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Snow Hill Growth Strategy

Connectivity Study Strategic Outline Business Case

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Birmingham City Council

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Project Manager:	Neil Davies
Author:	V Edge
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Jacobs U.K. Limited

7th Floor, 2 Colmore Square
38 Colmore Circus, Queensway
Birmingham, B4 6BN
United Kingdom
T +44 (0)121 237 4000
F +44 (0)121 237 4001
www.jacobs.com

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2.0	16/12/19	Client comments addressed, Final version	VE	RL	ND	DC
3.0	28/01/20	Revisions to reflect draft Transport Plan. Revised Final	DM	VE	ND	DC

Contents

Acronyms and Abbreviations

AST	Appraisal Summary Table
BCC	Birmingham City Council
BCR	Benefit to Cost Ratio
BDP	Birmingham Development Plan
BID	Business Improvement District
CAZ	Clean Air Zone
DEFRA	Department for Environment, Food & Rural Affairs
DM	Do Minimum
DS	Do Something
EAST	Early Assessment and Sifting Tool
GVA	Gross Value Added
HIL	Highway Improvement Line
HS2	High Speed Rail (2)
ITA	Integrated Transport Authority
LEP	Local Enterprise Partnership
LLM	Large Local Major
MRN	Major Road Network
NPV	Net Present Value
OAR	Options Assessment Report
SEP	Strategic Economic Plan
SHMPA	Snow Hill Masterplan Area
SOBC	Strategic Outline Business Case
STB	Sub-national Transport Body
TAG	Transport Assessment Guidance
TEE	Economic Efficiency of the Transport System Table
TfWM	Transport for West Midlands
VfM	Value for Money
WMCA	WMCA

Executive Summary

The Snow Hill district, within Birmingham's city centre, is identified in Birmingham's Big City Plan as an *Area of Transformation* - a place where big changes are anticipated and where key development opportunities exist. The Snow Hill Masterplan (October 2015) builds on wider regional and local policy including the HS2 Connectivity Package, Movement for Growth: the West Midlands Strategic Transport Plan, and Birmingham's Big City Plan. The Snow Hill Growth Strategy is promoted by Birmingham City Council.

The Snow Hill district is a major hub for business, including the Colmore Business District, which houses over 500 companies including major international, professional, and financial service businesses totalling over 500,000sqm floor space and over 35,000 employees. Snow Hill railway station sits at the centre of the Masterplan area.

The A38 is a barrier to free movement in the Snow Hill Masterplan area. Pedestrian access across the A38 is restricted to grade separated links including a bridge and subways, and at-grade crossings where the road is in tunnel at Newhall Street and St Chads Circus.

The proposed connectivity project aims to facilitate city-wide expansion, particularly in areas such as the Gun Quarter and Jewellery Quarter and will result in a step change in travel behaviour across the city, improving health and air quality.

The proposed scheme packages include upgrade of the ring road and consideration of the future of the central section of the A38 through Birmingham. These changes will support improvements to public transport (bus) and reduce severance for walking and cycling trips. .

Three potential packages of interventions along the ring road have been appraised using the standard Five Cases Business Case approach, although the Financial, Commercial and Management Cases have not been considered in any detail due to the level of development of the schemes at this stage.

Currently the conventional transport modelling and appraisal of the scheme's options indicates the proposed scheme offers poor value for money primarily due to significant highway disbenefits from the longer alternative route, even when Level 3 wider benefits are considered, however several recommendations are made regarding the way forward for developing and appraising the connectivity project, under headings of:

- **Financial**
- **Policy**
- **Appraisal**

The suggested recommendations, if all fully explored and adopted, may reduce the capital costs of the transport connectivity project and the revised definition of options and the proposed modelling approaches could result in much higher conventional transport user benefits and wider impacts. This would significantly improve the proposed scheme's value for money proposition.

This work has been undertaken without discussion with Highways England, who are likely to raise questions regarding the potential impact of the scheme on the strategic road network. This is one particular element which requires further assessment prior to any discussions commencing.

1. Introduction

The Snow Hill district, within Birmingham's city centre, is identified in Birmingham's Big City Plan as an *Area of Transformation* - a place where big changes are anticipated and where key development opportunities exist. It is a major hub for business, including the Colmore Business District, which houses over 500 companies including major international, professional, and financial service businesses totalling over 500,000sqm floor space and over 35,000 employees.

The Snow Hill Masterplan (October 2015) builds on wider regional and local policy including the HS2 Connectivity Package, Movement for Growth: the West Midlands Strategic Transport Plan, and Birmingham's Big City Plan. The Masterplan aims to regenerate and enhance the area, driving growth by creating an additional:

- 200,000sqm office floor space;
- 4,000 residential units;
- 10,000 jobs.

Snow Hill station sits at the centre of the Masterplan area. Other key features are the Children's Hospital and Courts in the Steelhouse Lane area, and St Philips Place, which houses St Philips Cathedral and the surrounding Victorian architecture. The Masterplan area connects to Birmingham New Street station and the Bull Ring shopping centre to the south, Aston University to the northeast, and St Paul's Square and the Jewellery Quarter to the west.

Analysis of current planning data shows significant demand for residential development around the city centre, especially within the Jewellery Quarter, and for office space primarily in Colmore Business District, including substantial developments around Snow Hill station. There is limited capacity for growth to the south and east of the A38, but significant opportunity for growth on sites to the north and west of the A38.

The core highway access to the north and west of the area is from the A38/A4400, which runs through two tunnels breaking out at Great Charles Street and St Chads Queensway. This route connects the area with the M6 motorway via the A38(M) to the north, and to the M5, M42, and Bromsgrove via the A38 Bristol Road. The other main point of access is from the A4540 Ring Road via one of three strategic links: A34/B4114, A41/B4100, and A457/B4135.

The A38 is a barrier to free movement in the Snow Hill Masterplan area. Access across the A38 is restricted to grade separated links including a bridge and subways, and at-grade crossings where the road is in tunnel at Newhall Street and St Chads Circus.

The Snow Hill Growth Strategy is promoted by Birmingham City Council. The scheme includes upgrade of the ring road and consideration of the future of the central section of the A38 through Birmingham which will support improvements to public transport (bus) and reduce severance for walking and cycling trips.

The scheme will facilitate city-wide expansion, particularly in areas such as the Gun Quarter and Jewellery Quarter. It will result in a step change in travel behaviour across the city, improving health and air quality.

1.1 Snow Hill Growth Strategy

The proposed scheme includes:

- Junction capacity enhancements and simplification of some junctions to remove selected movements and improve flow on the Western side of the Ring Road.

- All city centre tunnels to be filled in, with the surface route to be reconfigured to be local access only.
- A moderate public transport package, to include expansion of park and ride facilities and some bus and Sprint investment (for example provision of bus gates at key junctions).

The above will result in additional land being available within the constrained city centre area to support other development schemes, including employment and residential.

1.1.1 Study Area

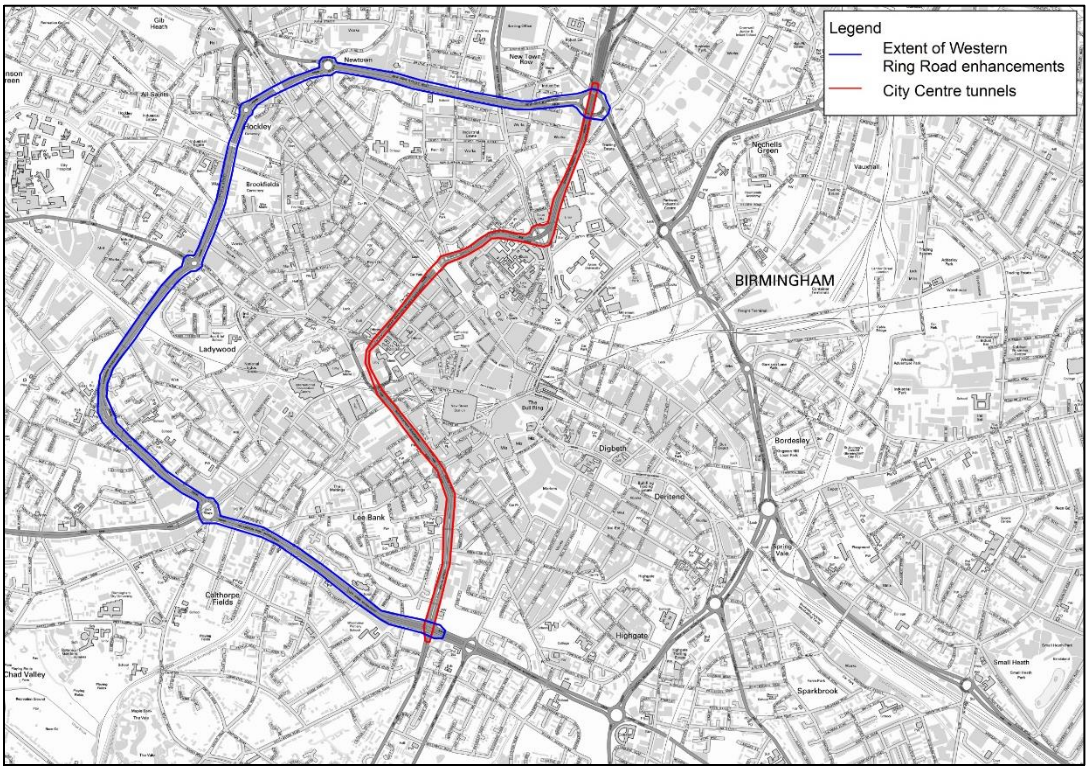

Figure 1.1 Extent of the proposed scheme

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The study area comprises the western side of the A4540 Ring Road, also known as the Middle Ring Road or the Middleway. Improvements to the Ring Road will facilitate consideration of the future of the central section of the A38 through Birmingham. The western side of the Ring Road includes the following junctions (north to south):

- Dartmouth Circus
- New Town Row/Summer Lane
- Summer Lane to Lucas Circus
- Lucas Circus
- Pitsford Street
- Spring Hill
- Five Ways
- Belgrave Interchange

The eastern side of the Ring Road is not included within this proposed scheme. It is acknowledged that this is a constrained corridor and additional traffic may result from HS2, however there would be land acquisition issues, and it is likely that this option would return a lower BCR.

Tunnels in the city centre to be infilled are St Chad's and Queensway tunnels, which direct the A38 into the city centre with associated flyovers to be removed. It is estimated that this would release approximately 2.6 hectares of predominantly highway land for development and urban realm improvement (source: Baseline Report, Jacobs, 2018). This would facilitate significant economic development in the Masterplan area and provide public transport routes and interchange with the new Snow Hill station. It would also allow significant improvements to cycling and pedestrian facilities within the city.

1.2 Policy Background

1.2.1 HS2 Connectivity Package

HS2 will connect Birmingham Curzon Street and Birmingham Interchange stations with Old Oak Common and London Euston stations by 2026. In order to take full advantage of the benefits which will be presented by HS2, the Region produced a Connectivity Package in 2015.

HS2 Curzon Street Station will be located alongside Moor Street Station, just over half a mile from Colmore Row. Midland Metro is being extended to interchange with the HS2 station and travel from Snow Hill to Moor Street station takes 2 minutes with 6 trains per hour throughout the day. The masterplan area will be between 12 minutes and 20 minutes walking time from the HS2 station and will involve significant gradients as the city centre is on a hill.

1.2.2 Midlands Connect

The Midlands Connect 'Picking up the Pace' document was developed and delivered in July 2016, and identifies a number of areas where development can maximise the economic growth opportunities which it brings to the wider West Midlands, but more specifically in the context of this baseline report to the city centre and the proposed transport hub at Curzon Street for HS2.

Following on from this, in March 2017 the Department for Communities and Local Government, HM Treasury and Department for Business, Energy & Industrial Strategy published the Midlands Engine Strategy. The strategy seeks to address productivity barriers enabling businesses to create more jobs, export more goods and services, and grow their productivity. The strategy includes concrete actions including Midlands Skills Challenge, Investment Funds and Trade and Investment Programme. The growth ambitions of the Midlands Connect strategy including creating 300,000 new jobs driving up to £5bn of GVA growth.

Drivers of competitiveness outlined within the reports include access to markets, access to supply chains and access to labour market. Transport improvements outlined include faster highway journey times and improved highway journey time reliability. The reports identify two main areas which have the capacity to support economic growth in the Midlands: the Midlands Rail Hub and the Midlands Motorway Hub.

The Midlands Rail Hub includes investment and enhancement of services on the Snow Hill Lines, making better use of Snow Hill Station, investment on the Camp Hill line and Bordesley Chords to make better use of Moor Street Station and increase rail capacity in Birmingham.

1.2.2.1 National Roads Fund

In the Autumn Budget 2018, the Government announced that the National Roads Fund would be £28.8 billion between 2020 and 2025. This fund is expected to be spent on the Strategic Road Network managed by

Highways England and local roads managed by local highway authorities, with £3.5 billion to be spent on local roads through the delivery of Major Road Network (MRN) and Large Local Major (LLM) schemes.

In order for funding to be allocated where the potential benefits are greatest, the DfT empowered Sub-national Transport Bodies (STBs) including Midlands Connect to submit ten priority MRN schemes and two to three LLM schemes for their areas.

Midlands Connect worked with partners to identify the region's MRN and LLM priorities and developed a Regional Evidence Base that drew on work already undertaken to provide justification for the prioritised schemes.

Birmingham City Council proposed to Midlands Connect that the Ring Road elements of the Snow Hill Growth Strategy be included as one of the LLM fund scheme submissions put forward to the DfT. However, the scheme was dropped during the prioritisation exercise and was not ultimately included by Midlands Connect for this round of funding.

1.2.3 West Midlands Strategic Transport Plan 'Movement for Growth'

The West Midlands ITA approved the final version to "Movement for Growth" on 17 December 2015, and was subsequently re-adopted by the West Midlands Combined Authority in June 2016.

The document outlines that there are five challenges for which an excellent transport system is an essential part of the solution:

- Economic Growth and Economic Inclusion;
- Population Growth and Housing Development;
- Environment;
- Public Health; and
- Social Well-Being.

The vision within the document is to *"make great progress for a Midlands economic 'Engine for Growth', clean air, improved heath and quality of life for the people of the West Midlands. We will do this by creating a transport system befitting a sustainable, attractive and economically vibrant conurbation in the world's sixth largest economy"*.

Key growth locations for economic development are situated across the conurbation. In order to attract new development to the West Midlands, the transport strategy must be able to sustain the resulting travel demand. After making better use of existing transport capacity, the preferred approach of the strategy is to meet increased demand by providing new road capacity alongside higher quality public transport, better conditions for walking and cycling and new public transport capacity, rail capacity, and cycling and walking capacity.

1.2.4 Movement for Growth Delivery Plan

The Movement for Growth Delivery Plan was published in 2017 and sets out the transport schemes and initiatives that will be delivered by the West Midlands Combined Authority between 2017 and 2026, to support the vision and objectives of the Strategic Transport Plan. It also sets out proposals for new forms of collaborative working with Universities and industry, and innovative use of new technologies.

The Delivery Plan sets out a number of key priorities, including:

- HS2 Connectivity Package and related schemes, including city centre metro extensions and a SPRINT programme;
- Priority links in the Metropolitan cycle network, and development of the local cycle network;
- Key walking routes;
- Local bus network improvements;

The first version of the Delivery Plan is intended to drive assessment of the pressures facing the West Midlands transport network through a suite of subsidiary documents including corridor-based delivery programmes targeted on immediate growth areas. Although Birmingham city centre sits at the centre of many important transport corridors, and is key to the wider transport network, it has not been included in these subsidiary documents. Instead, the West Midlands Combined Authority will continue to work with the City Council and stakeholders to develop a wider city centre masterplan.

1.2.5 Birmingham Connected (Birmingham Mobility Action Plan)

Birmingham Connected is a White Paper which was published in November 2014. The document provides a long-term vision for transport which is to create a transport system which puts the user first and delivers the connectivity that people and businesses require.

One of the key initiatives outlined within the document is to develop *"a strategy for the long-term future and role of the A38 through the city centre. Recognising the potentially enormous economic and social benefits which could be realised by removing structures, closing the existing tunnels and redirecting through-traffic on to a substantially upgraded ring road*".

It is recognised within the White Paper that the future of the A38 through the city centre is a vitally important issue and it is stated that the vision will be developed further before proposals are widely consulted on.

Birmingham Connected also outlines that investment in rail across the Midlands and taking advantage of the opportunities provided by HS2 is given particular emphasis by Midlands Connect. Another of the initiatives is to invest "*up to £400 million to upgrade Snow Hill Station, providing another gateway to the city after New Street Station reopens fully in 2015*".

1.2.5.1 Technical Packages

Technical Package 1 outlines the approach to Transport Space Allocation. Streets are broadly classified using a five-by-five Link and Place matrix.

Case studies within Technical Package 1 include recommending junction remodelling on a Link which acts as a public transport corridor with over 35 buses per hour (two-way). It states that "*the introduction of at-grade pedestrian and cyclist crossings on all arms significantly reduces barriers to movement on key desire lines, and provides improved facilities for interchanging passengers and local place users. The signals also afford further opportunities for priority measures for BRT services.*

The introduction of bus lanes on each of the approaches supports the proposed BRT routes, whilst the expanded and re-modelled footways afford opportunities to accommodate their respective superstops in close proximity for convenient interchange."

Another case study of a District Centre includes *"a dedicated eastbound bus lane can also be accommodated to provide improved journey reliability to services travelling inbound towards the City centre; although this would necessitate removing around 25-30 on-street parking bays"*.

It is understood that, although not formally adopted, the Transport Space Allocation plan is still used to shape scheme development and provide an indication as to the Council's preferred direction for future streetscape enhancements.

Technical Package 2 summarises the framework for Public Transport and states that *"although the residual conventional bus network is considered to be lower down in the hierarchy of modes of the future mass transit network, it will be of crucial importance to the success of the network overall and therefore must not be 'left behind' in terms of investment or standards of service. Therefore, whichever approach is adopted, key steps must be taken in order to achieve a coordinated and attractive public transport network"*. This includes arrangements to deliver punctual services.

It is acknowledged within Technical Package 2 that the success of the revised public transport network will be determined by the effectiveness of the priority which it receives. Without priority measures public transport services get caught up in general traffic congestion.

The report goes on to state that *"significant investment is recommended in order to generate a step-change in the quality of the public transport network as a whole and it is therefore crucial that new modes achieve higher levels of speed and reliability than can be achieved currently if the investment is to pay off and travel habits are to change sustainably… where it is essential to accommodate turning movements or for fully justified capacity reasons that a dedicated lane ends before a junction, priority and enhanced journey times should be achieved by appropriate engineering measures"*.

1.2.6 Big City Plan

The Big City Plan City Centre Masterplan was produced in July 2011 as a non-statutory planning and regeneration framework for Birmingham's city centre. The masterplan is divided into three sections:

- The key issues facing the physical development of the city in the next 20 years and the council's proposed strategic responses;
- A detailed overview of how the city centre will develop over time; and
- How the council will deliver their vision.

For the purposes of the masterplan, the city has been divided into seven distinctive 'quarters', which are:

- City Core (including Snow Hill);
- Eastside;
- Digbeth;
- Southside and Highgate;
- Westside and Ladywood;
- Jewellery Quarter; and
- St George and St Chad.

The Snow Hill District is included as an '*Area of Transformation*' and the Masterplan states that:

"The eastern expansion of the central office core incorporating key developments around Snow Hill Station will generate major opportunities for mixed-use office led floorspace. Enhanced pedestrian linkages across Great Charles Street will improve the transition from the City Core into the Jewellery Quarter."

The Masterplan states that "t*he improvement of key junctions around the Ring Road will be required to reduce delays for public transport routes and encourage cross-city drivers to use this route rather than the A38".* City centre wide improvements are proposed in order to make highways more efficient. These include:

- A number of junction alterations may be required as part of the Rapid Transit Routes.
- Other junction improvements may be required at locations on the Ring Road.
- An effective signage strategy to encourage cross-city car drivers to use the Ring Road.
- Development of a co-ordinated and effective strategy to promote sustainable travel.

1.2.7 Birmingham Development Plan

The Birmingham Development Plan (BDP) was adopted by Birmingham City Council in January 2017. It sets out the statutory planning framework to guide decisions on development and regeneration in Birmingham until 2031.

The BDP sets out how and where new homes, jobs, services and infrastructure will be delivered and the type of places and environments that will be created.

The document states that:

- With a population of just over 1 million, the Census 2011 recorded Birmingham as having a significantly younger population profile than the national average, and an ethnically diverse population.
- The city centre accounts for a third of Birmingham's economic output, supporting over 150,000 jobs and home to over 30,000 people.
- By 2031, Birmingham's population is expected to grow by 150,000.
- There will be a provision of 51,100 additional homes during the plan period.

The report identifies that in the city centre, there will be an emphasis on delivering major new investment in retail and office provision. As well as the aspiration of providing a high-quality environment with a mixture of uses in order to cater to the growing residential population.

If Birmingham is to deliver its growth agenda and attract investment it must provide the necessary infrastructure. This will include easy movement within and into the City and the provision of high-quality transport links to the rest of the country and beyond.

Policy TP38 of the BDP states that the delivery of a sustainable transport network will require:

- Improved choice by developing and improving public transport, cycling and walking networks.
- The facilitation of modes of transport that reduce carbon emissions and improve air quality.
- Improvements and development of road, rail and water freight routes to support the sustainable and efficient movement of goods.
- Reduction in the negative impact of road traffic, for example, congestion and road accidents.
- Working with partners to support and promote sustainable modes and low emission travel choices.
- Ensuring that land use planning decisions support and promote sustainable travel.

- Building, maintaining and managing the transport network in a way that reduces CO2, addresses air quality problems and minimises transport's impact on the environment.
- In some circumstances, the re-allocation of existing road space to more sustainable transport modes.

Policy TP44 of the BDP relates to traffic and congestion management and states that the efficient, effective and safe use of the existing transport network will be promoted through measure including the following:

- Route Management Strategies on key routes which will aim to improve the routes for all users and improve network resilience.
- Targeted investments, including the provision of new connections, which reduce the negative impacts of road traffic, for example congestion, air pollution and road accidents.
- Ensuring that the planning and location of new development supports the delivery of a sustainable transport network and development agenda.

In order to deliver a number of the City's aspirational highway improvements the City Council will maintain a number of highway improvement lines. The purpose of a Highway Improvement Line (HIL) is to protect land required for highway and public transport schemes from other development(s). 'Ring Road Improvements' is included as HIL Scheme, referring to Bordesley Circus (scheme recently implemented), Camp Hill Circus, Dartmouth Circus and Haden Circus.

Snow Hill area is identified as being within the 'City Centre Enterprise Zone' and being a 'wider area of change'.

2. The Strategic Case

2.1 Introduction

This section sets out the Strategic Case for the Snow Hill Growth Strategy. It explains the wider context, presents the rationale for the scheme and makes the case for why the investment is required. Specifically, it:

- Describes the problems identified and the justification for intervention;
- Explains the impact/consequences of not changing;
- Outlines the scheme objectives and how they align with the strategic aims of BCC, TfWM, WMCA and Midlands Connect;
- Presents the key measures for success for the scheme;
- Sets out the scope of the project;
- Identifies high level constraints;
- Explains the factors (interdependencies) upon which the successful delivery of the project is dependent;
- Outlines how stakeholders have been involved in the development of the scheme; and
- Sets out the options identified and explains how the options now being taken forward were identified.

2.2 Business Strategy

The current Council Plan for Birmingham City Council covers the period 2018 to 2022. The vision is outlined as:

> *"a city of growth where every child, citizen and place matters".*

Outcomes published in the Council Plan include:

- Birmingham is an entrepreneurial city to learn, work and invest in;
- Birmingham is a great city to live in; and
- Birmingham residents gain the maximum benefit from hosting the Commonwealth Games.

Sitting within these outcomes, priorities include creating quality jobs, developing transport infrastructure and keeping the city moving through walking, cycling and improved public transport and tackling air pollution.

