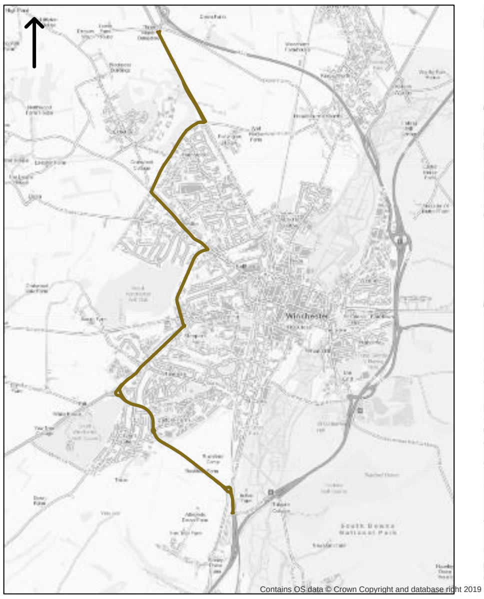
▼ A34 Route



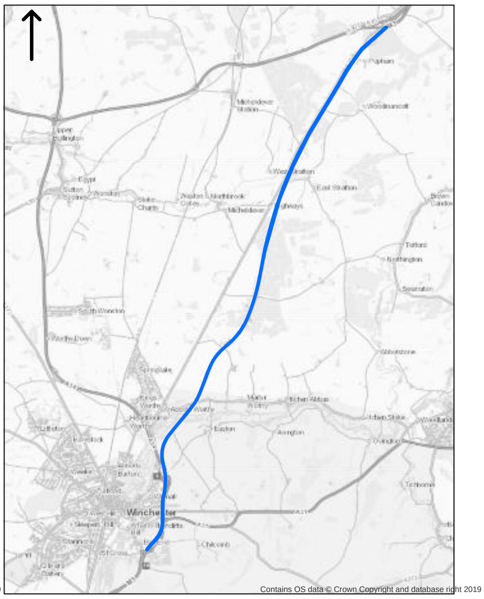
▼ Easton Lane Route



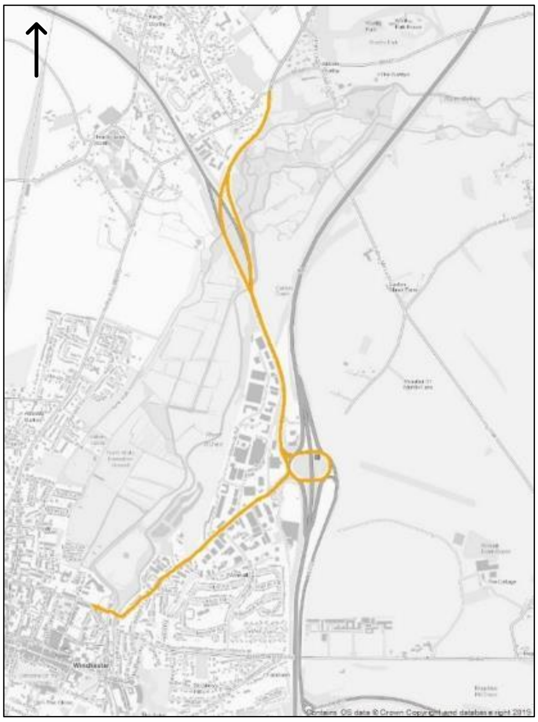
▼ Hockley Alternative Route



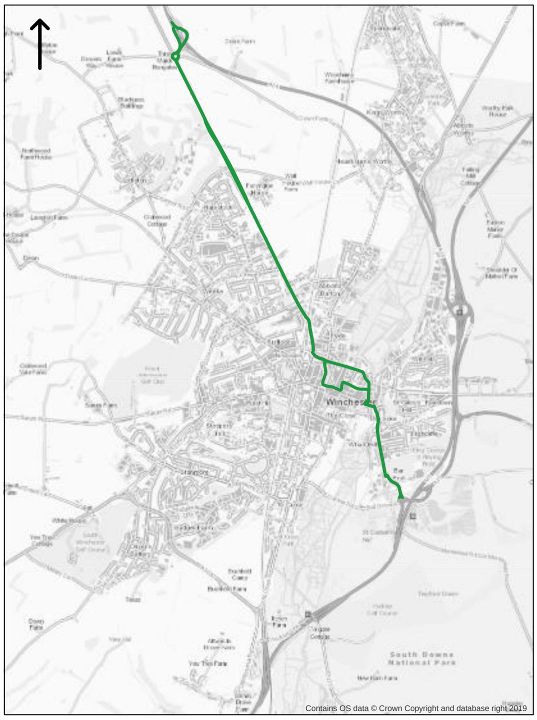
▼ M3 Route



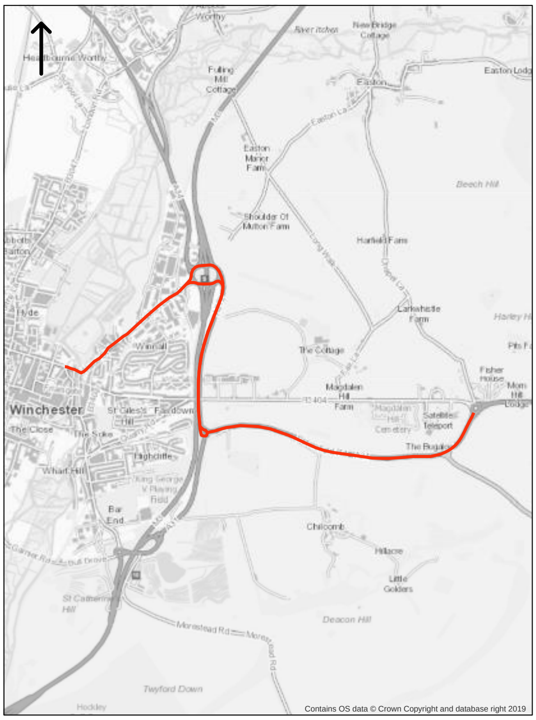
▼ A33 Route



▼ Winchester NS SN Route



▼ A31/A272 Route



4.5.6 Several analysed routes demonstrate predicted journey time improvements with the introduction of the Scheme.

4.5.7 The A34 route northbound between M3 Junction 10 and A34/A272 junction is predicted to have journey time savings in excess of two minutes in 2027, in excess of three minutes in 2042, and in excess of four minutes in 2047 in the PM peak period and around one minute for the AM Peak. The equivalent southbound journey time savings are approximately one minute in 2027, 2042 and 2047. The Scheme provides a direct connection between the M3 and A34, hence the journey time improvements.

4.5.8 The eastbound Easton Lane route is predicted to have journey time savings in 2027, 2042 and 2047 across all time periods resulting from the alleviation of congestion at the Easton Lane approach to Junction 9. The highest predicted impact is in 2047 in the PM peak with a journey time saving more than four minutes. The westbound Easton Lane route also demonstrates journey time savings across each forecast year, although much smaller than the equivalent eastbound direction.

4.5.9 The Hockley Alternative route demonstrates minor predicted journey time savings in all forecast years, where the Scheme reduces traffic flows on this route.

4.5.10 As mainline M3 congestion increases in the Do Minimum AM and PM peaks, the Scheme is predicted to provide northbound journey time benefits for the mainline M3 in all three forecast years.

4.5.11 The remaining route through Winchester (Route Winchester NS SN) is also predicted to have minor journey time savings in 2027 in the AM and PM peak, with greater journey time savings in all time periods in 2042 and 2047.

4.5.12 Journey times in both directions of the A33 route are predicted to reduce across all years and time periods, with the largest reductions in 2047 of two and half minutes in the AM Peak. The southbound direction follows a similar pattern, with journey time savings between one and two minutes.

4.5.13 In 2027, journey time savings for the A31/A272 route (Route A31 in the tables) are predicted to be between one and four minutes in all time periods, with the AM Peak showing the largest journey time savings. In 2042 and 2047 AM and PM peaks, the westbound direction demonstrates a journey time reduction of four to five minutes. The inter-peak travel time saving is predicted to be around two minutes. These journey time benefits are predominantly as a result of the reduction of conflicting traffic at the A272 approach to the Scheme.

Table 4-7: 2027 Journey Time DS-DM Comparison

Route	Do-Minimum			Do-Something			Difference			% Difference		
	AM	IP	PM	AM	IP	PM	AM	IP	PM	AM	IP	PM
A34 Route												
From M3 Junction 10 to A34/A272 (northbound)	08:45	07:34	08:35	07:43	06:02	06:07	-01:02	-01:32	-02:28	-12%	-20%	-29%
From A34/A272 to M3 Junction 10 (southbound)	08:12	07:22	08:40	06:55	06:06	07:07	-01:17	-01:16	-01:34	-16%	-17%	-18%
Route Easton Lane												
From South Winchester Golf Club to Easton Lane Roundabout (eastbound)	16:27	14:53	14:52	14:26	14:06	13:30	-02:01	-00:46	-01:22	-12%	-5%	-9%
From Easton Lane Roundabout to South Winchester Golf Club (westbound)	16:17	12:39	14:54	16:14	12:41	14:19	-00:03	00:02	-00:35	0%	0%	-4%
Route Hockley Alternative												
From Hockley Link Roundabout to A34/A272 via west Winchester (northbound)	14:47	13:31	14:26	14:37	13:29	14:13	-00:10	-00:02	-00:13	-1%	0%	-2%
From A34/A272 to Hockley Link Roundabout via west Winchester (southbound)	15:15	13:37	15:10	14:54	13:25	14:40	-00:22	-00:12	-00:30	-2%	-1%	-3%
Route M3												
From M3 Junction 10 to M3 Junction 8 (northbound)	13:09	12:08	12:12	11:43	12:11	10:48	-01:26	00:03	-01:23	-11%	0%	-11%
From M3 Junction 8 to M3 Junction 10 (southbound)	12:04	11:50	12:35	12:04	11:52	12:26	00:00	00:02	-00:09	0%	0%	-1%
Route Winchester NS SN												
From Bar End Road Roundabout to A34/A272 (northbound)	14:07	13:13	15:43	13:36	13:11	15:19	-00:31	-00:03	-00:25	-4%	0%	-3%
From A34/A272 to Bar End Road Roundabout (southbound)	12:45	12:58	12:27	12:09	12:40	11:41	-00:36	-00:18	-00:47	-5%	-2%	-6%
Route A33												
From Easton Lane to A33 in Kings Worthy (northbound)	06:31	05:22	05:25	04:57	04:43	04:54	-01:34	-00:39	-00:32	-24%	-12%	-10%
From A33 in Kings Worthy to Easton Lane (southbound)	06:31	06:13	06:39	05:28	05:16	05:27	-01:03	-00:57	-01:12	-16%	-15%	-18%
Route A31												
From A31 Percy Hobbs Roundabout to Union St/N Walls Junction (westbound)	11:15	07:01	08:02	07:08	06:19	06:34	-04:07	-00:42	-01:28	-37%	-10%	-18%
From Union St/N Walls Junction to A31 Percy Hobbs Roundabout (eastbound)	08:45	07:09	07:42	05:51	05:40	05:53	-02:54	-01:28	-01:48	-33%	-21%	-23%

Table 4-8: 2042 Journey Time DS-DM Comparison

Route	Do-Minimum			Do-Something			Difference			% Difference		
	AM	Inter	PM	AM	Inter	PM	AM	Inter	PM	AM	Inter	PM
A34 Route												
From M3 Junction 10 to A34/A272 (northbound)	10:00	10:28	11:33	08:35	07:22	07:47	-01:25	-03:06	-03:47	-14%	-30%	-33%
From A34/A272 to M3 Junction 10 (southbound)	09:21	08:16	09:24	08:08	06:47	07:56	-01:13	-01:29	-01:28	-13%	-18%	-16%
Route Easton Lane												
From South Winchester Golf Club to Easton Lane Roundabout (eastbound)	18:11	15:54	16:50	15:08	14:29	14:24	-03:04	-01:25	-02:26	-17%	-9%	-14%
From Easton Lane Roundabout to South Winchester Golf Club (westbound)	18:04	13:41	16:56	17:55	13:18	15:53	-00:09	-00:23	-01:03	-1%	-3%	-6%
Route Hockley Alternative												
From Hockley Link Roundabout to A34/A272 via west Winchester (northbound)	15:41	14:14	15:32	14:49	13:52	14:52	-00:52	-00:22	-00:41	-6%	-3%	-4%
From A34/A272 to Hockley Link Roundabout via west Winchester (southbound)	16:37	14:21	16:03	15:59	13:55	15:29	-00:38	-00:26	-00:34	-4%	-3%	-4%
Route M3												
From M3 Junction 10 to M3 Junction 8 (northbound)	13:43	12:41	13:00	12:11	12:43	11:26	-01:32	00:03	-01:35	-11%	0%	-12%
From M3 Junction 8 to M3 Junction 10 (southbound)	12:38	12:18	12:46	12:27	12:13	12:34	-00:11	-00:05	-00:13	-1%	-1%	-2%
Route Winchester NS SN												
From Bar End Road Roundabout to A34/A272 (northbound)	14:33	13:58	17:42	13:53	13:27	16:18	-00:40	-00:31	-01:24	-5%	-4%	-8%
From A34/A272 to Bar End Road Roundabout (southbound)	13:33	13:14	12:50	12:42	12:43	11:58	-00:51	-00:30	-00:52	-6%	-4%	-7%
Route A33												
From Easton Lane to A33 in Kings Worthy (northbound)	07:19	06:35	06:33	05:07	04:47	05:02	-02:13	-01:48	-01:31	-30%	-27%	-23%
From A33 in Kings Worthy to Easton Lane (southbound)	07:08	06:26	06:55	05:35	05:20	05:31	-01:33	-01:06	-01:24	-22%	-17%	-20%
Route A31												
From A31 Percy Hobbs Roundabout to Union St/N Walls Junction (westbound)	12:33	08:27	11:15	07:39	06:39	07:05	-04:54	-01:48	-04:10	-39%	-21%	-37%
From Union St/N Walls Junction to A31 Percy Hobbs Roundabout (eastbound)	09:28	07:45	08:50	06:04	05:46	06:05	-03:25	-01:59	-02:46	-36%	-26%	-31%

Table 4-9: 2047 Journey Time DS-DM Comparison

Route	Do-Minimum			Do-Something			Difference			% Difference		
	AM	Inter	PM	AM	Inter	PM	AM	Inter	PM	AM	Inter	PM
A34 Route												
From M3 Junction 10 to A34/A272 (northbound)	10:09	11:02	12:31	08:46	07:43	08:11	-01:24	-03:19	-04:20	-14%	-30%	-35%
From A34/A272 to M3 Junction 10 (southbound)	09:40	08:35	09:33	08:30	07:01	08:10	-01:10	-01:34	-01:23	-12%	-18%	-14%
Route Easton Lane												
From South Winchester Golf Club to Easton Lane Roundabout (eastbound)	18:44	16:28	18:51	16:11	14:43	14:41	-02:33	-01:45	-04:10	-14%	-11%	-22%
From Easton Lane Roundabout to South Winchester Golf Club (westbound)	18:46	14:22	17:47	18:33	13:44	16:32	-00:13	-00:38	-01:14	-1%	-4%	-7%
Route Hockley Alternative												
From Hockley Link Roundabout to A34/A272 via west Winchester (northbound)	15:47	14:33	17:00	15:40	14:03	14:59	-00:07	-00:30	-02:01	-1%	-3%	-12%
From A34/A272 to Hockley Link Roundabout via west Winchester (southbound)	17:05	14:47	16:34	16:24	14:12	15:53	-00:41	-00:35	-00:41	-4%	-4%	-4%
Route M3												
From M3 Junction 10 to M3 Junction 8 (northbound)	13:45	12:45	13:10	12:13	12:46	11:34	-01:32	00:01	-01:36	-11%	0%	-12%
From M3 Junction 8 to M3 Junction 10 (southbound)	12:43	12:27	12:42	12:31	12:19	12:33	-00:12	-00:08	-00:09	-2%	-1%	-1%
Route Winchester NS SN												
From Bar End Road Roundabout to A34/A272 (northbound)	14:55	14:23	18:46	14:05	13:39	16:48	-00:49	-00:43	-01:58	-5%	-5%	-10%
From A34/A272 to Bar End Road Roundabout (southbound)	13:55	13:29	13:05	13:11	12:52	12:08	-00:44	-00:37	-00:58	-5%	-5%	-7%
Route A33												
From Easton Lane to A33 in Kings Worthy (northbound)	07:40	06:53	07:01	05:09	04:48	05:07	-02:30	-02:05	-01:54	-33%	-30%	-27%
From A33 in Kings Worthy to Easton Lane (southbound)	07:22	06:30	07:19	05:38	05:22	05:31	-01:44	-01:08	-01:48	-23%	-17%	-25%
Route A31												
From A31 Percy Hobbs Roundabout to Union St/N Walls Junction (westbound)	12:53	08:55	11:48	07:53	06:47	07:17	-05:01	-02:08	-04:31	-39%	-24%	-38%
From Union St/N Walls Junction to A31 Percy Hobbs Roundabout (eastbound)	09:57	08:00	09:21	06:09	05:48	06:10	-03:48	-02:12	-03:11	-38%	-27%	-34%

Strategic model volume to capacity – Core scenario

4.5.14 **Figure 4-13** and **Figure 4-14** present Volume to Capacity Ratio (V/C) plots for key links around the Scheme for the 2042 DS scenario and for the AM and PM peak periods, respectively. The green colour represents V/C of less than 75%, orange V/C between 75% and 85% and red V/C of over 85%. The results are also presented as full-size images in **Appendix D**.

4.5.15 While the V/C values are generally below 85%, the key areas of pressure are predicted to be on the A34 in the northbound direction and on the M3 south of Junction 9 in both directions.

Figure 4-13: Volume to Capacity Ratio, 2042 Do-Something and Do-Minimum AM Peak

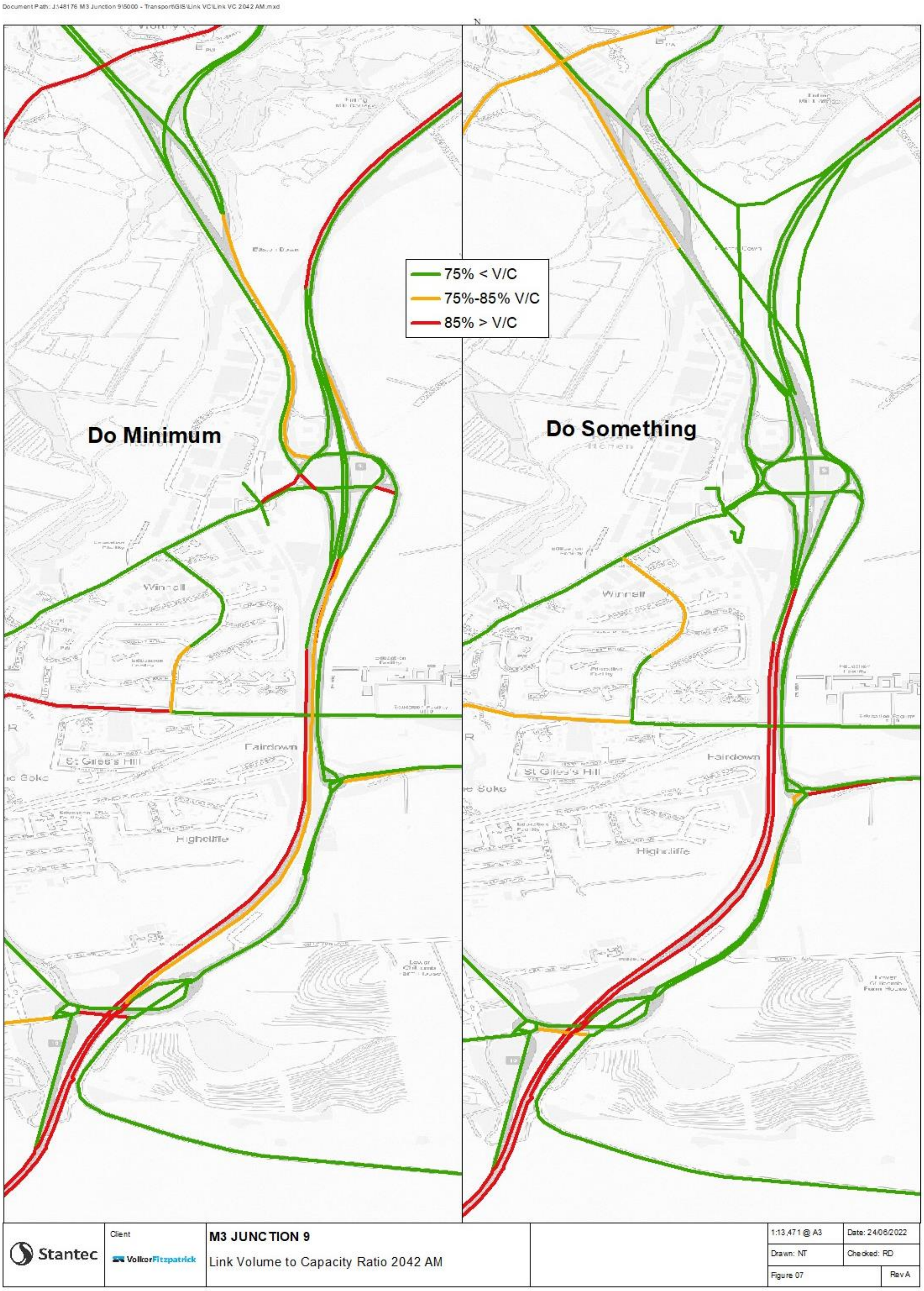
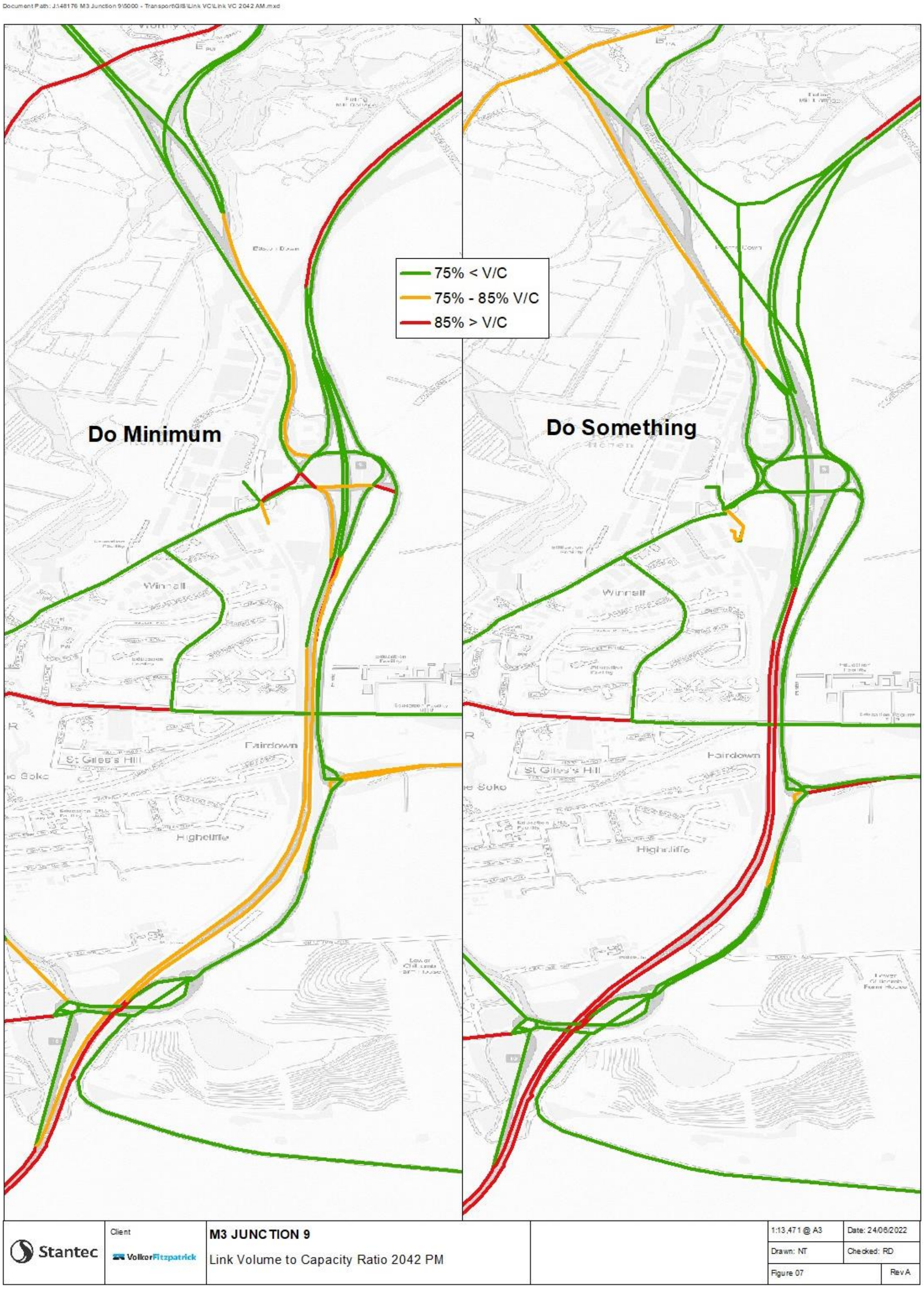


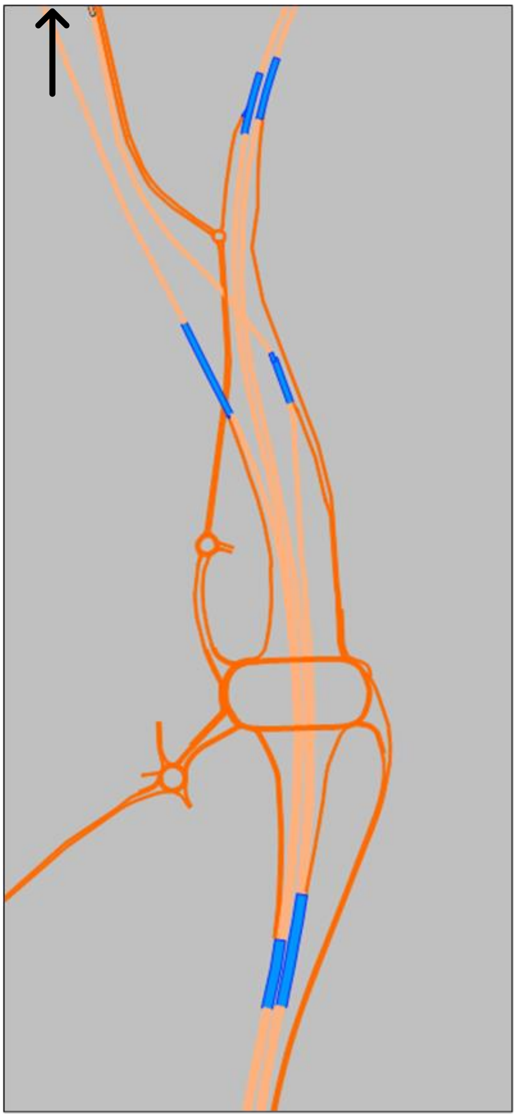
Figure 4-14: Volume to Capacity Ratio, 2042 Do-Something and Do-Minimum PM Peak



Operational model outputs

4.5.16 The Scheme was coded into the Operation Model, as illustrated in **Figure 4-15**. The light orange represents the mainline carriageways e.g. M3, A34, the dark orange represents the road network around the junction and the blue represents the merge diverge.

Figure 4-15: Stage 3b Do Something Operational Model (Source: Interim PCF Stage 3a Economic Assessment Technical Note, Highways England, 2020)



Operational model journey time results

4.5.17 Journey times were calculated for ten separate routes in the network to illustrate the impact of the Scheme on journey times. These routes are illustrated in **Figure 4-16** and Routes and described in **Table 4-12**.

Figure 4-16: Operational Model Journey Time Routes (Source: PCF Stage 2 Options Selection) Local Model Validation Report, Highways England, 2017)

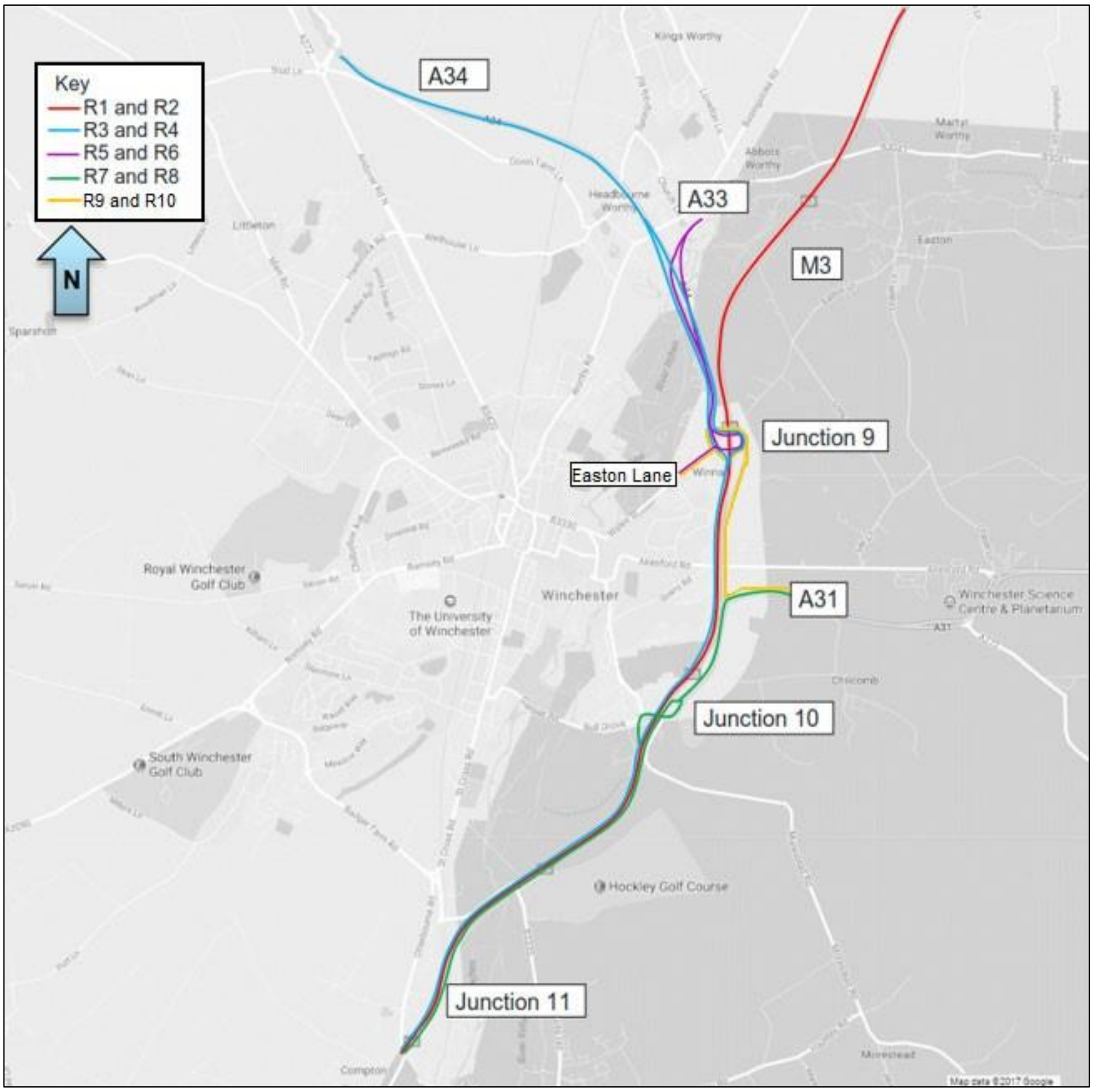


Table 4-10: Journey Time Assessment Routes

Route	Description
R1	M3 south to M3 north
R2	M3 north to M3 south
R3	M3 south to A34
R4	A34 to M3 south
R5	A33 to Easton Lane
R6	Easton Lane to A33
R7	A31 to M3 south via J10
R8	M3 south to A31 via J10
R9	A31 to Easton Lane
R10	Easton Lane to A31

4.5.18 **Table 4-11** and **Table 4-12** present the 2017 base, 2047 Do-Minimum (DM) and 2047 Do-Something (DS) journey times.

Table 4-11: AM Peak Journey Times

Route	Description	2017	2047		
		Base	DM	DS	Difference (DS-DM)
R1	M3S to M3N	06:37	08:00	09:09	01:09
R2	M3N to M3S	06:31	05:58	06:02	00:04
R3	M3S to A34	09:04	10:22	10:45	00:23
R4	A34 to M3S	09:07	08:23	07:44	-00:39
R5	A33 to Easton Lane	03:38	03:43	04:35	00:52
R6	Easton Lane to A33	03:03	06:49	03:07	-03:42
R7	A31 to M3S	04:14	03:57	03:53	-00:04
R8	M3S to A31	05:29	06:10	07:35	01:25
R9	A31 to Easton Lane	03:42	03:46	03:05	-00:41
R10	Easton Lane to A31	04:45	07:09	03:19	-03:50

Table 4-12: PM Peak Journey Times

Route	Description	2017	2047		
		Base	DM	DS	Difference (DS-DM)
R1	M3S to M3N	05:35	06:13	06:16	00:04
R2	M3N to M3S	06:49	06:13	06:38	00:25
R3	M3S to A34	09:10	11:02	08:26	-02:35
R4	A34 to M3S	10:55	10:50	08:20	-02:31
R5	A33 to Easton Lane	05:05	05:03	04:22	-00:41
R6	Easton Lane to A33	02:57	03:56	03:21	-00:35
R7	A31 to M3S	04:25	05:25	04:12	-01:13
R8	M3S to A31	04:17	04:23	04:35	00:12
R9	A31 to Easton Lane	04:33	06:35	02:54	-03:41
R10	Easton Lane to A31	05:03	06:05	03:38	-02:28

4.5.19 The majority of routes show a predicted decrease in journey time with the Scheme in place. The largest reductions are between the A31 and Easton Lane where southbound (Route 10) journey times reduce by almost 4 minutes in the AM peak and northbound (Route 9) journey times reduce by around 3.5 minutes in the PM peak. This is due to the significant congestion in the Do-Minimum being alleviated with the introduction of the Scheme.

Operational model relative delay results

4.5.20 **Figure 4-17** and **Figure 4-18** show relative delay heatmaps that visualise the delay as the percentage of the free flow journey time for the Do-Minimum and Do-Something model scenarios.

