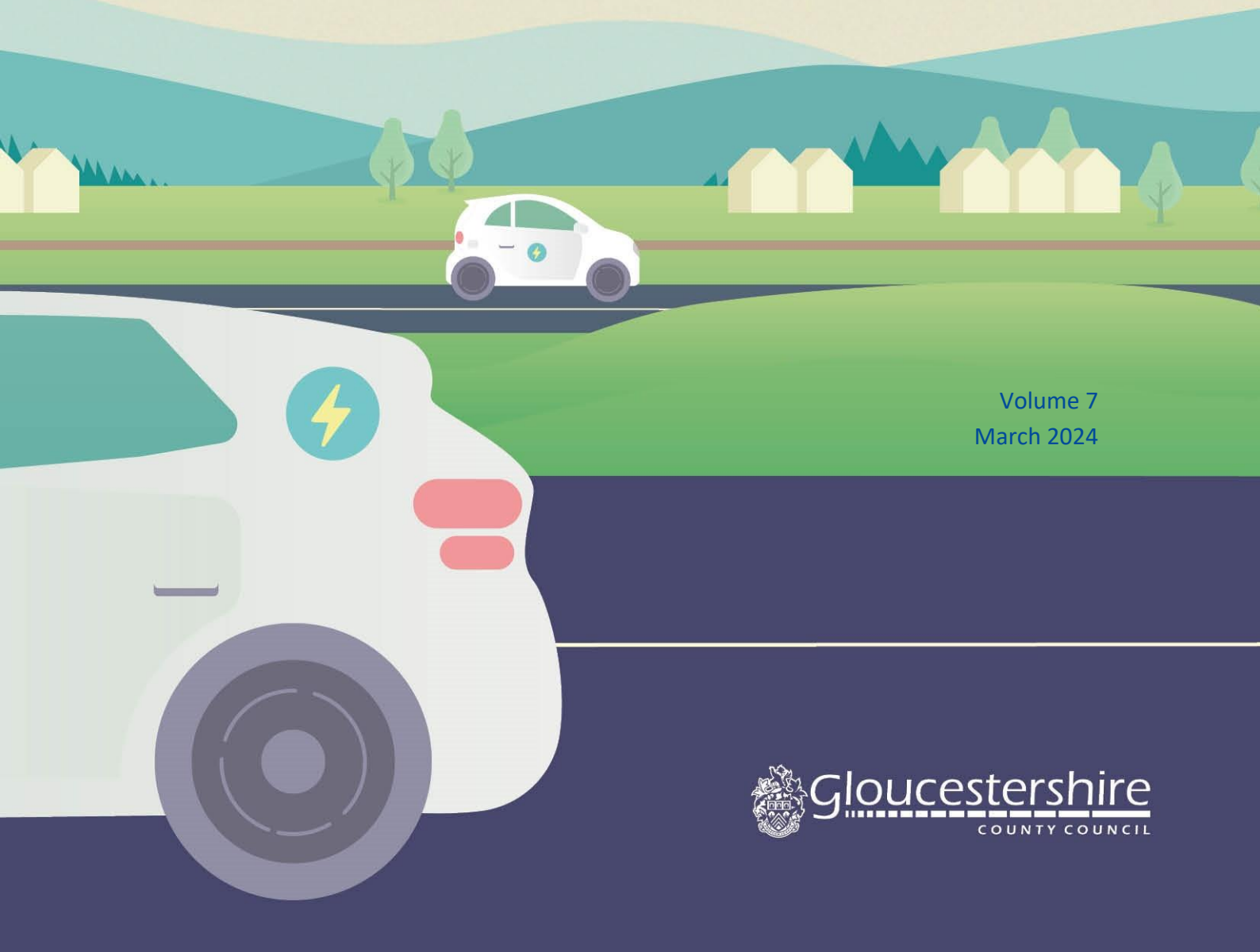
M5 Junction 10 Improvements Scheme

Transport Assessment

Regulation 5 (2) (q)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009



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Gloucestershire COUNTY COUNCIL

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Document history

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Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

M5 Junction 10 Improvements Scheme

Development Consent Order 202[x]

7.5 Transport Assessment

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1. Introduction

1.1.1. This Transport Assessment (TA) has been prepared to support the application by Gloucestershire County Council (GCC) for a Development Consent Order (DCO) to authorise the construction of the M5 Junction 10 Improvements Scheme (the 'Scheme').

1.2. Scheme Background

1.2.1. Gloucestershire faces significant challenges to achieve its vision for economic growth. An adopted Joint Core Strategy (JCS) – a partnership between Gloucester City Council, Cheltenham Borough Council (CBC) and Tewkesbury Borough Council (TBC) has been formed to produce a co-ordinated strategic development plan to show how the region will develop during the period 2011 - 2031. This includes a shared spatial vision targeting 35,175 new homes and 39,500 new jobs by 2031.

1.2.2. Major development of new housing (c.9,000 homes) and employment land is proposed in the JCS in strategic allocations and safeguarded land to the west and north-west of Cheltenham, much of which lies within TBC's boundary as the Local Planning Authority. This development, in turn, is linked to wider economic investment, including a government supported and nationally significant cyber business park (Cyber Central UK) adjacent to the Government Communications Headquarters (GCHQ) site in west Cheltenham, as part of the West Cheltenham allocation.

1.2.3. The existing M5 Junction 10 only provides access and egress to and from the north, with no connectivity to M5 south; this causes existing traffic to cross Cheltenham through various routes to access and leave the M5 from the south using other M5 junctions. This contributes significantly to existing traffic flows across Cheltenham, with significant congestion at peak times. To unlock the housing and job opportunities, a highway network is needed that has the capacity to accommodate the increased traffic it will generate, within a sustainable transport context.

1.2.4. Upgrading M5 Junction 10 to an all movements junction has been identified as a key infrastructure requirement to enable the housing and economic development proposed by the Gloucestershire Local Enterprise Partnership's (GFirst LEP) Strategic Economic Plan and is central to the transport network sought by GCC in the adopted Gloucestershire Local Transport Plan. This planned housing and economic growth have been included in the adopted JCS. Improvements to the existing M5 J10 are critical to maintaining the safe and efficient operation of the junction; and enabling the planned development and economic growth around Cheltenham, Gloucester and Tewkesbury. A bid was submitted in March 2019 to Homes England to the Housing Infrastructure Fund (HIF), wherein an investment case was made for the following infrastructure improvements. Funding was successfully awarded by Homes England in March 2020:

- Element 1: Improvements to Junction 10 on the M5.
- Element 2: A new road linking Junction 10 to West Cheltenham.
- Element 3: A4019 widening, east of Junction 10.
- Element 4: A38/A4019 Junction Improvements at Coombe Hill.
- Element 5: An upgrade to Arle Court Park and Ride.

1.2.5. Elements 1, 2 and 3 comprise the M5 Junction 10 Improvements Scheme. The junction improvements at Coombe Hill (Element 4) and the upgrade to Arle Court Park and Ride (now known as the Arle Court Transport Hub) (Element 5) were included as part of the package of improvements funded by Homes England. As they do not form part of the proposed Scheme, and are located some distance from the junction, GCC has decided to take these two elements forward as separate packages of work in order to accelerate the programme for these elements and will deliver them through separate planning strategies.

1.2.6. An application for a DCO under S.22 of the Planning Act 2008 has been submitted for carrying out works to M5 Junction 10, consisting of a new all-movements junction; the

widening of the A4019 east of the M5 J10 to the Gallagher Retail Park Junction; and a new West Cheltenham Link Road (the Link Road from the A4019 to the B4634). A small section of the A4019 will also be widened to the west of the M5 J10.

1.3. The Applicant

1.3.1. The application has been submitted by GCC and includes works to the Strategic Road Network (SRN) controlled by National Highways as well as works to the local road network managed by GCC's Highways Authority. If approved, the DCO powers will be granted to GCC, with both National Highways and GCC's Highway Authority acting as formal consultees to the Scheme.

1.4. The Designer

1.4.1. Atkins Limited has been appointed as the designer under GCC's highways framework to undertake the Preliminary Design of the Scheme. This includes responsibility for the preparation of this TA.

1.5. Need for a Transport Assessment

1.5.1. The Planning Act 2008 introduced a new planning system for determining Nationally Significant Infrastructure Projects (NSIP)s. Under the Act, the Department for Transport (DfT) which is responsible for preparing the National Policy Statement for National Networks (NN NPS), sets out government policy on the development of national road and rail networks. In establishing the general principles of assessment, Section 4.6 of NN NPS notes that applications for road and rail projects should usually be supported by a local transport model to provide sufficiently accurate detail of the impacts of a project, and the Applicant's assessment should include a proportionate assessment of the transport impacts on other networks as part of the application.

1.5.2. The TA will be submitted under Regulation 5(2)(q) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009, as a document considered necessary to support the application.

1.5.3. The National Planning Policy Framework (NPPF) notes at Paragraph 113 that: All developments that will generate significant amounts of movement should be required to provide a Travel Plan (TP), and the application should be supported by a Transport Statement (TS) or Transport Assessment (TA) so that the likely impacts of the proposal can be assessed. As such, a TA has been prepared to accompany the DCO application for the Scheme.

1.5.4. It is important to note that the Scheme which is subject to the DCO application is a highway Scheme. This highway Scheme will enable the delivery of wider development, the impact of which will be assessed in a cumulative scenario and distinguished from the impact of the Scheme in isolation.

1.6. The Scheme

1.6.1. The infrastructure works under consideration in this TA comprise the following main elements which are, or are related to, changes to the strategic road network and together make up the Scheme:

- An all-movements junction at M5 Junction 10 (Scheme Element 1).
- A new West Cheltenham Link Road east of Junction 10 from the A4019 to the B4634 (Scheme Element 2).
- Widening of the A4019 to the east of Junction 10, including a bus lane on the A4019 eastbound carriageway from the West Cheltenham Fire Station to the Gallagher Junction (Scheme Element 3).

1.6.2. The locations of the proposed infrastructure elements that make up the wider M5 Junction 10 improvements are illustrated in Figure 2.

1.6.3. The improvements at Coombe Hill and extension to Arle Court Transport Hub have been progressed through planning applications. The elements can be seen in Figure 1

alongside the M5 Junction 10 Improvement Scheme. Figure 1 also illustrates the location of the major development of new housing (c.9,000 homes) and employment land proposed in the JCS in strategic allocations and safeguarded land to the west and north-west of Cheltenham.

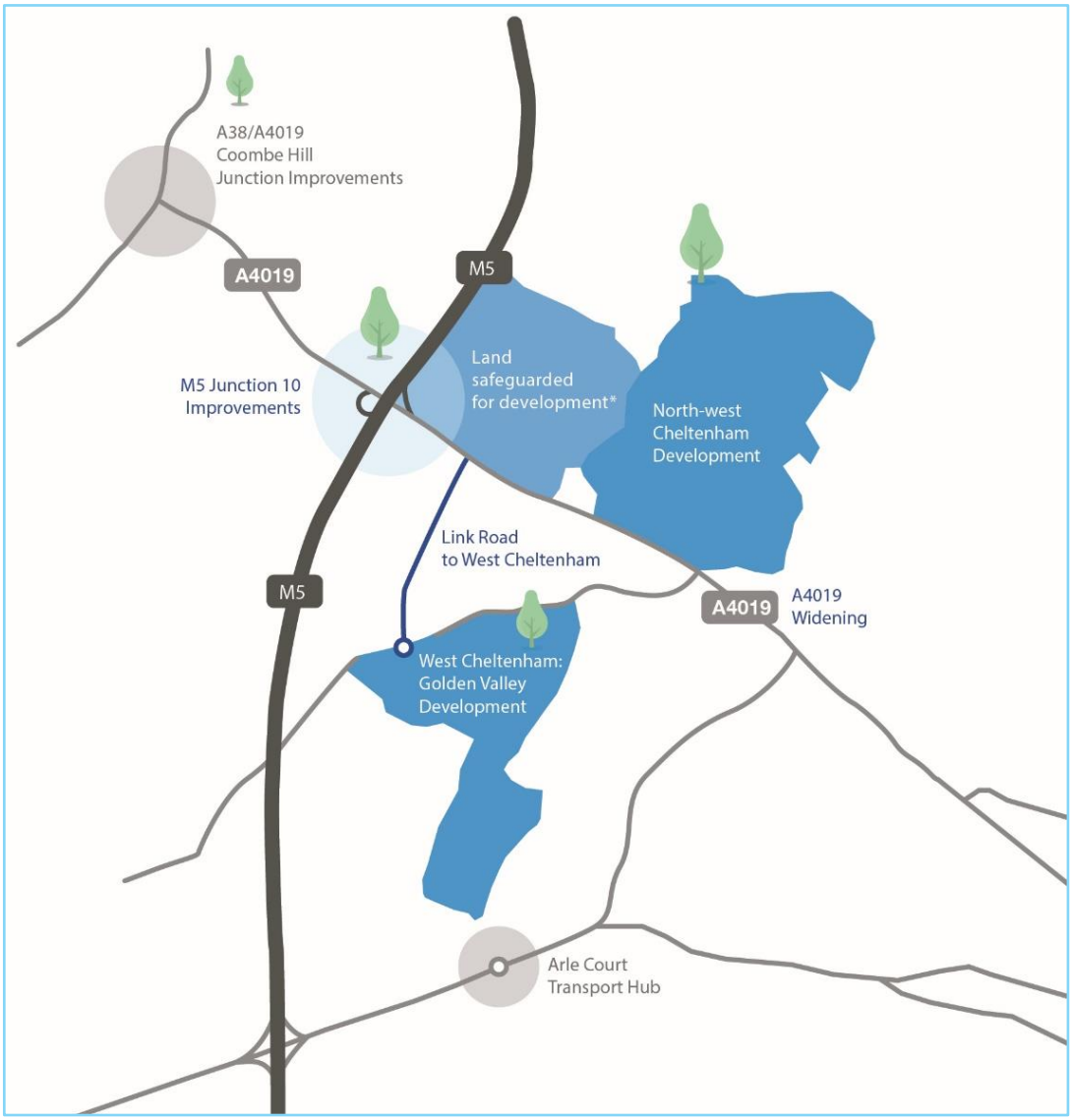


Figure 1 – North West and West Cheltenham Site Locations

1.7. Location of the Scheme

1.7.1. M5 Junction 10 is located 77km to the south of Birmingham, 8km to the south of Tewkesbury, 6km to the north-west of Cheltenham, and 13km to the north-east of Gloucester. It is the northernmost of four junctions serving the Gloucester and Cheltenham urban areas.

1.7.2. This places the junction in a strategically important location for the region, particularly as northern and western Cheltenham are the sites of a number of large retail parks and employment areas, and the location of planned future housing and NSIPs.

1.7.3. The locations of the proposed infrastructure improvements that make up the Scheme are illustrated in Figure 2.

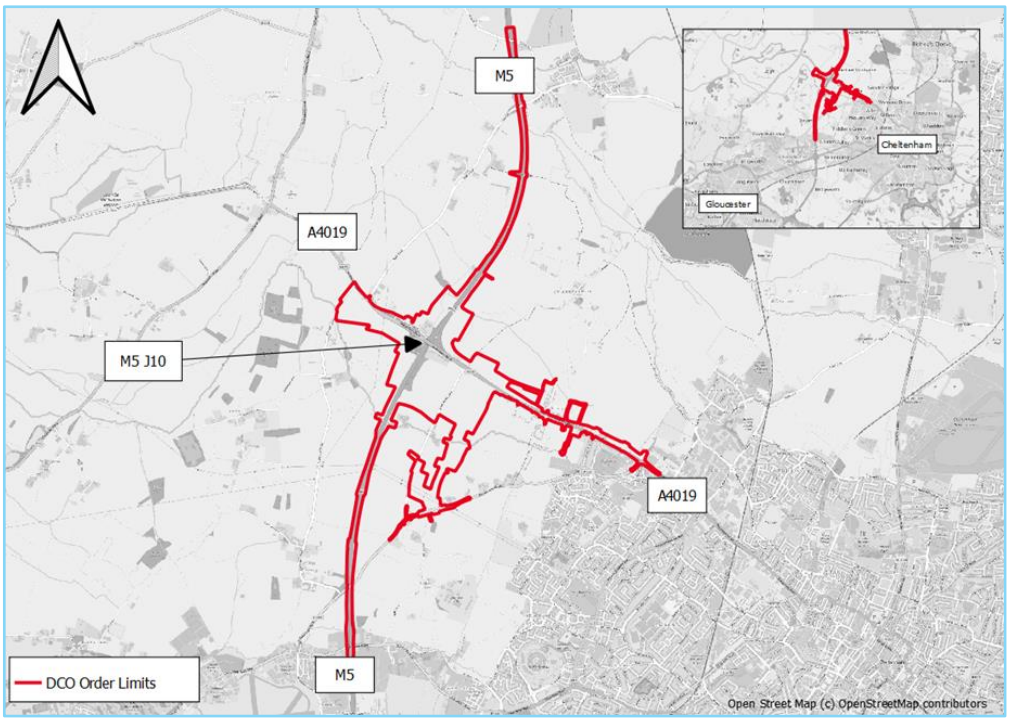


Figure 2 – Scheme Location

1.8. The Need for the Scheme

1.8.1. The need for the Scheme has been developed from the limitations of the existing M5 Junction 10, and the identification in the JCS of land for development in the vicinity of the existing junction:

- The existing M5 Junction 10 only provides access and egress to and from the north, with no connectivity to M5 south; this causes existing traffic to cross Cheltenham through various routes to access and leave the M5 from the south using other M5 junctions. This contributes significantly to existing traffic flows across Cheltenham, with significant congestion at peak times.
- Upgrading M5 Junction 10 to an all movements junction has been identified as a key infrastructure requirement to enable the housing and economic development allocated in the JCS and proposed by the GFirst LEP Strategic Economic Plan. The Scheme is also central to the transport network sought by GCC in the adopted Gloucestershire Local Transport Plan. The provision of the Link Road will further ease congestion in the town.

1.9. Scheme Objectives

1.9.1. The objectives for the Scheme are:

1. Support economic growth and facilitate growth in jobs and housing by providing improved transport network connections in west and north-west Cheltenham.
2. Enhance the transport network in the west and north-west of Cheltenham area with the resilience to meet current and future needs.
3. Improve the connectivity between the Strategic Road Network (SRN) and the local transport network in west and north-west Cheltenham.
4. Deliver a package of measures which is in keeping with the local environment, establishes biodiversity net gain and meets climate change requirements.
5. Provide safe access to services for the local community and including for users of sustainable transport modes within and to west and north-west Cheltenham.

1.10. Purpose and Structure of the TA

1.10.1. The purpose of this TA is to evaluate the transportation aspects of the Scheme in relation to the existing highway network and sustainable transport provision within the vicinity of the Scheme. This TA has been prepared in accordance with 'Travel Plans, Transport Assessments and Statements' guidance from the Ministry of Housing, Communities & Local Government.

1.10.2. This TA includes the following sections:

- Section 2 provides a review of relevant national, regional and local planning policy.
- Section 3 describes the baseline conditions, in terms of the local highway network and multi-modal accessibility.
- Section 4 contains a detailed description of the Scheme.
- Section 5 discusses the traffic modelling.
- Section 6 summarises the Scheme assessment methodology.
- Section 7 summarises the impact of the Scheme.
- Section 8 outlines the impact of the cumulative scenarios.
- Section 9 provides details of the non traffic assessment.
- Section 10 summarises the findings and conclusions.

2. Planning Policy

2.1. Introduction

2.1.1. The TA has been prepared in accordance with 'Travel Plans, Transport Assessments and Statements' guidance from the Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government.

2.1.2. This chapter provides a review of the transportation policy that is considered relevant to the Scheme at a national, regional, and local level. The following documents have been included in this review:

- National Policy Statement for National Networks (December 2014).
- National Planning Policy Framework (NPPF) (July 2023).
- Gloucester, Cheltenham and Tewkesbury Joint Core Strategy (JCS).
- Gloucestershire's Local Transport Plan (LTP) (2020-2041).
- Cheltenham Plan (Adopted July 2020).
- Tewkesbury Borough Plan (Adopted 2022).

2.2. National Policy

National Policy Statement for National Networks (NPS NN) (December 2014)

2.2.1. The Planning Act 2008 introduced a new planning system for determining NSIPs. Under the Act, the Department for Transport (DfT) which is responsible for preparing the NN NPS which sets out government policy on the development of national road and rail networks. The Secretary of State makes decisions on applications for development consent for NSIPs based upon this policy.

2.2.2. The policy in the NN NPS aims to deliver national networks that meet the country's needs through:

- Creating networks with the capacity and connectivity to support national and local economic activity and facilitate growth.
- Creating networks which improve journey quality, reliability and safety.
- Creating networks which support the delivery of a low carbon economy.
- Creating networks which enable communities to link effectively to each other.

2.2.3. In establishing the general principles of assessment, Section 4.6 of NN NPS notes that applications for road and rail projects should usually be supported by a local transport model to provide sufficiently accurate detail of the impacts of a project.

2.2.4. The impacts of the Scheme have been assessed using the Gloucestershire Countywide Traffic Model (GCTM) The GCTM is a SATURN strategic model which has been used to test the impact of the Scheme on the wider road network.

2.2.5. The NPS NN includes details on the assessment of impacts on transport networks. It notes that for road and rail developments, if a development is subject to EIA and is likely to have significant environmental impacts arising from impacts on transport networks, the Applicant's Environmental Statement should describe those impacts and mitigating commitments. In all other cases the Applicant's assessment should include a proportionate assessment of the transport impacts on other networks as part of the application.

2.2.6. The ES for the Scheme assesses the likely significant environmental impacts arising from the Scheme, including those arising from impacts on transport networks where relevant: This TA also includes a proportionate assessment of the transport impacts on other networks.

National Planning Policy Framework (NPPF) (2023)

2.2.7. The NPPF was first published in March 2012, updated in February 2019, and revised in July 2021. It sets out the government's planning policies for England and how these are expected to be applied. The NPPF aims to make the planning system more accessible, and to promote sustainable growth.

2.2.8. The NPPF states that significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions and improve air quality and public health. However, opportunities to maximise sustainable transport solutions will vary between urban and rural areas, and this should be considered in both plan-making and decision-making (Paragraph 105. Section 9).

2.2.9. The NPPF states that planning policies should:

- Be prepared with the active involvement of local highways authorities, other transport infrastructure providers and operators and neighbouring councils, so that strategies and investments for supporting sustainable transport and development patterns are aligned (Paragraph 106.b. Section 9).
- Identify and protect, where there is robust evidence, sites and routes which could be critical in developing infrastructure to widen transport choice and realise opportunities for large scale development (Paragraph 106.c. Section 9).
- Provide for high quality walking and cycling networks and supporting facilities such as cycle parking drawing on Local Cycling and Walking Infrastructure Plans (Paragraph 106.d. Section 9).
- Provide for any large-scale transport facilities that need to be in the area, and the infrastructure and wider development required to support their operation, expansion, and contribution to the wider economy (Paragraph 106.e. Section 9).

2.2.10. The NPPF states that in assessing sites that may be allocated for development in plans, or specific applications for development, it should be ensured that:

- Appropriate opportunities to promote sustainable transport modes can be – or have been – taken up, given the type of development and its location (Paragraph 110.a. Section 9).
- Safe and suitable access to the site can be achieved for all users (Paragraph 110.b. Section 9).
- The design of streets, parking areas, other transport elements and the content of associated standards reflects current national guidance, including the National Design Guide and the National Model Design Code (Paragraph 110.c. Section 9).
- Any significant impacts from the development on the transport network (in terms of capacity and congestion), or on highway safety, can be cost effectively mitigated to an acceptable degree (Paragraph 110.d. Section 9).

2.2.11. The NPPF also states that development should only be prevented or refused on highways grounds if there would be an unacceptable impact on highway safety, or the residual cumulative impacts on the road network would be severe (Paragraph 111. Section 9).

2.2.12. Within this context, applications for development should:

- Give priority first to pedestrian and cycle movements, both within the Scheme and with neighbouring areas; and second–so far as possible–to facilitate access to high quality public transport, with layouts that maximise the catchment area for bus or other public transport services, and appropriate facilities that encourage public transport use (Paragraph 112.a. Section 9).

- Address the needs of people with disabilities and reduced mobility in relation to all modes of transport (Paragraph 112.b. Section 9).
- Create places that are safe, secure, and attractive–which minimise the scope for conflicts between pedestrians, cyclists, and vehicles, avoid unnecessary street clutter, and respond to local character and design standards (Paragraph 112.c. Section 9).
- Allow for the efficient delivery of goods, and access by service and emergency vehicles (Paragraph 112.d. Section 9).

2.2.13. All developments that will generate significant amounts of movement should be required to provide a travel plan, and the application should be supported by a Transport Statement or Transport Assessment so that the likely impacts of the proposal can be assessed (Paragraph 113. Section 9).

2.3. Regional and Local Policy

Gloucester, Cheltenham and Tewkesbury Joint Core Strategy (JCS)

2.3.1. The Joint Core Strategy (JCS) is a partnership between Gloucester City Council, CBC and TBC which sets out a strategic planning framework for the three areas. The JCS was adopted in December 2017 and is now undergoing a review as local plans are required to be reviewed every five years.

2.3.2. For now, the 2017 JCS sets out the quantum of new residential development, jobs and supporting infrastructure that is required up to 2031.

2.3.3. Within Part 2 of the 2017 strategy, a vision is provided that focusses on developing the region as highly attractive and providing accessible places to live, work and socialise. The vision makes it clear that development should be established in sustainable locations, and that residents and businesses will benefit from the improved resultant infrastructure, including roads, public transport and services, and community facilities.

2.3.4. Within the strategy, a number of ambitions and associated strategic objectives have been provided. Those relevant to this development are as follows:

- Ambition 2 – A sustainable natural, built and historic environment
  - Strategic Objective Six – Meeting the challenges of climate change by ensuring that developments are located in sustainable locations.
- Ambition 3 – A healthy, safe and inclusive community
  - Strategic Objective Seven – Reducing the need to travel and reliance on the car by making routes more convenient, safe and attractive by improving provision of existing public transport and sustainable transport modes.
- Strategic Objective Nine – Promoting development that contributed to a healthy population by encouraging healthy lifestyles and a well society through sustainable transport, including public transport.

2.3.5. Policy INF1 specifically relates to the transport network, with the following points considered key:

- Developments should provide safe and accessible connections to the transport network to enable travel choices ensuring that connections are provided to existing network which encourage maximum use and that opportunities for sustainable travel are maximised.
- Planning permission will only be granted where the impact is not considered severe.

2.3.6. Policy SD4 relates to design requirements which states that proposals will need to clearly demonstrate how the following principles have been incorporated:

- Context, Character and Sense of Place.
- Legibility and identity.
- Amenity and space.
- Public realm and landscape.
- Safety and security.
- Inclusiveness and adaptability.
- Movement and connectivity.

2.3.7. Within the movement and connectivity principle, it states that new development should be integrated with existing development and prioritise movement by sustainable transport modes through connections to the wider movement network and use of the hierarchy of transport modes illustrated in Figure 3.

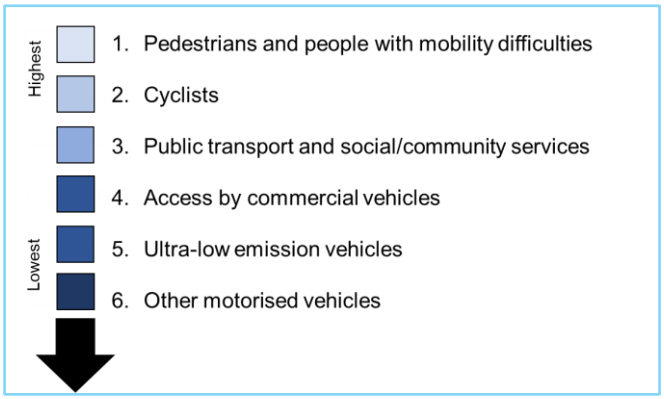


Figure 3 – Hierarchy of Transport Modes

Gloucestershire's Local Transport Plan (LTP) (2020-2041)

2.3.8. The Gloucestershire Local Transport Plan (2020-2041) sets out the long-term strategic transport vision for the County to 2041. The county's vison for transport is 'a resilient transport network that enables sustainable economic growth by providing travel choices for all, making Gloucestershire a better place to live, work and visit'.

2.3.9. The key objectives of Gloucestershire's Local Transport Plan are as follows:

- Protect and enhance the natural and built environment.
- Support sustainable economic growth.
- Enable safe and affordable community connectivity.
- Improve community health and wellbeing and promote equality of opportunity.

2.3.10. Within the Local Transport Plan there are a series of policy objectives.

2.3.11. Policy PD 0.1 – Reducing transport carbon emissions and adapting to climate change, notes that GCC will work with its partners to reduce transport carbon emissions by 2045 and improve air quality in the County by addressing travel demand, promoting the use of sustainable modes of transport and the uptake of ultra-low emission vehicles to tackle climate change. Policy proposals include:

- Ensure public availability of infrastructure required for low emission vehicles, for example a network of electric vehicle charging points or alternative technologies.
- Work towards electric vehicle charging points being provided at interchange hubs and other key locations.

- Develop and maintain a comprehensive bus network supported by interchange hubs across rural and urban areas, to improve connectivity within and across the county boundary.

2.3.12. Policy PD 0.3 – Maximising investment in a sustainable transport network, notes that GCC will work with partners to ensure the delivery of a financially sustainable transport network, through maximising opportunities for inward investment.

Tewkesbury Borough Plan (Adopted 2022)

2.3.13. The Tewkesbury Borough Plan guides where and how development will take place in the borough and provides an appropriate planning policy framework to ensure that Council policy on development is effectively implemented, that development aspirations are reasonable and that communities are protected against the built and natural environment. The Tewkesbury Borough Plan has a role to further develop the transport objectives of the Gloucestershire LTP by providing more detailed guidance on the delivery of transport infrastructure and consideration of transport as a fundamental part of the design of new developments.

2.3.14. Policy TRAC1 – pedestrian accessibility – notes that proposals which reduce pedestrian connectivity, or fail to optimise it, will be resisted. It is noted that pedestrian connectivity should be a fundamental consideration in design-led process and that pedestrian movements should be prioritised over motorised vehicles in a way that promotes pedestrian safety and convenience.

2.3.15. Policy TRAC2 – cycle networks and infrastructure – notes that the protection and enhancement of the cycle network, infrastructure and facilities across the Borough will be sought through safeguarding, developing and promoting a safe and convenient cycle route, segregated from motorised traffic where this does not detract from the pedestrian environment when where it confers an advantage to the cyclist in terms of journey directness and cycle trip experience.

2.3.16. Policy TRAC3 – Bus infrastructure – notes that strategic-scale developments should explore the potential for bus services to move through the site and that the design of developments should enable the safe, direct and convenient movement of buses including appropriate passenger facilities.

2.3.17. Policy TRAC4 – High frequency bus routes – notes that measures to improve journey times and reliability should be implemented for public transport along high frequency bus routes. Any development proposals which lead to an increase in vehicle traffic on high frequency corridors will be required to contribute towards the provision of sustainable transport and bus improvement measures to mitigate any impact and maintain the operation of the high frequency route.

Cheltenham Local Plan (Adopted 2020)

2.3.18. The Cheltenham Plan sets out a series of visions for the area and provides a planning framework to ensure that development is effectively implemented. The plan sets out a series of vision themes, these include the following:

2.3.19. Vision Theme A – to ensure Cheltenham is a place with well connected communities which are sustainable places to live and work and that they contain the necessary infrastructure to support social and cultural life. As part of this vision there are a series of objectives, these include:

- ‘Design places, with a focus on connectivity, that are accessible to all and where barriers to walking and cycling are removed so that active travel and public transport are the default choices.’
- ‘Improve health outcomes by promoting and prioritising active travel.’

2.3.20. Vision Theme B – to ensure Cheltenham has a prosperous economy where education, skills and employment opportunities are growing and diverse and to create an environment that supports economic growth. As part of this theme there are a series of objectives, including:

- To deliver a range of sustainable transport choices through appropriate infrastructure improvements including better links, prioritised junctions and improved public transport.

2.3.21. Vision Theme C – to ensure Cheltenham is a place where the built environment and assets are valued where tourists choose to visit and return. This vision includes to following transport related policy:

- 'Improve pedestrian and cycle connectivity and permeability throughout the town by creating a network of convenient routes which include multifunctional green spaces that link with the wider countryside, attractive and safe streets and spaces and measures which reduce the visual and environmental impact of vehicular traffic.'

2.4. Policy Summary

2.4.1. This TA has been prepared in line with the national, regional and local policy context outlined above, and in accordance with 'Travel Plans, Transport Assessments and Statements' guidance from the Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government. The subsequent sections of the TA will demonstrate how the Scheme will align with these policies.

3. Baseline Conditions

3.1. Introduction

3.1.1. This chapter of the report outlines the site location and provides details of the existing surrounding highway network and provision for sustainable travel modes, including pedestrian and cycle facilities.

3.2. Site Location

3.2.1. The site is located approximately 6km north-west of Cheltenham town centre and, 8km to the south of Tewkesbury and 13km to the north-east of Gloucester. It is the northernmost of four junctions serving the Gloucester and Cheltenham urban areas. As such the junction is in a strategically important location for the region, particularly as northern and western Cheltenham are the sites of a number of large retail parks and employment areas, and the location of planned future housing and nationally significant business development.

3.3. Local Highway Network

3.3.1. The Scheme is located on the following roads and junctions:

- M5 Junction 10.
- A4019.
- Withybridge Lane.
- Withybridge Garden.
- Stanboro Lane.
- Old Gloucester Road.

3.3.2. Figure 4 shows the local highway network.

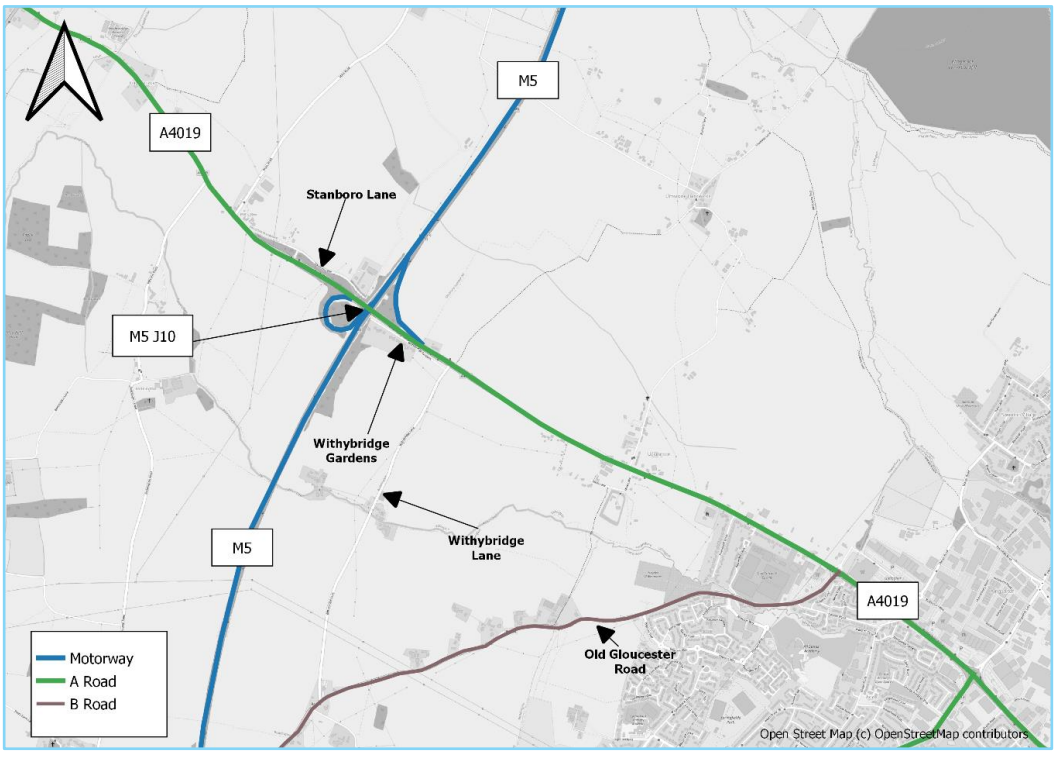


Figure 4 – Local Highway Network Plan

M5

3.3.3. The M5 is part of the Strategic Road Network (SRN) and provides a connection for the South West to the West Midlands. The M5 is subject to the national speed limit.