Table 2.1 Scheme alignment with Council Plan

Outcome	Priority	Alignment
Outcome 1: Birmingham is an entrepreneurial city to learn, work and invest in.	We will create opportunities for local people to develop skills and make the best of economic growth.	The scheme will reduce severance and therefore improve access to education, training and employment.
	We will develop our transport infrastructure, keep the city moving through walking, cycling and improved public transport.	Journeys by public transport, cycling and walking will all be improved as part of the scheme.

Outcome	Priority	Alignment
Outcome 2: Birmingham is an aspirational city to grow up in.	We will improve early intervention and prevention work to secure healthy lifestyles and behaviours.	The scheme will encourage journeys to be undertaken on foot and by bicycle, improving health and wellbeing.
Outcome 4: Birmingham is a great city to live in.	We will improve the environment and tackle air pollution.	The scheme will result in a step change in use of alternatives to the private car, improving air quality throughout the city.
	We will work with partners to ensure everyone feels safe in their daily lives.	The scheme provides the opportunity to divert non-destination traffic away from the city centre, thus reducing conflicts and improving safety.

2.3 Problem Identified

2.3.1 Economic Context

Greater Birmingham is the main driver of the UK economy outside London. The Midlands Engine is proving to be a successful conduit to enhancing this position within the UK economy. The HS2 project throws up significant regional advantages and the ability to tap into this opportunity is paramount in regional thinking and planning.

The region has established itself as one of the largest professional and financial centres outside London and recently attracted HSBC to construct their European HQ in the city, along with Deutsche Bank setting up a front office function.

The ability of such world class businesses to successfully operate from the city is closely linked to the effective supply of labour and within that an active and efficient transport system. Whilst we have a strong network now, the growth in city centre business, the growth of HS2 and the establishment of new development sites such as UK Central are adding pressures on the network. The LEP Strategic Economic Plan cites ‘connectivity and congestion’ as one of the challenges facing the region, stating *“the area’s unique connectivity advantage is at risk as a result of increasing congestion…”.*

In its SEP ‘Making our mark’, the West Midlands Combined Authority sets out its mission, vision and objectives to improve the quality of life for everyone who lives and works in the West Midlands. Progress in delivering the vision will be tracked through a number of SMART objectives.

The Vision of the SEP is:

“Our Vision is for Greater Birmingham to be a top global city region that drives the Midlands Engine and is the major driver of the UK economy outside London.”

To support this Vision, the Strategy is stated as:

“Rapid acceleration in growth, employment and productivity through targeted actions in key sectors, enhanced innovation incubation and skills development alongside public sector reform.”

Specific Targets set to meet the Objectives are:

- Create 500,000 jobs by 2030.

- Productivity (GVA per head) will be 5% higher than the national average.
- At least 153,000 fewer people with no formal qualifications and 156,000 more people with level 4 qualifications or above.
- Home to 150,000 businesses, almost 20,000 more than in 2016.

In spite of the above, forecasts suggest that on current trends the output gap between the West Midlands and the rest of the UK will widen between now and 2030. Transport and its links to widening the labour market pool is a key enabler and the Snow Hill Growth Strategy would go some way to achieving this.

2.3.2 Housing and Population Growth

Birmingham has strong growth forecasts and a significant proportion of this growth is envisaged to be delivered in and around the city centre. This growth is currently constrained by the capacity of the city's transport infrastructure.

The BDP sets out how and where new homes, jobs, services and infrastructure will be delivered and the type of places and environments that will be created. Aligned with this regeneration and growth, the City's population is projected to grow by an additional 150,000 people by 2031 and in order to provide employment for the City's growing population, an additional 100,000 jobs need to be created. It is estimated that the growth in the city's population will result in 200,000 additional car trips across the network by 2031 (all trips, Birmingham).

Forecast growth means that improved accessibility and connectivity is required, including enhanced provision and pedestrian cyclists and bus services and infrastructure where they may be gaps.

Plan 4 Spatial distribution of growth

Figure 2.1 Growth locations within the Birmingham Development Plan

2.3.3 Congestion

The figures below compare the available capacity on the A38 and A4540 in the 2016 (baseline report base model year). These highlight existing capacity constraints at a number of key locations on both roads in both the Peak and Inter-peak periods. A volume/capacity ratio of over 85% is considered to exceed capacity, and it can be seen that the ratio of some links currently extends to over 100%.

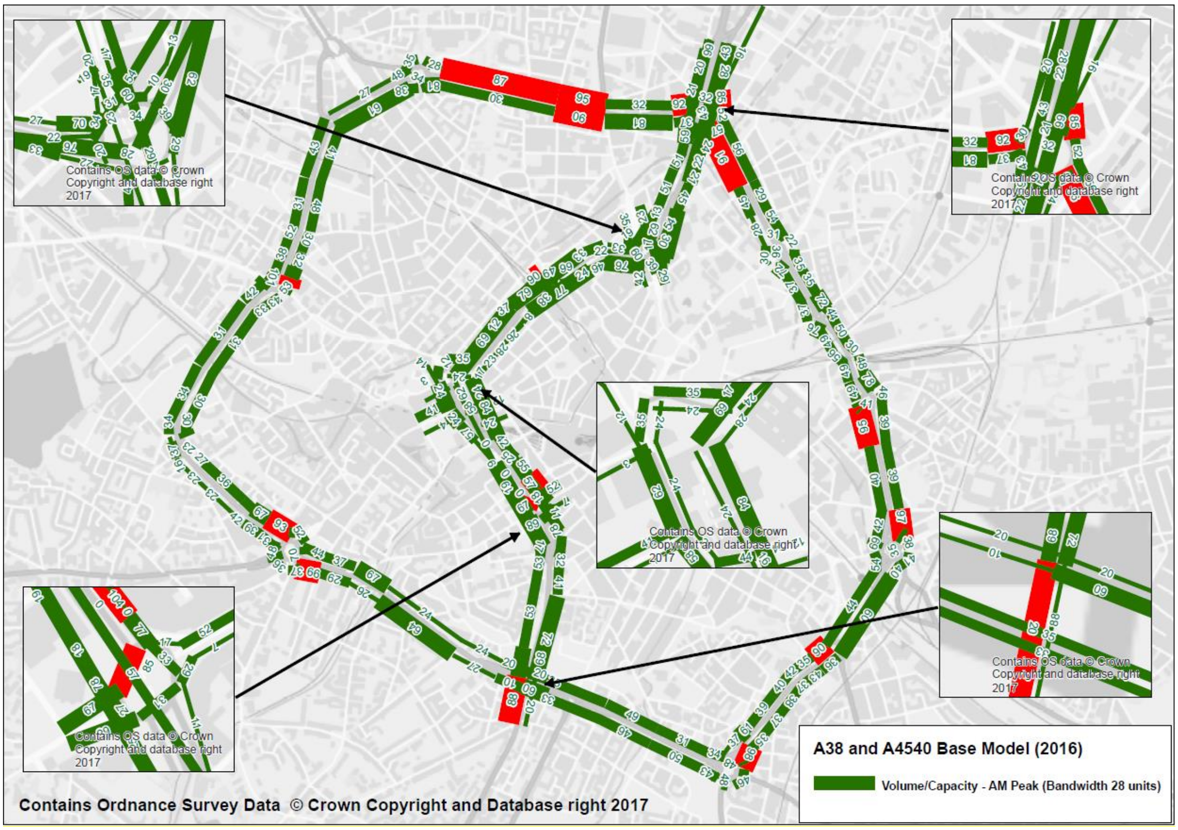

Figure 2.2 A4540 and A38 capacity in the AM Peak

The long-term strategy for Birmingham, outlined in Movement for Growth would result in emphasis of travel in line with large European city regions such as Munich, Stuttgart and Dusseldorf, where car use accounts for typically 35-45% of all journeys, compared to 63% in the West Midlands Metropolitan Area. The strategy includes making more effective use of existing capacity, improved junctions, better walking and cycling conditions and additional public transport capacity.

In line with this growth in population, there is expected to be an additional 150,000 trips to and from the city centre each day (source: Birmingham Connected: Birmingham Mobility Action Plan scoping paper).

Movement for Growth outlines that "*travel demand is forecast to increase by 22% over the next twenty years, due to increased population and higher employment levels. This combined with a long term trend for longer journeys, particularly for work, gives a 34% forecast increase in the number of car kilometres travelled.*"

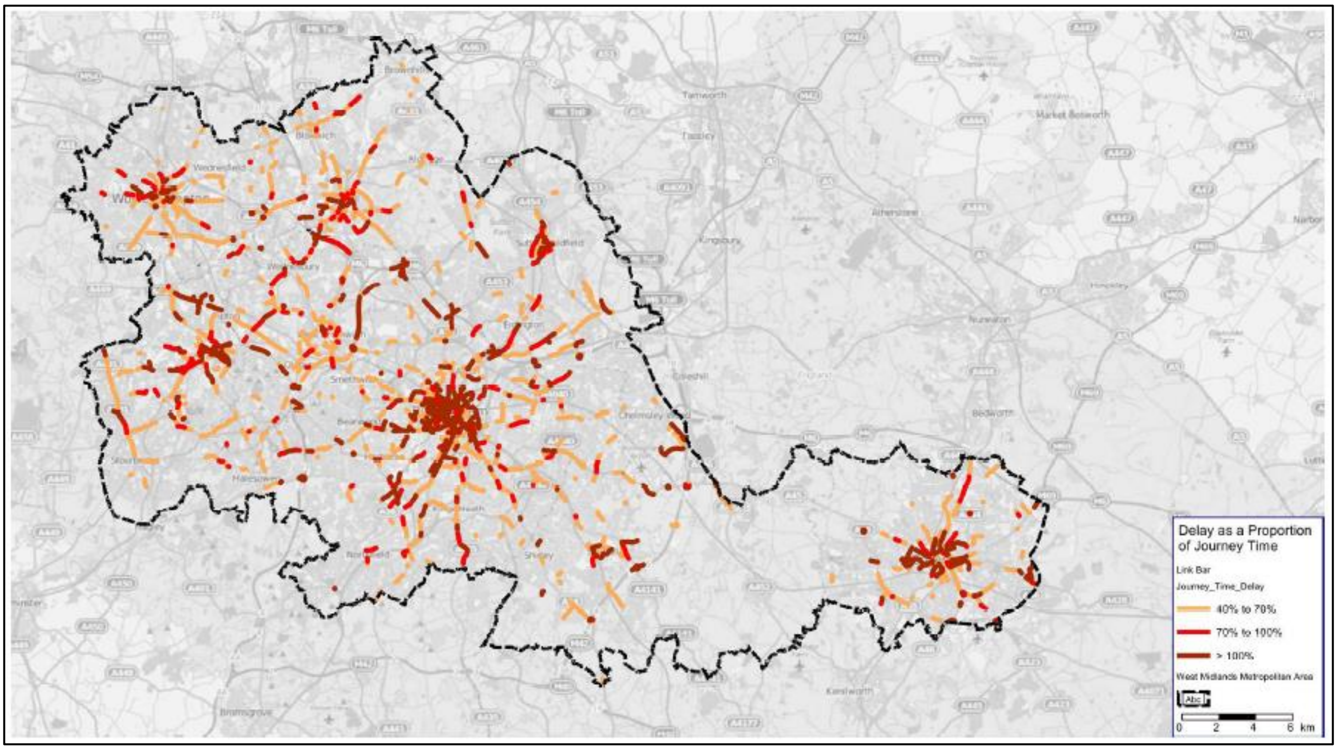

Figure 2.3 Congestion forecast for 2031 with a 'business as usual approach' (Source: Movement for Growth: The West Midlands Strategic Transport Plan)

The Birmingham City Centre Parking study (2016) noted that the numbers of people driving into the city centre is larger than the supply of long stay commuter parking and that a significant number of vehicles are parked in the neighbouring quarters where there has been demand for temporary off-street parking. The parking study recommended restricting the supply of parking in the city centre and restricting the number of temporary sites by planning controls including raising the quality standards. It was also noted that in the Snow Hill Masterplan area a number of vehicles using the on-street short stay parking were being repositioned during the day. It was recommended to make changes to the system to prevent re-parking and encourage use of off-street parking releasing on-street operational parking.

2.3.4 Public Transport

As already outlined, forecast growth in population and associated journeys within the West Midlands will put additional pressure on the transport network. The overarching principles of Movement for Growth include ensuring that all parts of the West Midlands are 'plugged-in' to the two High Speed Rail Stations and the significant growth and development that is happening at their locations and providing a joined-up land use/transport planning approach to support the aims of the Strategic Economic Plan.

The congestion issues outlined in Section 2.3.3 have an impact on bus services, increasing journey times and reducing journey time reliability. Cross-city bus services are avoided by operators due to difficulties and queues experienced crossing the Ring Road.

There are plans to improve the West Midlands rail network, which will be implemented by 2021. This includes another 80 carriages on the Snow Hill line. In addition, an extension of the West Midland Metro is proposed. However, there is limited additional parking to support these network enhancements.

There are aspirations for additional bus priority across the city, but funding is not currently identified.

2.3.5 Public Realm and Severance

The quality of public realm within the study area is poor.

The Ring Road and tunnels act as a barrier to city movements on foot and by bicycle. Crossing points are typically provided at-grade, staggered and signalised with metal barriers. There are some other crossing points not at grade, for example a bridge over Great Charles Street Queensway close to Church Street and a number of subways.

Two cycle super highways have recently opened in Birmingham as part of Birmingham Cycle Revolution; from Selly Oak along the A38 Bristol Road and from Birchfield along the A34. In other areas of the city, including the city centre cyclists are mixed in with traffic along the corridors.

Figure 2.4 Ring Road towards Lucas Circus (left) and Ladywood Circus and Middleway (right)

In addition to the segregating city movements on foot and by bicycle, the Ring Road and A38 currently isolate surrounding areas including the Jewellery Quarter and Gun Quarter from the City Centre Core.

Figure 2.5 A38 merge / diverge between tunnels

2.3.6 Network Safety

The most recent 5-year collision data for the A38 and the western section of the ring road has been extracted from TfWM's Data Insight database. Table 2.2 and Table 2.3 show the collisions on the A38 and the western ring road respectively, by year and severity.

Table 2.2 A38 collisions by year and severity

Severity	Year					Total	Percent
	2014-15	2015-16	2016-17	2017-18	2018-19		
Slight	41	51	37	39	27	195	83%
Serious	11	7	7	5	7	37	16%
Fatal	0	1	1	1	1	4	2%
Total	52	59	45	45	35	236	
Total / km	14	16	13	13	10	66	

Table 2.3 Western Ring Road collisions by year and severity

Severity	Year					Total	Percent
	2014-15	2015-16	2016-17	2017-18	2018-19		
Slight	70	71	56	61	60	318	91%
Serious	6	6	5	6	6	29	8%
Fatal	1	0	0	1	2	4	1%
Total	77	77	61	68	68	351	
Total / km	13	13	11	12	12	61	

The western section of the ring road has had more collisions over that past 5 years than the A38, but it is also a much longer section of road. The western section of the ring road is approximately 5.8km long and the A38 section is approximately 3.6km long. Per kilometre, the western section of the ring road has had slightly fewer collisions than the A38.

The western section of the ring road has also had fewer collisions resulting in a serious injury or fatality. 9% of collisions on this section were serious or fatal, compared to 18% on the A38.

Table 2.4 and Table 2.5 show the number of collisions involving a pedestrian or cyclist on each section of road and the severity of the injury.

Table 2.4 A38 collisions, pedestrians and cyclists

Severity	Year		Total	Percent
	Pedestrian	Cyclist		
Slight	18	12	30	13%
Serious	16	6	22	9%
Fatal	1	0	1	0%
Total	35	18	53	22%
Total / km	10	5	15	

Table 2.5 Western Ring Road collisions, pedestrians and cyclists

Severity	Year		Total	Percent
	Pedestrian	Cyclist		
Slight	25	26	51	15%
Serious	12	5	17	5%
Fatal	2	0	2	1%
Total	39	31	70	20%
Total / km	7	5	12	

As above, the western section of the ring road has had more pedestrian and cyclist collisions than the A38 in total over the past 5 years, but the A38 has had more per kilometre. 22% of the collisions on the A38 involved a pedestrian or cyclist, compared to 20% on the western ring road. However, the western ring road did have 2 fatal pedestrian collisions, compared to 1 fatal pedestrian collision on the A38.

Figure 2.6 shows the location of pedestrian and cyclist collisions on the western section of the ring road.

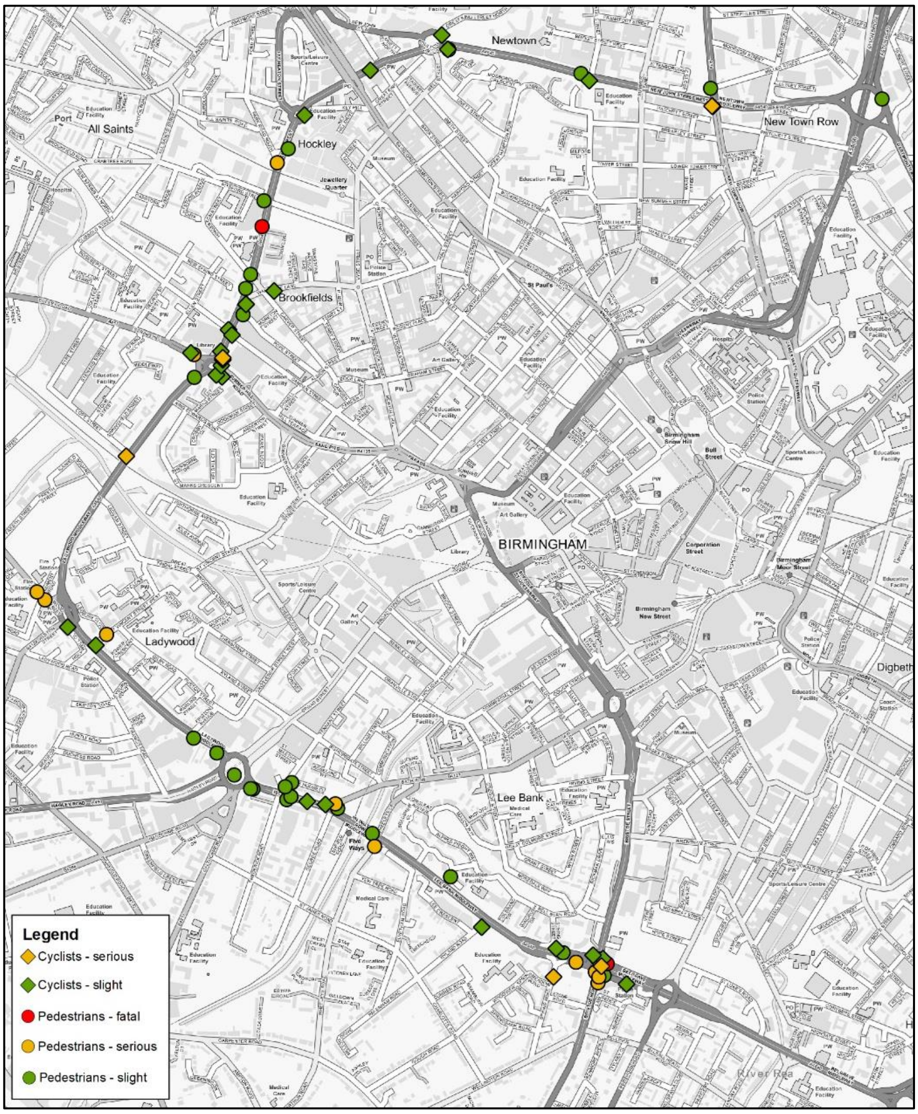

Figure 2.6 Western Ring Road, pedestrian and cyclist collision locations

As shown in the figure, there are clusters of pedestrian and cyclist collisions at the following locations on the western ring road:

- A4540 Icknield Street, between Hingeston Street and Pope Street;
- The A4540 Ladywood Middleway / A457 Spring Hill junction;
- The A4540 Islington Row Middleway, between Tennant Street and B4127 Bath Row; and
- The A4540 Lee Bank Middleway / A38 Bristol Street junction.

2.4 Impact of Not Changing

Movement for Growth outlines that the forecast increase in travel demand over the next twenty years would result in *"an extra 1.2 million extra car journeys per weekday which is equivalent to the amount of traffic carries by ten 3 lane motorways, a huge increase in urban highway capacity".* Without drastic intervention, this increase in travel demand could significantly impede growth within the city. Drivers must be compelled to use public transport, walk or cycle rather than continue to use their car to access the city centre.

Air quality within the city entre requires improvement, over and above that provided by the Birmingham CAZ. There is forecast to be more traffic on the Ring Road once the CAZ is in place, as drivers seek to avoid charges. Removing the majority of traffic from the A38 in the city centre and enhancing walking, cycling and public transport access across the Ring Road will result in a step change in air quality. The provision of additional Park and Ride spaces will improve access to public transport services.

Without the improvements proposed, severance within the city centre will continue to be an issue and areas surrounding the city centre including the Jewellery Quarter and Gun Quarter won't become part of the inner core and reach their development potential.

Continued investment in non-motorised user facilities will increasingly be in conflict with growing traffic levels, particularly from a safety perspective. The opportunity to divert non-destination traffic away from the city centre will constrain the potential for a more accessible and safer city centre, where the hierarchy of modes is more focused on vulnerable users.

2.5 Internal Drivers for Change

The key internal drivers of the Scheme relate to the objectives and resultant policies of national, regional and local bodies. These policies are centred on facilitating economic growth through investment in transport infrastructure improvements and improving health and air quality.

Policy documents prepared in the region which outline the internal drivers for change include:

- Birmingham Development Plan;
- Big City Plan;
- Movement for Growth; and
- Birmingham Connected.

The policies are summarised in Chapter 1.

2.5.1 Birmingham Clean Air Zone

In December 2015, the Department for Environment, Food & Rural Affairs (DEFRA) set out actions on how to improve air quality in major UK cities, to achieve compliance with the EU Air Quality Directive, in the document "Improving Air Quality in the UK, Tackling Nitrogen Dioxide in our Towns and Cities".

Birmingham plans to introduce a Clean Air Zone (CAZ) covering all roads within the A4540 Middleway Ring Road (but not the Middleway itself) in 2020. This will radically change travel patterns into and around the city.

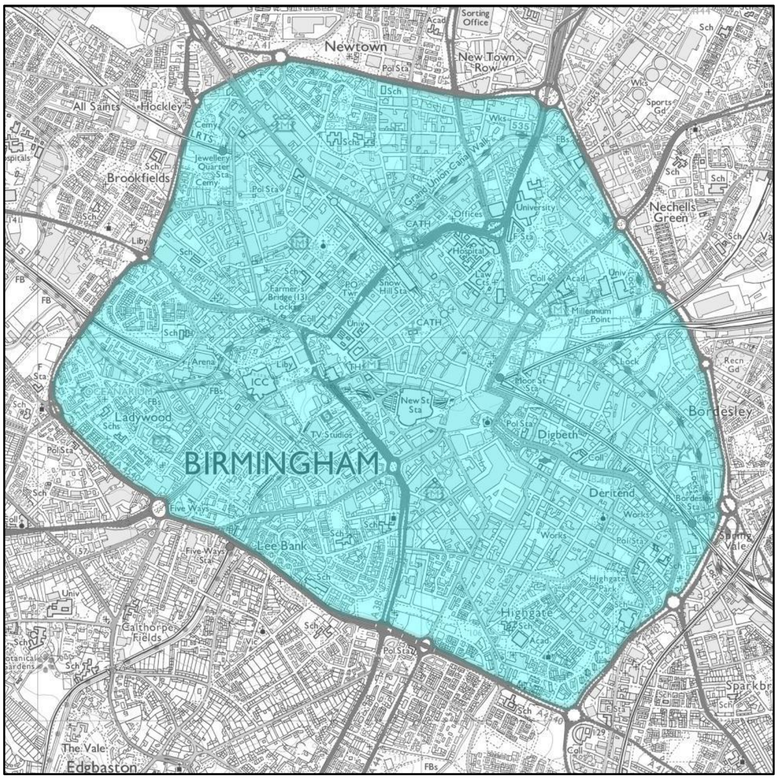

Figure 2.7 Birmingham Clean Air Zone

https://www.birmingham.gov.uk/info/20076/pollution/1763/a_clean_air_zone_for_birmingham/3 Map © Crown copyright and database rights 2018 Ordnance Survey

Birmingham's CAZ will operate 24 hours a day, 365 days a year and the charges will be applied daily. CAZ charges will be based on the vehicle and not the person driving or any passengers or goods being carried. Charges depend on the type of vehicle (e.g. car, bus, taxi, van, HGV) and what sort of engine it has.