Figure 4-17: 2047 Do-Minimum Delay Heatmaps

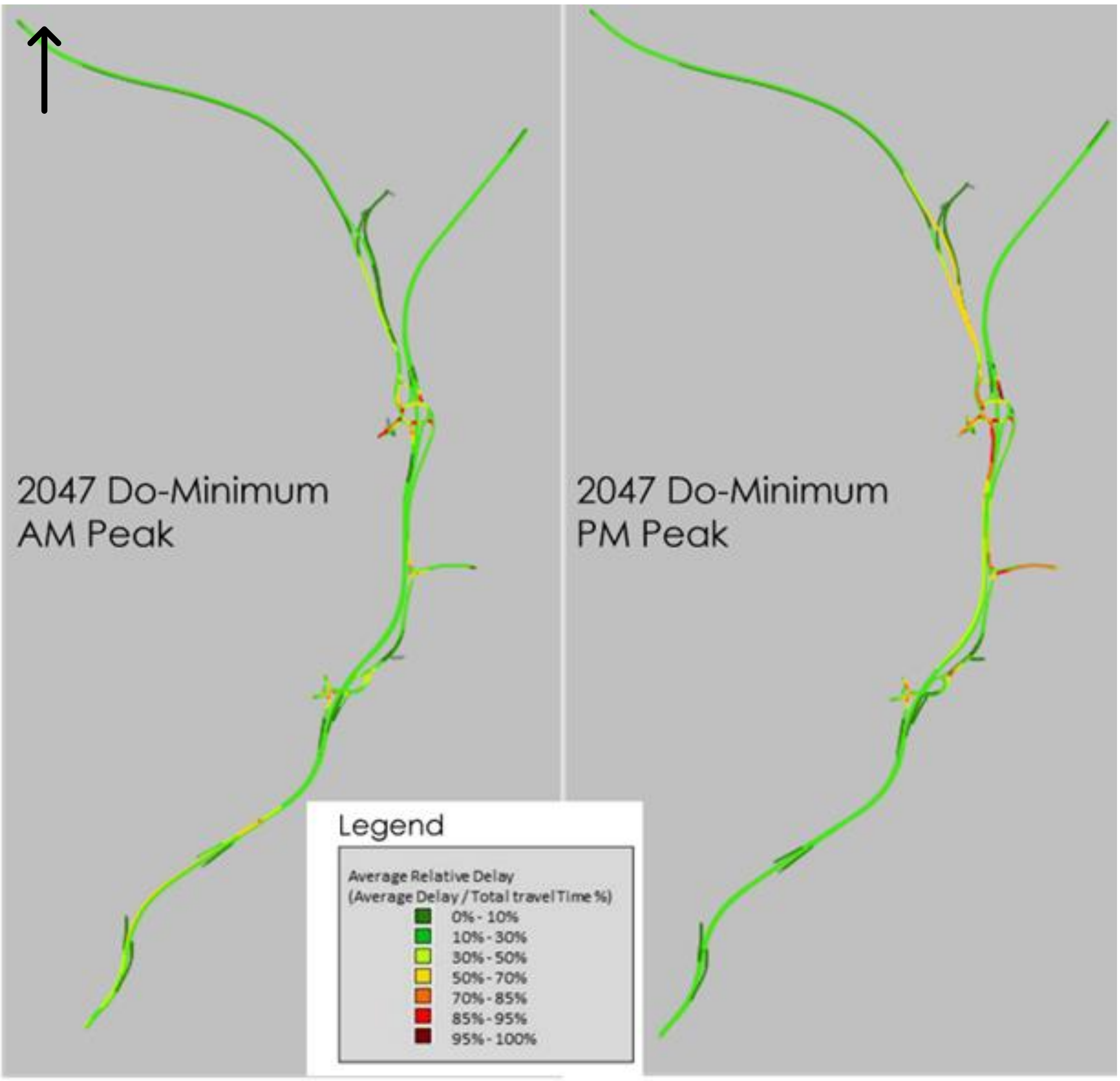
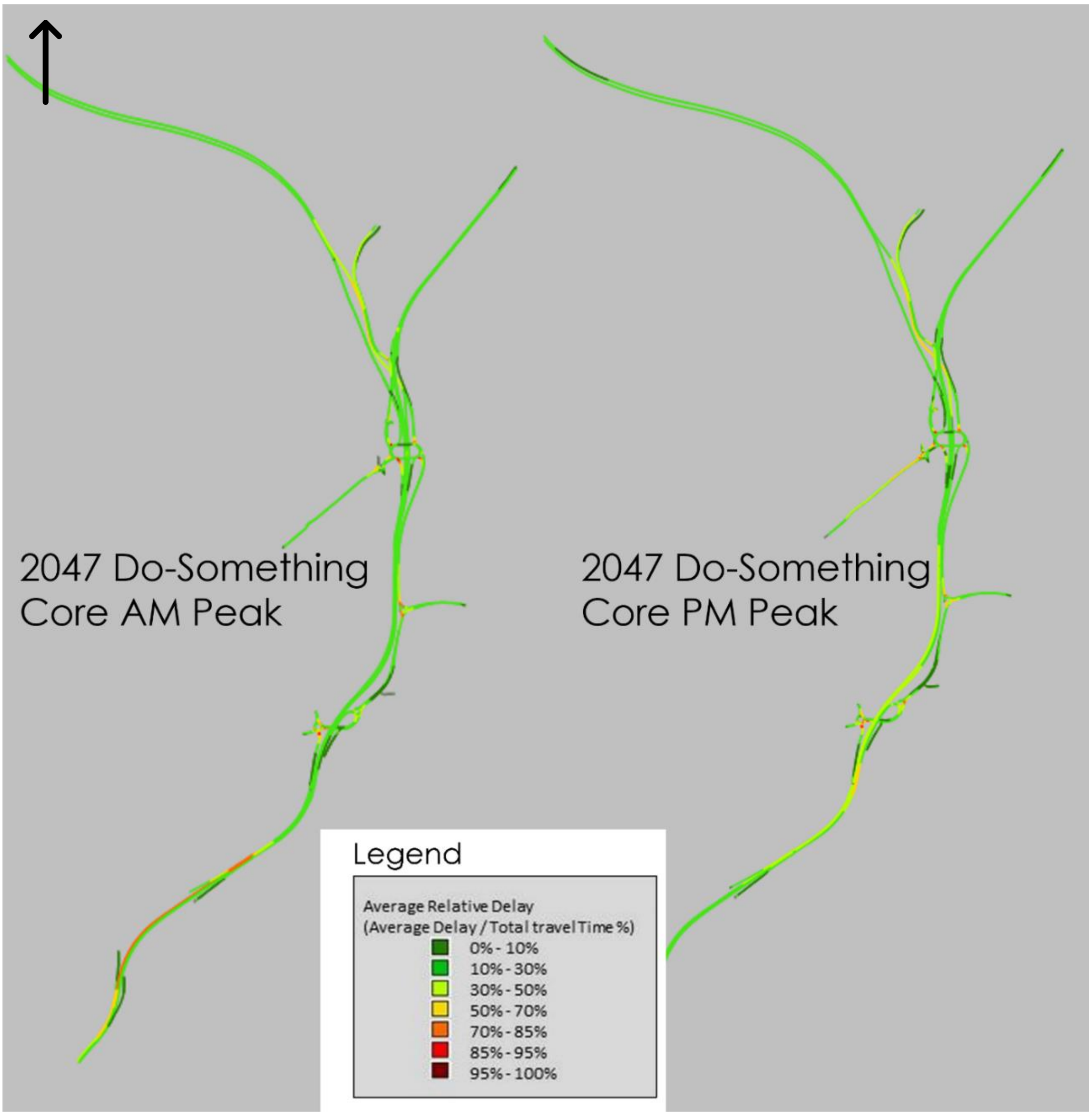


Figure 4-18: 2047 Do-Something Delay Heatmaps



4.5.21 Inspection of the relative delay heatmaps above indicates a reduction in congestion in the Do-Something relative to the Do-Minimum, reflecting the increase in capacity associated with the Scheme.

Operational model queue length results

4.5.22 This section presents the results for queues and delays of the approaches to M3 Junction 9 as well as adjacent junctions (Easton Lane Tesco roundabout and A31/A272 roundabout).

4.5.23 Queue lengths were recorded for each arm of M3 Junction 9.

4.5.24 Modelled junction flows, delays, and queues were extracted from the operational model to provide an indication of network performance at the M3 Junction 9 gyratory and adjacent junctions (Easton Lane Tesco roundabout and A31/A272 roundabout).

4.5.25 Queue lengths are output by VISSIM in metres. Two metrics are provided for queues: the average queue length in metres, which is the average of the queue on each arm based on every model time step and the Max Queue in metres, which is the average of the maximum queue observed in each arm across the 10 model runs in the hourly period. Showing the Max Queue provides an indication of a worst-case scenario of queuing in the Peak hours.

4.5.26 The Do-Something scenario (with Scheme) junction results are presented in **Table 4-13** and **Table 4-15** compared to the Do-Minimum scenario (without scheme).

Table 4-13: 2047 Do-Minimum and Do-Something Junction Results AM

		Do-Minimum - AM				Do-Something - AM			
Junction	Approach	Flow	Delay (s)	Avg Queue (m)	Max Q (m)	Flow	Delay (s)	Avg Queue (m)	Max Q (m)
M3 Junction 9	A272	391	100	30	177	690	27	13	145
	M3 southbound off-slip / A34	263	88	21	81	1,368	11	7	77
	A33 (old A34)	2,699	28	75	593	399	29	9	91
	Easton Lane	603	165	150	184	1,057	11	15	146
	M3 northbound off-slip	2,320	19	30	196	703	21	14	89

Table 4-14: 2047 Do-Minimum and Do-Something Junction Results PM

		Do-Minimum - PM				Do-Something - PM			
Junction	Approach	Flow	Delay (s)	Avg Queue (m)	Max Q (m)	Flow	Delay (s)	Avg Queue (m)	Max Q (m)
M3 Junction 9	A272	405	138	76	402	611	24	8	87
	M3 southbound off-slip / A34	356	170	87	192	1,097	16	10	76
	A33 (old A34)	2,697	37	870	2,099	358	27	7	75
	Easton Lane	1,230	91	107	181	1,471	17	25	126
	M3 northbound off-slip	1,972	54	695	2,594	451	7	3	32

4.5.27 From the results above, the Scheme is predicted to reduce queuing and delay at Junction 9. Most significantly at the A33 (old A34 approach), where average queuing in the Do-Minimum 2047 forecast is over 0.8 kilometres in the PM peak period, which is removed following the introduction of the Scheme.

4.6 Sensitivity testing

4.6.1 Three further sensitivity tests, referred to as the Low, High, and Optimistic growth scenarios were prepared to consider uncertainties in travel demand forecasts.

High / Low growth scenarios

4.6.2 In accordance with TAG Unit M4 section 4.2, the high growth scenario should consist of forecasts that are based on a proportion of base year demand added to the demand from the core scenario, whilst the low growth scenario should be based on the same ranges below the core scenario.

4.6.3 **Table 4-15** outlines the proportion of the base year demand added/subtracted from the core scenario forecast year using parameters defined with Tag Unit M4 to generate the High and Low forecast scenarios.

Table 4-15: High/Low Growth Scenario Proportion of Base Demand

Forecast Years	Highway	Bus	Train
2027	8.7%	5.2%	6.9%
2042	13.0%	7.8%	10.4%
2047	14.1%	8.5%	11.3%

4.6.4 When comparing the low growth scenario results against the core scenario, as would be expected there are general decreases in delay and total travel times and increases in average speed predicted as a result of the lower forecast in travel demand.

4.6.5 When comparing the high growth scenario results against the core scenario results, as would be expected there are general increases in delay and total travel times and reductions in average speed predicted as a result of the lower forecast in travel demand.

4.6.6 The flow variation between the Do-Minimum and the Do-Something is greater in the high growth scenario, in particular on the A34, Easton Lane and the M3 South of Junction 9.

Optimistic scenario

4.6.7 An optimistic scenario sensitivity test was developed which takes into consideration developments and schemes classified as ‘Reasonably Foreseeable’ in the uncertainty log for the year 2047 only. Developments classified as ‘Reasonably Foreseeable’ are listed in the Uncertainty Log. Highway schemes included in the optimistic scenario are listed in **Table 4-5**.

4.6.8 The optimistic scenario was prepared and run to provide operational performance results for the 2047 forecast year only. A core purpose of this model run was to stress test the performance of the Scheme against the high-level objectives relating to journey time savings.

4.6.9 In order to provide further detail of congestion and journey time impacts resulting from the optimistic forecasts, the strategic model flows of the optimistic scenario were extracted and input into the operational model.

4.6.10 **Table 4-16** and **Table 4-17** present journey time outputs of the operational assessment model for the Do-Something optimistic scenario against the Do-Something core scenario for the AM and PM Peak respectively.

Table 4-16: 2047 AM Optimistic Scenario Journey Time Comparison

Route	Description	Core	Optimistic	Diff
R1	M3S to M3N	09:09	09:17	00:08
R2	M3N to M3S	06:02	06:02	00:00
R3	M3S to A34	10:45	10:46	00:00
R4	A34 to M3S	07:44	07:08	-00:36
R5	A33 to Easton Lane	04:35	04:33	-00:02
R6	Easton Lane to A33	03:07	03:04	-00:03
R7	A31 to M3S	03:53	03:51	-00:02
R8	M3S to A31	07:35	07:38	00:02
R9	A31 to Easton Lane	03:05	03:05	-00:00
R10	Easton Lane to A31	03:19	03:14	-00:06

Table 4-17: 2047 PM Optimistic Scenario Journey Time Comparison

Route	Description	Core	Optimistic	Diff
R1	M3S to M3N	06:16	06:35	00:19
R2	M3N to M3S	06:38	06:34	-00:04
R3	M3S to A34	08:26	08:48	00:22
R4	A34 to M3S	08:20	08:39	00:19
R5	A33 to Easton Lane	04:22	04:26	00:04
R6	Easton Lane to A33	03:21	03:24	00:04
R7	A31 to M3S	04:12	04:09	-00:03
R8	M3S to A31	04:35	04:48	00:13
R9	A31 to Easton Lane	02:54	02:56	00:02
R10	Easton Lane to A31	03:38	03:39	00:01

4.6.11 Comparing the Do-Something core scenario against the Do-Something optimistic scenario indicates minor increases in delay as a result of the optimistic scenario's higher level of travel demand. However, there are no significant increases in journey times.

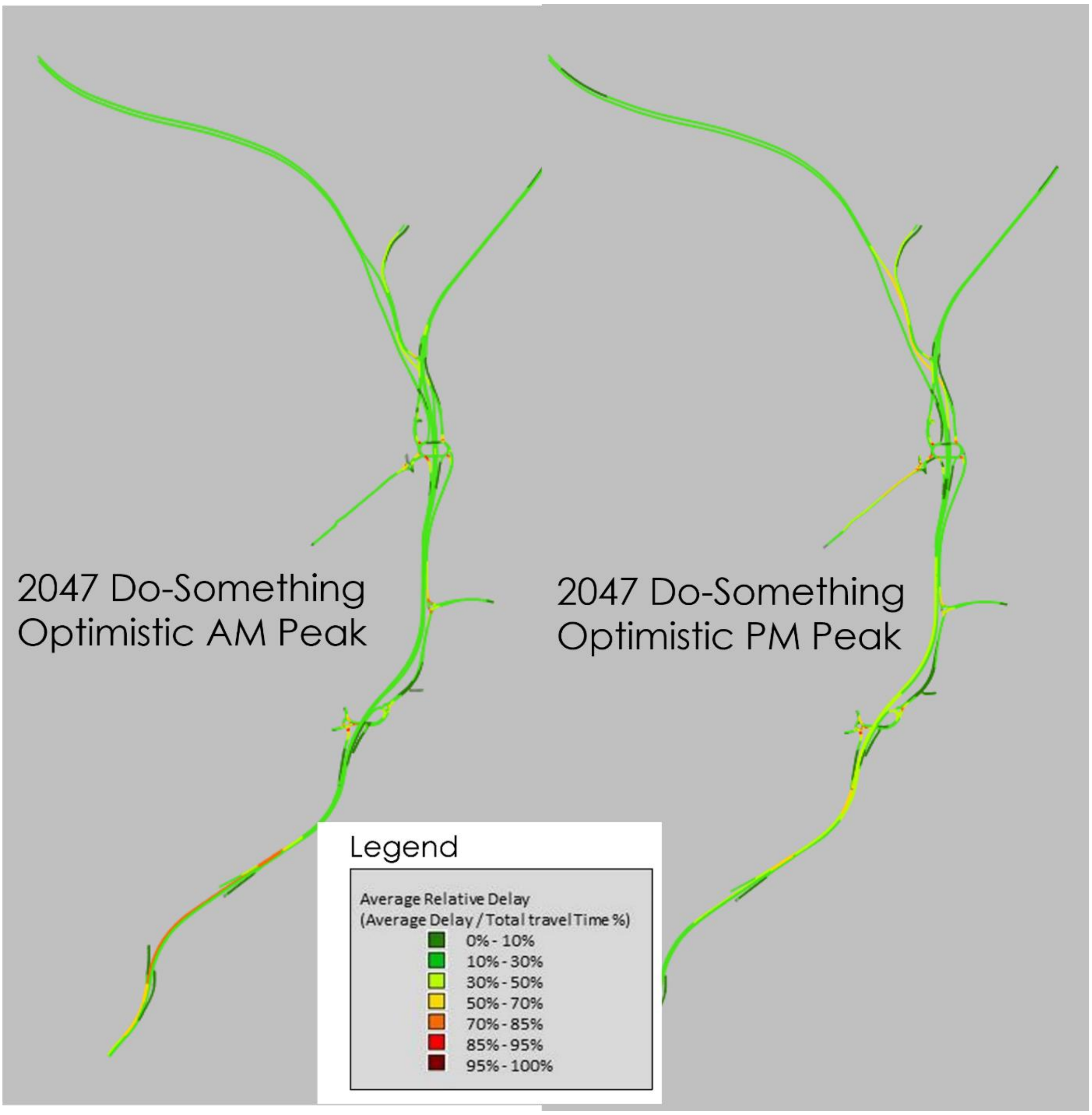
4.6.12 Although route R4 in the PM peak exhibits increases in journey time in comparison to the core scenario, the increase in journey time falls below the journey time of the Do-Minimum scenario. Therefore, the optimistic scenario forecasts are predicted to operate efficiently and meet the Scheme objectives of reducing congestion.

4.6.13 **Figure 4-19** illustrates the relative delay heatmaps that visualise the delay as the percentage of the free flow journey time for the optimistic scenario.

4.6.14 From the heatmaps (**Figure 4-19**), it can be discerned from the AM Peak model that the increased travel demand of the optimistic scenario in comparison to the core scenario generally causes greater delay on the M3 northbound off-slip at junction 9. However, the queueing/congestion does not block back to the mainline and therefore this is not seen to be significantly detrimental to the performance of the Scheme and against the high-level objectives of reducing delay in comparison to the Do-Minimum scenario. All other elements of the Scheme perform adequately with the increased traffic demand.

4.6.15 The PM Peak optimistic scenario heatmap outputs illustrate no significant detrimental increases in congestion predicted, when compared against the core scenario. The A34 southbound does illustrate increased congestion to a minor degree, however this is not seen to be significantly detrimental to the performance of the Scheme.

Figure 4-19: 2047 Optimistic Scenario Heatmaps



4.7 Construction traffic management

4.7.1 Traffic modelling was undertaken to assess Construction Traffic Management (CTM) impacts and provide data for the economic appraisal and environmental noise/air quality impact assessment of the Scheme. This Section provides an overview of the CTM assessment, which is included in **Appendix E**.

4.7.2 CTM impacts were assessed following a hierarchical approach, where operational (micro-simulation) traffic modelling was first used to consider impacts, followed by strategic traffic modelling if necessary, and then variable demand modelling if applicable. This is described further below.

4.7.3 Impact analysis of the Construction Traffic Management (CTM) operations were assessed using the operational model (described in **Section 3.7**). The 2027 Do-Minimum forecast scenario was used for the Do-Minimum and all assessed CTM phases.

Construction traffic management phases

4.7.4 The CTM phasing details for the Scheme are reported in the **Outline Traffic Management Plan (Document Reference 7.8)** and these are summarised in **Table 4-18**.

Table 4-18: Construction Traffic Management Phases

Phase	Summary Specification
1a	Lane narrowing and speed restrictions on the M3 mainline with limited traffic impacts and not included in assessment.
1b	Revised M3 southbound off-ramp. Gyratory and A34 approach reduced to 2 lanes. 3 lanes retained on M3 northbound off-slip and Easton Lane approaches. Signal- control in operation on all gyratory approaches including the A272, which is not signal-controlled in current arrangement. Modification to southbound M3 on-ramp, with slight impact on general traffic arrangement.
2	M3 northbound and southbound mainline displaced with contraflow operation with 40mph or 50mph operation. Gyratory and A34 and M3 northbound off-slip approaches reduced to 2 lanes. 3 lanes retained on Easton Lane approach. Signal-control in operation on all gyratory approaches. M3 northbound on-ramp from gyratory closed with diversion, which was not modelled as this extends outside the M3 Junction 9 operational model noting the associated traffic flow is relatively slight.
3a	Revised gyratory setup to cross over new bridges. Gyratory and all approaches with 2 lanes. Signal-control in operation on all approaches including A272. New access for A33/A34 to M3 northbound and temporary diverted southbound route to Junction 9 gyratory including reduced speed limit. M3 northbound on-ramp from gyratory closed.

Phase	Summary Specification
3b	Revised gyratory setup to cross over new bridges. Gyratory and all approaches with 2 lanes except A33 which has 1 lane. Signal-control in operation on all approaches except the A272. New access for A33/A34 to M3 northbound. Revised lane allocation on A272 gyratory approach. New northbound link from M3 to A33/A34. New southbound link from A33/A34 to M3 and gyratory. A variation of Option 3b was also tested with signal-control removed from the gyratory replaced by give-ways on all approaches. This test was undertaken following analysis of the Phase 3b impacts which indicated that it may be possible to remove the signal-control and maintain good operational performance. The scenario without gyratory signal-control was used in the economic analysis where this was considered to be the arrangement most likely to be taken forward.

4.7.5 Adjustments were made to the signal-control timings to optimise network performance in each CTM phase. TRANSYT models were prepared for each CTM phase which were used to determine signal stage times and junction offset times for optimum network performance which were applied in the operational model.

CTM assessment

4.7.6 **Appendix E** includes a summary of the operational impact of each CTM phase based on model indicators including journey times, gyratory network statistics, and relative delay heatmaps. The assessment revealed the following key CTM impacts.

- Overall journey times and network congestion were forecast to increase, relative to the Do-Minimum, due to the reduction in capacity, particularly on the M3 Junction 9 gyratory approaches;
- The M3 mainline 40mph and 50mph contraflow speeds in Phase 2 demonstrated relatively limited difference on overall network performance where the operation of the gyratory was the constraining factor on overall network;
- In Phase 3b, northbound traffic blocked back from the M3 diverge to the northbound off-slip where four lanes of northbound traffic are reduced to two lanes under the southern gyratory bridge, which creates queues and slow-moving traffic. This indicated that the northbound route going through the underpass is slower than the Phase 3a equivalent route using the gyratory; and
- The removal of the gyratory signal-control in Phase 3b had a generally positive impact on journey times, particularly to/from Easton Lane. However, congestion was still evident on the M3 northbound.

4.7.7 Specific phases of the CTM suggested the possibility of re-routing impacts beyond the scope of the operational model, in particular the closure of the M3 Junction 9 northbound on-slip. To assess potential wider impacts of not allowing access onto the M3 north on-slip from Junction 9, a strategic traffic model test run of the Phase 3a layout was undertaken based on the 2027 Do-Minimum scenario. The strategic model was run using fixed traffic demand and did not include variable demand model responses such as destination choice or mode choice, however, these would be expected to be slight given the temporary nature of the CTM.

4.7.8 The outputs of the Phase 3a strategic model test was compared against the Do-Minimum scenario to highlight the Annual Average Daily Traffic (AADT) variance.

4.7.9 Based on the 1,000 AADT environmental assessment scoping criteria, it was considered that the forecast impacts of the CTM arrangements on wider re-routing were slight, with the M3 northbound off-slip closure being the most significant cause of localised re-routing. Therefore, applying a proportionate approach, it was deemed that no further CTM phasing impacts required to be assessed in the strategic model.

5 Economic appraisal

5.1 Introduction

5.1.1 The economic appraisal presented in this report was informed by analysis of the M3 Junction 9 Model version that was prepared for the Stage 3b M3 Junction 9 Improvement Scheme as defined in December 2020, and to inform the 2021 Statutory Public Consultation.

5.1.2 The economic appraisal of the Scheme is an assessment of the benefits to users and the wider population. This is compared against the Scheme capital costs and maintenances and operational costs. The monetised impacts cover the following: accidents; transport user impacts; environmental impacts e.g. local air quality, greenhouse gases, noise. Other impacts have been qualitatively assessed e.g. journey time reliability and physical activity.

5.1.3 The Stage 3a interim economic appraisal (produced prior to statutory consultation in 2019) considered only a selection of benefit calculations due to constraints on time and the extent of the technical work undertaken by other disciplines, which are required to provide inputs into the economic appraisal process. Examples of these other discipline requirements include: the monetisation of the environmental inputs, which require detailed and time-consuming modelling of noise and air quality, or the monetisation of traffic delays during construction, which require detailed modelling of the Traffic Management Plan.

5.2 Economic appraisal process

5.2.1 The Stage 3b Economic Appraisal was carried out using standard procedures and economic parameters as defined by Department for Transport (DfT) Transport Analysis Guidance (TAG) Unit A1. The full list of impacts covered in the final PCF Stage 3 (Preliminary Design) product is presented in **Table 5-1**.

Table 5-1: Impacts Considered in Stage 3b Economic Appraisal

Impacts	Methodology	Quantified
Scheme costs	Prepared by the Applicant	✓
Operating and Maintenance costs	Prepared by the Applicant	✓
Transport Economic Efficiency (TEE) - Travel Times and Vehicle Operating Costs (VOC)	Use of Transport Users Benefit Analysis (TUBA) software – version 1.9.17 with TAG 1.18 parameters.	✓
TEE - Travel Times and VOC (during construction and maintenance activities)	To be updated when construction plan becomes available. Calculated using transport model and TUBA.	✓
Journey Time Reliability	Qualitative assessment only.	×
Accidents	COBALT v2.3. Update observed accident rates to include latest accident data. Use of latest available economic parameters.	✓
Greenhouse Gases	From environmental assessment and TAG workbooks.	✓
Noise	From environmental assessment and TAG workbooks.	✓
Air Quality	From environmental assessment and TAG workbooks.	✓
Indirect Taxes	Use of TUBA – version 1.9.17 with TAG 1.18 parameters.	✓
Wider Impacts - Connectivity	Use of Wider Impacts in Transport Appraisal (WITA) software (version 2.2).	✓
Wider Impacts - Structural and Context Specific	Qualitative assessment.	×
Social Impacts	Qualitative assessment.	×

✓ = Quantified × = *Not Quantified*

5.3 Economic parameters

5.3.1 Economic appraisal parameters, such as values of time and vehicle operating costs, were taken from the Department for Transport (DfT) Transport Analysis Guidance (TAG) data book version 1.18 (May 2022).

5.3.2 This set of economic appraisal parameters are incorporated in the transport modelling, forecasting, scheme appraisal, and economics.

5.3.3 Following the release of TAG data book version 1.19 (June 2022 forthcoming updates), an assessment of the change in impacts associated with the updated economic parameters was undertaken. The forthcoming updates proposed in version 1.19 include changes to vehicle fleet assumptions and related fuel consumption / efficiency values. A Transport Economic Efficiency sensitivity test was undertaken using this version of the economic parameters, which is presented in **Section 5.9**.

5.4 Scheme costs

5.4.1 Scheme construction costs were prepared by the Applicant. Estimated costs were provided for the economic assessment as follows:

- the 'Most Likely Cost' (including Portfolio Risk) figures were used for the economic assessment;
- expenditure was provided for Preparation, Supervision, Works (construction), and Lands;
- spend to date (prior to 2022) was removed;
- costs were provided on a year-by-year basis deflated to 2010 prices using the TAG Databook GDP deflator series;
- costs accounted for project risk and uncertainty and the effects of construction related price inflation and, therefore, optimism bias was not applicable; and
- all costs were in 'factor cost unit of account' and excluded VAT, both recoverable and non-recoverable.

5.4.2 **Table 5-2** provides the Scheme construction costs by year.

Table 5-2: Scheme Construction Costs by Year (£, undiscounted, 2010 prices)

Year	Preparation	Supervision	Lands	Works	Total
2022	7,277,466	0	0	0	7,277,466
2023	5,989,953	0	0	0	5,989,953
2024	158,016	1,243,781	1,603,272	50,677,849	53,682,918
2025	0	2,732,768	522,920	56,908,648	60,164,337
2026	0	929,714	280,146	15,844,528	17,054,387
2027	0	742,965	382,494	0	1,125,459
2028	0	0	64,662	0	64,662
2029	0	0	32,901	0	32,901
2030	0	0	14,858	0	14,858
2031	0	0	11,509	0	11,509
2032	0	0	7,113	0	7,113
2033	0	0	2,320	0	2,320
2034	0	0	0	0	0
2035	0	0	0	0	0
Total	**13,425,436**	**5,649,228**	**2,922,195**	**123,431,024**	**145,427,884**

5.4.3 The present value of the construction costs was calculated as follows:

- discounting to 2010 values from a current year of 2022 using discount factors from the TAG Databook (3.5% per annum until 30 years after opening, then 3% for the remainder of the 60-year appraisal period); and
- Conversion to market prices (using a factor for the average rate of indirect taxation in the economy of 1.19).

5.4.4 **Table 5-3** provides the present value of the construction costs for each category.

Table 5-3: Present Value of Scheme Construction Costs (£, discounted to 2010 in market prices)

Category	Scheme Cost
Preparation	10,405,034
Supervision	3,986,147
Works	88,552,330
Lands	2,078,521
Total	**105,022,033**

Operating and maintenance costs

5.4.5 Scheme operating and maintenance costs were prepared by the Applicant. Estimated costs were provided for the economic assessment as follows:

- costs were for the incremental impact of the Scheme representing the change relative to the Do-Minimum;
- costs were provided based on an opening year of 2026 and were adjusted to remove this year to reflect an opening year of 2027 with an additional year added to the end of the appraisal year based on preceding years;
- costs represented the plausible range of operating and maintenance costs for the 'Most Likely' capital works estimate;
  - costs included a breakdown of operating and maintenance activities including highways assets, structures, and technology and the total cost was used in the economic assessment;
- maintenance activities and intervention frequencies were based on the Applicant's Asset Delivery Asset Maintenance Requirements;
- the expenditure profile was based on operating and maintenance cost estimates prepared in Q1 2019 prices and then inflated to outturn costs using HE projected construction related inflation;
- costs were provided on a year-by-year basis deflated to 2010 prices using the TAG Databook GDP deflator series;
- costs accounted for project risk and uncertainty and the effects of construction related price inflation and, therefore, optimism bias was not applicable; and
- all costs were in factor cost unit of account and excluded VAT, both recoverable and non-recoverable.

5.4.6 **Table 5-4** provides the Scheme operating and maintenance costs by year.

Table 5-4: Scheme Operating and Maintenance Costs by Year (£, undiscounted, 2010 prices)

Year	Cost	Year	Cost	Year	Cost
2027	273,901	2047	2,746,362	2067	286,879
2028	274,410	2048	2,746,362	2068	286,879
2029	274,584	2049	274,584	2069	2,812,536
2030	-265,253	2050	274,584	2070	2,799,666
2031	-265,253	2051	274,584	2071	274,009
2032	220,705	2052	-265,253	2072	286,879
2033	220,705	2053	-265,253	2073	286,879
2034	274,584	2054	274,584	2074	-252,958
2035	148,468	2055	2,243,073	2075	-379,075
2036	1,207,190	2056	2,243,073	2076	160,762
2037	1,333,307	2057	274,584	2077	232,999
2038	274,584	2058	1,333,307	2078	232,999
2039	274,584	2059	1,333,307	2079	286,879
2040	261,714	2060	274,584	2080	1,345,601
2041	-278,123	2061	274,584	2081	1,345,601
2042	-265,253	2062	220,705	2082	286,879
2043	274,584	2063	-319,132	2083	286,879
2044	274,584	2064	-265,253	2084	286,879
2045	-183,846	2065	-3,145,913	2085	2,479,555
2046	-183,846	2066	2,380,686	2086	286,879
				60-year Total	**30,688,097**

5.4.7 The present value of the operating and maintenance costs was calculated as follows:

- discounting to 2010 values from a current year of 2022 using discount factors from the TAG Databook (3.5% per annum until 30 years after opening, then 3% for the remainder of the 60-year appraisal period); and
- Conversion to market prices (using a factor for the average rate of indirect taxation in the economy of 1.19).

5.4.8 **Table 5-5** presents the present value of the operating and maintenance costs.

Table 5-5: Present Value of Scheme Operating and Maintenance Costs (£, discounted to 2010 in market prices)

Category	Scheme Cost
Operating and Maintenance	7,688,652

Tax revenues, grants and subsidies

5.4.9 The impact of indirect taxation revenue is calculated in TUBA. As per TAG, indirect taxation revenue impacts were assessed as affecting the level of benefits rather than the level of costs. This means that in the Benefit Cost Ratio (BCR) calculation indirect taxation revenue was added to the benefits rather than subtracted from the Scheme costs.

5.4.10 No grants or subsidies are anticipated to be associated with the Scheme and, therefore, these are not included in the economic assessment.

Present value cost (PVC)

5.4.11 **Table 5-6** summarises the Scheme Present Value Cost (PVC) which comprises the construction and operating and maintenance costs presented above.

Table 5-6: Present Value of Scheme Construction Costs (£, discounted to 2010 in market prices)

Category	Scheme Cost
Construction	105,022,033
Operating and Maintenance	7,688,652
Total	112,710,685

5.5 Scheme benefits

5.5.1 This chapter describes the Level 1 user benefit impacts included in economic appraisal for the Stage 3b assessment, which are included in the initial BCR. This also sets out the related model versions and the principle forecasting and economic appraisal assumptions.

5.5.2 As described in Section 4.3, the model forecast years are 2027, 2042 and 2047, which were based on the anticipated opening year of the Scheme (2027).

User benefits

5.5.3 The TUBA inputs for the assessment include a standard TUBA scheme file. The parameters used in the Scheme file are presented in **Table 5-7.**

Table 5-7: TUBA Input Parameters

Parameter	Value
TUBA Version	1.9.17
Economic Parameters	TAG data book version 1.18 (May 2022)
First Year	2027
Horizon Year	2086
Modelled Years	2027, 2042 and 2047
Current Year	2022 (defines the first year in which the discount rate is applied)
Time Slices	5 time slices (AM, IP, PM, Weekend & Bank Holiday)
Opening Year	2027
Unit of account	Factor cost
GDP Deflator Index	100.00 (costs input in 2010 prices)
User Classes	5 user classes (Car Employers Business, Car Commute, Car Other, LGV and HGV)
LGV and HGV Split Factors	LGV (Other 0.12 and Freight 0.88) HGV (OGV1 0.2 and OGV2 0.2; includes a 2.5 PCU factor)
Input Matrices	Time (factor: 0.00028), distance (factor: 0.001), toll skims and trip matrices
Value of Time method	Method 1 – continuous function, based on distance
Annualisation Factors	AM: 759 IP: 1,518 PM: 759 Weekend: 390 Bank Holiday: 6 *These factors were calculated during Stage 3a using local traffic counts and TRIS counts on M3 and A34, based on the standard procedures outlined in the TUBA manual. Weekend and bank holiday period annualisation factors were applied to represent scheme impacts based on the modelled periods and relative traffic flow ratios.*
Do-Something Costs	As presented in **Section 5.4**

5.5.4 In producing the User Benefits for the Scheme, and with the M3 Junction 9 Model being a large-scale strategic model, it was necessary to undertake masking of some sector-to-sector movements to exclude potential model noise and help ensure that the monetised impacts reported are reasonably attributed to the Scheme.

5.5.5 To develop an appropriate method for masking, a system of 43 sectors was prepared. Of these, the first 19 Sectors were within the Hampshire area. **Figure 5-1** and **Figure 5-2** illustrate the sector system.

Figure 5-1: Sectors defined for TUBA Analysis (Hampshire Area)

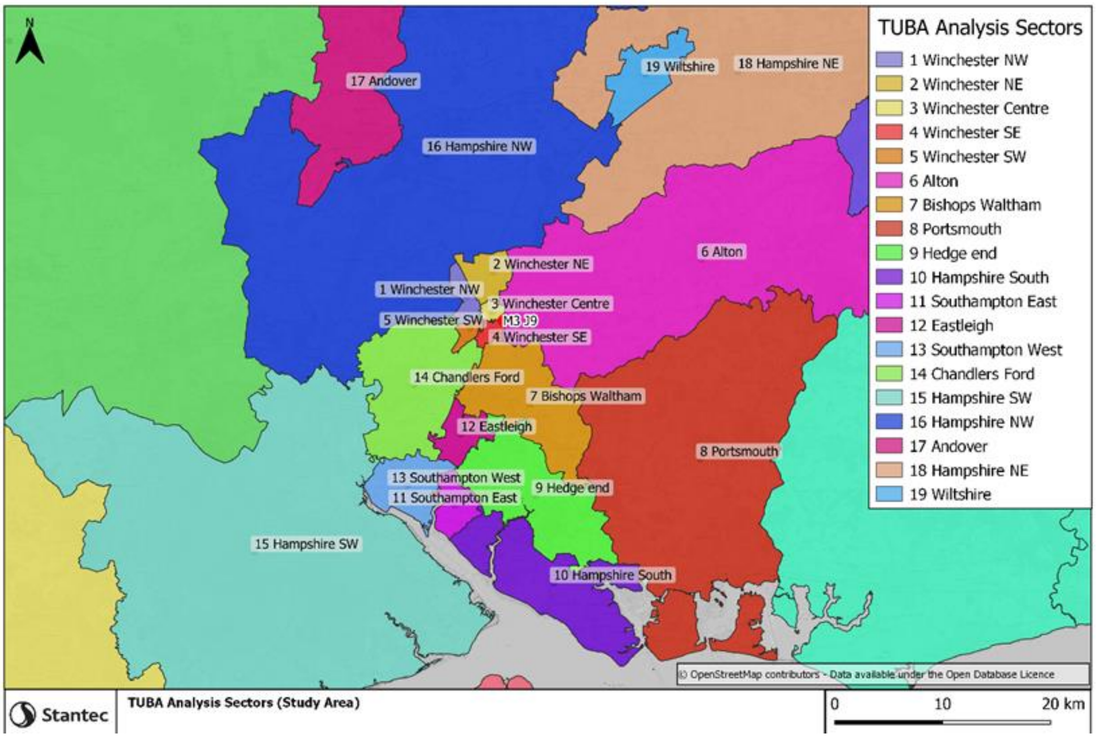
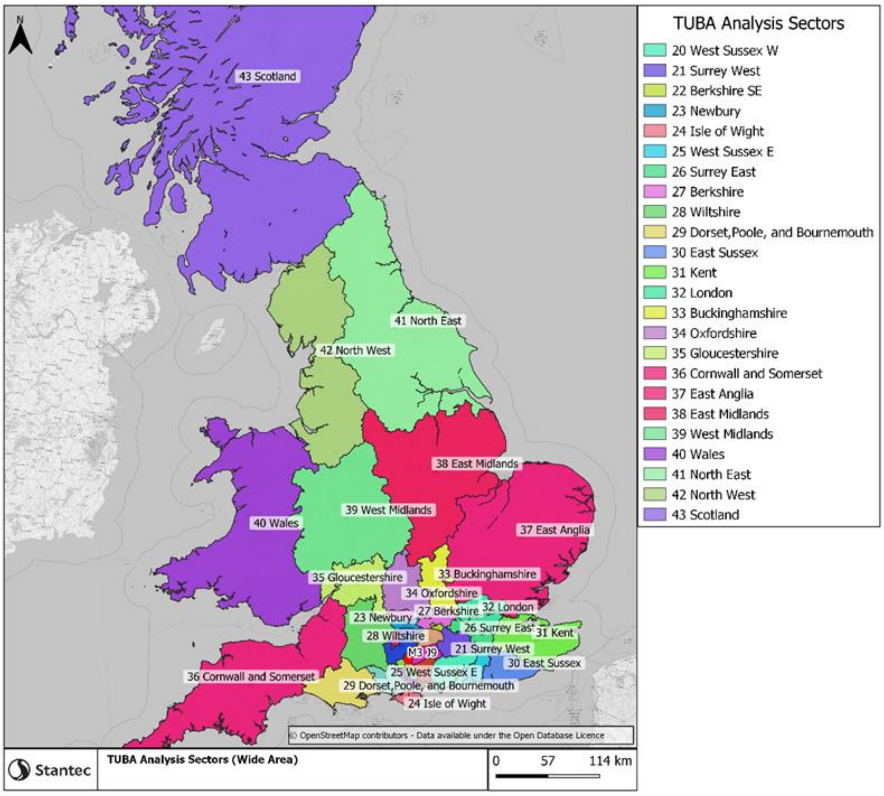
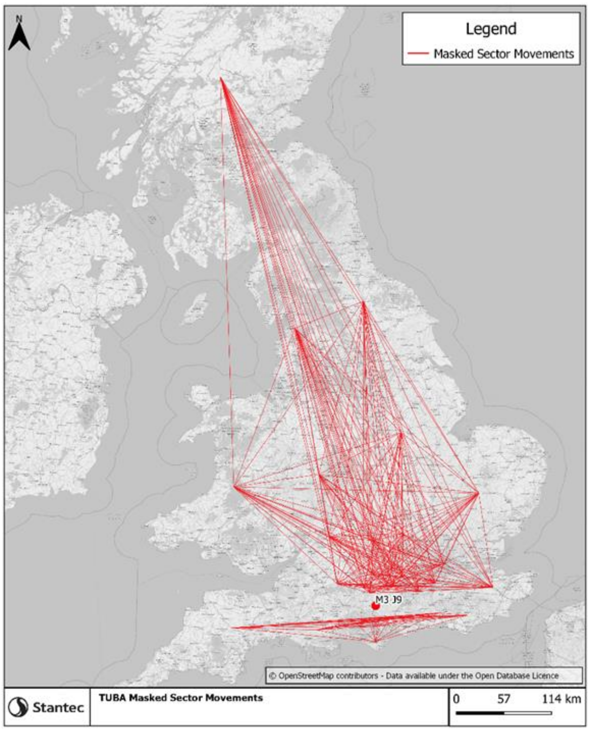


Figure 5-2: Sectors defined for TUBA Analysis (Wider Area)



5.5.6 **Figure 5-3** illustrates the resultant sector to sector movements that were masked out of the User Benefits calculations.