M5 Junction 10

3.3.4. M5 Junction 10 is a limited movement junction which only provides access to the M5 northbound and from the M5 southbound. Vehicles cannot leave the M5 northbound or join the M5 southbound. In order for traffic to travel south, traffic from Cheltenham must access the southbound M5 via Junction 11 which can be accessed from Cheltenham on the A40.

3.3.5. The section of the M5 which runs through Junction 10 has three lanes and a hard shoulder either side, an on-slip for traffic joining northbound and an off-slip for traffic leaving southbound.

A4019

3.3.6. The A4019 is a predominantly single carriageway road which runs from the Coombe Hill junction in the west where it meets the A38, to Cheltenham in the east. The A4019 provides access to the M5 northbound via junction 10 and provides an egress point for traffic on the M5 southbound, at this point the A4019 is dual carriageway and subject to a 50mph speed limit.

3.3.7. The dual carriageway section of the A4019 ends approximately 100m west of the junction with Withybridge Lane in the eastbound direction, and approximately 150m west of the junction with Stanboro Lane in the westbound direction, where the A4019 becomes a single carriageway subject to a 50mph speed limit.

3.3.8. The A4019 has sections of footway on the eastbound carriageway which runs from the west of Junction 10, up to the motorway overbridge, and then continue east of Withybridge Lane.

Withybridge Lane

3.3.9. Withybridge Lane is a two-way single carriageway road which runs from the A4019 in the north to Old Gloucester Road in the south. Withybridge Lane is subject to a 50mph speed limit and does not have any pedestrian facilities.

3.3.10. Withybridge Lane meets both the A4019 and Old Gloucester Road at priority junctions, where both the A4019 and Old Gloucester Road have priority over Withybridge Lane.

Withybridge Gardens

3.3.11. Withybridge Gardens is a two-way single carriageway road which has no through route and provides local access only with footway provision along housing frontages.

3.3.12. It meets Withybridge Lane at a priority junction.

Stanboro Lane

3.3.13. Stanboro Lane is a two-way single carriageway road with no through route which provides local access only. Stanboro Lane is subject to the national speed limit and has no pedestrian facilities with the exception of footway provision where it meets the A4019. Stanboro Lane meets the A4019 at a priority junction.

Old Gloucester Road (B4634)

3.3.14. Old Gloucester Road is single carriageway two-way road which provides a link between Cheltenham and Gloucester. Where the road interacts with the Scheme, Old Gloucester Road is subject to a 50mph speed limit and has no pedestrian facilities or street lighting.

3.4. Sustainable Transport

3.4.1. This section summarises the existing sustainable transport provision in the vicinity of the site.

Pedestrian Access

3.4.2. The A4019 is the only road within the Scheme with pedestrian facilities. Footways are present from Junction 10 on the eastbound carriageway of the A4019, these footways provide pedestrian access to the junction and a pedestrian connection towards Cheltenham. This footway provision is inconsistent with approximately 200m of the A4019 without pedestrian facilities between the M5 Junction 10 Southbound slip and the A4019 and Withy Bridge.

3.4.3. The footways are not well lit with lighting only present towards the junction with the Old Gloucester Road. In addition to this there are no formal crossing facilities present along the majority of the A4019, with signal controlled crossing points only at the junction with the Old Gloucester Road.

Cycle Access

3.4.4. There are no formal cycle facilities present along the Scheme extent, with cyclists required to use the carriageway. In addition to this, there are no crossing facilities present.

3.4.5. The closest cycle route is the National Cycle Network (NCN) 41 which runs close to M5 Junction 11.

3.5. Public Transport

3.5.1. This section summarises the bus provision in the vicinity of the site.

Bus Services

3.5.2. Figure 5 illustrates the bus stops that are located within the vicinity of the Scheme. These bus stops include:

- The Gloucester Old Spot.
- Stanboro Lodge.
- Withybridge Gardens.
- Cooks Lane.
- Moat Lane.
- The Plant Centre.

3.5.3. These bus stops are served by the following services:

- 41 – Cheltenham to Northway.
- 42 – Cheltenham to Tewkesbury.
- 43 – Cheltenham to Tewkesbury.
- 43A – Cheltenham to Tewkesbury.

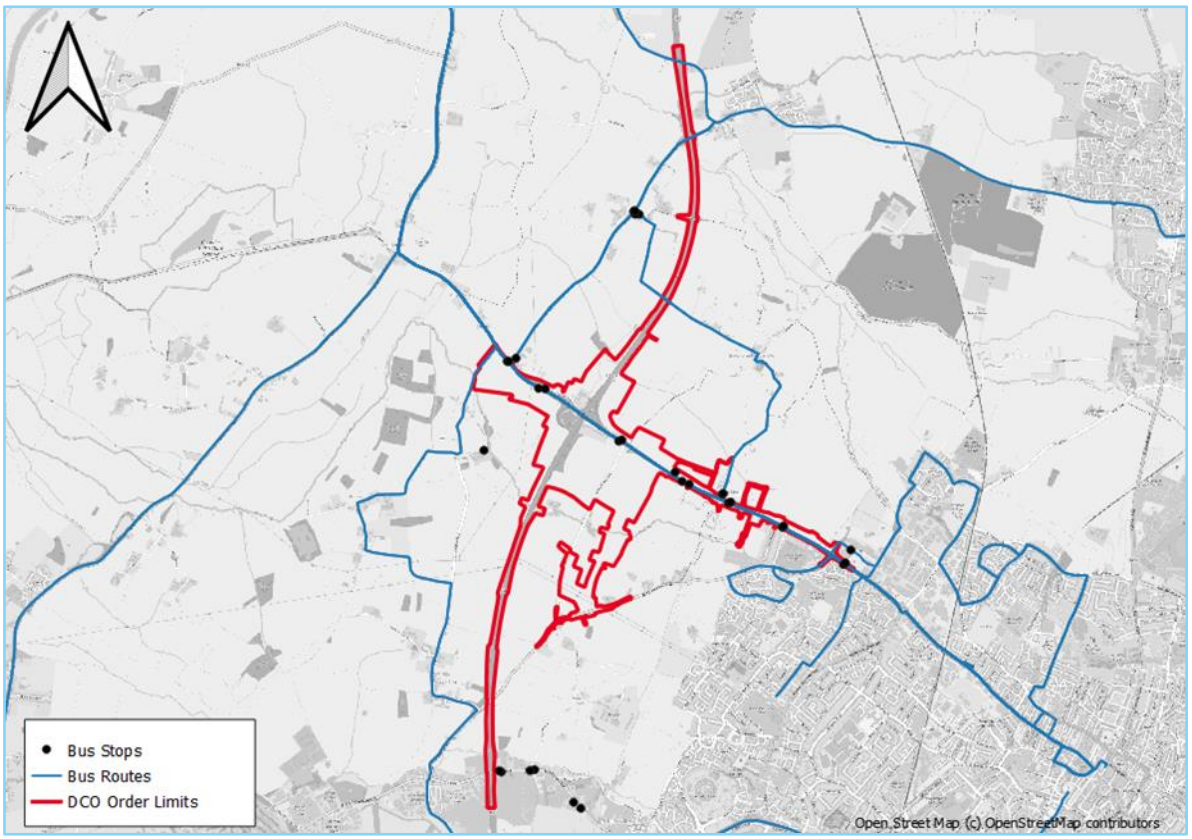


Figure 5 – Bus Stop Locations

3.6. Personal Injury Accident (PIA) Analysis

3.6.1. Personal Injury Accident (PIA) data has been obtained for the latest five-year period between 2017 and 2021. The study area covers the immediate highway network of the site and includes the following roads:

- M5.
- A4019.
- Withybridge Lane.
- Withybridge Gardens.
- Stanboro Lane.
- Old Gloucester Road.

3.6.2. Figure 6 shows the location and severity of the recorded PIAs within the study area during the five-year analysis period.

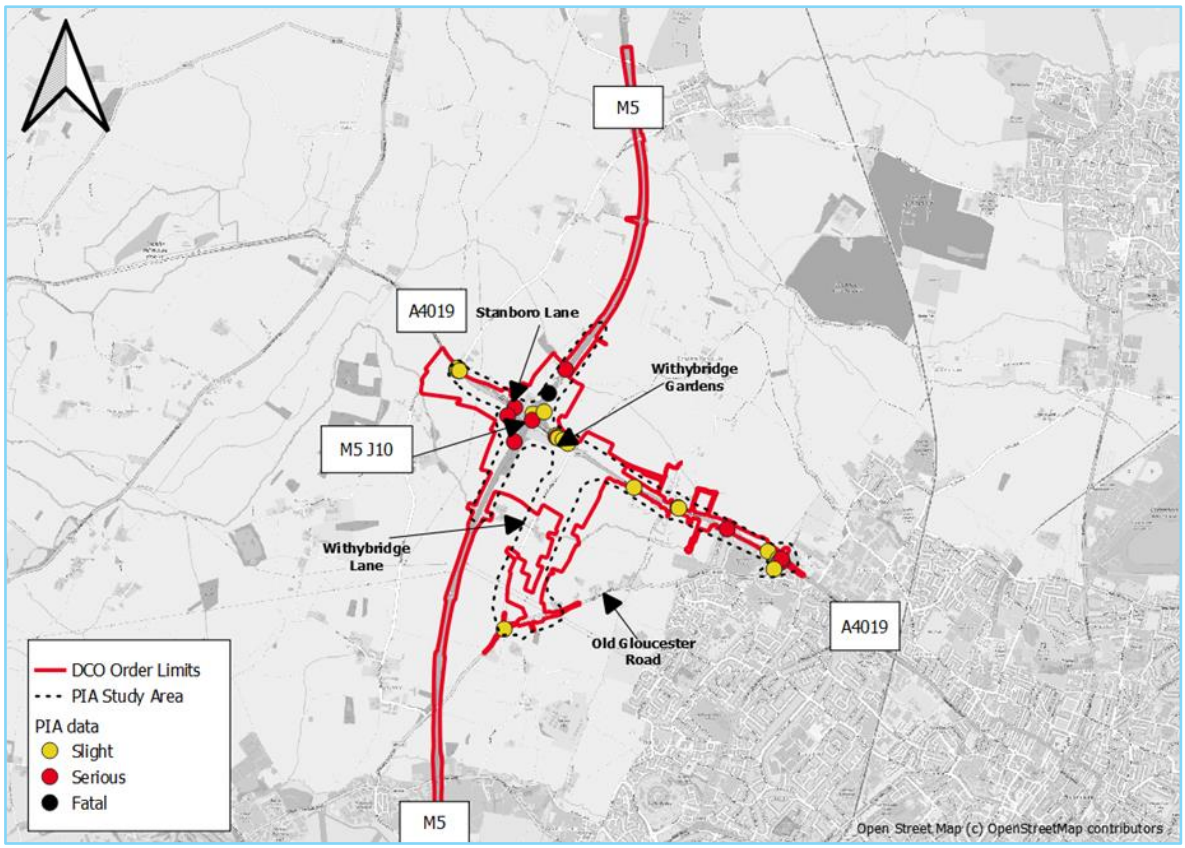


Figure 6 – Recorded PIAs – Study Area

PIA Severity

3.6.3. The Severity of a PIA is categorised as slight, serious, or fatal as defined by DfT:

- Slight – one in which at least one person is slightly injured. This includes minor injuries such as sprains, bruises, slight cuts, or shock, requiring only roadside attention.
- Serious – one in which a person is detained in hospital as an 'in-patient', or any of the following injuries whether or not they are detained in hospital: fractures, concussion, internal injuries, crushing, burns (excluding friction burns), severe cuts, severe general shock requiring medical treatment and injuries causing death 30 or more days after the accident. An injured casualty is recorded as seriously or slightly injured by the police based on information available within a short time of the accident. This generally will not reflect the results of a medical examination but may be influenced according to whether the casualty is hospitalised or not. Hospitalisation procedures will vary regionally.
- Fatal – one in which at least one person is killed, either immediately or at any time within 30 days after the accident.

PIA Severity by Year

3.6.4. The total number of slight, serious and data accidents within the study area are shown in Table 1.

Table 1 – Severity of Accidents – Study Area (2017-2021)

Severity	2017	2018	2019	2020	2021	Total
Fatal	0	0	1	0	0	1
Serious	6	2	1	0	1	10
Slight	3	7	2	5	2	19
Total	9	9	4	5	3	30

3.6.5. The table indicates that there has been one recorded fatality, 10 serious PIAs and 19 slight PIAs across the study area in the five-year study period.

PIA Severity by Location

3.6.6. The locations of the recorded accidents are outlined below separately for road links and junctions. An accident is defined as occurring at a junction when it is within 20m of a junction.

Links

3.6.7. Table 2 presents a summary of the PIAs recorded by severity at the links within the study area, these links include:

- Link 1 – M5 Southbound.
- Link 2 – M5 Northbound.
- Link 3 – M5 Southbound Slip.
- Link 4 – M5 Northbound Slip.
- Link 5 – A4019.
- Link 6 – Withybridge Lane.
- Link 7 – Withybridge Gardens.
- Link 8 – Stanboro Lane.
- Link 9 – Old Gloucester Road.
- Link 10 – Hayden Road.

Table 2 – Severity of Accidents – Per Link (2017-2021)

Severity	Link 1	Link 2	Link 3	Link 4	Link 5	Link 6	Link 7	Link 8	Link 9	Link 10	Total
Fatal	0	1	0	0	0	0	0	0	0	0	1
Serious	0	2	0	1	2	0	0	0	0	0	5
Slight	0	0	1	0	4	0	0	0	0	1	6
Total	0	3	1	1	7	0	0	0	0	1	12

3.6.8. The table indicates that there has been one fatality across the study area in the last five years and that this was located on the M5 Northbound. In addition to this there has been five serious and six slight accidents.

Junctions

3.6.9. Table 3 presents a summary of the PIAs by severity at the junctions within the study area, these junctions include:

- Junction 1- A4019/The Gloucester Old Spot.
- Junction 2 - A4019/Stanboro Lane.
- Junction 3 - M5 Junction 10 Northbound Slip/M5.
- Junction 4 – M5/M5 Junction 10 Southbound Slip
- Junction 5 – M5 Junction 10 Northbound Slip/A4019.
- Junction 6 – M5 Junction 10 Southbound Slip/A4019.
- Junction 7 - A4019/Withybridge Lane.
- Junction 8 - A4019/Moat Lane.
- Junction 9 - A4019/Homecroft Drive.
- Junction 10 - A4019/Hayden Road.
- Junction 11 - Withybridge Lane/Withybridge Gardens.
- Junction 12 - Withybridge Lane/Old Gloucester Road.

Table 3 – Severity of Accidents Per Junction (2017-2021)

Severity	1	2	3	4	5	6	7	8	9	10	11	12	Total
Fatal	0	0	0	0	0	0	0	0	0	0	0	0	0
Serious	0	0	0	0	0	1	0	0	1	2	0	0	4
Slight	6	0	1	0	0	3	0	0	0	3	0	1	14
Total	6	0	1	0	0	4	0	0	1	5	0	1	18

3.6.10. The table indicates that there have been 18 PIAs at junctions across the study area with four serious and 14 slight recorded.

Summary

3.6.11. The PIA review has demonstrated that there have been 30 PIAs within the five years between 2017 and 2021, this includes one ‘fatal’ PIA. Given the context of the study area with strategic roads and high traffic volumes, the severity and frequency of accidents is not considered to be significantly high, and it is not considered that there are any particular locations experiencing significant accident problems.

3.7. Existing Conditions

3.7.1. To provide context on the existing traffic conditions on the local highway network, a combination of observations of typical operation and information from traffic counts has been used. Traffic count data for the development of the Paramics model (see Section 5 of the TA) was collected for both link and turning flows across the study area in November 2017. Further details of the data collected to understand baseline conditions including survey data are included in the Model Package Data Report (GCCM5J10-ATK-HTA-ZZ-RP-TR-000003 at Appendix K) The surveys were undertaken in the form of single-day Manual Classified Counts (MCC) at junctions, and two-week Automatic Traffic Counts (ATC) on links. The locations of the MCC's and ATC's are shown below in Figure 7.

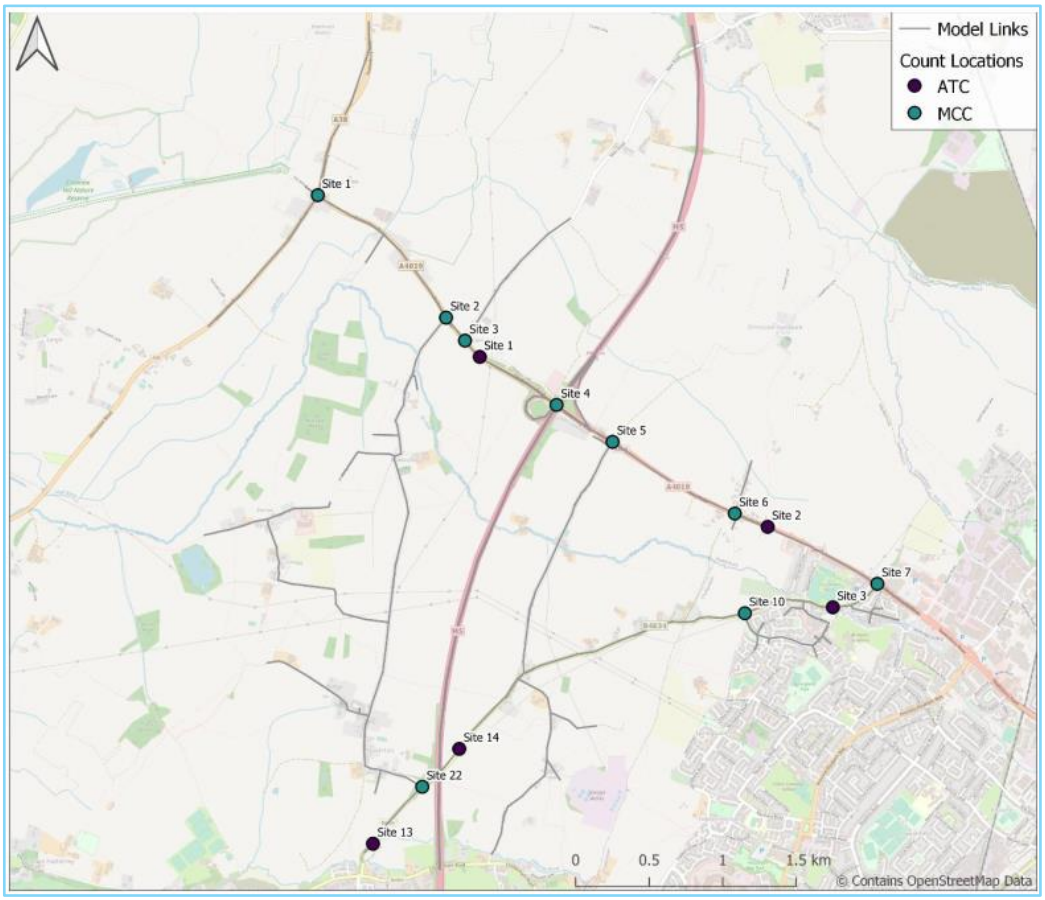


Figure 7 – Surveyed flow information

M5 Junction 10

3.7.2. M5 Junction 10 is currently a limited movement junction which only provides access to the M5 northbound and from the M5 southbound. This means traffic using M5 Junction 10 travelling to or from Gloucester and destinations to the south-west must travel through Cheltenham to Junction 11 of the M5.

3.7.3. In the AM peak, congestion has been observed on the A4019 extending back from Cheltenham to the motorway junction, resulting in instances where the southbound off-slip queue extends into the M5 mainline. No congestion issues are typically observed on the northbound on-slip.

A4019

3.7.4. The A4019 is a predominantly single carriageway road which in the 2017 AM peak carried around 1200 vehicles eastbound towards Cheltenham along with around 650 vehicles westbound towards M5 Junction 10. In the 2017 PM peak, the westbound flow towards M5 Junction 10 was around 1200 vehicles, with around 875 heading eastbound towards Cheltenham.

3.7.5. Congestion has been observed on all approaches to the A4019 /A4013 Princess Elizabeth Way/Kingsditch Lane roundabout in the AM peak.

3.7.6. In the PM peak, the A4019 /A4013 Princess Elizabeth Way/Kingsditch Lane roundabout has been observed as the main point of congestion along the A4019 corridor, with queues on all approaches and most noticeably on Kingsditch Lane and Princess Elizabeth Way arms.

4. Scheme Proposals

4.1. Introduction

4.1.1. The Scheme subject to the DCO is the proposed alterations to the existing M5 Junction 10 and the surrounding highway network. The main elements of the proposed works comprise:

- The improvements to M5 Junction 10.
- Construction of the West Cheltenham Link Road.
- Widening along the A4019 east of the junction, including a bus lane on the A4019 eastbound carriageway from the West Cheltenham Fire Station to the Gallagher Junction.

4.1.2. The Scheme aims to increase the capacity and accessibility of M5 Junction 10 whilst improving active travel provision.

4.1.3. The objectives of the Scheme are to:

- Support economic growth and facilitate growth in jobs and housing by providing improved transport network connections in West and North-West Cheltenham.
- Enhance the transport network in the West and North-West of Cheltenham area with the resilience to meet current and future needs.
- Improve the connectivity between the Strategic Road Network (SRN) and the local transport network in West and North-West Cheltenham.
- Deliver a package of measures which is in keeping with the local environment, establishes biodiversity net gain and meets climate change requirements.
- Provide safe access to services for the local community and including for users of sustainable transport modes within and to West and North-West Cheltenham.

4.1.4. It is noted that the basis of the Scheme is to 'enable' major developments, rather than to provide all the network improvement requirements for such development. Furthermore, in order to design a Scheme that had no adverse impact on the future journey times, a much larger Scheme with notably higher cost and more importantly considerably increased impact on the environment would have been needed which would be unacceptable.

4.2. Development Description

4.2.1. The full Scheme description is outlined in Chapters 1-4 of the ES (TR010063 – APP 6.2). A summary of the works relevant to the TA are outlined below.

4.2.2. M5 Junction 10 currently only provides slip roads from the north and to the north meaning that traffic from Cheltenham must access the southbound M5 via Junction 11. As part of the Scheme, it is proposed to increase the capacity and improve the accessibility of M5 Junction 10 by removing the existing provision, and building four new slip roads onto the M5 thereby creating an all-movements signalised junction.

4.2.3. In order to create this, the existing bridge over the M5 will be demolished and replaced with a new roundabout with two bridges, a segregated cycle track and a footway.

4.2.4. The plan for the Scheme is provided in Appendix A. The main elements of the proposed works comprise:

M5 Junction 10

- A new signalised roundabout at Junction 10 with three lanes.
- Widening to three lanes westbound and two lanes eastbound on A4019 approach to Junction 10 with a cycle and pedestrian route over the motorway bridge.
- New slip road onto the M5 southbound and a slip road off the M5 northbound.
- New tracks for access to farmland at a controlled access point.

West Cheltenham Link Road

- A new single carriageway link road from West Cheltenham Golden Valley Development to A4019.
- Signalised junctions on the A4019 and B4634.
- Segregated cycle track and footway on western side of the link road.

A4019 Tewkesbury Road

- Existing A4019 widened to dual carriageway.
- Bus lane on the A4019 eastbound carriageway from the West Cheltenham Fire Station to the Gallagher Junction.
- Segregated cycle track and footway.
- Signalised junctions with pedestrian and cycle facilities.

Walking and Cycling Infrastructure

4.2.5. The Scheme provides a number of walking and cycling infrastructure improvements along the entire Scheme extent. These include pedestrian and cycle facilities alongside the A4019, formal crossing points across the A4019, and crossing facilities at M5 Junction 10.

4.2.6. A summary of these improvements is contained within the Walking, Cycling and Horse-riding Assessment and Review (WCHAR) (Included in Appendix I).

Public Transport Infrastructure

4.2.7. The Scheme will not adversely affect the existing public transport routes. Any existing bus stops that are impacted by the Scheme will be suitably replaced, and/or relocated as necessary.

4.2.8. The Scheme includes a section of bus lane on the A4019 eastbound carriageway from the West Cheltenham Fire Station to the Gallagher Junction. This is likely to provide a benefit to the existing public transport routes along the corridor.

Safety

4.2.9. The Scheme is a highways improvements Scheme which aims to provide safe access to services for the local community and for users of sustainable transport modes within and to West and North West Cheltenham. The Scheme has been designed in accordance with all current standards and guidance. Therefore, it is expected that the proposed Scheme will help to improve road safety in the area.

5. Traffic Modelling

5.1. Introduction

5.1.1. This chapter summarises the traffic modelling undertaken to predict the operational impact of the Scheme on the road network. A Paramics Discovery microsimulation model has been developed to assess the impact of the Scheme on the strategic and local highway networks surrounding the M5 J10 and A4019 corridor.

5.2. Assessment Methodology

5.2.1. The assessment methodology was outlined during scoping discussions in the TA scoping note. The Gloucestershire Countywide Traffic Model (GCTM) Version 2.3 has been used to identify the transportation impacts of the proposed development. The GCTM is a SATURN strategic model which has been used to test the impact of the M5 J10 Scheme on the wider road network.

5.2.2. The resultant trip matrices from the GCTM were then used in the Paramics model to understand the impact of the Scheme in more detail at the junctions on the local highway network.

5.3. GCTM Scenarios

5.3.1. The GCTM 2015 base year model, which was updated in June 2019, has been developed in accordance with DfT guidelines and advice set out in the Design Manual for Roads and Bridges (DMRB) and Transport Assessment Guidance (TAG) acceptability criteria, and has achieved relevant validation standards.

5.3.2. A series of GCTM future forecast year models has been used to estimate the forecast traffic flows in future year scenarios, with and without the Scheme, and then in a cumulative scenario including the Scheme and the associated Joint Core Strategy (JCS) developments which are dependent on provision of the Scheme. Details of the “dead weight” (non-dependent) and dependent developments are included in the Traffic Forecasting Report.

5.3.3. The resultant scenarios modelled in the GCTM were:

Scenario P

5.3.4. The future year scenario without the Scheme, and without the dependent development. Local improvements included in Scenario P are the Coombe Hill improvement Scheme and upgrading Arle Court Roundabout. It represents a scenario without any improvement along the Scheme extent.

Scenario S

5.3.5. The future year scenario with the Scheme. The network is based on the Scheme, with all other elements identical to the Scenario P network. This scenario does not include the traffic associated with dependent developments. As such, it captures the impact of the Scheme in isolation.

Scenario R

5.3.6. The future year scenario with the Scheme and dependent development. This scenario includes the traffic associated with Scheme dependent developments. It represents a cumulative scenario.

5.4. GCTM Assessment Years

5.4.1. The GCTM was developed for the following assessment years:

- 2027 (planned opening year).
- 2042 (design year).

5.5. GCTM Modelled Periods

5.5.1. The GCTM covers the following time periods:

- AM peak period (07:00-10:00).
- PM peak period (16:00-19:00).

5.5.2. The flow information from the model is output as an average peak period flow.

5.6. GCTM Modelled Area

5.6.1. The area covered by the GCTM Version 2.3 is shown in Figure 8. The GCTM (v2.3) includes a "fully modelled area" where junctions are explicitly modelled (Simulation Area) to encompass the Scheme study area in more detail including the M6 and A46 strategic corridors south of Birmingham, recognising the potential for the Scheme to affect wider strategic movements. The highway network outside the Simulation part of the model has been coded in the Buffer Area where they are presented as links with their speed and capacity defined.

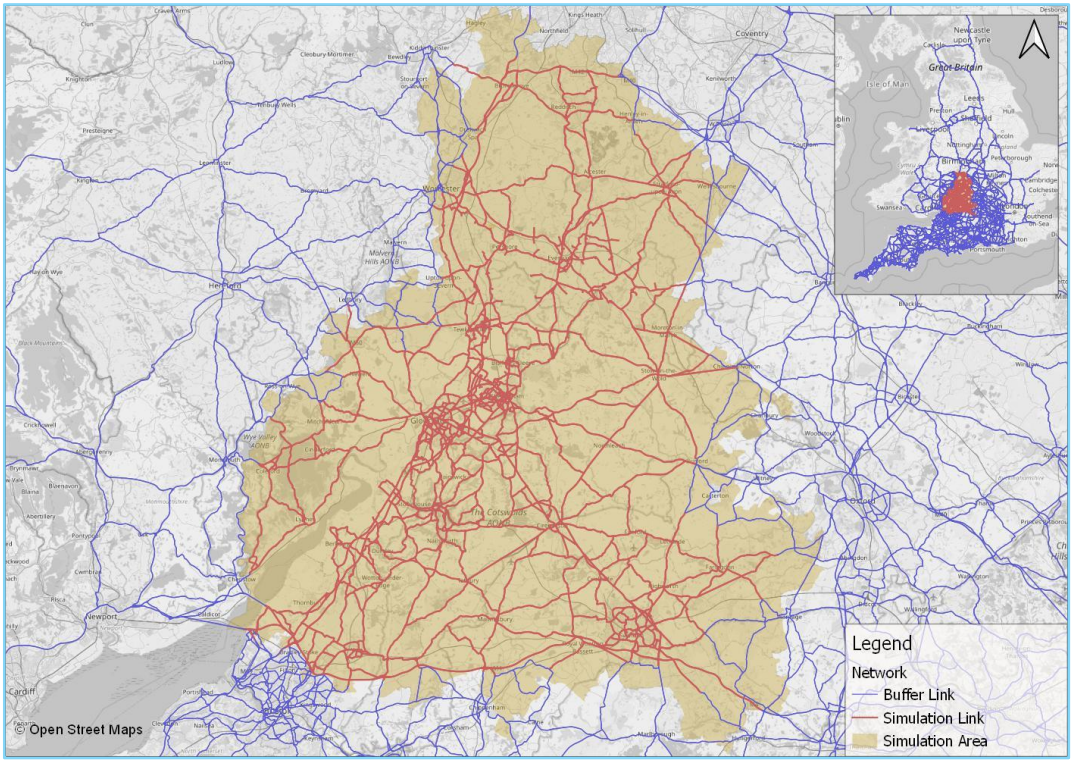


Figure 8 – GCTM Model Area

5.7. GCTM Flow Differences

5.7.1. The changes in flow between the different scenarios are illustrated in flow difference plots included in Appendix B.

5.7.2. The general summary of the flow changes predicted by the GCTM are as follows:

- Scenario P in the future with no improvements along the corridor shows a congested network.
- Comparing Scenario S to P to understand the impact of just the Scheme in isolation shows some changes to flows in the area around the Scheme. The improvements to performance from the Scheme attract a small amount of additional traffic into the area.
- Comparing Scenario R to P to understand the cumulative impact of the Scheme and the associated dependent development shows larger increases in flows. These changes are mainly as a result of the trips generated by the dependent developments and partly due to the Scheme itself.
- The differences between the R to P cumulative comparison are greater in 2042 compared to 2027, due to the amount of dependent development that is built out increasing over time.

5.8. Background for Paramics Model

5.8.1. Jacobs Consultants had previously developed a Paramics Discovery model for wider area surrounding the M5 Junction 10. This Paramics Discovery model was supplied to Atkins to use as a starting point in the development of a more context specific microsimulation model for the Scheme testing. Atkins has updated the supplied Paramics model along with a version update to 24.0.1 of the Paramics Discovery software. The updated base model has then been used to test the GCTM scenarios outlined above for both 2027 and 2042, using flow demand matrices derived from representative GCTM scenarios.

5.9. Model Layout

Model Extents

5.9.1. As the purpose of the operational modelling is to understand the detailed operation of the Scheme, enable design refinement to ensure the Scheme does not have a detrimental impact on the SRN under forecast year conditions; it was agreed with National Highways during scoping discussions that the M5 J10 operational modelling would be undertaken over a smaller localised extent. Figure 9 shows the coverage of the Paramics model, herein known as the Paramics model area.

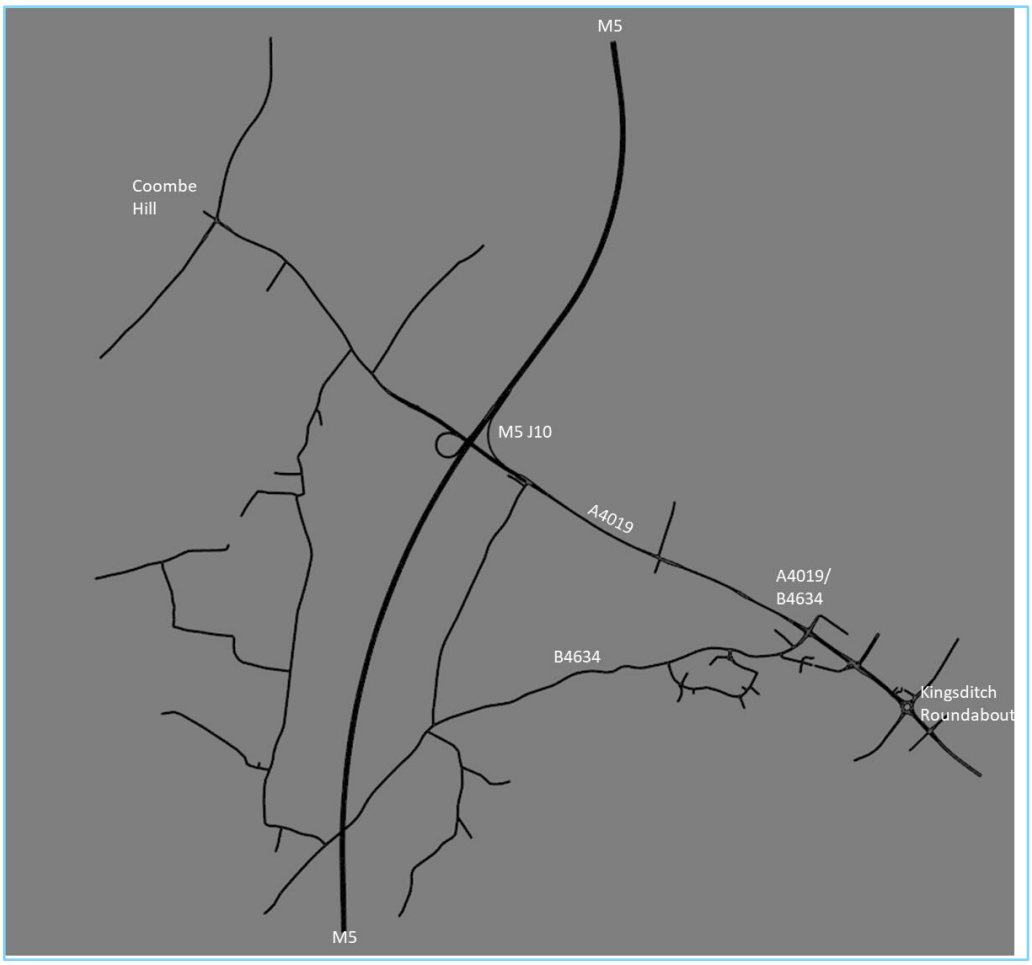


Figure 9 – M5 J10 Paramics Model Extents

Model Assignment

5.9.2. A 'dynamic' traffic assignment method is used for all the assessed scenarios. The traffic growth for Paramics models is provided by the cordoned version of the SATURN strategic model for each forecast year. The Paramics base year model (2017) trip matrices are then growthed for each forecast year in line with the growth produced by the SATURN strategic forecast models. The Paramics model runs are then undertaken based on dynamic method of assignment which means the routes between origin-destinations are not pre-determined or fixed and would vary in different time periods depending upon the travel cost in terms of time and distance.