The Full Business Case for the CAZ[1] states that it will result in a reduction of roughly 4,240 tonnes of NOx emissions and 79 tonnes of PM10 emissions over the appraisal period.

It is anticipated that following implementation of the CAZ, a significant proportion of non-compliant HGVs, LGVs and cars (between 29 and 47% depending on vehicle type) would either change their travel patterns to avoid the zone or cancel their trip altogether. It is anticipated that approximately 2% of journeys made by car would instead by undertaken by public transport, cycling or walking.

When considered against the population of Birmingham (over one million), a 2% modal shift has a potentially significant effect on journey patterns. The Snow Hill Growth Strategy will facilitate journeys by modes other than the car by reducing severance on the ring road.

2.5.2 Birmingham City Centre Enterprise Zone

The Birmingham City Centre Enterprise Zone comprises 26 sites across the city centre, in seven clusters:

[1] https://birmingham.cmis.uk.com/birmingham/Decisions/tabid/67/ctl/ViewCMIS_DecisionDetails/mid/391/Id/dbb0a2ee-0e5c-4c26-bb25-5e8ffacb8066/Default.aspx

- Snow Hill District;
- Westside;
- Eastside;
- Southern Gateway;
- Digbeth Creative Cluster;
- Birmingham Science Park Aston; and
- Jewellery Quarter.

When all the development is achieved, the Enterprise Zone will:

- Secure 1.3m sq. metres of new floor space, of which 700,000 sq. metres is for business and financial services, digital media, ICT and creative industries;
- Create 40,000 new private sector jobs;
- Contribute £2.8 billion to the economy in GVA per annum once the above growth is delivered; and
- Generate, once fully developed, additional business rates of circa £70 million per annum.

2.5.3 Snow Hill Masterplan

A masterplan for Snow Hill Station covers a 20 year period and was published in October 2015 as part of the Big City Plan. The area is a major hub for the business, professional and financial services sector. It is home to over 500 companies including major international businesses which together occupy a total of 500,000sqm of office space and employ over 35,000 people.

The masterplan sets out a vision for the area to bring about major transformation. It states that *"the A38 is an important vehicular link route but a major scar in the city fabric, difficult to cross and with poor quality spaces and buildings alongside it. Its width, traffic speed and extensive land take have a major impact on adjacent sites"*.

The Vision of the masterplan includes a number of Big Moves:

- Expanded Office Core – new landmark developments;
- Snow Hill Station – transformed to an attractive high-quality public transport interchange;
- St Mary's Place – reconfiguration to unlock new sites;
- North/South Connectivity – enhanced pedestrian routes;
- East-West Connection – creation of a grand pedestrian and cycle route;
- Public realm interventions – provision of a consistently high quality, inclusive and safe environment; and
- Great Charles Street Boulevard – reconfiguration of Queensway (A38) to restore sustainable connectivity and free up land for development.

In relation to the final Big Move, the A38 Queensway, the masterplan states that:

"Forming an urban motorway, the Queensway supports tens of thousands of traffic movements every day but constitutes a formidable barrier to movement and isolates surrounding areas including The Jewellery Quarter, Gun Quarter and Learning Quarter from the City Centre Core.

The vision of this Masterplan is to transform the Queensway between Lancaster Circus and Paradise Circus Queensway into a series of attractive boulevards and public spaces, leaving the road to function as a local *distributor rather than a through route and urban motorway. The reconfigured route would feature dedicated space for buses and cycle traffic. This would unlock land for new developments, support improvements to public transport movement, create opportunities for regeneration and make a bold statement for the City as it delivers a more sustainable transport system and continues to remove barriers to growth…*

…Major changes to the A38 would require a series of interventions to mitigate transport impacts. A significant modal shift to public transport and cycling will be required, and cross-city traffic would need to be diverted to other routes including the Middleway, leaving only local access traffic using the much reduced remaining road capacity.

This would facilitate the improvement of St Chad's Circus by making use of redundant road space and creating a focal point for the City Centre Core's interface with the Constitution Hill/Great Hampton Street corridor. A further benefit would be the opportunity to transform Lancaster Circus into 'Lancaster Place' - the potential removal of the gyratory and A38 flyover creating opportunities for new development sites and open space."

2.6 External Drivers for Change

The underlying case for the scheme is the lack of transport network capacity, which will become more pronounced over future years without intervention. The Ring Road and A38 are already congested at key locations. Doing nothing would result in constrained growth of the city centre, particularly in the areas of Snow Hill, Gun Quarter and Jewellery Quarter.

Severance is also a key concern, with the Ring Road acting as a barrier to journeys made by cycling, walking and bus.

There is a real drive within cities to improve air quality, with a requirement for Birmingham to implement a CAZ.

2.7 Objectives

In the Options Assessment Report (OAR) for the Snow Hill Growth Strategy, forty-one intervention objectives were identified. These were based on the Snow Hill Masterplan aims and baseline report evidence of need for change as well as capturing the DfT objectives for transport specified in business case and appraisal guidance and the Early Assessment and Sifting Tool (EAST) guidance. The objectives were grouped into key subject areas and expanded to cover deliverability issues. The criteria for appraisal were defined as;

- Allowing increase in people and freight movement into, and out of, the Snow Hill Masterplan Area (SHMPA).
- Improving people movement within the Snow Hill Masterplan area internally.
- Creation of additional re-developable land.
- Improving the quality of the connections from SHMPA to major transport hubs (improve external connectivity).
    - New Street Station
    - Snow Hill Station
    - Curzon Station
    - Metro Stops
    - Sprint Stops
- Support Key development sites
    - In SHMPA

  - In City Region
- Wider economic impact benefits arising to the City and wider West Midlands.
  - Job Creation
  - Land Availability
  - Inward Investment
  - Agglomeration/connecting businesses
  - Connecting employers to labour markets
- Improve Transport network performance.
  - Through
    - Traffic
    - PT
    - Active
  - Into City
    - Traffic
    - PT
    - Active
  - Revenue
    - Direct
    - Indirect
  - Safety and Personal Security
    - Road user
    - PT user
    - Active Modes
  - Environmental Impacts
    - Noise
    - Air Quality (NOX/CO2)
    - Public Realm
    - Historic Environment
    - Biodiversity/water
  - Severance
    - SHMPA
    - Non-SHMPA
  - Positively supports CAZ Objectives
  - Social Distribution Impacts (SDI)

- Deliverability
  - Technical Feasibility
  - Buildability
  - Acceptability
- Consistent with other Transport Network changes
- Finances
  - Land Value Increase
  - Affordability

2.8 Measures for Success

Detailed measures for success for this scheme have yet to be fully scoped, but are likely to indicatively include the following:

- Scheme delivery – to time and budget;
- Changes of the performance of the ring road and wider transport network arising from the scheme;
- Changes to perceptions and usage arising from the scheme – public transport, cycling and walking;
- Changes to outcomes related to the transport improvements – general Gross Value Added and jobs monitoring, transport emissions and collisions.

Furthermore, measures of success should be linked to objectives, so could include the following:

- Allowing increase in people and freight movement into, and out of, the Snow Hill Masterplan area
- Improving people movement within the Snow Hill Masterplan area internally
- Creation of additional re-developable land
- Improving the quality of the connections from SHMPA to major transport hubs
- Support Key development sites
- Wider economic impact benefits arising to the City and wider West Midlands
- Improve Transport network performance

2.9 Scope

The Snow Hill Growth Strategy encompasses the following:

- Highways interventions on the ring road (junction improvements on the western side;
- Reconfiguration of the A38 and car access within city centre;
- Public transport strategy (rail Park & Ride and Sprint/bus improvements); and
- Walking and cycling improvements at junctions.

The scheme supports, but does not include and is not dependent on, the redevelopment of Snow Hill Station itself. This separate scheme is being developed by Network Rail in conjunction with BCC.

2.10 Constraints

A key constraint to a successful implementation of the scheme is consideration of the wider effects on traffic across the city. Regional traffic modelling (PRISM) and the BCC Saturn city model will be used to forecast the impact of the scheme.

There is still a need to identify and engage with landowners and wider stakeholders. For example, Highways England will need to be consulted on proposals at an early stage.

2.11 Inter-dependencies

The need for the Snow Hill Growth Strategy is already evidenced by:

- Highway congestion and journey time data;
- Constrained public transport network needing to cater for anticipated patronage growth due to population and employment increases;
- Continued investment in active modes on routes into the city centre, such as the success of the Birmingham Cycle Revolution corridors;
- Provision of additional high-quality land for the expansion of the city centre core, with the removal of the barrier-to-movement of the A38 allowing the westward and northward growth of the centre;
- Changes in perception of private travel, through the introduction of the Clean Air Zone and climate change debates.

Other proposals which support the delivery of the Snow Hill Growth Strategy are:

- Snow Hill (Station) masterplan;
- Birmingham CAZ;
- HS2 and Curzon Street Station;
- Proposed Sprint Bus Network;
- Birmingham Cycle Revolution;
- Public transport improvements proposed by West Midlands Rail Executive and TfWM;

Given the scale of the scheme, there will be interdependencies with other schemes. These will be defined as the project develops.

2.12 Stakeholders

The scheme is being developed by BCC with extensive stakeholder support, including TfWM. Due to the scale of the scheme, there are a number of other key stakeholders, including:

- Key local authority Officers;
- WMCA;

- Cabinet Members;
- Media;
- West Midlands Mayor;
- Ward Councillors;
- Transport Delivery Committee;
- MPs;
- Emergency services;
- Impacted businesses;
- Impacted residents;
- Utilities;
- LEP, BIDs, Chambers;
- Groups along the route e.g. Residents Groups;
- General groups e.g. Bus Users UK, cycle and walking groups;
- Specific needs groups e.g. Visually impaired, disability groups;
- Bus Users along the route;
- Public.

Highways England are another key stakeholder and need to be approached to discuss proposals at the earliest opportunities.

2.13 Options

A long list of options was prepared, and this was narrowed to a short list of preferred options. The short list of options is included within the baseline report (Jacobs, 2018).

Six emerging options were identified. These consisted of two limited schemes (options 1 and 2), and 4 transformational schemes (options 4 to 6).

The transformational schemes all include delivering the same set of city centre works, with varying levels of wider network mitigation for dispersed traffic. These options are summarised in Table 2.6 below:

Table 2.6 Short list of options included within baseline report

Option	City Centre Works	Additional Mitigation Measures	Est. Cost
Option 1 – Improved and new bridges across the A38	A38 remains "as is" for traffic.	No wider mitigation.	£15m
Option 2 – Cut and Cover Tunnels	Public realm improvements and release of highway land between Newhall Street and Livery Street only.	Cut and cover tunnel linking Great Charles Street and St Chad's Tunnels.	£150m
Option 3 – Transformational City Centre Scheme Base Option	Look at different options for the central section of the A38, including re-routing it to an upgraded ring road. Major urban realm and release c. 2.6ha of highway for additional development between Lancaster Circus and Paradise Circus.	No wider mitigation – traffic dispersed onto wider network and mode switch to public transport.	£150m
Option 4 – as option 3 plus improvements to Ring Road East	As for option 3	Major improvements to 8 Ring Road junctions – grade separation and / or major increase in size for re-routed traffic.	£450m
Option 5 – as option 3 plus major public transport package	As for option 3	Public transport improvements for rail, metro and SPRINT including Park and Ride in wider A38 corridor. Excludes new Cross City rail tunnel.	£1bn+
Option 6 – as option 3 plus Deep Bore Tunnel	As for option 3	New deep bore tunnel 2km from north of Lancaster Circus to Bristol Street.	£1bn

The above options were assessed and ranked using Highways England Standard Appraisal Methodology (EAST) as part of the baseline report. This resulted in the following ranking:

1. **Option Six**: Transformational city centre scheme with Deep Bore Tunnel
2. **Option Five**: Transformational city centre scheme with major public transport package
3. **Option Four**: Transformational city centre scheme with improvements to junctions on the eastern side of the Ring Road
4. **Option Two**: Cut and Cover Tunnel
5. **Option One**: Improved and New Bridges over the A38
6. **Option Three**: Transformational city centre scheme

The two highest-ranking options scored very similarly using the EAST approach, and cost similar amounts. Option Six has minimum environmental impact and maximum benefits in the city centre, but facilitates through traffic along the underground corridor. Option Five is most in line with Birmingham City Council's transport policy, but the long term impacts on inward investment are uncertain.

It was reported to be likely that Option Six would perform better and deliver a stronger BCR under traditional transport appraisal. However, both options will deliver wider economic benefits and the city centre transformation of the existing A38.

Following further analysis of various data, and in discussion with the BCC's lead officers, the Project Board and the Steering Group, it was determined that Options One, Two, Three and Six were either not aspirational enough (Options One, Two and Three), or were unlikely to be deliverable (Option Six).

It was therefore agreed that essentially Options Four and Five should be considered further but with slight amendments. The project scope for the more detailed assessment was agreed to encompass three scenarios:

- A highways-focussed package of measures;
- A public transport-focussed package; and
- A hybrid package combining elements from Scenarios One and Two.

It was also agreed that a 'Do Nothing' or 'Do Minimum' scenario, where the existing situation would be maintained, would only be used for comparative purposes and not used as one of the potential assessment scenarios.

These scenarios are in line with the final Big Move of the Snow Hill Masterplan, supporting the reconfiguration of the Queensway.

2.13.1 Options addressing problems identified

The three scenarios outlined above would all improve a number of existing and forecast issues outlined in Sections 2.3 and 2.4.

Through capacity improvements at major junctions, all scenarios would improve the reliability of bus and Sprint services, particularly across the Ring Road. Further opportunities for additional cross city services would therefore be promoted. In addition, options would include banning cars from some turns, which would allow for bus gates and improve bus and Sprint reliability further.

The public transport package would include provision of additional Park and Ride capacity across Birmingham, allowing for more journeys into the city to be undertaken by rail, Sprint, bus and metro. Connections to city centre stations, including the new HS2 station at Curzon Street would be improved.

A reduction in traffic and severance across the Ring Road, and improvement of the city centre area would improve safety for all users and also result in improved conditions for walking and cycling.

These improvements would have the knock-on effect of improved air quality, health and wellbeing across the city and would support the objectives of the clean air zone.

3. Economic Case

3.1 Introduction

This section presents an overview of the economic impacts appraised for the Snow Hill Connectivity packages of potential schemes. Supporting the options for reconfiguration of the central section of the current A38 Queensway tunnels and flyover including re-routing it to an upgraded ring road, between Dartmouth Circus and Belgrave Interchange, the packages include combinations of highway and/or public transport improvements to provide additional capacity for trips displaced from the through highway route.

For this Strategic Outline Business Case, a high-level economic assessment has been made, to provide a Level 1 BCR. Further option development and traffic modelling will enable more detailed assessments to be made and Level 2 and Level 3 BCRs to be calculated in greater detail.

3.2 Options appraised

As outlined in Section Options of the Strategic Case, the following options have been assessed:

- DM – current situation with existing configuration of highways and public transport networks;
- DS1 – closure of A38 tunnels/flyover and reconfiguration of parallel surface routes. Capacity enhancements to Ring Road western side;
- DS2 – closure of A38 tunnels/flyover and reconfiguration of parallel surface routes. Increased rail Park and Ride capacity, bus corridor improvements, Sprint Park and Ride, cross-city bus services and local investment in walking and cycling; and
- DS3 – hybrid of DS1 and DS2, with closure of A38 tunnels/flyover and reconfiguration of parallel surface routes, capacity enhancements to Ring Road western side, increased rail Park and Ride, bus corridor enhancements.

Details of the scheme are provided in Appendix A

3.2.1 Costs

The following scheme elements have been included for each option (. For this initial appraisal, for TUBA it was assumed that all costs were purely construction.

The summary profile of scheme elements is shown in Table 3.1. Assumed delivery profile for implementation of each scenario is shown in Appendix A.

Table 3.1 Scheme cost elements

Expenditure profile - Snow Hill Connectivity Study

Location	Approximate Construction Costs	Option DS1	DS2	DS3
Dartmouth Circus	£20,000,000	✓		✓
New Town Road and Summer Lane	£40,000,000	✓		✓
Summer Lane to Lucas Circus	£6,000,000	✓		✓
Lucas Circus	£4,000,000	✓		✓
Spring Hill	£10,000,000	✓		✓
Five Ways	£60,000,000	✓		✓
Belgrave Interchange and Bristol Road	£11,000,000	✓		✓
Coseley	£1,750,000		✓	
Tipton	£13,125,000		✓	✓
Dudley Port	£4,200,000		✓	✓
Sandwell & Dudley	£3,500,000		✓	
Smethwick Rolfe Street	£7,000,000		✓	✓
Stourbridge Junction	£5,250,000		✓	
Cradley Heath	£7,000,000		✓	
Old Hill	£7,000,000		✓	✓
Rowley Regis	£31,500,000		✓	✓
Blake Street	£3,500,000		✓	
Four Oaks	£7,000,000		✓	✓
Sutton Coldfield	£10,500,000		✓	
Chester Road	£9,450,000		✓	✓
Aston	£24,500,000		✓	✓
Selly Oak	£3,500,000		✓	✓
Bournville	£10,500,000		✓	✓
Kings Norton	£3,500,000		✓	✓
Sprint P&R - M5 J3, M6 J7, M6 J5	£30,000,000		✓	✓ *M5 J3 only, £10m
Bus Improvement Corridors	£57,000,000		✓	✓
Cross-city bus services	£10,000,000		✓	
Walking and cycling improvements	£50,000,000		✓	
Tunnels/flyover and surface reconfiguration	£150,000,000	✓	✓	✓
	Package capital cost:	**£301,000,000**	**£449,775,000**	**£489,275,000**

3.2.2 Value for Money Assessment

The summary Economic Efficiency of the Transport System (TEE) table for users is given in Table 3.2 overleaf.

Table 3.2 Economic Efficiency of the Transport System (TEE) in £000s

	DS1	DS2	DS3
Non-business: Commuting	**ALL MODES**	**ALL MODES**	**ALL MODES**
User benefits	**TOTAL**	**TOTAL**	**TOTAL**
Travel time	-575,807	-523,167	-541,744
Vehicle operating costs	-21,756	-18,317	-20,292
User charges	0	0	0
During Construction & Maintenance	0	0	0
NET NON-BUSINESS BENEFITS: COMMUTING	-597,563	-541,484	-562,036
Non-business: Other	**ALL MODES**	**ALL MODES**	**ALL MODES**
User benefits	**TOTAL**	**TOTAL**	**TOTAL**
Travel time	-370,021	-339,299	-286,888
Vehicle operating costs	-11,191	-8,057	-10,678
User charges	0	0	0
During Construction & Maintenance	0	0	0
NET NON-BUSINESS BENEFITS: OTHER	-381,212	-347,356	-297,566
Business			
User benefits			
Travel time	-416,780	-381,361	-409,977
Vehicle operating costs	-57,732	-53,048	-57,240
User charges	0	0	0
During Construction & Maintenance	0	0	0
Subtotal	-474,512	-434,409	-467,217
Private sector provider impacts			
Revenue	26,847	28,763	53,050
Operating costs	0	0	0
Investment costs	0	0	0
Grant/subsidy	0	0	0
Subtotal	26,847	28,763	53,050
Other business impacts			
Developer contributions	0	0	0
NET BUSINESS IMPACT	-447,665	-405,646	-414,167
TOTAL			
Present Value of Transport Economic Efficiency Benefits (TEE)	-1,426,440	-1,294,486	-1,273,769

Notes: Benefits appear as positive numbers, while costs appear as negative numbers.
All entries are discounted present values, in 2010 prices and values

Summary scheme costs related to public accounts are presented in Table 3.3 overleaf.

Table 3.3 Public Accounts

	DS1	DS2	DS3
	ALL MODES	ALL MODES	ALL MODES
Local Government Funding	TOTAL	TOTAL	TOTAL
Revenue	0	0	0
Operating Costs	0	0	0
Investment Costs	0	0	0
Developer and Other Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	0	0	0
Central Government Funding: Transport			
Revenue	0	0	0
Operating costs	0	0	0
Investment Costs	212,342	346,377	372,750
Developer and Other Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	212,342	346,377	372,750
Central Government Funding: Non-Transport			
Indirect Tax Revenues	-5,427	-218	663
TOTALS			
Broad Transport Budget	212,342	346,377	372,750
Wider Public Finances	-5,427	-218	663

Notes: Costs appear as positive numbers, w hile revenues and 'Developer and Other Contributions' appear as negative numbers.

All entries are discounted present values in 2010 prices and values.

The summary initial BCR for the scheme is presented in Table 3.4.

Table 3.4 Initial BCR from Analysis of Monetised Costs and Benefits (AMCB)

	DS1	DS2	DS3	
Noise	0	0	0	
Local Air Quality	0	0	0	
Greenhouse Gases	-4,704	-2,402	-3,792	
Journey Quality	0	0	0	
Physical Activity	34,883	41,478	45,502	
Accidents	0	0	0	
Economic Efficiency: Consumer Users (Commuting)	-597,563	-541,484	-562,036	
Economic Efficiency: Consumer Users (Other)	-381,212	-347,356	-297,566	
Economic Efficiency: Business Users and Providers	-447,665	-405,646	-414,167	
Wider Public Finances (Indirect Taxation Revenues)	5,427	218	-663	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	-1,390,834	-1,255,192	-1,232,722	
Broad Transport Budget	212,342	346,377	372,750	
Present Value of Costs (see notes) (PVC)	212,342	346,377	372,750	
OVERALL IMPACTS				
Net Present Value (NPV)	-1,603,176	-1,601,569	-1,605,472	
Benefit to Cost Ratio (BCR)	-6.55	-3.62	-3.31	

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

This appraisal should not be looked at in isolation of the wider case for investment. Key aspects of the wider case have greater influence over the broader considerations, but are more difficult to calculate at this stage using traditional approaches set out in WebTAG and the Green Book.

One of the major positives of the scheme is unlocking the potential of the Snow Hill Masterplan, which would bring increased land-use densities and improved transport connectivity out as far as the Ring Road. Allowing the city centre to organically expand westwards, rather than being constrained by the A38, would support increased activity across the core area. Improving active mode facilities would also bring additional benefits.

Following a WebTAG-compliant appraisal means that externalities are not considered. As outlined above, the closure of tunnels supports positive change for active modes and public transport usage. The appraisal doesn't capture the increased activity – agglomeration - which could be brought by the revised masterplan through the broadening of objectives and support for densification of employment and residential opportunities.

3.3 Assumptions

Economic benefits from the scheme were quantified over a 60-year appraisal period from the scheme opening year in 2026, by comparing outputs from the modelling scenarios of the 2026 forecasting year. The assumption has been taken that benefits from 2026 reduce to 2036 and are then static, this approach being taken due to time constraints with the PRISM model.

All usual assumptions for estimating economic benefits, such as discount rate, price base year, inflation and deflation, value of time and its growth, are in line with the latest WebTAG guidelines.

For this SOBC, a high-level economic assessment has been made, to provide a Level 1 BCR. The levels of BCR calculation are as follows:

- Level 1 – includes user benefits from fixed land uses only;
- Level 2 – considers Wider Economic Benefits arising from agglomeration and other implicit land use changes; and
- Level 3 – considers land value uplift and impacts on dependent development which may otherwise be capacity constrained.

Firstly, estimation of the Level 1 BCR values was undertaken using the latest version of TUBA with its default economics file. This initial assessment mainly captures transport economic efficiency savings for existing and new transport users and costs of the proposed scheme. Both elements are deemed to be based on outputs from a robust transport model or actual design and risk analyses. Level 2 and Level 3 BCRs will be calculated at Outline Business Case stage.