Figure 5-3: Masked Sector to Sector User Benefits



5.5.7 **Table 5-8** presents the total user benefits and indirect taxation revenues predicted for the 60-year appraisal period.

Table 5-8: Total User Benefits (£M, discounted to 2010, in 2010 prices)

Category	60-year Total
Journey Times	155.48
Vehicle Operating Costs (VOCs)	-8.34
National Tolls	-0.06
Indirect Tax	5.66
Total	**152.73**

5.5.8 The results of the transport economic analysis indicated that the Scheme is predicted to generate economic benefits in the order of £152.73M. The greatest benefit relates to travel time savings, amounting to £155.48M, which are predominantly due to the provision of the free-flow movement between the A34 and the M3. An overall VOC disbenefit of £8.34M, is small in comparison to travel time benefits but considered logical as the total travel distance across the transport network was slightly higher with the Scheme than without the Scheme. The benefit analysis indicated a forecast user charge disbenefit of -£0.06M, which reflects a marginal impact on vehicle tolls across the model area. A positive indirect tax benefit is forecast which is reflective of an increase in VOCs and, specifically, fuel tax revenues.

5.5.9 The spatial breakdown of the user benefits is presented in **Table 5-9**. Most benefits are due to movements to / from the Winchester area, and through movements to / from Southampton and Portsmouth where there are forecast in journey time reductions. There are small disbenefits associated with Eastleigh / Chandler's Ford, which may be related to some re-routed or induced traffic leading to congestion but may also be reflective of small changes in travel times arising from model instability.

Table 5-9: Total User Benefits by Sector (discounted to 2010, in 2010 prices)

Origin	Berkshire/Surrey	Eastleigh/Chandler's Ford	North	South East	South West	Southampton/ Portsmouth	Winchester	Total
Berkshire/Surrey		£4.2M		£1.4M	-£1.0M	£9.4M	£10.4M	£24.4M
Eastleigh/Chandler's Ford	£6.3M	£2.2M	£4.0M	-£0.0M	£0.9M	£0.9M	£6.2M	£20.5M
North		£3.0M		£2.5M	-£0.0M	£16.3M	£3.9M	£25.6M
South East	£4.0M	-£0.4M	£5.0M				£0.1M	£8.7M
South West	-£0.5M	£0.1M	-£0.7M				£0.3M	-£0.8M
Southampton/Portsmouth	£10.7M	-£5.7M	£22.6M				£2.0M	£29.6M
Winchester	£9.7M	£8.8M	£3.6M	£0.2M	£1.3M	£10.8M	£10.4M	£44.7M
Total	£30.2M	£12.2M	£34.5M	£4.1M	£1.2M	£37.3M	£33.3M	£152.7M

Impact of masking

5.5.10 **Table 5-10** presents the masked total user benefits for the relevant sector movements, which indicates that impact of masking was relatively small, with the removal of £0.5M (~0.3%) of benefits where these would not be expected and most likely arising from model instability.

Table 5-10: Masked User Benefits by Sector (discounted to 2010, in 2010 prices)

Origin	Berkshire/Surrey	Eastleigh/Chandler's Ford	North	South East	South West	Southampton/ Portsmouth	Winchester	Total
Berkshire/Surrey	-£1.4M		-£2.2M					-£3.7M
Eastleigh/Chandler's Ford								
North	£2.4M		£2.6M					£5.0M
South East				-£1.4M	£0.9M	-£1.0M		-£1.5M
South West				£0.1M	£0.0M	£0.2M		£0.3M
Southampton/Portsmouth				-£1.4M	£3.3M	-£1.5M		£0.4M
Winchester								
Total	£0.9M		£0.4M	-£2.7M	£4.2M	-£2.3M		£0.5M

5.5.11 The benefit profile over the lifetime of the Scheme can illustrate if the benefits are likely to occur earlier rather than later. The profile presented in **Figure 5-4** shows that the undiscounted benefits increase over time. However, this is largely driven by forecast changes in values of time and scheme benefits are broadly similar in each modelled year. With the application of discounting, scheme benefits are predicted to decrease slightly between the 2027 opening year and 2042 (accounting for 30% of the total benefits), and slightly increase until 2047, before decreasing again where the increase in benefits per annum is less than the discount factors.

Figure 5-4: 60-year Benefit Profile (£M, discounted to 2010, in 2010 prices)

Construction traffic management impacts

5.5.12 **Section 4.7** describes the methodology used to assess the Scheme construction traffic management impacts.

5.5.13 TUBA software was applied to quantify user impacts during construction of the Scheme based on the operational model outputs. Version 1.9.17 of TUBA software, with TAG 1.18 parameters, was applied as per the Scheme economic appraisal.

5.5.14 The TUBA inputs for the assessment included a standard TUBA scheme file. The parameters used within the Scheme file are presented in **Table 5-11**.

Table 5-11: CTM TUBA Input Parameters

Parameter	Value
TUBA Version	1.9.17
Economic Parameters	TAG data book version 1.18 (May 2022)
Modelled Year	2027
Current Year	2022 (defines the first year in which the discount rate is applied)
Time Slices	2 time slices (AM, PM)
User Classes	5 user classes (Car Employers Business, Car Commute, Car Other, LGV and HGV)
Car Purpose Splits	Default TUBA values taken from TAG
LGV and HGV Split Factors	LGV (Other 0.12 and Freight 0.88) HGV (OGV1 0.5 and OGV2 0.5)
Input Matrices	Time, distance, and trip matrices
Value of Time method	Method 1 – continuous function, based on distance

5.5.15 The construction traffic management phase durations are listed in **Table 5-12**. Within the TUBA appraisal process, the CTM phase duration was factored using a 12-month annualisation factor of 759 for the AM and PM modelled peak hour periods based on 253 weekdays per annum. This, therefore, excluded impacts during other weekday periods and at weekends that were not modelled as these are not included in the operational model.

Table 5-12: CTM Phase Durations

Phase	Duration (Months)	Annualisation Factor (weekdays)
1b	4	253
2	12	759
3a	3	190
3b	4	253
Total	**23**	**1,455**

5.5.16 The 50mph contraflow option was selected for economic analysis for Phase 2 noting that the model network performance was broadly similar to the 40mph contraflow option. For Phase 3b, the scenario without gyratory signal-control was used in the economic analysis where this was considered to be the arrangement most likely to be taken forward.

5.5.17 The present value of CTM benefits is displayed in **Table 5-13**.

Table 5-13: Construction Traffic Management Impacts (£M, discounted to 2010, in 2010 prices)

Phase	Present Value of Benefits
Phase 1b	-£0.21
Phase 2 (50 mph contraflow)	-£0.75
Phase 3a	-£1.02
Phase 3b (without signal-control)	-£0.70
Total	**-£2.69**

** includes Indirect Taxation Revenue impacts, excludes Greenhouse Gases*

5.5.18 Examination of the CTM economic impacts reflect the traffic network operation assessment where the temporary traffic management arrangements increased journey times and congestion in the model area.

Maintenance impacts

5.5.19 Scheme maintenance impacts on user travel times were assumed to be marginal relative to existing infrastructure maintenance requirements over the 60-year appraisal period and, therefore, were not quantified.

Accidents

5.5.20 The impact of the Scheme on accidents over a 60-year period was assessed using DfT COBALT[7] software.

5.5.21 **Table 5-14** presents the input parameters used for the Stage 3b COBALT assessment.

[7] COBALT (Cost and Benefit to Accidents – Light Touch) https://www.gov.uk/government/publications/tag-unit-a4-1-social-impact-appraisal

Table 5-14: Stage 3b COBALT Input Parameters

Parameter	Value
Assessment Mode	Separate Links; Separate Junctions; Combined Links and Junctions
Version	COBALT v2.3
Parameters	TAG data book version 1.18 (May 2022)
Base Year	2015
Years 1, 2 and 3	2027, 2042 and 2047
First Year	2027
Horizon Year	2086
Current Year	2022 (defines the first year in which the discount rate is applied)
Observed Accident Data	2015 to 2019

5.5.22 Observed accident data for a 5-year period (2015-2019) was obtained by analysing the STATS19[8] (Road Safety Data) accident data published from the DfT.

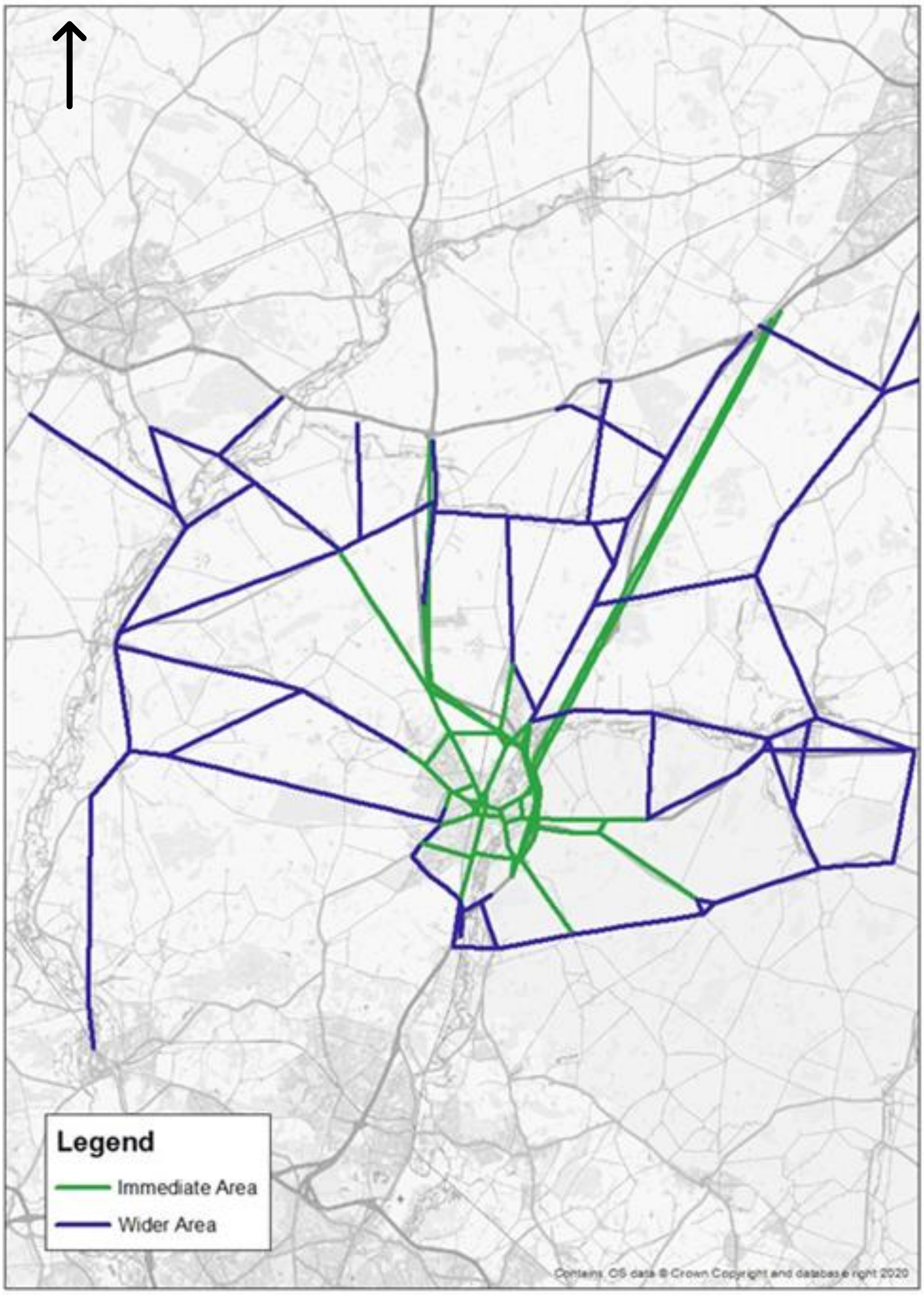
5.5.23 For links and/or junctions with no observed accident data, default accident rates were applied with the assumption that over a longer period some accidents will occur rather than absolute zero.

5.5.24 **Figure 5-5** illustrates the highway network coverage included in the accident assessment, which was defined as follows:

- immediate area of influence (illustrated in Green), which was assessed in terms of separate link and junction impacts; and
- wider impacts area (illustrated in Blue), which was assessed with combined link and junction impacts. This area was determined based on links with a 10% change in traffic flow between the Do-Minimum and Do-Something scenarios.

[8] https://data.gov.uk/dataset/cb7ae6f0-4be6-4935-9277-47e5ce24a11f/road-safety-data

Figure 5-5: Stage 3b COBALT Assessment Area



Note: This has been assessed using the SATURN Highway Network which is not georeferenced to the actual road network in this figure.

5.5.25 AADT flow, speed, and link length data were extracted from the M3 Junction 9 Model.

5.5.26 Modelled one-way links (e.g., motorways) were retained in the COBALT assessment with derivation and application of AADT and accident rates.

5.5.27 The accident assessment, as presented in **Table 5-15** and **Table 5-16**, indicates an overall reduction in accidents with a corresponding benefit of £22.9M over the appraisal period. This included a reduction in 696 slight casualties, 59 serious, and 9 fatal casualties over the 60-year appraisal period. This reduction in accidents is due to the improved infrastructure implemented as part of the scheme, replacing existing elements of road network with safety issues.

Table 5-15: Forecast Accidents (60-year Appraisal Period)

Area of Influence	Number of Accidents		Casualties - Fatal		Casualties - Serious		Casualties - Slight	
	DM	WS	DM	WS	DM	WS	DM	WS
Immediate area of influence - links only	5,248	4,831	77	67	790	736	6,197	5,597
Immediate area of influence - junctions only	2,611	2,686	32	35	327	354	3,820	3,942
Wider area of influence	2,819	2,624	46	44	479	447	3,218	3,000
Total	**10,678**	**10,141**	**155**	**146**	**1,596**	**1,537**	**13,235**	**12,539**

DM = Do-Minimum, WS = With Scheme

Table 5-16: Accident Impacts (60-year Appraisal Period)

Area of Influence	Reduction in number of Accidents	Casualties Reduction - Fatal	Casualties Reduction - Serious	Casualties Reduction -Slight	Present Value of Benefits*
Immediate area of influence - links only	417	10	54	600	20,905
Immediate area of influence - junctions only	-75	-3	-27	-122	-6,732
Wider area of influence	195	2	32	218	8,745
Total	**537**	**9**	**59**	**696**	**22,918**

* present value in £M, discounted to 2010, in 2010 prices

Noise assessment

5.5.28 The Noise monetary environmental impacts appraisal was undertaken in accordance with TAG Unit A3.

5.5.29 The outputs of this assessment were provided by the environmental team for use in the economic appraisal and further details are provided in the **Environmental Statement (Document Reference 6.1)**.

5.5.30 Noise impacts were determined using outputs from the Stage 3b 2027 and 2042 Post VDM scenarios for network links with changes in traffic flow greater than 1,000 Annual Average Weekday Traffic (AAWT) between the 'without scheme' and 'with scheme' scenarios. Data from the model used in the calculations included traffic flow, speed, and percentage of heavy vehicles.

5.5.31 Noise benefits over the 60-year appraisal period were monetised using the standard TAG Noise Workbook (aligned with TAG data book version 1.18, May 2022).

Local air quality

5.5.32 The Local Air Quality monetary environmental impacts appraisal was undertaken in accordance with TAG Unit A3 using the Applicant's version of the Emissions Factors Toolkit (EFT)[9], which was based on emissions factors from the EFT V11.0 (Defra, 2021).

5.5.33 The outputs of this assessment were provided by the environmental team for use in the economic appraisal and further details are provided in the **Environmental Statement (Document Reference 6.1)**.

5.5.34 Local Air Quality impacts were determined using outputs from the Stage 3b 2027 and 2047 Post VDM scenarios for network links with changes in traffic flow greater than 1,000 AADT between the 'without scheme' and 'with scheme' scenarios. Data from the model used in the calculations included traffic flow, speed, and percentage of heavy vehicles.

5.5.35 In line with TA Unit A3[10], the Damage Costs Approach and Impact-Pathways Approach (I-PA) was used to estimate air impacts. The I-PA was applied to reflect the geographic distribution of impacts, for example reduced pollution in Winchester and increased pollution along more sparsely populated trunk roads. Local air quality benefits over the 60-year appraisal period were monetised using the standard TAG Air Quality Workbook (aligned with TAG data book version 1.18, May 2022).

5.5.36 The I-PA was also applied to assess air quality impacts for the Environmental Statement and to inform the Distribution Impact Appraisal, which is summarised below.

[9] IAN185-13 Speed Band Emissions Factors v3.1 Worksheet

[10] TA Unit A3 Section 3.2 and Figure 2 (Determining the appropriate appraisal approach for air quality impacts)

Greenhouse gases

5.5.37 The Greenhouse Gases monetary environmental impacts appraisal was undertaken in accordance with TAG Unit A3.

5.5.38 The Applicant's Carbon Tool V2.4 was used to assess the Greenhouse Gases emissions associated with the extraction, manufacturing, and transportation within the supply chain of permanent construction materials, plant equipment, temporary welfare facilities and construction waste. This indicated that approximately 37 thousand tonnes of Greenhouse Gases emissions are estimated to be produced with the construction of the Scheme.

5.5.39 The Applicant's version of the EFT, based on emissions factors from the EFT V11.0 (Defra, 2021), was used to assess the operational impact of the Scheme on Greenhouse Gas emissions. This version of the EFT included revised vehicle fleet projections beyond 2030.

5.5.40 The outputs of this assessment were provided by the environmental team for use in the economic appraisal and further details are provided in the **Environmental Statement (Document Reference 6.1)**.

5.5.41 Outputs of vehicle speed and flow were derived from the Stage 3b 2027 and 2047 Post VDM scenarios. The full M3 Junction 9 simulated highway network was used in the Greenhouse Gases calculations for the economic appraisal. It is noted that EFT V11.0 does not include fleet projections for London roads beyond 2030. However, this did not affect the Scheme assessment as the strategic model simulated network does not extend to the London area.

5.5.42 Emissions were calculated using the 'without scheme' and 'with scheme' scenarios to quantify the difference and impact of the Scheme. This indicated an increase in emissions in each model forecast year with an additional 271 thousand tonnes (+0.12%) over the 60-year appraisal period for the simulated network extent.

5.5.43 Greenhouse gas benefits over the 60-year appraisal period were monetised using the standard TAG Greenhouse Gases Workbook with interpolation of greenhouse gas values between model years.

Noise, air quality and greenhouse gas monetised impacts

5.5.44 Environmental benefits provided by the Scheme relating to Noise, Local Air Quality, and Greenhouse Gases are displayed in **Table 5-17**.

Table 5-17: Environmental Impacts – (£M, discounted to 2010, in 2010 prices)

Category	Present Value of Benefits
Noise	-1.34
Local Air Quality	+4.74
Greenhouse Gases	-24.11

5.5.45 The Local Air Quality impacts are positive, and the Scheme provides benefits of +£4.74M, principally due to the reduction of traffic in central Winchester which is densely populated. However, Greenhouse Gases and Noise impacts are negative, and the Scheme provides disbenefits of -£24.11M and -£1.34M respectively where the overall increase in traffic flows results in greater carbon and noise impacts.

5.5.46 Greenhouses Gases impacts included a £4.6M disbenefit relating to the construction of the Scheme, and a £19.5M disbenefit relating to the operational impact of the Scheme on vehicle emissions.

Social and distributional impacts

5.5.47 The social impacts of the Scheme cover the human experience of the transport system and its impact on social factors that are not considered as part of economic or environmental impacts. They were assessed qualitatively in line with TAG Unit A4.1 – Social Impact Appraisal (May 2022).

Social impacts

5.5.0 The following paragraphs describe the type of social impacts and the impact of the Scheme on them:

- **Accidents** - new transport schemes may result in a change in the risk of personal injury collisions, for both users and non-users of transport. The Scheme is anticipated to alter traffic movements and the volume of traffic on the M3 Junction 9 and some surrounding roads. Overall, the study area will experience a decrease in the total number of collisions and casualties. The greatest benefits are experienced as a consequence of the reduced traffic demand through the junction gyratory. The overall impact is **moderate beneficial**.

- **Security** - transport interventions can impact upon the personal security of transport users or other people. The principal security impacts on road users relate to situations where they are required to leave their vehicle or where they are forced to stop or travel at low speeds. In terms of the Scheme, it is not expected to have an impact on security as the impacts on security of the junction are expected to be minimal. The overall impact is **neutral**.

- **Journey quality** - a measure of the real and perceived physical and social environment experience while travelling. A poor journey quality may dissuade users from using particular modes of transport. Interventions that improve journey quality may lead to a choice of an alternative mode. In terms of the Scheme it will reduce journey times and therefore frustration for drivers. In addition, the Scheme will provide safer travel and reduce fear of accidents for pedestrians and cyclists. The overall impact is **moderate beneficial.**

- **Physical activity** - There is longstanding recognition of the interrelation between transport, the environment and health. Changes to transport infrastructure can affect levels of physical activity. In terms of the Scheme, the transport model does not include active modes, therefore the impacts on physical activity have not been quantitatively assessed. However, it should be noted that the Scheme does include improving cycle connectivity, especially for the National Cycle Network route 23. This would result in benefits associated with the fitness impact of increased physical activity considered as **moderate beneficial.**

- **Option and non-use values** are assessed when a scheme includes measures that will substantially change the availability of transport services within the study area. In terms of the Scheme, the proposals do not include any improvements directly related to public transport, meaning option values remain unaffected and this is not assessed.

- **Accessibility** reflects the range of opportunities and choices people have in connecting with jobs, services and family and friends. The level of access will depend on where people choose to live, where services are located and the availability of 'home delivery' of goods or services. The Scheme does not inherently provide any change in network connectivity or public transport facilities. The overall impact is **neutral.**

- **Severance -** community severance is defined as the separation of residents from facilities and services they use within their community caused by substantial changes in transport infrastructure or by changes in traffic flows. The Scheme is not expected to have an impact on severance. The overall impact is **neutral**

- **Personal affordability** – the monetary costs of travel can be a major barrier to mobility for certain groups of people. Affordability is likely to decrease as the Scheme increases speed and creates induced demand along the M3, thus leading to an increase in vehicle operating costs along the route. The overall impact is **slight adverse.**

Distributional impact summary

5.5.1 The Distributional Impacts of the Scheme consider how the impacts of a Scheme vary across different social groups and have been assessed, in accordance with TAG unit A4.2 Distributional Impact Appraisal (May 2020), either quantitatively or qualitatively, for the following:

- **Noise** – impacts are likely to occur where a Scheme results in changes to traffic flows or speeds or where the physical gap between people and traffic is altered. The Scheme includes changes to the network road alignment, traffic flows, and speeds. There are no receptors in Income Quintile 1 (most deprived) or Income Quintile 4. For Income Quintiles 2 and 3 the Scheme has large adverse impacts on noise levels but for 5, the impacts are moderate beneficial.

- **Air quality** – impacts are likely to occur where a Scheme results in changes to traffic flows or speeds or where the physical gap between people and traffic is altered. The Scheme includes changes to the network road alignment, traffic flows, and speeds. There are no receptors in Income Quintile 1 (most deprived). For all other Income Quintiles the scheme has beneficial air quality impacts ranging from a slight beneficial impact for Income Quintile 5, a moderate beneficial impact for Income Quintile 3, and large beneficial impacts for Income Quintiles 2 and 4.

- **Accidents** - any change to the road network can affect the number of accidents that occur. Groups that are particularly vulnerable to increases in risk of accidents include children, the elderly, young males, and motorcyclists. There is also a strong link between deprivation and road accidents. For the Scheme, the number and proportion of accidents on links with a forecast decrease in accident rate was higher than those with a forecast increase in accident rate. Therefore, the accident assessment for most vulnerable groups was assessed **slight beneficial** as percentages were below that of the national average for the influence area.

- **Security** – there are potential personal security impacts from making changes to the transport system and these can raise specific concerns for women, young people, older people, people with disabilities and black and minority ethnic communities. For the Scheme this was screened out as any changes to pedestrian accesses through the Scheme are unlikely to alter perceptions of personal security from current perceptions. Therefore, this was scoped out.

- **Severance** – consideration is given to how groups such as children, people without access to a car, older people, people with disabilities and parents with pushchairs are impacted by severance. These groups often experience longer journey times or are often required to use pedestrian routes that are inappropriate and difficult to use. The Scheme impacts are generally limited to the SRN which will generally not impact pedestrian movements, as segregated pedestrian crossings are being retained so this was scoped out.

- **Accessibility** - public transport accessibility for different groups to access employment, services, and social networks. The Scheme itself is not expected to have changes to public transport services routing, frequencies or timings, or waiting facilities and related public transport accessibility so this was scoped out of the assessment.

- **Personal affordability** - changes in transport costs could have disproportionate effects where there are few or no travel alternatives, especially where income levels preclude car ownership and use. For the Scheme there were generally increases in fuel and non-fuel vehicle operating costs for all vehicles. This did not affect those in the lowest income quintile as there are none of these areas within the impact area. Income Quintile 3 had a moderate adverse affordability impact and Income Quintiles 2 and 4 had a large adverse impact where the share of increase in user charge was greater than population proportion in that quintile. Income Quintile 5 had a slight beneficial impact where the share of user charge decrease was higher than the population proportion in that quintile.

- **User benefits -** User benefits (time and costs impacts) are experienced in certain areas and by certain groups of people. For the Scheme, those in the most income deprived quintile are not affected. For all other income quintiles there are beneficial user benefit impacts, due to journey time benefits. Therefore, the overall impact is **moderate beneficial**.

5.6 Journey time reliability

5.6.1 Journey Time Reliability estimates are not required to form a core part of the cost-benefit analysis but can form an additional consideration in value for money assessment. The methodology developed by the Applicant for the assessment of journey time reliability (MyRIAD) primarily applies to mainline improvements and the applications of it to junction improvements are not common. Therefore only a qualitative assessment was undertaken, and impacts were not monetised for Stage 3b (the DCO application Scheme).

5.6.2 Recurring congestion at approaches to Junction 9 is evident in the base year and Do-Minimum forecast year scenarios and can be deemed to reflect unpredictable variation in journey time delays due to sensitivities caused by day-to-day demand variations.

5.6.3 The Scheme is expected to improve journey time reliability where it provides more capacity which reduces congestion and journey time delays. This is evident from the forecast journey time savings associated with the Scheme, particularly to/from the Easton Lane gyratory approach at M3 Junction 9. As these routes are shown to be more “free flowing” with the Scheme, it can be expected that journey time reliability along these routes will improve. In addition, there is a predicted reduction in accidents, which will have a positive impact on journey time reliability.

5.7 Wider economic impacts

5.7.1 TAG Unit 2-1 sets out the methodology for estimating wider economic impacts (WEIs) to be considered in addition to the Level 1 economic benefits. The WEIs are categorised into three themes with corresponding TAG units providing guidance on the analytical methods with two levels of analysis as shown in **Table 5-18**.

Table 5-18: Estimation of Wider Economic Impacts

	Induced Investment Impacts	Employment Effects	Productivity Impacts
TAG Unit	A2.2	A2.3	A2.4
Level 2	Output Change in Imperfectly Competitive Markets	Labour Supply Impacts	Agglomeration – Static Clustering
Level 3	Land-use Change and Dependent Development	Move to More/Less Productive Jobs	Agglomeration – Dynamic Clustering

5.7.2 The Level 2 wider economic impacts were quantified based on the relevant TAG methods and application of the DfT Wider Impacts in Transport Appraisal (WITA) software (version 2.2).

5.7.3 The Level 3 wider economic impacts were not quantified at this stage as it was not considered proportionate to carry out a detailed assessment and related land-use and economic modelling.

5.7.4 Wider economic impacts refer to economic impacts which are additional to transport user benefits. They arise because market failures in secondary markets (non-transport markets), such as the product, labour, and land markets, mean that the full welfare impact of a transport investment may not be reflected in the transport market.

Output change in imperfectly competitive markets (Level 2)

5.7.5 The Scheme is expected to address capacity issues on routes to international gateways and help provide more efficient routes to global markets through reduced travel costs. The corresponding benefits in terms of increased output in imperfectly competitive markets were estimated reflecting the additional margin firms make on each unit of output they produce.

5.7.6 TAG unit 2-2 suggests a simplified approach to estimating the benefits related to changes in imperfectly competitive markets, using a proportion of the calculated (Level 1) business user and reliability benefits. The DfT Wider Impacts Dataset provides an uplift parameter of 10% which are included in the Level 2 benefits noting that reliability benefits were not quantified, so this only includes business user benefits.

5.7.7 An estimate of the impact of increased output in imperfectly competitive markets has been derived directly from the estimated business user benefits (as per TAG Unit A2.2) and is estimated to be £7.1 million (NPV, 2010 prices and values).

Productivity impacts

5.7.8 The Scheme is expected to increase business productivity by reducing travel costs and improving accessibility.

5.7.9 An agglomeration economy suggests that there are benefits gained from businesses within an industrial sector locating themselves within close proximity of each other. The effective density of these clusters of businesses can be changed by transport investment making it easier to travel through the cluster, facilitating interactions.

5.7.10 Agglomeration benefits were quantified following the approach set out in TAG Unit 2-4 using the WITA software[11] and transport model data.

Static clustering (Level 2)

5.7.11 Static clustering impacts were quantified using WITA software, where land-use is fixed, and only changes in travel costs alter the effective density of the clusters.

5.7.12 A proportionate approach was taken in quantifying the agglomeration benefits based on consideration of the underlying transport model features and available data. This was based on considerations explained in the Economics Appraisal Package, TAG Unit A2.4 guidance (specifically Appendix C), and liaison with the WITA software developers. The geographic focus of the agglomeration calculations reflects where Winchester is one of the primary employment locations in the Enterprise M3 area and the Scheme is expected to boost productivity by removing congestion.

5.7.13 Whilst this excludes potential productivity benefits from other areas associated with reduced travel times to Winchester or that intercept the Scheme, the reliable estimation of them would not be proportionate to the associated data and analytical requirements. This approach is in line with TAG Unit 2-4, which suggests the estimation of agglomeration benefits is limited to areas where the modelling is likely to provide a good estimate of generalised costs. This approach is likely to underestimate productivity benefits where the economic narrative sets out how the Scheme may also help better integrate the Solent area with the wider South East and generate productivity gains as well as improving access to global markets.

5.7.14 Overall, the quantified productivity benefits were in the order of ~25% of total TEE user benefits, which is line with the range (10-30%) indicated in TAG. **Table 5-19** presents the productivity impacts (Level 2) which are included in the adjusted BCR. This indicates the greatest agglomeration benefit is to the Producer Services sector reflecting the profile of businesses in the Winchester area.

11 [redacted]

Table 5-19: Productivity (Static Clustering) Impacts – (£M, discounted to 2010, in 2010 prices)

Category	Excluding Freight
Agglomeration - Manufacturing	0.4
Agglomeration - Construction	1.5
Agglomeration - Consumer Services	7.3
Agglomeration - Producer Services	25.6
Total	**34.7**

5.7.15 The sensitivity test including freight trips indicated a total productivity benefit of £44.0M reflecting the positive impact of the Scheme on freight movements and associated agglomeration.

Total wider economic impacts

5.7.16 **Table 5-20** presents the quantified wider economic impacts (Level 2) which are included in the adjusted BCR.

Table 5-20: Wider Economic Impacts (£M, discounted to 2010, in 2010 prices)

Category	Value
Output Change in Imperfectly Competitive Markets	7.1
Productivity Impacts – Static Clustering (excluding freight)	34.7
Total Wider Economic Impacts	**41.8**

5.8 Comparison of costs and benefits

5.8.1 The Transport Economic Efficiency (TEE) results are presented in **Table 5-21**. The TEE benefits consist of two key components: travel time savings and Vehicle Operating Costs (VOCs), as a result of the Scheme and during construction. The TEE table presents the monetised impacts in the form of Present Value of Benefit (PVB), which is the value of benefits in 2010 prices, discounted to 2010 values over the 60-year appraisal period.

Table 5-21: TEE Table (£, discounted to 2010, in 2010 prices)

Non-business: Commuting	ALL MODES		ROAD	
User benefits	TOTAL		Private Cars and LGVs	
Travel time	29,932,300		29,932,300	
Vehicle operating costs	-2,359,099		-2,359,099	
User charges	-2,112		-2,112	
During Construction & Maintenance	-755,633		-755,633	
NET NON-BUSINESS BENEFITS: COMMUTING	26,815,456	*(1a)*	26,815,456	
Non-business: Other	ALL MODES		ROAD	
User benefits	TOTAL		Private Cars and LGVs	
Travel time	57,158,838		57,158,838	
Vehicle operating costs	-8,606,906		-8,606,906	
User charges	-49,848		-49,848	
During Construction & Maintenance	-561,073		-561,073	
NET NON-BUSINESS BENEFITS: OTHER	47,941,011	*(1b)*	47,941,011	
Business				
User benefits			Goods Vehicles	Business Cars & LGVs
Travel time	68,388,099		22,032,099	46,356,000
Vehicle operating costs	2,625,462		3,410,701	-785,239
User charges	-11,875		0	-11,875
During Construction & Maintenance	-1,402,613		-490,941	-911,672
Subtotal	69,599,073	(2)	24,951,859	44,647,214
Private sector provider impacts				
Revenue				
Operating costs				
Investment costs				
Grant/subsidy				
Subtotal	0	*(3)*		
Other business impacts				
Developer contributions		*(4)*		
NET BUSINESS IMPACT	69,599,073	*(5) = (2) + (3) + (4)*		
TOTAL				
Present Value of Transport Economic Efficiency Benefits (TEE)	144,355,540	*(6) = (1a) + (1b) + (5)*		
Notes: Benefits appear as positive numbers, while costs appear as negative numbers. All entries are discounted present values, in 2010 prices and values				

Public Accounts (PA) table

5.8.2 **Table 5-22** presents the Public Accounts (PA) table, which provides a summary of the Scheme costs in the form of PVC. The costs were summed over the 60-year appraisal period, converted to 2010 prices, discounted to 2010, and converted to the market price unit of account.

5.8.3 The conversion of Scheme costs, presented in **Section 5.4**, to PVC resulted in £112.7M.

5.8.4 The PA table also includes the effect of the Scheme on indirect tax revenues, amounting to -£5.7M, which reflects the fact that the Government receives more indirect tax revenues with the Scheme in place due to an increase in fuel consumption.

Table 5-22 : PA Table (£, discounted to 2010, in 2010 prices

Local Government Funding	**ALL MODES TOTAL**		**ROAD INFRASTRUCTURE**
Revenue	0		
Operating Costs	0		
Investment Costs	0		
Developer and Other Contributions	0		
Grant/Subsidy Payments	0		
NET IMPACT	0		0
Central Government Funding: Transport			
Revenue	0		
Operating costs	7,688,652		7,688,652
Investment Costs	105,022,033		105,022,033
Developer and Other Contributions	0		
Grant/Subsidy Payments	0		
NET IMPACT	112,710,685		112,710,685
Central Government Funding: Non-Transport			
Indirect Tax Revenues	-5,691,758	*(9)*	-5,691,758
TOTALS			
Broad Transport Budget	112,710,685		*(10) = (7) + (8)*
Wider Public Finances	-5,691,758		*(11) = (9)*
Notes: Costs appear as positive numbers, while revenues and ‘Developer and Other Contributions' appear as negative numbers.			
All entries are discounted present values in 2010 prices and values.			

Analysis of Monetised Costs and Benefits (AMCB) table

5.8.5 Analysis of Monetised Costs and Benefits (AMCB) results are presented in **Table 5-23**.

5.8.6 The total PVB (Level 1) is £152.3M. The Scheme is predicted to deliver a Net Present Value (NPV) of £39.5M, resulting in an Initial BCR of 1.35.

Table 5-23: AMCB Table (£, discounted to 2010, in 2010 prices)

Noise	-1,343,544	*(12)*
Local Air Quality	4,742,333	*(13)*
Greenhouse Gases	-24,110,508	*(14)*
Journey Quality	0	*(15)*
Physical Activity	0	*(16)*
Accidents	22,918,178	*(17)*
Economic Efficiency: Consumer Users (Commuting)	26,815,456	*(1a)*
Economic Efficiency: Consumer Users (Other)	47,941,011	*(1b)*
Economic Efficiency: Business Users and Providers	69,599,073	*(5)*
Wider Public Finances (Indirect Taxation Revenues)	5,691,758	*-(11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	152,253,757	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*
Broad Transport Budget	112,710,685	*(10)*
Present Value of Costs (see notes) (PVC)	112,710,685	*(PVC) = (10)*
OVERALL IMPACTS		
Net Present Value (NPV)	39,543,072	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)	1.35	BCR=PVB/PVC

Note: This table includes costs and benefits which are regularly or occasionally presented in monetised form in transport appraisals, together with some where monetisation is in prospect. There may also be other significant costs and benefits, some of which cannot be presented in monetised form. Where this is the case, the analysis presented above does NOT provide a good measure of value for money and should not be used as the sole basis for decisions.