Model Durations

5.9.3. The following time-periods for all AM and PM peak scenarios have been modelled which include an hour of 'warm-up' and 'cool-down' periods.

- 3-hour Weekday AM peak between 07:00 and 10:00
- 3-hour Weekday PM peak between 16:00 and 19:00

Vehicle Compositions

5.9.4. Atkins have used following vehicle class categories in M5 J10 Paramics Discovery model.

- User class 1 – Car,
- User class 2 – Light Goods Vehicle (LGV),
- User class 3 – Medium Good Vehicle (MGV) and Heavy Goods Vehicle (HGV).

5.9.5. Vehicle proportion for User class 3 are as below:

- AM modelled period – MGV (68%) and HGV (32%)
- PM modelled period – MGV (61%) and HGV (39%).

5.10. Base Model Calibration / Validation

5.10.1. The Paramics Discovery model was built following TAG guidance with the aim of achieving relevant validation standards to give confidence in the demand data and resulting model performance. Atkins has performed a comparison for modelled and observed traffic flows and modelled and observed journey times along selected routes.

5.10.2. The model has been validated for flows using observed traffic counts collected in November 2017 following the DfT TAG Unit M3.1 guidelines. Both modelled time periods have demonstrated a good correlation with observed flows, as more than 98% of the 68 individual link and turn counts passed the TAG criteria for the AM and PM peaks.

5.10.3. The modelled journey times also provided a reasonable representation of delay across the modelled network, with all journey time routes passing within the criteria. More details on Calibration / Validation of the base year Paramics model can be found in the Local Model Validation Report (LMVR) which is an appendix to the Model Package Report (included as Appendix J).

5.11. Modelled Scenarios

5.11.1. Table 4 provides information on various scenarios that have been modelled using the Paramics Discovery model.

Table 4 – Scenarios modelled in Paramics Discovery model

Scenario Name	Description
Scenario P 2027 AM	Uses the forecast growth from cordoned demand matrices of 2027 GCTM Scenario P model (without the Scheme) for AM and PM peak.
Scenario P 2027 PM	
Scenario S 2027 AM	Uses the forecast growth from cordoned demand matrices of 2027 GCTM Scenario S (with the Scheme) for AM and PM peak, excluding any dependent future developments in the area.
Scenario S 2027 PM	
Scenario R 2027 AM	Uses the forecast growth from cordoned demand matrices of 2027 GCTM Scenario R model (with the Scheme) for AM and PM peak, including any dependent future developments in the area completed by 2027.
Scenario R 2027 PM	
Scenario P 2042 AM	Uses the forecast growth from cordoned demand matrices of 2042 GCTM Scenario P model (without the Scheme) for AM and PM peak.
Scenario P 2042 PM	
Scenario S 2042 AM	Uses the forecast growth from cordoned demand matrices of 2042 GCTM Scenario S (with the Scheme) for AM and PM peak, excluding any dependent future developments in the area.
Scenario S 2042 PM	
Scenario R 2042 AM	Uses the forecast growth from cordoned demand matrices of 2042 GCTM Scenario R model (with the Scheme) for AM and PM peak, including any dependent future developments in the area completed by 2042.
Scenario R 2042 PM	

5.12. Model Assumptions

5.12.1. The forecast growth in demand for the Paramics model is derived from the strategic models. The assumptions which the SATURN models are based upon including the developments, trip generation and growth scenarios are detailed in the Traffic Forecasting Report (TFR - GCCM5J10-ATK-HTA-ZZ-RP-TR-000004 at Appendix L).

6. Scheme Assessment Methodology

6.1. Introduction

6.1.1. This section provides an overview of how the modelling results were interpreted to understand the impact of just the Scheme in isolation.

6.2. Assessment Scope

6.2.1. It is important to note that the Scheme which is subject to the DCO is a highway scheme. This highway scheme will enable the delivery of wider developments with a focus on three major developments situated along A4019 and Old Gloucester Road (shown in Figure 2), but the impact of this associated dependent development is assessed in a cumulative scenario and distinguished from the impact of the Scheme in isolation.

6.3. Assessment Scenarios

6.3.1. The Scheme is being assessed in future year scenarios (2027 and 2042) so there are associated performance impacts of traffic growth on the Paramics model area compared to existing conditions irrespective of the Scheme being implemented. Details of the changes to create the future year scenarios are outlined in the Model Package Report (included as Appendix J).

6.3.2. The interpretation of the results between Scenarios S to P has provided the findings for the Scheme assessment; it isolates just the impacts of the Scheme itself, rather than impacts of future year growth, and /or future development.

6.4. Model Result Collection

6.4.1. All the modelled scenarios are run for 10 different random seed numbers to account for the daily variability of the traffic arrival pattern and network operation. The results reported in subsequent sections are an average of 10 model runs for each scenario. However, to account for variations in the sample of 10 model runs, the minimum and maximum values for appropriate model performance indicators are also illustrated.

6.4.2. The modelling results that will be analysed within subsequent sections include the network performance results which provide a holistic view across the network as a whole, as well as detailed journey time analysis and queue analysis.

6.5. Network Performance Results

6.5.1. The model results for all vehicles throughout the entire Paramics model area for each peak hour. The results are presented for:

- Average Journey Time (mins).
- Average Network Speed (mph).
- Total Travel Time (hours).
- Total Demand.
- Unreleased demand.

6.5.2. The average journey time is the value for the average of all of the trips within the Paramics model area, so can show general trends between assessment years (e.g., average times increasing over time indicate overall performance is deteriorating).

6.5.3. Average speeds are taken as an average of the average network speed for each run. In assessing the average network wide speed, variation within the 10 model runs was also investigated to understand the range of average speeds within the sample.

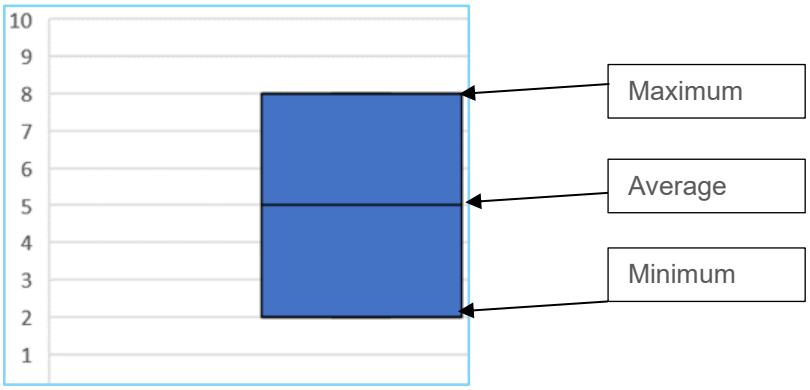
6.5.4. Total demand is the number of vehicles trying to enter into the Paramics model area in each peak hour. Unreleased demand is the number of those vehicles that were unable to be released into the Paramics model area during the peak hour (due to congestion or

queues extending back out of the modelled area).

6.6. Interpreting Variance

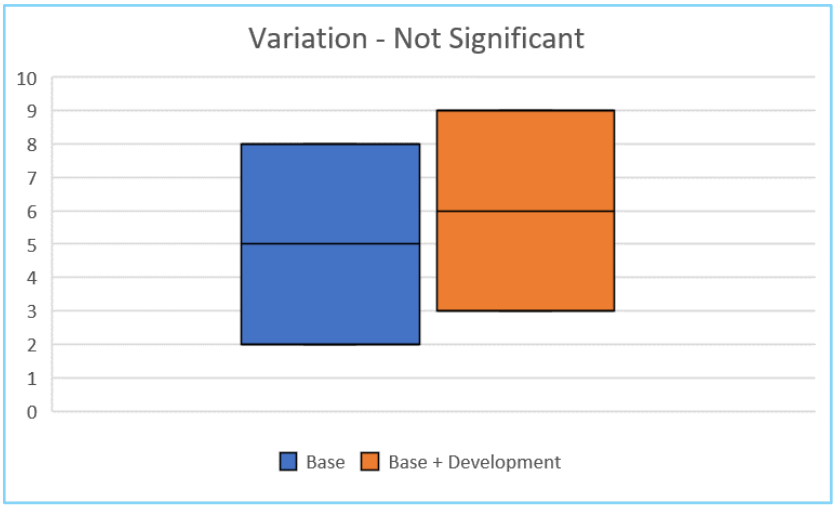
6.6.1. The model produces results for 10 modelled runs which is typically averaged to produce average values. However, in order to better understand the significance of some of the differences in average results, 'box and whisker' type plots have been used to show the range of results in the sample.

6.6.2. The plots show the maximum (top of the bar) and minimum (bottom of the bar) of the sample of the results as well as the average result from the sample (the line across the bar). These have been presented to help provide context into the range of results in each scenario, rather than just the average result in isolation.



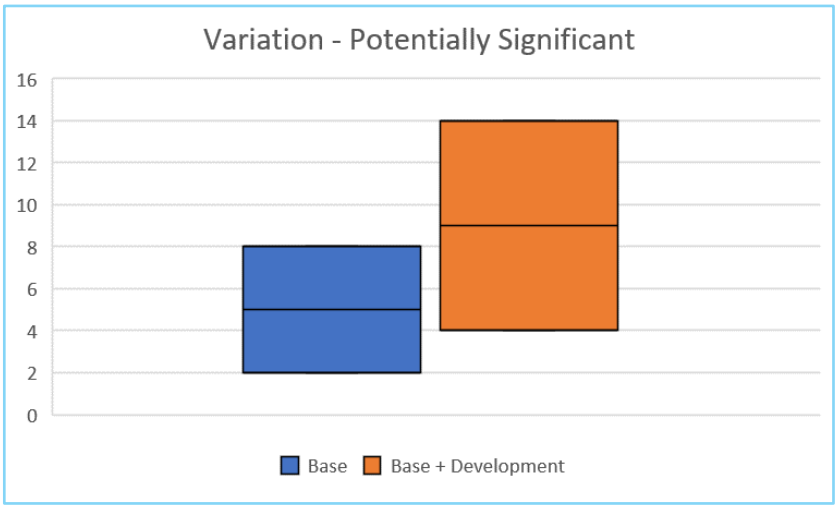
6.6.3. A general explanation of the plots, and the interpretation of the ranges is explained in the following sections.

Variation Not Considered Signficant



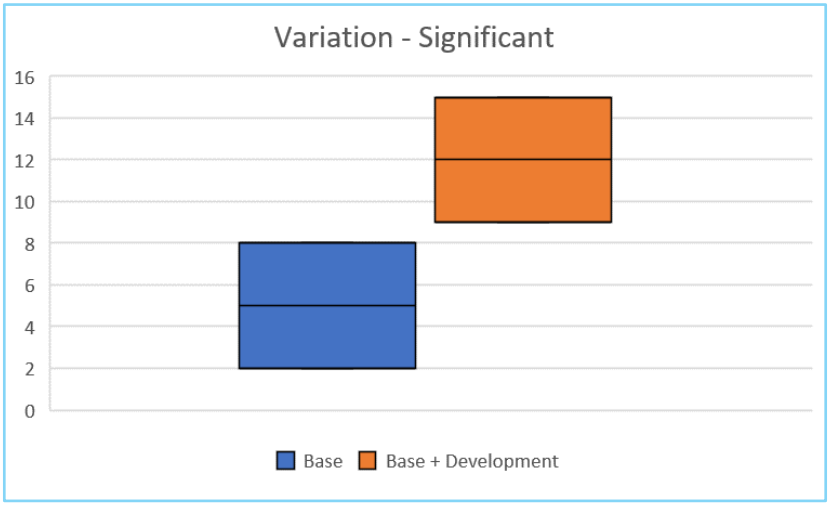
6.6.4. In this example, the results with the development have a higher average result (as shown by the higher middle line). However, when considered against the overall range, the results for the average value with the development fall well within the range of results in the base (without the development). There are model runs in the sample without the development that have similar (and higher) values than the average result in the Base + Development. Therefore, the overall average increase is not considered significant.

Variation Potentially Signficant



6.6.5. In this example, the results with the development have a higher average result (as shown by the higher middle line). This average line with the development is above the range of values in the base sample. So when considered against the overall range, the results for the average value with the development fall outside of the range of results in the base (without the development), but there are some model runs in the sample with the development that have similar (and lower) values than the average result in the Base. Therefore, the overall average increase is potentially significant, and would require further investigation.

Variation Considered Signficant



6.6.6. In this example, the results with the development have a higher average result (as shown by the higher middle line). All of the runs in the sample with the development are above the range of values in the base sample. Therefore, the overall average increase is considered significant in this instance.

6.7. Interpreting Reliability

6.7.1. The 'box and whisker' type plots also help provide an indication of reliability by demonstrating how big the range of results in each sample are for the various scenarios. A large range between maximum and minimum values indicate a large variation between results within a sample, indicating users could experience a range of day to day journey times.

6.7.2. A much smaller range between maximum and minimum values indicate that users are less likely to experience a range of day to day journey times, resulting in a more reliable journey.

7. Scheme Assessment

7.1. Introduction

7.1.1. This section provides an overview of how 2027 and 2042 Scenario P compares against 2027 and 2042 Scenario S in terms of traffic operation. This represents the impact of just the Scheme in isolation.

7.1.2. It is important to note that the Scheme which is subject to the DCO is a highway scheme. This highway scheme will enable the delivery of wider developments with a focus on three major developments situated along A4019 and Old Gloucester Road (shown in Figure 1), but the impact of this associated dependent development is assessed in a cumulative scenario and distinguished from the impact of the Scheme in isolation.

7.2. Traffic Flows

7.2.1. Comparing Scenario S to P to understand the impact of just the Scheme in isolation shows some changes to flows in the area around the Scheme. The improvements to performance from the Scheme attract a small amount of additional traffic into the area. The changes in flow between the different scenarios are illustrated in flow difference plots included in Appendix B.

7.3. Network Performance Results

7.3.1. The network performance results provide an overview of the performance of all vehicles within the Paramics model area as a whole and therefore give a good overall indication of the operational impacts of the proposed Scheme. They focus on the changes in key network wide results parameters including average journey time, network speed and total travel time.

Opening Year - 2027

7.3.2. Table 6 below provide a comparative summary of the network performance results for 2027 Scenario P and 2027 Scenario S for the AM and PM peak periods.

Table 5 – Network performance results – 2027 AM peak period (08:00-09:00)

Performance Indicator	Scenario P	Scenario S	% Change
Average Journey Time (mins)	5.42	4.71	-13%
Average Network Speed (mph)	27	29	4%
Total Travel Time (hours)	1408	1348	-4%
Total Demand	16589	16815	+1%
Unreleased demand	1011	0	-

Table 6 – Network performance results – 2027 PM peak period (17:00-18:00)

Performance Indicator	Scenario P	Scenario S	% Change
Average Journey Time (mins)	4.65	4.08	-12%
Average Network Speed (mph)	29	30	3%
Total Travel Time (hours)	1231	1153	-6%
Total Demand	16836	16955	+1%
Unreleased demand	962	17	-

7.3.3. The results for opening year 2027 indicate that the Scheme in isolation improves network-wide performance in both AM and PM peak with improved average journey times and improved average network speed across the network. Details of the variation within the 10 model runs for the average network speed is included in Appendix C.

Future Year - 2042

7.3.4. Table 7 and Table 8 below provide a comparative summary of the network performance results for 2042 Scenario P and 2042 Scenario S for the AM and PM peak periods.

Table 7 – Network performance results – 2042 AM peak period (08:00-09:00)

Performance Indicator	Scenario P	Scenario S	% Change
Average Journey Time (mins)	5.78	4.80	-17%
Average Network Speed (mph)	26	28	10%
Total Travel Time (hours)	1609	1480	-8%
Total Demand	18051	18344	+2%
Unreleased Demand	1329	0	-

Table 8 – Network performance results – 2042 PM peak period (17:00-18:00)

Performance Indicator	Scenario P	Scenario S	% Change
Average Journey Time (mins)	4.94	4.15	-16%
Average Network Speed (mph)	28	30	6%
Total Travel Time (hours)	1433	1280	-11%
Total Demand	18388	18478	+1%
Unreleased Demand	992	0	-

7.3.5. The results for future year 2042 indicate that the Scheme in isolation improves network-wide performance in both AM and PM peak with improved journey times and average network speed across the network.

7.4. Journey Time Results

7.4.1. Various journey time counters have been set up in Paramics model to extract the journey time results for five main routes in both directions.

7.4.2. Figure 10 shows the journey times routes which have been analysed to assess the operational impact of the Scheme on travel times for the various scenarios .

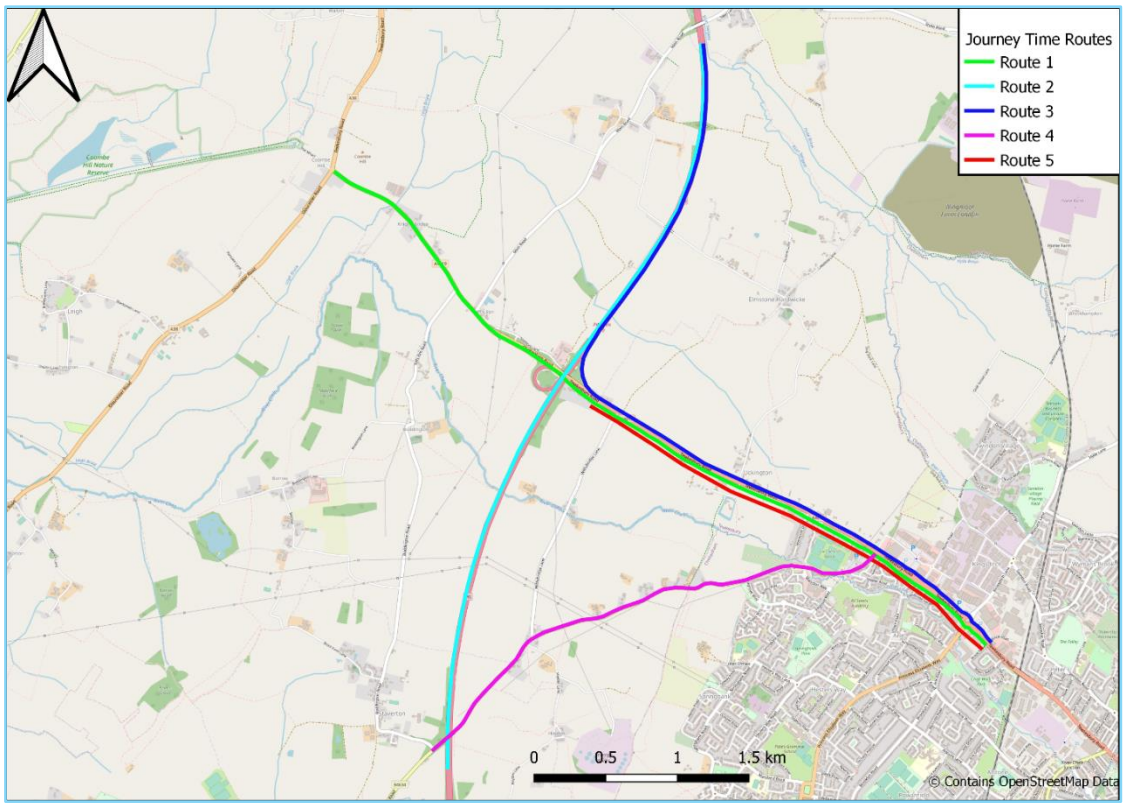


Figure 10 – M5 J10 Paramics Model Extents

Opening Year - 2027

7.4.3. Table 9 and Table 10 show the average modelled journey times for 2027 Scenario P and 2027 Scenario S for the AM and PM peak periods.

Table 9 – Modelled Journey Times – 2027 AM peak period

Route ID	Route	Modelled Journey time (hh:mm:ss)		
		Scenario P	Scenario S	% Change
R1_EB	A4019 Tewkesbury Road EB	00:11:55	00:10:17	-14%
R1_WB	A4019 Tewkesbury Road WB	00:07:05	00:09:52	39%
R2_NB	M5 Northbound	00:03:04	00:02:58	-3%
R2_SB	M5 Southbound	00:04:36	00:03:43	-19%
R3_EB	M5 North to A4019 East	00:17:42	00:09:29	-46%
R3_WB	A4019 East to M5 North	00:06:49	00:08:42	28%
R4_NB	Old Gloucester Road Northbound	00:07:33	00:05:08	-32%
R4_SB	Old Gloucester Road Southbound	00:03:36	00:03:58	10%
R5_EB	A4019 Eastbound	00:09:35	00:07:27	-22%
R5_WB	A4019 Westbound	00:05:00	00:06:17	26%

Table 10 – Modelled Journey Times – 2027 PM peak period

Route ID	Route	Modelled Journey time (hh:mm:ss)		
		Scenario P	Scenario S	% Change
R1_EB	A4019 Tewkesbury Road EB	00:11:54	00:08:22	-30%
R1_WB	A4019 Tewkesbury Road WB	00:06:19	00:08:18	31%
R2_NB	M5 Northbound	00:03:07	00:03:01	-3%
R2_SB	M5 Southbound	00:03:15	00:03:09	-3%
R3_EB	M5 North to A4019 East	00:11:59	00:07:30	-37%
R3_WB	A4019 East to M5 North	00:06:11	00:08:01	30%
R4_NB	Old Gloucester Road Northbound	00:05:48	00:05:10	-11%
R4_SB	Old Gloucester Road Southbound	00:03:35	00:04:29	25%
R5_EB	A4019 Eastbound	00:09:58	00:05:55	-41%
R5_WB	A4019 Westbound	00:04:21	00:05:29	26%

7.4.4. The results indicate that across majority of the routes there are journey time improvements in the AM and PM peak, however there are some routes where average journey times have increased in both AM and PM peak. It is noted that the Scheme includes the provision of six additional traffic signals along relatively short corridor, which has an impact on some journey times. The largest percentage increase is in the AM peak on the A4019 westbound route; an increase of around 2.8 minute on a 7 minute journey.

7.4.5. The comparison of journey time results with variations between 10 runs were investigated to better understand the significance of some of the differences. Figure 11 shows the journey time variance for A4019 westbound AM peak for 2027 Scenario P & S. The full outputs of variations in 2027 for all journey time routes are included in Appendix D

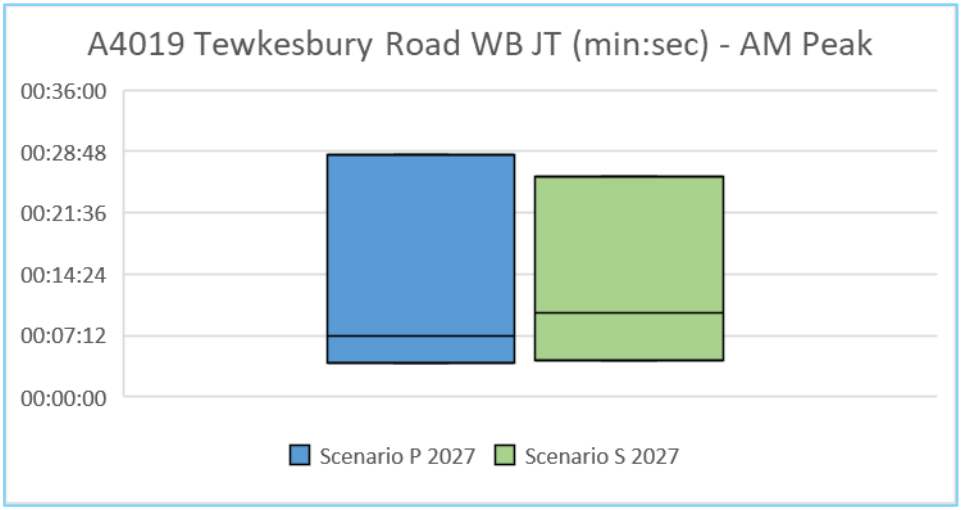


Figure 11 – Journey time variance A4019 Tewkesbury Road WB 2027 AM peak

7.4.6. It is clear from investigation of the variations within the 10 runs, the results for the average journey time for Scenario S fall well within the range of results in the Scenario P. Therefore, the overall average journey time increase is not considered significant.

7.4.7. Considering some of the forecast improvements to journey times as a result of the Scheme, there are no routes in which the range of Scenario S results fall entirely outside of the range of Scenario P results . Figure 12 shows the journey time variance for M5 North to A4019 East in the AM peak for 2027 Scenario P & S.

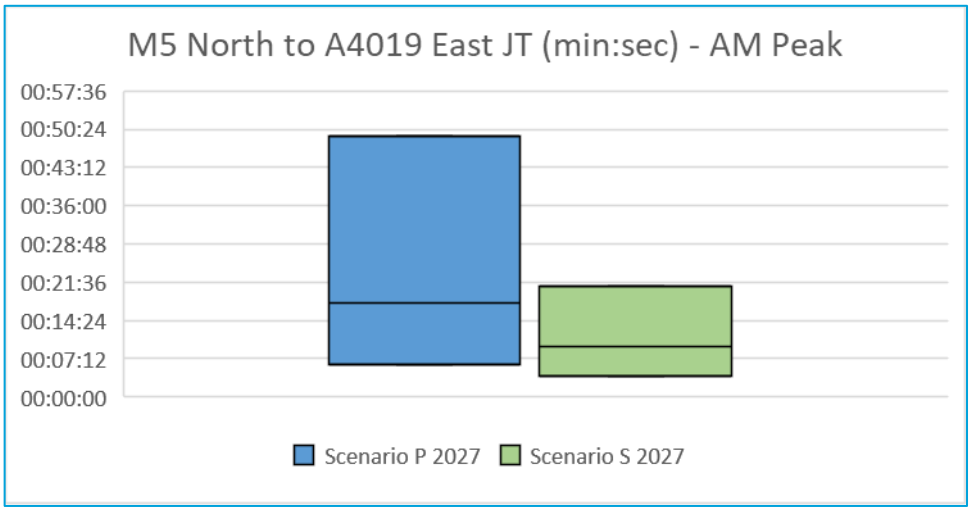


Figure 12 – Journey time variance Old Gloucester Road NB 2027 AM peak

7.4.8. It is clear from investigation of the variations within the 10 runs, the improved results for this average journey time for Scenario S fall at the lower end of the range of results in the Scenario P variation. However, not all Scenario S results are an improvement compared to the average of Scenario P. Therefore, this journey time improvement is not considered significant.

Future Year – 2042

7.4.9. Table 11 and Table 12 show the modelled journey times for 2042 Scenario P and 2042 Scenario S for the AM and PM peak periods.

Table 11 – Modelled Journey Times – 2042 AM peak period

Route ID	Route	Modelled Journey time (hh:mm:ss)		
		Scenario P	Scenario S	% Change
R1_EB	A4019 Tewkesbury Road EB	00:12:22	00:10:31	-15%
R1_WB	A4019 Tewkesbury Road WB	00:11:13	00:09:43	-13%
R2_NB	M5 Northbound	00:03:08	00:03:01	-4%
R2_SB	M5 Southbound	00:05:22	00:04:09	-23%
R3_EB	M5 North to A4019 East	00:19:56	00:09:59	-50%
R3_WB	A4019 East to M5 North	00:10:53	00:08:31	-22%
R4_NB	Old Gloucester Road Northbound	00:08:36	00:05:33	-35%
R4_SB	Old Gloucester Road Southbound	00:05:09	00:04:02	-22%
R5_EB	A4019 Eastbound	00:10:15	00:07:20	-29%
R5_WB	A4019 Westbound	00:09:02	00:06:04	-33%

Table 12 – Modelled Journey Times – 2042 PM peak period

Route ID	Route	Modelled Journey time (hh:mm:ss)		
		Scenario P	Scenario S	% Change
R1_EB	A4019 Tewkesbury Road EB	00:14:08	00:09:02	-36%
R1_WB	A4019 Tewkesbury Road WB	00:06:24	00:08:40	35%
R2_NB	M5 Northbound	00:03:12	00:03:07	-3%
R2_SB	M5 Southbound	00:03:32	00:03:12	-9%
R3_EB	M5 North to A4019 East	00:16:12	00:07:56	-51%
R3_WB	A4019 East to M5 North	00:06:16	00:08:20	33%
R4_NB	Old Gloucester Road Northbound	00:08:09	00:06:59	-14%
R4_SB	Old Gloucester Road Southbound	00:03:37	00:05:15	45%
R5_EB	A4019 Eastbound	00:12:10	00:06:18	-48%
R5_WB	A4019 Westbound	00:04:25	00:05:40	28%

7.4.10. The results indicate that across majority of the routes there are journey time improvements in the AM and PM peak, however there are some routes where average journey times have increased in the PM peak.

7.4.11. The largest percentage increase is in the PM peak on Old Gloucester Road southbound movements; an increase of around 1.5 minutes on a journey time of around 3.5 minutes.

7.4.12. Figure 13 shows the journey time variance for Old Gloucester Road soutbound PM peak for 2042 Scenario P & S. The full outputs of variations in 2042 for all journey time routes are included in Appendix E.

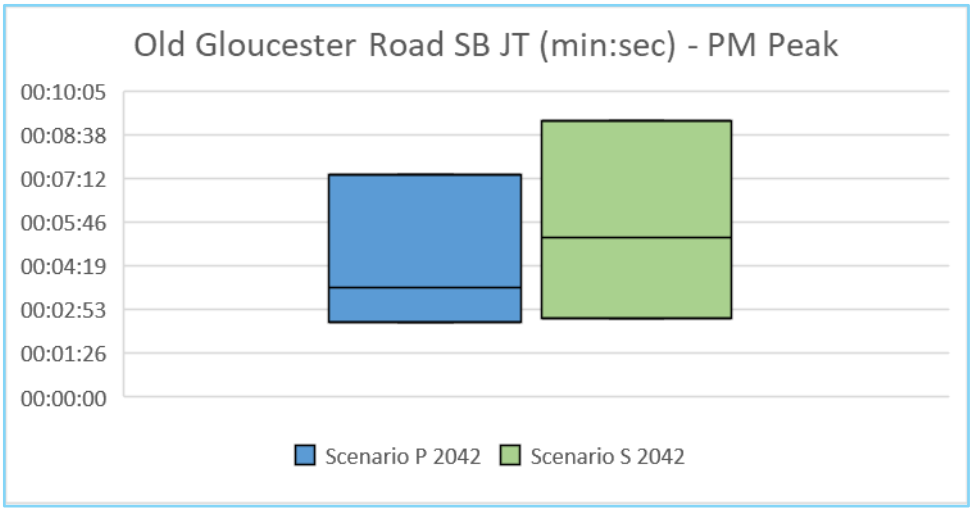


Figure 13 – Journey time variance Old Gloucester Road SB 2042 PM peak

7.4.13. It is clear from investigation of the variations within the 10 runs, the results for the average journey time for Scenario S fall well within the range of results in the Scenario P. Therefore, the overall average journey time increase is not considered significant.

7.5. Queue Results

7.5.1. Details of queues at all approaches to all junctions within the Paramics model area are included in Appendix F. The table in Appendix F identifies the available queueing length for each approach and outlines the Mean-Maximum Queue lengths (MMQ) as well as average queue lengths. Where queues exceed available storage, the values are

highlighted. The data is provided for Scenarios P, R and S for 2027 and 2042.

7.5.2. Across a number of currently congested junctions within the study area, MMQs are predicted to reduce as a result of the Scheme. At junctions where queues are predicted to exceed storage without the Scheme (such as the A4019 / B4634 Signalised Junction), the Scheme is predicted to reduce these queue lengths, and Scenario S results indicate that they will be contained within the storage available.

7.5.3. There are some increases in predicted queue lengths, partly as a result of introducing signalised junctions at locations where junctions were priority controlled, or no junction previously existed. The impact of these queues on journey times is captured by the reporting of journey times outlined in Section 7.3.

Queues And The Mainline Motorway

7.5.4. Queue lengths for the M5 off-slips are considered here in further detail due to the potential for queues to block mainline traffic which is a specific safety issue. Queue counters were set up at the M5 off-slips in the Paramics model to extract the queue results for M5 J10 in detail. It is noted that in Scenario P there are no results for the northbound offslip due to its existing layout.

7.5.5. Mean-max queue (MMQ) lengths for the AM and PM peak have been plotted on aerial imagery to provide a better visual comparison of queue length changes across different scenarios.