Key considerations throughout different stages of the appraisal process are highlighted below:

- Optimism Bias of 66% was assumed for capital investment, due to the level of detail to which design work has previously been taken. Revenue costs have not been considered at this stage, partially accounting for the use of a higher Optimism Bias value;
- Maintenance costs have assumed to be no more than currently, and are expected to be lower due to the new structure. Detailed calculations will be made at OBC stage. For this SOBC, it is considered proportionate to not calculate maintenance and wider economic costs/benefits; and
- Calculation of highways disbenefits during construction has been undertaken at a basic level and will be assessed in greater detail at OBC stage.

No sensitivity tests have been undertaken at this stage of scheme development.

3.4 Sensitivity and Risk Profile

Sensitivity and risk within the NPV has not yet been considered, given the stage of scheme development and costing. These will be examined for the Outline Business Case.

3.5 Appraisal Summary Table

The initial Appraisal Summary Table is provided in Appendix B of this report.

Stage 3 of the Value for Money assessment considers findings from the previous two stages as well as other aspects of the economic assessment where the proposed scheme may have material impacts.

Assessment in this stage is in particular focused on possible alteration to the value of the scheme resulting from qualitative assessments of impacts for which it is not possible to give monetary values or no reliable evidence is available to undertake such analysis at the current stage of the study.

On a traditional Transport Scheme Appraisal, the journey time disbenefits due to the reconfiguration of the A38 out-weighs any other scheme benefit. However, the following observations have been made:

Economic perspective –the scheme is also found to be beneficial to journey reliability and regeneration, by improving network resilience. The current route is subject to significant variation in journey times due to their use for access to the city centre core. By distributing this access traffic across a greater number of routes from the Ring Road, it is anticipated that journey time reliability will improve;

Environmental perspective – although not yet assessed, it is anticipated that the proposed scheme will be slight beneficial in terms of noise, air quality, greenhouse gases and townscape. There is limited relevance to landscape, heritage, biodiversity and water environment so these impacts were deemed neutral; and

Social – benefits for commuting and other users account for a significant part of the social impact. Impacts on journey quality and option values are next to transport user impacts in terms of significance. The affordability impact is neutral as it is assumed that public transport options will continue as present (i.e. no changes in fares due to reconfiguration of the highway.

4. Financial Case

4.1 Introduction

This chapter sets out the approach taken to determining the funding requirements for delivering the Snow Hill Growth Strategy scheme, along with any budgetary and accounting implications.

4.2 Costs

Current scheme costs have been derived using standard local unit costs with suitable benchmarking to ensure that these are still reasonable and not subject to any significant increases due to inflation or other factors.

Whole life costs have not yet been calculated, as these will be determined by the final scheme design. In particular, the assumption to be taken regarding any residual tunnel assets has not been scoped. It is assumed that on-going costs relating to additional Park and Ride facilities will be covered by Transport for West Midlands through an applicable budget or policy.

The matter of on-going costs and responsibility for them will be essential to determine, given the potential that responsibility for some new assets may pass to other parties.

4.3 Budgets / Funding cover

The indicative funding package for the scheme is likely to come from a mix of Government and local funding, with actual sources and splits of the funding package dependent on the option taken forward for more detailed consideration.

5. Commercial Case

The Commercial Case for this scheme has not yet been scoped, due to the stage of option development and wider uncertainties regarding which elements will be taken forward and how they may be delivered.

Birmingham City Council has a strong track record on procuring large schemes through available frameworks and other mechanisms, which will be reviewed for appropriate use as schemes progress through concept design, detailed design and implementation.

6. Management Case

The Management Case for this scheme has not yet been scoped, due to the stage of option development and wider uncertainties regarding which elements will be taken forward and how they may be delivered.

Birmingham City Council has a strong track record on delivering large schemes through available frameworks and other mechanisms, which will be reviewed for appropriate use as schemes progress through concept design, detailed design and implementation.

7. Way Forward

7.1 Introduction

The Snowhill Transport Connectivity Project aims to facilitate expansion of Birmingham city centre by removing the A38 severance and encouraging more sustainable modes of travel to access the city centre. The conventional transport modelling and appraisal approach indicates that the closure of the heavily utilised A38, even with the proposed improvements (scheme's options) is likely to result in approximately £1 billion of transport use disbenefits. This initial appraisal of the scheme's options indicates the project offers poor value for money, even when active mode and Level 3 wider benefits (land value uplift) are considered. This is primarily due to the following reasons:

- Lack of intelligence on reduction in maintenance burden for A38 (including the tunnels), and alternative use of tunnels
- A WebTAG compliant transport model
- Inability to capture transformational impacts
- Definition of the scheme's 'do minimum' and 'do something' options.

The following section outlines in greater detail the implications of these issues for forecasting the scheme's impacts. Subsequently, as a conclusion, the section presents a way forward to tackle such issues to enhance the presentation of the scheme's value for money proposition.

7.2 Reduction in maintenance burden for A38 (including the tunnels) and alternative use of the tunnels

The scheme 'do something' options currently include declassification of A38 through Birmingham city centre. This includes closure of the two tunnels. This is likely to deliver significant savings in Birmingham City Council's maintenance expenditure and any refurbishment costs over a traditional sixty-year appraisal period. Due to data limitations, the appraisal does not include any benefits related to savings in maintenance and refurbishment expenditure resulting from declassification of A38, including closure of the tunnels.

Furthermore, the closure of the tunnels creates two significantly large land assets within Birmingham city centre, which could be released for high value alternative uses (e.g. 'utility tunnels'). Forecasting economic and financial implications of such alternative uses, which are also excluded from the appraisal at present, should be one of the key priorities going forward.

7.3 A WebTAG compliant transport model

The transport model currently follows a WebTAG guidance for undertaking Level 1 modelling associated with fixed land use. This results in inclusion of some very significant demand drivers for highway infrastructure around the city centre, for example the Children's Hospital, throughout the appraisal period. It is understood that the scheme's intervention cases would facilitate relocation of the Children's Hospital, opening the site for a significantly less traffic intensive development.

On a different note the WebTAG compliant model does not assume the lasting behavioural effects of Clean Air Zone (CAZ) changing in Birmingham city centre. Furthermore, to facilitate further behaviour change for accessing Birmingham city centre through sustainable modes as well as to discourage through traffic on A38, there may be a need to consider further options around road usage pricing after the CAZ expires.

Traffic modelling sensitivities such as, relocation of Children's Hospital and other current demand drivers, CAZ impacts and future road pricing options for CAZ boundary should also be included as key priorities going forward.

7.4 Inability to capture transformational impacts

The current modelling of the intervention options suggests that the scheme is likely to result in transport user disbenefit of over £1 billion (2010 prices and values) for motorised traffic over the appraisal period. This is primarily because the declassification of A38, including the closure of the tunnels, would result in longer journeys for existing traffic.

That said, a scheme of this nature, given its location, provides an opportunity to facilitate a significant expansion of Birmingham city centre, which is currently perceived to be constrained by the major severance created by A38.

Although not currently modelled, the estimation of Level 2 wider benefits associated with fixed land use typically relies on traffic modelling outputs. Given the current outputs of the scheme's traffic impacts the estimation of Level 2 wider benefits using WebTAG prescribed methodology would not represent the transformational impact the scheme can facilitate. Although there are no direct comparators, evidence from elsewhere suggests that transport interventions which seek to improve the attractiveness of city centre expansions have a significant potential to create Level 2 wider benefits.

Furthermore, a pessimistic estimation of Level 3 impacts which focuses on enabling approximately 15 hectares of land for expansion of Birmingham city centre, forecasts land value uplift of approximately £30 million (2010 prices and values) net of displacement, Transport External Costs and other adjustments. This analysis adopts Birmingham city centre land values sourced from MHCLG's Land Values for Policy Appraisal (2017). The data indicates that other urban locations, which have been through transformational change as result of transport interventions in the past two / three decades have now achieved per hectare land values almost four times the Birmingham city centre average (e.g. Croydon is reported to have achieved land values of £47 million per hectare for CBD developments). Adopting such transformational land values estimates, along with a much larger expansion of Birmingham city centre has the potential deliver more than £500 million (2010 prices and values) of land value impacts.

Within this content, strengthening the transformational economic case of the scheme's intervention options should also be a key priority going forward.

7.5 Definition of the scheme's options

As highlighted earlier, the scheme 'do something' options currently include declassification of A38 through Birmingham city centre. This includes closure of the two tunnels. Defining the options in such a way results in transport user disbenefit of over £1 billion (2010 prices and values) for motorised traffic over the appraisal period.

A38 through the city centre, including the tunnels, are Birmingham City Council's highway assets. Declassification of the road, including closure of the tunnels, could be a 'financial' decision internalised to Birmingham City Council on the basis of reduction in the maintenance burden and releasing highways assets (including the tunnels) to high value uses.

On a different note, the analysis to date indicates that public transport interventions enhance options' performance. Such options support Council's policy on increasing sustainable travel based accessibility of the city centre.

Subsequently, the Connectivity Project could be present the 'do minimum' and 'do something' as following:

- Do minimum option: Declassified A38 through the city centre (including closure of the tunnels), CAZ until 2026 and subsequent road user charging within the CAZ boundary
- Do something options: ring road improvements and other complementary public transport and park and ride enhancements.

Such an approach will completely diminish the transport user disbenefit of over £1 billion (2010 prices and values) for motorised traffic over the appraisal period.

Within this context, redefining the 'do minimum' and 'do something' options should also be a key priority going forward.

7.6 Conclusions

Although the conventional modelling and appraisal of the scheme's options indicates the project offers poor value for money, even when Level 3 wider benefits are considered, this section highlights the approaches and techniques which could enhance the scheme's value for money proposition. The recommendations, categorised below, should be adopted as the way forward for developing and appraising the Connectivity Project:

- **Financial and Policy:** Internalise the decision on declassification of A38, including closure of the tunnels, as a 'financial' decision for Birmingham City Council, including reuse of former highways assets for high value uses (in line with the Big Moves in the Snow Hill Masterplan)
- **Policy:** Establish the lasting behaviour implications of the CAZ charging, and explore the potential of other future road user charging within the CAZ boundary
- **Appraisal:** Redefine the 'do minimum' option to reflect a declassified A38 (including closure of tunnels) along with CAZ until 2026 and a future road user charge within the CAZ boundary
- **Appraisal:** Redefine the 'do something' options as ring road improvements and other complementary public transport and park and ride enhancements
- **Appraisal:** Model sensitivities such as, relocation of Children's Hospital and other existing demand drivers
- **Appraisal:** Focussed effort on estimating transformation wider benefits (both Level 2 and Level 3).

The above approach to defining the 'do minimum' and 'do something' options, based on relevant new policies, is likely to reduce the Transport Connectivity project's capital costs to approximately £350 million. The revised definition of options and the proposed modelling approaches are likely to result in much higher conventional transport user benefits and wider impacts. This would significantly improve the scheme's value for money proposition.

This work has been undertaken without discussion with Highways England, who are likely to raise questions regarding the potential impact of the scheme on their network. This is one particular element which requires further assessment prior to any discussions commencing.

Appendix A. Scheme details

£0 FW - Full grade sep, West side
£153,800,000 IW - Intermediate, West
£0 SW - Standard West
£0 FE - Full grade sep, East side
£0 IE - Intermediate, East
£0 SE - Standard East

Snow Hill Growth Strategy Option Appraisal Table (DRAFT) - highways package (DS1)

The criteria for appraisal were scored for each option utilising a 7-point scale from +3 to -3 and using colour coding and total scores to aid interpretation and effectiveness. In addition, a column was added to record comments for each option.
No modelling or other quantification of impacts or issues was undertaken at this stage but appropriate professional opinions of those working on the project were used to score each criteria.
No allowance has been made for third party land purchasing and potential service diversion cost, the costs are rudimentary and should not be relied on for any design or construction purposes at this stage

Location	Option	What option is seeking to achieve (traffic and development terms)		Logistical/ deliverability issues (e.g. elevation, Land Constraints)		Environmental Impacts (Visual Intrusion, Noise etc)		Traffic routeing issues (wider reassignment)		Approximate Construction Costs		Total Score	Pacakge FW	IW	SW	FE	IE	SE
		Comments	Score	Comments	Score	Comments	Score	Comments	Score	Cost	Score							
Dartmouth Circus **Providing options for alternative routes to the A38** **Improve air quality within City centre.**	**Option 3 - Grade separated westbound, two way**	Provides free flow for A38 traffic to / from the west, encouraging traffic to use the west side of the Ring Road	3	Level difference between A38 and Ring Road creates engineering uncertainty. Needs to be integrated into New Town Row scheme. Disruption to footpaths through centre of roundabout	-1	No changes to elevated structures. Severance to pedestrians on western footpaths	-1	Potential increase in using other routes as well as the Ring Road.	-1	£20,000,000	2	2		1				
New Town Road and Summer Lane	**Option 3 - A34 overpass and closed Summer Lane**	Reduces traffic opposing ring road traffic at New Town Road junction, so more priority can be given to the ring road. Summer Lane becomes free flow as the junction is removed	2	Positioning of bridge supports may be difficult due to lack of space in central reservation in some areas to the south of the ring road. Overpass will need to be tied into widening at the canal bridge to the south	-3	Elevated structure creates visual impact. Severance to pedestrians crossing the A34	-2	Summer Lane is closed, causing traffic to need to be find alternative route to residential areas	-1	£40,000,000	-2	-6		1				
Summer Lane to Lucas Circus	**Option 1 - Link widening**	Widen into central reservation between Summer Lane and Lucas Circus to provide 3 lanes in each direction	2		0	Increased noise and air quality disturbance	-1		0	£6,000,000	2	3		1				
Lucas Circus	**Option 2 - Remove junction**	Remove the roundabout to make the ring road free flowing in both directions. Provide left in / left out junctions for each side road	3	During construction some short term disruption on a main aterial route	-1		0	Will divert additional traffic to Key Hill Circus. Left turners from side roads will have reduced opportunities to enter ring road	-2	£4,000,000	2	2		1				
Pitsford Street	**Option 1 - Remove right turners**	Close right turn from A4540 Icknield Street to Pitsford Street, so ring road becomes free flowing in both directions, and widen A4540 Icknields Street southbound carriageway into central reservation to provide 3 lanes	3		0	Removes rat run to A457 Spring Hill	1	Closed right turn to Pitsford Street, causing traffic to need to be find alternative route to industrial area	-1	£2,800,000	2	5		1				
Spring Hill	**Option 2c - Convert to signalised crossroads**	Convert roundabout to signalised crossroads	1		0	Reduces severance by providing potential crossing facilities for pedestrians	1	Unlikely to provide signifcant capacity , so likely to be some reassignment of traffic expected	-1	£10,000,000	1	2		1				
Five Ways	**Option 4a - Signalised T-junction, Monument Road changes**	Close the Broad Street slip roads and Harborne Road / Calthorpe Road. Convert the roundabout to a 3-arm signalised T-junction, with 3 lanes in each direction for the major movements along the ring road. Additional capacity provided by widening Monument Road (land acquisition), encouraging Harborne traffic to access Ring Road at Ladywood Circus	3	Could be undertaken within existing junction footprint, however closing Broad Street slips may create some difficult for service of retial frontages	-1	Minimal changes to elevated structures (new structure at grade with existing carriageway). Similar levels of severance as existing layout	0	Broad Street slip roads and Harborne Road / Calthorpe Road are closed, causing traffic to need to be find alternative route to these areas (possibly via Monument Road). Only 1 lane in each direction through underpass due to Metro using one side	-3	£60,000,000	-1	-2		1				
Belgrave Interchange and Bristol Road	**Option 1 - Carriageway realignment and widening**	Reduce A38 Bristol Road to 1 general traffic and 1 bus lane in each direction and realign the junction accordingly. Widen into thrid party land on ring road approaches and eastboudn exit of Belgrave Interchange	2	Will require third party land for widening at Belgrave Interchange	-1	Frees up highway land along Bristol Road for other uses, such as green corridor or other pedestrian friendly zone	1	Reduced capacity to city centre means potential increase in using other routes as well as the Ring Road.	-1	£11,000,000	1	2		1				

Snow Hill Growth Strategy - public transport package (DS2)

	Totals:	**6,865**	**£299,775,000**
		Extra spaces	**Cost estimate**
Wolverhampton Line	Coseley - potential deck on Gough Road. Option to acquire part of Cannon Business Park?	50	£1,750,000
	Tipton - confirm surface expansion. Potential further on NR compouond, 2 or 3 level deck?	375	£13,125,000
	Dudley Port - interchange with Metro. Potential further expansion to Park Lane E car park, consider 2 or 3 levels	120	£4,200,000
	Sandwell & Dudley - second deck to further expand	100	£3,500,000
	Smethwick Galton Bridge	0	£0
	Smethwick Rolfe Street - potential at grade car park (potentially second deck) on Rolfe Street	200	£7,000,000
Stourbridge Line	Stourbridge Junction - potential to be more ambitious with decking proposals. Section of CP by industrial buildings to north of station could be decked. Also tree lining of main car park by station building could provide screening for a 2nd deck here.	150	£5,250,000
	Cradley Heath - potential to CPO private car park land. Further potential to sensitively deck the CPO'd land, so as to not overlook residential properties. Also potential for council owned land and to take over the closed CP.	200	£7,000,000
	Old Hill - potential to acquire businesses of Station Road (near junction). Further option to remove redundant railway embankment to provide larger site	200	£7,000,000
	Rowley Regis - option for derelict site off Cakemore Road/Nimmings Road, walk distance shorter than extreme end of current CP. Pedestrian crossign and signage strategy required. Potential for 2 or 3 storey CP.	900	£31,500,000
	Langley Green - multiple options being explored by TfWM. Plans could be supported with additional funding.	0	£0
	The Hawthorns - a number of options being explored by TfWM. Plans could be supported with additional funding	0	£0
Cross City North	Blake Street - potential to partially deck 'to Birmingham' CP. Only 2nd storey due to residential area	100	£3,500,000
	Butlers Lane - TfWM exploring scheme, more detail needed		£0
	Four Oaks - revisit why main car park not decked. Explore acquisition of Four Oaks House to enable expansion of extension to CP. Car parking on Station Drive (5-8 spaces) would have to be removed to reduce edge friction of access	200	£7,000,000
	Sutton Coldfield - check within Jacobs re Sutton Interchange study. Potential acquisition of Sutton TC car park off Station Street, excavate down to provide ~2 storeys with interchange on top	300	£10,500,000
	Chester Road - existing plans being developed to deck, could support with additional funding. Potential to acquire current industrial uses opposite existing CP on Chester Road, would require enhanced crossing facilities. Potential 3 storey facility)	270	£9,450,000
	Aston - No immediate surrounding opportunity. Could acquire businesses on south side of Lichfield Road (north of railway line) to develop 2 or 3 storey CP with foot overbridge to Birmingham bound platform	700	£24,500,000
Cross City South	Selly Oak - support plans already under development by TfWM. Opportunity to fund additional deck (to give 3 storeys)?	100	£3,500,000
	Bournville - potential to acquire car repair businesses on Mary Vale Road (east of station) to provide decked car park. Not overlooked by residences. Would also serve Stirchley	300	£10,500,000
	Kings Norton - work with Network Rail to reconfigure land and accesses to permit decking of part of site	100	£3,500,000
	Northfield - options developed for surface expansion, support with additional funding	0	£0
	Longbridge - major scheme underway, additional cycle measures to be explored	0	£0
Dorridge/Solihull Line	Corridor not examined	-	£0
Shirley Line	Corridor not examined	-	£0
Rugeley/Walsall Line	Corridor not examined	-	£0
Coventry Line	Corridor not examined	-	£0
Sprint	Support current proposals for five routes to city centre: A34N, A45, Langley-Sutton, Bristol Road, Hagley Road. Potentially provide additional funding to expand measures		£0
Sprint P&R	Work with TfWM to develop options for major P&R sites on Sprint routes. M5 J3, M6 J7, M6 J5? £10m contrib ea. Approx 800 spaces each	2500	£30,000,000
Bus Improvement Corridors	Support proposals for priority improvements on four corridors: A435 Alcester Road, A41 Holyhead Road, A5127 Sutton, A441 Pershore Road		£57,000,000
Cross-city bus services	Support for additional infrastructure to facilitate cross-city bus services		£10,000,000
Walking and cycling improvements	General package for suburban access to transport		£50,000,000

Snow Hill Growth Strategy Option Appraisal Table (DRAFT) - hybrid package (DS3)

£151,000,000	IW - Intermediate, West
£188,275,000	PT
£339,275,000	**Sub-total**
£150,000,000	Assumed tunnel/flyover reconfiguration cost
£489,275,000	**TOTAL**

The criteria for appraisal were scored for each option utilising a 7-point scale from +3 to -3 and using colour coding and total scores to aid interpretation and effectiveness. In addition, a column was added to record comments for each option
No modelling or other quantification of impacts or issues was undertaken at this stage but appropriate professional opinions of those working on the project were used to score each criteria
No allowance has been made for third party land purchasing and potential service diversion cost, the costs are rudimentary and should not be relied on for any design or construction purposes at this stage

Location	Option	What option is seeking to achieve (traffic and development terms)		Logistical/ deliverability issues (e.g. elevation, Land Constraints)		Environmental Impacts (Visual Intrusion, Noise etc)		Traffic routeing issues (wider reassignment)		Approximate Construction Costs		Total Score	Pacakge	
		Comments	Score	Comments	Score	Comments	Score	Comments	Score	Cost	Score		IW	PT
Dartmouth Circus Providing options for alternative routes to the A38 Improve air quality within City centre.	**Option 3 - Grade separated westbound, two way**	Provides free flow for A38 traffic to / from the west, encouraging traffic to use the west side of the Ring Road	3	Level difference between A38 and Ring Road creates engineering uncertainty. Needs to be integrated into New Town Row scheme. Disruption to footpaths through centre of roundabout	-1	No changes to elevated structures. Severance to pedestrians on western footpaths	-1	Potential increase in using other routes as well as the Ring Road.	-1	£20,000,000	2	2	1	
New Town Road and Summer Lane	**Option 3 - A34 overpass and closed Summer Lane**	Reduces traffic opposing ring road traffic at New Town Road junction, so more priority can be given to the ring road. Summer Lane becomes free flow as the junction is removed	2	Positioning of bridge supports may be difficult due to lack of space in central reservation in some areas to the south of the ring road. Overpass will need to be tied into widening at the canal bridge to the south	-3	Elevated structure creates visual impact. Severance to pedestrians crossing the A34	-2	Summer Lane is closed, causing traffic to need to be find alternative route to residential areas	-1	£40,000,000	-2	-6	1	
Summer Lane to Lucas Circus	**Option 1 - Link widening**	Widen into central reservation between Summer Lane and Lucas Circus to provide 3 lanes in each direction	2		0	Increased noise and air quality disturbance	-1		0	£6,000,000	2	3	1	
Lucas Circus	**Option 2 - Remove junction**	Remove the roundabout to make the ring road free flowing in both directions. Provide left in / left out junctions for each side road	3	During construction some short term disruption on a main aterial route	-1		0	Will divert additional traffic to Key Hill Circus. Left turners from side roads will have reduced opportunities to enter ring road	-2	£4,000,000	2	2	1	
Spring Hill	**Option 2c - Convert to signalised crossroads**	Convert roundabout to signalised crossroads	1		0	Reduces severance by providing potential crossing facilities for pedestrians	1	Unlikely to provide signifcant capacity , so likely to be some reassignment of traffic expected	-1	£10,000,000	1	2	1	
Five Ways	**Option 4a - Signalised T-junction, Monument Road changes**	Close the Broad Street slip roads and Harborne Road / Calthorpe Road. Convert the roundabout to a 3-arm signalised T-junction, with 3 lanes in each direction for the major movements along the ring road. Additional capacity provided by widening Monument Road (land acquisition), encouraging Harborne traffic to access Ring Road at Ladywood Circus	3	Could be undertaken within existing junction footprint, however closing Broad Street slips may create some difficult for service of retial frontages	-1	Minimal changes to elevated structures (new structure at grade with existing carriageway). Similar levels of severance as existing layout	0	Broad Street slip roads and Harborne Road / Calthorpe Road are closed, causing traffic to need to be find alternative route to these areas (possibly via Monument Road). Only 1 lane in each direction through underpass due to Metro using one side	-3	£60,000,000	-1	-2	1	
Belgrave Interchange and Bristol Road	**Option 1 - Carriageway realignment and widening**	Reduce A38 Bristol Road to 1 general traffic and 1 bus lane in each direction and realign the junction accordingly. Widen into thrid party land on ring road approaches and eastboudn exit of Belgrave Interchange	2	Will require third party land for widening at Belgrave Interchange	-1	Frees up highway land along Bristol Road for other uses, such as green corridor or other pedestrian friendly zone	1	Reduced capacity to city centre means potential increase in using other routes as well as the Ring Road.	-1	£11,000,000	1	2	1	