5.8.7 The Inclusion of wider economic impacts increased the PVB from £152.3M to £194.1M. With the PVC of £112.7M, the adjusted NPV was £81.4M, resulting in an Adjusted BCR of 1.72.

5.9 Sensitivity testing

5.9.1 Sensitivity tests were undertaken to consider the following aspects of appraisal:

- the economic impact of Low and High traffic growth scenarios in terms of user benefits;
- application of TAG data book version 1.19 economic parameters.

Low/High growth scenarios

5.9.2 Three traffic forecast scenarios were developed to consider alternative levels of future travel demand growth – the Core scenario, High growth scenario, and Low growth scenario.

5.9.3 For the High and Low growth scenarios, user benefits were prepared using TUBA to assess the effect that these would be predicted to have on the BCR. Note that other elements, such as; Air Quality, Noise, Greenhouse Gases, Accident assessments, were not carried out for these sensitivity test scenarios.

5.9.4 **Table 5-24** presents the summary assessment results for the High and Low growth scenarios. As would be expected, the high growth scenario predicts a higher BCR than the core scenario and the low growth scenario predicts a lower BCR.

Table 5-24: Assessment Results - Alternative Growth Scenarios (£M, discounted to 2010, in 2010 prices)

Costs/Benefits		Low Growth	Core Growth	High Growth
Noise		-1.34		
Air Quality		4.74		
Greenhouse Gases		-24.11		
Accidents (from Core scenario only)		22.92		
Construction		-2.69		
User Benefits	Commuting	18.18	27.57	37.64
	Other	31.64	48.50	68.17
	Business	55.35	71.00	89.49
Indirect Tax Revenues		6.02	5.66	4.21
Present Value of Benefits (PVB)		**110.71**	**152.25**	**199.02**
Costs	Operating and Maintenance	7.69		
	Construction	105.02		
Present Value of Costs (PVC)		**112.71**		
Net Present Value (NPV)		**-2.00**	**39.54**	**86.31**
Benefit to Cost Ratio (BCR)		**0.98**	**1.35**	**1.77**

5.9.5 The PVB (Level 1) was £110.71M and £199.02M for the Low and High scenarios, respectively, compared with £152.25M for the core growth scenario. The associated adjusted PVBs (Level 2) were £150.98M and £242.71M compared with £194.09M for the core growth scenario.

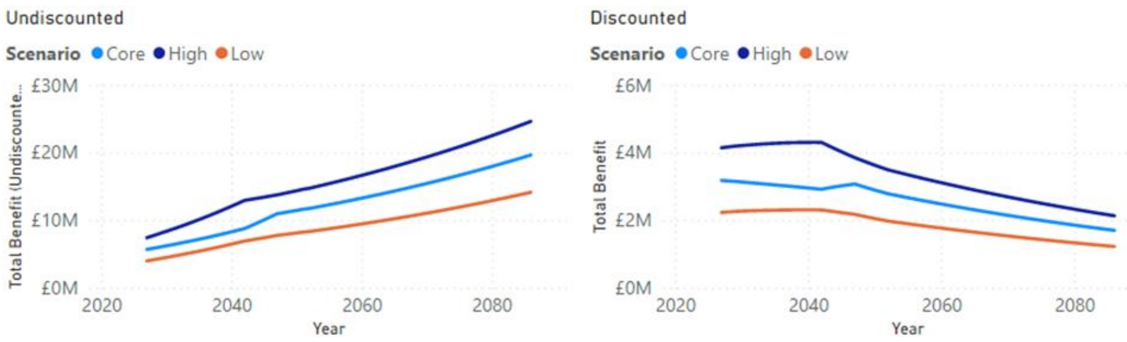
5.9.6 The NPV (Level 1) was -£2.00M and £86.31M for the Low and High scenarios, respectively, compared with £39.54M for the core growth scenario. The associated adjusted NPVs (Level 2) were £38.27M and £130.00M compared with £81.38M for the core growth scenario.

5.9.7 The Initial BCR was 0.98 and 1.77 for the Low and High scenarios, respectively, compared with 1.35 for the core growth scenario. The associated Adjusted BCRs were 1.34 (low) and 2.15 (high) compared with 1.72 for the core growth scenario.

5.9.8 The graph in **Figure 5-6** presents the predicted 60-year profile of user benefits for each scenario.

5.9.9 As expected, the low growth scenario is predicted to have a lesser level of benefit. For the high growth scenario, the reverse is true, with a greater level of benefits predicted.

Figure 5-6: TUBA Benefits - 60 Year Profile by Scenario (£M, discounted to 2010, in 2010 prices)



Economic parameters sensitivity test

5.9.10 A Transport Economic Efficiency sensitivity test was undertaken using TAG data book version 1.19 economic parameters. Comparison of the TEE user benefits are presented in **Table 5-25**.

Table 5-25: Assessment Results - Economic Parameters Sensitivity Test (£M, discounted to 2010, in 2010 prices)

Costs/Benefits		Core (TAG Parameters 1.18)	Core (TAG Parameters 1.19)
Noise		-1.34	
Air Quality		4.74	
Greenhouse Gases		-24.11	
Accidents (from Core scenario only)		22.92	
Construction (all purposes, including Indirect Tax Revenues)		-2.69	
User Benefits	Commuting	27.57	28.01
	Other	48.50	50.13
	Business	71.00	71.11
Indirect Tax Revenues		5.66	4.53
Present Value of Benefits (PVB)		**152.25**	**153.31**
Costs	Operating and Maintenance	7.69	
	Construction	105.02	
Present Value of Costs (PVC)		**112.71**	
Net Present Value (NPV)		**39.54**	**40.60**
Benefit to Cost Ratio (BCR)		**1.35**	**1.36**

5.9.11 This confirmed there was a positive impact on the Scheme economics, which increased the (Level 1) PVB from £152.25M to £152.31M, the NPV from £39.54M to £40.60M, and the Initial BCR from 1.35 to 1.36. The small increase in benefits was due to amended vehicle fleet assumptions.

5.9.12 The associated adjusted PVB (Level 2) was £195.16M with an NPV of £82.45M, resulting in an increase in the Adjusted BCR from 1.72 to 1.73.

6 Summary

6.1 Summary of economic impacts

6.1.1 Scheme costs were prepared by the Applicant, including construction and operating and maintenance, which were rebased to 2010 market prices with a total Present Value Cost (PVC) of £112.7M.

6.1.2 The results of the transport economic analysis indicated that the Scheme is forecast to generate user benefits in the order of £152.7M.

6.1.3 The greatest benefit relates to travel time savings, amounting to £155.5M, which are predominantly due to the provision of the free-flow movement between the A34 and the M3.

6.1.4 The accident assessment was modelled using COBALT with a predicted reduction in accidents and a corresponding benefit of £22.9M.

6.1.5 Construction traffic management impacts are -£2.7M.

6.1.6 Environmental impacts appraisal indicated minor negative impacts for Noise (£-1.3M), moderate positive impacts for Local Air Quality (£4.7M) and moderate negative impacts for Greenhouse Gases (£-24.1M).

6.1.7 Social and distributional impacts are presented in Section 5.5.

6.1.8 Journey time reliability was qualitatively assessed and does not form part of the monetised benefits. The Scheme is expected to improve journey time reliability where it provides more capacity which reduces congestion and journey time delays.

6.1.9 The total present value of benefits (Level 1) is £152.3M. The Scheme is predicted to deliver a Net Present Value (NPV) of £39.5M, resulting in an Initial BCR of 1.35.

6.1.10 Inclusion of (Level 2) wider economic impacts, estimated at £41.8M, increased the PVB to £194.1M, with an adjusted NPV of £81.4M, resulting in an Adjusted BCR of 1.72.

6.1.11 Further details on the data and summaries in the ComMA can be provided in Appendix F (ComMA Data Annex Table) and Appendix G (ComMA Summary Table).

6.2 Consideration of results against scheme objectives

6.2.1 The objectives of the Scheme are:

- To reduce delays at M3 Junction 9 on all links M3, A33 and A34
- Smooth the flow of traffic by improving journey time reliability and reducing delays (time lost per vehicle per mile) at M3 Junction 9 and the exit and entry roads for the A33 and A34
- Improve the safety for all road users and reduce the annual collision frequency and severity ratio on the M3 Junction 9
- Support economic growth and ensure the junction can accommodate additional traffic
- Improvements for walkers and cyclists, including connecting the National Cycle Network Route 23 which is severed by the current junction layout

6.2.2 The Scheme is predicted to meet the objectives by:

- **Reducing delays** at key areas that are presently congested. The Scheme also reduces journey times from the M3 South to the A34 and the A34 to the M3 South in the AM and PM peak period. Furthermore, there are reductions in journey times between Easton Lane and the A31 and A33
- **Reducing journey times** on key approaches to the M3 Junction 9. There are reductions in delays on the M3 Southbound off-slip/A34 and the A272 approach in the AM and PM peak periods
- **Providing safety benefits** of £22M and will save in the order of 537 collisions over the appraisal period with a predicted reduction in slight, serious, and fatal casualties
- **Providing Wider Economic Benefits** of £42M – which is expected to stimulate local development sites and economic activity
- **Providing improvements to walking and cycling** in terms of new, improved, and upgraded crossings for the M3.

Appendix A Uncertainty log

Development	Land Use Type	Local Planning Authority	Uncertainty scenario	Built-Up Year	Size (Housing Only)	Size (Converted to Jobs)
Manydown, Basingstoke	C - Housing	Basingstoke and Deane Borough Council	More than likely	2029	3400	0
Basingstoke Golf Course, Basingstoke	C - Housing	Basingstoke and Deane Borough Council	More than likely	2028	1000	0
Kennel Farm, Basingstoke	C - Housing	Basingstoke and Deane Borough Council	Near certain	2019	310	0
Hounsome Fields, Basingstoke	C - Housing	Basingstoke and Deane Borough Council	More than likely	2028	750	0
Basingstoke: Junction 7	B8 - Storage & Distribution	Basingstoke and Deane Borough Council	More than likely	2027	0	1443
Land East Of Icknield Way	C - Housing	Test Valley Borough Council	Near certain	2025	2870	0
Whitenap	C - Housing	Test Valley Borough Council	Reasonably foreseeable	2023	1300	0
Land At Picket Twenty	C - Housing	Test Valley Borough Council	Near certain	2023	1736	0
Adanac Park	B1 - Business Office	Test Valley Borough Council	More than likely	2029	0	3241
Andover Business Park	B1 - Business Office	Test Valley Borough Council	More than likely	2029	0	1111
	B2 - Industry	Test Valley Borough Council	More than likely	2030	0	741
	B8 - Storage & Distribution	Test Valley Borough Council	More than likely	2031	0	346
Land At Walworth Industrial Estate	B2 - Industry	Test Valley Borough Council	More than likely	2029	0	629
	B8 - Storage & Distribution	Test Valley Borough Council	More than likely	2030	0	294
Barton Farm Major Development, Andover Road, Winchester, Hampshire	C - Housing	Winchester City Council	Near certain	2036	2000	0
	A1 - Retail	Winchester City Council	Near certain	2031	0	150
	B1 - Business Office	Winchester City Council	Near certain	2031	0	167
Hampshire Constabulary Hq, Romsey Road, Winchester, Hampshire, So22 5Db	C - Housing	Winchester City Council	Near certain	2023	208	0
Silver Hill Development, Tanner Street, Winchester, Hampshire	C - Housing	Winchester City Council	Reasonably forseeable	2028	307	0
	A1 - Retail	Winchester City Council	Reasonably forseeable	2031	0	200
	B1 - Business Office	Winchester City Council	Reasonably forseeable	2031	0	333
Land East Of Sun Lane	C - Housing	Winchester City Council	Near certain	2028	325	0
Grainger Development	C - Housing	Winchester City Council	Near certain	2032	2114	0
Bottings Industrial Estate	B1 - Business Office	Winchester City Council	Not to include	2031	0	333

Development	Land Use Type	Local Planning Authority	Uncertainty scenario	Built-Up Year	Size (Housing Only)	Size (Converted to Jobs)
	B2 - Industry	Winchester City Council	Not to include	2031	0	222
	B8 - Storage & Distribution	Winchester City Council	Not to include	2031	0	104
Land At Little Park Farm	B1 - Business Office	Winchester City Council	Reasonably forseeable	2031	0	0
	B2 - Industry	Winchester City Council	Reasonably forseeable	2031	0	72
	B8 - Storage & Distribution	Winchester City Council	Reasonably forseeable	2031	0	34
Land Adjacent To Brambles Farm	B1 - Business Office, B1b - R&D Space, B1c - Light Industrial	Winchester City Council	Near certain	2031	0	665
	B2 - Industry	Winchester City Council	Near certain	2031	0	856
	B8 - Storage & Distribution	Winchester City Council	Near certain	2031	0	400
4300 Parkway	B1 - Business Office	Winchester City Council	Near certain	2031	0	623
Land At Bushfield Camp	B1 - Business Office	Winchester City Council	More than likely	2031	0	2000
Wessex Gate	B1 - Business Office	Winchester City Council	More than likely	2031	0	38
	B2 - Industry	Winchester City Council	More than likely	2031	0	25
	B8 - Storage & Distribution	Winchester City Council	More than likely	2031	0	12
Friarsgate Medical Centre	B1 - Business Office	Winchester City Council	More than likely	2031	0	155
Cattlemarket	B1 - Business Office	Winchester City Council	More than likely	2031	0	333
Carfax Site	B1 - Business Office	Winchester City Council	Near certain	2031	0	333
North Winchester Farm	B1 - Business Office	Winchester City Council	More than likely	2031	0	77
	B2 - Industry	Winchester City Council	More than likely	2031	0	46
	B8 - Storage & Distribution	Winchester City Council	More than likely	2031	0	21
Plots 2000-2500 And 3400	B1 - Business Office	Winchester City Council	Near certain	2031	0	2216
Solent 2, Area 12	B1 - Business Office	Winchester City Council	Near certain	2031	0	1334
Land At Segensworth North	B1 - Business Office	Winchester City Council	More than likely	2031	0	333
	B2 - Industry	Winchester City Council	More than likely	2031	0	111
	B8 - Storage & Distribution	Winchester City Council	More than likely	2031	0	52

Development	Land Use Type	Local Planning Authority	Uncertainty scenario	Built-Up Year	Size (Housing Only)	Size (Converted to Jobs)
Winchester Royal Hotel	C1 - Hotel	Winchester City Council	Near certain	2023	0	6
North Whiteley Urban Extension, Botley Road (A3051), Curbridge, Hampshire	C - Housing	Winchester City Council	Near certain	2035	3500	0
Pitt Manor	C - Housing	Winchester City Council	Near certain	2020	200	0
Land North Of Ravenswood House	C - Housing	Winchester City Council	More than likely	2026	200	0
Selhurst Poultry Farm	B1 - Business Office	Winchester City Council	More than likely	2031	0	13
	B8 - Storage & Distribution	Winchester City Council	More than likely	2031	0	8
Knowle Hospital	B1 - Business Office	Winchester City Council	More than likely	2031	0	43
Unit 3 Prospect Road	B2 - Industry	Winchester City Council	More than likely	2031	0	7
Bishops Hill House	B1 - Business Office	Winchester City Council	More than likely	2031	0	26
Newdown Farms	B8 - Storage & Distribution	Winchester City Council	More than likely	2031	0	13
New Farm Engineering	B1 - Business Office	Winchester City Council	More than likely	2031	0	30
Readypower Engineering	B8 - Storage & Distribution	Winchester City Council	More than likely	2031	0	5
Bta Car Sales, Redhill Service	B2 - Industry	Winchester City Council	Near certain	2031	0	3
	B8 - Storage & Distribution	Winchester City Council	Near certain	2031	0	1
Land At Barton Industrial Estate	B2 - Industry	Winchester City Council	More than likely	2031	0	13
Rivers Engineering	B2 - Industry	Winchester City Council	More than likely	2031	0	13
	A3 - Food & Drink	Winchester City Council	More than likely	2031	0	24
Barn At Merdon Castle Lane	B8 - Storage & Distribution	Winchester City Council	Near certain	2031	0	4
Cranburys	B1 - Business Office	Winchester City Council	More than likely	2031	0	11
	B8 - Storage & Distribution	Winchester City Council	More than likely	2031	0	7
New Barns Farm	B2 - Industry	Winchester City Council	More than likely	2031	0	16
	B8 - Storage & Distribution	Winchester City Council	More than likely	2031	0	8
Greener Landscapes Ltd	B8 - Storage & Distribution	Winchester City Council	More than likely	2031	0	3
Pitt Down Farm	B1 - Business Office	Winchester City Council	More than likely	2031	0	7

Development	Land Use Type	Local Planning Authority	Uncertainty scenario	Built-Up Year	Size (Housing Only)	Size (Converted to Jobs)
	B8 - Storage & Distribution	Winchester City Council	More than likely	2031	0	4
Land Opposite Tannery House	B1 - Business Office	Winchester City Council	More than likely	2031	0	31
	B2 - Industry	Winchester City Council	More than likely	2031	0	21
	B8 - Storage & Distribution	Winchester City Council	More than likely	2031	0	10
Land At Solent Way	A1 - Retail	Winchester City Council	Near certain	2019	0	124
Former Managers Accommodation	D2 - Mixed Leisure	Winchester City Council	Near certain	2019	0	2
Unit 3600A Parkway	D2 - Mixed Leisure	Winchester City Council	More than likely	2031	0	1
Winchester Sport And Leisure C	D2 - Mixed Leisure	Winchester City Council	More than likely	2031	0	33
9-11 High Street	C1 - Hotel	Winchester City Council	Near certain	2031	0	21
New Place Hotel, New Place	C1 - Hotel	Winchester City Council	More than likely	2031	0	5
Holiday Inn Hotel Winchester	C1 - Hotel	Winchester City Council	Near certain	2031	0	11
Land North And East Of Boorley, Green Botley, Southampton, So32 2Bx	C - Housing	Eastleigh Borough Council	Near certain	2026	1399	0
	C1 - Hotel	Eastleigh Borough Council	Near certain	2026	0	15
	A1 - Retail	Eastleigh Borough Council	Near certain	2026	0	218
Chalcroft Farm And Land West Of Horton Heath, Burnetts Lane, Eastleigh, Southampton, So30 2Hu	C - Housing	Eastleigh Borough Council	Near certain	2030	2500	0
	B8 - Storage & Distribution	Eastleigh Borough Council	Near certain	2022	0	125
	B1 - Business Office	Eastleigh Borough Council	Near certain	2022	0	400
	B2 - Industry	Eastleigh Borough Council	Near certain	2022	0	267
Land South Of Chestnut Avenue, North Stoneham Park, Chestnut Avenue, Stoneham Lane, Eastleigh	C - Housing	Eastleigh Borough Council	Near certain	2028	1157	0
	A1 - Retail	Eastleigh Borough Council	Near certain	2028	0	85
	B1 - Business Office	Eastleigh Borough Council	Near certain	2028	0	225
	D2 - Mixed Leisure	Eastleigh Borough Council	Near certain	2028	0	6
Former Alstom Railway Land	B8 - Storage & Distribution	Eastleigh Borough Council	Reasonably foreseeable	2036	0	987
Land At Chickenhall Lane	B8 - Storage & Distribution	Eastleigh Borough Council	Near certain	2036	0	23

Development	Land Use Type	Local Planning Authority	Uncertainty scenario	Built-Up Year	Size (Housing Only)	Size (Converted to Jobs)
Northern Business Park	B1 - Business Office	Eastleigh Borough Council	Reasonably foreseeable	2036	0	6500
Railtrack Land	B1 - Business Office	Eastleigh Borough Council	Reasonably foreseeable	2036	0	2667
Pembers Hill Farm	C - Housing	Eastleigh Borough Council	Near certain	2024	242	0
Strategic Growth Option (Garden Community)	C - Housing	Eastleigh Borough Council	Reasonably foreseeable	2044	3060	0
	B2 - Industry	Eastleigh Borough Council	Reasonably foreseeable	2044	0	333
	B8 - Storage & Distribution	Eastleigh Borough Council	Reasonably foreseeable	2044	0	156
	B1 - Business Office	Eastleigh Borough Council	Reasonably foreseeable	2044	0	500
Land At Chickenhall Lane	B8 - Storage & Distributio	Eastleigh Borough Council	Reasonably foreseeable	2036	0	208
Land At Royal Pier, Mayflower Park, Including Adjoining Highways And Part Of The River Test, Town Quay, Southampton, So14 2Aq	C - Housing	Southampton City Council	Reasonably foreseeable	2030	311	0
	B1 - Business Office	Southampton City Council	Reasonably foreseeable	2030	0	3933
	A1 - Retail	Southampton City Council	Reasonably foreseeable	2030	0	697
	C1 - Hotel	Southampton City Council	Reasonably foreseeable	2030	0	83
	D2 - Mixed Leisure	Southampton City Council	Reasonably foreseeable	2030	0	25
	D1 - Cultural/conference	Southampton City Council	Reasonably foreseeable	2030	0	40
	D2 - Casino	Southampton City Council	Reasonably foreseeable	2030	0	93
Centenary Quay	C - Housing	Southampton City Council	Near certain	2023	1228	0
	B1 - Business Office	Southampton City Council	Near certain	2023	0	473
	B2 - Industry	Southampton City Council	Near certain	2023	0	315
	A1 - Retail	Southampton City Council	Near certain	2023	0	275
	C1 - Hotel	Southampton City Council	Near certain	2023	0	33
	B8 - Storage & Distribution	Southampton City Council	Near certain	2023	0	147
Watermark West Quay	C - Housing	Southampton City Council	Near certain	2023	260	0
	D2 - Mixed Leisure	Southampton City Council	Near certain	2023	0	28
	B1 - Business Office	Southampton City Council	Near certain	2023	0	833

Development	Land Use Type	Local Planning Authority	Uncertainty scenario	Built-Up Year	Size (Housing Only)	Size (Converted to Jobs)
South Central	B1c - Light Industrial	Southampton City Council	Near certain	2023	0	81
	B2 - Industry	Southampton City Council	Near certain	2023	0	213
	B8 - Storage & Distribution	Southampton City Council	Near certain	2023	0	99
Station Quarter Southside	B1 - Business Office	Southampton City Council	Reasonably foreseeable	2023	0	291
	B2 - Industry	Southampton City Council	Reasonably foreseeable	2023	0	194
	B8 - Storage & Distribution	Southampton City Council	Reasonably foreseeable	2023	0	91
Units 4-7 Mountpark	B1 - Business Office	Southampton City Council	Near certain	2023	0	535
	B2 - Industry	Southampton City Council	Near certain	2023	0	357
	B8 - Storage & Distribution	Southampton City Council	Near certain	2023	0	167
Daedalus – Fareham	B1 - Business Office	Fareham Borough Council	Near certain	2018	0	502
	B1c - Light Industrial	Fareham Borough Council	Near certain	2018	0	508
	B8 - Storage & Distribution	Fareham Borough Council	Near certain	2018	0	116
Welborne Plan Allocation – Fareham	C - Housing	Fareham Borough Council	Reasonably foreseeable	2018	6000	0
	B1 - Business Office	Fareham Borough Council	Reasonably foreseeable	2018	0	1750
	B2 - Industry	Fareham Borough Council	Reasonably foreseeable	2018	0	1167
	A1 - Retail	Fareham Borough Council	Reasonably foreseeable	2018	0	305
	B8 - Storage & Distribution	Fareham Borough Council	Reasonably foreseeable	2018	0	545
Land At Little Park Farm	B1 - Business Office	Fareham Borough Council	Reasonably foreseeable	2023	0	374
	B2 - Industry	Fareham Borough Council	Reasonably foreseeable	2023	0	249
	B8 - Storage & Distribution	Fareham Borough Council	Reasonably foreseeable	2023	0	117
Solent Business Park	B1 - Business Office	Fareham Borough Council	Near certain	2023	0	392
	B2 - Industry	Fareham Borough Council	Near certain	2023	0	261
	B8 - Storage & Distribution	Fareham Borough Council	Near certain	2023	0	122
	C - Housing	Gosport Borough Council	Near certain	2019	193	0

Development	Land Use Type	Local Planning Authority	Uncertainty scenario	Built-Up Year	Size (Housing Only)	Size (Converted to Jobs)
Rowner Regeneration Area, Grange Road, Gosport	B1 - Business Office	Gosport Borough Council	Reasonably foreseeable	2019	0	160
	B2 - Industry	Gosport Borough Council	Reasonably foreseeable	2019	0	107
	B8 - Storage & Distribution	Gosport Borough Council	Reasonably foreseeable	2019	0	50
Daedalus Gosport	C - Housing	Gosport Borough Council	Near certain	2020	312	0
	A1 - Retail	Gosport Borough Council	Near certain	2020	0	54
	D2 - Mixed Leisure	Gosport Borough Council	Near certain	2020	0	8
	C1 - Hotel	Gosport Borough Council	Near certain	2020	0	79
	B1 - Business Office	Gosport Borough Council	Near certain	2020	0	1101
	B2 - Industry	Gosport Borough Council	Near certain	2020	0	734
	B8 - Storage & Distribution	Gosport Borough Council	Near certain	2020	0	343
Gosport Waterfront And Town Centre	C - Housing	Gosport Borough Council	Near certain	2029	693	0
	B1 - Business Office	Gosport Borough Council	Reasonably foreseeable	2029	0	2322
	A1 - Retail	Gosport Borough Council	Reasonably foreseeable	2029	0	268
Huhtamaki	B1 - Business Office	Gosport Borough Council	Near certain	2023	0	194
	B2 - Industry	Gosport Borough Council	Near certain	2023	0	130
	B8 - Storage & Distribution	Gosport Borough Council	Near certain	2023	0	61
Land At Fareham Road	A1 - Retail	Gosport Borough Council	Not included	2023	0	361
Dunsbury Hill Farm - Phase 1	B8 - Storage & Distribution	Havant Borough Council	Near certain	2017	0	148
Dunsbury Hill Farm - Phase 2	B1 - Business Office	Havant Borough Council	Near certain	2026	0	719
	D2 - Mixed Leisure	Havant Borough Council	Near certain	2026	0	19
	B2 - Industry	Havant Borough Council	Near certain	2026	0	761
Harts Farm Way - North Of Regional Business Centre And Brockhampton West	B1 - Business Office	Havant Borough Council	Reasonably foreseeable	2026	0	3133
Stanbridge Road	B1 - Business Office	Havant Borough Council	Near certain	2026	0	0
	B8 - Storage & Distribution	Havant Borough Council	Near certain	2026	0	127

Development	Land Use Type	Local Planning Authority	Uncertainty scenario	Built-Up Year	Size (Housing Only)	Size (Converted to Jobs)
Harts Farm Way North - Site Four	B1 - Business Office	Havant Borough Council	Near certain	2023	0	202
	B2 - Industry	Havant Borough Council	Near certain	2023	0	134
	B8 - Storage & Distribution	Havant Borough Council	Near certain	2023	0	63
Bae Systems	B1 - Business Office	Havant Borough Council	Near certain	2023	0	239
	B2 - Industry	Havant Borough Council	Near certain	2023	0	80
	D2 - Mixed Leisure	Havant Borough Council	Near certain	2023	0	16
	B8 - Storage & Distribution	Havant Borough Council	Near certain	2023	0	37
Kingscroft Farm	B1 - Business Office	Havant Borough Council	Reasonably foreseeable	2023	0	0
	B2 - Industry	Havant Borough Council	Reasonably foreseeable	2023	0	150
	B8 - Storage & Distribution	Havant Borough Council	Reasonably foreseeable	2023	0	70
New Lane B8 Distribution Centre	B8 - Storage & Distribution	Havant Borough Council	Near certain	2027	0	97
Caird Avenue	B1 - Business Office	New Forest District Council	Reasonably foreseeable	2038	0	540
Land East Of Caird Avenue	B1 - Business Office	New Forest District Council	Reasonably foreseeable	2038	0	277
	B2 - Industry	New Forest District Council	Reasonably foreseeable	2038	0	185
	B8 - Storage & Distribution	New Forest District Council	Reasonably foreseeable	2038	0	86
	B1 - Business Office	New Forest District Council	Reasonably foreseeable	2038	0	334
	B2 - Industry	New Forest District Council	Reasonably foreseeable	2038	0	223
	B8 - Storage & Distribution	New Forest District Council	Reasonably foreseeable	2038	0	104
Land West Of Crow Lane	B1 - Business Office	New Forest District Council	Near certain	2036	0	100
	B2 - Industry	New Forest District Council	Near certain	2036	0	67
	B8 - Storage & Distribution	New Forest District Council	Near certain	2036	0	31
Marchwood And Cracknore Industrial Estates	B1b - R&D Space	New Forest District Council	Reasonably foreseeable	2036	0	73
	B1c - Light Industrial	New Forest District Council	Reasonably foreseeable	2036	0	62
	B2 - Industry	New Forest District Council	Reasonably foreseeable	2036	0	323

Development	Land Use Type	Local Planning Authority	Uncertainty scenario	Built-Up Year	Size (Housing Only)	Size (Converted to Jobs)
	B8 - Storage & Distribution	New Forest District Council	Reasonably foreseeable	2036	0	151
Site Of Pond 1 - Marchwood	B1 - Business Office	New Forest District Council	Reasonably foreseeable	2023	0	238
	B2 - Industry	New Forest District Council	Reasonably foreseeable	2023	0	159
	B8 - Storage & Distribution	New Forest District Council	Reasonably foreseeable	2023	0	74
Gordleton Industrial Estate	B1 - Business Office	New Forest District Council	Reasonably foreseeable	2036	0	119
	B2 - Industry	New Forest District Council	Reasonably foreseeable	2036	0	79
	B8 - Storage & Distribution	New Forest District Council	Reasonably foreseeable	2036	0	37
Eling Wharf	B1 - Business Office	New Forest District Council	Reasonably foreseeable	2036	0	1667
	B2 - Industry	New Forest District Council	Reasonably foreseeable	2036	0	556
	C - Housing	New Forest District Council	Reasonably foreseeable	2036	400	0
	B8 - Storage & Distribution	New Forest District Council	Reasonably foreseeable	2036	0	260
Little Testwood Farm	B1 - Business Office	New Forest District Council	Reasonably foreseeable	2036	0	86
	B2 - Industry	New Forest District Council	Reasonably foreseeable	2036	0	57
	B8 - Storage & Distribution	New Forest District Council	Reasonably foreseeable	2036	0	27
Newmans Copse	B1 - Business Office	New Forest District Council	Reasonably foreseeable	2036	0	97
	B2 - Industry	New Forest District Council	Reasonably foreseeable	2036	0	64
	B8 - Storage & Distribution	New Forest District Council	Reasonably foreseeable	2036	0	30
Land To The North Of Totton	B1 - Business Office	New Forest District Council	Reasonably foreseeable	2036	0	1667
Former Fawley Power Station	B1 - Business Office	New Forest District Council	Reasonably foreseeable	2036	0	3333
Land To The North Of Hightown Road, Ringwood	B1 - Business Office	New Forest District Council	Reasonably foreseeable	2036	0	1000
Port Solent And Horsea Island	C - Housing	Portsmouth City Council	Reasonably foreseeable	2038	500	0
	B1 - Business Office	Portsmouth City Council	Reasonably foreseeable	2038	0	417
	B2 - Industry	Portsmouth City Council	Reasonably foreseeable	2038	0	278
	B8 - Storage & Distribution	Portsmouth City Council	Reasonably foreseeable	2038	0	130

Development	Land Use Type	Local Planning Authority	Uncertainty scenario	Built-Up Year	Size (Housing Only)	Size (Converted to Jobs)
Tipner Urban Priority Area	C - Housing	Portsmouth City Council	Near certain	2026	1276	0
Tipner Firing Range	C - Housing	Portsmouth City Council	Reasonably foreseeable	2026	600	0
	B1 - Business Office	Portsmouth City Council	Reasonably foreseeable	2026	0	500
	B2 - Industry	Portsmouth City Council	Reasonably foreseeable	2026	0	333
	B8 - Storage & Distribution	Portsmouth City Council	Reasonably foreseeable	2026	0	156
Merlin Park	B1 - Business Office	Portsmouth City Council	Near certain	2019	0	252
	B2 - Industry	Portsmouth City Council	Near certain	2019	0	168
	B8 - Storage & Distribution	Portsmouth City Council	Near certain	2019	0	79
Voyager Park	B1 - Business Office	Portsmouth City Council	More than likely	2023	0	149
	B2 - Industry	Portsmouth City Council	More than likely	2023	0	100
	B8 - Storage & Distribution	Portsmouth City Council	More than likely	2023	0	47
Lakeside Business Park, Western Road, Cosham, Portsmouth, Hampshire, Po6 3En	B1 - Business Office	Portsmouth City Council	Near certain	2027	0	5753
Land North Of Goldsmith Av	B1 - Business Office	Portsmouth City Council	Reasonably foreseeable	2027	0	160
	B2 - Industry	Portsmouth City Council	Reasonably foreseeable	2027	0	107
	B8 - Storage & Distribution	Portsmouth City Council	Reasonably foreseeable	2027	0	50
Portsdown Technology Park	B1 - Business Office	Portsmouth City Council	Near certain	2023	0	571

Appendix B Impact of VDM

Time Period	User Class	Reference - 2027			Post VDM - 2027			Difference		
		Grand Total	Intra Zonal	Inter Zonal	Grand Total	Intra Zonal	Inter Zonal	Grand Total	Intra Zonal	Inter Zonal
Do-Minimum										
AM	Car Business	509,636	317,591	192,045	509,661	317,622	192,039	25	31	-6
	Car Commuting	221,012	950,348	1,259,963	2,210,333	950,367	1,259,966	22	19	3
	Car Other	2,226,493	1,030,807	1,195,685	2,226,520	1,030,847	1,195,673	27	40	-12
	Total	2,957,141	2,298,746	2,647,693	4,946,514	2,298,836	2,647,678	74	90	-15
IP	Car Business	444,415	274,565	169,850	444,427	274,589	169,838	12	24	-12
	Car Commuting	758,706	448,999	309,707	758,714	449,010	309,704	8	11	-3
	Car Other	3,180,533	1,352,559	1,827,974	3,180,555	1,352,584	1,827,971	22	25	-3
	Total	4,383,654	2,076,123	2,307,531	4,383,696	2,076,183	2,307,513	42	60	-18
PM	Car Business	535,724	337,263	198,461	535,734	337,277	198,457	10	14	-4
	Car Commuting	2,054,006	989,402	1,064,604	2,054,011	989,414	1,064,597	5	12	-7
	Car Other	3,173,971	1,417,967	1,756,004	3,173,989	1,417,915	1,756,074	18	-52	70
	Total	5,763,701	2,744,632	3,019,069	5,763,734	2,744,606	3,019,128	33	-26	59
Do-Something										
AM	Car Business	509,636	317,591	192,045	509,662	317,623	192,039	26	32	-6
	Car Commuting	2,210,311	950,348	1,259,963	2,210,338	950,372	1,259,966	27	24	3
	Car Other	2,226,492	1,030,807	1,195,685	2,226,521	1,030,848	1,195,673	29	41	-12
	Total	4,946,439	2,298,746	2,647,693	4,946,521	2,298,843	2,647,678	82	97	-15
IP	Car Business	444,415	274,565	169,850	444,427	274,590	169,837	12	25	-13
	Car Commuting	758,706	448,999	309,707	758,715	449,011	309,704	9	12	-3
	Car Other	3,180,533	1,352,559	1,827,974	3,180,555	1,352,587	1,827,968	22	28	-6
	Total	4,383,654	2,076,123	2,307,531	4,383,697	2,076,188	2,307,509	43	65	-22
PM	Car Business	535,724	337,263	198,461	535,734	337,277	198,457	10	14	-4
	Car Commuting	2,054,006	989,402	1,064,604	2,054,015	989,418	1,064,597	9	16	-7
	Car Other	3,173,971	1,417,967	1,756,004	3,173,990	1,417,917	1,756,073	19	-50	69
	Total	5,763,701	2,744,632	3,019,069	5,763,739	2,744,612	3,019,127	38	-20	58

Time Period	User Class	Reference - 2042			Post VDM - 2042			Difference		
		Grand Total	Intra Zonal	Inter Zonal	Grand Total	Intra Zonal	Inter Zonal	Grand Total	Intra Zonal	Inter Zonal
Do-Minimum										
AM	Car Business	555,300	345,432	209,868	555,359	345,521	209,838	59	89	-30
	Car Commuting	2,401,266	1,028,317	1,372,949	2,401,307	1,028,353	1,372,954	41	36	5
	Car Other	2,506,868	1,170,288	1,336,580	2,506,928	1,170,486	1,336,442	60	198	-138
	Total	5,463,434	2,544,037	2,919,397	5,463,594	2,544,360	2,919,234	160	323	-163
IP	Car Business	482,484	297,823	184,661	482,516	297,897	184,619	32	74	-42
	Car Commuting	816,670	482,757	333,913	816,690	482,791	333,899	20	34	-14
	Car Other	3,580,409	1,538,076	2,042,333	3,580,461	1,538,335	2,042,126	52	259	-207
	Total	4,879,563	2,318,656	2,560,907	4,879,667	2,319,023	2,560,644	104	367	-263
PM	Car Business	582,198	366,137	216,061	582,226	366,195	216,031	28	58	-30
	Car Commuting	2,215,359	1,064,488	1,150,871	2,215,397	1,064,547	1,150,850	38	59	-21
	Car Other	3,541,392	1,591,626	1,949,766	3,541,433	1,591,758	1,949,675	41	132	-91
	Total	6,338,949	3,022,251	3,316,698	6,339,056	3,022,500	3,316,556	107	249	-142
Do-Something										
AM	Car Business	555,300	345,432	209,868	555,360	345,522	209,838	60	90	-30
	Car Commuting	2,401,266	1,028,317	1,372,949	2,401,314	1,028,361	1,372,953	48	44	4
	Car Other	2,506,868	1,170,288	1,336,580	2,506,928	1,170,485	1,336,443	60	197	-137
	Total	5,463,434	2,544,037	2,919,397	5,463,602	2,544,368	2,919,234	168	331	-163
IP	Car Business	482,484	297,823	184,661	482,516	297,897	184,619	32	74	-42
	Car Commuting	816,670	482,757	333,913	816,690	482,791	333,899	20	34	-14
	Car Other	3,580,409	1,538,076	2,042,333	3,580,461	1,538,338	2,042,123	52	262	-210
	Total	4,879,563	2,318,656	2,560,907	4,879,667	2,319,026	2,560,641	104	370	-266
PM	Car Business	582,198	366,137	216,061	582,225	366,195	216,030	27	58	-31
	Car Commuting	2,215,359	1,064,488	1,150,871	2,215,402	1,064,552	1,150,850	43	64	-21
	Car Other	3,541,392	1,591,626	1,949,766	3,541,434	1,591,762	1,949,672	42	136	-94
	Total	6,338,949	3,022,251	3,316,698	6,339,061	3,022,509	3,316,552	112	258	-146