Opening Year - 2027

7.5.6. Figures 14 and 15 show the MMQ plots for 2027 Scenario P and 2027 Scenario S for the AM and PM peak periods.

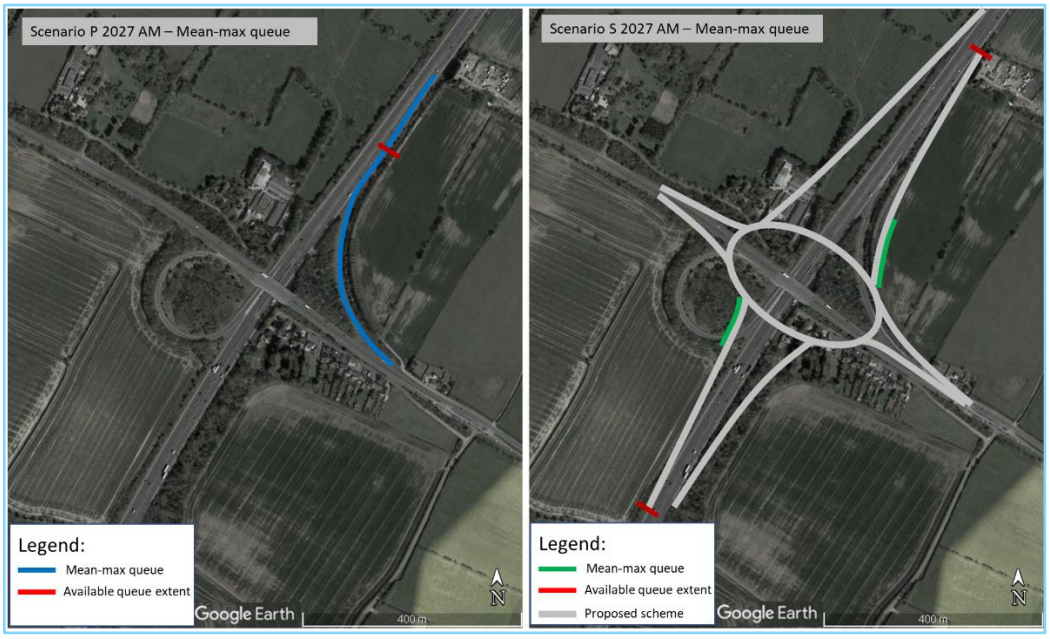


Figure 14 – Mean-max queue M5 off-slips 2027 AM Peak

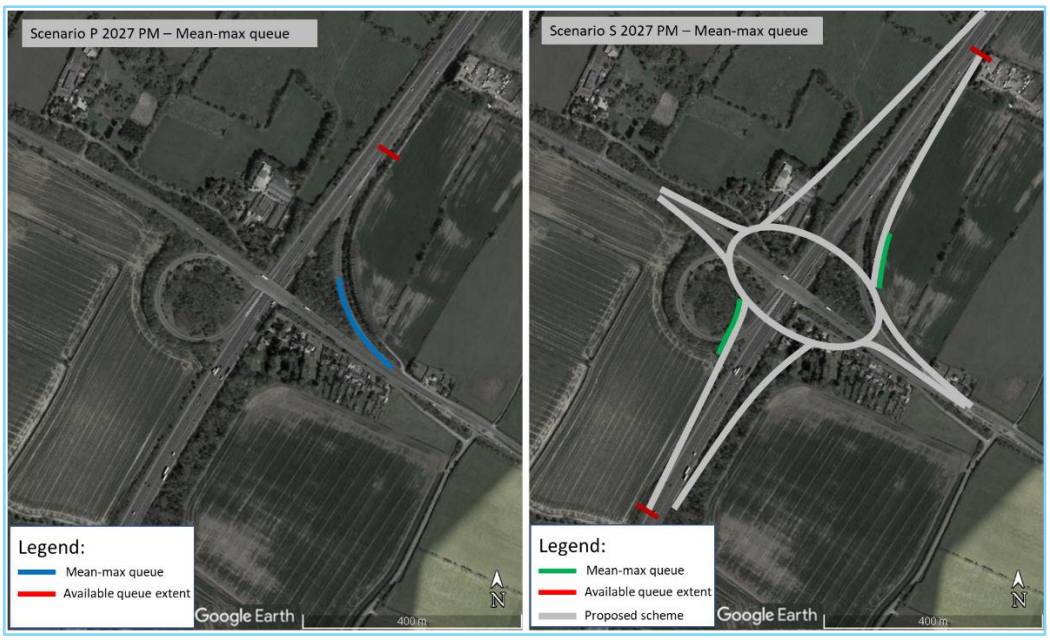


Figure 15 – Mean-max queue M5 off-slips 2027 PM Peak

The mean-max queue plots indicate that for opening year 2027 Scenario S reduces queue length at M5 southbound off-slip in both AM and PM peak along with minimal queues at M5 northbound off-slip. The proposed Scheme reduces the length of the queue on the southbound off-slip, which is predicted to exceed storage and extend into the mainline in the AM peak without the Scheme.

Future Year - 2042

7.5.7. Figures 16 and 17 show the MMQ plots for 2042 Scenario P and 2042 Scenario S for the AM and PM peak periods.

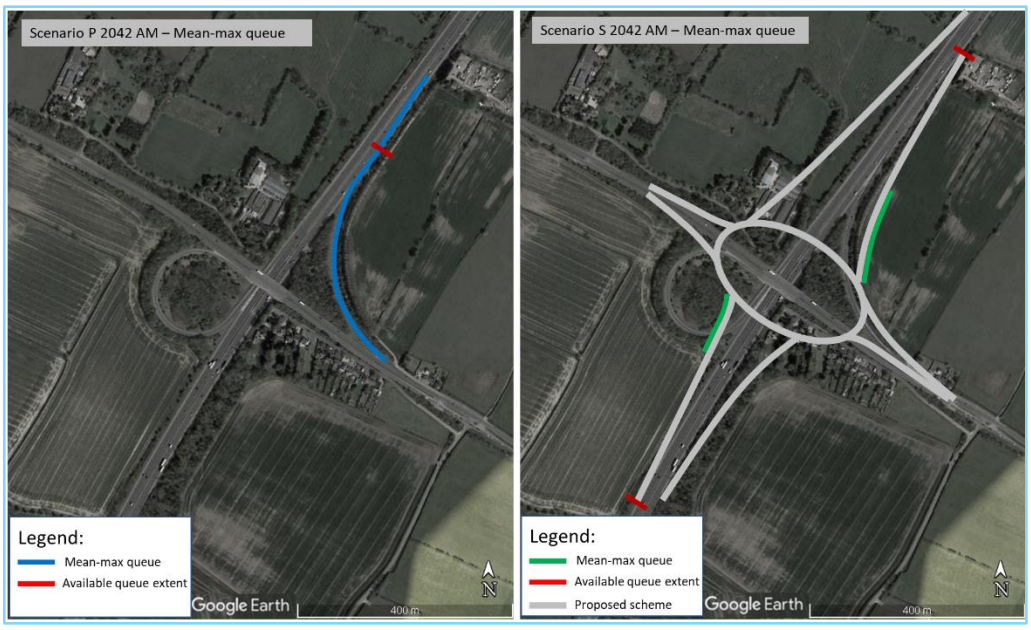


Figure 16 – Mean-max queue M5 off-slips 2042 AM Peak

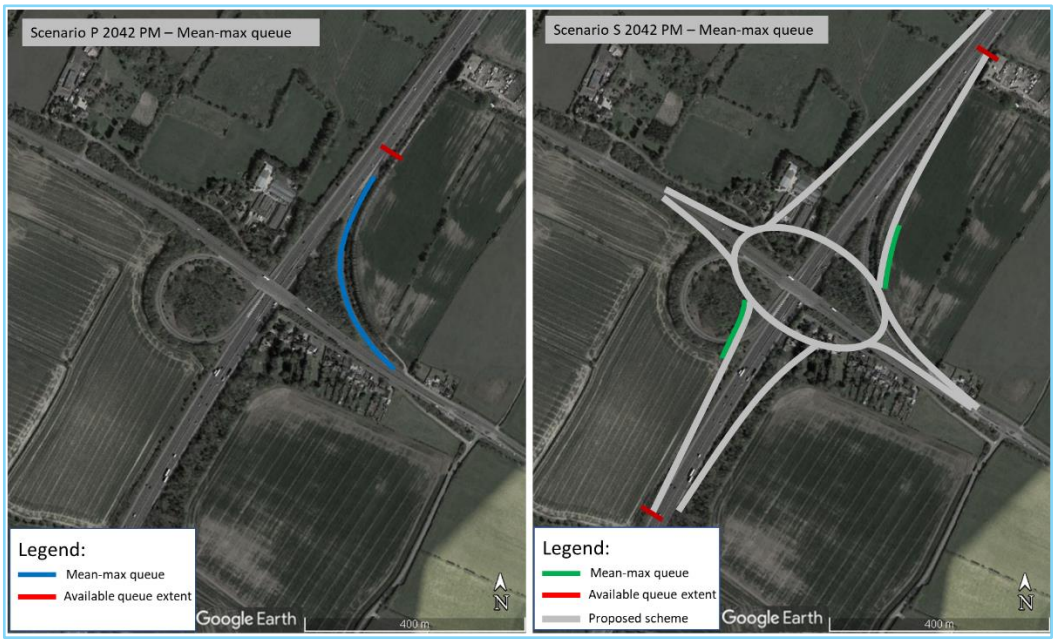


Figure 17 – Mean-max queue M5 off-slips 2042 PM Peak

7.5.8. The mean-max queue plots indicate that for future year 2042 Scenario S reduces queue length at M5 southbound off-slip in both AM and PM peak along with minimal queues at M5 northbound off-slip. They also indicate that the Scheme prevents queuing back to the mainline in the AM peak.

7.6. Results Summary

7.6.1. The comparison of performance between Scenario S and Scenario P has demonstrated the impact of the Scheme in isolation (without any dependent development).

7.6.2. Overall, the Scheme improves average journey times and increases average speeds across the Paramics model area.

7.6.3. Considering specific journey times for routes within the model, the results indicate that across the majority of the routes there are journey time improvements. There are some routes where average journey times have increased in the AM and, or PM peak. However, investigation of the variations within the model runs demonstrate that the results for the

average journey time for Scenario S fall well within the range of results in the Scenario P. Therefore, these journey time increases are not considered significant.

7.6.4. In terms of queuing, the Scheme reduces the length of the queue on the southbound off-slip, which is predicted to exceed storage and extend into the mainline in the AM peak without the Scheme. This is considered as a safety benefit of the Scheme as queues will no longer extend onto live lanes of motorway.

8. Cumulative Assessment

8.1. Introduction

8.1.1. This section provides an overview of how the 2027 and 2042 Scenario P (without the Scheme) compare against the 2027 & 2042 Scenario R (with the Scheme and with the dependent future development traffic) in terms of traffic operation. It represents a cumulative scenario.

8.1.2. It is noted that the basis of the Scheme is to 'enable' major developments, rather than to provide all the network improvement requirements for such development. The proposed Scheme results in 6 new signalised junctions, 5 of which are to be located along the relatively short length along the A4019 between M5 and Gallagher Junction. In order to design a Scheme that had no adverse impact on the future journey times, a much larger scheme with higher cost and considerably increased impact on the environment would have been needed which would have been unacceptable.

8.2. Traffic Flows

8.2.1. Comparing Scenario P to R to understand the cumulative impact of the Scheme and the associated dependent development shows larger increases in flows. These changes are mainly as a result of the trips generated by the dependent developments and partly due to the Scheme itself. Details of the changes to create the future year scenarios are outlined in the Model Package Report (included as Appendix J).

8.2.2. The changes in flow between the different scenarios are illustrated in flow difference plots included in Appendix B.

8.3. Network Performance Results

8.3.1. The network performance results provide an overview of the performance of all vehicles within the network as a whole and therefore give a good overall snapshot of the operational impacts of the Scheme. The results focus on the changes in key network wide results parameters including average journey time, network speed and total travel time.

Opening Year - 2027

8.3.2. Table 13 and Table 14 below provide a comparative summary of the network performance results for 2027 Scenario P and 2027 Scenario R for the AM and PM peak periods.

Table 13 – Network performance results – 2027 AM peak period (08:00-09:00)

Performance Indicator	Scenario P	Scenario R	% Change
Average Journey Time (mins)	5.42	4.73	-13%
Average Network Speed (mph)	27	29	4%
Total Travel Time (hours)	1408	1370	-3%
Total Demand	16589	17008	+3%
Unreleased demand	1011	0	-

Table 14 – Network performance results – 2027 PM peak period (17:00-18:00)

Performance Indicator	Scenario P	Scenario R	% Change
Average Journey Time (mins)	4.65	4.11	-12%
Average Network Speed (mph)	29	30	3%
Total Travel Time (hours)	1231	1167	-5%
Total Demand	16836	17087	+2%
Unreleased demand	962	68	-

8.3.3. The results for opening year indicate that Scenario R improves network-wide performance in both AM and PM peak with improved journey times and average network speed across the network. The level of dependent development built out at this time is lower than that in 2042.

Future Year – 2042

8.3.4. Table 15 and Table 16 below provide a comparative summary of the network performance results for 2042 Scenario P and 2042 Scenario R for the AM and PM peak periods.

Table 15 – Network performance results – 2042 AM peak period (08:00-09:00)

Performance Indicator	Scenario P	Scenario R	% Change
Average Journey Time (mins)	5.78	6.16	7%
Average Network Speed (mph)	26	25	-1%
Total Travel Time (hours)	1609	2133	33%
Total Demand	18051	20884	+16%
Unreleased demand	1329	95	-

Table 16 – Network performance results – 2042 PM peak period (17:00-18:00)

Performance Indicator	Scenario P	Scenario R	% Change
Average Journey Time (mins)	4.94	4.84	-2%
Average Network Speed (mph)	28	28	0%
Total Travel Time (hours)	1433	1695	18%
Total Demand	18388	21021	+14%
Unreleased demand	992	0	-

8.3.5. The results for future year 2042 indicate that the additional dependent demand in Scenario R has an impact on performance compared to Scenario P in the 2042 AM and PM peak.

8.3.6. The total demand is predicted to increase by around 15% in both peak hours, which results in a large increase in total travel time throughout the Paramics model area.

8.3.7. Average journey times in the AM peak increase but is comparable in the PM peak. The total travel time shows a significant increase in both AM and PM peak which is a result of increased demand in Scenario R compared to Scenario P, as well as the impacts of the Scheme with its additional signalised junctions.

8.3.8. Average network speeds are predicted to reduce slightly in the cumulative scenario for

the AM peak whereas PM peak average networks speeds are comparable. The variations between 10 runs were investigated to better understand the significance of the differences. Figure 18 shows the average network speed variance for 2042 Scenarios P & R.

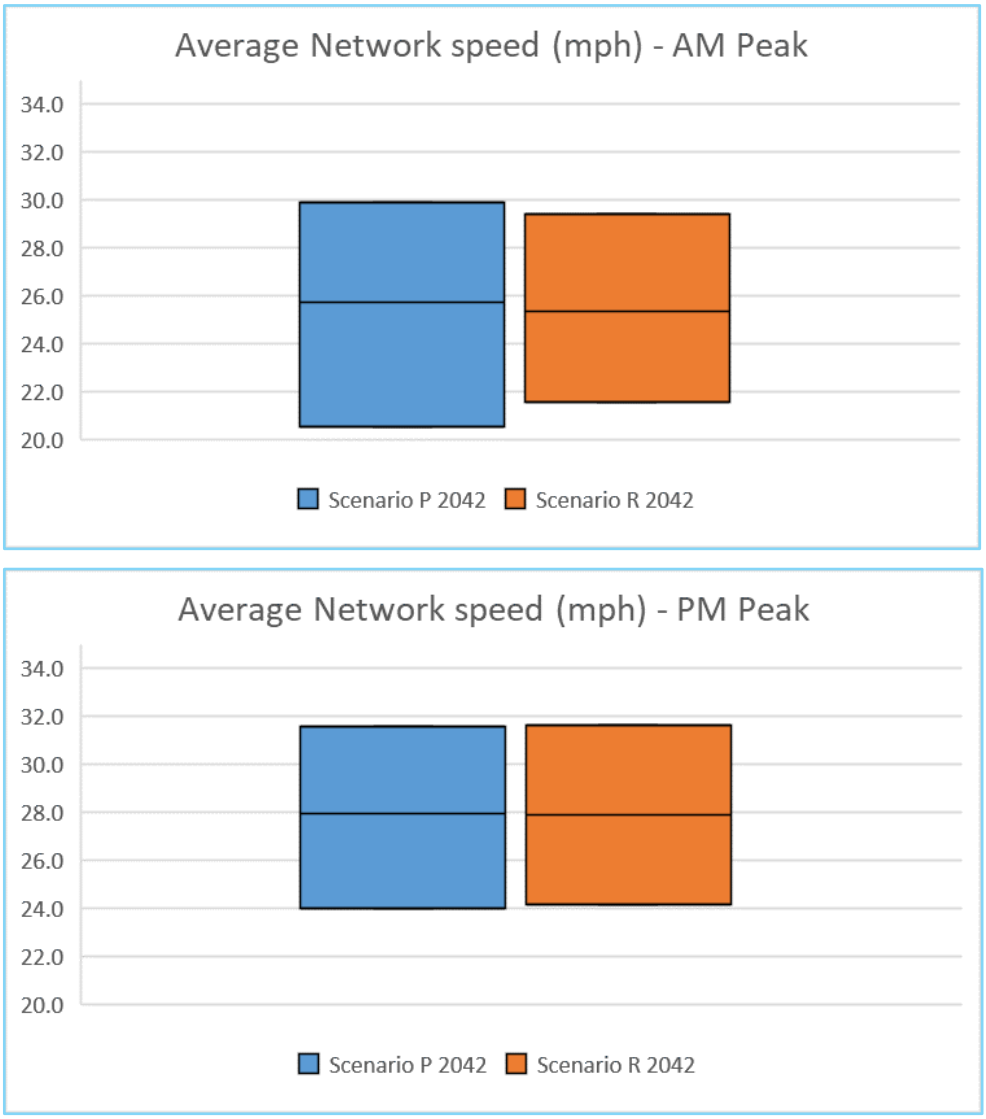


Figure 18 – Network Speed Variance 2042 AM peak and PM peak

8.3.9. It is clear from investigation of the variations within the 10 runs, the results for the average journey time for Scenario R fall well within the range of results in the Scenario P. Therefore, the overall network speed reductions are not considered significant, nor could they be considered severe.

8.4. Journey Time Results

8.4.1. Various journey time counters have been set up in Paramics model to extract the journey time results for identified five critical routes in both directions.

8.4.2. Figure 8 shows the journey times routes which have been analysed to assess the operation impact of proposed scheme on travel times.

Opening Year – 2027

8.4.3. Table 17 and Table 18 show the modelled journey times for 2027 Scenario P and 2027 Scenario R for the AM and PM peak periods.

Table 17 – Modelled Journey Times – 2027 AM peak period

Route ID	Route	Modelled Journey time (hh:mm:ss)		
		Scenario P	Scenario R	% Change
R1_EB	A4019 Tewkesbury Road EB	00:11:55	00:10:14	-14%
R1_WB	A4019 Tewkesbury Road WB	00:07:05	00:09:26	33%
R2_NB	M5 Northbound	00:03:04	00:02:58	-3%
R2_SB	M5 Southbound	00:04:36	00:03:47	-18%
R3_EB	M5 North to A4019 East	00:17:42	00:09:31	-46%
R3_WB	A4019 East to M5 North	00:06:49	00:08:29	24%
R4_NB	Old Gloucester Road Northbound	00:07:33	00:05:07	-32%
R4_SB	Old Gloucester Road Southbound	00:03:36	00:04:26	23%
R5_EB	A4019 Eastbound	00:09:35	00:07:24	-23%
R5_WB	A4019 Westbound	00:05:00	00:06:04	21%

Table 18 – Modelled Journey Times – 2027 PM peak period

Route ID	Route	Modelled Journey time (hh:mm:ss)		
		Scenario P	Scenario R	% Change
R1_EB	A4019 Tewkesbury Road EB	00:11:54	00:08:27	-29%
R1_WB	A4019 Tewkesbury Road WB	00:06:19	00:08:14	30%
R2_NB	M5 Northbound	00:03:07	00:03:01	-3%
R2_SB	M5 Southbound	00:03:15	00:03:09	-3%
R3_EB	M5 North to A4019 East	00:11:59	00:07:37	-36%
R3_WB	A4019 East to M5 North	00:06:11	00:08:02	30%
R4_NB	Old Gloucester Road Northbound	00:05:48	00:05:17	-9%
R4_SB	Old Gloucester Road Southbound	00:03:35	00:04:23	23%
R5_EB	A4019 Eastbound	00:09:58	00:06:02	-39%
R5_WB	A4019 Westbound	00:04:21	00:05:28	26%

8.4.4. The results indicate that across majority of the routes there are journey time improvements in the AM and PM peak, however, there are some routes where average journey times have increased in both AM and PM peak. This is as a result of increased demand in

Scenario R compared to Scenario P, as well as the impacts of the Scheme with its additional signalised junctions. The largest percentage increase is in the AM peak on A4019 westbound movements; an increase of around 2.3 minutes on a 7 minute journey time.

8.4.5. Figure 19 shows the journey time variance for A4019 westbound AM peak for 2027 Scenario P & R. The full outputs of variations for all journey time routes are included in Appendix G.

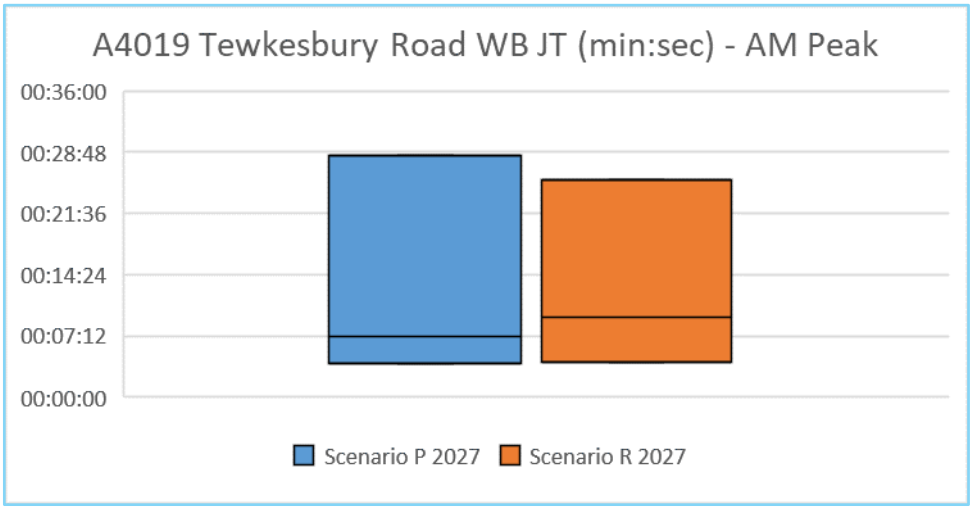


Figure 19 – Journey time variance A4019 Tewkesbury Road WB 2027 AM peak

8.4.6. The results for the average journey time for Scenario R fall within the range of results in the Scenario P. Whilst average journey times may be higher in Scenario R, journey time reliability is improved and the maximum modelled journey time is lower in Scenario R. Therefore, the overall average journey time increase is not considered significant.

Future Year – 2042

8.4.7. Table 19 and Table 20 show the modelled journey times for 2042 Scenario P and 2042 Scenario R for the AM and PM peak periods.

Table 19 – Modelled Journey Times – 2042 AM peak period

Route ID	Route	Modelled Journey time (hh:mm:ss)		
		Scenario P	Scenario R	% Change
R1_EB	A4019 Tewkesbury Road EB	00:12:22	00:14:33	18%
R1_WB	A4019 Tewkesbury Road WB	00:11:13	00:11:35	3%
R2_NB	M5 Northbound	00:03:08	00:05:12	66%
R2_SB	M5 Southbound	00:05:22	00:04:20	-19%
R3_EB	M5 North to A4019 East	00:19:56	00:12:37	-37%
R3_WB	A4019 East to M5 North	00:10:53	00:11:20	4%
R4_NB	Old Gloucester Road Northbound	00:08:36	00:06:14	-28%
R4_SB	Old Gloucester Road Southbound	00:05:09	00:05:21	4%
R5_EB	A4019 Eastbound	00:10:15	00:09:18	-9%
R5_WB	A4019 Westbound	00:09:02	00:06:52	-24%

Table 20 – Modelled Journey Times – 2042 PM peak period

Route ID	Route	Modelled Journey time (hh:mm:ss)		
		Scenario P	Scenario R	% Change
R1_EB	A4019 Tewkesbury Road EB	00:14:08	00:10:43	-24%
R1_WB	A4019 Tewkesbury Road WB	00:06:24	00:09:11	44%
R2_NB	M5 Northbound	00:03:12	00:03:37	13%
R2_SB	M5 Southbound	00:03:32	00:03:16	-7%
R3_EB	M5 North to A4019 East	00:16:12	00:09:24	-42%
R3_WB	A4019 East to M5 North	00:06:16	00:09:02	44%
R4_NB	Old Gloucester Road Northbound	00:08:09	00:07:32	-8%
R4_SB	Old Gloucester Road Southbound	00:03:37	00:06:04	68%
R5_EB	A4019 Eastbound	00:12:10	00:07:42	-37%
R5_WB	A4019 Westbound	00:04:25	00:06:01	36%

8.4.8. The results indicate that more of the routes have increased average journey times in the AM and PM peak. This is as a result of increased demand in Scenario R compared to Scenario P, as well as the impacts of the Scheme with its additional signalised junctions. One of the largest percentage increase is in the AM peak on M5 northbound; an increase of around 2 minutes on a 3 minute average journey time.

8.4.9. Figure 20 shows the journey time variance for M5 northbound AM peak for 2042 Scenario P & R. The full outputs of variations for all journey time routes are included in Appendix H.

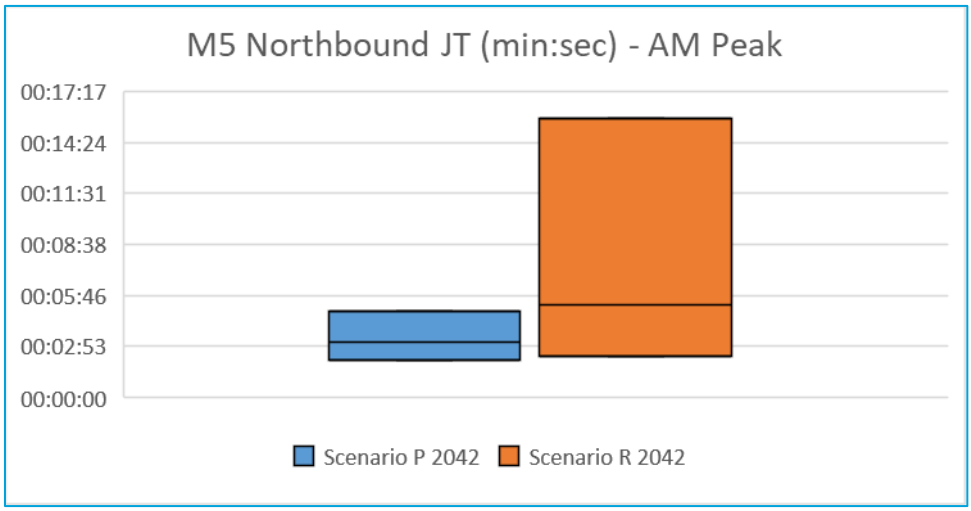


Figure 20 – Journey time variance M5 Northbound 2042 AM peak

8.4.10. The results for this average journey time for Scenario R fall just above the range of results in the Scenario P, but includes a larger maximum value in the sample of model runs. This indicates that the additional dependent development traffic demand considered in Scenario R has an adverse impact on the journey times on M5 Northbound in the AM peak.

8.4.11. It is noted that the basis of the Scheme is to 'enable' major developments, which would lead to much needed new housing and notable employment opportunities. This particular

impact, on this route in this peak hour, which could be considered potentially significant needs to be considered in this context. It is also noted that the Scheme has been designed in accordance with all current standards and guidance, and the merge and diverge has been designed in accordance with DMRB to accommodate the forecast levels of traffic.

8.4.12. Also, some of the other large percentage increases need consideration with respect to significance based on variation. Figure 21 shows the journey time variance for Old Gloucester Road 2042 PM peak in Scenario P & R which predicts a 68% increase.

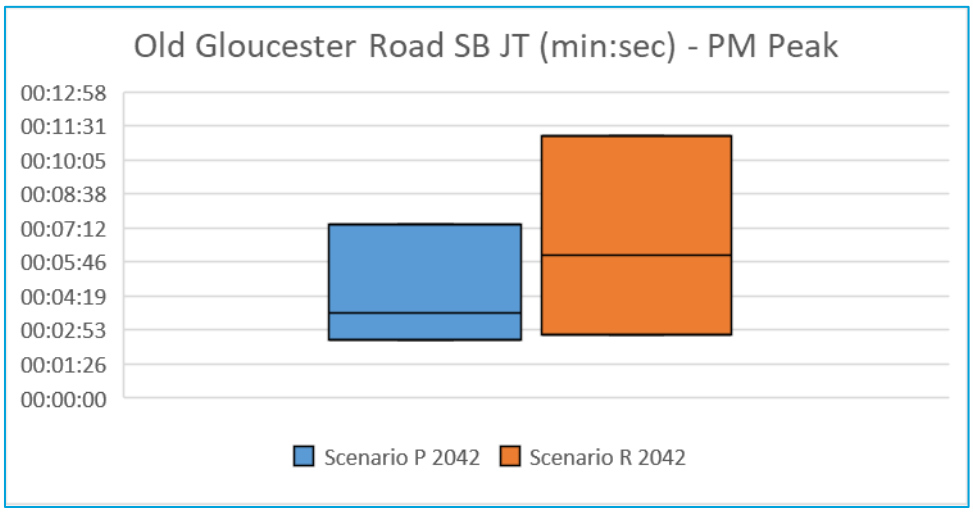


Figure 21 – Journey time variance Old Gloucester Road 2042 PM peak

8.4.13. The results for the average journey time for Scenario R falls within the range of results in Scenario P. This indicates that the additional dependent development traffic demand considered in Scenario R has an insignifcant impact on the journey time on this route.

8.4.14. The adverse impacts are also balanced against journey time improvements for certain routes in the cumulative scenario. Figure 22 shows the journey time variance for M5 southbound AM peak for 2042 Scenario P & R.

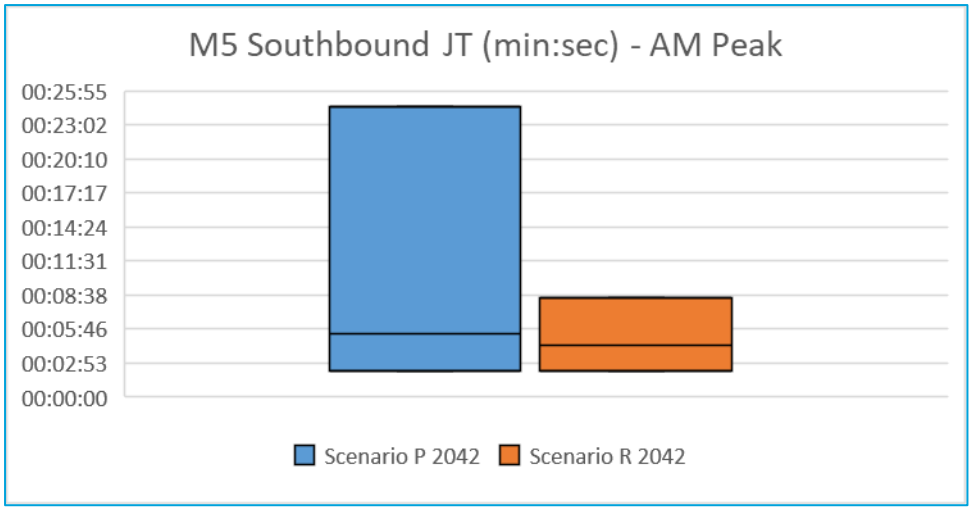


Figure 22 – Journey time variance M5 Northbound 2042 AM peak

8.4.15. The results for this average journey time for Scenario R fall towards the lower range of results in the Scenario P, and includes a much smaller maximum value in the sample of model runs. This indicates that the cumulative impacts of the Scheme and the additional dependent development traffic demand considered in Scenario R has a beneficial impact on the journey times on M5 Southbound, both in terms of averge journey time and journey time reliability.

8.5. Queue Results

8.5.1. Details of queues at all approaches to all junctions within the Paramics model area are included in Appendix F. The table in Appendix F identifies the available queueing length for each approach and outlines the Mean-Maximum Queue lengths (MMQ) as well as average queue lengths. Where queues exceed available storage, the values are highlighted. The data is provided for Scenarios P, R and S for 2027 and 2042.

8.5.2. Across a number of currently congested junctions within the study area, MMQs are predicted to reduce as a result of the Scheme and the additional dependent development traffic demand considered in Scenario R. At junctions where queues are predicted to exceed storage without the Scheme (such as the A4019 / B4634 Signalised Junction), the Scheme is predicted to reduce these queue lengths, and Scenario R results indicate that they will mostly be contained within storage.

8.5.3. There are some increases in predicted queue lengths, partly as a result of introducing signalised junctions as part of the Scheme, and also the additional dependent development traffic demand considered in Scenario R. The impact of these queues on journey times is captured by the reporting of journey times outlined in Section 7.3.

Queues And The Mainline Motorway

8.5.4. Queue lengths for the M5 off-slips are considered here in further detail due to the potential for queues to block mainline traffic which is a specific safety issue. Queue counters were set up at the M5 off-slips in the Paramics model to extract the queue results for M5 J10 in detail. It is noted that in Scenario P there are no results for the northbound offslip due to there not being a northbound offslip in the existing layout.

Opening Year - 2027

8.5.5. Figures 23 and 24 show the MMQ plots for 2027 Scenario P and 2027 Scenario R for the AM and PM peak periods.

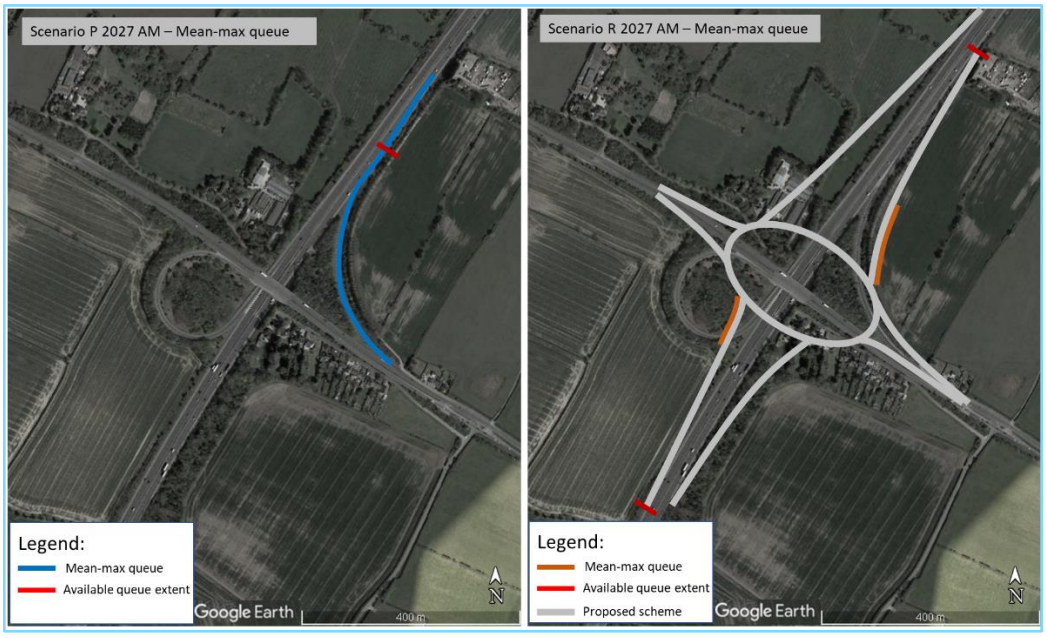


Figure 23 – Mean-max queue M5 off-slips 2027 AM Peak

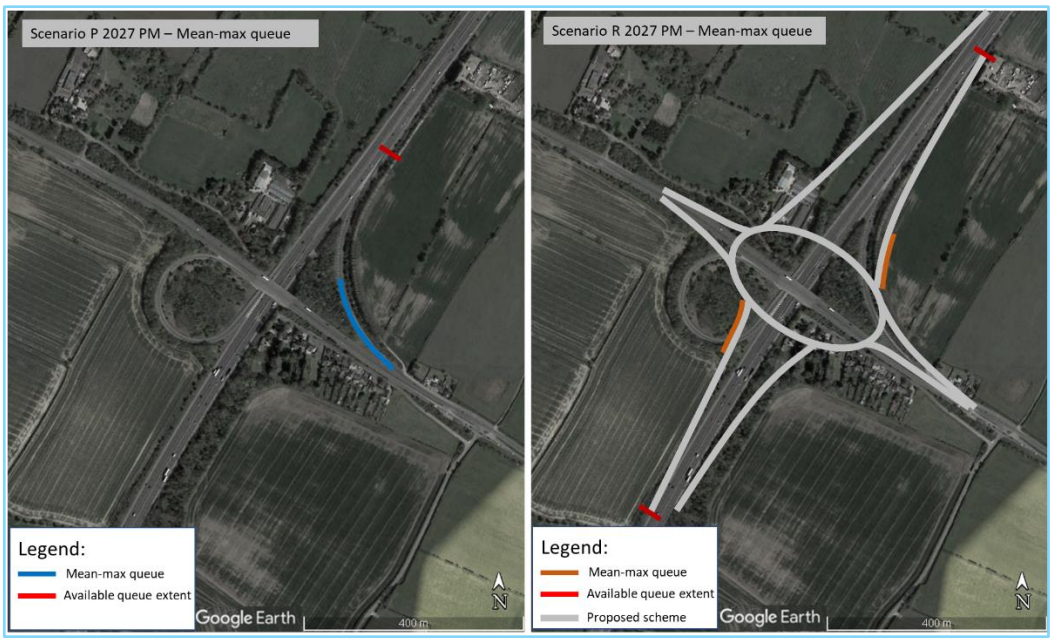


Figure 24 – Mean-max queue M5 off-slips 2027 PM Peak

8.5.6. The mean-max queue plots indicate that for opening year 2027 Scenario R reduces queue length at M5 southbound off-slip in both AM and PM peak along with minimal queues at M5 northbound off-slip With dependent development, the Scheme still reduces the length of the queue on the southbound off-slip, which is predicted to exceed storage and extend into the mainline in the AM peak without the Scheme.