		Extra spaces	Cost estimate	Retain for preferred package?
Wolverhampton Line	Tipton - confirm surface expansion. Potential further on NR compouond, 2 or 3 level deck?	375	£13,125,000	1
	Dudley Port - interchange with Metro. Potential further expansion to Park Lane E car park, consider 2 or 3 levels	120	£4,200,000	1
	Smethwick Rolfe Street - potential at grade car park (potentially second deck) on Rolfe Street	200	£7,000,000	1
Stourbridge Line	Old Hill - potential to acquire businesses of Station Road (near junction). Further option to remove redundant railway embankment to provide larger site	200	£7,000,000	1
	Rowley Regis - option for derelict site off Cakemore Road/Nimmings Road, walk distance shorter than extreme end of current CP. Pedestrian crossign and signage strategy required. Potential for 2 or 3 storey CP.	900	£31,500,000	1
Cross City North	Four Oaks - revisit why main car park not decked. Explore acquisition of Four Oaks House to enable expansion of extension to CP. Car parking on Station Drive (5-8 spaces) would have to be removed to reduce edge friction of access	200	£7,000,000	1
	Chester Road - existing plans being developed to deck, could support with additional funding. Potential to acquire current industrial uses opposite existing CP on Chester Road, would require enhanced crossing facilities. Potential 3 storey facility)	270	£9,450,000	1
	Aston - No immediate surrounding opportunity. Could acquire businesses on south side of Lichfield Road (north of railway line) to develop 2 or 3 storey CP with foot overbridge to Birmingham bound platform	700	£24,500,000	1
Cross City South	Selly Oak - support plans already under development by TfWM. Opportunity to fund additional deck (to give 3 storeys)?	100	£3,500,000	1
	Bournville - potential to acquire car repair businesses on Mary Vale Road (east of station) to provide decked car park. Not overlooked by residences. Would also serve Stirchley	300	£10,500,000	1
	Kings Norton - work with Network Rail to reconfigure land and accesses to permit decking of part of site	100	£3,500,000	1
Sprint P&R	M5 J3 Sprint P&R site		£10,000,000	1
Bus Improvement Corridors	Support proposals for priority improvements on four corridors: A435 Alcester Road, A41 Holyhead Road, A5127 Sutton, A441 Pershore Road		£57,000,000	1

Appendix B. Initial Appraisal Summary Table

Appraisal Summary Table

Date produced:	09/09/2019	**Contact:**	
Name of scheme:	Snow Hill Growth Strategy	**Name**	Julia Martin
Description of scheme:	Reconfiguration of the A38 Queensway (including the tunnels and flyover) with an associated package of public transport and highway improvements.	**Organisation**	Birmingham City Council
		Role	Promoter/Official

Impacts		Summary of key impacts	Assessment: Quantitative	Qualitative	Monetary £(NPV)	Distributional 7-pt scale/ vulnerable grp
Economy	Business users & transport providers		Value of journey time changes(£): ; Net journey time changes (£): 0 to 2min: ; 2 to 5min: ; > 5min:			
	Reliability impact on Business users	Journey time reliability due to highway improvements, coupled with increased public transport capacity. Encouragement of commuting trips to city centre to use public transport, thereby retaining capacity for through highway traffic for strategic uses				
	Regeneration	Network resilience supports regeneration of inner suburbs, ensuring reliable journey times on ring road for through traffic				
	Wider Impacts	Public transport improvements will support wider regeneration objectives and transformational change. Supports current trends in changes in travel behaviours amongst younger generations, also provides additional capacity required for housing and employment growth.				
Environmental	Noise	Not yet assessed, but assumed overall to be slightly positive due to improved reliability of ring road and modal shift to public transport. Noise impact on nearby residents during construction				
	Air Quality	Not yet assessed but assumed overall to be slightly positive due to improved reliability of ring road and model shift to public transport. Current air quality issues through the city centre (A38) alignment removed				
	Greenhouse gases	Not yet assessed but assumed neutral	Change in non-traded carbon over 60y (CO2e): ; Change in traded carbon over 60y (CO2e):			
	Landscape	Not yet assessed but assumed neutral				
	Townscape	Not yet assessed but assumed slightly positive due to city centre regeneration and removal of significant barrier to movement				
	Historic Environment	Not yet assessed but assumed neutral				
	Biodiversity	Not yet assessed but assumed neutral				
	Water Environment	Not yet assessed but assumed neutral				
Social	Commuting and Other users	Positive, due to removal of community severance	Value of journey time changes(£): ; Net journey time changes (£): 0 to 2min: ; 2 to 5min: ; > 5min:	Positive		SDIs not yet assessed but assumed impact positive
	Reliability impact on Commuting and Other users	Positive, due to increased network capacity and reduced vehicle network kilometres				
	Physical activity	Positive, due to improved provision for non-motorised users				
	Journey quality	Positive, due to new highway construction and reduction in delays due to increased capacity				
	Accidents	Not yet assessed but assumed slightly positive due to removal of key barrier to movement				SDIs not yet assessed but assumed impact positive
	Security	Not yet assessed but assumed neutral				
	Access to services	Positive, due to removal of barrier to movement, and hence community severance				
	Affordability					
	Severance	Positive, due to removal of barrier to movement, and hence community severance				
	Option and non-use values	Not yet assessed				
Public Account	Cost to Broad Transport Budget					
	Indirect Tax Revenues					

Appendix C. Modelling and Economic Appraisal Report

JACOBS

Snow Hill Growth Strategy: PRISM Traffic Modelling and Economic Appraisal Report

Highways and Public Transport Interventions

01| 02

January 2020

Snow Hill Growth Strategy: PRISM Traffic Modelling and Economic Appraisal Report

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Jacobs U.K. Limited

7th Floor, 2 Colmore Square
38 Colmore Circus Queensway
Birmingham, B4 6BN
United Kingdom
T +44 (0)121 237 4000
F +44 (0)121 237 4001
www.jacobs.com

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Revision	Date	Description	By	Review	Approved
01	Sep 2019	First Draft	S Mostafizur, J Smethurst	H Thogulava	S Bingham
02	Jan 2020	Final version	S Mostafizur, J Smethurst	H Thogulava	N Davies

Contents

1. Introduction

Jacobs has been commissioned by Birmingham City Council (BCC) to undertake the Snow Hill Growth Strategy Transportation and Connectivity works. This involves, amongst other measures, developing transport interventions to enhance the local and regional connectivity including measures such as looking at different options for the central section of the A38 Queensway including re-routing it to an upgraded ring road; creating new public thoroughfares through Snow Hill enhancing north-south and east west connections.

Among 3 options that were considered, it was decided that the following preferred mitigation option for the central section of the A38 through the city centre would be a hybrid option (DS3) of the following two options:

- Do Something Option 1 (DS1) – Infill tunnels & explore different options for the central section of the A38 including Transformational Urban Realm scheme + Improve Ring Road; and
- Do Something Option 2 (DS2)– Infill tunnels & explore different options for the central section of the A38 including Transformational Urban Realm scheme + Major Public Transport Package.

It was anticipated that neither of the options would be as extensive as required to totally mitigate the impacts of the different options for the central section of the A38 and would be considered to have budgetary considerations. The schemes should build upon those already committed by BCC in terms of both public transport and highway schemes, including through the Clean Air Zone and other relevant significant schemes. However, later it was decided not to include the clean air zone considering the long-term impact of the scheme.

As outlined above, scenarios will be considered, one with highways interventions as the major mode (and public transport the minor) and the other with major investment in public transport options supported by selected highways measures.

It should be noted that a preliminary modelling was undertaken to understand the required highway mitigations utilising the 2031 forecast SATURN Birmingham City model based on old 2015 SATURN Base model (OAR 18 July 2018 Final Issue). It is understood that the tunnel closure and other interventions will have a significant impact on mode choice and destination choice. Hence, it was decided to use the Policy Responsive Integrated Strategy Model (PRISM) demand model for further impact assessment study and economic appraisal in the absence of any other Demand model. As an outcome of the study a number of schemes have been proposed which have been tested in the current study using PRISM 5.2.1. 2026 has been considered as the scheme assessment year.

1.1 Structure of the report

This report is structured as follows;

- Section 2 discusses PRISM 5.2.1 overview;
- Section 3 discusses the forecast scenario modelled;
- Section 4 discusses the forecasting results;
- Section 5 discusses the economic impacts of the options; and
- Section 6 draws conclusion for the report.

2. PRISM 5.2.1 Overview

2.1 Introduction

Initially PRISM 5.1 was recommended for assessing the Snow Hill Growth strategy. Mott Macdonald (MM) provided PRISM 5.1 Models that comprised of the 2026 forecast year core scenario which has been considered as the reference case for this study. JACOBS completed a test run of Option 1. Prior to proceeding with the Option 2, it was revealed that PT model within the PRISM 5.1 suite required further update to include revised bus time table. Following the update, PRISM 5.2.1 was issued to JACOBS.

This chapter summarises the PRISM 5.2.1 modelling suite and its specifications.

2.2 PRISM 5.2.1

PRISM is a multi-modal disaggregate demand model of the West Midlands Metropolitan Area. The model comprises separate highway and Public Transport (PT) assignment models linked together with a demand model. It is a 4-stage multi-modal model. The PRISM 5.0 base model was last updated in 2016. The highway and the PT model were developed in VISUM software version 16 whilst the demand model was built based on Alogit software. The interaction between those models are executed through VBA and Python Scripts.

2.2.1 PRISM Highway Model (HAM) Overview

The HAM model is comprised of 996 zones and following 5 user class have been modelled:

- Car Business;
- Car Work;
- Car Other;
- LGV; and
- HGV.

The model represents average one-hour peak of the following peak period:

- AM peak period 0700-0930 hours;
- Inter peak period 0930-1530 hours; and
- PM peak period 1530-1900 hours

The assignment procedure used for the HAM model is an interaction between path based equilibrium assignment and a junction delay calculation, called Intersection Capacity Analysis (ICA). In Visum it is the delay (travel time) on link/turn that is estimated, and the Volume delay Function (VDF describes how this time increases as the traffic flow increases.

2.2.2 PRISM Public Transport Model (PTAM) Overview

The PTAM model is comprised of 1905 zones including 48 dedicated train and metro stations Park and Ride (P&R) zones. There are 7 user class as follows:

- Bus-Fare;
- Metro-Fare;
- Train-Fare;
- Bus-No Fare;
- Metro-No Fare;
- Train-No Fare; and
- Train Long Distance.

The model represents an average two-hour peak of the following peak periods:

- AM peak period 0700-0930 hours;
- Inter peak period 0930-1530 hours; and
- PM peak period 1530-1900 hours.

The demand model includes Park and Ride and kiss and ride at 48 Metro and rail stations. All P&R sites are assumed as free. The P&R choice comes under rail and metro as sub-mode choice. Local airport passenger and HS2 passengers are also included in the mode and destination choice model.

2.2.3 PRISM Demand Model (VDM) Overview

PRISM 24-hour demand model was built in Alogit software. It comprises of the following 3 components:

- The Population Model generates zonal demographic values and car ownership levels from the input planning data, based on given set of demographic data;
- The Travel Demand Model comprises of Time Period Choice, Destination choice and Mode Choice; and generates synthetic travel demand by purpose and distributes across modes and destinations;
- Final Processing model converts synthetic demand from 24hr PA to time period OD and applies the changes between base and forecast synthetic demand to the base calibrated matrices.

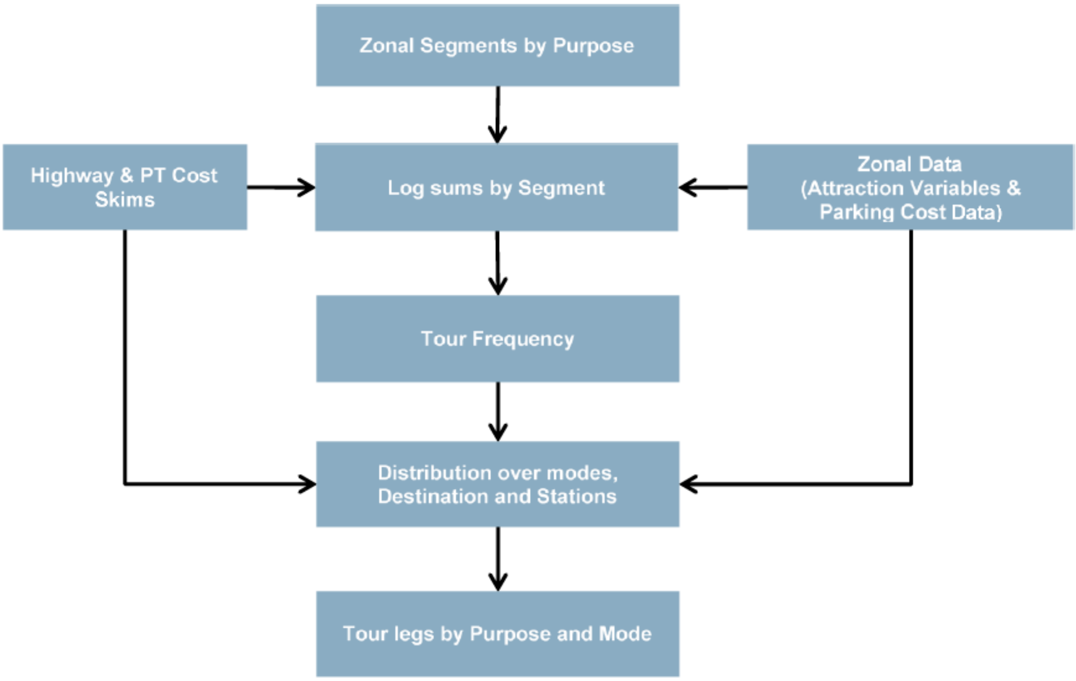
a. Population Model

It has three sub processes. Prototype sampling, expands the base Household Interview Survey samples to defined PRISM zonal planning data target. Car ownership model calculates the car ownership probabilities for each household in the prototype sample and predicts the probability of having number of cars in each household based on household income, household licence holding and other demographic data. The car ownership model then expands these predictions to the predicted number of households in each zone; Finally, output from both the prototype sampling and car ownership data are combined and zonal forecast population is aggregated by socio-economic segmentation and purpose. The zonal population segments by purpose are produced as separate files for each home-based purpose. Each file gives the number of persons in each model zone for each of the segments relevant for that travel purpose.

b. Travel demand Model

The Travel Demand Model calculates total travel demand by purpose by applying tour frequencies to zonal population segments provided by the Population Model. The output from the Travel Demand Model consists of tour legs by purpose, mode and time period and are in Production-Attraction format. It follows a demand model hierarchy among the mode choice, time period choice and destination choice for different purposes Within the model choice it uses the following hierarchy as shown in Figure 2.1.

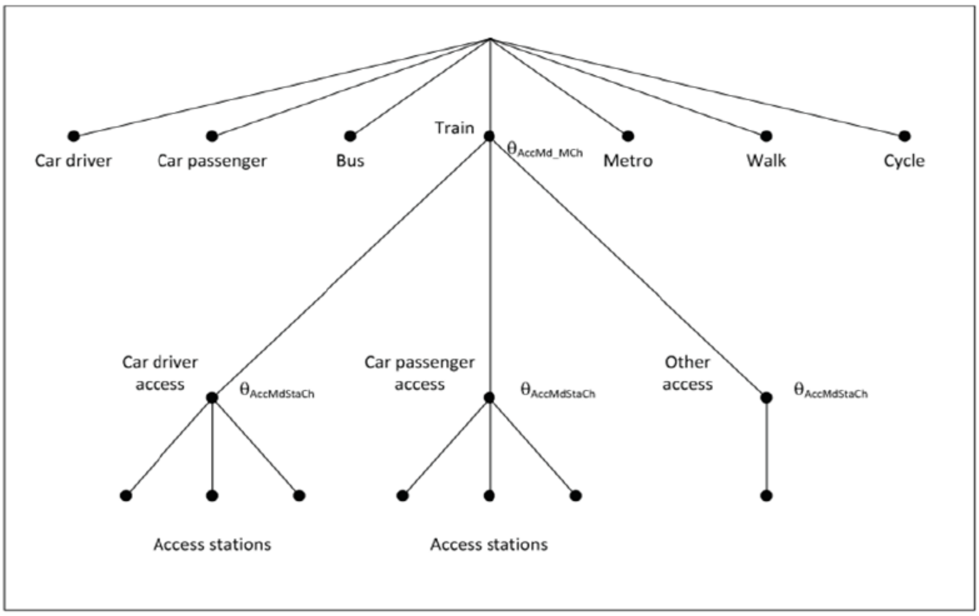
Figure 2-1: Demand Model Processes



Source: PRISM 5.0 LMVR

Figure 2.2 Shows the mode choice model structure used within the Demand model. Although it shows that P&R is sub-mode under train, metro also has got similar sub-mode choice for P&R trips.

Figure 2-2: Mode Choice Model Structure



Source: PRISM 5.0 LMVR

The Travel Demand Model represents 24-hrs in a typical weekday, and uses the following time period intervals:

- AM Peak 0700-0930 hours;
- IP 0930-1530 hours;
- PM peak 1530-1900 hours; and
- Off peak 1900-0700 hours.

c. Final Process Model

Under this stage the VDM process converts 24-hr PA-based synthetic tour matrices into time period OD-based trips matrices, and sums across the purposes to produce synthetic matrices at the assignment user-class level.

This is then followed by a pivoting process that makes incremental adjustments to the validated base highway and PT assignment matrices, based on the changes between the synthetic base and synthetic future matrices

- Pivoting Process

The preferred approach to pivot-point forecasting is to apply the ratio of model outputs for base and forecast situations as a growth factor to the base matrix – in a given cell the predicted number of trips P is given by

$$P = B \cdot \frac{Sf}{Sb}$$

where:

B is the base matrix

Sb is the base year synthetic trips

Sf is the future year synthetic trips.

Source: PRISM 2011 Base Demand Model Implementation Report by Rand Europe

As the calculation is applied cell by cell basis, there are instances where cells in any of the three matrices or all of the matrices could be zero. Rand Europe identified 8 pivoting cases to deal with these instances.

Table 2-1: Pivoting Cases

<table>
<tr><th>Case</th><th>Base (B)</th><th>Synthetic base (Sb)</th><th>Synthetic future (Sf)</th><th colspan="2">Predicted (P)</th></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td colspan="2">0</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>>0</td><td colspan="2">Sf</td></tr>
<tr><td>3</td><td>0</td><td>>0</td><td>0</td><td colspan="2">0</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">0</td><td rowspan="2">>0</td><td rowspan="2">>0</td><td>Normal growth, ($Sf < X_1$)</td><td>0</td></tr>
<tr><td>Extreme growth ($Sf > X_1$)</td><td>$Sf - X_1$</td></tr>
<tr><td>5</td><td>>0</td><td>0</td><td>0</td><td colspan="2">B</td></tr>
<tr><td>6</td><td>>0</td><td>0</td><td>>0</td><td colspan="2">$B + S_f$</td></tr>
<tr><td>7</td><td>>0</td><td>>0</td><td>0</td><td colspan="2">0</td></tr>
<tr><td rowspan="2">8</td><td rowspan="2">>0</td><td rowspan="2">>0</td><td rowspan="2">>0</td><td>Normal growth ($Sf < X_2$)</td><td>$B.Sf/Sb$</td></tr>
<tr><td>Extreme growth ($Sf > X_2$)</td><td>$B.X_2/Sb + (Sf - X_2)$</td></tr>
</table>

where:

$$X_1 = X_2 = 5Sb$$

Source: PRISM 2011 Base Demand Model Implementation Report by Rand Europe

- Normalisation Process

Normalisation was undertaken to reduce sparsity in the base matrix and to retain the distribution of the synthetic matrix. After pivoting process at the cell level, a normalisation factor was applied to the origin trips (row level) so that the predicted growth in trips at the origin level is equal to the growth predicted between the synthetic future and base.

2.2.4 Model Limitations

There are some key limitations of the demand model. It does not model PT crowding and PT capacity is unrestrained. Similarly, it does not specify car park capacity for normal car parks i.e. city centre car parks and capacity is not constrained. Airport passengers do not have metro as their mode choice. A major limitation with the PT model is that it is not dynamic in nature (i.e., not included in the demand model re-assignment loop) and does not take account of highway network congested speeds.

2.2.5 PRISM Forecast Model Overview

The core PRISM 5.2.1 forecast model has three forecast year models as follows:

- 2026
- 2036
- 2046

It predicts growth based on demographic, future planning and economic data and in-built car ownership model.

3. Forecast Modelling

3.1 Introduction

PRISM 5.2.1 forecast models for 2026 were used to assess the transport interventions measures. Due to the strategic characteristics of this study and programme constraints, it was agreed to use a proportionate approach and not use the 2036 and 2046 models to assess the impacts of the transport interventions. Outputs form the 2026 models aim to provide an initial understanding of the potential impacts and serve as an evidence base to progress the study further.

This chapter describes the processes to assess various options and the modelling assumptions.

3.2 Modelling Scenario

The following scenarios have been modelled for this study:

1. Do Minimum (DM);
2. Do Something 1 (DS1) – Option 1;
3. Do Something 2 (DS2) – Option 2; and
4. An option combining DS1 and DS2, Do Something 3 (DS3) – Option 3;

3.2.1 Do Minimum Model (DM)

The Do Minimum model (DM) is based on the 2026 PRISM 5.2.1 forecast model as received from MM. It includes refinements to the highway network to reflect committed schemes in Digbeth and Paradise circus in Birmingham city centre. The remaining highway network, all of the PT network and demands remain unchanged from the donor model. The model was run through the demand model which shows minor changes when compared to the donor model.

3.2.2 Do Something 1 (DS1) Model

The scenario comprises 8 (eight) proposed highway interventions as described below and locations are shown in Figure 3.1:

1. Grade Separated Westbound Two Way at Dartmouth Circus and existing A38 carriageway underpass has been proposed to be closed for all traffic except buses;
2. 2 lanes-2 ways A34 over pass over the A4540 Newtown Middle way and closure of summer lane in both directions except for buses with bus gates;
3. Widening of A4540 Newtown Middle Way into central reservation between Summer Lane and Lucas Circus to provide 3 lanes in each direction;
4. Altering the Lucas Circus roundabout to a Priority junction to make the ring road free flowing in both directions and widening into central reservation to the east of roundabout to provide 3 lanes in each direction;
5. Conversion of Spring Hill roundabout to a signalised cross road junction;
6. Conversion of 5 ways roundabout to a signalised T-junction. Hagley road / Broad street underpass is completely closed for the general traffic except for metro and buses. Proposed closure of Harborne

road / Calthorpe road for access / exit to the ring road and widening of Monument road to relieve pressure to two lanes in the northbound direction using BCC-owned land;

7. Reconfiguring the Belgrave Interchange and Bristol Road junction within existing boundaries to provide enhanced turning capacities and far reduced capacity onto Bristol Street (one lane plus bus lane ahead only);

8. Closing the A38 tunnel in Birmingham City centre.

Figure 3-1: Location of the proposed Highway Interventions

The details of each interventions have been attached in Appendix A.