Time Period	User Class	Reference - 2047			Post VDM - 2047			Difference		
		Grand Total	Intra Zonal	Inter Zonal	Grand Total	Intra Zonal	Inter Zonal	Grand Total	Intra Zonal	Inter Zonal
Do-Minimum										
AM	Car Business	573,581	356,662	216,919	573,639	356,748	216,891	58	86	-28
	Car Commuting	2,476,765	1,059,696	1,417,069	2,476,769	1,059,684	1,417,085	4	-12	16
	Car Other	2,600,758	1,214,508	1,386,250	2,600,824	1,214,701	1,386,123	66	193	-127
	Total	5,651,104	2,630,866	3,020,238	5,651,232	2,631,133	3,020,099	128	267	-139
IP	Car Business	497,477	307,019	190,458	497,511	307,098	190,413	34	79	-45
	Car Commuting	839,126	495,888	343,238	839,145	495,922	343,223	19	34	-15
	Car Other	3,707,920	1,593,155	2,114,765	3,707,980	1,593,436	2,114,544	60	281	-221
	Total	5,044,523	2,396,062	2,648,461	5,044,636	2,396,456	2,648,180	113	394	-281
PM	Car Business	600,611	377,625	222,986	600,636	377,681	222,955	25	56	-31
	Car Commuting	2,278,448	1,094,177	1,184,271	2,278,458	1,094,208	1,184,250	10	31	-21
	Car Other	3,664,075	1,646,672	2,017,403	3,664,122	1,646,808	2,017,314	47	136	-89
	Total	6,543,134	3,118,474	3,424,660	6,543,216	3,118,697	3,424,519	82	223	-141
Do-Something										
AM	Car Business	573,581	356,662	216,919	573,639	356,748	216,891	58	86	-28
	Car Commuting	2,476,765	1,059,696	1,417,069	2,476,774	1,059,689	1,417,085	9	-7	16
	Car Other	2,600,758	1,214,508	1,386,250	2,600,824	1,214,700	1,386,124	66	192	-126
	Total	5,651,104	2,630,866	3,020,238	5,651,237	2,631,137	3,020,100	133	271	-138
IP	Car Business	497,477	307,019	190,458	497,512	307,099	190,413	35	80	-45
	Car Commuting	839,126	495,888	343,238	839,146	495,923	343,223	20	35	-15
	Car Other	3,707,920	1,593,155	2,114,765	3,707,980	1,593,439	2,114,541	60	284	-224
	Total	5,044,523	2,396,062	2,648,461	5,044,638	2,396,461	2,648,177	115	399	-284
PM	Car Business	600,611	377,625	222,986	600,635	377,681	222,954	24	56	-32
	Car Commuting	2,278,448	1,094,177	1,184,271	2,278,466	1,094,216	1,184,250	18	39	-21
	Car Other	3,664,075	1,646,672	2,017,403	3,664,122	1,646,811	2,017,311	47	139	-92
	Total	6,543,134	3,118,474	3,424,660	6,543,223	3,118,708	3,424,515	89	234	-145

Appendix C Flow difference plots

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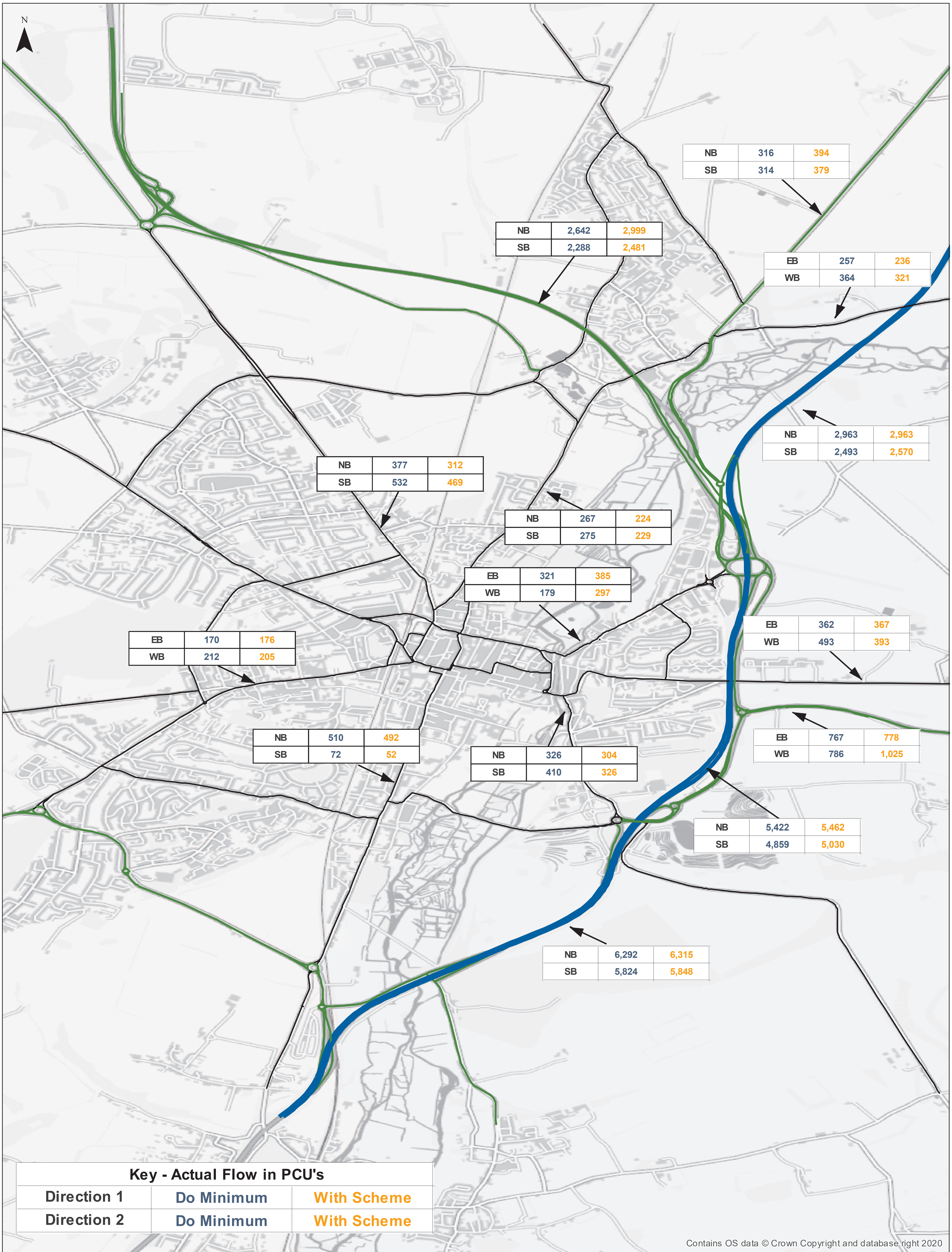


Key - Actual Flow in PCU's		
Direction 1	Do Minimum	With Scheme
Direction 2	Do Minimum	With Scheme

Stantec

Client: VolkerFitzpatrick

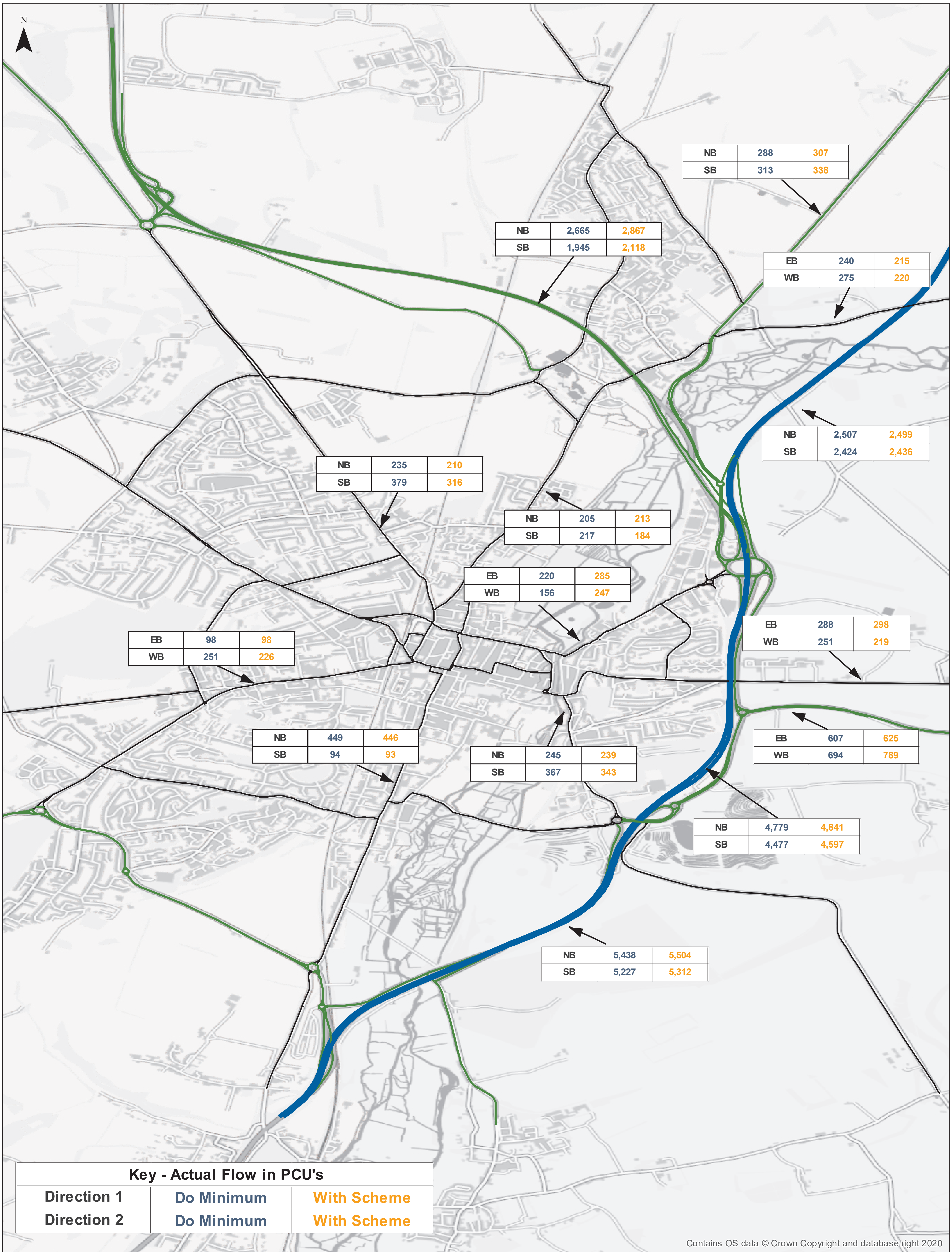
M3 JUNCTION 9

Actual Flow 2027 AM Peak Hour

0 250 500 m

1:30,172 @ A3	Date: 06/06/2023
Drawn: NT	Checked: RD
Figure 01	Rev B

Document Path: \\Cbh-vfil-001\cbh\Projects\48176 M3 Junction 9\5000 - Transport\COBA-LT\COBA-LT prepare\05022021 Updated Cobalt\GIS\2027_IP.mxd



Stantec

Client: VolkerFitzpatrick

M3 JUNCTION 9

Actual Flow 2027 Inter Peak Average Hour

0 250 500 m

1:30,172 @ A3	Date: 06/06/2023
Drawn: NT	Checked: RD
Figure 02	Rev B

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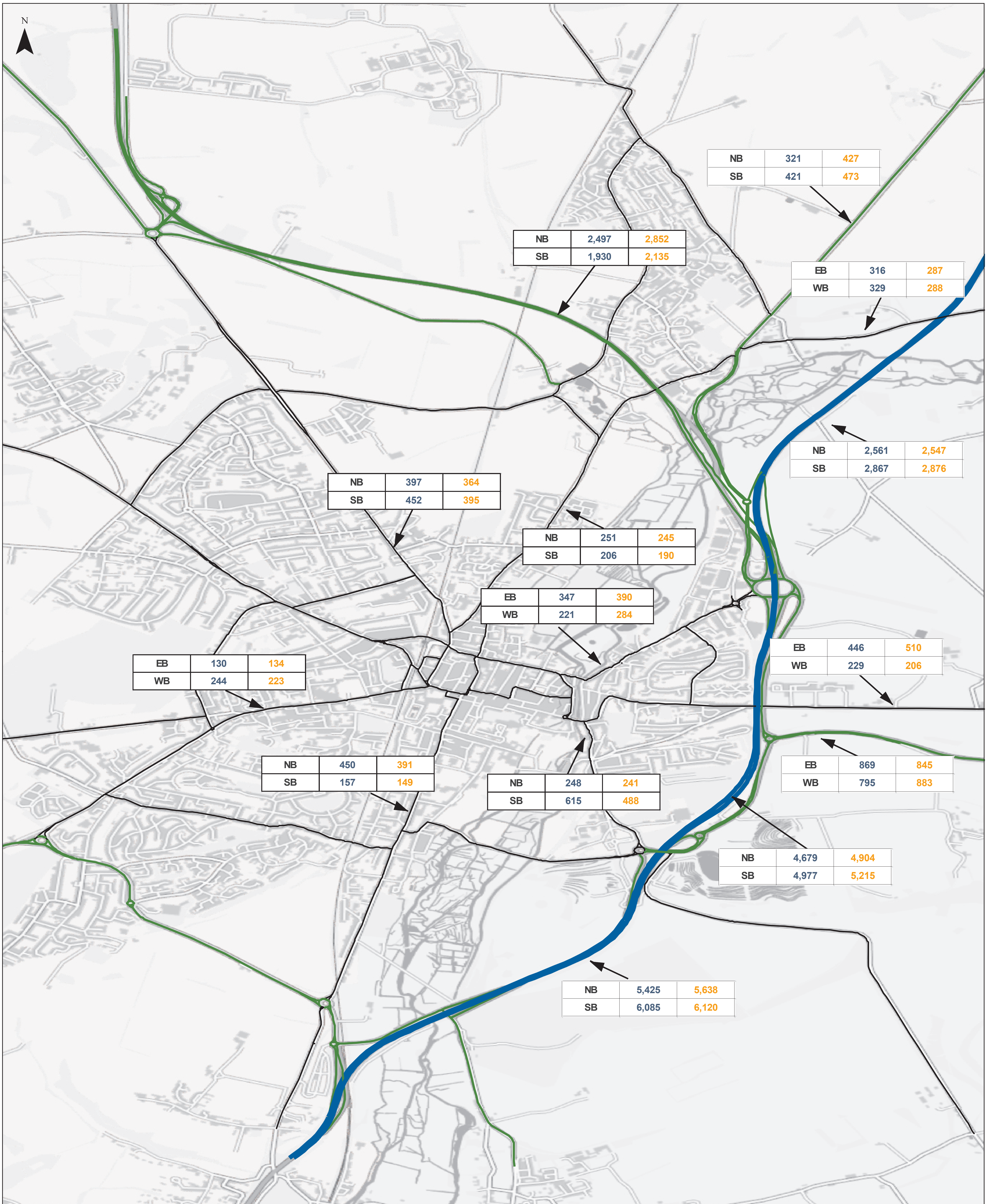

Key - Actual Flow in PCU's		
Direction 1	Do Minimum	With Scheme
Direction 2	Do Minimum	With Scheme

Stantec	Client: VolkerFitzpatrick	M3 JUNCTION 9 Actual Flow 2027 PM Peak Hour	0 250 500 m	1:30,172 @ A3	Date: 06/06/2023
				Drawn: NT	Checked: RD
				Figure 03	Rev B

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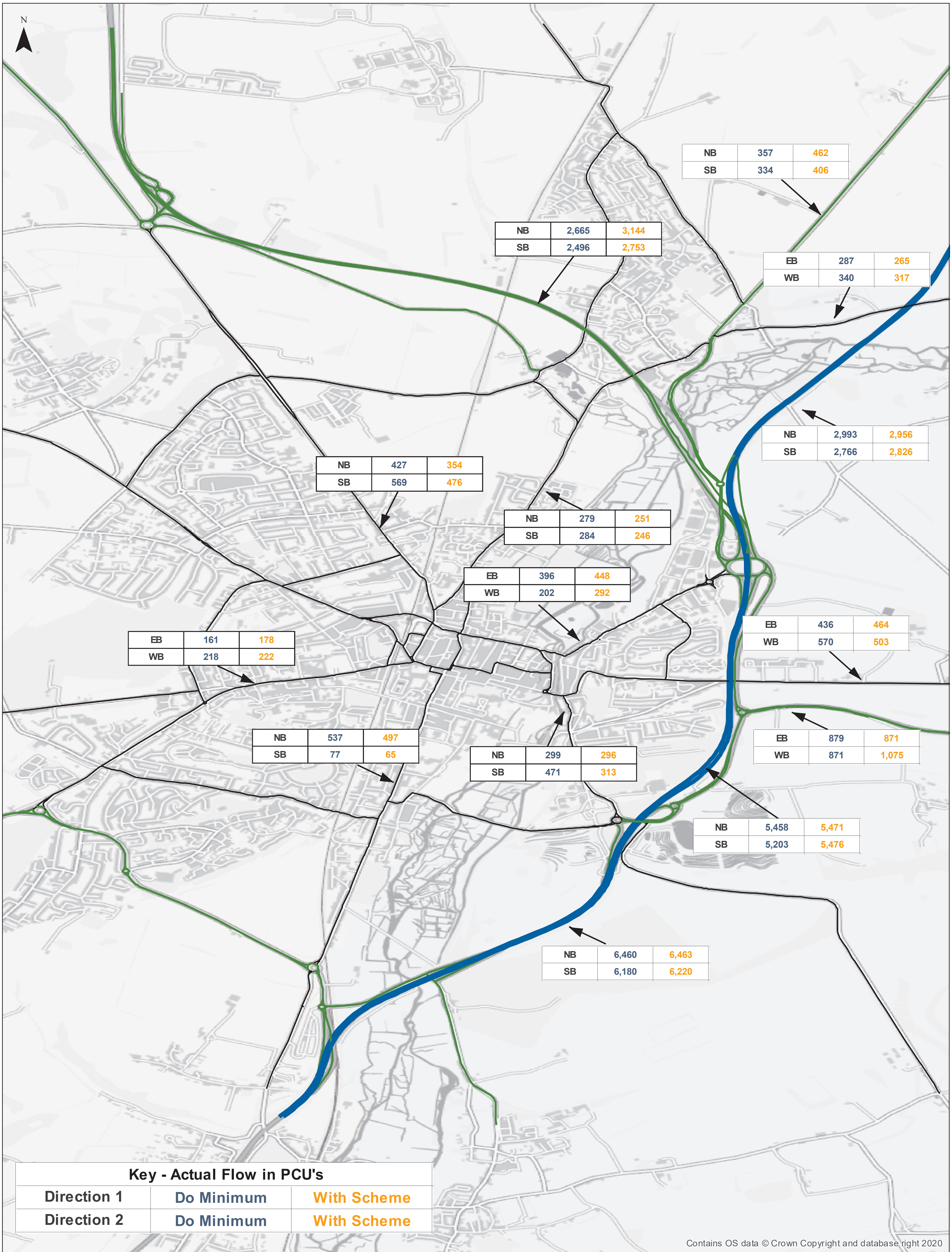

Stantec	Client: VolkerFitzpatrick	**M3 JUNCTION 9** Actual Flow 2042 AM Peak Hour	0 250 500 m	1:30,172 @ A3 / Date: 06/06/2023 Drawn: NT / Checked: RD Figure 04 / Rev B

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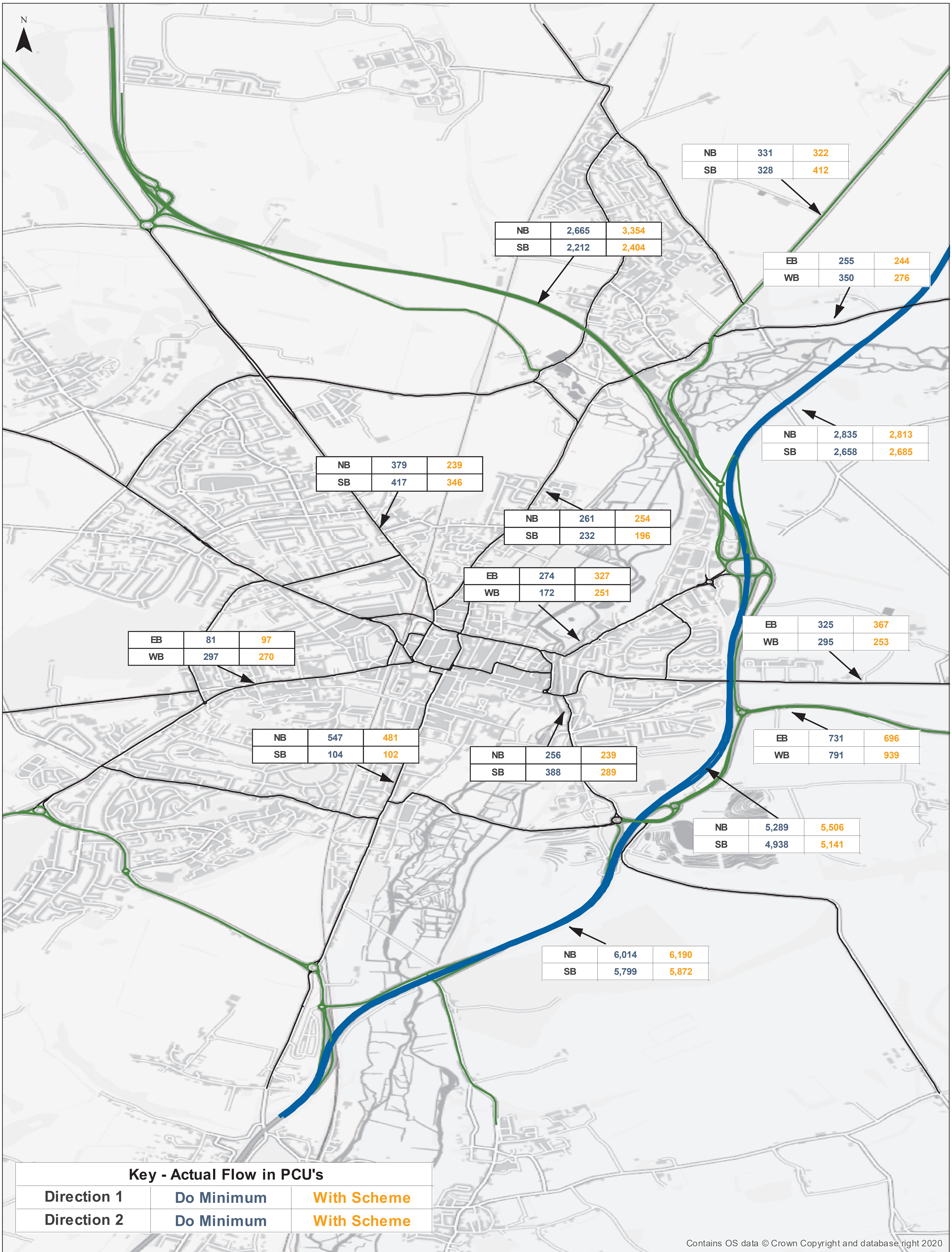

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				Figure 05	Rev B

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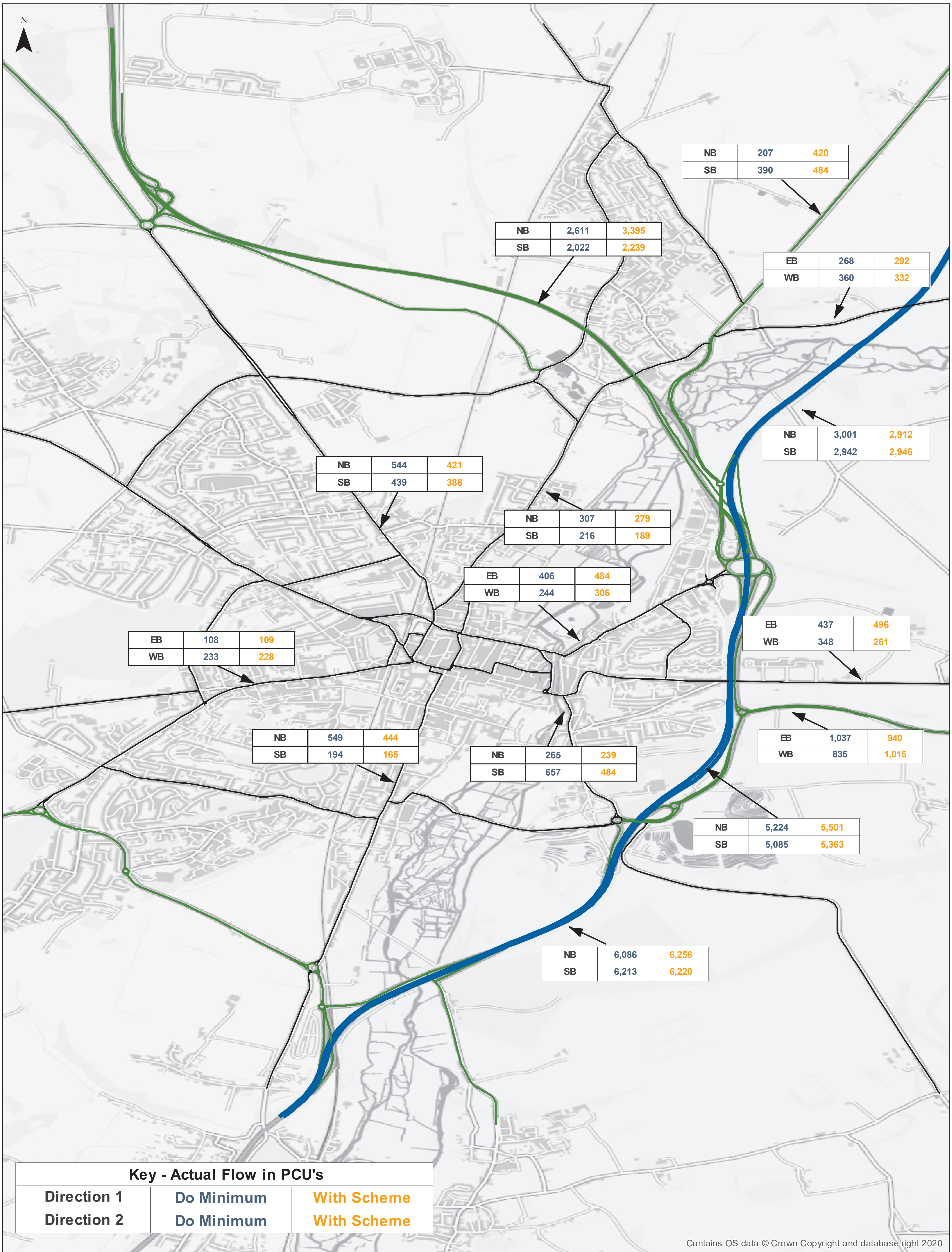
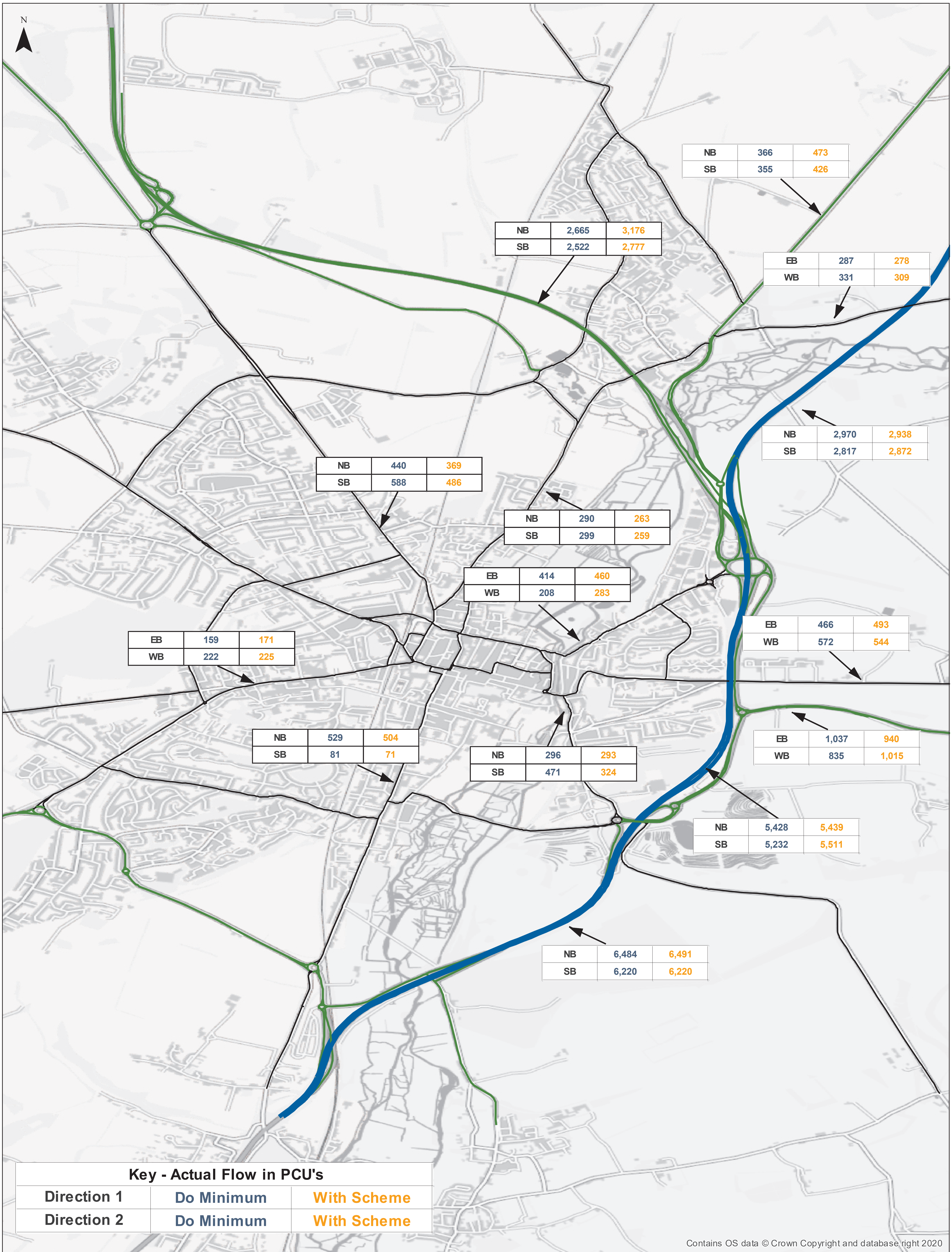


Stantec	Client: VolkerFitzpatrick	**M3 JUNCTION 9** Actual Flow 2042 PM Peak Hour	0 250 500 m	1:30,172 @ A3 / Date: 06/06/2023 Drawn: NT / Checked: RD Figure 06 / Rev B

Document Path: J:\48176 M3 Junction 9\5000 - Transport\COBA-LT\COBA-LT prepare\05022021 Updated Cobalt\GIS\2047_AM.mxd



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				Drawn: NT	Checked: RD
				Figure 07	Rev B

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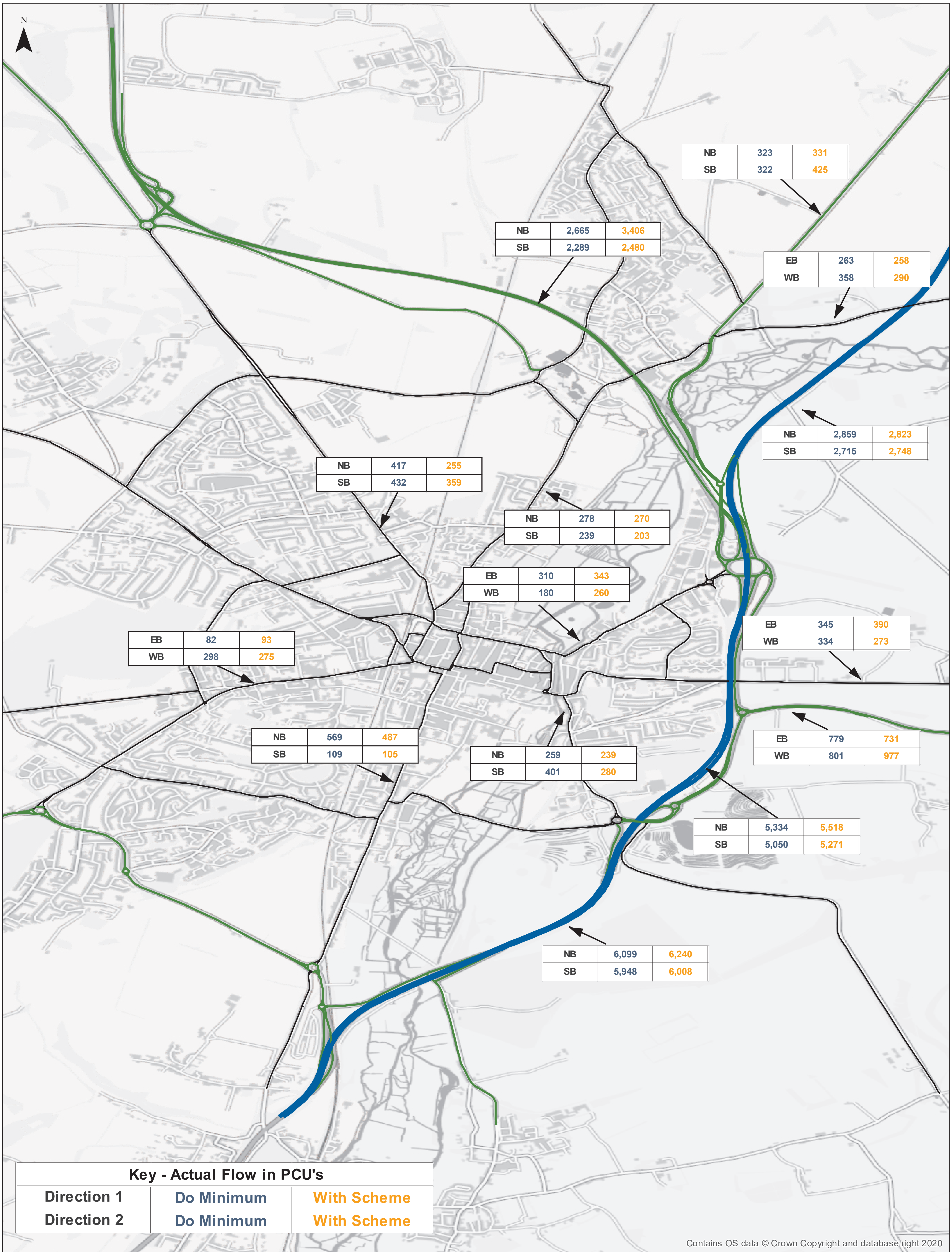