Future Year - 2042

8.5.7. Figures 25 and 26 show the MMQ plots for 2042 Scenario P and 2042 Scenario R for the AM and PM peak periods.

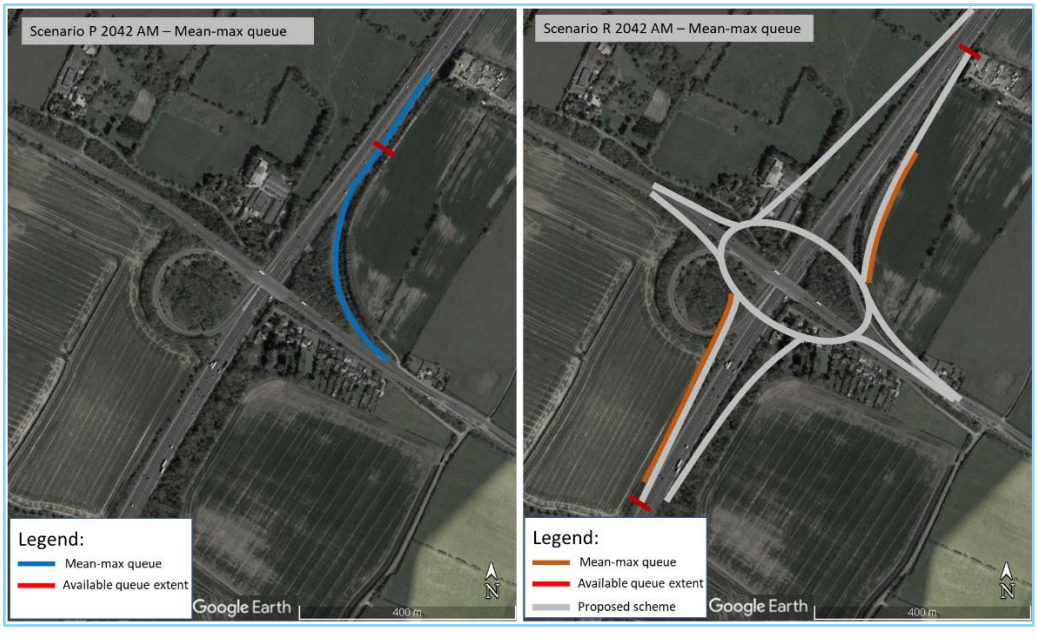


Figure 25 – Mean-max queue M5 off-slips 2042 AM Peak

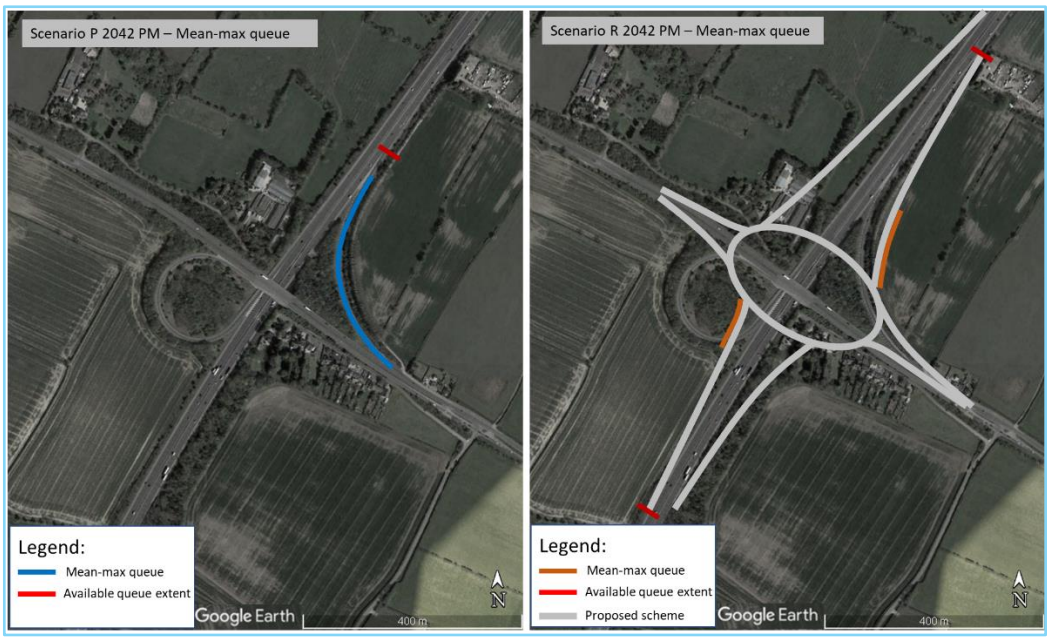


Figure 26 – Mean-max queue M5 off-slips 2042 PM Peak

8.5.8. The mean-max queue plots indicate that for future year 2042 Scenario R reduces queue length at M5 southbound off-slip in both AM and PM peak along with acceptable queues at M5 northbound off-slip. The mean-max queue on the northbound off-slip in the AM peak is not predicted to exceed available storage. With dependent development, the Scheme still reduces the length of the queue on the southbound off-slip, which is predicted to exceed storage and extend into the mainline in the AM peak without the Scheme.

8.6. Results Summary

8.6.1. The comparison of performance between Scenario S and Scenario R has demonstrated the cumulative impact of the Scheme in combination with the dependent development.

8.6.2. Overall, the results indicate that the additional dependent demand in Scenario R has an impact on performance compared to Scenario P, particularly in the 2042 future year.

8.6.3. Average network speeds are predicted to reduce in the cumulative scenario, but from investigation of the variations within the model runs, the results for the average network speed for Scenario R fall within the range of results in the Scenario P. Therefore, the overall network speed reductions in the cumultive scenario are not considered significant, nor could they be considered severe.

8.6.4. Considering specific journey times for routes within the model, the results indicate that there are journey time improvements alongside increases to journey time caused by the demand dependent development. For these routes where average journey times have increased in the AM and, or PM peak, investigation of the variations within the model runs demonstrate that the results for almost all of the average journey time for Scenario R fall within the range of results in the Scenario P.

8.6.5. It is noted that the basis of the Scheme is to ‘enable’ major developments which would lead to provision of much needed new housing and notable employment opportunities and as such the Scheme enables significant additional traffic without severe impact.

8.6.6. In terms of queuing, and specifically queue lengths for the M5 off-slips due to the potential for queues to block mainline traffic, which is a safety issue, the Scheme reduces the length of the queue on the southbound off-slip, which is predicted to exceed storage and extend into the mainline in the AM peak without the Scheme. The mean-max queue on the northbound off-slip in the AM peak is not predicted to exceed available storage.

9. Non Traffic Assessments

9.1. Sustainable Transport

9.1.1. The Scheme provides a number of walking and cycling infrastructure improvements along the entire Scheme extent. These include pedestrian and cycle facilities alongside the A4019, formal crossing points across the A4019, and crossing facilities at M5 Junction 10.

9.1.2. Providing these infrastructure improvements is likely to make walking and cycling a genuine choice of transport option for users of the Scheme, including the future users from the major development of new housing (c.9,000 homes) and employment land proposed. This achieves the aims of the NPS to create networks which support the delivery of a low carbon economy, and creating networks which enable communities to link effectively to each other.

9.1.3. An assessment of these improvements is contained within the Walking, Cycling and Horse-riding Assessment and Review (WCHAR) at Appendix I.

9.1.4. The assessment included use of the scoring tools contained within LTN 1/20 Cycle Infrastructure Design guidance. These tools were introduced by the Department for Transport (DfT) to set minimum quality criteria for cycling infrastructure design.

9.1.5. An extract of the Cycling Level of Service (CLoS) assessment is replicated below.

Table 3-2 - CLoS summary comparison

Key Requirement	Maximum Score	Existing (Combined Scores)	DF 2.2 (Combined Scores)	DF 2 (Public Consultation)	DF 3 (end of prelim design)
Cohesion	6	0/1	2/1	3	3
Directness	10	6/7	5/7	4	4
Safety	16	CRITICAL (0)	11	16	16
Comfort	8	2/3	6	7	7
Attractiveness	10	1	1	5	5
Total (X/50)	50	9/12	25/26	35	35
Percentage (Pass = 70%)	100%	18%/24%	50%/52%	70%	70%

9.1.6. Overall, the Scheme meets the minimum 70% standard for the LTN 1/20 CLoS assessment, scoring strongly for safety and comfort. The WCHAR notes that safety is also a consistent strength of the junction designs within the Scheme.

9.1.7. In terms of public transport journey time impacts, the impact of the Scheme on journey times for all vehicles (including buses) are outlined in Sections 6.3 and 7.3. The results indicate that across majority of the routes there are journey time improvements. There are some routes where average journey times have increased in the AM and, or PM peak. but these journey time increases are not considered significant.

9.2. Highways Safety

9.2.1. The impact of the Scheme across the GCTM model network shown in Figure 9 above has also been assessed using the DfT COBALT software. COBALT assesses the safety aspects of road schemes based on a comparison of accidents by severity and associated costs, across an identified network, for the 'Without-Scheme' and 'With-Scheme' forecast scenarios. The analysis is undertaken using details of the individual link and junction characteristics, their forecast traffic volumes and relevant accident rates and costs.

9.2.2. The results for the comparison between Scenario P (Without the Scheme) and Scenario S (With the Scheme but without dependent development) shows that there are accidents and casualties saved by the Scheme. Based on the outputs of GTCM v2.3, it is estimated that there will be about 195 accidents and about 250 casualties saved under this scenario over the assessment period across the GCTM highway network. The corresponding figures for the Paramics model area shown in Figure 9 above are reported as about 32 and 34 respectively.

9.2.3. The comparison between Scenario R (With the Scheme and with the dependent development) and Scenario P show that the accidents saved by the Scheme are offset by the additional accidents resulting from the increased demand arising from the dependent JCS developments which result in higher traffic flows across the highway network, so there are not predicted to be any accident savings in the cumulative scenario.

9.2.4. In addition to the assessment in COBALT, the Scheme addresses the specific safety issue of queues extending back from the M5 southbound off-slip onto the mainline. The modelling indicates that without the Scheme in future years the queues are predicted to extend back beyond the extents of the slip road. With the Scheme these queues are predicted to be contained within storage. In the Cumulative scenarios with the Scheme and dependent development traffic, the queues are still predicted to be contained within the off-slip storage.

9.2.5. It has been demonstrated that all reasonable steps have been taken and will be taken to minimise the risk of road casualties arising from the Scheme and contribute to an overall improvement in the safety of the Strategic Road Network, as outlined in NPS NN at paragraph 4.66.

9.2.6. It is therefore considered that the Scheme achieves the NPS NN aim to deliver national networks that meet the country's needs through creating networks which improve journey quality, reliability, and safety.

10. Assessment of Highway Network During Construction

10.1. Introduction

10.1.1. This chapter summarises the traffic modelling undertaken to predict the construction phase impacts of the proposed Scheme on the road network resulting from traffic management measures such as the closure of the existing M5 J10 slip roads during the construction period, and changes to operation of sections of A4019.

10.1.2. The M5 and A4019 will remain operational for the majority of the construction of the Scheme, albeit impacted by traffic management measures. However, the closure of the two slip roads at Junction 10 will be for prolonged periods, with closure for 15 months for the northbound on-slip and 9 months for the southbound off-slip, with an overlap of 5 months when both slip roads are closed. The slip road closures and impacts from the associated traffic management measures have the potential to result in significant transport impacts on the road network, so have therefore been assessed for the construction phase of the Scheme.

10.2. Assumptions

10.2.1. At this stage, detailed construction information such as construction worker numbers and HGV numbers for delivery of materials are not available, so the impacts associated with additional trips specifically generated by construction activities cannot be modelled. However, these impacts will be considered in subsequent stages prior to construction when more details on construction activities are known. A comprehensive Traffic Management Plan (TMP) will be in place prior to commencement of construction, to minimise their impacts on the highway network.

10.2.2. However, the impacts to general traffic on the existing road network from the major traffic management measures such as closure of the existing M5 Junction 10 slip roads have been assessed using traffic modelling at this stage, and the summary of the assessment results is detailed in this section of the report.

10.3. M5 J10 Construction Phase Traffic Management

10.3.1. In order to construct the Scheme, temporary traffic management measures will be required. These include lane closures, full road closures, and temporary speed limit reductions.

10.3.2. Information on the predicted slip road closures associated with the construction phase of the Scheme has been taken from Chapter 2 of the Environmental Statement (ES), (TR010063 - APP 6.2) which was informed by the most recent Buildability report for the Scheme.

10.3.3. In addition to the closure of M5 J10 slip roads at various points throughout the construction phase, the current construction plan for the Scheme will also include the following traffic management changes to the surrounding highway network:

- M5 J10 mainline traffic management involving speed limit reduction on the M5 mainline on the approaches to J10 during construction period.
- A4019 traffic management - Lane closure and speed reduction on the A4019 in vicinity of the Scheme.
- Closure of Withybridge Lane junction with the A4019.

10.3.4. In terms of full road closures at M5 J10, there are three major different closure types which occur for extended periods of time during the Scheme construction phase. These include:

- Southbound off-slip closed (northbound on-slip remains open)
- Both southbound off-slip and northbound on-slip closed.
- Northbound on-slip closed (new southbound off-slip alignment open).

10.3.5. The sequence of the traffic management and slip road closures are outlined in Table 21.

Table 21 – Traffic Management Timings

Date	Description
5	M5 Junction 10 Motorway works commence – traffic management starts
11	Southbound off-slip closed
15	Northbound on-slip closed
20	New Southbound off-slip opened
30	New Northbound on-slip opened
30	M5 Junction 10 Motorway works complete – traffic management ends

10.4. Assessment Methodology

10.4.1. As with the operational phase assessment reported in previous sections of this report, the Gloucestershire Countywide Traffic Model (GCTM) has been used to identify transportation impacts on the highway network. The GCTM is a SATURN strategic model which has been used to test the impacts of traffic management measures such as the slip road closures at M5 J10 on the wider road network during the construction phase.

10.4.2. The GCTM is considered to be the most appropriate modelling tool to understand traffic reassignment, which is the main impact on traffic that results from closing the M5 J10 slip roads and other major traffic management measures detailed above. As identified in Section 10.2, the construction phase assessment considers the impact of the slip road closures and traffic management measures on the road network. The impacts associated with additional trips from construction workers and materials will be covered in the Traffic Management Plan, when the details are known prior to construction commencing.

10.4.3. There will be signed diversion routes directing traffic along specified routes during slip road closures, It is acknowledged that some of the regular users of the slip roads who are likely to be familiar with the local road network, will find alternative routes along non-signed diversion routes during the construction phase, The modelling has therefore assumed a reasonable worst case scenario where traffic has free choice over routes, rather than assessing an unrealistic scenario whereby all affected traffic only uses the signed diversion routes.

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10.5. GCTM Assessment Year for Construction Phase

10.5.1. The GCTM was developed for an assessment year of 2024 to correspond to the planned start of construction. This was done by developing a forecast 2024 model by interpolating the 2015 Base Year and 2027 Scenario P (without the Scheme) models.

10.6. GCTM Construction Assessment Scenarios

10.6.1. A series of GCTM future forecast year (2024) models has been used to forecast traffic conditions in the future year construction phase scenarios, with and without the different slip road closures and other major traffic management measures.

10.6.2. The resultant scenarios modelled in the GCTM are detailed in Table 22 below.

Table 22 – Construction Phase Scenarios

Construction Phase Scenario Reference	Description of Construction Phase Scenario
Do-Minimum (DM)	• Model with the M5 J10 current layout (both slip roads open). • Includes the local schemes for Coombe Hill improvement scheme and upgrading Arle Court Roundabout. • No changes to highway networks associated with construction of the M5 J10 Scheme.
Do-Something 1 (DS1)	• M5 J10 slip roads open. • Speed limit reduction on the M5 mainline on approaches to J10. • Lane closure and speed limit reductions along sections of the A4019. • Withybridge Lane junction with A4019 open. • Other elements the same as DM scenario.
Do-Something 2 (DS2)	• M5 J10 southbound off-slip closed. • Speed limit reduction on the M5 mainline on approaches to J10. • Lane closure and speed limit reductions along sections of the A4019. • Withybridge Lane junction with A4019 closed. • Other elements the same as DM scenario.
Do-Something 3(DS3)	• M5 J10 southbound off-slip and northbound on-slip closed. • Speed limit reduction on the M5 mainline on approaches to J10. • Lane closure and speed limit reductions along sections of the A4019. • Withybridge Lane junction with A4019 closed. • Other elements the same as DM Scenario.
Do-Something 4 (DS4)	• M5 J10 northbound on-slip closed. • M5 J10 southbound off-slip open (using new alignment, but operation same as existing priority controlled off-slip). • Speed limit reduction on the M5 mainline on approaches to J10. • Lane closure and speed limit reductions along sections of the A4019. • Withybridge Lane junction with A4019 closed. • Other elements the same as DM Scenario.

10.6.3. A summary of the network operation in the GCTM scenarios are detailed in Table 23 below.

Table 23 – GCTM Network Coding Summary

Scenario Reference	M5 mainline Traffic Management (speed limit reduction)	A019 Traffic Management (lane closure and speed limit reduction)	Withybridge Lane / A4019 Junction closure	M5 J10 Slip Road operation	
				SB off-slip	NB on-slip
DM				Open	Open
DS1	y	y		Open	Open
DS2	y	y	y	Closed	Open
DS3	y	y	y	Closed	Closed
DS4	y	y	y	Open	Closed

10.7. GCTM Construction Phase Modelled Periods

10.7.1. The GCTM covers the following time periods for the construction phase scenarios:

- Average AM peak period (07:00-10:00).
- Average Interpeak (IP) period (10:00-16:00).
- Average PM peak period (16:00-19:00).

10.8. GCTM Construction Assessment Modelled Area

10.8.1. The area covered by the GCTM Version 2.3 is shown in Figure 8 of Chapter 5.

10.9. Flow Differences

10.9.1. The changes in traffic flows between the different construction phase scenarios are illustrated in traffic flow difference plots included in Appendix M for the three modelled periods. The plots have been used to show the general trends in flow changes (blue representing reductions, green increases, and the size of the bar relating to the relative scale of the change) but the plots in Appendix M also include the difference in numbers of vehicles plotted alongside the affected links.

10.9.2. The general summary of the flow changes predicted by the GCTM for the impacts associated with the traffic management measures during the construction phase are described in the following paragraphs.

10.9.3. To understand the potential general extent of the impact of the slip road closures during the construction phase, the scenario where both of the M5 J10 slip roads will be closed (DS3) was investigated. This represents the most significant impact and can be considered as the 'worst case scenario'. It was investigated to identify the extent of large traffic flow changes across the highway network.

10.9.4. Figure 27 is a diagrammatic output from the GCTM which shows the general pattern of traffic flow differences between Do Minimum (DM) and Do Something Scenario 3 (DS3) for the AM peak period, although similar trends in terms of extents occur in the other modelled periods.

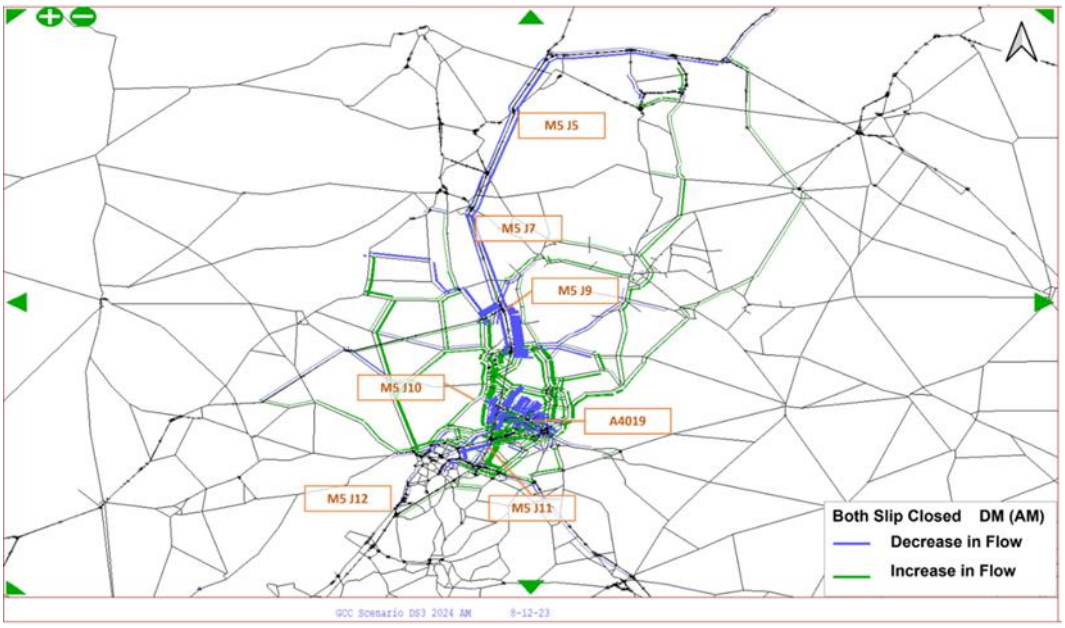

Figure 27 – GCTM Extent of Construction Assessment Impact

10.9.5. Figure 27 demonstrates that whilst there are some small flow differences predicted as far north as M5 J5, the main impact is focused on the area of the network between M5 J9 and M5 J11. The focus of the assessment therefore covers the area of road network between M5 J9 and M5 J11, including the adjacent local road network.

10.9.6. There are two main factors impacting on performance of the road network during the construction period; Firstly, the traffic management measures such as lane closures on the A4019 and speed limit reductions, and secondly the full road closures of the M5 J10 slip roads.

Traffic Management Impacts with Both M5 J10 Slip Roads Open

10.9.7. Comparing the traffic flow difference plots included in Appendix M for DM to DS1 scenario to understand the impact of the traffic management and speed limit restrictions to general traffic shows that there would be, as expected, some reduction in traffic flows along the M5 mainline and the A4019. The traffic management measures on the mainline (such as the speed limit reduction) act as a 'bottleneck' to flow when compared to DM conditions, meaning that slightly fewer vehicles are able to complete their journeys within the modelled period. These vehicles are likely to be delayed by the traffic management measures on the M5 mainline, particularly in the AM peak. A similar pattern of traffic flow reduction is predicted on the A4019 as a result of the traffic management measures. There is evidence of localised rerouting (such as through Boddington and Staverton). This is likely to be the result of vehicles avoiding the constricted A4019, and rerouting to reach the north of Cheltenham via Old Gloucester Road. The general patterns of flow differences are comparable in all modelled periods.

10.9.8. The changes to flows from just the traffic management measures when the slip roads are open are considered to be minor, with forecast increase on local roads around 60 to 70 vehicles in the AM peak hour, although similar magnitudes of flow changes are seen in other peaks. This roughly equates to an additional 1 vehicle every minute per hour in the peak periods, which is unlikely to result in severe impacts to network operation. The impact of traffic management combined with the M5 J10 slip road closures is assessed below.

Traffic Management Impacts with only M5 J10 Southbound Off-slip Closed

10.9.9. Comparing the traffic flow difference plots included in Appendix M for DM to DS2 reveals that the impact of closing the southbound off-slip to general traffic, which includes some changes to flows in the surrounding area of the M5 J10 where vehicles are predicted to choose alternative routes (in addition to the reductions in flow from the traffic management). The vehicles choosing alternative routes comprise the current users of the southbound off-slip who will not be able to choose the route which includes the slip road, and other general traffic choosing different routes due to the knock on impacts of those slip road users on the highway network.

10.9.10. In the 2024 DM scenario, there are predicted to be 886 users of the southbound off-slip in the AM peak, 548 in the Interpeak, and 479 in the PM peak. Further detailed assessment of the impact to these users is included in Section 10.11.

10.9.11. The assessment shows that the general reassigned traffic (slip road users, and general traffic) would disperse across multiple different routes towards Cheltenham, including the A38 to the west of the M5 and the A435 to the east of the M5. There are also some increases on the M5 southbound south of M5 J10 with trips using the A40 from M5 J11 towards Cheltenham, and on the A46 from the M5 J11a towards Cheltenham. The combined increases in flows along these routes which carry the diverted traffic are broadly comparable to the number of current slip road users, indicating that the flow changes are mainly (but not exclusively) from slip road users diverting to alternative routes. There are similar patterns in the flow differences for all modelled periods.

Traffic Management Impacts with Both M5 J10 Slip Roads Closed

10.9.12. Comparing the traffic flow difference plots included in Appendix M for DM to DS3 provides an insight to the impact of closing both slip roads at the M5 J10 which represents the maximum of the impacts among the construction phase scenarios considered.

10.9.13. In the 2024 DM scenario, there are predicted to be 354 users of the northbound on-slip in the AM peak, 383 in the Interpeak, and 687 in the PM peak. Further detailed assessment of the impact to these users is included in Section 10.11.

10.9.14. The DS3 to DM comparison shows further general reassignment of trips (slip road users and general traffic) onto other routes in the highway network compared to DS2 where only southbound off-slip is closed. There are increases in traffic flows from Cheltenham along the A40 towards M5 J11. As with the other flow difference plots, there are similar patterns across all modelled periods. Figure 28 shows the patterns of differences in traffic flows in the AM peak for DS3 scenario, which as stated previously is the scenario when the largest impact is likely to occur from the closure of both the M5 J10 slip roads during construction phase.

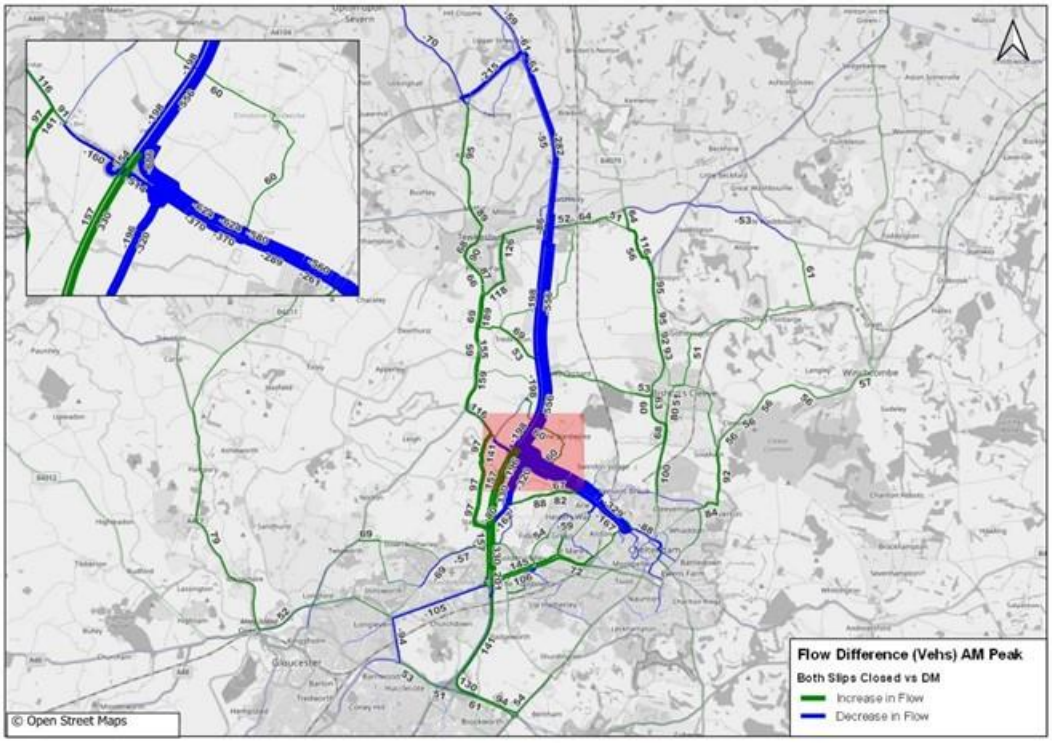

Figure 28 – Flow differences during closure of both slip roads at M5 J10

Traffic Management Impacts with Only M5 J10 Northbound On-slip Closed

10.9.15. Finally, the comparison of the traffic flow difference plots included in Appendix M for DM to DS4 scenario shows the impact on traffic flows from closure of the M5 J10 northbound on-slip with the new southbound off-slip open. Under this scenario it can be seen that there would be increases in flows from Cheltenham along the A40 to M5 J11. There are also the same impacts to flows resulting from the traffic management measures, although the reduction in flows along the M5 and A4019 is lower because the southbound off-slip has reopened.

Traffic Flow Changes Summary

10.9.16. The magnitude of change in traffic flows on some of the local roads for most of the slip road closure scenarios is predicted to be in the region of increases around the tens of vehicles to below 200 in the modelled peak hours. For example, in the DS3 AM peak scenario where both the M5 J10 slip roads are closed (representing the maximum impact on the affected highway network during the construction phase), there are predicted to be increases in flow northbound on the A38 south of Tewkesbury of 69 vehicles, and southbound increases of 189 vehicles. The road through Staverton and Boddington is predicted to carry an additional 97 and 157 vehicles in the northbound and southbound directions respectively in the AM peak during the period when both M5 J10 slip roads are closed. These increases equate to an additional 1 to 3 vehicles every minute per hour in the peak periods, which is unlikely to result in severe impacts. It is acknowledged that whilst these predicted flow changes from the traffic management measures during the construction phase are not likely to result in severe transport impacts, they may have noise and air quality impacts; these are covered separately in Chapter 6 of the ES (TR010063 – APP 6.4.)

10.9.17. In order to understand if these flow changes are likely to result in severe impacts to the operation of the road network during the construction phase, further interrogation of the GCTM has been undertaken to investigate changes to the predicted levels of congestion.

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10.10. Volume Over Capacity

10.10.1. In order to understand the impact of the slip road closures on the road network in terms of congestion, volume over capacity ratios for links have been interrogated in the GCTM model runs. Volume over capacity (V/C) ratios identify when predicted volumes of traffic approach the theoretical capacity of the link, with a V/C over 100% indicating that congestion may occur along the link.

10.10.2. The V/C ratios have been grouped into categories and illustrated for the different construction phase scenarios in plots included in Appendix M for the three modelled periods. It is important to note that V/C is a modelling concept, so a link that experiences a V/C over 100% isn't 'full'. It can still take more traffic flow, but the chances of the link experiencing congestion and delay increases. As such, V/C is being used as a proxy to identify potential congestion increases in more detail compared to just considering flow differences.

10.10.3. A general summary of the congestion on the network predicted by the GCTM is provided below.

10.10.4. The 2024 DM Scenario in the future before construction of the Scheme commences shows some congestion on local roads with V/Cs over 100% (shown in red), and other roads approaching their capacity (between 85% and 100% shown in amber). Links with V/C below 85% are colour coded green and are generally predicted to operate within capacity. The signed diversion routes for the slip road closures are predicted to be operating with V/C below 85%.

10.10.5. With the traffic management in place but the M5 J10 slip roads open (Scenario DS1), there is no change to congestion category levels predicted by the model compared to DM Scenario. Whilst V/C values may increase slightly due to flow increases, the change is not at a level to push the links into the next category, and so is unlikely to lead to significant increases in congestion on the road network.

10.10.6. With the closure of the M5 J10 southbound off-slip in DS2, there is very little change to congestion category levels predicted by the model. The reassignment caused by closure of the southbound off-slip results in some links that were previously approaching their capacity now being more likely to experience congestion (around Bishops Cleave), but this is mainly observed just in the AM peak, with the majority of links staying in the same categories as the DM scenario in the Interpeak and PM peak.

10.10.7. For the DS3 scenario where both M5 J10 slip roads are closed, the same patterns of V/C category changes are observed as those for the scenario with just the southbound off-slip closed. The small number of links that are predicted to experience congestion are those that were already approaching their capacity in the DM scenario, and the changes are largely only observed during the AM peak period, with modest changes to congestion categories in the other modelled periods. The local roads such as the route through Staverton and Boddington is predicted to remain in the 'green' category with V/C below 85% and unlikely to experience congestion for all slip road closure scenarios in all modelled peak periods.

10.10.8. For the DS4 scenario with just the M5 J10 northbound on-slip closed and the new southbound off-slip open, there do not appear to be any significant changes to V/C levels, with no links changing category as defined in the plots (V/C less than 85%; between 85% and 100% and over 100%) in any of the modelled periods.

10.10.9. The general trends observed to V/C resulting from the slip road closures indicate that there are no significant increases in the V/C ratios and links which are predicted to experience congestion were already predicted to be operating close to their capacity prior to construction commencing.

10.11. Impact on Journey Times During Construction Phase

10.11.1. The potential impacts on journey lengths and journey times resulting from the M5 J10 slip road closures on the affected highway road network during the construction phase have been investigated using the outputs from GCTM. This has been investigated for current users of the M5 J10 slip roads, and the M5 mainline users between M5 J9 and J11.

Impact on M5 J10 Slip Road Users

10.11.2. Select Link Analysis (SLA) has been undertaken to identify the Origins and Destinations of trips that use the southbound off-slip and northbound on-slip in the DM scenario when the slip roads are open.

10.11.3. Figure 29 and Figure 30 show the SLA for the two slip roads. It is clear that the majority of current southbound off-slip users originate from destinations to the north travelling along the M5 towards destinations in central Cheltenham.