It should be noted that Scheme 5 (Alteration of Spring Hill junction) resulted in illogical traffic redistribution during model assignment. This is due to the PRISM model limitations (VISUM) that is highly sensitive under congested conditions to signal timings as opposed to 'give-way' rules at priority junctions and roundabouts (where the model under-estimates delay). Considering the time scale and scope of the study, the rectification of this problem was not possible as it had the potential to affect other junctions within the model. Hence, the scheme was not particularly coded in DS1.

The public transport network and services remains unchanged in this option.

3.2.3 Do Something 2 (DS2) Model

The scenario focussed on the public transport interventions by the following improvements:

1. Park and Ride Car Park Capacity enhancement as shown in Table 3.1 resulting in an additional 3665 parking spaces. In addition, the proposal also includes building a new P&R car park at Aston station with 700 spaces to attract car users using the A38 and A5127. Modelling the Aston station car park within PRISM requires significant revisions to the demand model structure (introducing P&R as a sub-

mode choice under private mode) or changing the zones dimensions within the existing structure, both of which were considered dis-proportionate to this study without impacting the programme.

Table 3-1: Park and Ride Capacity Enhancement in DS2

Line	Model Station(s)	Car Park Spaces in DM	Car Park Spaces in DS2	Change in car park spaces (DS2 – DM)
Wolverhampton Line	Coseley	95	145	50
	Tipton and Dudley Port	147	642	495
	Sandwell & Dudley	393	493	100
	Smethwick Galton Bridge	77	277	200
Stourbridge Line	Stourbridge Junction	1069	1219	150
	Cradley Heath	545	745	200
	Old Hill	54	254	200
	Rowley Regis	741	1641	900
Cross City North	Blake Street	151	251	100
	Four Oaks	266	466	200
	Sutton Coldfield	569	869	300
	Wylde Green and Chester Road	237	507	270
Cross City South	Selly Oak	454	704	250
	Kings Norton	314	564	250
Total		**5112**	**8777**	**3665**

2. In the case of the Highway network, only Scheme 8 (closure of A38 tunnels in Birmingham city centre) described in section 2.2.1 has been included in DS2 model.

3.2.4 Do Something 3 (DS2) Model

The outputs from the DS1 and DS2 scenario were analysed and a hybrid option developed based on the analysis. The hybrid option includes -

1. Enhancing capacity at selected train station car parks as shown in Table 3.2 resulting in 2565 additional car park spaces

Table 3-2: Park and Ride Capacity Enhancement in DS3

Line	Model Station(s)	Car Park Spaces in DM	Car Park Spaces in DS3	Change in car park spaces (DS3 – DM)
Wolverhampton Line	Coseley	95	95	0
	Tipton and Dudley Port	147	642	495
	Sandwell & Dudley	393	393	0
	Smethwick Galton Bridge	77	277	200
Stourbridge Line	Stourbridge Junction	1069	1069	0
	Cradley Heath	545	545	0
	Old Hill	54	54	0
	Rowley Regis	741	1641	900
Cross City North	Blake Street	151	151	0
	Four Oaks	266	466	200
	Sutton Coldfield	569	569	0
	Wylde Green and Chester Road	237	507	270
Cross City South	Selly Oak	454	704	250
	Kings Norton	314	564	250
Total		**5112**	**7677**	**2565**

2. Bus Corridor priority improvements along four corridors serving Birmingham city centre: A435 Alcester Road, A41 Holyhead Road, A5127 Sutton, A441 Pershore Road. These bus corridor improvements aim to reduce the bus travel times. As the PRISM PT assignment is time-table based, changing time-tables to all services operating along these routes to generate cost skims for input to the demand model was too onerous. Trial runs amending the time-table resulted in the model crashing in the process.. Hence, an alternative methodology was adopted, and assumptions applied to reflect the benefit of bus corridor improvements. A 5% reduction to bus in-vehicle time was assumed for all bus journeys made along these four corridors. The origin-destination movements that use bus along these corridors were extracted using Flow Bundle (similar to select link analysis in SATURN) matrices and a 5% reduction applied to the corresponding cell values of the In-Vehicle time skims prior to input into the Demand model run.

3. Highway improvement options were as in DS1.

4. Model Results and Analysis

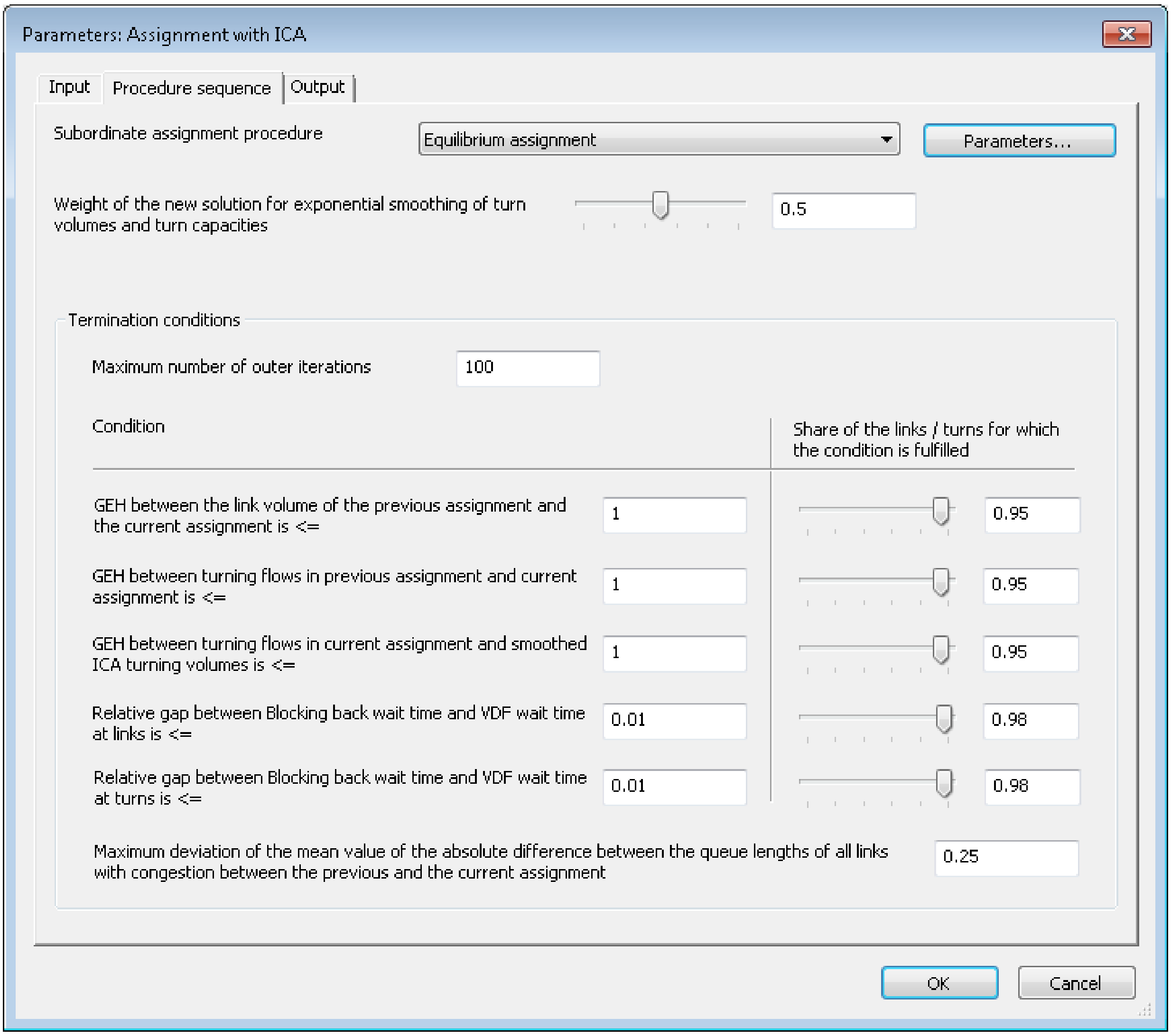
4.1 Introduction

This Chapter discusses the model convergence and outputs from the different scenarios against the DM outputs.

4.2 Model Convergence

The Highway model convergence criteria were retained as in the donor PRISM models and shown in Figure 4.1.

Figure 4-1: Convergence Criteria Set in PRISM Highway Model



The highway model convergence for all the scenarios is shown in the Table 4.1. It shows that all the models have converged satisfactorily.

Table 4-1: Highway Model Convergence Results

Scenario	AM		IP		PM	
	No. of Assignment Loop	%GAP	No. of Assignment Loop	%GAP	No. of Assignment Loop	%GAP
2026 DM	14	0.00009	12	0.00021	26	0.00003
2026 DS1	20	0.00004	12	0.00011	84	0.00004
2026DS2	13	0.00015	9	0.00008	20	0.00021
2026DS3	13	0.00020	15	0.00005	31	0.00014

It should be noted that the GAP in VISUM is the assignment gap and not the assignment-simulation gap as required by TAG. The GAP in VISUM has been defined as below:

"GAP= (vehicle impedance- Hypothetic Vehicle Impedance)/Hypothetic Vehicle Impedance

Minimum Hypothetic Impedance value calculate hypothetically for the next iteration step on the assumption that all vehicles, based on the current impedance in the network, use the best path."

Demand model converged to GAP values below 0.1% in all scenarios except DM scenario with a gap of 0.12% which is significantly lower than the TAG recommended value of 0.2%. The convergence of the demand models reflects a well converged highway model.

Table 4.2 shows the demand model convergences for the different scenarios.

Table 4-2: Demand Model convergence

Scenario	No. of Assignment Loop	%GAP
2026 DM	8	0.12
2026 DS1	10	0.08
2026 DS2	9	0.09
2026 DS3	9	0.09

4.3 Overall Demand Matrix Comparison

The 2026 post VDM demand outputs for 24-hr period have been compared for different scenarios and are presented in Table 4.3. It should be noted these demands are the synthetic outputs before the pivoting process is undertaken. After pivoting the demand matrices were converted into the peak period matrices prepared for the input into the PT and Highway assignment models.

Table 4-3: 24-Hr Demand Comparison in 2026 Model Scenario

Mode	All Purpose 24-Hr Demand in Person Trips			
	Post-VDM			
	DM	DS1	DS2	DS3
Car	1784267	1779736	1778839	1778343
Bus	1161701	1164572	1163889	1165632
Metro	13042	13086	13029	13041
Rail	524903	525138	527174	526505
Active Mode	1304001	1305310	1305365	1304994
PT Total	**1699645**	**1702796**	**1704092**	**1705177**
All Mode	**4787914**	**4787842**	**4788297**	**4788514**

The results also have been shown as bar chart in Figure 4.2.

Table 4.4 shows the demand differences between the different scenarios and Table 4.5 shows the percentage change between the scenarios.

Table 4-4: 24-Hour Demand Differences (Person Trips) Among Different Scenario

Mode	Post-VDM Differences					
	DS1-DM	DS2-DM	DS3-DM	DS2-DS1	DS3-DS1	DS3-DS2
Car	-4531	-5428	-5924	-896	-1392	-496
Bus	2871	2188	3931	-683	1059	1743
Metro	44	-13	-1	-56	-45	12
Rail	236	2271	1602	2036	1366	-669
Active Mode	1309	1364	993	55	-316	-371
PT Total	**3151**	**4447**	**5532**	**1296**	**2381**	**1085**
All Mode	**-72**	**383**	**601**	**455**	**672**	**217**

Table 4-5: 24-Hour Demand Differences (Person Trips) in Percent Among Different Scenario

Mode	Post-VDM % Differences					
	DS1-DM	DS2-DM	DS3-DM	DS2-DS1	DS3-DS1	DS3-DS2
Car	-0.25%	-0.30%	-0.33%	-0.05%	-0.08%	-0.03%
Bus	0.25%	0.19%	0.34%	-0.06%	0.09%	0.15%
Metro	0.34%	-0.10%	-0.01%	-0.43%	-0.34%	0.09%
Rail	0.04%	0.43%	0.31%	0.39%	0.26%	-0.13%
Active Mode	0.10%	0.10%	0.08%	0.00%	-0.02%	-0.03%
PT Total	**0.19%**	**0.26%**	**0.33%**	**0.08%**	**0.14%**	**0.06%**
All Mode	**0.00%**	**0.01%**	**0.01%**	**0.01%**	**0.01%**	**0.00%**

The above analysis shows that DS1 highway only option reduced car trips by 4500 trips due to the A38 tunnel closure with most trips transferring to bus followed by active modes. In DS2, where rail station park and ride capacity was increased by 3600 spaces at different locations around Birmingham, the rail trips increased by over 2200 trips (0.43%) when compared against the DM. When compared against DS1, rail trips under DS2 increase by 2000 trips drawing demand from both car and bus modes. The preferred option DS3 included increases in rail station car park spaces by over 2500 spaces in selected locations based on the P&R demand observed in DS2. In addition, 4 bus corridors were improved. As a result, car trips reduction is more pronounced (by almost 6000 trips) when compared to DM with mode shift to buses being the highest. When compared to DS1, both bus and rail demand increases whereas when compared to DS2, only bus demand increases whilst rail demand decreases as they are drawn to buses. The active mode demand reduces under DS3 when compared to both DS1 and DS2 options.

As mentioned in Section 2.2.3, the 24-hour demand was later pivoted off the base and the demand distribution normalised with synthetic demand. The demand was processed to prepare the Highway and PT peak hour demand matrices.

Table 4.6 to Table 4.8 shows the AM, IP and PM modelled demand for both highway and PT model under different scenarios. The tables also include the difference between the DM demand.

Table 4-6: Demand Comparison in AM Peak for Both Highway and PT

Purpose	Base	DM	DS1	DS2	DS3
	Hourly Highway Demand in Vehicles				
Car Business	49860	54418	54354	54355	54347
Car Commuter	253561	270336	269839	270070	269901
Car Other	199300	222648	222029	222074	222009
LGV	24404	50363	50363	50363	50363
HGV	43156	24282	24282	24282	24282
Highway Total	570280	622047	620866	621144	620900
Highway Trip Diff.			DS1-DM	DS2-DM	DS3-DM
			-1181	-903	-1147
PT Segment	Average 2-Hour PT Demand in Person Trips				
	Base	DM	DS1	DS2	DS3
PT_F	44178	46806	47024	47048	47158.601
PT_NF	39387	39382	39632	39743	39775.041
PT_Total	83565	86188	86655	86791	86934
PT Trip Diff			DS1-DM	DS2-DM	DS3-DM
			467	603	746

Table 4-7: Demand Comparison in Inter Peak for Both Highway and PT

Purpose	Base	DM	DS1	DS2	DS3
	Hourly Highway Demand in Vehicle				
Car Business	39802	43645	43592	43581	43570
Car Commuter	76260	82774	82722	82917	82808
Car Other	340242	373784	373209	373236	373131
LGV	43767	51077	51077	51077	51077
HGV	24117	23996	23996	23996	23996
Highway Total	**524188**	**575275**	**574595**	**574807**	**574582**
Highway Trip Diff.			DS1-DM	DS2-DM	DS3-DM
			-680	-469	-693
PT Segment	Average 2-Hour PT Demand in Person Trips				
	Base	DM	DS1	DS2	DS3
PT_F	32192	32991	33089	33094	33141.97817
PT_NF	35228	35730	35859	35893	35925.10393
PT_Total	67420	68721	68948	68987	69067
PT Trip Diff			DS1-DM	DS2-DM	DS3-DM
			227	266	346

Table 4-8: Demand Comparison in PM Peak for Both Highway and PT

Purpose	Base	DM	DS1	DS2	DS3
	Hourly Highway Demand in Vehicle				
Car Business	54534	59304	59240	59238	59235
Car Commuter	238932	255218	254781	255049	254920
Car Other	268207	295307	294633	294676	294580
LGV	34754	40558	40558	40558	40558
HGV	19561	19463	19463	19463	19463
Highway Total	**615987**	**669850**	**668675**	**668984**	**668755**
Highway Trip Diff.			**DS1-DM**	**DS2-DM**	**DS3-DM**
			-1175	-866	-1094
PT Segment	**Average 2-Hour PT Demand in Person Trips**				
	Base	**DM**	**DS1**	**DS2**	**DS3**
PT_F	47002	49424	49620	49641	49740.07
PT_NF	46572	46445	46705	46781	46842.727
PT_Total	93574	95869	96325	96423	96583
PT Trip Diff			**DS1-DM**	**DS2-DM**	**DS3-DM**
			456	554	714

The above table shows that car trips reduce under all DS scenarios across the three model periods with DS2 having the least reduction. This contradicts the patterns from the synthetic 24-hr demand changes shown in Table 4.4 that shows DS2 has greater reduction in car trips than DS1. Investigation of the model outputs revealed that the PRISM pivoting and normalising process resulted in matrix changes to ensure the observed demand distribution patterns are not significantly distorted.

Additional analysis was undertaken based on two cordon areas around the Birmingham city centre as shown in Figure 4-2 to understand the impact of the A38 tunnels closure. The cordons were defined inside and outside the A4540 ring road to assess demand that potentially uses the alternative routes to the A38 via the city centre.

Figure 4-2: Cordon Locations for Comparing the Impact of A38 Tunnel Closure

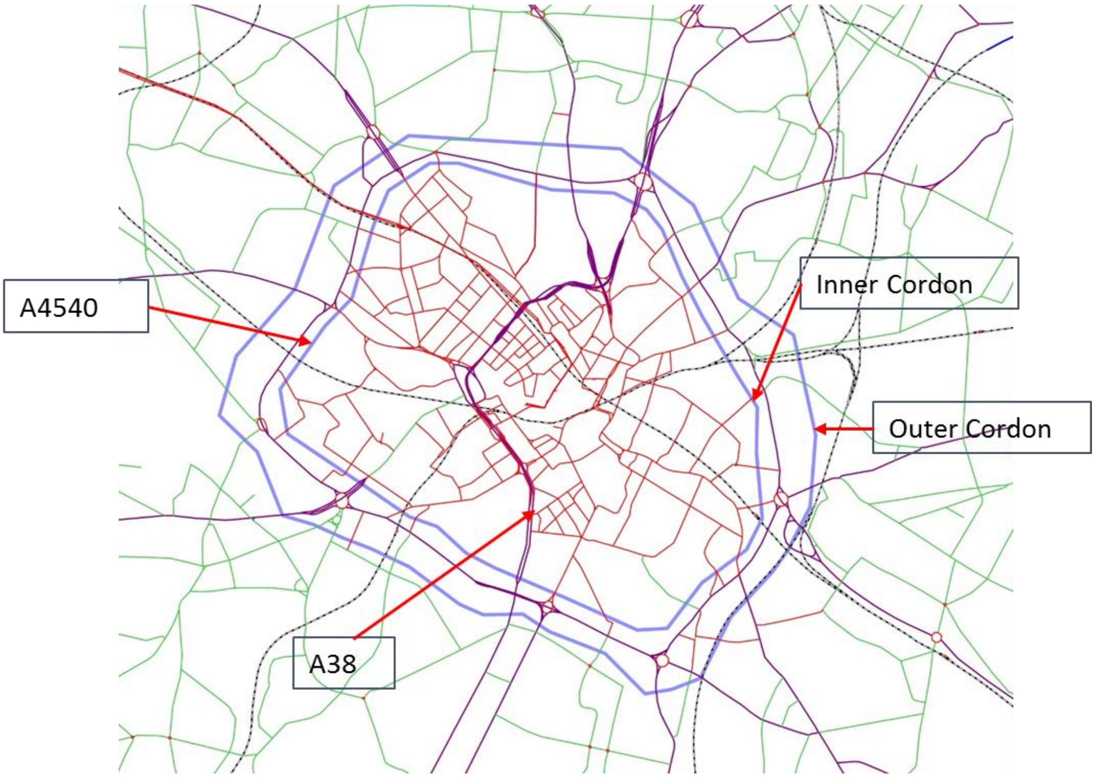


Table 4.9 and Table 4.10 show the Highway demand comparison for the inner and outer cordon for all model periods.

Table 4-9: One-Hour Inner Cordon Highway Demand (Vehicle) Comparison

Purpose	DM	DS1	DS2	DS3
AM				
Car Business	3877	3409	3470	3410
Car Commuter	20179	18053	18387	18086
Car Other	7656	6707	6905	6719
LGV	1018	890	891	891
HGV	1787	1577	1577	1577
Total	**34517**	**30636**	**31231**	**30683**
Difference		**DS1-DM**	**DS2-DM**	**DS3-DM**
		-3881	**-3286**	**-3834**
IP				
Car Business	3767	3337	3391	3332
Car Commuter	7130	6545	6632	6532
Car Other	16950	15451	15686	15395
LGV	1083	975	975	976
HGV	1951	1731	1730	1735
Total	**30882**	**28039**	**28414**	**27970**
Difference		**DS1-DM**	**DS2-DM**	**DS3-DM**
		-2843	**-2468**	**-2911**
PM				
Car Business	4398	3949	4003	3948
Car Commuter	18740	16953	17202	16965
Car Other	12236	11099	11278	11078
LGV	700	616	616	616
HGV	1220	1083	1083	1083
Total	**37293**	**33700**	**34181**	**33690**
Difference		**DS1-DM**	**DS2-DM**	**DS3-DM**
		-3593	**-3112**	**-3603**

Table 4-10: One-Hour Outer Cordon Highway Demand (Vehicle) Comparison

Purpose	DM	DS1	DS2	DS3
AM				
Car Business	4739	4274	4301	4272
Car Commuter	23946	21527	21830	21597
Car Other	10155	8750	8971	8749
LGV	1523	1461	1458	1461
HGV	2485	2361	2360	2365
Total	**42848**	**38373**	**38921**	**38443**
Difference		**DS1-DM**	**DS2-DM**	**DS3-DM**
		-4475	**-3927**	**-4405**
IP				
Car Business	4630	4189	4224	4183
Car Commuter	8407	7794	7826	7766
Car Other	20838	18925	19182	18864
LGV	1681	1625	1618	1627
HGV	2682	2562	2558	2558
Total	**38238**	**35095**	**35407**	**34998**
Difference		**DS1-DM**	**DS2-DM**	**DS3-DM**
		-3143	**-2831**	**-3240**
PM				
Car Business	5245	4729	4810	4747
Car Commuter	22402	20090	20534	20120
Car Other	15290	13579	13927	13583
LGV	1075	1021	1021	1021
HGV	1653	1552	1558	1554
Total	**45666**	**40970**	**41850**	**41025**
Difference		**DS1-DM**	**DS2-DM**	**DS3-DM**
		-4695	**-3815**	**-4641**

The tables show that the demand through both cordons reduce under all DS options compared to the DM flows through the cordon. The reduction in the outer cordons are greater than the inner cordons as would be expected as vehicles routes along better alternatives in the absence of A38 tunnels being open to traffic.

Similar to the Highway demand comparison the public transport passenger demand within the inner and outer cordon for all peaks were extracted and the results shown in Table 4.11 to Table 4.12

Table 4-11: 2-Hour Inner Cordon PT Passenger Flow Comparison

Purpose	DM	DS1	DS2	DS3
AM				
PT Fare	31566	31909	31955	32182
PT No-Fare	33407	33811	34033	34154
Total	**64973**	**65720**	**65988**	**66337**
Difference		**DS1-DM**	**DS2-DM**	**DS3-DM**
		746	**1014**	**1363**
IP				
PT Fare	20995	21174	21170	21338
PT No-Fare	23043	23301	23363	23536
Total	**44038**	**44474**	**44533**	**44874**
Difference		**DS1-DM**	**DS2-DM**	**DS3-DM**
		436	**495**	**835**
PM				
PT Fare	32607	32926	32939	33176
PT No-Fare	33954	34380	34521	34742
Total	**66560**	**67305**	**67460**	**67917**
Difference		**DS1-DM**	**DS2-DM**	**DS3-DM**
		745	**900**	**1357**

Table 4-12: 2- Hour Outer Cordon PT Passenger Flow Comparison

Purpose	DM	DS1	DS2	DS3
AM				
PT Fare	32705	33089	33124	33368
PT No-Fare	35179	35580	35801	35924
Total	**67883**	**68669**	**68925**	**69291**
Difference		**DS1-DM**	**DS2-DM**	**DS3-DM**
		785	**1041**	**1408**
IP				
PT Fare	21639	21831	21826	21998
PT No-Fare	24089	24356	24417	24591
Total	**45727**	**46188**	**46242**	**46589**
Difference		**DS1-DM**	**DS2-DM**	**DS3-DM**
		460	**515**	**862**
PM				
PT Fare	33999	34357	34365	34615
PT No-Fare	36417	36862	37004	37227
Total	**70416**	**71219**	**71369**	**71841**
Difference		**DS1-DM**	**DS2-DM**	**DS3-DM**
		802	**953**	**1425**

As the PT services are adversely affected by the closure of the A38 tunnels, the demand increases between the two cordons are comparable under each of the scenarios.