Stantec | Client: VolkerFitzpatrick

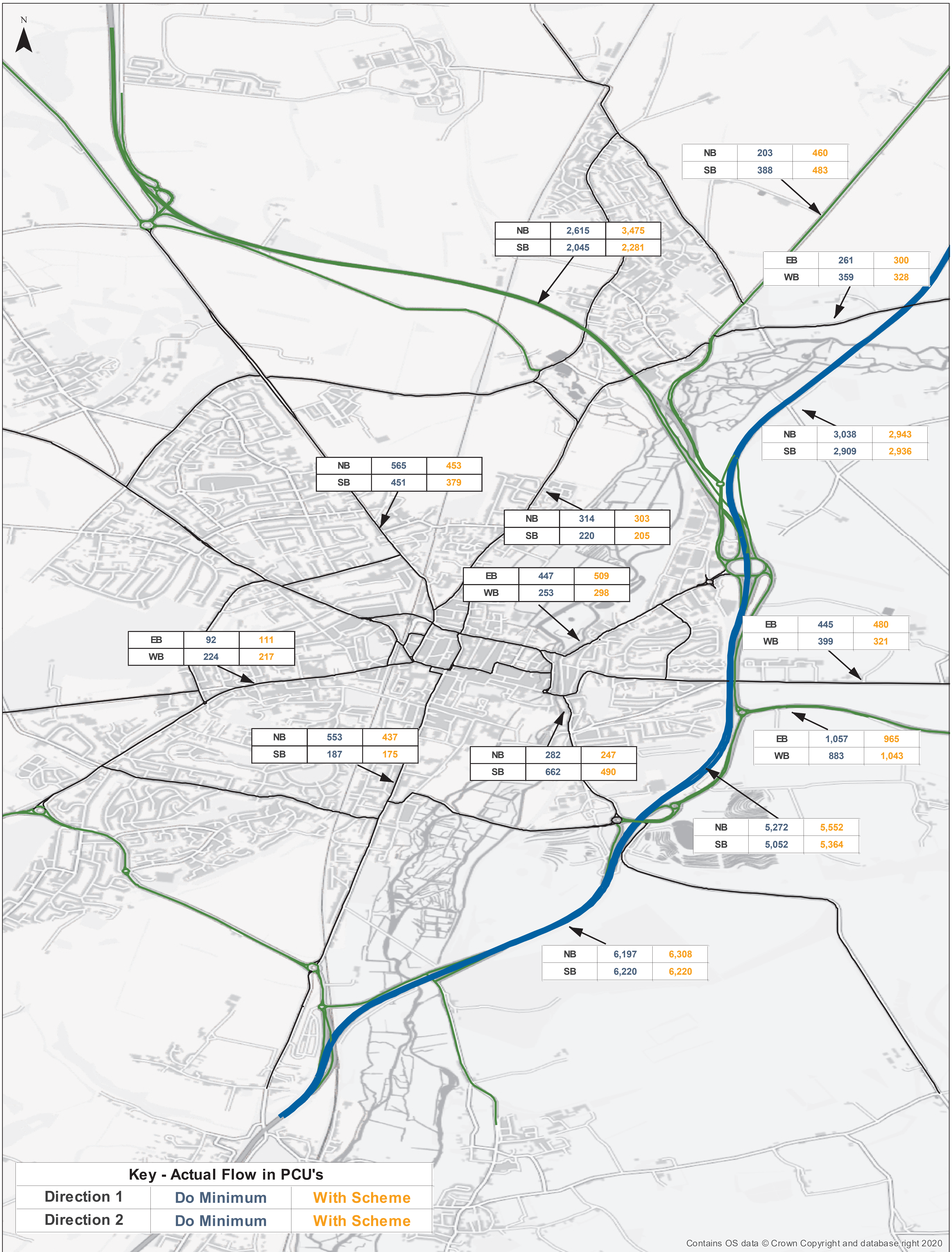
M3 JUNCTION 9

Actual Flow 2047 Inter Peak Average Hour

0 250 500 m

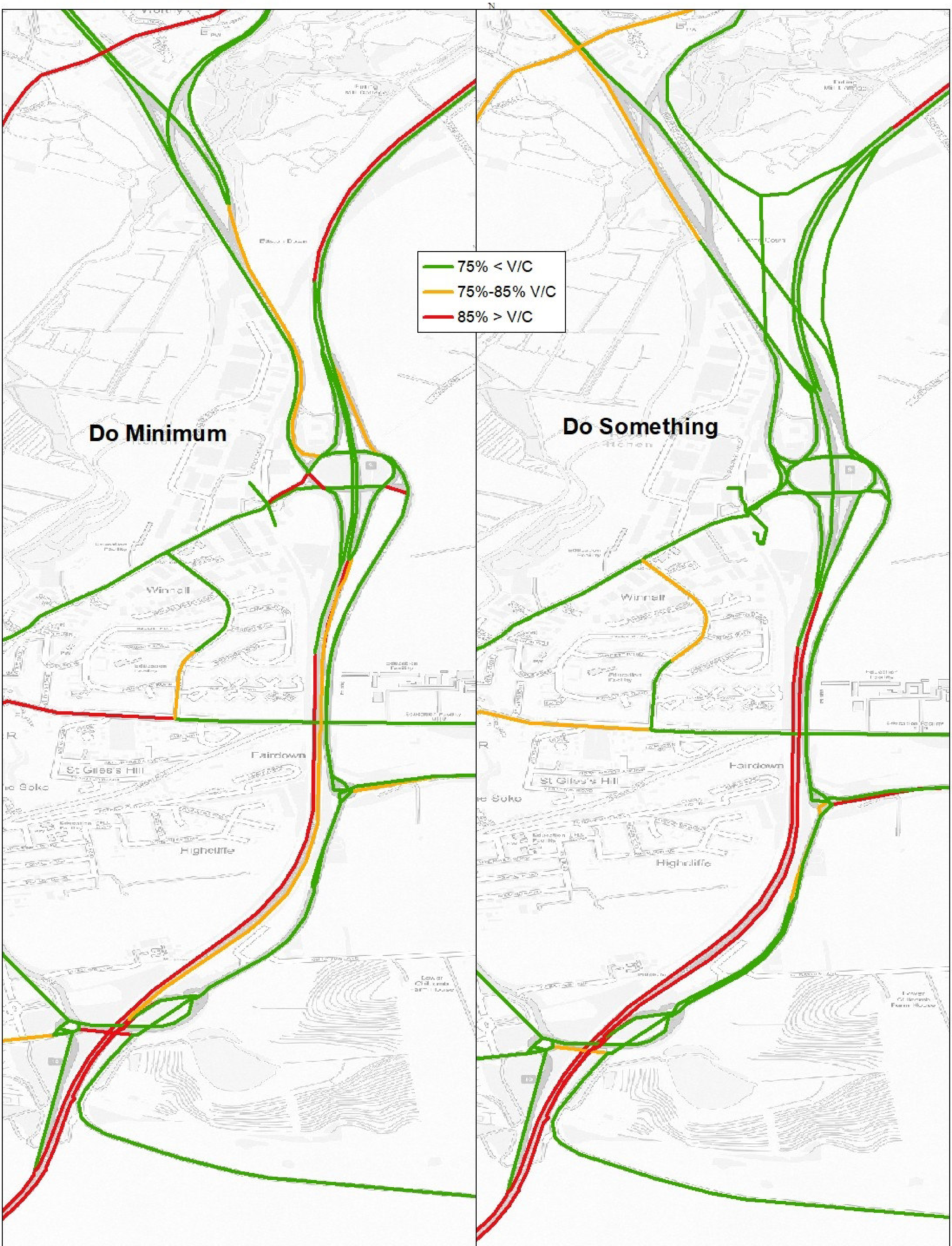
1:30,172 @ A3	Date: 06/06/2023
Drawn: NT	Checked: RD
Figure 08	Rev B

Document Path: J:\48176 M3 Junction 9\5000 - Transport\COBA-LT\COBA-LT prepare\05022021 Updated Cobalt\GIS\2047_PM.mxd

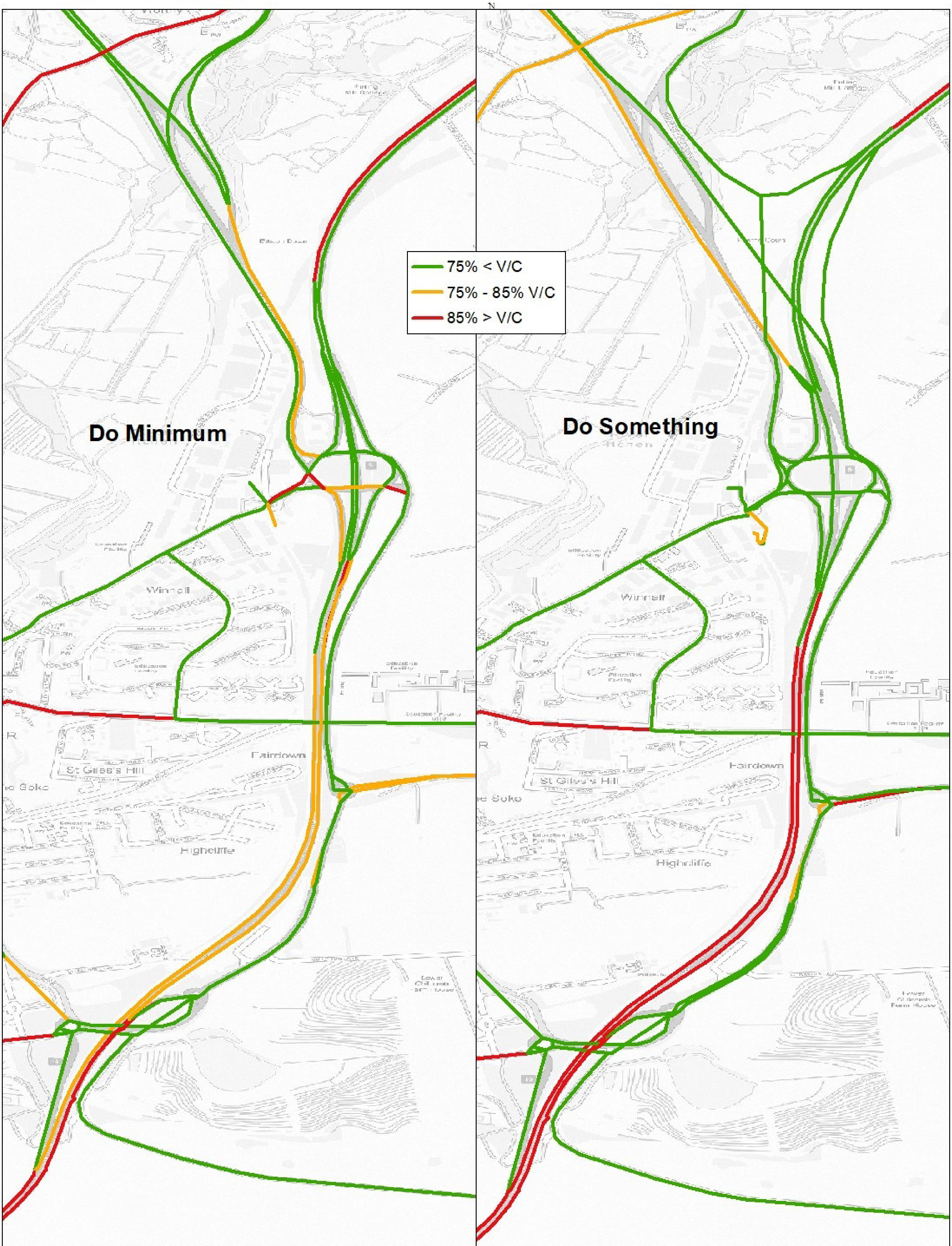


Stantec	Client VolkerFitzpatrick	M3 JUNCTION 9 Actual Flow 2047 PM Peak Hour	0 250 500 m	1:30,172 @ A3	Date: 06/06/2023
				Drawn: NT	Checked: RD
				Figure 09	Rev B

Appendix D Volume capacity ratio plots



Stantec	Client: VolkerFitzpatrick	M3 JUNCTION 9 Link Volume to Capacity Ratio 2042 AM		1:13,471 @ A3	Date: 24/06/2022
				Drawn: NT	Checked: RD
				Figure 07	Rev A



Stantec

Client: VolkerFitzpatrick

M3 JUNCTION 9

Link Volume to Capacity Ratio 2042 PM

1:13,471 @ A3	Date: 24/06/2022
Drawn: NT	Checked: RD
Figure 07	Rev A

Appendix E Construction traffic management assessment

TECHNICAL NOTE

Job Name:	**M3 Junction 9 Improvement Scheme**
Job No:	**48176**
Note No:	**HE551511-VFK-GEN-X_XXXX_XX-TN-TT-0008**
Date:	**01/09/2022**
Prepared By:	**Grant Paterson & Robert Dziurla**
Subject:	**Construction Traffic Management Assessment**

1 Introduction

1.1 Overview

This Technical Note presents the operational assessment of the M3 Junction 9 Improvement Scheme Construction Traffic Management (CTM) phasing arrangements.

Traffic modelling was undertaken to assess CTM impacts and provide data for the Scheme economic appraisal and environmental noise/air quality impact assessment.

In accordance with DfT appraisal guidance, construction traffic management impacts were assessed and input into the TUBA (Transport User Benefits & Appraisal) software[1] and are included in the scheme benefits.

1.2 Microsimulation Traffic Modelling

The CTM traffic modelling assessment was undertaken using the M3 Junction 9 operational (VISSIM[2]) microsimulation model. Further details of the operational model can be found in the M3 Junction 9 Improvement Scheme PCF Stage 2 – Operational Model Local Model Validation Report (HE551511-WSP-GEN-M3J9PCF2-RP-TR00029-P02).

The 2027 Do-Minimum forecast scenario was used as the basis to assess each of the CTM phases. Further details of the Do-Minimum scenario can be found in the Transport Forecast Package Report (ref. HE551511-VFK-GEN-X_XXXX_XX-RP-TR-0003).

Due to the change in network operation relative to the Do-Minimum, all CTM phase scenario models were ‘converged’ in VISSIM to update trip assignment paths through the network.

The microsimulation modelling provides junction performance statistics including traffic flows,delays, average and maximum queuing, and journey times.

Model outputs were extracted from an average of 10 assignments, to represent variation in driver behaviour.

[1] https://www.gov.uk/government/publications/tuba-downloads-and-user-manuals
[2] [redacted]

1.3 CTM Phasing

Stantec were provided with CTM phasing details for the Scheme as reported in the Traffic Management Plan (HE551511-VFK-TTM-X-XXXX-XX-PL-WM). Each phase of CTM is summarised below.

Phase 1a

Lane narrowing and speed restrictions on the M3 mainline with limited traffic impacts and not included in assessment.

Phase 1b

Revised M3 southbound off-ramp. Gyratory and A34 approach reduced to 2 lanes. 3 lanes retained on M3 northbound off-slip and Easton Lane approaches. Signal-control in operation on all gyratory approaches, including the A272 which is not signal-controlled in the current arrangement. Modification to southbound M3 on-ramp, with slight impact on general traffic arrangement.

Phase 2a

M3 northbound and southbound mainline displaced with contraflow operation. This was tested with both 40mph and 50mph operation. Gyratory, A34 and M3 northbound off-slip approaches reduced to 2 lanes. 3 lanes retained on Easton Lane approach. Signal-control in operation on all gyratory approaches. M3 northbound on-ramp from gyratory closed with diversion, which was not modelled as this extends outside the operational model noting the associated traffic flow is relatively slight.

Phase 3a

Revised gyratory setup to cross over new bridges. Gyratory and all approaches with 2 lanes. Signal-control in operation on all approaches including A272. New access for A33/A34 to M3 northbound and temporary diverted southbound route to Junction 9 gyratory including reduced speed limit. M3 northbound on-ramp from gyratory closed.

Phase 3b

Revised gyratory setup to cross over new bridges. Gyratory and all approaches with 2 lanes except A33 which has 1 lane. Signal-control in operation on all approaches except the A272. New access for A33/A34 to M3 northbound. Revised lane allocation on A272 gyratory approach. New northbound link from M3 to A33/A34. New southbound link from A33/A34 to M3 and gyratory.

Phase 3b with gyratory signal-control removed

As per Phase 3b, with signal-control removed from the gyratory replaced by give-ways on all approaches. This test was undertaken following analysis of the Phase 3b impacts which indicated that it may be possible to remove the signal-control and maintain good operational performance.

1.4 Signal Control Optimisation

Adjustments were made to the signal-control timings to optimise network performance in each CTM phase. TRANSYT[3] models were prepared for each CTM phase which were used to determine signal stage times and junction offset times in the VISSIM models for optimum network performance. The TRANSYT models included the following inputs:

- staging, initial timings, and inter-greens from Do-Minimum scenario;
- traffic flows from operational model for relevant CTM phase scenarios; and
- road geometries from CTM phase drawings.

2 Traffic Model Assessment

2.1 Overview

This section summarises the operational impact of each CTM phase based on the VISSIM model indicators including; journey times, gyratory network statistics, and relative delay heatmaps.

The traffic model assessment was undertaken in phase order, where Phase 1b was compared with the Do-Minimum, Phase 2 with Phase 1b etc.

2.2 Model Analysis

Journey Times

Figure 2.1 illustrates the routes for which journey times were extracted to provide an indication of network performance in each CTM phase.

[redacted]

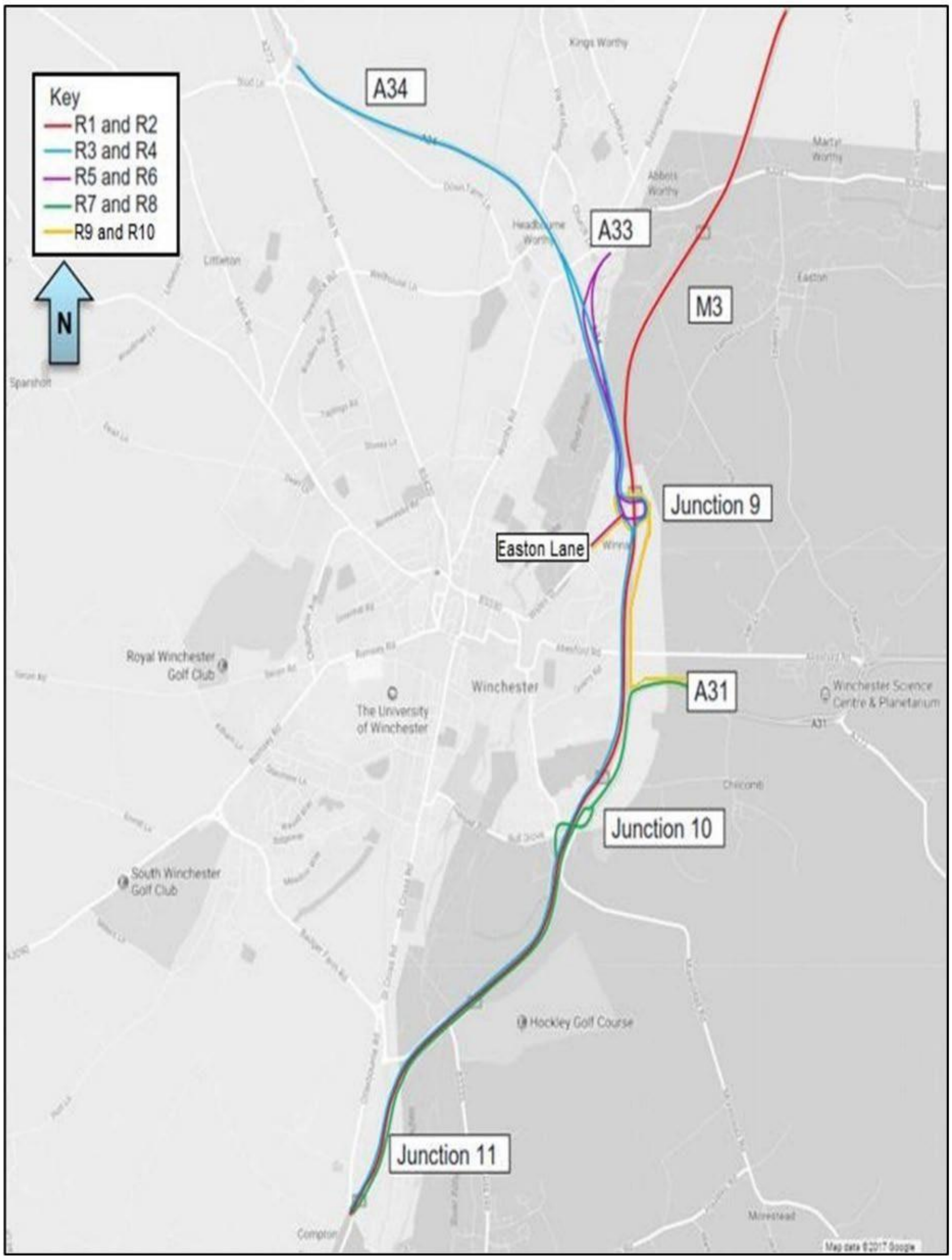


Figure 2.1: Journey Time Routes

Phase 3b provides direct access from the A34/A33 to the M3, as such amended journey time routes (R3a, R4a) were via the M3 underpass.

Figure 2.2 and Figure 2.3 present a summary of modelled journey times on each route in the Do-Minimum and each CTM phase for the AM and PM peaks, respectively. Tabulated journey time analysis is provided in Annex A.

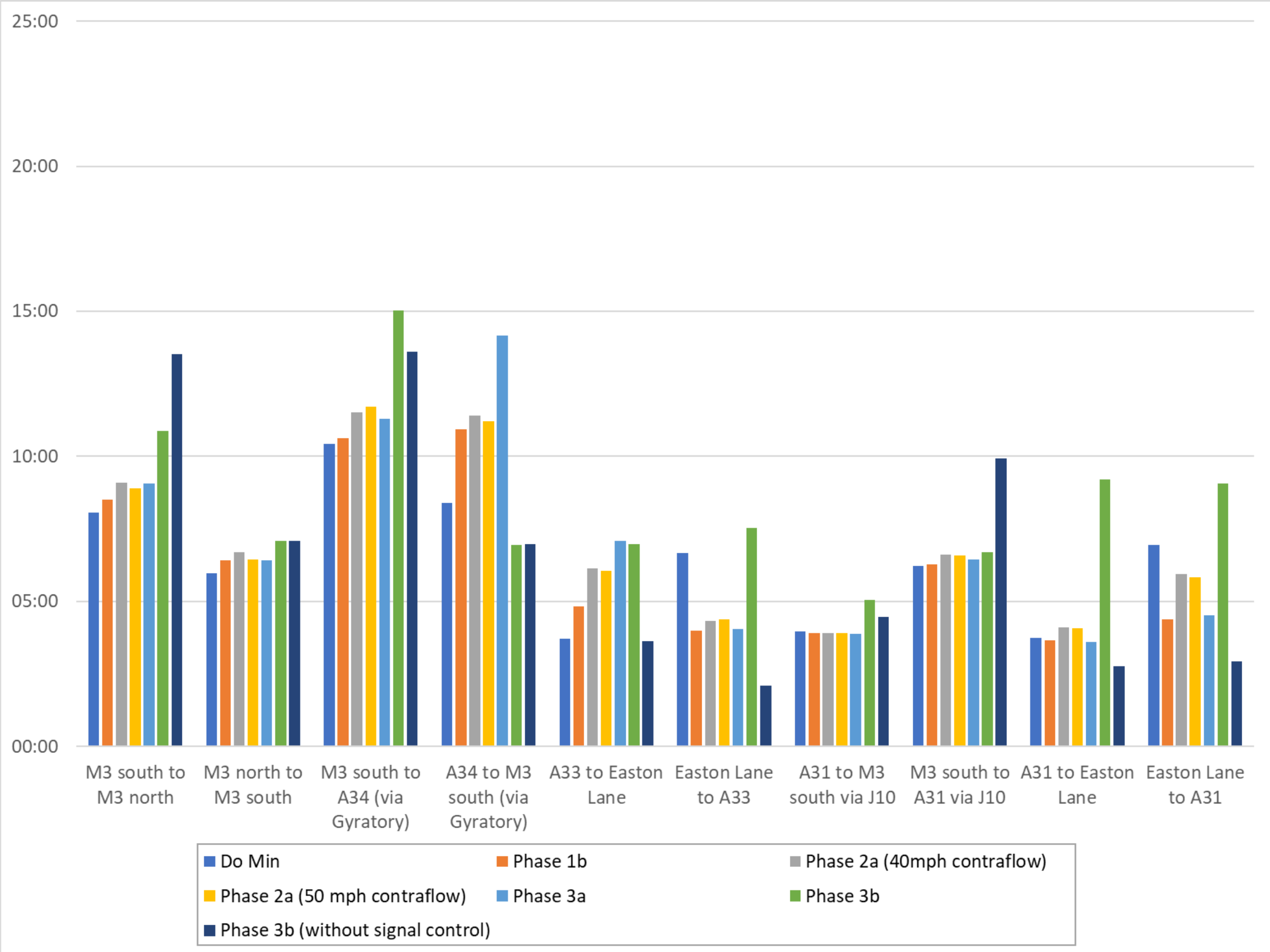


Figure 2.2: AM Peak Hour Modelled Journey Times (mm:ss)

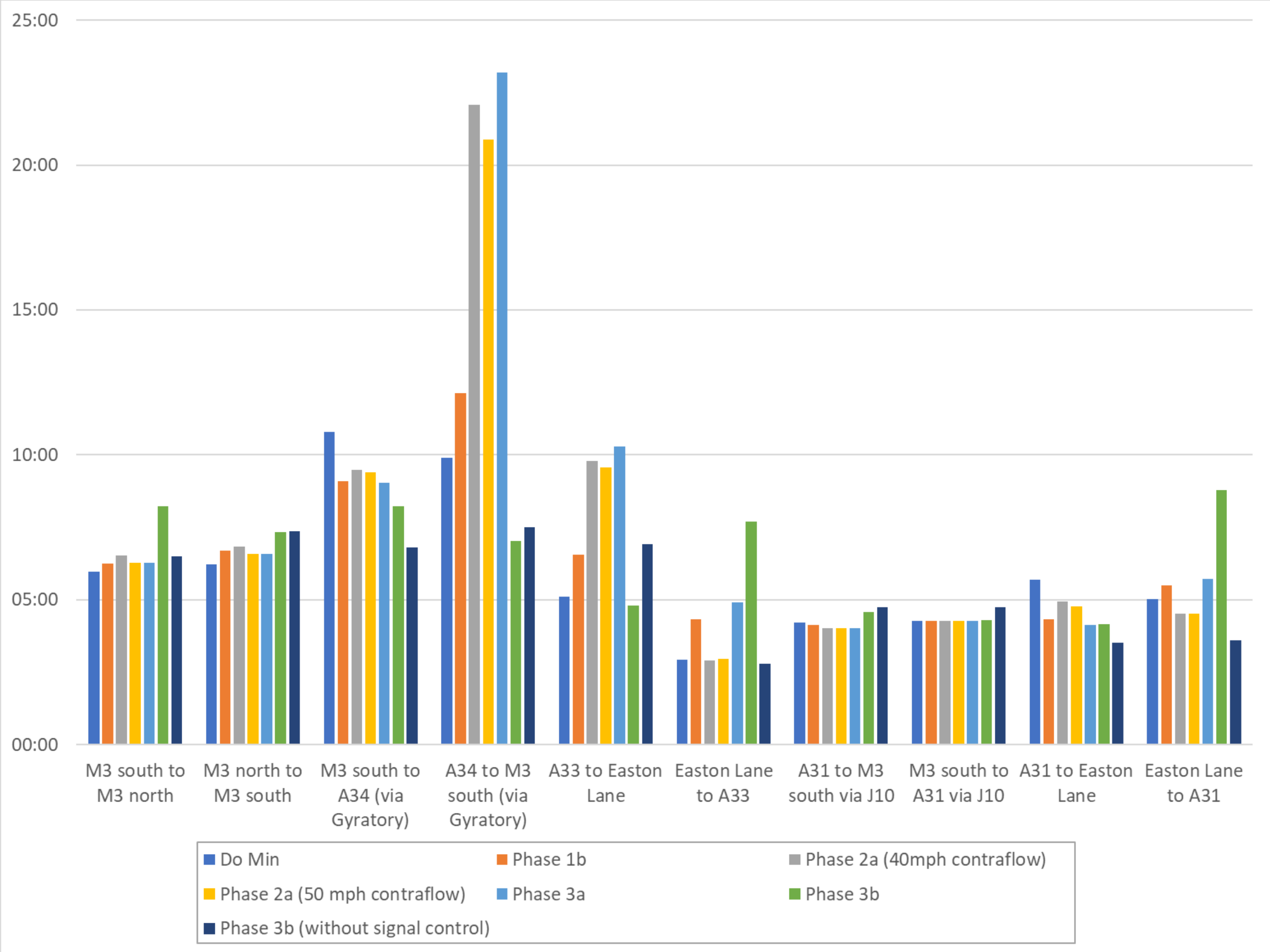


Figure 2.3: PM Peak Hour Modelled Journey Times (mm:ss)

Gyratory Network Statistics

Each CTM phase was analysed using a set of gyratory network statistics, presented in Annex B, which were defined to determine the impact of each scenario on the transport network in a consistent manner. These statistics present the change in traffic flow, delays and queues and provide a high-level overview of the performance of the network in each of the scenarios.

Queues in VISSIM are measured from the upstream position of where a queue starts to form, to the last vehicle that has entered the queue conditions. For the purpose of this study, a queue has been defined with the following parameters:

- Begin speed, i.e. the first vehicle in the queue, is less than 5 km/hr;
- End speed, i.e. the last vehicle in the queue, is greater than 10 km/hr;
- Maximum gap between vehicles considered to be in a queue is 20 metres; and
- Maximum length back from a model queue collection point is 5,000 metres.

Figure 2.4 and Figure 2.5 present a summary of modelled *average queues* on each gyratory approach in the Do-Minimum and each CTM phase for the AM and PM peaks, respectively.

Figure 2.6 and Figure 2.7 present a summary of modelled *delays* on each gyratory approach in the Do-Minimum and each CTM phase for the AM and PM peaks, respectively.

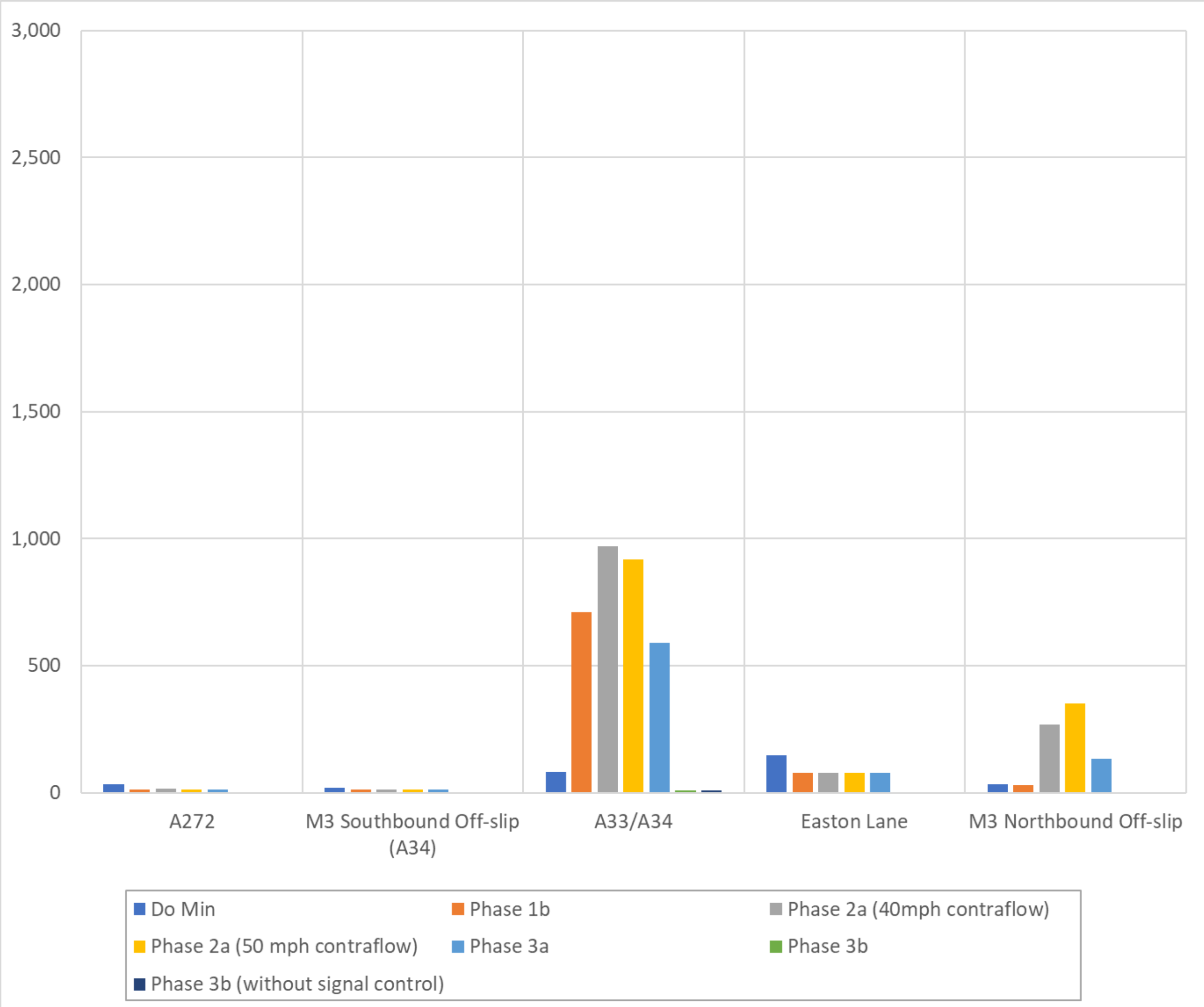


Figure 2.4: AM Peak Hour Modelled Average Queues (metres)

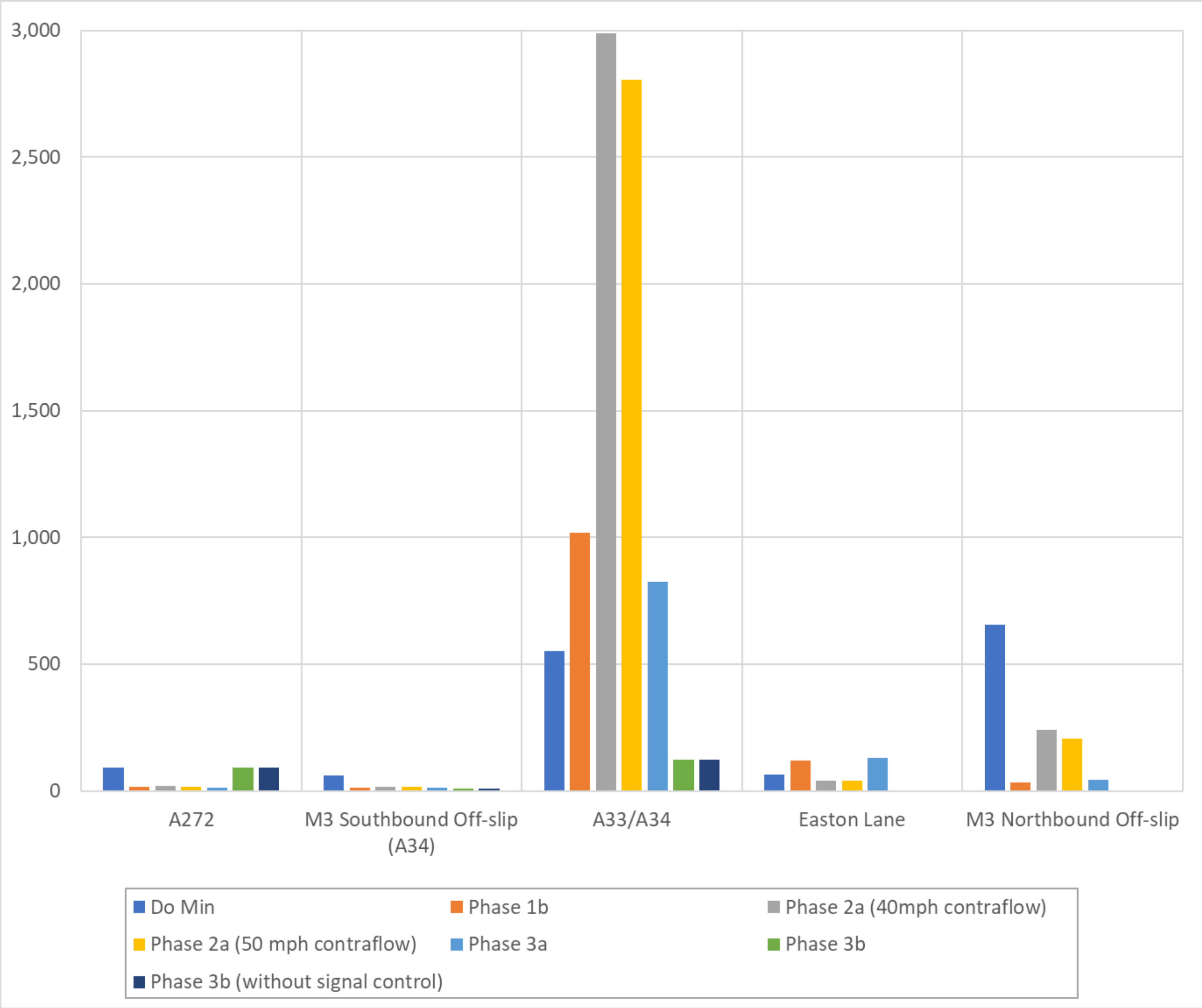


Figure 2.5: PM Peak Hour Modelled Average Queues (metres)

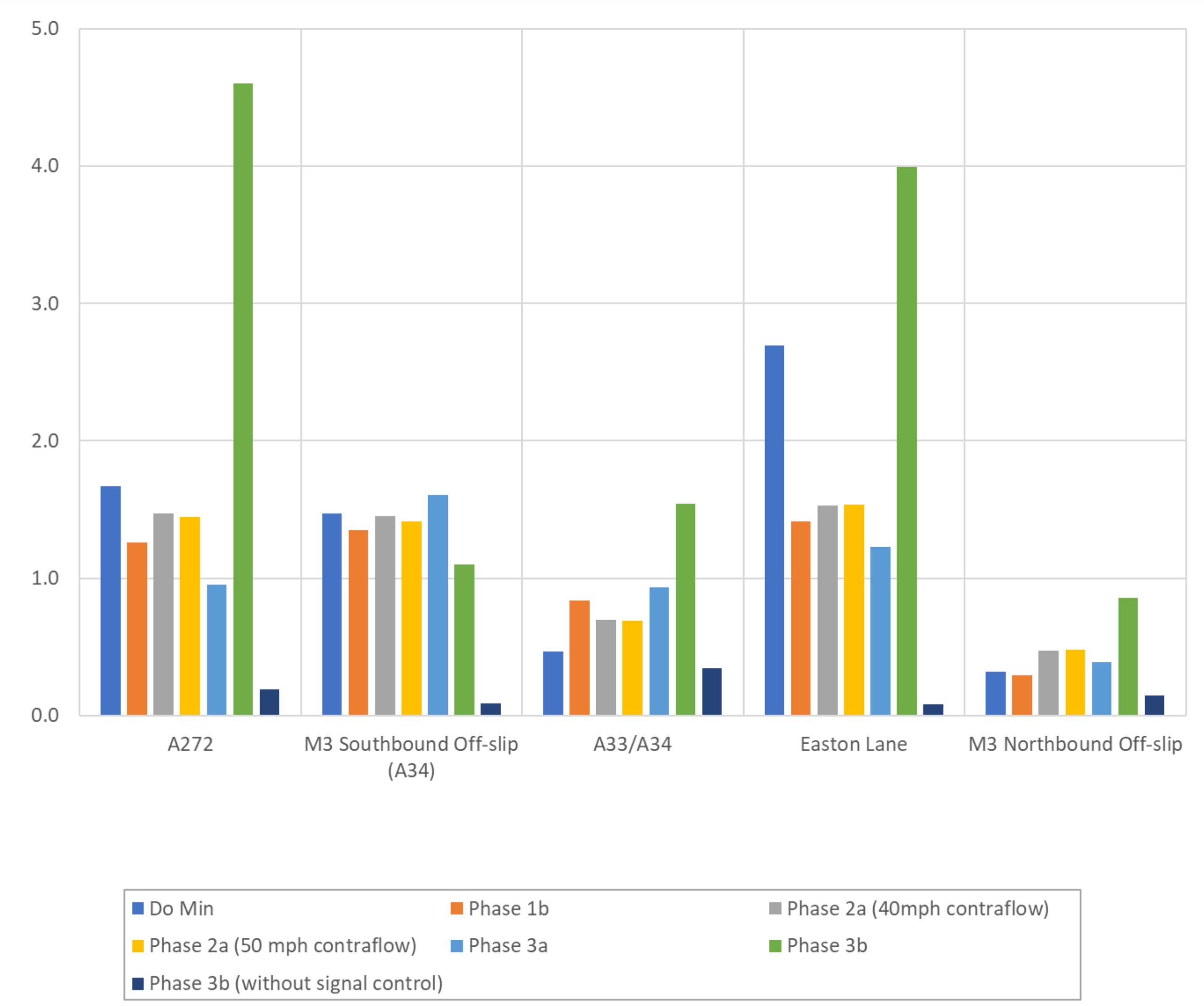


Figure 2.6: AM Peak Hour Modelled Delays (minutes)

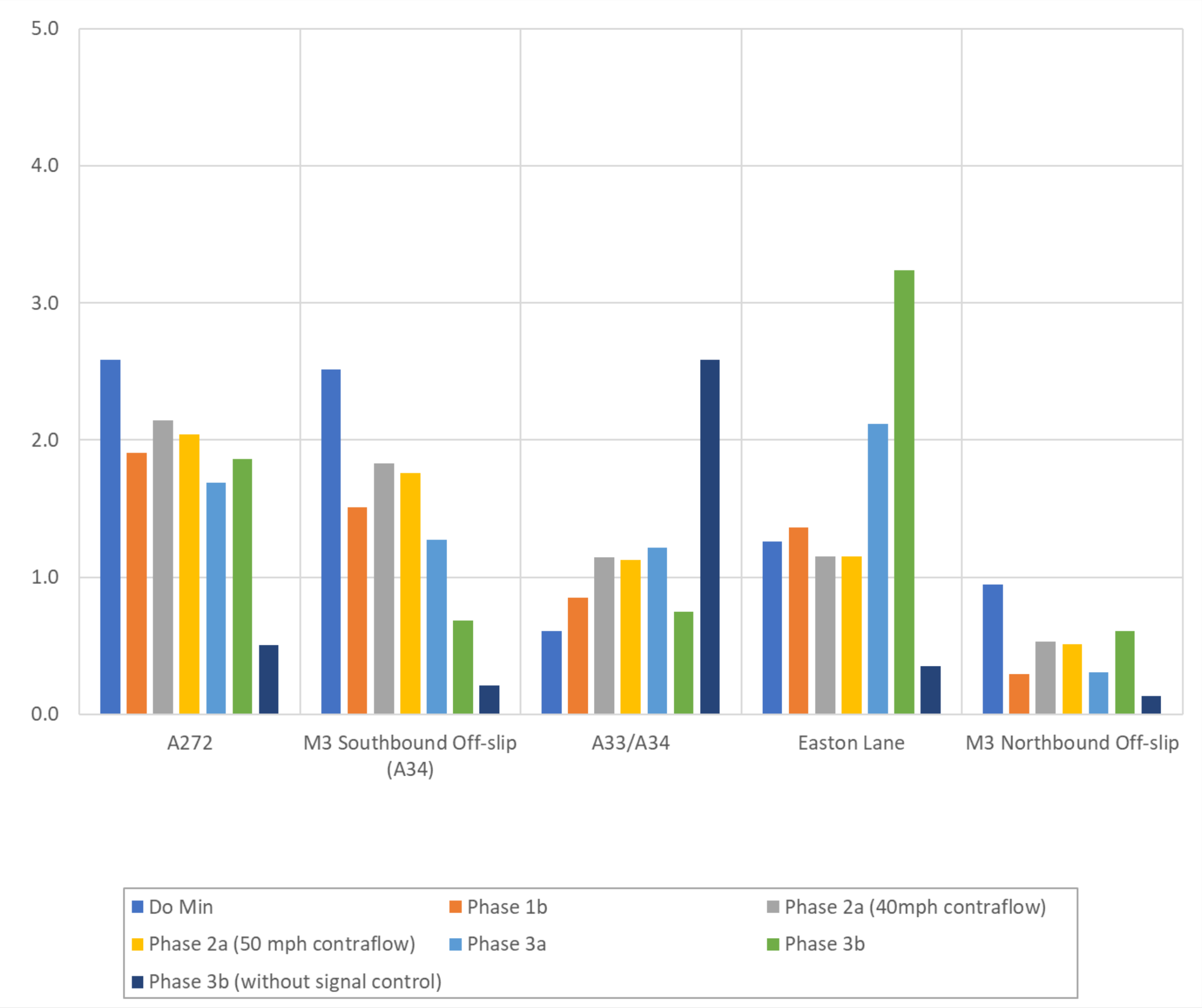


Figure 2.7: PM Peak Hour Modelled Delays (minutes)

Relative Delay Heatmaps

Annex B includes a series of model network heatmaps which show the relative delay of each CTM phase and the 2027 Do-Minimum forecast scenario for comparison. The visualisations illustrate delay as a percentage of total travel time with areas highlighted in red showing the most significant predictions of delay.