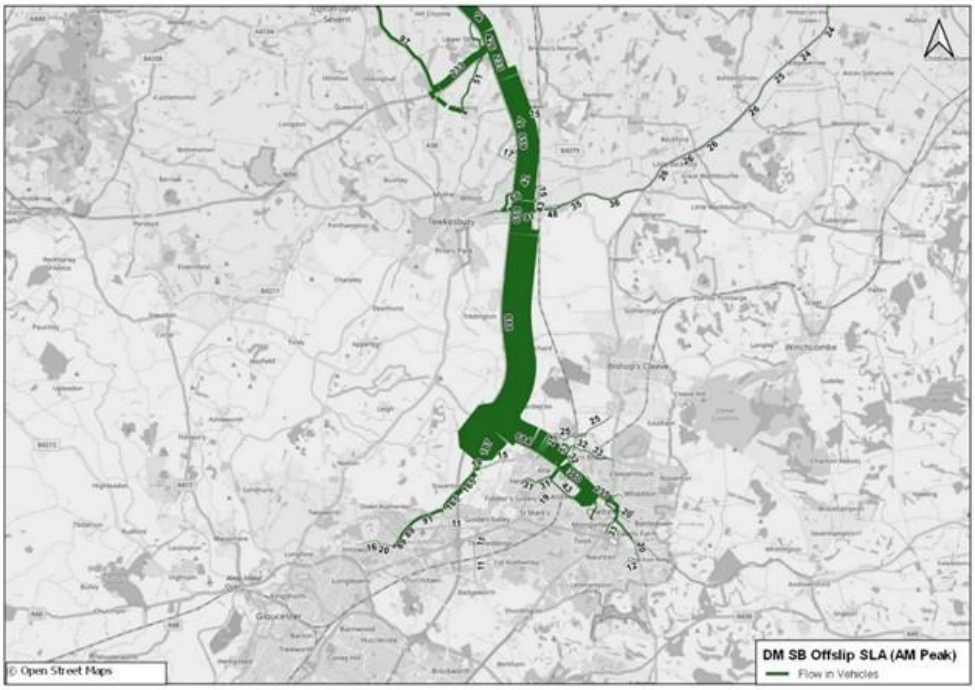


Figure 29 – M5 J10 southbound off-slip Select Link Analysis

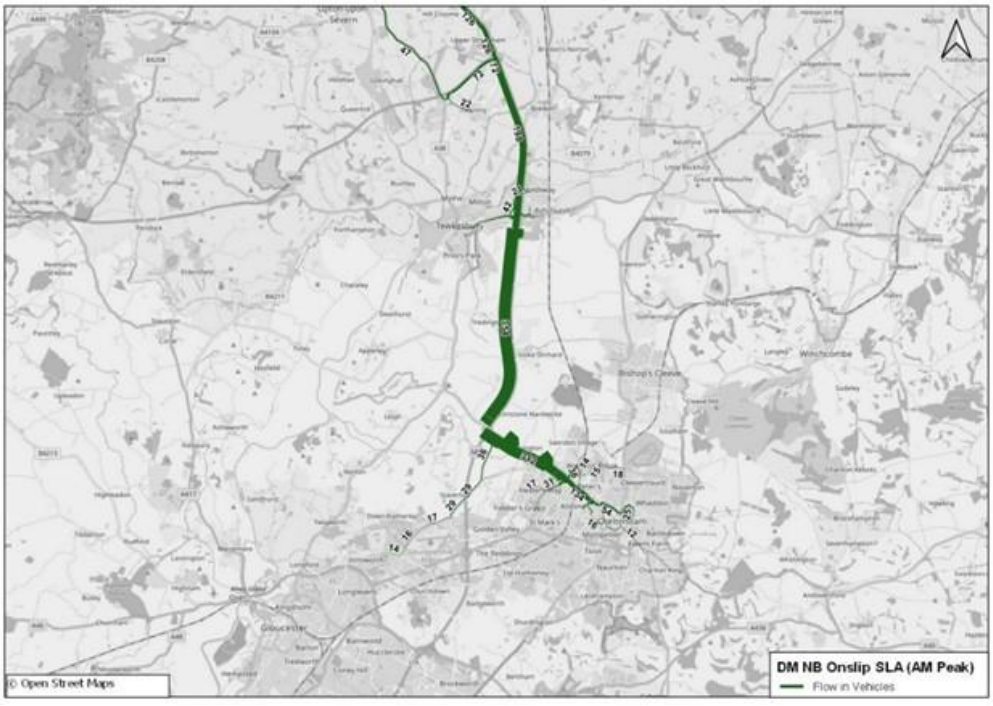


Figure 30 – M5 J10 northbound on-slip Select Link Analysis

10.11.4. The current northbound on-slip road users are predominantly from origins in central Cheltenham who are heading towards the M5 northbound mainline.

10.11.5. In order to understand the routes that the slip road users are reassigning to during the construction phase, the trips to and from the same OD pairs as contained in the SLA matrices were assigned onto the highway networks with the M5 J10 slip road closures.

10.11.6. Figure 31 and Figure 32 show the alternative routes used by the M5 J10 slip roads users.

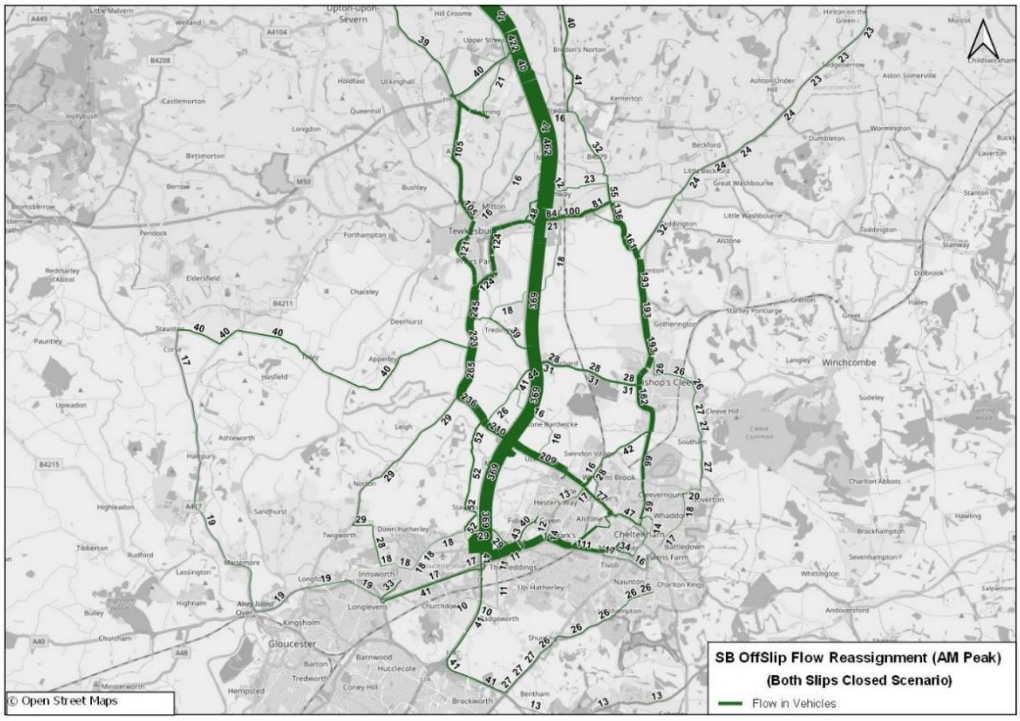


Figure 31 – M5 J10 southbound off-slip Alternative Routes

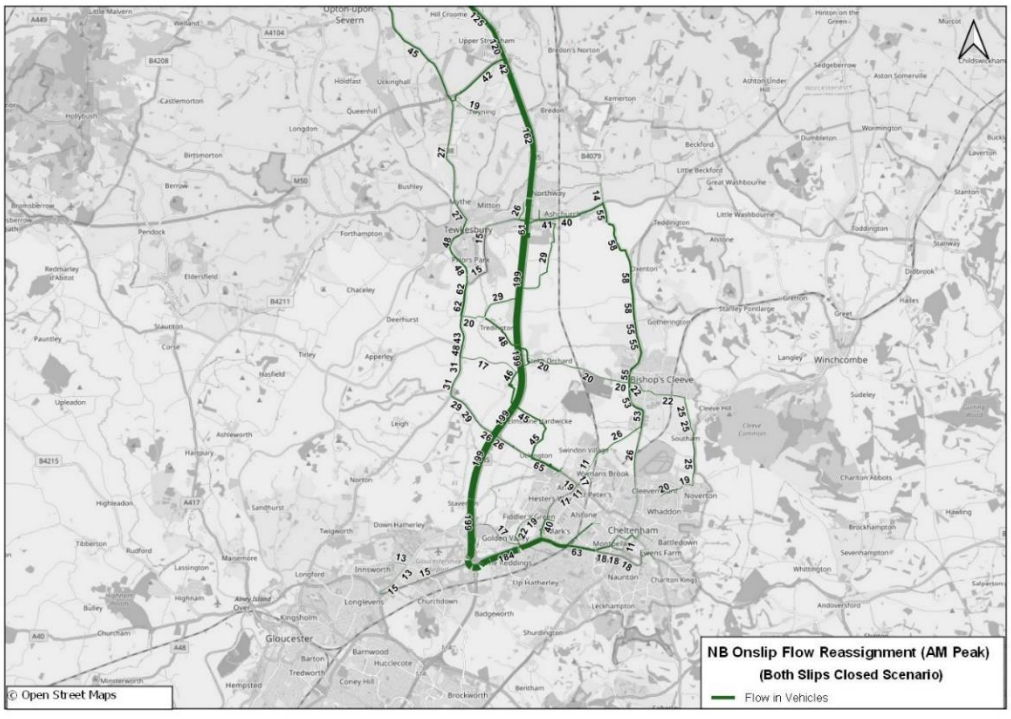


Figure 32 – M5 J10 northbound on-slip Alternative Routes

10.11.7. The alternative routes used by the M5 J10 slip roads users show additional trips on the similar routes to those that were illustrated in the general flow difference plots, indicating that the majority of flow changes on the network are from the diverted traffic from closure of the slip roads, rather than significant rerouting of general network traffic. The numbers of vehicles taking these alternative routes are shown in Figures included in Appendix M.

10.11.8. It is acknowledged that although there may be signed diversion routes directing traffic along specified routes during slip roads closures, some of the regular users of the slip roads who are likely to be familiar with the local road network, can find alternative routes along non-signed diversion routes during the construction phase, Given the relatively low number of the total diverted traffic from the slip roads, the impact of a small number of drivers who may use the non-signed diversion on operation of the highway network is thought to be negligible. However, through good traffic management practices and continued liaison with the residents of the affected areas during construction phase, appropriate additional mitigation measures would be implemented to minimise excessive impact of non-signed diversion routes.

10.11.9. In order to understand the changes to journey lengths and journey times for the slip road users, an OD pair was selected from the SLA trip matrices to represent a typical journey that currently uses the M5 J10 slip roads. The changes for these 'typical' OD pairs have then been calculated in the various DS scenarios when one or both slip roads are closed i.e Scenarios DS2, DS3 and DS4. It is worth noting that M5 J10 slip roads are both open in DS1 during construction phase. The typical southbound OD pair represent trips from a zone north of Worcester to a zone in central Cheltenham (zone 90059 to 23009), and the northbound pair are the return from Cheltenham to Worcester (zone 23009 to 90059).

10.11.10. Table 24 presents the results of the journey distance and journey time analysis for the 'typical' current slip road users.

Table 24 – Journey time changes – typical M5 J10 slip road user trips

		AM Peak		Interpeak		PM Peak	
		Dist (km)	Time (mins)	Dist (km)	Time (mins)	Dist (km)	Time (mins)
DM	NB OD pair	45.5	38	45.5	39	45.2	42
	SB OD Pair	44.9	42	45.1	38	44.9	39
DS2 (SB off-slip closed)	NB OD pair	48.8	39	48.8	38	48.8	42
	SB OD Pair	48.6	46	48.6	38	48.6	39
DS3 (both slip roads closed)	NB OD pair	48.8	39	48.8	39	48.8	43
	SB OD Pair	48.6	46	48.6	38	48.6	39
DS4 (NB on-slip closed, SB off-slip re-open)	NB OD pair	48.8	39	48.8	39	48.8	43
	SB OD Pair	44.9	44	48.6	38	48.6	39

10.11.11. Table 24 demonstrates that the change to the distance travelled for typical current southbound off-slip road users who will divert to other available routes during the construction phase in the DS2 and DS3 scenarios is approximately an additional 3.7 km. For the current northbound on-slip road users, the change to the distance travelled is approximately an additional 3.3km.

10.11.12. The corresponding increases in journey time are largest, as expected, in the southbound journey during the AM peak with both M5 J10 slip roads closed as assessed in DS3, with an increase of around 4 minutes to a current journey time of 42 minutes, which is equivalent to an increase of 10% predicted to occur over a route of over 45 km long. The changes to southbound journeys in the interpeak and PM peak are much lower with increases of less than a minute.

10.11.13. For all the slip roads closure scenarios, the current typical users of the northbound slip road experience journey time increases which are much lower than the southbound slip road users at reported as usually less than a minute which is equivalent to around 2% in all the modelled periods.

10.11.14. It is therefore considered that the majority of impacts to journey times for typical users of the M5 slip roads during construction phase are not considered severe, and any larger impacts will be monitored and considered in mitigation.

M5 Mainline Users

10.11.15. In terms of M5 mainline journey time changes, the journey times for trips between M5 J9 to M5 J11 have been analysed for all the modelled periods in each of the slip road closure scenarios. Full details of all journey times for the modelled scenarios as reported by GCTM for the M5 mainline between Junctions 9 and 11 are included in Appendix M.

10.11.16. The highest increase in M5 mainline journey times along the northbound section between J11 to J9 is reported by the GCTM as about 30 seconds (27 seconds in the AM peak in DS4 where the northbound on-slip is closed).

10.11.17. The increase in the M5 mainline journey times along the southbound section between J9 and J11 are reported to be below 30 seconds, with the greatest increase of 29 seconds in the Interpeak in DS4 when the northbound on-slip is closed, and the southbound off-slip has reopened along the new alignment.

10.11.18. The increases in journey times along the M5 mainline between J9 and J11 are, as expected, impacted by both the traffic management measures such as the reduction to speed limits during the construction phase, and also the changes in flow due to traffic rerouting. For the southbound journey times, the reduction of flows along the mainline from rerouting when the southbound off-slip is closed help with journey times to remain largely unaffected, and as such offset the impacts of the reduction in speed limit.

10.11.19. The predicted increases in journey times along the M5 mainline between J9 and J11 for all modelled scenarios and time periods during the construction phase are all predicted to be less than 30 seconds, and as such are not considered to be severe.

10.12. Non Traffic Impacts of M5 J10 Construction Phase

10.12.1. It is recognised that the traffic management measures implemented during the construction phase of the Scheme also have the potential to impact on non-vehicle users of the road network such as pedestrians, cyclists and public transport users.

10.12.2. The Traffic Management Plan will outline the detailed closures of footways throughout the construction phase and will ensure that the impact to pedestrians will be considered in all traffic management measures.

10.12.3. The A4019 will remain operational throughout construction (albeit with lane closures) so bus routes along the corridor will not be subject to significant impacts such as route diversions.

10.12.4. A detailed assessment of the impacts of the construction phase to walking and cycling routes is outlined in Chapter 13 of the ES (TR010063 – APP 6.11) It is noted that mitigation measures proposed as part of the construction phase of the Scheme will ensure that there will be safe access for pedestrians and cyclists through areas under traffic management. It is therefore concluded that there is unlikely to be any unacceptable impacts to these users.

10.13. Mitigation of Construction Phase Impacts

10.13.1. A Traffic Management Plan (TMP) will be in place prior to commencement of construction, to mitigate severe construction phase impacts.

10.13.2. The TMP is likely to include measures such as advanced notice of roadworks using signage, which will enable existing users at this location to plan their regular journeys to avoid or minimise potential delays, such as those predicted to be experienced by the current southbound off-slip users in the AM peak.

10.13.3. It is also considered that good management of construction traffic and diversion routes in the local area, through the use of the Traffic Management Plan, onto the signed diversion routes would lead to fewer roads being affected by increases in traffic during the closures of the slip roads. However, it is not possible to make traffic use the signed diversion routes, so this measure has not been included in the assessment. Notwithstanding this fact the Applicant is committed to reducing the effects of the construction phase as far as is reasonably practicable. As such it is proposed to include the signed diversion routes as an additional mitigation measure, during the construction stage, to help reduce some of the impacts on local routes.

10.13.4. The TMP will also include details of traffic management measures for all road users (including walking and cycling) to ensure that there are no unacceptable safety impacts as a result of construction activities.

10.14. Summary of Highway Impacts during the Construction Phase

10.14.1. In order to construct the Scheme, there will be a requirement for traffic management and slip road closures at M5 J10. The M5 and A4019 will remain operational for the majority of the construction of the Scheme, albeit impacted by traffic management measures. However, the closure of the two slip roads at Junction 10 will be for prolonged periods, with closure for 15 months for the northbound on-slip and 9 months for the southbound off-slip, with an overlap of 5 months when both slip roads are closed. The GCTM has been used to assess the impacts of these slip road closures as well as other major changes on the operation of the highway network.

10.14.2. The construction phase traffic modelling has demonstrated that there are likely to be changes in traffic flows on the road network in the vicinity of the Scheme resulting from both the implementation of traffic management measures, and the M5 J10 slip road closures. The modelling results show that the general magnitude of flow changes on the local road network is unlikely to result in severe traffic impacts.

10.14.3. The GCTM has also been used to understand the impacts of the slip roads closures on the capacity and level of potential congestion across the affected network which are reported as Volume over Capacity (V/C) ratios. The general trends observed from changes to V/C categories resulting from the slip road closures indicate that the increases in V/C categories are modest and consistent with the pattern of reassigned traffic, and as such are not considered to be severe.

10.14.4. Select Link Analysis has been used to identify the current M5 J10 slip road users in terms of numbers, trip origins and destinations, and changes to the routes of diverted traffic when the slip roads are closed.

10.14.5. Changes in journey distances and time have been assessed for the typical current users of the slip roads. These changes for the majority of the modelled peak periods and scenarios are not considered to be severe, and any larger impacts would be subject to mitigation measures that would be outlined in the TMP. The predicted changes in journey times along the M5 mainline between J9 and J11 for any of the scenarios in any of the modelled time periods are all predicted to be less than 30 seconds, and as such they are not considered to be severe.

10.14.6. It is therefore concluded that during the construction phase of the Scheme there would not be an unacceptable impact on highway safety, and that the residual cumulative impacts on the road network would not be severe, in accordance with paragraph 111 of the NPPF.

11. Validation of the Traffic Model

11.1.1. Through Section 51 Advice, the Examining Authority (ExA) recommended, in November 2023, that the current traffic model is assessed against present day (2023) observed traffic data to confirm that it remains valid in light of the impact of the COVID-19 pandemic on travel patterns.

11.1.2. The ExA also suggested that this Transport Assessment (TA) is updated to include the current year (2023) assessments so that the future operational performance of the modelled road network can be considered against current operational performance.

11.1.3. The supplementary report (TR010063/APP/9.17), submitted alongside this updated TA, provides the results of the traffic modelling work undertaken to address the ExA's comments regarding the potential impact of the COVID-19 on the validity of the current forecast models.

11.1.4. The work reported in the supplementary report includes the development of two 2023 forecast models, namely 'with' and 'without' COVID-19 adjustments and their comparisons against 2023 observed data, which include journey time and traffic counts data obtained from Gloucestershire County Council (GCC), National Highways (NH) and Department for Transport (DfT).

11.1.5. The results of this work show that both the 2023 models, with and without COVID-19 adjustment factors, correlate with observed traffic data within acceptable TAG validation tolerances. This demonstrates that the differences in the modelled traffic demand between the two models fall within the range of acceptable validation tolerances for strategic traffic models.

11.1.1. Interrogation of the two models shows that the modelled traffic flows on the road network are consistently higher for the without COVID adjustment model compared to the with COVID adjustment model, but in both cases the variation from the 2023 observed data is within acceptable validation tolerances. This confirms that the traffic model is performing as expected in response to changes in traffic demand. It also indicates that, overall, the with COVID-19 adjustment model compares marginally better with observed traffic flow data. I

11.1.2. The findings of the supplementary report demonstrate that the 2015 base used in the traffic modelling submitted for the DCO application remains valid and is fit for purpose in assessing the proposed Scheme.

12. Summary and Conclusion

12.1. Summary

12.1.1. Having been validated against present day (2023) observed traffic data, and through the application of COVID-19 adjustments factors, this document provides a review of the existing transport conditions within the vicinity of the Scheme. This has highlighted poor existing walking, cycling and public transport facilities in the vicinity of the Scheme. The area benefits from access to bus routes and some pedestrian facilities on the A4019, but poor access to cycle facilities. A review of local accident data indicates that there has been 30 PIAs in the last five years, including one 'fatal' PIA.

12.1.2. Additionally, the TA has outlined the Scheme proposals, including details of the improvements to pedestrian and cycle facilities. The Scheme proposes to provide an upgrade to pedestrian and cycle facilities. These will provide an improvement compared to the existing situation for pedestrian and cycle users.

12.1.3. The predicted impact of the Scheme on the local road network has been identified using the GCTM, the GCC strategic SATURN model. The GCTM has predicted the change in flows on the road network in a number of assessment years using the following scenarios:

- Scenario P – Without dependent development and without the Scheme.
- Scenario S – Without dependent development and with the Scheme.
- Scenario R – With dependent development and with the Scheme.

12.1.4. The GCTM predicts that the proposed Scheme in isolation (the difference between Scenario S and Scenario P) will result in some minor reassignment of existing traffic through the Scheme.

12.1.5. For the cumulative scenario (the difference between Scenario R and Scenario P) the GCTM predicts much larger increases in flows in the Scheme area. These are mainly as a result of the trips generated by the dependent development rather than Scheme itself.

12.1.6. Detailed microsimulation modelling has been undertaken using a Paramics Discovery model in the study area around the Scheme, to understand the impact of the Scheme at these junctions in more detail.

12.1.7. The comparison of performance between Scenario S and Scenario P has demonstrated the impact of the Scheme in isolation (without any dependent development). Overall, the Scheme improves average journey times and increases average speeds across the Paramics model area. Considering specific journey times for routes within the model, the results indicate that across majority of the routes there are journey time improvements. In terms of queuing, and specifically queue lengths for the M5 off-slips due to the potential for queues to block mainline traffic, which is a safety issue, the proposed Scheme reduces the length of the queue on the southbound off-slip, which is predicted to exceed storage and extend into the mainline in the AM peak without the Scheme and is therefore a safety benefit.

12.1.8. The comparison of performance between Scenario R and Scenario P has demonstrated the cumulative impact of the Scheme in combination with the dependent development. Overall, the results indicate that the additional dependent demand in Scenario R has an impact on performance compared to Scenario P, particularly in the 2042 future year.

12.1.9. Average network speeds are predicted to reduce in the cumulative scenario, but from investigation of the variations within the model runs, the results for the average network speed for Scenario R fall within the range of results in the Scenario P. Therefore, the overall network speed reductions in the cumultive scenario are not considered significant, nor could they be considered severe.

12.1.10. Considering specific journey times for routes within the model, the results indicate that there are journey time improvements, alongside increases to journey time caused by the demand dependent development. For these routes where average journey times have

increased in the AM and, or PM peak, investigation of the variations within the model runs demonstrate that the results for almost all of the average journey time for Scenario R fall within the range of results in the Scenario P.

12.1.11. It is noted that the basis of the Scheme is to 'enable' major developments, which would lead to provision of much needed new housing and notable employment opportunities, and as such the proposed Scheme enables significant additional traffic without severe impact.

12.1.12. In terms of queuing, the Scheme reduces the length of the queue on the southbound off-slip, which is predicted to exceed storage and extend into the mainline in the AM peak without the Scheme. The mean-max queue on the northbound off-slip in the AM peak is not predicted to exceed available storage.

12.1.13. The Scheme provides a number of walking and cycling infrastructure improvements along the entire Scheme extent. Overall, the M5 Junction 10 Improvement Scheme meets the minimum 70% standard for the LTN 1/20 CLoS assessment, scoring strongly for safety and comfort. Safety is also a consistent strength of the junction designs within the Scheme.

12.1.14. The impacts resulting from traffic management measures during the construction phase of the Scheme have been assessed. These measures which include lane closures, reduction in speed limit, and full road closure of the M5 J10 slip roads have been modelled in the GCTM, to understand their impacts on the affected highway network in terms of flow changes, congestion, journey distance and journey times. The results of the assessment show that the impacts from these traffic management measures are not by and large considered to be severe, and mitigation measures such as a TMP will be in place prior to commencement of construction, to ensure that there are no severe residual cumulative impacts.

12.1.15. It is concluded that there would not be an unacceptable impact on highway safety, and that the residual cumulative impacts on the road network would not be severe for all stages of the Scheme, so accords with the NPPF and NPS NN.

12.1.16. It has been demonstrated that the Scheme creates networks with the capacity and connectivity to support national and local economic activity and facilitate growth. The modelling demonstrates that the Scheme creates networks which improve journey quality, reliability, and safety.

12.1.17. The sustainable transport infrastructure improvements in the Scheme achieve the aims of the NPS to create networks which support the delivery of a low carbon economy and create networks which enable communities to link effectively to each other.

12.1.18. It is therefore concluded that the Scheme accords with the aims of the National Policy Statement for National Networks.

Appendix A. Masterplan

NOTE:

1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE DEVELOPMENT CONSENT ORDER AND OTHER APPLICATION PLANS.

KEY:

DEVELOPMENT CONSENT ORDER (DCO) LIMITS

1 IN 40000 SCALE ORDNANCE RASTER DATA

1 IN 25000 SCALE ORDNANCE VECTOR DATA

REFER TO INSET A FOR SCHEME DETAIL

M5 JUNCTION 10

INSET A

CHELTENHAM

GLOUCESTER

TEWKESBURY

Scale 1:25000
500m 0m 500m 1000m 1500m

Scale 1:40000
500m 0m 500m 1000m 1500m 2000m

Description						
Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date
Description						
Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date
Description						
Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date
Description						
Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date
Description	FIRST SUBMISSION					
Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date
A1	C01	NKRP	CJ	HC	BM	18/10/23

Drawing Suitability: APPROVED - PUBLISHED — Status: A1

Project Title: M5 Junction 10 Improvements Scheme

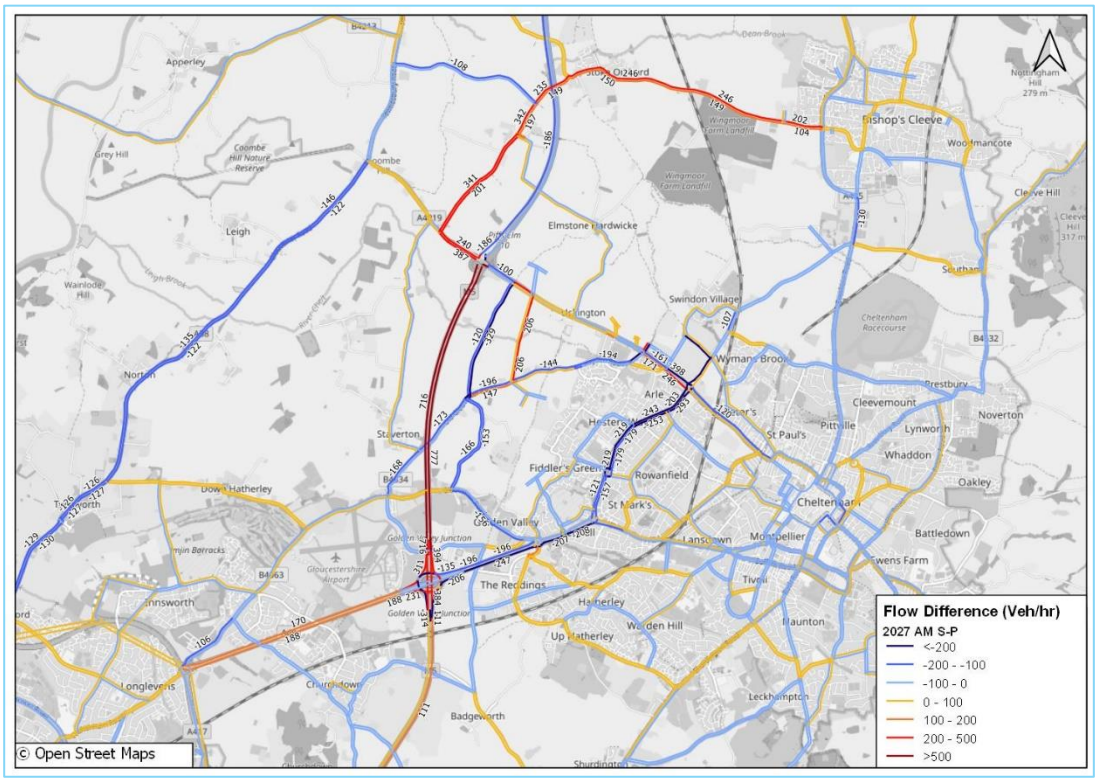
Drawing Title: LOCATION PLAN REGULATION 5(2)(o)

Drawing Number: TR010063/APP/2.1

Original Size:	Scale:	Project Ref. No:	Sheet:	Rev:
A1	AS SHOWN	5197035	1 of 1	C01

This Drawing is saved on ProjectWise as Drawing No.GCCM5J10-ATK-HGN-ZZ-DR-CH-001000 Plotted: 19/10/2023 15:22:27 By: CHAU8495

Appendix B. GCTM Flow Difference Plots


Flow Difference (Veh/hr)
2027 AM S-P
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0 - 100
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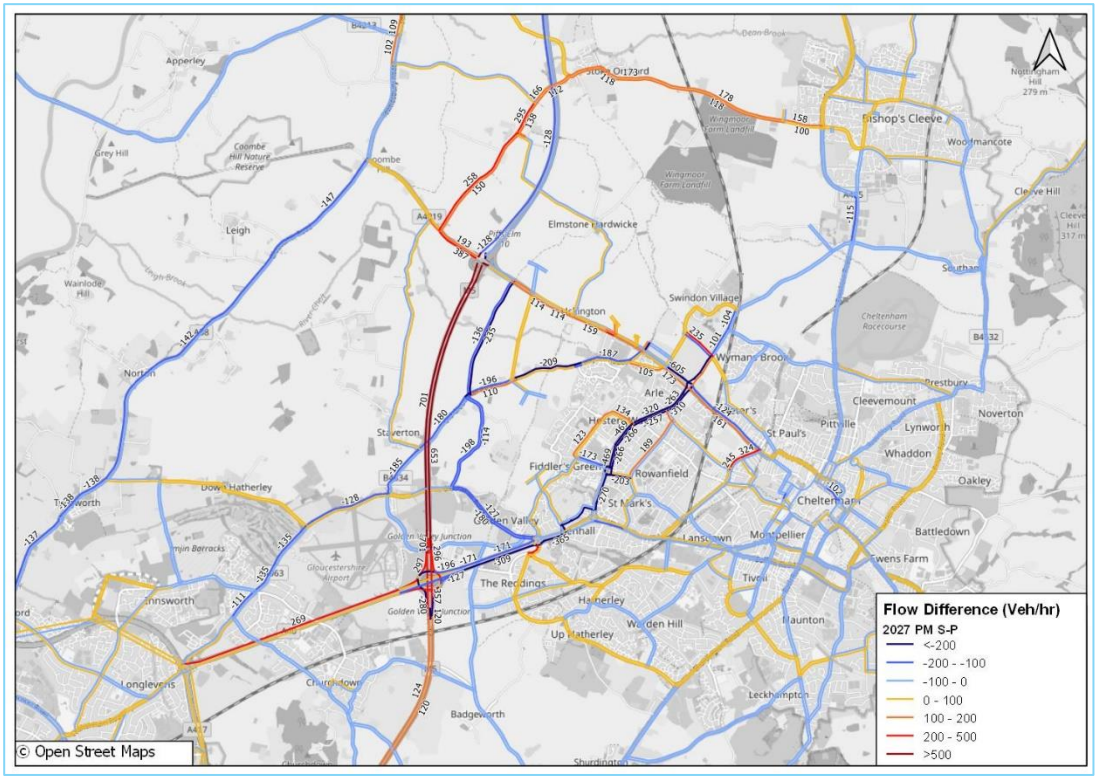
© Open Street Maps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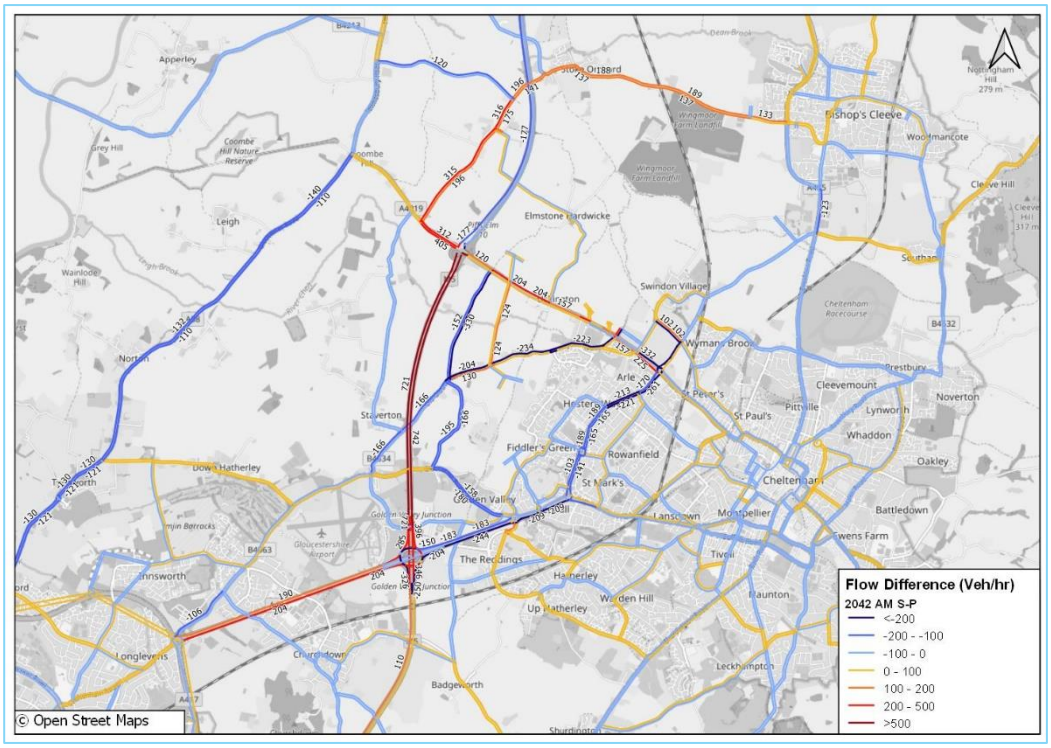
© Open Street Maps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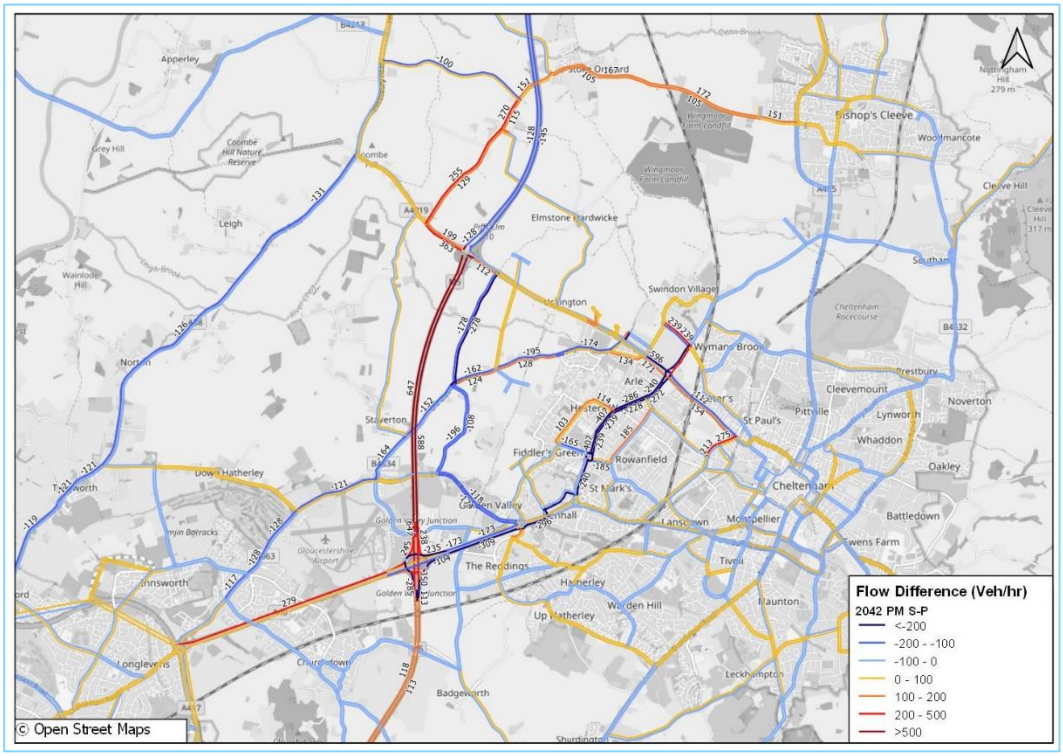
© Open Street Maps