4.4 Park and Ride Demand Changes

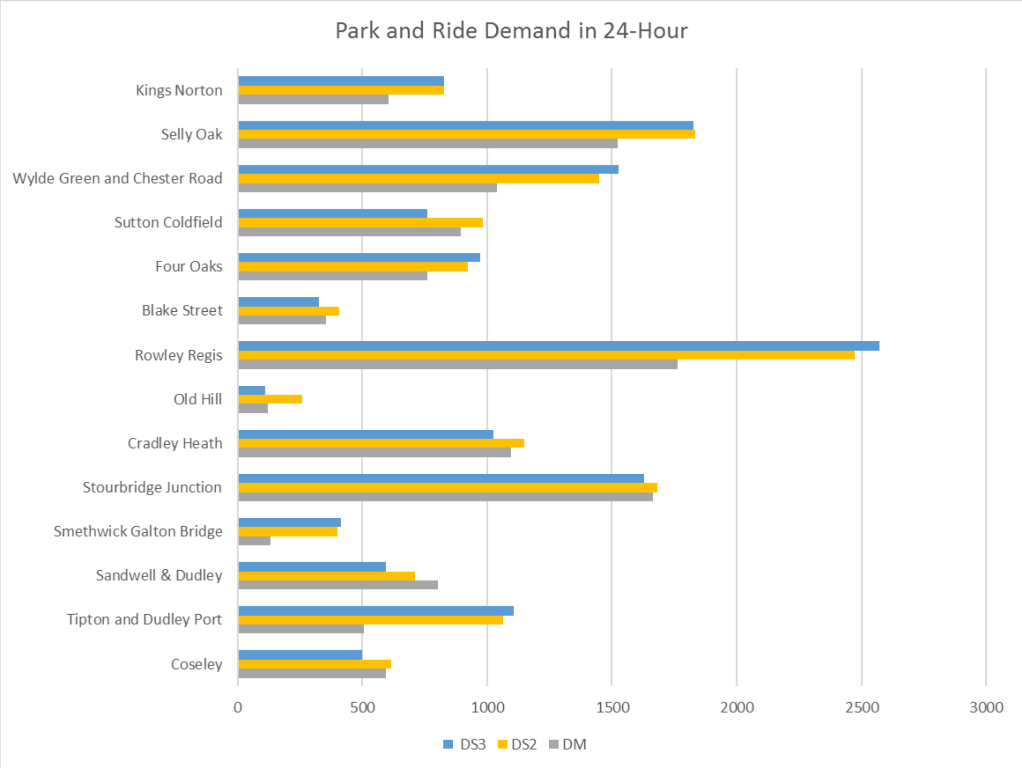
Table 4.13 shows the P&R car park 24- hour demand changes due to the increased capacity in DS2 and DS3.

Table 4-13: Park and Ride Demand Changes due to Capacity Enhancement

Model Station(s)	DM Parking Spaces	DS2 Parking Spaces Proposed	DS3 Parking Spaces Proposed	DM Demand	DS2 Demand	DS3 Demand	Change in demand DS2 - DM	Change in demand DS3 - DM
Coseley	95	145	95	593	616	497	22	-96
Tipton and Dudley Port	147	642	642	504	1063	1106	558	602
Sandwell & Dudley	393	493	393	802	710	594	-93	-208
Smethwick Galton Bridge	77	277	277	131	401	413	270	282
Stourbridge Junction	1069	1219	1069	1665	1681	1627	16	-38
Cradley Heath	545	745	545	1095	1148	1024	53	-71
Old Hill	54	254	54	121	258	109	137	-12
Rowley Regis	741	1641	1641	1762	2475	2573	714	811
Blake Street	151	251	151	352	406	325	54	-27
Four Oaks	266	466	466	760	923	973	163	213
Sutton Coldfield	569	869	569	895	983	760	88	-135
Wylde Green and Chester Road	237	507	507	1040	1448	1525	408	485
Selly Oak	454	704	704	1524	1834	1828	310	304
Kings Norton	314	564	564	605	828	827	221	222
Total	**5112**	**8777**	**7677**	**11849**	**14774**	**14181**	**2921**	**2332**

The above result shows that increasing P&R spacea has a positive impact on station car park usage. Rowley Regis and Dudley Port stations are top on the list in both DS2 and DS3 where passenger demand using the car parks is predicted to be increased substantially. A reduction in demand is predicted only at Sandwell and Dudley car park in DS2. It is understood that those trips prefer to go to Tipton and Dudley port stations which have larger spaces proposed. Many zones around rail corridors can access multiple station car parks as available alternatives to choose from. As a result, with the increased station car park spaces, the more attractive car parks see a greater increase whilst some are likely to experience a decrease. This pattern is more evident under DS3 where few stations are likely to witness a decline in usage. Figure 4.4 shows the predicted utilisation of car parks under different scenarios at 24-hour level.

Figure 4-3: Park and Ride Car Park Space Utilisation



4.5 Link Flow Differences

Figure 4-4 to Figure 4-12 shows the Link flow differences between DM and DS options for AM, IP and PM peak respectively. In the figures, 'green' indicates a reduction in traffic and 'red' indicates an increase in traffic along the links. The link flow differences show that traffic disperses through the A4540 ring road as a result of the tunnel closure. However, the extent of the traffic reduction (indicated by the bandwidths) on the A38 is significantly greater than the increases along the ring road as traffic diverts to other modes of travel.

Figure 4-4: Highway Flow Difference between DS1 and DM during AM Peak

Figure 4-5: Highway Flow Difference between DS2 and DM during AM Peak

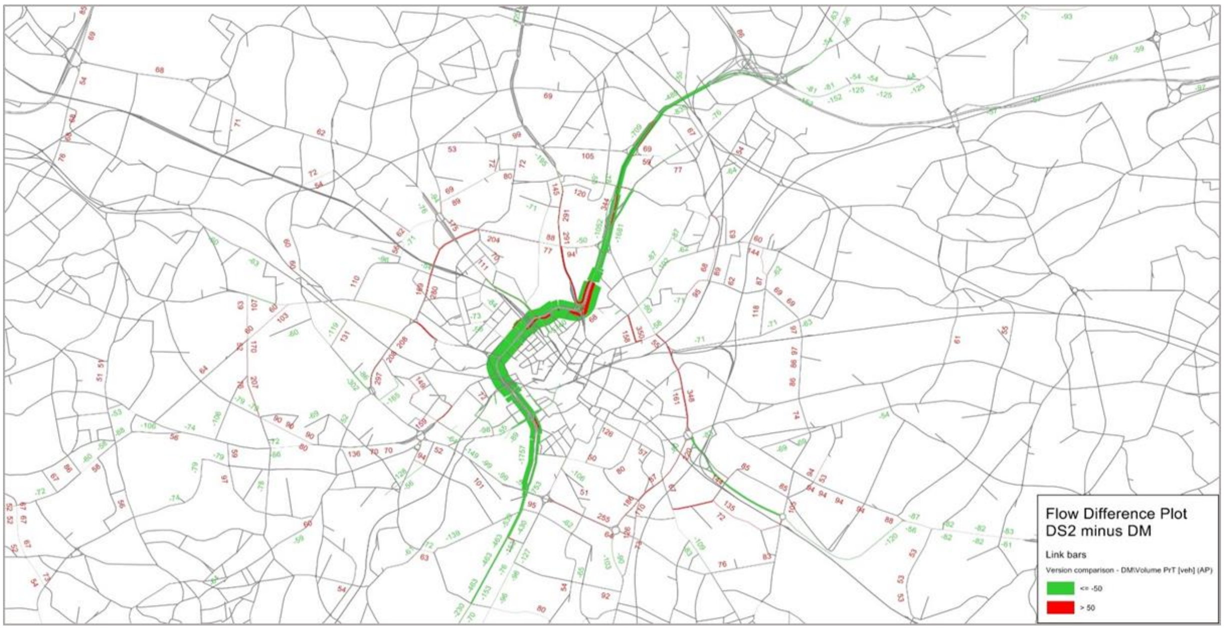


Figure 4-6: Highway Flow Difference between DS3 and DM during AM Peak

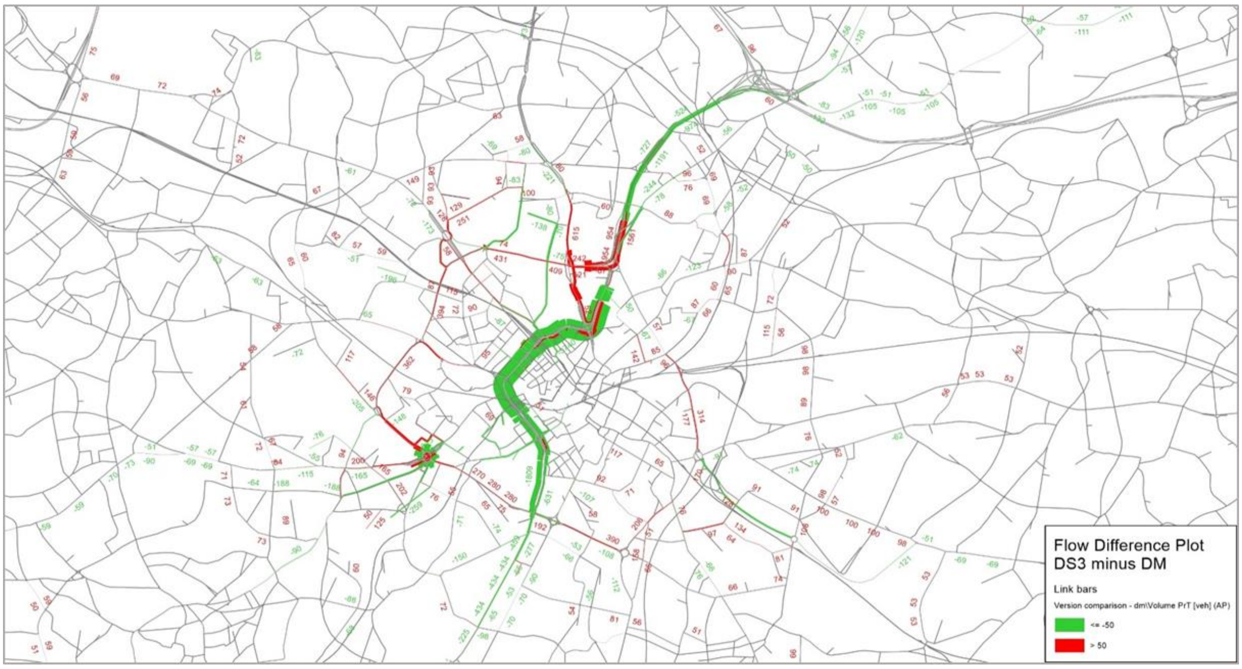


Figure 4-7: Highway Flow Difference between DS1 and DM during IP Peak

Figure 4-8: Highway Flow Difference between DS2 and DM during IP Peak

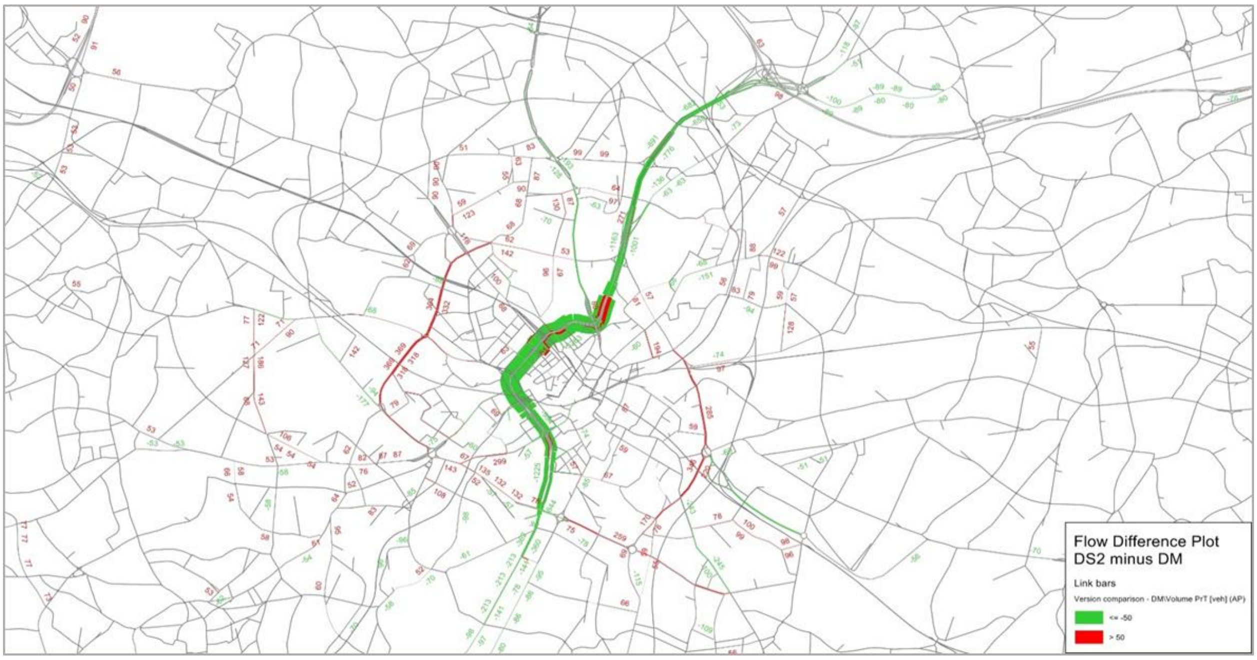


Figure 4-9: Highway Flow Difference between DS3 and DM during IP Peak

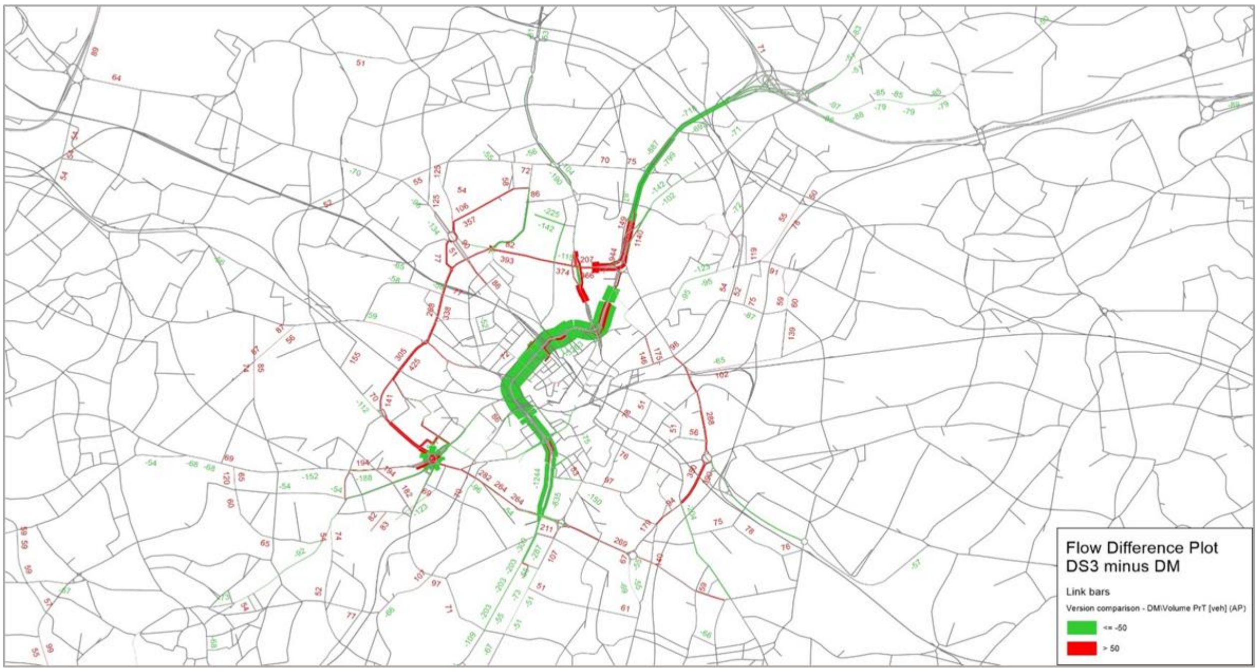
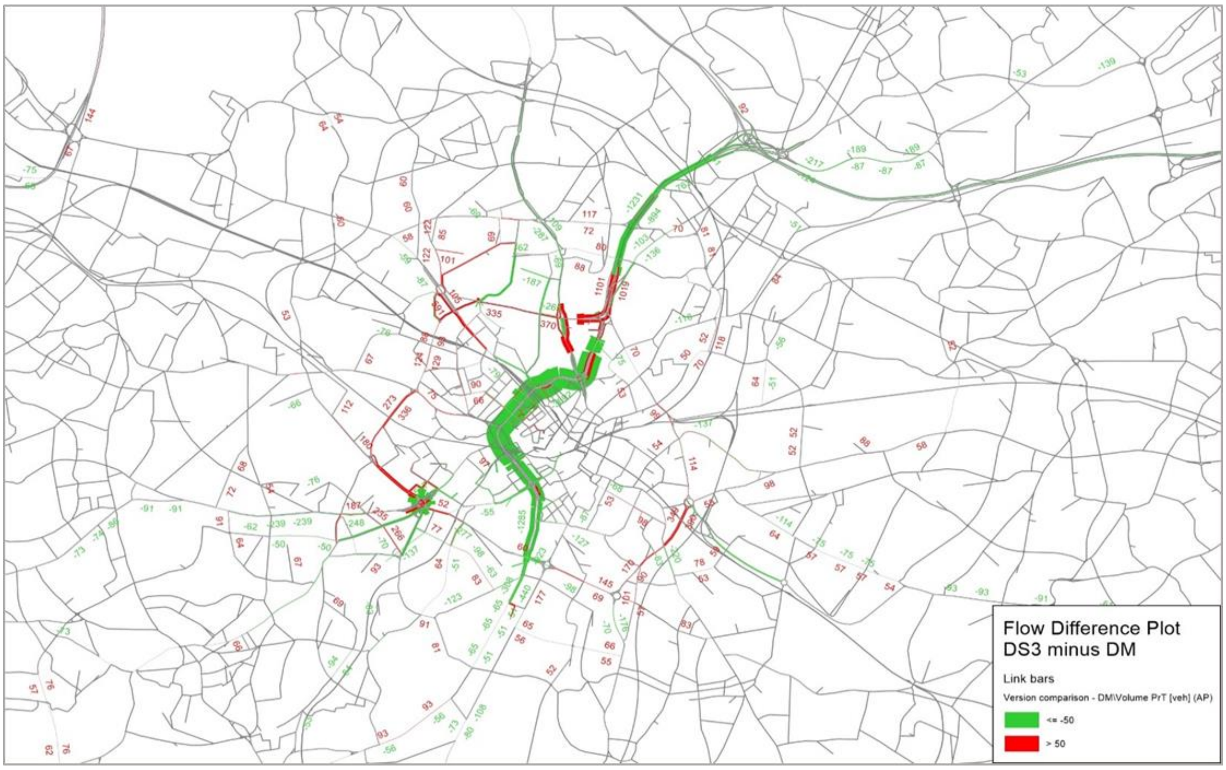


Figure 4-10: Highway Flow Difference between DS1 and DM during PM Peak

Figure 4-11: Highway Flow Difference between DS2 and DM during PM Peak

Figure 4-12: Highway Flow Difference between DS3 and DM during PM Peak



Similar to the highway model, PT model passenger flow differences are shown in Figure 4-13 to Figure 4-21 for AM, IP and PM peak (2-hr) respectively. The analysis shows that due to the tunnel closure passenger trips increase towards the city centre in DS1 scenario. Under DS2 and DS3 scenarios, passenger increases are more predominant along rail corridors due to the enhanced P&R car park capacity. Under DS3, PT trips increases are in train as well as bus service due to the improvements in bus corridors.