2.3 Phase 1b Impacts

In general, the introduction of signal control on the A272 gyratory approach and signal control optimisation mitigates the impact of the reduction in capacity on the gyratory. However, there were predicted moderate increases in journey times relative to the Do-Minimum particularly on the A33 and A34 southbound routes.

Phase 1b versus Do-Minimum Journey Times Summary

Journey Time Route	AM Peak		PM Peak	
	Northbound	Southbound	Northbound	Southbound
M3 mainline (R1/R2)	⇔	⇔	⇔	⇔
M3 (S) to/from A34 (R3/R4)	⇔	↑↑	↓↓	↑↑
Easton Lane to/from A33 (R6/R5)	↓↓	↑↑	↑↑	↑↑
M3 (S) to/from A31 (via J10) (R8/R7)	⇔	⇔	⇔	⇔
A31 to/from Easton Lane (R9/R10)	⇔	↓↓	↓↓	⇔

Key:
⇔ negligible impact on journey times
↑ minor increase ↑↑ moderate increase ↑↑↑ major increase
↓ minor decrease ↓↓ moderate decrease ↓↓↓ major decrease
(minor >=30 seconds or >=15%, moderate >=1 minute or >=25%, major >=5 minutes or >=50%)

Inspection of the gyratory network statistics and relative delay heatmaps indicated the following key points:

- Relatively minor impacts on most approaches.
- Signal control optimisation benefits indicated by reduction in total delays at gyratory in both time periods.
- Increase in queues and delays on the A33/A34 approach in the AM and PM peaks.
- Queuing on the A272 and M3 northbound off-slip approaches in the PM peak decreases, where changes to the gyratory layout and signal control timings altered the network operation.

2.4 Phase 2a Impacts

Two variants of Phase 2a were modelled with 40mph and 50mph speed limits on the M3 mainline contraflow.

Minor journey times impacts were predicted on most of the routes in the AM Peak, relative to Phase 1b, with some moderate increases on routes to/from Easton Lane. This was primarily due to the closure of the gyratory M3 northbound on-ramp and removal of associated traffic using this link.

In the PM Peak, a major increase in journey times on the A33/A34 southbound was predicted, due to reduced capacity on the gyratory and where changes to signal control timings were applied to balance overall network performance. Further testing of signal control timings was undertaken to try to reduce impacts on the A33/A34 southbound. However, this was countered by resultant negative impacts on other approaches such as the A272. It is recommended that further analysis of the signal control settings for this phase is undertaken prior to implementation, potentially including on-the-ground adjustments relative to real traffic flows noting that the traffic modelling does not include any potential reduction of traffic flows such as diversionary effects.

In general, the journey time analysis showed no significant differences (when comparing the differences in contraflow speeds) in terms of having a higher contraflow speed where the operation of the gyratory was the constraining factor on overall network performance.

Phase 2a (40mph Contraflow) versus Phase 1b Journey Times Summary

Journey Time Route	AM Peak		PM Peak	
	Northbound	Southbound	Northbound	Southbound
M3 mainline (R1/R2)	↑	⇔	⇔	⇔
M3 (S) to/from A34 (R3/R4)	↑	⇔	⇔	↑↑↑
Easton Lane to/from A33 (R6/R5)	⇔	↑↑	↓↓	↑↑
M3 (S) to/from A31 (via J10) (R8/R7)	⇔	⇔	⇔	⇔
A31 to/from Easton Lane (R9/R10)	⇔	↑↑	↑	↓

Key:

⇔ negligible impact on journey times

↑ minor increase ↑↑ moderate increase ↑↑↑ major increase

↓ minor decrease ↓↓ moderate decrease ↓↓↓ major decrease

(minor >=30 seconds or >=15%, moderate >=1 minute or >=25%, major >=5 minutes or >=50%)

Phase 2a - 50mph Contraflow versus 40mph Contraflow Journey Times Summary

Journey Time Route	AM Peak		PM Peak	
	Northbound	Southbound	Northbound	Southbound
M3 mainline (R1/R2)	⇔	⇔	⇔	⇔
M3 (S) to/from A34 (R3/R4)	⇔	⇔	⇔	↓↓
Easton Lane to/from A33 (R6/R5)	⇔	⇔	⇔	⇔
M3 (S) to/from A31 (via J10) (R8/R7)	⇔	⇔	⇔	⇔
A31 to/from Easton Lane (R9/R10)	⇔	⇔	⇔	⇔

Key:
⇔ negligible impact on journey times
↑ minor increase ↑↑ moderate increase ↑↑↑ major increase
↓ minor decrease ↓↓ moderate decrease ↓↓↓ major decrease
(minor >=30 seconds or >=15%, moderate >=1 minute or >=25%, major >=5 minutes or >=50%)

Inspection of the gyratory network statistics and relative delay heatmaps, compared to Phase 1b, indicated the following key points:

- Broadly similar network performance in terms of delay, compared to Phase 1b, in the AM peak with increased congestion in the PM peak.
- Increase in queues on the A33/A34 southbound and M3 northbound off-ramp in the AM and PM peaks, relative to Phase 1b. Reduction in queues on Easton Lane in the PM peak.
- The M3 mainline 40mph and 50mph contraflow speeds demonstrated relatively limited differences in terms of traffic flows and congestion impacts on the gyratory with a slight reduction in queueing on the A33/A34 in both time periods.

2.5 Phase 3a Impacts

Overall journey times were broadly consistent with Phase 2a, with the exception of A34 and A33 southbound routes which indicated an increase in the AM and PM peak. This was as a result of changes to the southbound route including reduced speed limits. Routes from Easton Lane in the PM peak also indicated an increase in journey time, which was due to signal control timing changes that were applied to balance overall network performance with the revised gyratory setup.

Phase 3a versus Phase 2 (50mph Contraflow) Journey Times Summary

Journey Time Route	AM Peak		PM Peak	
	Northbound	Southbound	Northbound	Southbound
M3 mainline (R1/R2)	⇔	⇔	⇔	⇔
M3 (S) to/from A34 (R3/R4)	⇔	↑↑	⇔	↑↑
Easton Lane to/from A33 (R6/R5)	⇔	↑↑	↑↑↑	↑
M3 (S) to/from A31 (via J10) (R8/R7)	⇔	⇔	⇔	⇔
A31 to/from Easton Lane (R9/R10)	⇔	↓↓	↓↓	↑↑

Key:

⇔ negligible impact on journey times

↑ minor increase ↑↑ moderate increase ↑↑↑ major increase

↓ minor decrease ↓↓ moderate decrease ↓↓↓ major decrease

(minor >=30 seconds or >=15%, moderate >=1 minute or >=25%, major >=5 minutes or >=50%)

Inspection of the gyratory network statistics and relative delay heatmaps indicated the following key points:

- Broadly similar network performance at the gyratory, compared to Phase 2a.
- Decrease in queues and delays on the A33/A34 gyratory approach in the AM and PM peaks. However, inspection of the delay heatmaps indicates increased congestion on the A34 southbound near the A33 merge as demonstrated in the journey times.
- Decrease in queues and delays on the M3 northbound off-slip approach in the PM peak.

2.6 Phase 3b With Signal Control Impacts

Phase 3b introduces a direct connection between the A33/A34 and the M3 in both directions, thus bypassing the gyratory. This significantly reduced corresponding southbound journey times in the AM and PM peaks, relative to Phase 3a as well as the Do-Minimum.

Despite the more direct routing, the assessment indicated that northbound traffic was blocking back from the M3 diverge to the northbound off slip where four lanes of northbound traffic are reduced to two lanes under the southern gyratory bridge, which creates queues and slow-moving traffic. This indicated that the northbound route going through the underpass is slower than the Phase 3a equivalent route using the gyratory.

Journey times from Easton Lane to the A33 and A31 increased in both time periods due to increased congestion on the gyratory, relative to Phase 3a. Journey times to Easton Lane from the A33 reduced in the PM peak due to reduced congestion on the A33/A34/M3 southbound gyratory approach associated with the revised layout and diverted traffic.

Phase 3b versus Phase 3a Journey Times Summary

Journey Time Route	AM Peak		PM Peak	
	Northbound	Southbound	Northbound	Southbound
M3 mainline (R1/R2)	↑↑	↑	↑↑	↑
M3 (S) to/from A34 (R3/R4)	↑↑	↓↓↓	↑	↓↓↓
Easton Lane to/from A33 (R6/R5)	↑↑↑	⇔	↑↑↑	↓↓↓
M3 (S) to/from A31 (via J10) (R8/R7)	⇔	↑↑	⇔	↑
A31 to/from Easton Lane (R9/R10)	↑↑↑	↑↑↑	⇔	↑↑↑

Key:
⇔ negligible impact on journey times
↑ minor increase ↑↑ moderate increase ↑↑↑ major increase
↓ minor decrease ↓↓ moderate decrease ↓↓↓ major decrease
(minor >=30 seconds or >=15%, moderate >=1 minute or >=25%, major >=5 minutes or >=50%)

Inspection of the gyratory network statistics and relative delay heatmaps indicated the following key points:

- There was a notable reduction in traffic using the M3 northbound off-slip and A33/A34 gyratory approaches with the provision of direct access between the M3 and A33/A34.
- Southbound traffic from the A33/A34 is routed via the new link to merge with the M3 southbound off-slip with a notable increase in traffic on this gyratory approach.
- Traffic flows on the A272 approach increased in the AM Peak, relative to Phase 3a, due to traffic rerouting from the M3 northbound to avoid the congestion caused by the reduction in lanes from four to two.

- A general increase in queuing and delays in the AM peak, relative to Phase 3a, as demonstrated in the journey time analysis.
- Changes in traffic volumes resulted in a general reduction in queuing and delay in the PM peak, with the exception of the Easton Lane approach.

Phase 3b Without Gyratory Signal-control

This test was undertaken following analysis of the Phase 3b with signal control test impacts which indicated that it may be possible to remove the signal-control and maintain good operational performance, particularly on the A272 and Easton Lane approaches, and that give-way control may be more effective with the removal of traffic from the gyratory onto the new M3-A34/A33 link roads in this phase.

The removal of the gyratory signal-control had a generally positive impact on journey times. However, congestion was still evident on the M3 northbound routes in the AM peak. Journey times to/from Easton Lane and the A33 and A31 reduced in both AM and PM peaks.

Phase 3b (Without Signal-control) versus Phase 3a Journey Times Summary

Journey Time Route	AM Peak		PM Peak	
	Northbound	Southbound	Northbound	Southbound
M3 mainline (R1/R2)	↑↑	↑	⇔	↑
M3 (S) to/from A34 (R3/R4)	↑↑	↓↓↓	↓↓	↓↓↓
Easton Lane to/from A33 (R6/R5)	↓↓	↓↓	↓↓	↓↓
M3 (S) to/from A31 (via J10) (R8/R7)	↑↑↑	↓	⇔	↑
A31 to/from Easton Lane (R9/R10)	↓	↓↓	↓	↓↓

Key:
⇔ negligible impact on journey times
↑ minor increase ↑↑ moderate increase ↑↑↑ major increase
↓ minor decrease ↓↓ moderate decrease ↓↓↓ major decrease
(minor >=30 seconds or >=15%, moderate >=1 minute or >=25%, major >=5 minutes or >=50%)

Inspection of the gyratory network statistics and relative delay heatmaps indicated the following key points:

- Improved performance to the signal-controlled variant of this phase. The benefit of removing signals was evident by some reduction in queuing and delays, particularly in the AM peak. A slight increase in delay was predicted on the A33 in the PM Peak; however, this was offset by reduced delays elsewhere.
- The removal of signal control resulted in more traffic using the A272 to route to the A33/A34, avoiding the congestion noted on the M3 northbound.

- Additional queuing on the A33 gyratory approach in the PM Peak, as a result of an increase in circulating traffic routing via the northbound on-ramp from the A272 and reduced opportunity to access the gyratory due to the give way conditions in operation.

3 Strategic Network Impact

3.1 Overview

Modelling of the construction works suggested the possibility of re-routing impacts beyond the scope of the VISSIM model, in particular the closure of the M3 Junction 9 northbound on-slip.

In order to assess potential wider impacts of not allowing access onto the M3 north on-slip from Junction 9, a strategic traffic model run of the Phase 3a layout was undertaken based on the 2027 Do-Minimum scenario. Further details of the strategic modelling can be found in the Transport Forecast Package Report (ref. HE551511-VFK-GEN-X_XXXX_XX-RP-TR-0003).

3.2 Strategic Traffic Model Outputs

The outputs of this strategic model test were combined to highlight the Annual Average Daily Traffic (AADT) variance in comparison to the 2027 Do-Minimum scenario.

The strategic model was run using fixed travel demand – i.e. variable demand model responses such as destination choice or mode choice were not included. However, these traveller responses would be expected to be slight given the temporary nature of the CTM.

Figure 3-1 highlights links within the model that exceed 1,000 AADT variance (this is the same criteria used as the scoping criteria for noise and environmental assessment).

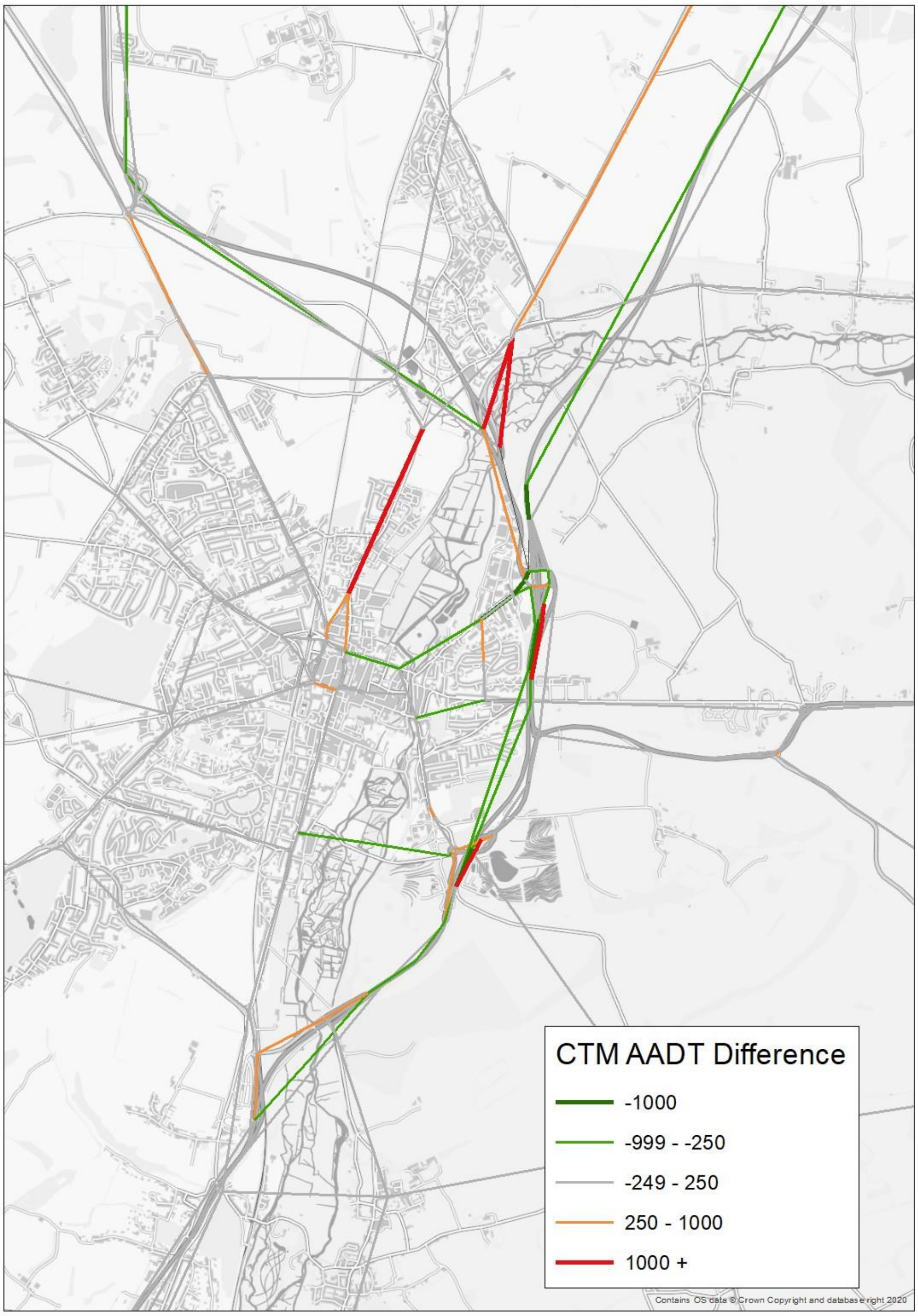


Figure 3-1: CTM Strategic Traffic Model AADT Variance

The above figure illustrates a predicted increase greater than 1,000 AADT on Worthy Road northbound and the A33/A34 southbound, which is traffic to/from zones in central Winchester re-routing away from Junction 9. Local reassignment was predicted on the M3 southbound on-slip at Junction 9 due to a small change in the slip road configuration.

Based on the 1,000 AADT environmental assessment scoping criteria it was considered that the forecast impacts of the CTM arrangements on wider re-routing were relatively slight with the M3 northbound off slip closure being the most significant cause of localised re-routing. Therefore, applying a proportionate approach it was deemed that no further CTM phasing impacts required to be assessed in the strategic model.

The outputs of the CTM strategic model were used in the noise and environmental impact assessments, which required interpeak traffic data to estimate AADT.

For context, the Design Manual for Roads and Bridges, LA 105 Air quality-web.pdf[4] sections 2.60 to 2.62 state:

'the impact of construction activities on vehicle movements shall be assessed where construction activities are programmed to last for more than 2 years.

NOTE If the construction activities are less than 2 years it is unlikely that the construction activities would constitute a significant air quality effect or impinge on the UK's reported ability to comply with the Air Quality Directive [Ref 4.N] given the short-term duration of the construction activities as opposed to the long-term operation of the project.

The traffic scoping criteria shall be used to determine whether changes in traffic as a consequence of construction activities require further assessment.

The assessment of construction traffic impacts on sensitive receptors shall be proportionate and limited to the areas of key risk of exceeding air quality thresholds.'

4 Economic Analysis

4.1 Economic Appraisal Parameters

Economic appraisal parameters, such as values of time and vehicle operating costs, were taken from the Department for Transport (DfT) TAG data book version 1.18 (May 2022).

Version 1.9.17 of Transport Users Benefit Analysis (TUBA) software was applied as per the main scheme economic appraisal.

The TUBA inputs for the assessment included a standard TUBA scheme file. The parameters used within the scheme file are presented in Table 4.1.

[4] Design Manual for Roads and Bridges, LA 105 Air quality-web.pdf

Table 4.1: TUBA Input Parameters

Parameter	Value
TUBA Version	1.9.17
Economic Parameters	TAG data book version 1.18 (May 2022)
Modelled Year	2027
Current Year	2022 (defines the first year in which the discount rate is applied)
Time Slices	2 time slices (AM, PM)
User Classes	5 user classes (Car Employers Business, Car Commute, Car Other, LGV and HGV)
Car Purpose Splits	Default TUBA values taken from TAG
LGV and HGV Split Factors	LGV (Other 0.12 and Freight 0.88) HGV (OGV1 0.5 and OGV2 0.5)
Input Matrices	Time, distance, and trip matrices
Value of Time method	Method 1 – continuous function, based on distance

4.2 Construction Traffic Analysis

Stantec were provided with construction traffic management phase durations, which are listed in Table 4.2. Within the TUBA appraisal process, the CTM phase duration was factored using a 12-month annualisation factor of 759 for the AM and PM modelled peak hour periods based on 253 weekdays per annum. This, therefore, excluded impacts during other weekday periods and weekends as they were not modelled using the VISSIM model.

Table 4.2: Construction Traffic Management Phasing Durations

Phase	Duration (months)	Annualisation Factor (weekdays)
1b	4	253
2a	12	759
3a	3	190
3b	4	253
Total	23	1,455

The 50mph contraflow option was selected for economic analysis for Phase 2a noting that the model network performance was broadly the same as the 40mph contraflow option. For Phase 3b, the scenario without gyratory signal-control was used in the economic analysis were this was considered to be the arrangement most likely to be taken forward.

Tabulated analysis of TUBA Present Value of Benefit (PVB outputs) are presented in Table 4.3.

Table 4.3: CTM TUBA Outputs (£M, discounted to 2010, in 2010 prices)

Phase	Present Value of Benefits (£M)
Phase 1b	-£0.21
Phase 2a (50 mph contraflow)	-£0.75
Phase 3a	-£1.02
Phase 3b (without signal-control)	-£0.70
Total PVB	-£2.69

* *includes Indirect Taxation Revenue impacts, excludes Greenhouse Gases*

Examination of the CTM economic impacts reflect the traffic network operation assessment presented in Section 2, where the temporary traffic management arrangements increased journey times and congestion in the model area.

As noted above, the assessment does not allow for potential wider re- routing or changes in travel demand profiles which may reduce overall impacts.

TECHNICAL NOTE

DOCUMENT ISSUE RECORD

Reference	Rev	Date	Prepared	Checked	Reviewed (Discipline Lead)	Approved (Project Director)
HE551511-VFK-GEN- X_XXXX_XX-TN-TT- 0008	P01	22/08/2021	GP and RD	AB	AB	TW
	P02	12/08/2022	GP	AB	AB	KL
	P03	01/09/2022	GP	AB	AB	KL

Annex A Modelled Journey Times

Table A1: AM Peak Journey Time Analysis (mm:ss)

ID	Description	Do Min	Phase 1b	Phase 2a (40mph contra-flow)	Phase 2a (50 mph contra-flow)	Phase 3a	Phase 3b	Phase 3b (without signal control)
R1	M3 south to M3 north	08:03	08:31	09:05	08:54	09:04	10:52	13:31
R2	M3 north to M3 south	05:58	06:25	06:42	06:26	06:25	07:05	07:05
R3	M3 south to A34 (via gyratory)	10:27	10:38	11:31	11:42	11:17		
R3a	M3 south to A34 (via M3 underpass)						12:26	15:00
R4	A34 to M3 south	08:23	10:56	11:24	11:13	14:10		
R4a	A34 to M3 south (via underpass)						08:24	08:26
R5	A33 to Easton Lane	03:42	04:49	06:08	06:03	07:05	06:58	03:38
R6	Easton Lane to A33	06:40	04:00	04:20	04:23	04:03	07:32	02:06
R7	A31 to M3 south via J10	03:57	03:54	03:54	03:54	03:53	05:03	04:29
R8	M3 south to A31 via J10	06:13	06:17	06:36	06:35	06:27	06:41	09:55
R9	A31 to Easton Lane	03:45	03:39	04:06	04:04	03:36	09:12	02:46
R10	Easton Lane to A31	06:57	04:23	05:57	05:50	04:31	09:04	02:57

Table A2 PM Peak Journey Time Analysis (mm:ss)

ID	Description	Do Min	Phase 1b	Phase 2a (40mph contra-flow)	Phase 2a (50 mph contra-flow)	Phase 3a	Phase 3b	Phase 3b (without signal control)
R1	M3 south to M3 north	05:57	06:15	06:32	06:16	06:17	08:13	06:30
R2	M3 north to M3 south	06:13	06:41	06:51	06:34	06:35	07:19	07:21
R3	M3 south to A34 (via gyratory)	10:47	09:05	09:29	09:23	09:01		
R3a	M3 south to A34 (via M3 underpass)						10:16	08:28
R4	A34 to M3 south	09:53	12:07	22:04	20:52	23:12		
R4a	A34 to M3 south (via underpass)						08:46	11:04
R5	A33 to Easton Lane	05:07	06:32	09:47	09:33	10:18	04:48	06:55
R6	Easton Lane to A33	02:56	04:20	02:55	02:57	04:55	07:42	02:47
R7	A31 to M3 south via J10	04:13	04:08	04:01	04:02	04:02	04:34	04:44
R8	M3 south to A31 via J10	04:16	04:16	04:15	04:16	04:16	04:18	04:44
R9	A31 to Easton Lane	05:42	04:20	04:56	04:47	04:07	04:10	03:31
R10	Easton Lane to A31	05:02	05:30	04:31	04:31	05:44	08:47	03:36

Annex B Modelled Gyratory Network Statistics

Table B1: Gyratory Analysis – Traffic Flows (vehicles)

Approach	Do Min Core Scenario	Phase 1b	Phase 2a (40mph contra-flow)	Phase 2a (50mph contra-flow)	Phase3a	Phase3b	Phase 3b (without signal control)
AM Peak							
A272	390	401	395	373	354	290	482
M3 Southbound Off-slip (A34)	263	264	262	263	262	1078	855
A33/A34	2694	2420	2350	2364	2180	350	357
Easton Lane	615	660	511	506	535	529	559
M3 Northbound Off-slip	2316	2303	2190	2197	2310	450	373
Total	6278	6048	5708	5703	5641	2697	2626
PM Peak							
A272	461	438	376	374	372	451	786
M3 Southbound Off-slip (A34)	335	339	340	342	338	879	870
A33/A34	2650	2456	2020	2036	1985	317	316
Easton Lane	1018	967	862	863	795	736	864
M3 Northbound Off-slip	1883	2136	2084	2091	2137	189	240
Total	6347	6336	5682	5706	5627	2572	3076

Note: The M3 southbound off slip also forms part of the A34 approach in Phase 3b

Table B2: Gyratory Analysis – Delay (seconds)

Approach	Do Min Core Scenario	Phase 1b	Phase 2a (40mph contra-flow)	Phase 2a (50mph contra-flow)	Phase3a	Phase3b	Phase 3b (without signal control)
AM Peak							
A272	100	76	88	87	57	276	11
M3 Southbound Off-slip (A34)	88	81	87	85	96	66	6
A33/A34	28	50	42	41	56	93	21
Easton Lane	162	85	92	92	74	240	5
M3 Northbound Off-slip	19	18	28	29	23	51	9
Total	397	309	337	334	306	726	52
PM Peak							
A272	155	114	128	122	101	112	30
M3 Southbound Off-slip (A34)	151	91	110	106	76	41	13
A33/A34	36	51	69	67	73	45	155
Easton Lane	76	82	69	69	127	194	21
M3 Northbound Off-slip	57	17	32	31	18	37	8
Total	475	355	408	395	396	428	227

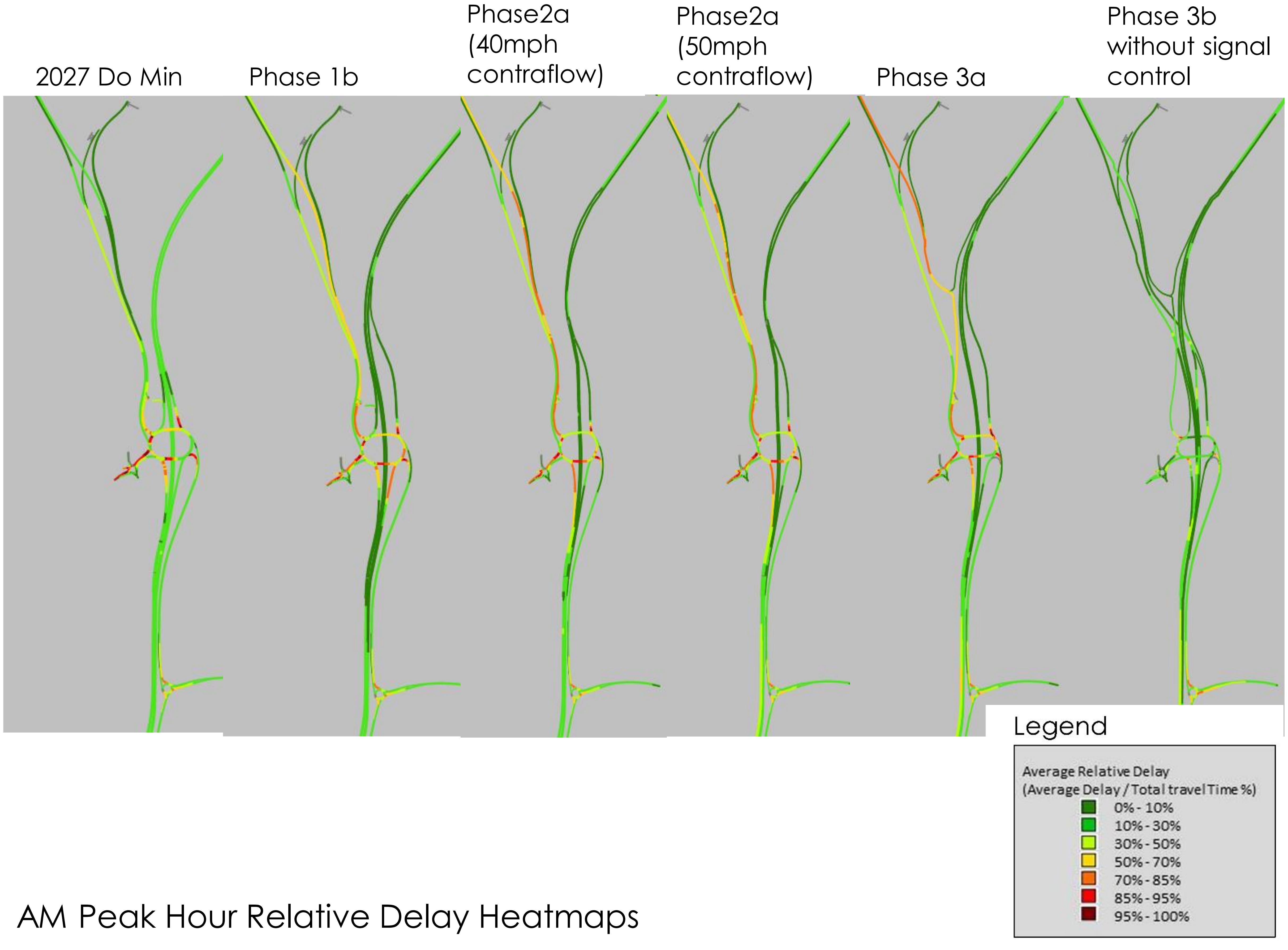
Table B3: Gyratory Analysis – Average Queue (metres)

Approach	Do Min Core Scenario	Phase 1b	Phase 2a (40mph contra-flow)	Phase 2a (50mph contra-flow)	Phase 3a	Phase 3b	Phase 3b (without signal control)
AM Peak							
A272	33	13	15	14	11	96	3
M3 Southbound Off-slip (A34)	21	12	13	12	14	15	2
A33/A34	81	710	969	918	589	11	10
Easton Lane	149	77	77	77	77	133	1
M3 Northbound Off-slip	34	31	270	352	133	22	2
PM Peak							
A272	91	16	21	17	12	11	91
M3 Southbound Off-slip (A34)	61	14	15	15	12	16	10
A33/A34	552	1017	2987	2805	826	7	123
Easton Lane	65	120	39	41	129	0	0
M3 Northbound Off-slip	656	34	239	207	43	8	1

Table B4: Gyratory Analysis – Maximum Queue (metres)