Flow Difference (Veh/hr)
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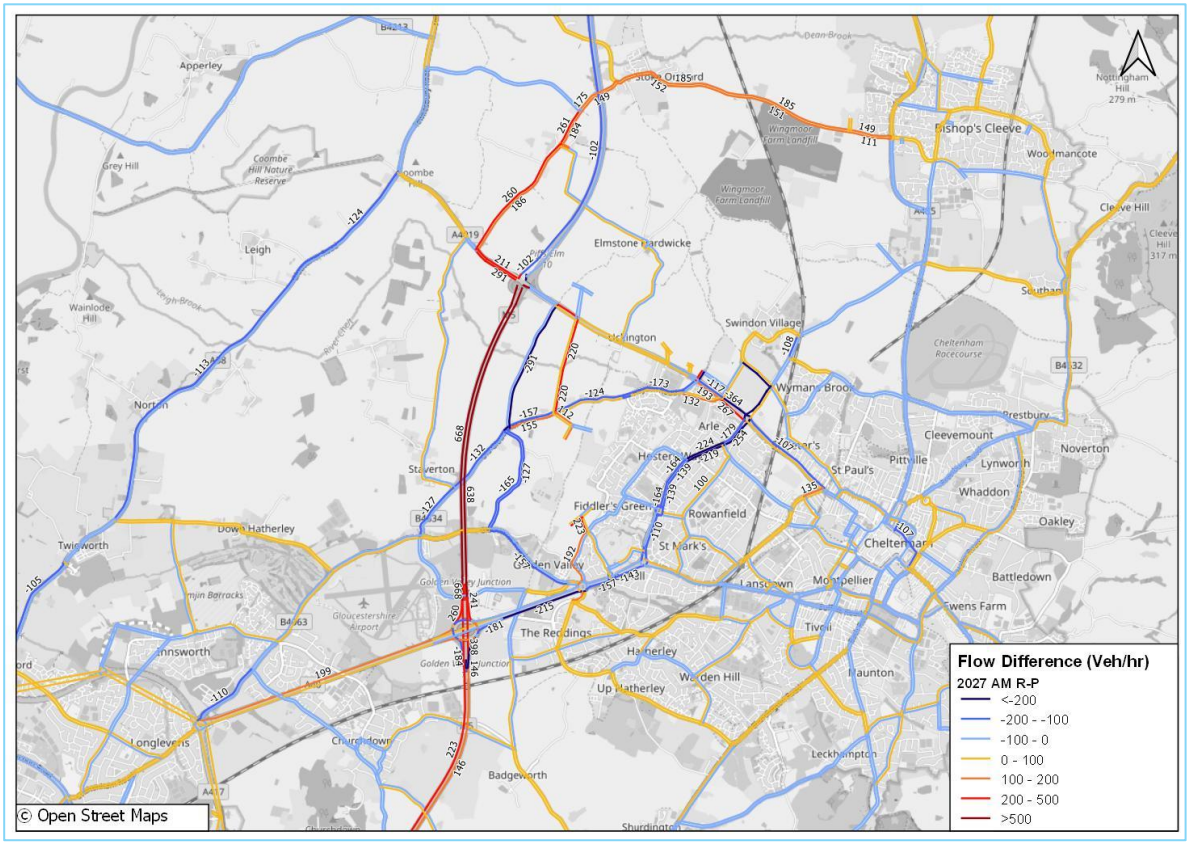
Flow Difference (Veh/hr)
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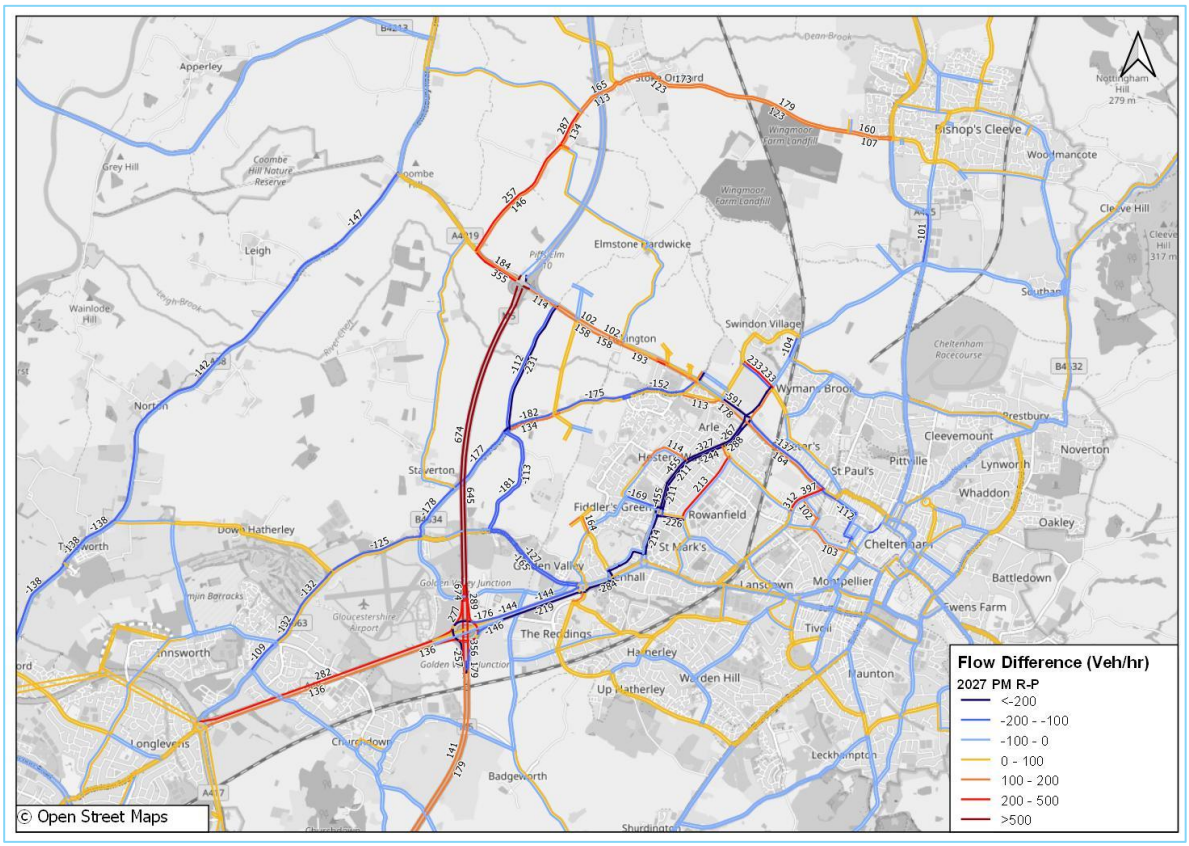
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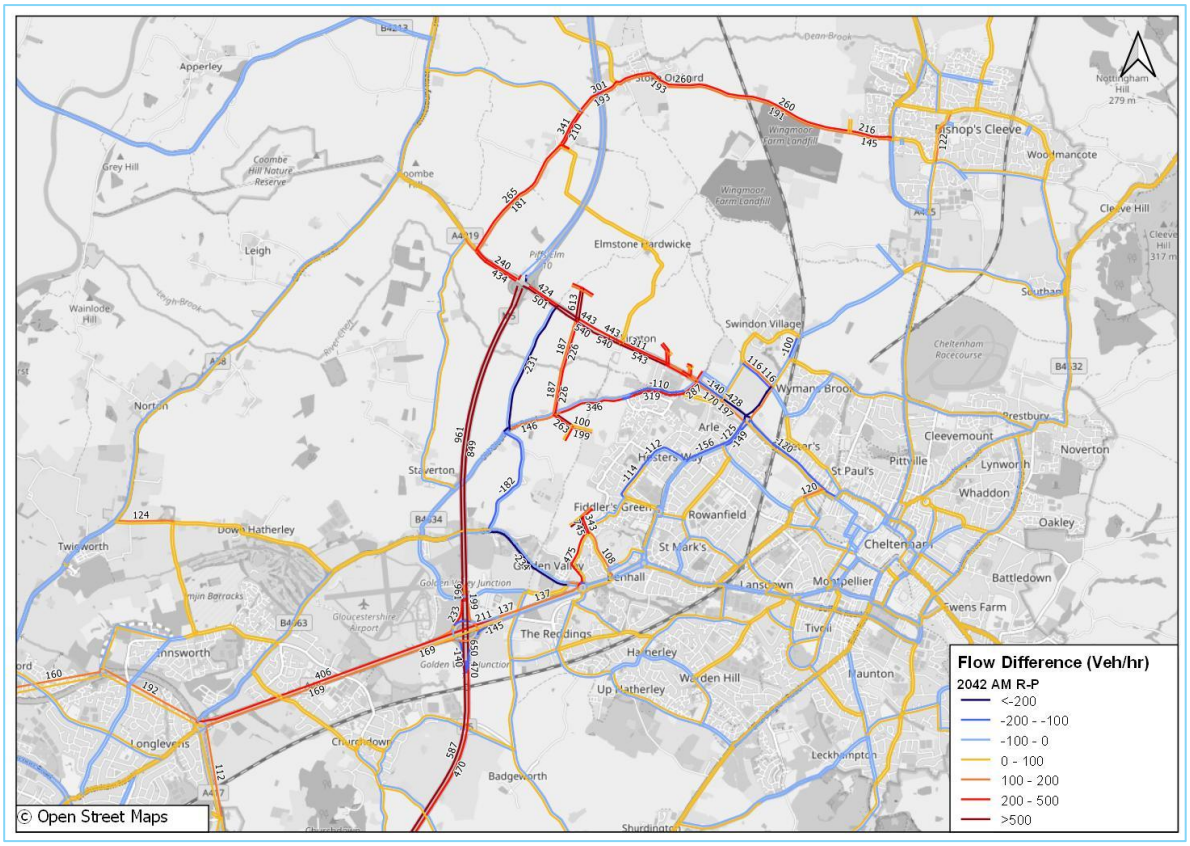
© Open Street Maps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2042 AM R-P
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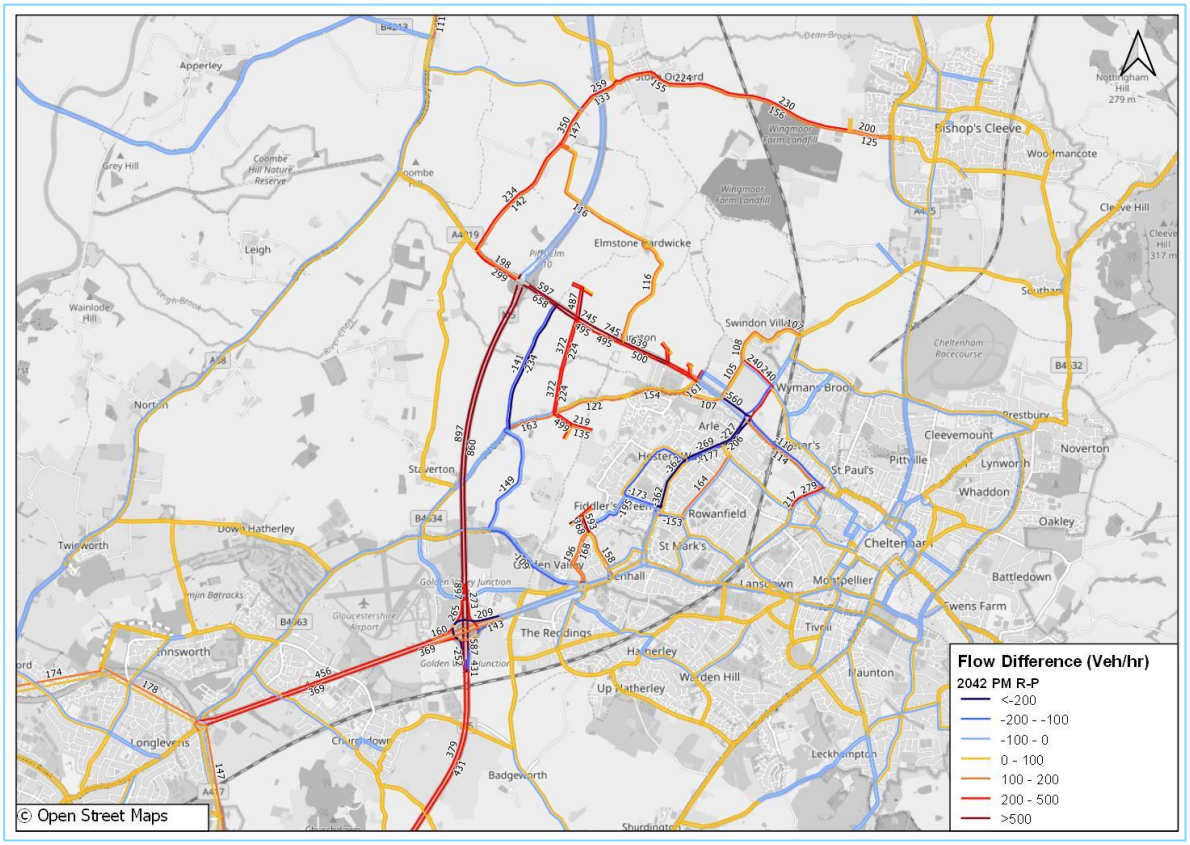
© Open Street Maps

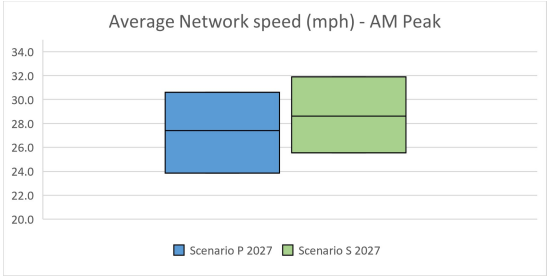

Flow Difference (Veh/hr)
2042 PM R-P
<-200
-200 - -100
-100 - 0
0 - 100
100 - 200
200 - 500
>500
© Open Street Maps

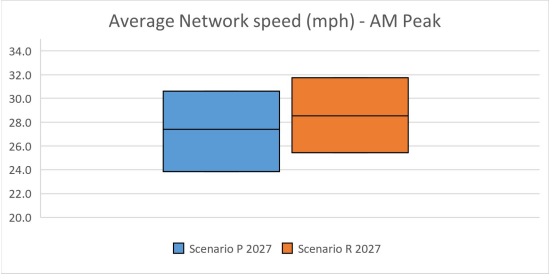
Appendix C. Overall network performance speed variance graphs

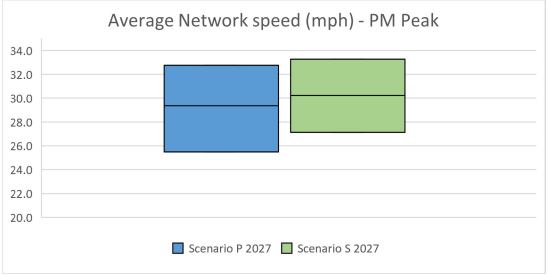
Average Network Speed Performance Indicator - 2027

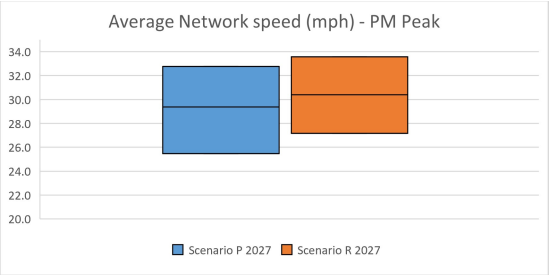
Average Network Speed			
Average Network Speed (mph)	Avg	Min	Max
Scenario P 2027	27.39	23.85	30.60
Scenario R 2027	28.52	25.44	31.75
Scenario S 2027	28.60	25.55	31.89

Average Network Speed			
Average Network Speed (mph)	Avg	Min	Max
Scenario P 2027	29.37	25.48	32.75
Scenario R 2027	30.39	27.18	33.57
Scenario S 2027	30.24	27.14	33.28





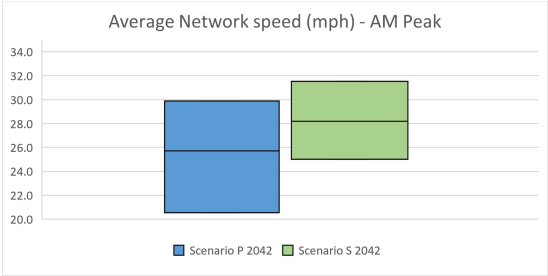


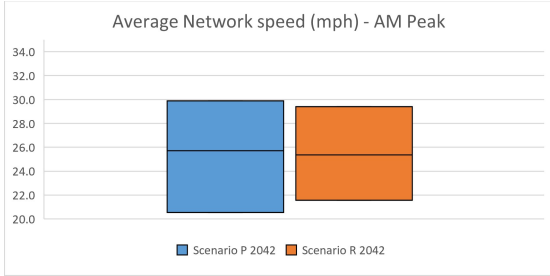


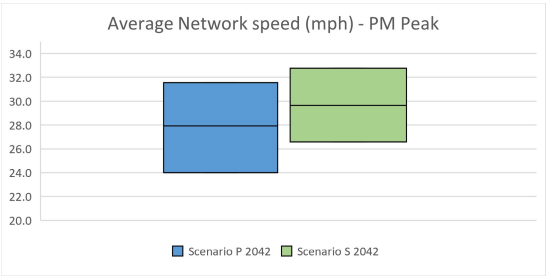
Average Network Speed Performance Indicator - 2042

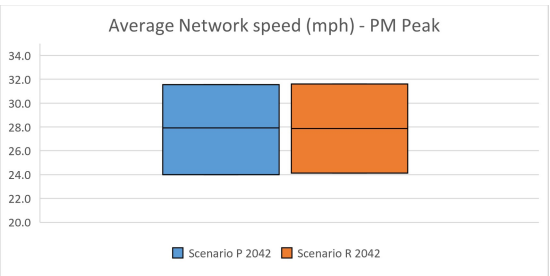
Average Network Speed			
Average Network Speed (mph)	Avg	Min	Max
Scenario P 2042	25.72	20.55	29.89
Scenario R 2042	25.37	21.57	29.39
Scenario S 2042	28.19	25.02	31.52

Average Network Speed			
Average Network Speed (mph)	Avg	Min	Max
Scenario P 2042	27.92	23.99	31.55
Scenario R 2042	27.87	24.13	31.62
Scenario S 2042	29.64	26.58	32.77



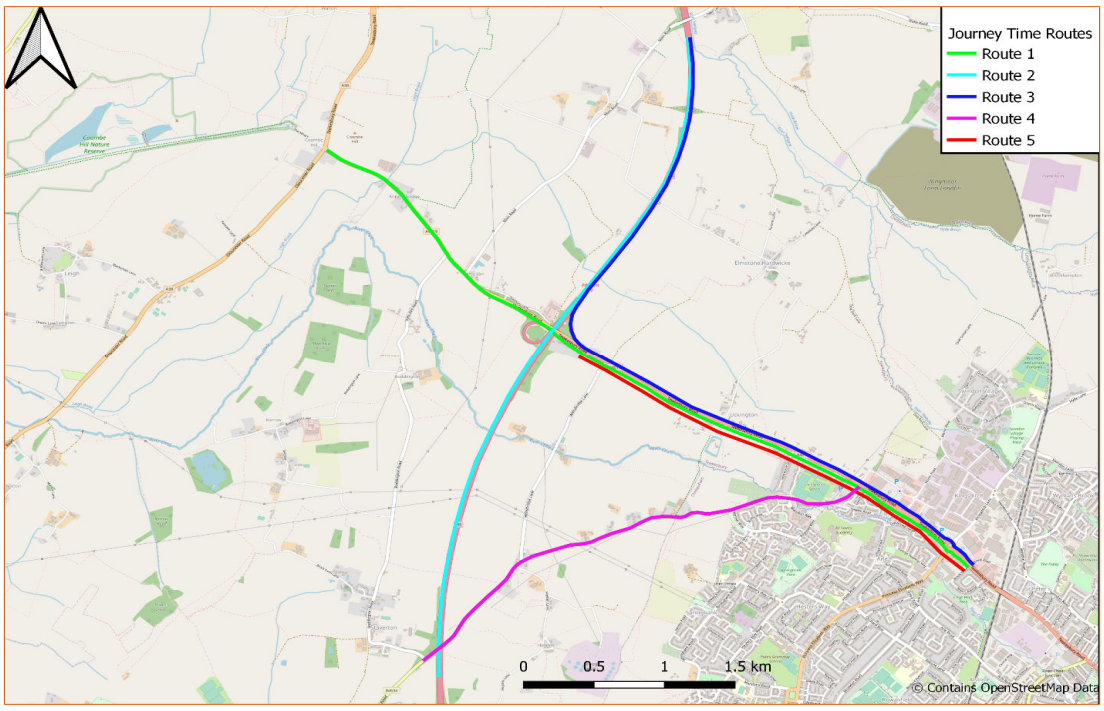






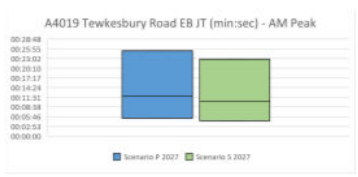
Appendix D. Journey Time graphs – P& S 2027

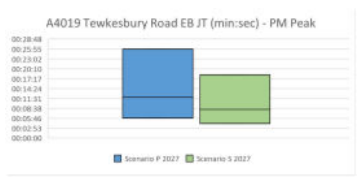
Journey Time Results



Route 1	A4019 Tewkesbury Road EB - AM Peak			
		Avg	Min	Max
	Scenario P 2027	00:11:55	00:05:20	00:25:25
	Scenario S 2027	00:10:17	00:04:32	00:22:53

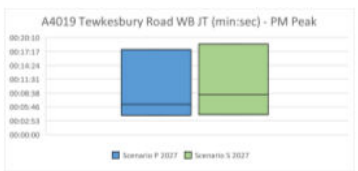
A4019 Tewkesbury Road EB - PM Peak			
	Avg	Min	Max
Scenario P 2027	00:11:54	00:05:51	00:25:54
Scenario S 2027	00:08:22	00:04:16	00:18:29





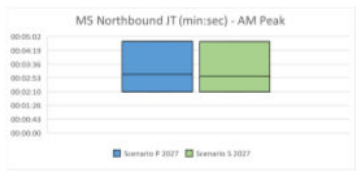
A4019 Tewkesbury Road WB - AM Peak			
	Avg	Min	Max
Scenario P 2027	00:07:05	00:04:00	00:28:25
Scenario S 2027	00:09:52	00:04:12	00:25:51

A4019 Tewkesbury Road WB - PM Peak			
	Avg	Min	Max
Scenario P 2027	00:06:19	00:04:00	00:17:40
Scenario S 2027	00:08:18	00:04:10	00:18:50



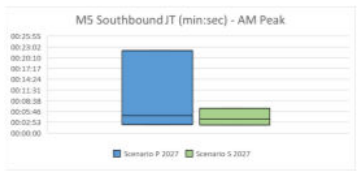
Route 2	M5 Northbound - AM Peak			
		Avg	Min	Max
	Scenario P 2027	00:03:04	00:02:09	00:04:48
	Scenario S 2027	00:02:58	00:02:08	00:04:46

M5 Northbound - PM Peak			
	Avg	Min	Max
Scenario P 2027	00:03:07	00:02:10	00:04:48
Scenario S 2027	00:03:01	00:02:11	00:04:51



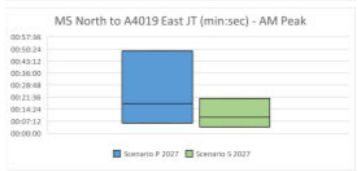
M5 Southbound - AM Peak			
	Avg	Min	Max
Scenario P 2027	00:04:36	00:02:10	00:22:06
Scenario S 2027	00:03:43	00:02:09	00:06:39

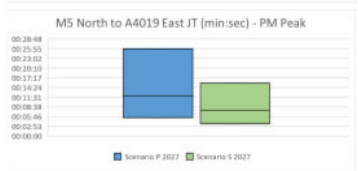
M5 Southbound - PM Peak			
	Avg	Min	Max
Scenario P 2027	00:03:15	00:02:08	00:04:56
Scenario S 2027	00:03:09	00:02:08	00:04:57



Route 3	M5 North to A4019 East - AM Peak			
		Avg	Min	Max
	Scenario P 2027	00:17:42	00:06:05	00:49:08
	Scenario S 2027	00:09:29	00:03:51	00:20:48

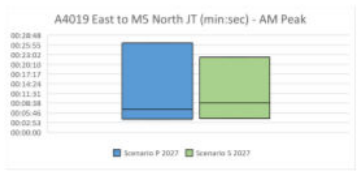
M5 North to A4019 East - PM Peak			
	Avg	Min	Max
Scenario P 2027	00:11:59	00:05:23	00:25:59
Scenario S 2027	00:07:30	00:03:35	00:15:43





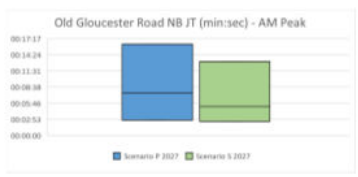
A4019 East to M5 North - AM Peak			
	Avg	Min	Max
Scenario P 2027	00:06:49	00:03:56	00:26:34
Scenario S 2027	00:08:42	00:04:06	00:22:20

A4019 East to M5 North - PM Peak			
	Avg	Min	Max
Scenario P 2027	00:06:11	00:03:57	00:16:14
Scenario S 2027	00:08:01	00:04:07	00:16:54



Route 4	Old Gloucester Road NB - AM Peak			
		Avg	Min	Max
	Scenario P 2027	00:07:33	00:02:43	00:16:18
	Scenario S 2027	00:05:08	00:02:29	00:13:14

Old Gloucester Road NB - PM Peak			
	Avg	Min	Max
Scenario P 2027	00:05:48	00:02:39	00:13:04
Scenario S 2027	00:05:10	00:02:30	00:12:36

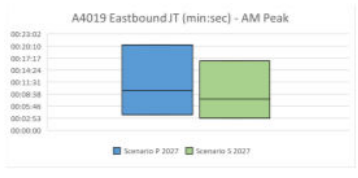


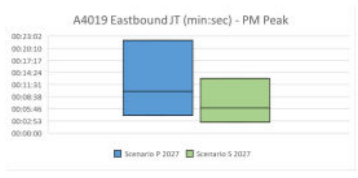
Old Gloucester Road SB - AM Peak			
	Avg	Min	Max
Scenario P 2027	00:03:36	00:02:28	00:07:17
Scenario S 2027	00:03:58	00:02:30	00:07:20

Old Gloucester Road SB - PM Peak			
	Avg	Min	Max
Scenario P 2027	00:03:35	00:02:27	00:07:25
Scenario S 2027	00:04:29	00:02:35	00:08:11

Route 5	A4019 Eastbound - AM Peak			
		Avg	Min	Max
	Scenario P 2027	00:09:35	00:03:41	00:20:25
	Scenario S 2027	00:07:27	00:02:51	00:16:35

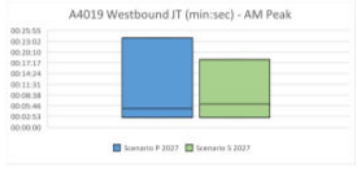
A4019 Eastbound - PM Peak			
	Avg	Min	Max
Scenario P 2027	00:09:58	00:04:14	00:22:02
Scenario S 2027	00:05:55	00:02:36	00:13:02

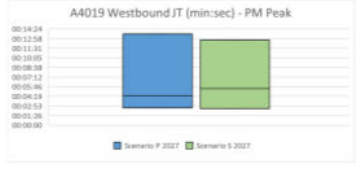




A4019 Westbound - AM Peak			
	Avg	Min	Max
Scenario P 2027	00:05:00	00:02:35	00:23:59
Scenario S 2027	00:06:17	00:02:31	00:18:12

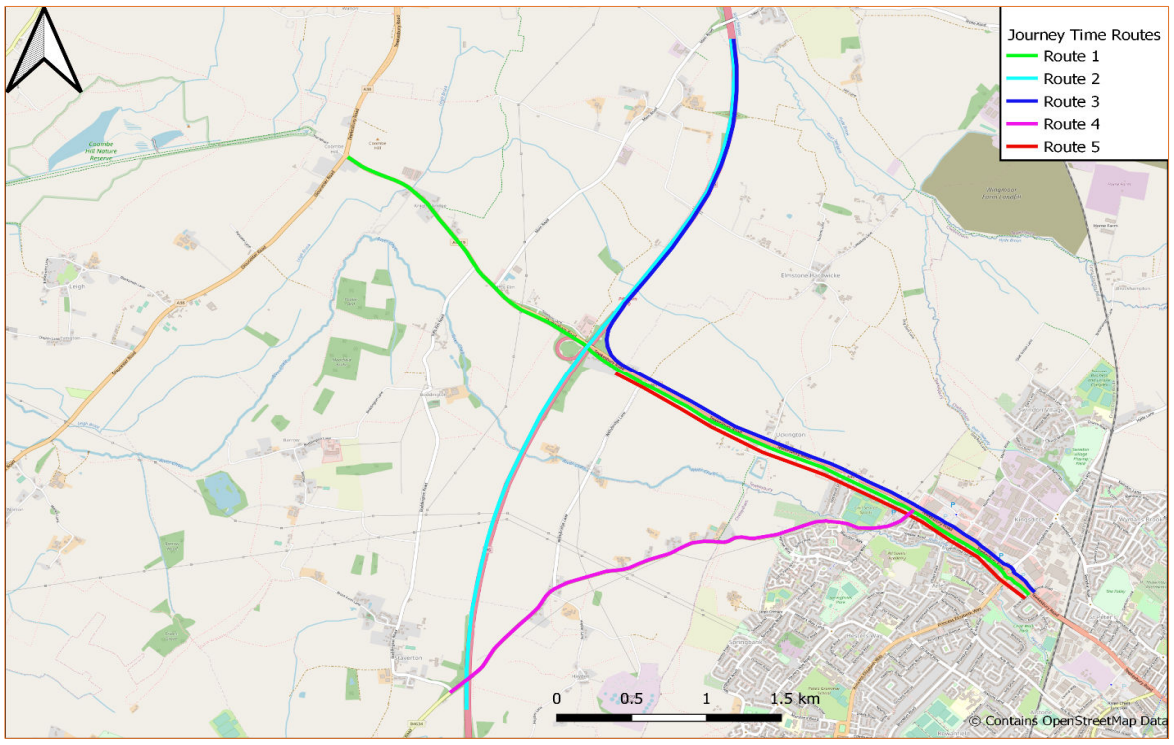
A4019 Westbound - PM Peak			
	Avg	Min	Max
Scenario P 2027	00:04:21	00:02:35	00:13:39
Scenario S 2027	00:05:29	00:02:29	00:12:44





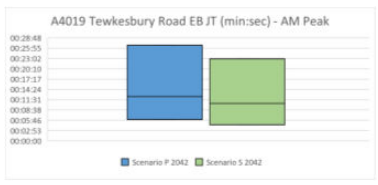
Appendix E. Journey Time graphs – P& S 2042

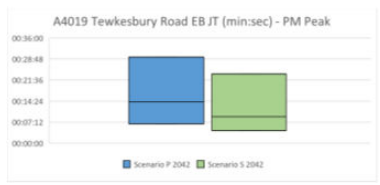
Journey Time Results



Route 1	A4019 Tewkesbury Road EB - AM Peak			
		Avg	Min	Max
	Scenario P 2042	00:12:22	00:06:00	00:26:42
	Scenario S 2042	00:10:31	00:04:30	00:22:57

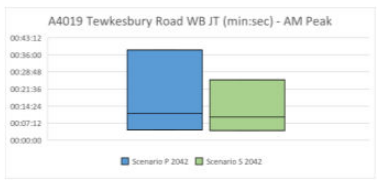
A4019 Tewkesbury Road EB - PM Peak			
	Avg	Min	Max
Scenario P 2042	00:14:08	00:06:39	00:29:32
Scenario S 2042	00:09:02	00:04:19	00:23:42

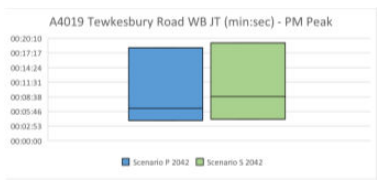




A4019 Tewkesbury Road WB - AM Peak			
	Avg	Min	Max
Scenario P 2042	00:11:13	00:04:22	00:38:02
Scenario S 2042	00:09:43	00:04:07	00:25:27

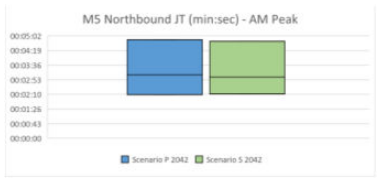
A4019 Tewkesbury Road WB - PM Peak			
	Avg	Min	Max
Scenario P 2042	00:06:24	00:04:00	00:18:20
Scenario S 2042	00:08:40	00:04:17	00:19:15

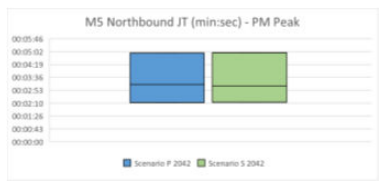




Route 2	M5 Northbound - AM Peak			
		Avg	Min	Max
	Scenario P 2042	00:03:08	00:02:09	00:04:51
	Scenario S 2042	00:03:01	00:02:10	00:04:47