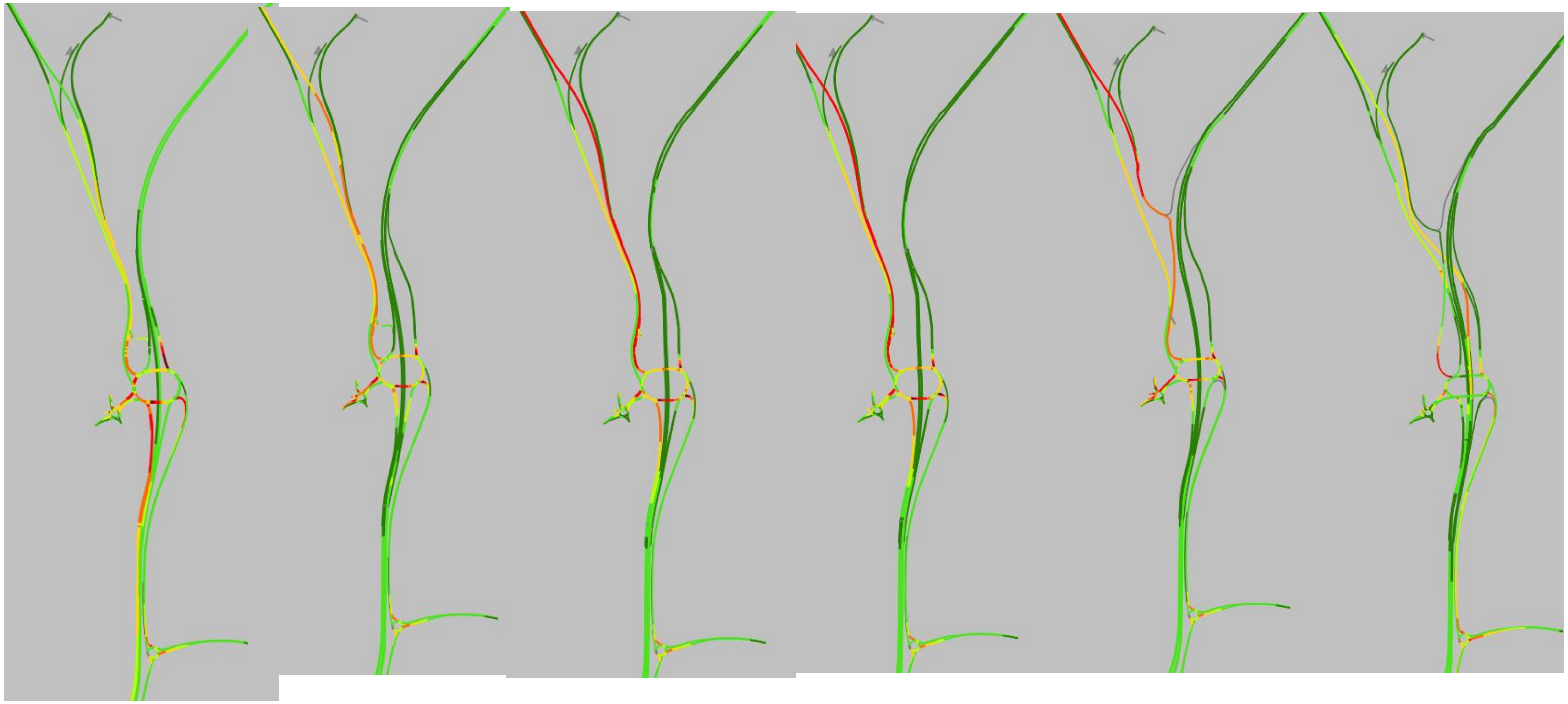
Approach	Do Min Core Scenario	Phase 1b	Phase 2a (40mph contra-flow)	Phase 2a (50mph contra-flow)	Phase 3a	Phase 3b	Phase 3b (without signal control)
AM Peak							
A272	165	87	110	98	78	206	112
M3 Southbound Off-slip (A34)	81	57	58	60	58	128	67
A33/A34	599	2339	2761	2675	878	83	96
Easton Lane	179	177	177	177	181	182	30
M3 Northbound Off-slip	227	212	702	971	652	158	51
PM Peak							
A272	329	114	145	111	81	116	471
M3 Southbound Off-slip (A34)	159	65	64	69	55	98	113
A33/A34	1405	2178	4753	4655	878	68	307
Easton Lane	174	183	156	156	189	225	100
M3 Northbound Off-slip	2079	233	731	669	272	71	40

Annex C Relative Delay Heat Maps



AM Peak Hour Relative Delay Heatmaps

2027 Do Min | Phase 1b | Phase2a (40mph contraflow) | Phase2a (50mph contraflow) | Phase 3a | Phase 3b without signal control



Legend

Average Relative Delay
(Average Delay / Total travel Time %)
- 0% - 10%
- 10% - 30%
- 30% - 50%
- 50% - 70%
- 70% - 85%
- 85% - 95%
- 95% - 100%

PM Peak Hour Relative Delay Heatmaps

Appendix F ComMA data annex

ComMA Data Annex

Scheme costs

Table 1: Scheme investment cost profile in 2010 prices

Year	2010 factor prices (not discounted)	2010 market prices (discounted)
2022	7,277,466	4,816,106
2023	5,989,953	3,830,001
2024	53,682,918	33,164,329
2025	60,164,337	35,911,528
2026	17,054,387	9,835,366
2027	1,125,459	627,110
2028	64,662	34,812
2029	32,901	17,113
2030	14,858	7,467
2031	11,509	5,589
2032	7,113	3,337
2033	2,320	1,052
2034	0	0
2035	0	0

Table 2: Scheme O&M cost profile in 2010 prices

Year	2010 factor prices (not discounted)	2010 market prices (discounted)
2027	273,901	181,616
2028	274,410	175,801
2029	274,584	169,964
2030	-265,253	-158,635
2031	-265,253	-153,271
2032	220,705	123,217
2033	220,705	119,050
2034	274,584	143,105
2035	148,468	74,760
2036	1,207,190	587,318
2037	1,333,307	626,740
2038	274,584	124,708
2039	274,584	120,490
2040	261,714	110,959
2041	-278,123	-113,928
2042	-265,253	-104,982
2043	274,584	105,000
2044	274,584	101,450
2045	-183,846	-65,628

2046	-183,846	-63,409
2047	2,746,362	915,191
2048	2,746,362	884,243
2049	274,584	85,418
2050	274,584	82,529
2051	274,584	79,738
2052	-265,253	-74,785
2053	-265,253	-72,607
2054	274,584	72,972
2055	2,243,073	578,745
2056	2,243,073	561,888
2057	274,584	66,780
2058	1,333,307	314,820
2059	1,333,307	305,650
2060	274,584	61,113
2061	274,584	59,333
2062	220,705	46,301
2063	-319,132	-65,000
2064	-265,253	-52,453
2065	-3,145,913	-603,974
2066	2,380,686	443,748
2067	286,879	51,915
2068	286,879	50,403
2069	2,812,536	479,756
2070	2,799,666	463,651
2071	274,009	44,057
2072	286,879	44,783
2073	286,879	43,478
2074	-252,958	-37,221
2075	-379,075	-54,153
2076	160,762	22,297
2077	232,999	31,375
2078	232,999	30,461
2079	286,879	36,412
2080	1,345,601	165,817
2081	1,345,601	160,988
2082	286,879	33,322
2083	286,879	32,352
2084	286,879	31,410
2085	2,479,555	263,573
2086	286,879	29,607

Scheme benefits / disbenefits

Journey times

Table 3: Average journey times during construction period along route by phase (minutes)

	Phase 1b	*Phase 2a*	*Phase 3a*	*Phase 3b*
Without scheme	10:47	10:47	10:47	10:47
With scheme	09:05	09:29	09:23	09:01

This is for Operational Model Route R3 (see below figure) from the M3 J11 to the A34 north (via gyratory or M3 underpass). This is for the PM peak.

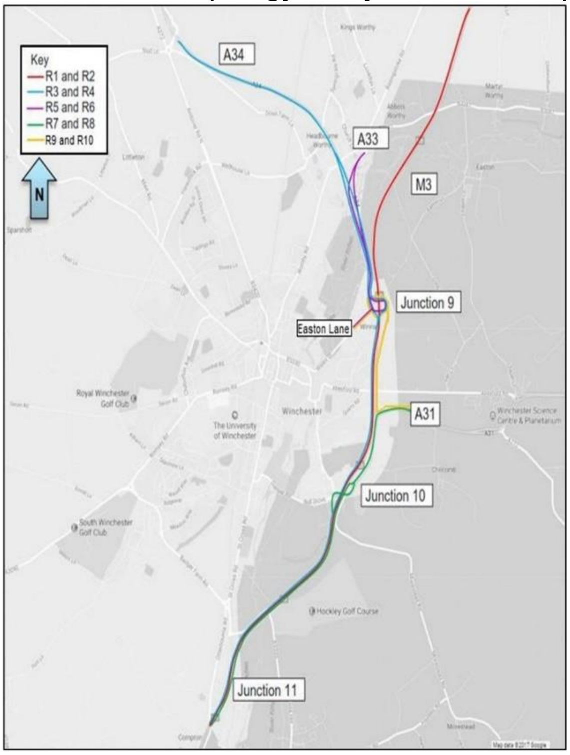
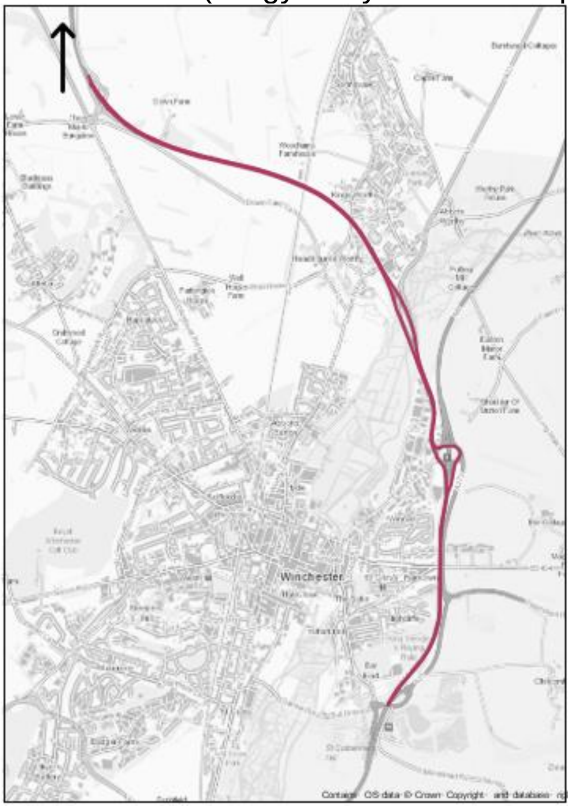


Table 4: Average journey times along route (minutes)

	Opening year (2027)	Design year (2042)	Change (%)
Without scheme	08:35	11:33	35%
With scheme	08:11	07:47	-5%

This is for Strategic Model A34 Route (see below figure) from the M3 J10 to the A34 north (via gyratory or M3 underpass). This is for the PM peak.



Safety

Table 5: Number of accidents by year

Year		Without scheme	With scheme	Difference
Opening year	2027	160	154	-6
Year 2	2028	160	153	-7
Year 3	2029	159	153	-7
Year 4	2030	160	153	-7
Year 5	2031	160	153	-7
Year 6	2032	161	154	-7
Year 7	2033	162	155	-7
Year 8	2034	163	155	-7
Year 9	2035	164	156	-7
Year 10	2036	164	157	-8
Year 11	2037	165	157	-8
Year 12	2038	166	158	-8
Year 13	2039	166	158	-8
Year 14	2040	168	160	-8
Year 15	2041	170	161	-8
Year 16	2042	172	163	-9
Year 17	2043	174	165	-9
Year 18	2044	176	167	-9
Year 19	2045	179	169	-9
Year 20	2046	181	172	-9
Year 21	2047	183	174	-9
Year 22	2048	184	174	-10
Year 23	2049	184	174	-10
Year 24	2050	184	174	-10
Year 25	2051	184	174	-10
Year 26	2052	184	174	-10
Year 27	2053	184	174	-10
Year 28	2054	184	174	-10
Year 29	2055	184	174	-10
Year 30	2056	184	174	-10
Year 31	2057	184	174	-10
Year 32	2058	184	174	-10
Year 33	2059	184	174	-10
Year 34	2060	184	174	-10
Year 35	2061	184	174	-10
Year 36	2062	184	174	-10
Year 37	2063	184	174	-10
Year 38	2064	184	174	-10
Year 39	2065	184	174	-10
Year 40	2066	184	174	-10
Year 41	2067	184	174	-10
Year 42	2068	184	174	-10

Year 43	2069	184	174	-10
Year 44	2070	184	174	-10
Year 45	2071	184	174	-10
Year 46	2072	184	174	-10
Year 47	2073	184	174	-10
Year 48	2074	184	174	-10
Year 49	2075	184	174	-10
Year 50	2076	184	174	-10
Year 51	2077	184	174	-10
Year 52	2078	184	174	-10
Year 53	2079	184	174	-10
Year 54	2080	184	174	-10
Year 55	2081	184	174	-10
Year 56	2082	184	174	-10
Year 57	2083	184	174	-10
Year 58	2084	184	174	-10
Year 59	2085	184	174	-10
Year 60	2086	184	174	-10

Table 6: Number of Fatal casualties by year

Year		Without scheme	With scheme	Difference
Opening year	2027	2.4	2.3	-0.1
Year 2	2028	2.4	2.3	-0.1
Year 3	2029	2.4	2.3	-0.1
Year 4	2030	2.4	2.3	-0.1
Year 5	2031	2.4	2.3	-0.1
Year 6	2032	2.4	2.3	-0.1
Year 7	2033	2.4	2.3	-0.1
Year 8	2034	2.4	2.3	-0.1
Year 9	2035	2.4	2.3	-0.1
Year 10	2036	2.4	2.3	-0.1
Year 11	2037	2.4	2.3	-0.1
Year 12	2038	2.4	2.3	-0.1
Year 13	2039	2.4	2.3	-0.1
Year 14	2040	2.5	2.3	-0.1
Year 15	2041	2.5	2.3	-0.1
Year 16	2042	2.5	2.4	-0.1
Year 17	2043	2.5	2.4	-0.2
Year 18	2044	2.6	2.4	-0.2
Year 19	2045	2.6	2.4	-0.2
Year 20	2046	2.6	2.5	-0.2
Year 21	2047	2.7	2.5	-0.2
Year 22	2048	2.7	2.5	-0.2
Year 23	2049	2.7	2.5	-0.2
Year 24	2050	2.7	2.5	-0.2
Year 25	2051	2.7	2.5	-0.2
Year 26	2052	2.7	2.5	-0.2
Year 27	2053	2.7	2.5	-0.2
Year 28	2054	2.7	2.5	-0.2
Year 29	2055	2.7	2.5	-0.2
Year 30	2056	2.7	2.5	-0.2
Year 31	2057	2.7	2.5	-0.2
Year 32	2058	2.7	2.5	-0.2
Year 33	2059	2.7	2.5	-0.2
Year 34	2060	2.7	2.5	-0.2
Year 35	2061	2.7	2.5	-0.2
Year 36	2062	2.7	2.5	-0.2
Year 37	2063	2.7	2.5	-0.2
Year 38	2064	2.7	2.5	-0.2
Year 39	2065	2.7	2.5	-0.2
Year 40	2066	2.7	2.5	-0.2
Year 41	2067	2.7	2.5	-0.2
Year 42	2068	2.7	2.5	-0.2
Year 43	2069	2.7	2.5	-0.2
Year 44	2070	2.7	2.5	-0.2

Year 45	2071	2.7	2.5	-0.2
Year 46	2072	2.7	2.5	-0.2
Year 47	2073	2.7	2.5	-0.2
Year 48	2074	2.7	2.5	-0.2
Year 49	2075	2.7	2.5	-0.2
Year 50	2076	2.7	2.5	-0.2
Year 51	2077	2.7	2.5	-0.2
Year 52	2078	2.7	2.5	-0.2
Year 53	2079	2.7	2.5	-0.2
Year 54	2080	2.7	2.5	-0.2
Year 55	2081	2.7	2.5	-0.2
Year 56	2082	2.7	2.5	-0.2
Year 57	2083	2.7	2.5	-0.2
Year 58	2084	2.7	2.5	-0.2
Year 59	2085	2.7	2.5	-0.2
Year 60	2086	2.7	2.5	-0.2

Table 7: Number of Serious casualties by year

Year		Without scheme	With scheme	Difference
Opening year	2027	24.0	23.5	-0.6
Year 2	2028	23.9	23.4	-0.6
Year 3	2029	23.8	23.2	-0.6
Year 4	2030	23.9	23.2	-0.6
Year 5	2031	24.0	23.3	-0.6
Year 6	2032	24.1	23.4	-0.7
Year 7	2033	24.2	23.5	-0.7
Year 8	2034	24.3	23.6	-0.7
Year 9	2035	24.4	23.7	-0.7
Year 10	2036	24.5	23.8	-0.7
Year 11	2037	24.6	23.8	-0.8
Year 12	2038	24.7	23.9	-0.8
Year 13	2039	24.8	24.0	-0.8
Year 14	2040	25.0	24.2	-0.8
Year 15	2041	25.3	24.4	-0.9
Year 16	2042	25.6	24.7	-0.9
Year 17	2043	25.9	25.0	-0.9
Year 18	2044	26.3	25.3	-1.0
Year 19	2045	26.6	25.7	-1.0
Year 20	2046	27.0	26.0	-1.0
Year 21	2047	27.4	26.3	-1.1
Year 22	2048	27.5	26.4	-1.1
Year 23	2049	27.5	26.4	-1.1
Year 24	2050	27.5	26.4	-1.1
Year 25	2051	27.5	26.4	-1.1
Year 26	2052	27.5	26.4	-1.1
Year 27	2053	27.5	26.4	-1.1
Year 28	2054	27.5	26.4	-1.1
Year 29	2055	27.5	26.4	-1.1
Year 30	2056	27.5	26.4	-1.1
Year 31	2057	27.5	26.4	-1.1
Year 32	2058	27.5	26.4	-1.1
Year 33	2059	27.5	26.4	-1.1
Year 34	2060	27.5	26.4	-1.1
Year 35	2061	27.5	26.4	-1.1
Year 36	2062	27.5	26.4	-1.1
Year 37	2063	27.5	26.4	-1.1
Year 38	2064	27.5	26.4	-1.1
Year 39	2065	27.5	26.4	-1.1
Year 40	2066	27.5	26.4	-1.1
Year 41	2067	27.5	26.4	-1.1
Year 42	2068	27.5	26.4	-1.1
Year 43	2069	27.5	26.4	-1.1
Year 44	2070	27.5	26.4	-1.1

Year 45	2071	27.5	26.4	-1.1
Year 46	2072	27.5	26.4	-1.1
Year 47	2073	27.5	26.4	-1.1
Year 48	2074	27.5	26.4	-1.1
Year 49	2075	27.5	26.4	-1.1
Year 50	2076	27.5	26.4	-1.1
Year 51	2077	27.5	26.4	-1.1
Year 52	2078	27.5	26.4	-1.1
Year 53	2079	27.5	26.4	-1.1
Year 54	2080	27.5	26.4	-1.1
Year 55	2081	27.5	26.4	-1.1
Year 56	2082	27.5	26.4	-1.1
Year 57	2083	27.5	26.4	-1.1
Year 58	2084	27.5	26.4	-1.1
Year 59	2085	27.5	26.4	-1.1
Year 60	2086	27.5	26.4	-1.1

Table 8: Number of Slight casualties by year

Year		Without scheme	With scheme	Difference
Opening year	2027	199.8	190.9	-8.8
Year 2	2028	199.2	190.3	-8.9
Year 3	2029	198.5	189.6	-8.9
Year 4	2030	198.9	189.8	-9.1
Year 5	2031	199.9	190.7	-9.2
Year 6	2032	200.9	191.5	-9.4
Year 7	2033	201.8	192.3	-9.6
Year 8	2034	202.7	193.0	-9.7
Year 9	2035	203.6	193.8	-9.8
Year 10	2036	204.5	194.5	-10.0
Year 11	2037	205.3	195.2	-10.1
Year 12	2038	206.1	195.9	-10.3
Year 13	2039	206.9	196.6	-10.4
Year 14	2040	208.7	198.1	-10.6
Year 15	2041	211.1	200.2	-10.9
Year 16	2042	213.5	202.3	-11.1
Year 17	2043	216.0	204.6	-11.4
Year 18	2044	218.7	207.1	-11.6
Year 19	2045	221.3	209.5	-11.8
Year 20	2046	224.0	212.0	-12.0
Year 21	2047	226.6	214.4	-12.2
Year 22	2048	227.4	215.0	-12.3
Year 23	2049	227.4	215.0	-12.3
Year 24	2050	227.4	215.0	-12.3
Year 25	2051	227.4	215.0	-12.3
Year 26	2052	227.4	215.0	-12.3
Year 27	2053	227.4	215.0	-12.3
Year 28	2054	227.4	215.0	-12.3
Year 29	2055	227.4	215.0	-12.3
Year 30	2056	227.4	215.0	-12.3
Year 31	2057	227.4	215.0	-12.3
Year 32	2058	227.4	215.0	-12.3
Year 33	2059	227.4	215.0	-12.3
Year 34	2060	227.4	215.0	-12.3
Year 35	2061	227.4	215.0	-12.3
Year 36	2062	227.4	215.0	-12.3
Year 37	2063	227.4	215.0	-12.3
Year 38	2064	227.4	215.0	-12.3
Year 39	2065	227.4	215.0	-12.3
Year 40	2066	227.4	215.0	-12.3
Year 41	2067	227.4	215.0	-12.3
Year 42	2068	227.4	215.0	-12.3
Year 43	2069	227.4	215.0	-12.3
Year 44	2070	227.4	215.0	-12.3

Year 45	2071	227.4	215.0	-12.3
Year 46	2072	227.4	215.0	-12.3
Year 47	2073	227.4	215.0	-12.3
Year 48	2074	227.4	215.0	-12.3
Year 49	2075	227.4	215.0	-12.3
Year 50	2076	227.4	215.0	-12.3
Year 51	2077	227.4	215.0	-12.3
Year 52	2078	227.4	215.0	-12.3
Year 53	2079	227.4	215.0	-12.3
Year 54	2080	227.4	215.0	-12.3
Year 55	2081	227.4	215.0	-12.3
Year 56	2082	227.4	215.0	-12.3
Year 57	2083	227.4	215.0	-12.3
Year 58	2084	227.4	215.0	-12.3
Year 59	2085	227.4	215.0	-12.3
Year 60	2086	227.4	215.0	-12.3

Environment

Table 9: NOx emissions (tonnes)

Year		Without scheme	With scheme	Difference
Opening year	2027	301.0	302.9	1.9
Year 2	2028	293.9	295.7	1.8
Year 3	2029	286.7	288.5	1.7
Year 4	2030	279.6	281.3	1.7
Year 5	2031	272.5	274.1	1.6
Year 6	2032	265.3	266.8	1.5
Year 7	2033	258.2	259.6	1.5
Year 8	2034	251.1	252.4	1.4
Year 9	2035	243.9	245.2	1.3
Year 10	2036	236.8	238.0	1.2
Year 11	2037	229.6	230.8	1.2
Year 12	2038	222.5	223.6	1.1
Year 13	2039	215.4	216.4	1.0
Year 14	2040	208.2	209.2	0.9
Year 15	2041	201.1	202.0	0.9
Year 16	2042	194.0	194.8	0.8
Year 17	2043	186.8	187.5	0.7
Year 18	2044	179.7	180.3	0.6
Year 19	2045	172.6	173.1	0.6
Year 20	2046	165.4	165.9	0.5
Year 21	2047	158.3	158.7	0.4
Year 22	2048	158.3	158.7	0.4
Year 23	2049	158.3	158.7	0.4
Year 24	2050	158.3	158.7	0.4
Year 25	2051	158.3	158.7	0.4
Year 26	2052	158.3	158.7	0.4
Year 27	2053	158.3	158.7	0.4
Year 28	2054	158.3	158.7	0.4
Year 29	2055	158.3	158.7	0.4
Year 30	2056	158.3	158.7	0.4
Year 31	2057	158.3	158.7	0.4
Year 32	2058	158.3	158.7	0.4
Year 33	2059	158.3	158.7	0.4
Year 34	2060	158.3	158.7	0.4
Year 35	2061	158.3	158.7	0.4
Year 36	2062	158.3	158.7	0.4
Year 37	2063	158.3	158.7	0.4
Year 38	2064	158.3	158.7	0.4
Year 39	2065	158.3	158.7	0.4
Year 40	2066	158.3	158.7	0.4
Year 41	2067	158.3	158.7	0.4
Year 42	2068	158.3	158.7	0.4

Year 43	2069	158.3	158.7	0.4
Year 44	2070	158.3	158.7	0.4
Year 45	2071	158.3	158.7	0.4
Year 46	2072	158.3	158.7	0.4
Year 47	2073	158.3	158.7	0.4
Year 48	2074	158.3	158.7	0.4
Year 49	2075	158.3	158.7	0.4
Year 50	2076	158.3	158.7	0.4
Year 51	2077	158.3	158.7	0.4
Year 52	2078	158.3	158.7	0.4
Year 53	2079	158.3	158.7	0.4
Year 54	2080	158.3	158.7	0.4
Year 55	2081	158.3	158.7	0.4
Year 56	2082	158.3	158.7	0.4
Year 57	2083	158.3	158.7	0.4
Year 58	2084	158.3	158.7	0.4
Year 59	2085	158.3	158.7	0.4
Year 60	2086	158.3	158.7	0.4

Table 10:PM10 emissions (tonnes)

Year		Without scheme	With scheme	Difference
Opening year	2027	45.4	46.3	0.9
Year 2	2028	45.4	46.3	0.9
Year 3	2029	45.3	46.3	0.9
Year 4	2030	45.3	46.2	0.9
Year 5	2031	45.2	46.2	0.9
Year 6	2032	45.2	46.1	0.9
Year 7	2033	45.1	46.1	0.9
Year 8	2034	45.1	46.0	0.9
Year 9	2035	45.0	46.0	0.9
Year 10	2036	45.0	45.9	0.9
Year 11	2037	44.9	45.9	0.9
Year 12	2038	44.9	45.8	0.9
Year 13	2039	44.9	45.8	0.9
Year 14	2040	44.8	45.7	0.9
Year 15	2041	44.8	45.7	0.9
Year 16	2042	44.7	45.6	0.9
Year 17	2043	44.7	45.6	0.9
Year 18	2044	44.6	45.6	0.9
Year 19	2045	44.6	45.5	0.9
Year 20	2046	44.5	45.5	0.9
Year 21	2047	44.5	45.4	0.9
Year 22	2048	44.5	45.4	0.9
Year 23	2049	44.5	45.4	0.9
Year 24	2050	44.5	45.4	0.9
Year 25	2051	44.5	45.4	0.9
Year 26	2052	44.5	45.4	0.9
Year 27	2053	44.5	45.4	0.9
Year 28	2054	44.5	45.4	0.9
Year 29	2055	44.5	45.4	0.9
Year 30	2056	44.5	45.4	0.9
Year 31	2057	44.5	45.4	0.9
Year 32	2058	44.5	45.4	0.9
Year 33	2059	44.5	45.4	0.9
Year 34	2060	44.5	45.4	0.9
Year 35	2061	44.5	45.4	0.9
Year 36	2062	44.5	45.4	0.9
Year 37	2063	44.5	45.4	0.9
Year 38	2064	44.5	45.4	0.9
Year 39	2065	44.5	45.4	0.9
Year 40	2066	44.5	45.4	0.9
Year 41	2067	44.5	45.4	0.9
Year 42	2068	44.5	45.4	0.9
Year 43	2069	44.5	45.4	0.9
Year 44	2070	44.5	45.4	0.9

Year 45	2071	44.5	45.4	0.9
Year 46	2072	44.5	45.4	0.9
Year 47	2073	44.5	45.4	0.9
Year 48	2074	44.5	45.4	0.9
Year 49	2075	44.5	45.4	0.9
Year 50	2076	44.5	45.4	0.9
Year 51	2077	44.5	45.4	0.9
Year 52	2078	44.5	45.4	0.9
Year 53	2079	44.5	45.4	0.9
Year 54	2080	44.5	45.4	0.9
Year 55	2081	44.5	45.4	0.9
Year 56	2082	44.5	45.4	0.9
Year 57	2083	44.5	45.4	0.9
Year 58	2084	44.5	45.4	0.9
Year 59	2085	44.5	45.4	0.9
Year 60	2086	44.5	45.4	0.9

Table 11: Greenhouse gas emissions (tonnes CO2e)

Year		Without scheme	With scheme	Difference
Opening year	2027	4,157,875	4,161,194	3,319
Year 2	2028	4,117,306	4,120,716	3,410
Year 3	2029	4,076,737	4,080,238	3,502
Year 4	2030	4,036,167	4,039,760	3,593
Year 5	2031	3,995,598	3,999,283	3,685
Year 6	2032	3,955,028	3,958,805	3,776
Year 7	2033	3,914,459	3,918,327	3,868
Year 8	2034	3,873,890	3,877,849	3,959
Year 9	2035	3,833,320	3,837,371	4,051
Year 10	2036	3,792,751	3,796,893	4,142
Year 11	2037	3,752,182	3,756,416	4,234
Year 12	2038	3,711,612	3,715,938	4,325
Year 13	2039	3,671,043	3,675,460	4,417
Year 14	2040	3,630,474	3,634,982	4,509
Year 15	2041	3,589,904	3,594,504	4,600
Year 16	2042	3,549,335	3,554,026	4,692
Year 17	2043	3,549,335	3,554,026	4,692
Year 18	2044	3,549,335	3,554,026	4,692
Year 19	2045	3,549,335	3,554,026	4,692
Year 20	2046	3,549,335	3,554,026	4,692
Year 21	2047	3,549,335	3,554,026	4,692
Year 22	2048	3,549,335	3,554,026	4,692
Year 23	2049	3,549,335	3,554,026	4,692
Year 24	2050	3,549,335	3,554,026	4,692
Year 25	2051	3,549,335	3,554,026	4,692
Year 26	2052	3,549,335	3,554,026	4,692
Year 27	2053	3,549,335	3,554,026	4,692
Year 28	2054	3,549,335	3,554,026	4,692
Year 29	2055	3,549,335	3,554,026	4,692
Year 30	2056	3,549,335	3,554,026	4,692
Year 31	2057	3,549,335	3,554,026	4,692
Year 32	2058	3,549,335	3,554,026	4,692
Year 33	2059	3,549,335	3,554,026	4,692
Year 34	2060	3,549,335	3,554,026	4,692
Year 35	2061	3,549,335	3,554,026	4,692
Year 36	2062	3,549,335	3,554,026	4,692
Year 37	2063	3,549,335	3,554,026	4,692
Year 38	2064	3,549,335	3,554,026	4,692
Year 39	2065	3,549,335	3,554,026	4,692
Year 40	2066	3,549,335	3,554,026	4,692
Year 41	2067	3,549,335	3,554,026	4,692
Year 42	2068	3,549,335	3,554,026	4,692
Year 43	2069	3,549,335	3,554,026	4,692
Year 44	2070	3,549,335	3,554,026	4,692
Year 45	2071	3,549,335	3,554,026	4,692

Year 46	2072	3,549,335	3,554,026	4,692
Year 47	2073	3,549,335	3,554,026	4,692
Year 48	2074	3,549,335	3,554,026	4,692
Year 49	2075	3,549,335	3,554,026	4,692
Year 50	2076	3,549,335	3,554,026	4,692
Year 51	2077	3,549,335	3,554,026	4,692
Year 52	2078	3,549,335	3,554,026	4,692
Year 53	2079	3,549,335	3,554,026	4,692
Year 54	2080	3,549,335	3,554,026	4,692
Year 55	2081	3,549,335	3,554,026	4,692
Year 56	2082	3,549,335	3,554,026	4,692
Year 57	2083	3,549,335	3,554,026	4,692
Year 58	2084	3,549,335	3,554,026	4,692
Year 59	2085	3,549,335	3,554,026	4,692
Year 60	2086	3,549,335	3,554,026	4,692

Appendix G ComMA summary table

Summary Template

High level benefits and costs

Present Value of Benefits (initial)	£152.3
Present Value of Benefits (adjusted)	£194.1
Present Value of Costs	£112.7M
Initial BCR	1.35
Adjusted BCR	1.72

Sources of Costs

Scheme construction costs and operating and maintenance costs were provided by the National Highways Commercial Services Division.

The 'Most Likely Cost' construction figures for the Stage 3 preliminary design were used for the economic assessment including Preparation, Supervision, Works (construction), and Lands. The estimated operating and maintenance costs were for the incremental impact of the Scheme representing the change relative to the Do Minimum and represented the plausible range of costs for the 'Most Likely' capital works estimate. The operating and maintenance costs included a breakdown of activities including highways assets, structures, and technology and the total cost was used in the economic assessment. Maintenance activities and intervention frequencies were based on National Highways' Asset Delivery Asset Maintenance Requirements.

The costs accounted for project risk and uncertainty and the effects of construction related price inflation and, therefore, optimism bias was not applicable. All costs were in factor cost unit of account and excluded VAT, both recoverable and non-recoverable.

Sources of Benefits

The majority of Scheme benefits relate to journey time improvements for consumer and business users. This includes notable reductions in journey times between the A34, north of M3 Junction 9, and the M3, south of Junction 9. There are also predicted journey times benefits on other routes via Easton Lane and M3 Junction 9 including movements between central Winchester and the A31 to the east and the A33/A34 to the north.

There are also benefits relating to wider economic impacts, including static clustering impacts where Winchester is one of the primary employment locations in the Enterprise M3 area and the Scheme is expected to boost productivity by removing congestion. The Scheme is also expected to address capacity issues on routes to international gateways and help provide more efficient routes to global markets through reduced travel costs and this provides competitive market wider impact benefits.

The Scheme also provides safety benefits from improvements in the junction layout and reducing the number of collisions and related casualties. There are also local air quality benefits relating to emission reductions in properties around Winchester.

Demand Growth along the Route (Do Minimum)

2027 is the opening year and 2042 is the design year. For the following route:

- *A34 North at A272 to M3 South at J10*
- *M3 South at J10 to A34 North at A272*

Link	**AADT (Opening Year (2027))**	**AADT (Design Year (2042))**	**AADT change (%)**
A34 SB, north of A33	23,900	26,300	10%
M3 SB between J9 and J10	57,200	65,600	15%
M3 NB between J10 and J9	59,500	70,000	18%
A34 NB, north of A33	29,700	30,600	3%
Distance-weighted Average	38,600	43,200	12%

Total AADT in vehicles

Demand Growth along the Route (Do Something – each option)

Link	**AADT (Opening Year (2027))**	**AADT (Design Year (2042)**	**AADT change (%)**
A34 SB, north of A33	26,400	29,200	11%
M3 SB between J9 and J10	61,000	66,500	9%
M3 NB between J10 and J9	63,900	70,200	10%
A34 NB, north of A33	35,500	40,800	15%
Distance-weighted Average	42,800	47,500	11%

Total AADT in vehicles

Key Monetised Benefits and Costs

Category	Benefits and costs in £'000 (PV)
Business Users	
Journey Time Savings	68,388
Vehicle Operating Costs	2,625
Non-Business users	
Journey Time Savings	87,091
Vehicle Operating Costs	-10,966
Reliability	
Business Reliability	Not quantified
Non-business Reliability	Not quantified
Safety	
Safety	22,918
Environmental Impacts	
Noise	-1,344
Local Air Quality	4,742
Greenhouse Gases	-24,111
Landscape	Not calculated
Wider Economic Impacts	
Agglomeration	34,735
Market Competition	7,100
Dependent Development	Not quantified
Labour Supply	Not quantified
Customer Impact	
Traffic delays due to Construction	-2,719
Traffic impacts due to Maintenance	Not quantified
Journey Quality	Not quantified
Developer contributions	
Developer contributions	0
Other Impacts	
Indirect tax Revenues	-5,692
[Other - please specify]	
Costs	
Cost to Broad Transport Budget	112,711
Cost savings (where relevant)*	0

*****The cost savings row should only be completed where the option being considered will deliver financial savings to Highways England'

Key quantified benefits / costs

Category	Quantified impacts	*Units*
Journey times		
Journey Time Savings	2.7	*(average saving per journey on scheme sections in minutes) * This includes the route A34 to M3 from the 2042 strategic model (the average of the Northbound and Southbound journey times in the PM peak by AADT weighted average).*
Safety		
Accidents	537	*(total number saved)*
Fatalities	9	*(total number saved)*
Seriously injured	59	*(total number saved)*
Slightly injured	696	*(total number saved)*
Environmental Impacts		
Number of Noise important areas affected	3	*(number)*
Names of AQMAs	Winchester Town Centre, Eastleigh AQMA No.1 and No. 2	*(names)*
Change in NOx emissions	40.6	*(tonnes)*
Change in PM10 emissions	55.9	*(tonnes)*
Change in greenhouse gas emissions	307,580	*(tonnes CO2e)*
Customer Impact: Totals		
Traffic delays due to Construction	441,000 person hrs	*(total loss on scheme sections in hours)*
Traffic impacts due to Maintenance	0	*(total impact on scheme sections in hours)*

Customer Impact: Per journey		
Traffic delays due to Construction (cars)	+1.1 (average time increase for all vehicles)	*(average loss per journey on scheme sections in minutes) **
Traffic delays due to Construction (LGVs)		*(average loss per journey on scheme sections in minutes) **
Traffic delays due to Construction (HGVs)		*(average loss per journey on scheme sections in minutes) **
Traffic impacts due to Maintenance (cars)	N/A	*(average impact per journey on scheme sections in minutes) **
Traffic impacts due to Maintenance (LGVs)		*(average impact per journey on scheme sections in minutes) **
Traffic impacts due to Maintenance (HGVs)		*(average impact per journey on scheme sections in minutes) **

**Defined as total saving or loss on all scheme sections per day divided by distance-weighted AADT on scheme sections*

Strategic Outcome	KPI	Scheme Contribution – Qualitative	Scheme Contribution - Quantitative
Making the network safer	The number of KSIs on the SRN.	There is overall a reduction in accidents and KSIs. The improved junction layout will help improve overall safety of the junction.	Fatal reduction with Scheme -9 casualties Serious reduction with Scheme -59 casualties Reduction of 537 accidents over the appraisal period
Delivery of better environmental outcomes	Noise: Number of Noise Important Areas mitigated. Biodiversity: Delivery of improved biodiversity, as set out in the Company's Biodiversity Action Plan	There are overall beneficial impacts of the scheme on air quality. With the amalgamations of scheme construction noise impacts and post scheme operation noise impacts, there is a slight adverse impact over the scheme appraisal period. In the context of the proposed creation of extensive areas of chalk grassland, woodland, and scrub, beneficial effects will offset identified slight negative effects.	Households experiencing increased noise (daytime): 424 Households experiencing decreased noise (daytime): 81 Properties experiencing an improvement in PM2.5 levels: 7,459 Properties experiencing a deterioration in PM2.5 levels: 8,950 Properties experiencing an improvement in NO2 levels: 10,085 Properties experiencing a deterioration in NO2 levels: 6,324
Helping cyclists / walkers and other vulnerable users	The number of new and upgraded crossings	The Scheme will deliver improvements to the path and active travel network in the human health study area in terms of accessibility, including the NCN 23. However, this is not considered significant enough to increase active travel journeys.	N/A