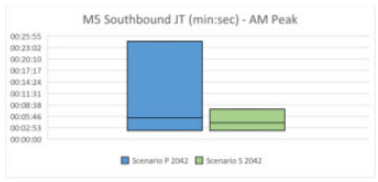
M5 Northbound - PM Peak			
	Avg	Min	Max
Scenario P 2042	00:03:12	00:02:11	00:04:58
Scenario S 2042	00:03:07	00:02:13	00:04:59

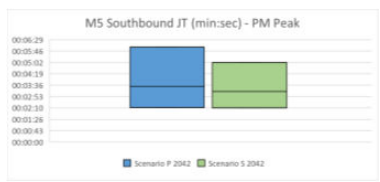




M5 Southbound - AM Peak			
	Avg	Min	Max
Scenario P 2042	00:05:22	00:02:12	00:24:35
Scenario S 2042	00:04:09	00:02:12	00:07:33

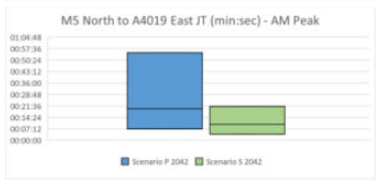
M5 Southbound - PM Peak			
	Avg	Min	Max
Scenario P 2042	00:03:32	00:02:10	00:06:01
Scenario S 2042	00:03:12	00:02:10	00:05:02

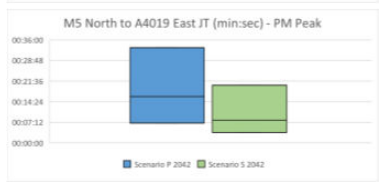




Route 3	M5 North to A4019 East - AM Peak			
		Avg	Min	Max
	Scenario P 2042	00:19:56	00:07:08	00:55:07
	Scenario S 2042	00:09:59	00:03:51	00:21:25

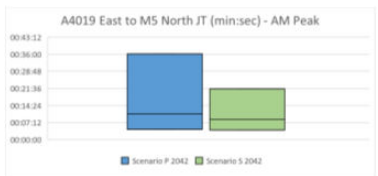
M5 North to A4019 East - PM Peak			
	Avg	Min	Max
Scenario P 2042	00:16:12	00:06:55	00:33:15
Scenario S 2042	00:07:56	00:03:38	00:20:08





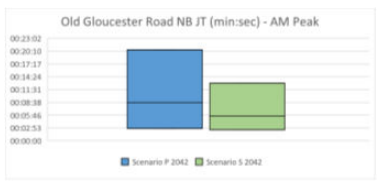
A4019 East to M5 North - AM Peak			
	Avg	Min	Max
Scenario P 2042	00:10:53	00:04:19	00:36:05
Scenario S 2042	00:08:31	00:04:02	00:21:23

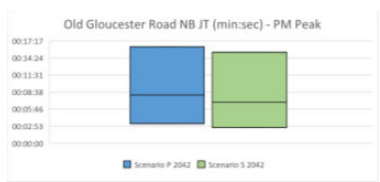
A4019 East to M5 North - PM Peak			
	Avg	Min	Max
Scenario P 2042	00:06:16	00:03:58	00:17:01
Scenario S 2042	00:08:20	00:04:16	00:17:20



Route 4	Old Gloucester Road NB - AM Peak			
		Avg	Min	Max
	Scenario P 2042	00:08:36	00:02:44	00:20:25
	Scenario S 2042	00:05:33	00:02:30	00:12:57

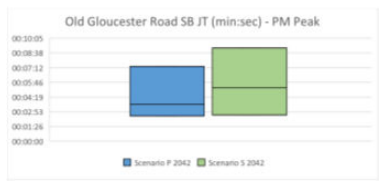
Old Gloucester Road NB - PM Peak			
	Avg	Min	Max
Scenario P 2042	00:08:09	00:03:20	00:16:18
Scenario S 2042	00:06:59	00:02:39	00:15:22





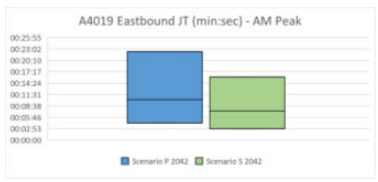
Old Gloucester Road SB - AM Peak			
	Avg	Min	Max
Scenario P 2042	00:05:09	00:02:29	00:12:04
Scenario S 2042	00:04:02	00:02:31	00:07:30

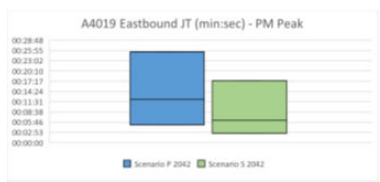
Old Gloucester Road SB - PM Peak			
	Avg	Min	Max
Scenario P 2042	00:03:37	00:02:28	00:07:19
Scenario S 2042	00:05:15	00:02:35	00:09:07



Route 5	A4019 Eastbound - AM Peak			
		Avg	Min	Max
	Scenario P 2042	00:10:15	00:04:22	00:22:19
	Scenario S 2042	00:07:20	00:02:49	00:15:55

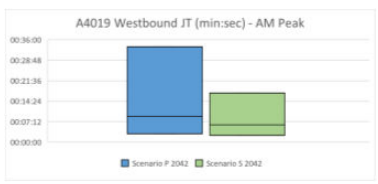
A4019 Eastbound - PM Peak			
	Avg	Min	Max
Scenario P 2042	00:12:10	00:05:02	00:25:31
Scenario S 2042	00:06:18	00:02:39	00:17:23

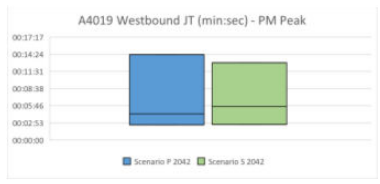




A4019 Westbound - AM Peak			
	Avg	Min	Max
Scenario P 2042	00:09:02	00:02:57	00:33:30
Scenario S 2042	00:06:04	00:02:26	00:17:14

A4019 Westbound - PM Peak			
	Avg	Min	Max
Scenario P 2042	00:04:25	00:02:35	00:14:21
Scenario S 2042	00:05:40	00:02:37	00:12:59





Appendix F. Queue Data

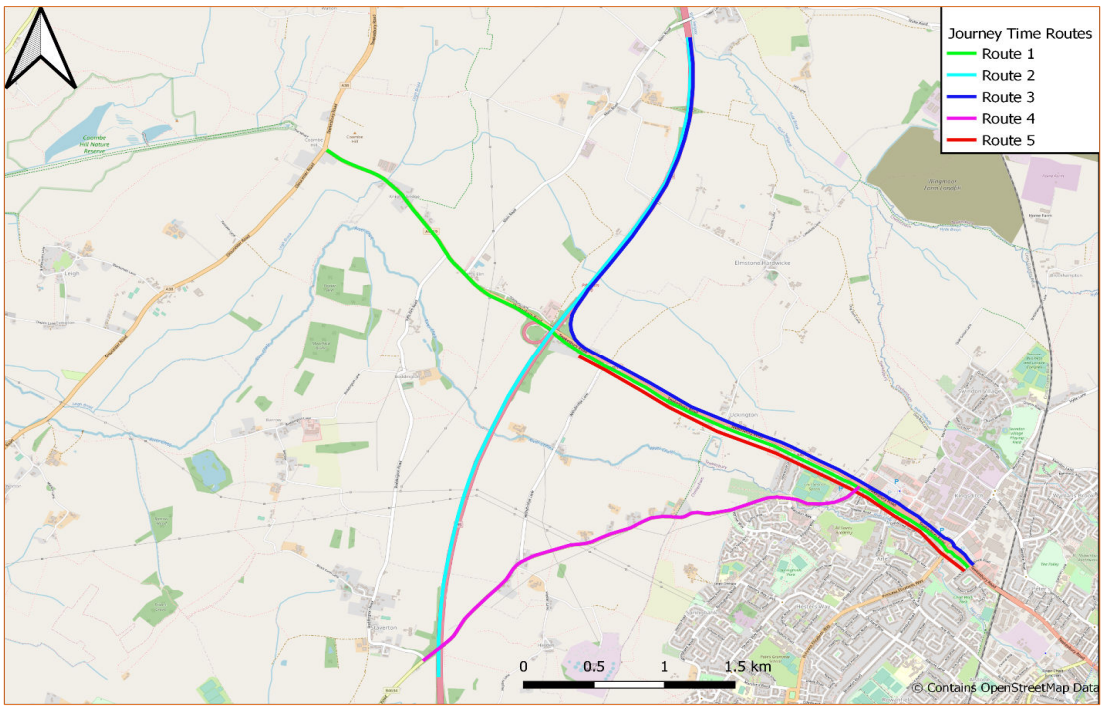
DCO

Where Queues are 0, it means it's N/A

Ref No.	Junctions	Available Queuing Length (m)	Available Queuing Length (m)	Available Queuing Length (m)	P_2027				S_2027				R_2027				P_2042				S_2042				R_2042			
					AM		PM		AM		PM		AM		PM		AM		PM		AM		PM		AM		PM	
					P_2027_AM		P_2027_PM		S_2027_AM		S_2027_PM		R_2027_AM		R_2027_PM		P_2042_AM		P_2042_PM		S_2042_AM		S_2042_PM		R_2042_AM		R_2042_PM	
		A	DM	DS	MMQ	Avg	MMQ	Avg	MMQ	Avg	MMQ	Avg	MMQ	Avg	MMQ	Avg	MMQ	Avg	MMQ	Avg	MMQ	Avg	MMQ	Avg	MMQ	Avg	MMQ	Avg
1	**Coombe Hill Junction**																											
	A38 North Approach (SB)	1700	1700	1700	86	52	63	44	80	44	61	42	85	45	65	40	92	56	62	45	90	52	62	47	102	53	64	42
	A4019 East Approach (WB)	503	503	503	93	53	85	45	109	69	130	52	99	64	99	55	106	60	92	45	106	58	106	53	116	65	118	52
	A38 South Approach (NB)	1155	1155	1155	125	53	79	37	105	44	78	35	106	43	77	35	125	50	90	38	112	45	86	38	122	49	81	37
2	**M5 Junction 10**																											
	A4019 West Approach (EB)	1048/657	1048	657	61	50	31	31	115	50	119	51	115	50	109	49	104	71	57	40	234	86	181	63	384	120	208	73
	M5 North Approach (SB)	582/488	582	488	614	372	179	70	86	39	72	38	97	39	74	38	615	409	410	182	129	42	82	38	236	75	114	40
	A4019 East Approach (WB)	520/344	520	344	0	0	0	0	95	40	133	50	108	40	132	50	0	0	0	0	72	38	130	52	168	66	162	54
	M5 South Approach (NB)	470	470	470	0	0	0	0	76	34	85	35	76	34	80	35	0	0	0	0	90	36	88	35	421	237	75	34
3	**A4019 / Link Road Junction : Access A**																											
	A4019 West Approach (EB)	236	236	236	0	0	0	0	150	59	114	40	150	58	108	40	0	0	0	0	162	76	127	58	193	119	189	102
	A4019 West Approach (EB) Right Turn	162	162	162	0	0	0	0	79	40	73	37	82	45	76	38	0	0	0	0	87	58	82	49	88	73	89	73
	North Approach (SB)	360	360	360	31	22	0	0	42	41	34	30	36	31	0	0	117	61	175	125	44	37	54	38	253	102	326	149
	North Approach Left Turn (SB)	129	129	129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29	27	28	26	62	31	89	39
	A4019 East Approach (WB)	733	733	733	0	0	0	0	84	49	79	55	96	49	129	72	0	0	0	0	102	51	138	99	136	87	206	131
	West Cheltenham Link Road (NB)	1300	1300	1300	0	0	0	0	83	45	89	45	71	44	120	49	0	0	0	0	104	49	84	48	293	108	410	117
4	**A4019 / Green Junction**																											
	A4019 West Approach (EB)	733	733	733	0	0	0	0	206	83	94	43	207	80	112	47	0	0	0	0	171	73	95	42	222	86	196	77
	The Green Approach (SB)	368	368	368	355	215	28	19	138	66	70	34	160	75	70	34	258	118	28	21	140	64	74	33	206	104	85	37
	A4019 East Approach (WB)	537	537	537	250	172	143	112	85	37	135	57	79	38	146	63	336	209	191	77	67	35	118	50	139	49	141	55
	Moat Ln (NB)	60	60	60	33	22	38	24	42	32	50	34	40	31	50	34	44	31	37	25	42	33	48	34	40	32	52	33
5	**A4019 / Development Site Junction : Access B1**																											
	A4019 West Approach (EB)	537	537	537	0	0	0	0	85	45	66	37	101	50	60	33	0	0	0	0	103	50	97	48	286	106	152	76
	Development Site Approach Link	255	255	255	0	0	0	0	68	42	61	40	59	40	57	40	0	0	0	0	70	43	59	41	107	54	75	50
	A4019 East Approach (WB)	376	376	376	0	0	0	0	0	0	40	39	40	40	40	40	0	0	0	0	39	39	37	35	38	38	39	39
	A4019 East Approach (WB) Right turn	137	137	137	0	0	0	0	33	24	29	24	31	24	30	24	0	0	0	0	30	25	30	25	46	31	44	29
6	**A4019/ Development Site Junction : Access B2**																											
	A4019 West Approach (EB)	376	376	376	0	0	0	0	170	69	101	45	161	68	112	48	0	0	0	0	152	71	106	47	135	76	101	55
	Development Site Approach Link	300	300	300	0	0	0	0	33	30	31	31	36	34	30	26	0	0	0	0	43	42	52	45	75	52	74	52
	A4019 East Approach (WB)	166	166	166	0	0	0	0	0	0	26	25	0	0	25	25	0	0	0	0	0	0	27	26	27	27	51	38
	Homecroft Dr	50	50	50	0	0	0	0	53	30	31	27	51	29	31	27	0	0	0	0	56	32	32	27	50	31	36	28
7	**A4019 / B4634 Signalised Junction (Gallagher) : Access B3**																											
	A4019 West Approach (EB)	1079/166	1079	166	1256	601	1588	726	266	74	122	45	247	67	118	45	1221	521	1675	777	238	71	129	44	218	66	147	50
	Gallagher Retail Park Approach	340	340	340	264	85	364	220	145	132	96	89	141	112	91	77	286	93	373	210	125	100	93	83	119	109	232	220
	A4019 East Approach (WB)	334	334	334	57	34	89	40	122	61	146	60	132	61	140	56	93	42	96	40	138	71	162	72	138	68	159	73
	B4634 Approach (NB)	555	555	555	547	183	487	142	382	111	363	117	359	112	357	121	576	189	545	167	360	104	453	148	462	145	550	185
8	**A4019/ Manor Road Junction**																											
	A4019 West Approach (EB)	334	334	334	245	90	300	132	257	78	134	51	241	77	132	52	242	85	338	159	236	75	153	59	202	71	166	60
	Manor Road	240	240	240	264	233	257	179	164	67	234	107	250	143	263	191	264	203	265	219	185	78	224	119	191	83	263	186
	A4019 East Approach (WB)	387	387	387	73	26	84	37	86	37	96	47	92	38	94	47	76	28	84	37	92	38	99	46	89	39	93	44
	Hayden Road	255	255	255	167	129	165	108	161	75	166	114	164	85	161	79	169	132	163	109	165	92	152	71	165	98	161	84
9	**Kingsditch Roundabout**																											
	A4019 West Approach (EB)	387	387	387	319	76	266	68	119	55	97	44	118	55	97	44	303	73	285	70	114	55	96	45	114	52	98	45
	Kingsditch Lane	520	520	520	565	121	518	178	538	90	108	42	551	88	102	42	580	132	537	189	514	81	115	43	547	90	119	45
	A4019 East Approach (WB)	195	195	195	167	63	123	44	188	78	120	43	182	70	122	42	179	70	139	47	185	74	117	43	185	77	120	43
	Princess Elizabeth Way	470	470	470	420	87	397	70	295	71	98	37	249	67	95	37	414	87	404	71	337	72	104	39	202	62	108	43
10	**A4019 / Brook Road Junction**																											
	A4019 West Approach (EB)	140	140	140	137	70	108	53	192	76	113	54	181	77	113	52	143	68	104	51	194	77	115	54	184	76	115	53
	Brook Road North Approach (SB)	150	150	150	60	46	62	45	63	47	67	45	64	47	66	45	58	45	65	46	59	46	63	47	62	47	63	50
	A4019 East Approach (WB)	433	433	433	118	45	122	45	230	72	162	49	166	61	161	49	153	53	132	45	223	69	144	50	259	88	152	47
	Brook Road South Approach (NB)	180	180	180	51	40	54	41	54	41	57	41	53	41	53	40	56	42	52	41	56	41	57	41	56	41	55	41
11	**New Link Rd / B4634 Junction : Development Site Access C**																											
	B4634 West Approach (EB)	313	313	313	24	16	16	15	111	51	122	52	123	52	117	51	36	20	23	18	121	53	139	58	155	58	160	64
	Development Site Approach Link North (SB)	1300	1300	1300	0	0	0	0	113	60	80	44	151	62	83	45	0	0	0	0	85	54	77	46	254	62	102	45
	B4634 EAST Approach (WB)	1267	1267	1267	0	0	0	0	142	47	151	51	152	53	129	49	170	85	0	0	155	50	154	55	190	64	174	60
	Development Site Approach Link South (NB)	254	254	254	17	15	20	17	47	43	54	44	50	43	77	47	25	19	27	18	56	44	65	45	118	57	185	76

Appendix G. Journey Time graphs – P& R 2027

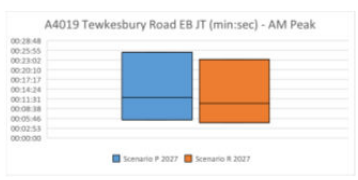
Journey Time Results

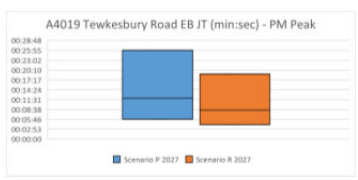


Route 1

A4019 Tewkesbury Road EB - AM Peak			
	Avg	Min	Max
Scenario P 2027	00:11:55	00:05:20	00:25:25
Scenario R 2027	00:10:14	00:04:29	00:23:18

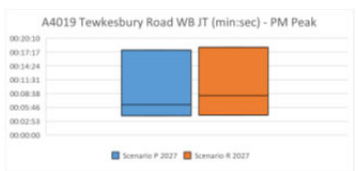
A4019 Tewkesbury Road EB - PM Peak			
	Avg	Min	Max
Scenario P 2027	00:11:54	00:05:51	00:25:54
Scenario R 2027	00:08:27	00:04:16	00:19:01





A4019 Tewkesbury Road WB - AM Peak			
	Avg	Min	Max
Scenario P 2027	00:07:05	00:04:00	00:28:25
Scenario R 2027	00:09:26	00:04:10	00:25:33

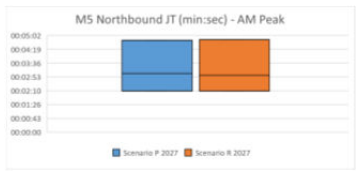
A4019 Tewkesbury Road WB - PM Peak			
	Avg	Min	Max
Scenario P 2027	00:06:19	00:04:00	00:17:40
Scenario R 2027	00:08:14	00:04:08	00:18:19



Route 2

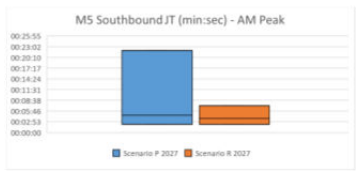
M5 Northbound - AM Peak			
	Avg	Min	Max
Scenario P 2027	00:03:04	00:02:09	00:04:48
Scenario R 2027	00:02:58	00:02:09	00:04:50

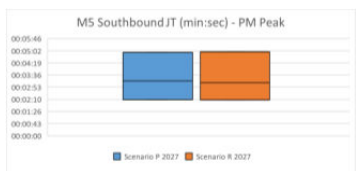
M5 Northbound - PM Peak			
	Avg	Min	Max
Scenario P 2027	00:03:07	00:02:10	00:04:48
Scenario R 2027	00:03:01	00:02:09	00:04:53



M5 Southbound - AM Peak			
	Avg	Min	Max
Scenario P 2027	00:04:36	00:02:10	00:22:06
Scenario R 2027	00:03:47	00:02:10	00:07:13

M5 Southbound - PM Peak			
	Avg	Min	Max
Scenario P 2027	00:03:15	00:02:08	00:04:56
Scenario R 2027	00:03:09	00:02:08	00:04:59

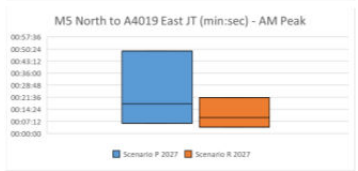


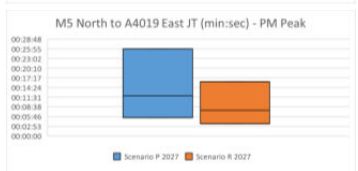


Route 3

M5 North to A4019 East - AM Peak			
	Avg	Min	Max
Scenario P 2027	00:17:42	00:06:05	00:49:08
Scenario R 2027	00:09:31	00:03:48	00:21:27

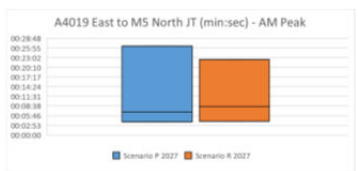
M5 North to A4019 East - PM Peak			
	Avg	Min	Max
Scenario P 2027	00:11:59	00:05:23	00:25:59
Scenario R 2027	00:07:37	00:03:35	00:16:11

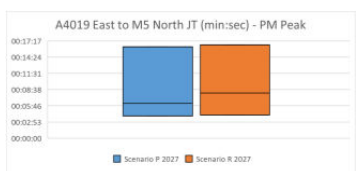




A4019 East to M5 North - AM Peak			
	Avg	Min	Max
Scenario P 2027	00:06:49	00:03:56	00:26:34
Scenario R 2027	00:08:29	00:04:05	00:22:31

A4019 East to M5 North - PM Peak			
	Avg	Min	Max
Scenario P 2027	00:06:11	00:03:57	00:16:14
Scenario R 2027	00:08:02	00:04:06	00:16:37

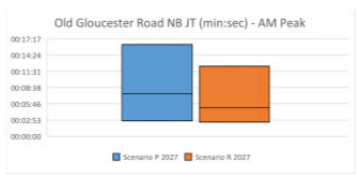




Route 4

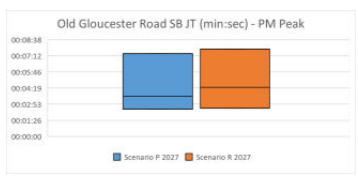
Old Gloucester Road NB - AM Peak			
	Avg	Min	Max
Scenario P 2027	00:07:33	00:02:43	00:16:18
Scenario R 2027	00:05:07	00:02:30	00:12:28

Old Gloucester Road NB - PM Peak			
	Avg	Min	Max
Scenario P 2027	00:05:48	00:02:39	00:13:04
Scenario R 2027	00:05:17	00:02:31	00:12:26



Old Gloucester Road SB - AM Peak			
	Avg	Min	Max
Scenario P 2027	00:03:36	00:02:28	00:07:17
Scenario R 2027	00:04:26	00:02:31	00:08:10

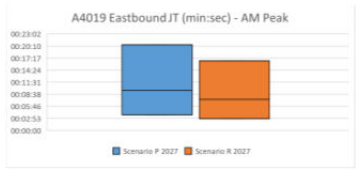
Old Gloucester Road SB - PM Peak			
	Avg	Min	Max
Scenario P 2027	00:03:35	00:02:27	00:07:25
Scenario R 2027	00:04:23	00:02:31	00:07:49

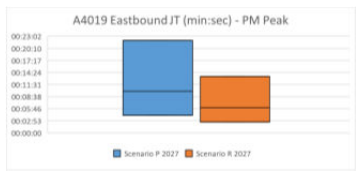


Route 5

A4019 Eastbound - AM Peak			
	Avg	Min	Max
Scenario P 2027	00:09:35	00:03:41	00:20:25
Scenario R 2027	00:07:24	00:02:48	00:16:38

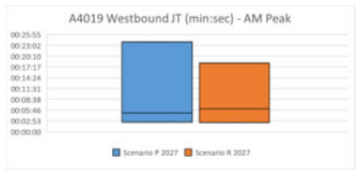
A4019 Eastbound - PM Peak			
	Avg	Min	Max
Scenario P 2027	00:09:58	00:04:14	00:22:02
Scenario R 2027	00:06:02	00:02:36	00:13:29

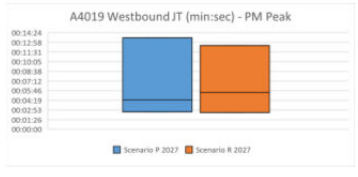




A4019 Westbound - AM Peak			
	Avg	Min	Max
Scenario P 2027	00:05:00	00:02:35	00:23:59
Scenario R 2027	00:06:04	00:02:29	00:18:20

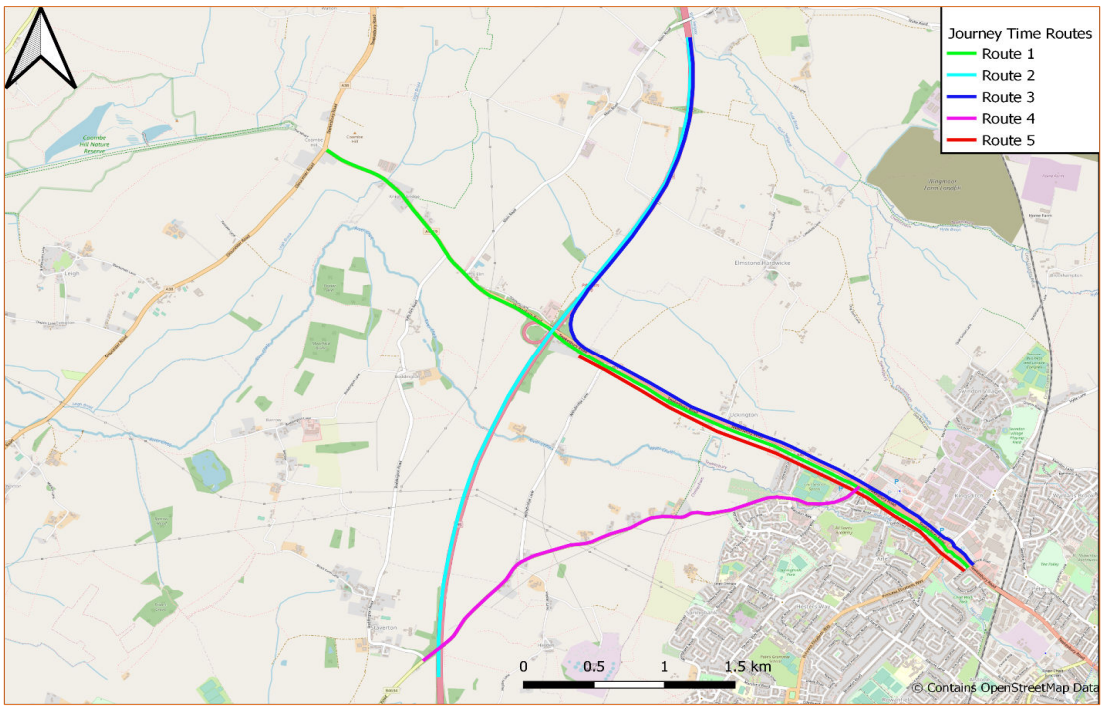
A4019 Westbound - PM Peak			
	Avg	Min	Max
Scenario P 2027	00:04:21	00:02:35	00:13:39
Scenario R 2027	00:05:28	00:02:28	00:12:30





Appendix H. Journey Time graphs – P& R 2042

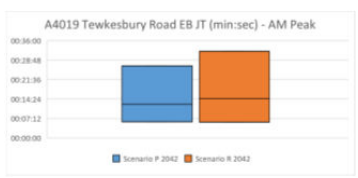
Journey Time Results

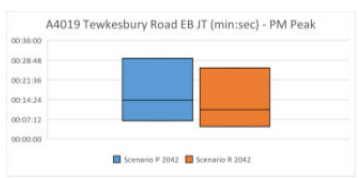


Route 1

A4019 Tewkesbury Road EB - AM Peak			
	Avg	Min	Max
Scenario P 2042	00:12:22	00:06:00	00:26:42
Scenario R 2042	00:14:33	00:05:51	00:32:01

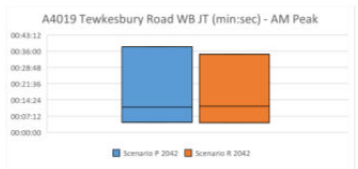
A4019 Tewkesbury Road EB - PM Peak			
	Avg	Min	Max
Scenario P 2042	00:14:08	00:06:39	00:29:32
Scenario R 2042	00:10:43	00:04:36	00:26:01

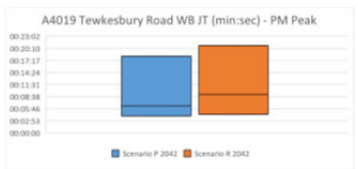




A4019 Tewkesbury Road WB - AM Peak			
	Avg	Min	Max
Scenario P 2042	00:11:13	00:04:22	00:38:02
Scenario R 2042	00:11:35	00:04:14	00:34:49

A4019 Tewkesbury Road WB - PM Peak			
	Avg	Min	Max
Scenario P 2042	00:06:24	00:04:00	00:18:20
Scenario R 2042	00:09:11	00:04:27	00:20:51

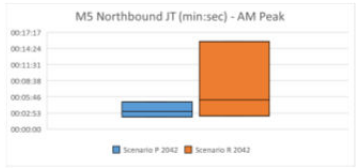


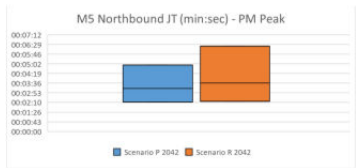


Route 2

M5 Northbound - AM Peak			
	Avg	Min	Max
Scenario P 2042	00:03:08	00:02:09	00:04:51
Scenario R 2042	00:05:12	00:02:19	00:15:43

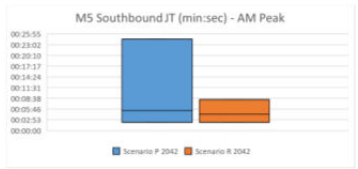
M5 Northbound - PM Peak			
	Avg	Min	Max
Scenario P 2042	00:03:12	00:02:11	00:04:58
Scenario R 2042	00:03:37	00:02:15	00:06:23

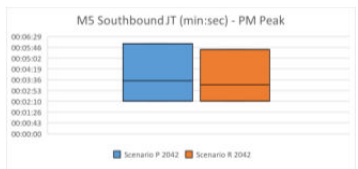




M5 Southbound - AM Peak			
	Avg	Min	Max
Scenario P 2042	00:05:22	00:02:12	00:24:35
Scenario R 2042	00:04:20	00:02:13	00:08:20

M5 Southbound - PM Peak			
	Avg	Min	Max
Scenario P 2042	00:03:32	00:02:10	00:06:01
Scenario R 2042	00:03:16	00:02:10	00:05:37

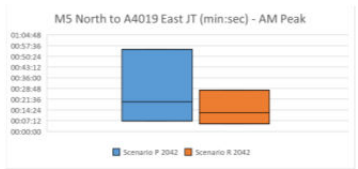


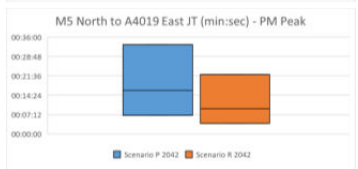


Route 3

M5 North to A4019 East - AM Peak			
	Avg	Min	Max
Scenario P 2042	00:19:56	00:07:08	00:55:07
Scenario R 2042	00:12:37	00:05:00	00:27:48

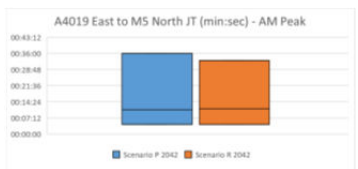
M5 North to A4019 East - PM Peak			
	Avg	Min	Max
Scenario P 2042	00:16:12	00:06:55	00:33:15
Scenario R 2042	00:09:24	00:03:54	00:22:06

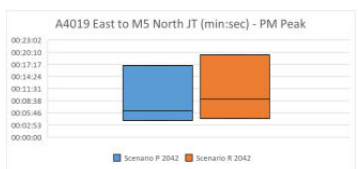




A4019 East to M5 North - AM Peak			
	Avg	Min	Max
Scenario P 2042	00:10:53	00:04:19	00:36:05
Scenario R 2042	00:11:20	00:04:11	00:32:51

A4019 East to M5 North - PM Peak			
	Avg	Min	Max
Scenario P 2042	00:06:16	00:03:58	00:17:01
Scenario R 2042	00:09:02	00:04:26	00:19:32





Route 4

Old Gloucester Road NB - AM Peak			
	Avg	Min	Max
Scenario P 2042	00:08:36	00:02:44	00:20:25
Scenario R 2042	00:06:14	00:02:37	00:14:15

Old Gloucester Road NB - PM Peak			
	Avg	Min	Max
Scenario P 2042	00:08:09	00:03:20	00:16:18
Scenario R 2042	00:07:32	00:02:45	00:16:37

Old Gloucester Road SB - AM Peak			
	Avg	Min	Max
Scenario P 2042	00:05:09	00:02:29	00:12:04
Scenario R 2042	00:05:21	00:02:34	00:10:50

Old Gloucester Road SB - PM Peak			
	Avg	Min	Max
Scenario P 2042	00:03:37	00:02:28	00:07:19
Scenario R 2042	00:06:04	00:02:40	00:11:07

Route 5

A4019 Eastbound - AM Peak			
	Avg	Min	Max
Scenario P 2042	00:10:15	00:04:22	00:22:19
Scenario R 2042	00:09:18	00:03:58	00:19:50

A4019 Eastbound - PM Peak			
	Avg	Min	Max
Scenario P 2042	00:12:10	00:05:02	00:25:31
Scenario R 2042	00:07:42	00:02:54	00:18:58

A4019 Westbound - AM Peak			
	Avg	Min	Max
Scenario P 2042	00:09:02	00:02:57	00:33:30
Scenario R 2042	00:06:52	00:02:28	00:21:51

A4019 Westbound - PM Peak			
	Avg	Min	Max
Scenario P 2042	00:04:25	00:02:35	00:14:21
Scenario R 2042	00:06:01	00:02:43	00:14:21

Appendix I. WCHAR

Appendix I –Walking, Cycling and Horse-Riding Assessment is provided as a separate document (application document TR010063 – APP 7.5).

Appendix J. Transport Model Package Report

Appendix J –Transport Model Package Report is provided as a separate document (application document TR010063 – APP 7.5).

Appendix K. Model Package Data Report

Appendix K –Model Package Data Report is provided as a separate document (application document TR010063 – APP 7.5).

Appendix L. Traffic Forecasting Report

Appendix L –Traffic Forecasting Report is provided as a separate document (application document TR010063 – APP 7.5).

Appendix M. Construction Phase Figures

Appendix M –Construction Phase Figures are provided as a separate document (application document TR010063 – APP 7.5).

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