Figure 4-13: Passenger Flow Difference between DS1 and DM during AM Peak

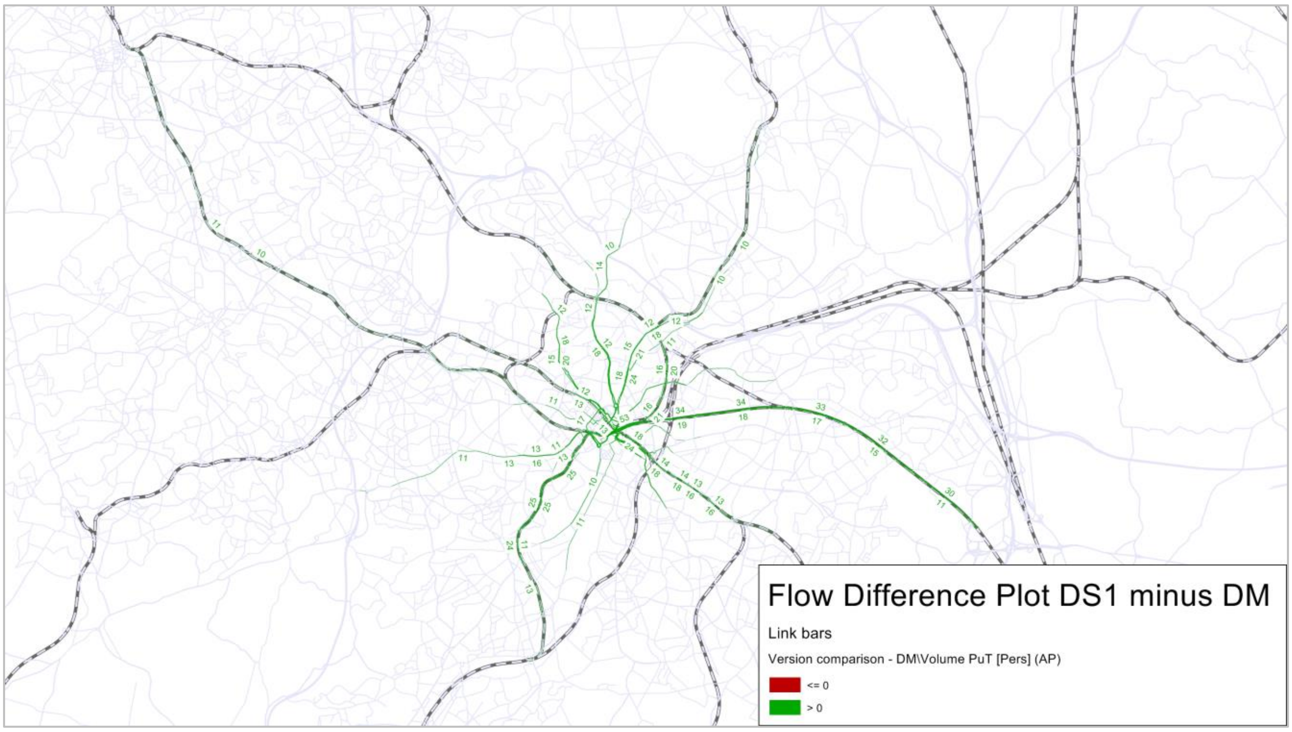


Figure 4-14: Passenger Flow Difference between DS2 and DM during AM Peak

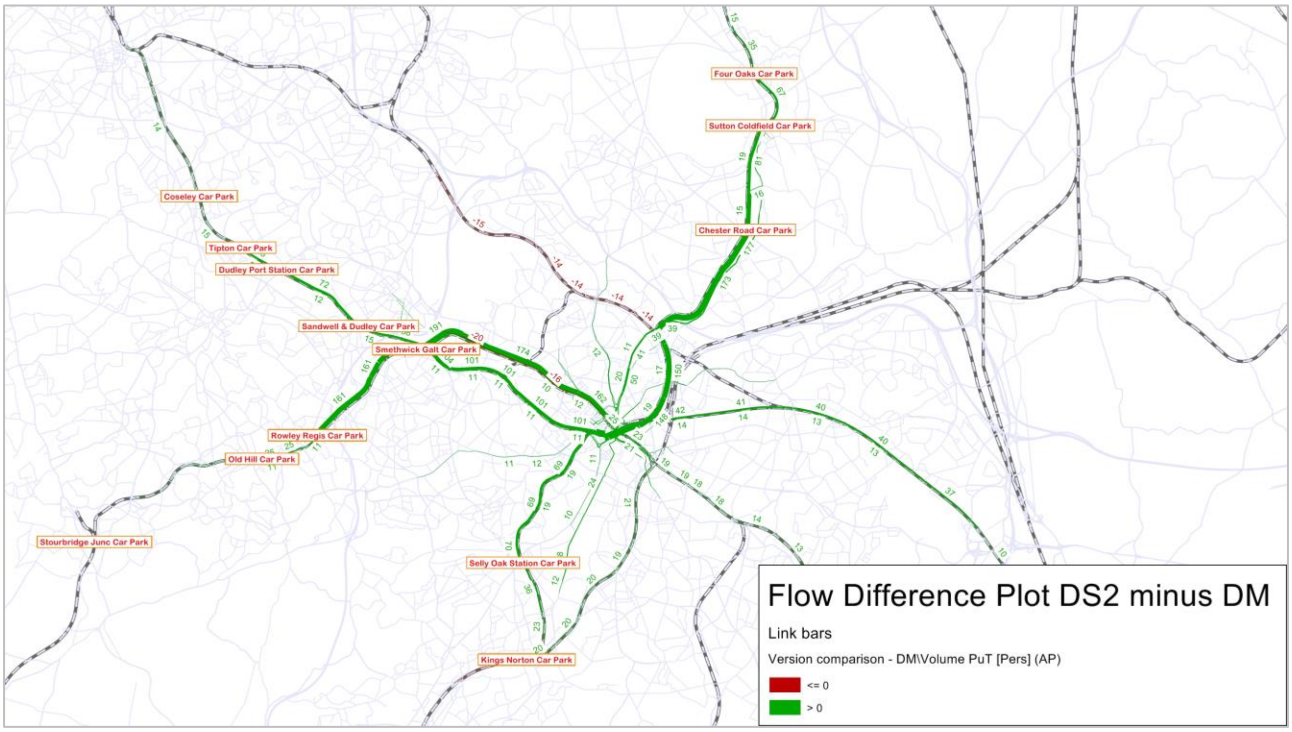


Figure 4-15: Passenger Flow Difference between DS3 and DM during AM Peak

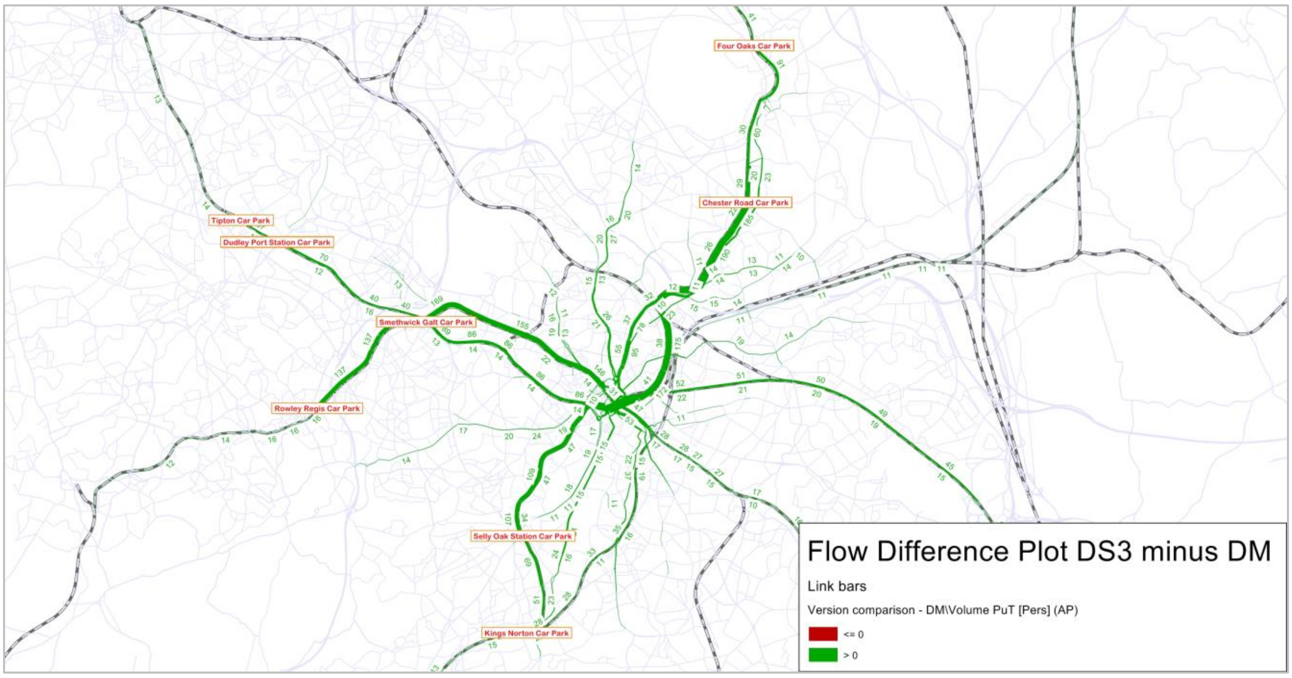


Figure 4-16: Passenger Flow Difference between DS1 and DM during Inter Peak

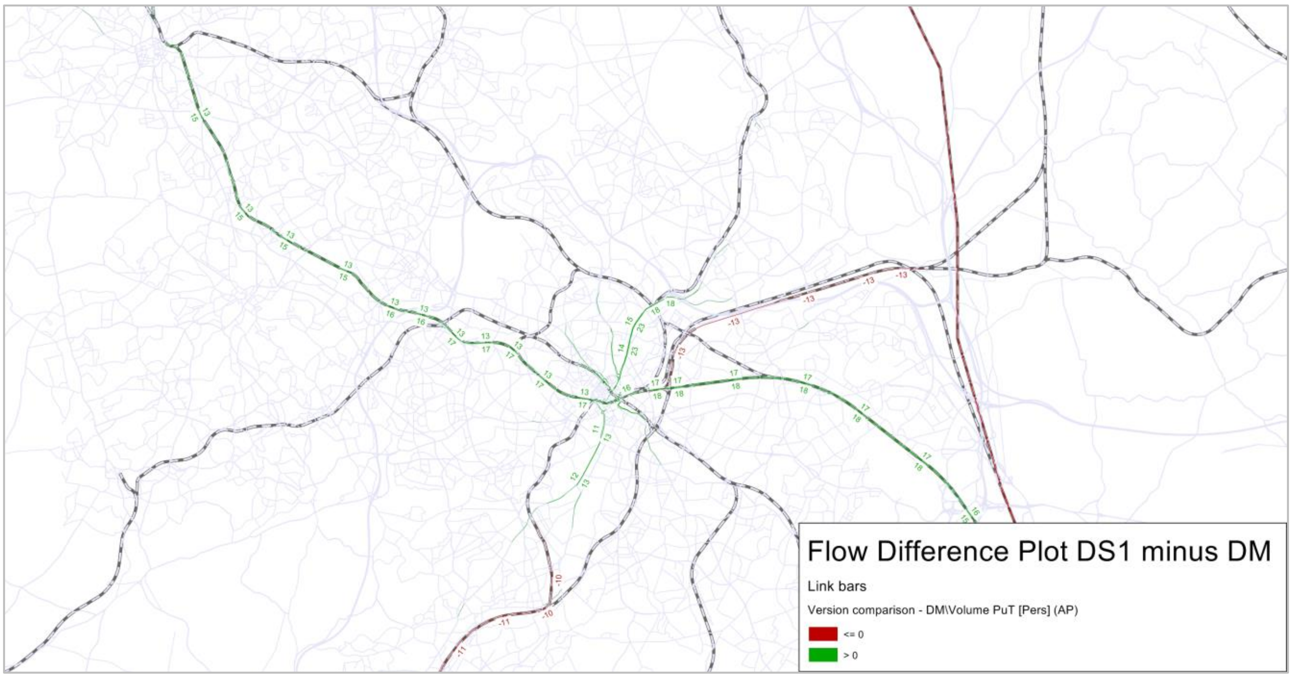


Figure 4-17: Passenger Flow Difference between DS2 and DM during Inter Peak

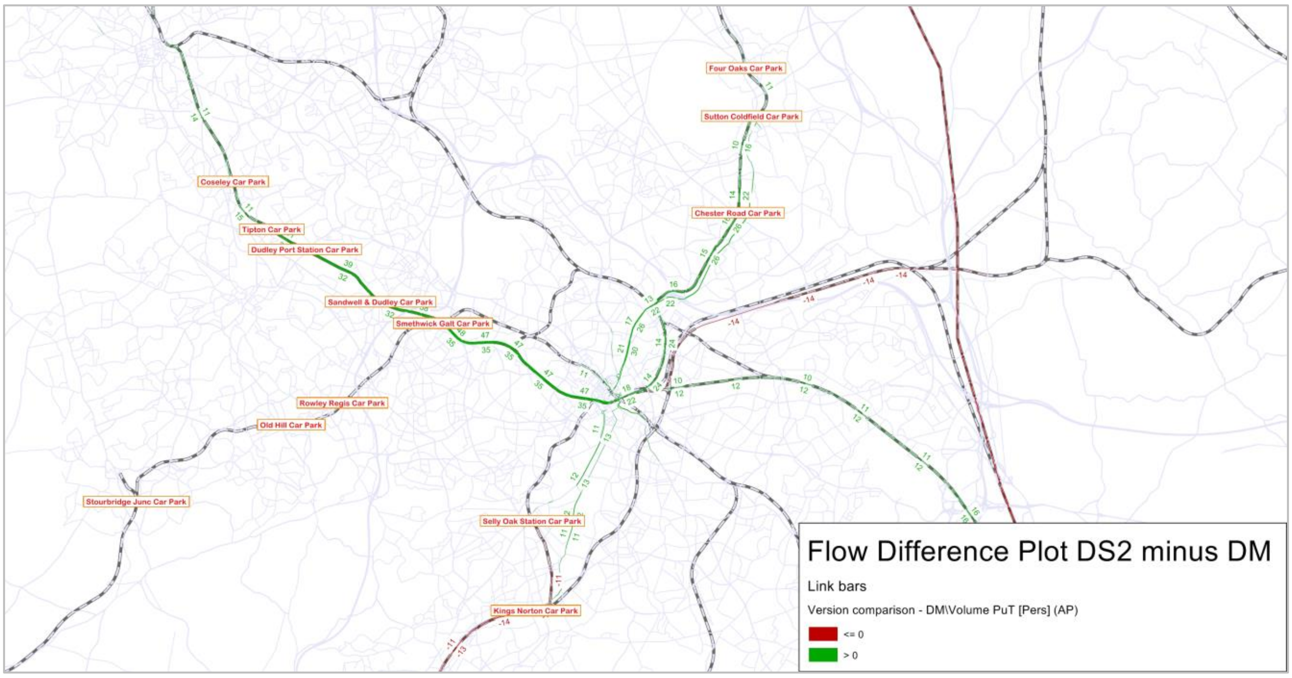


Figure 4-18: Passenger Flow Difference between DS3 and DM during Inter Peak

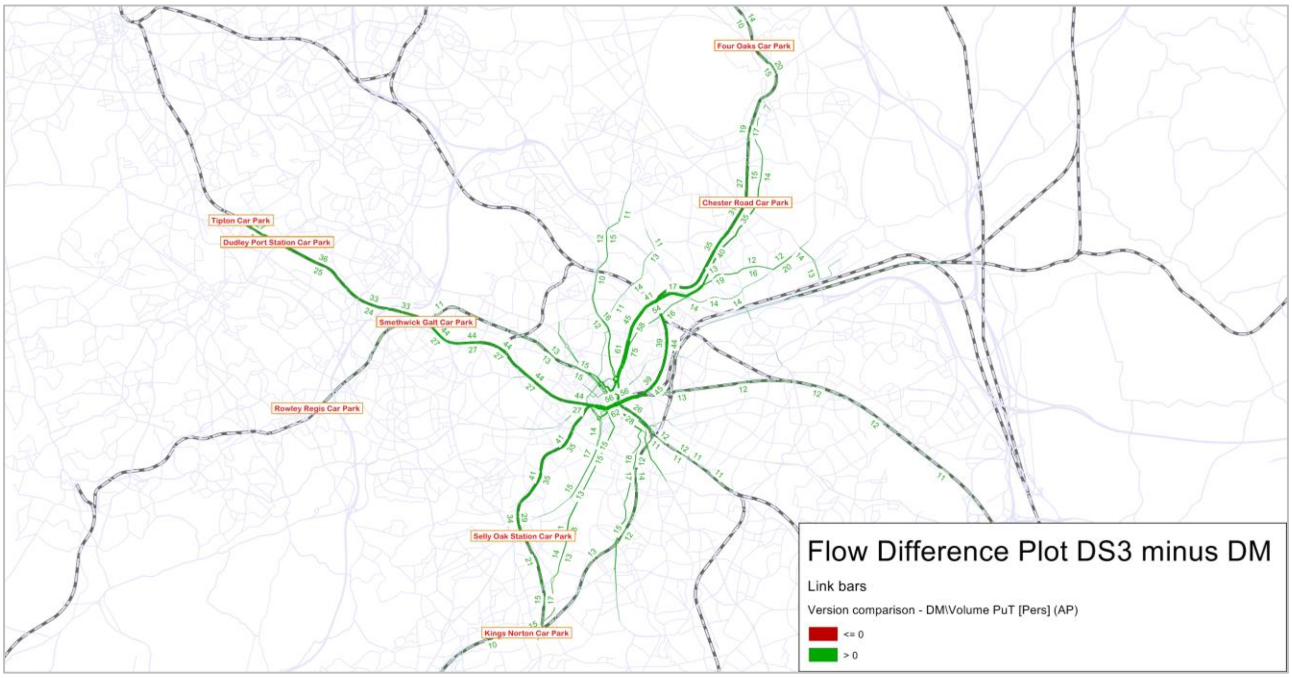


Figure 4-19: Passenger Flow Difference between DS1 and DM during PM Peak

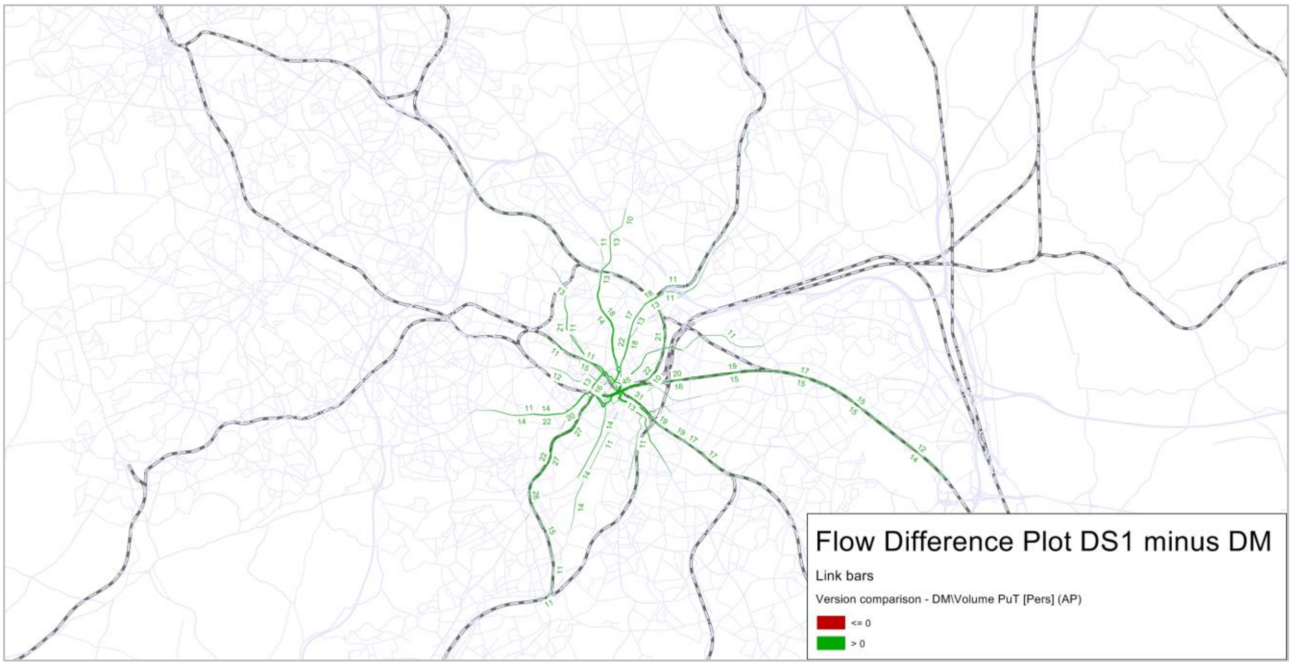


Figure 4-20: Passenger Flow Difference between DS2 and DM during PM Peak

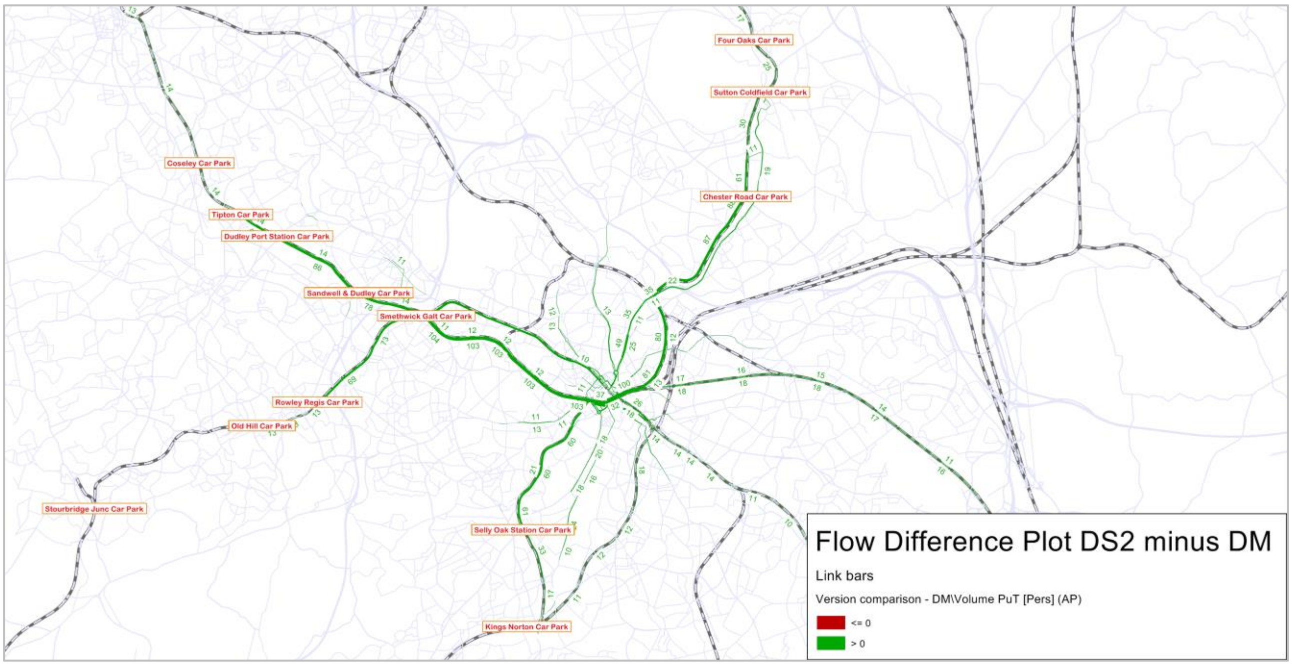
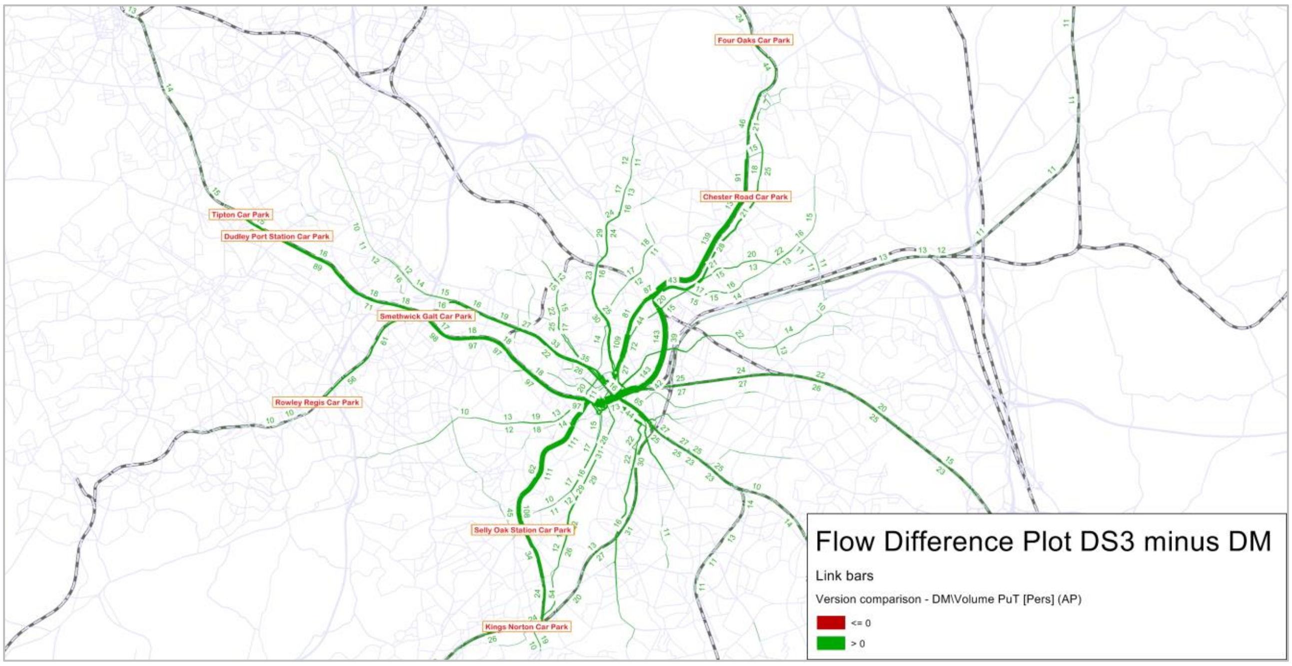


Figure 4-21: Passenger Flow Difference between DS3 and DM during PM Peak



4.6 Flow Bundles on Key Links

To understand the impact of through traffic due to the A38 tunnel closure, flow bundle (Select Link Analysis) was undertaken at 2 key locations; one at the A38 Bristol Road located south of the A38 / Belgrave Middle way junction and another at the A38(M) located north of the Matalan roundabout considering that most of the A38 through traffic uses these two links. These flow bundles also help to understand the alternate routes for A38 tunnel user in case of tunnel closure. Figure 4-22 to Figure 4-37 shows flow bundle plots only for AM peak under the different scenarios. The analysis shows that under the DS options, the through trips disperse along the eastern and western sides of the ring road. Further, it also shows that some through trips to North disappear either due to modal shift or changes to destination under the DS scenarios.

Figure 4-22: Flow bundle Analysis at A38 (M) in NB Direction in DM – AM Peak

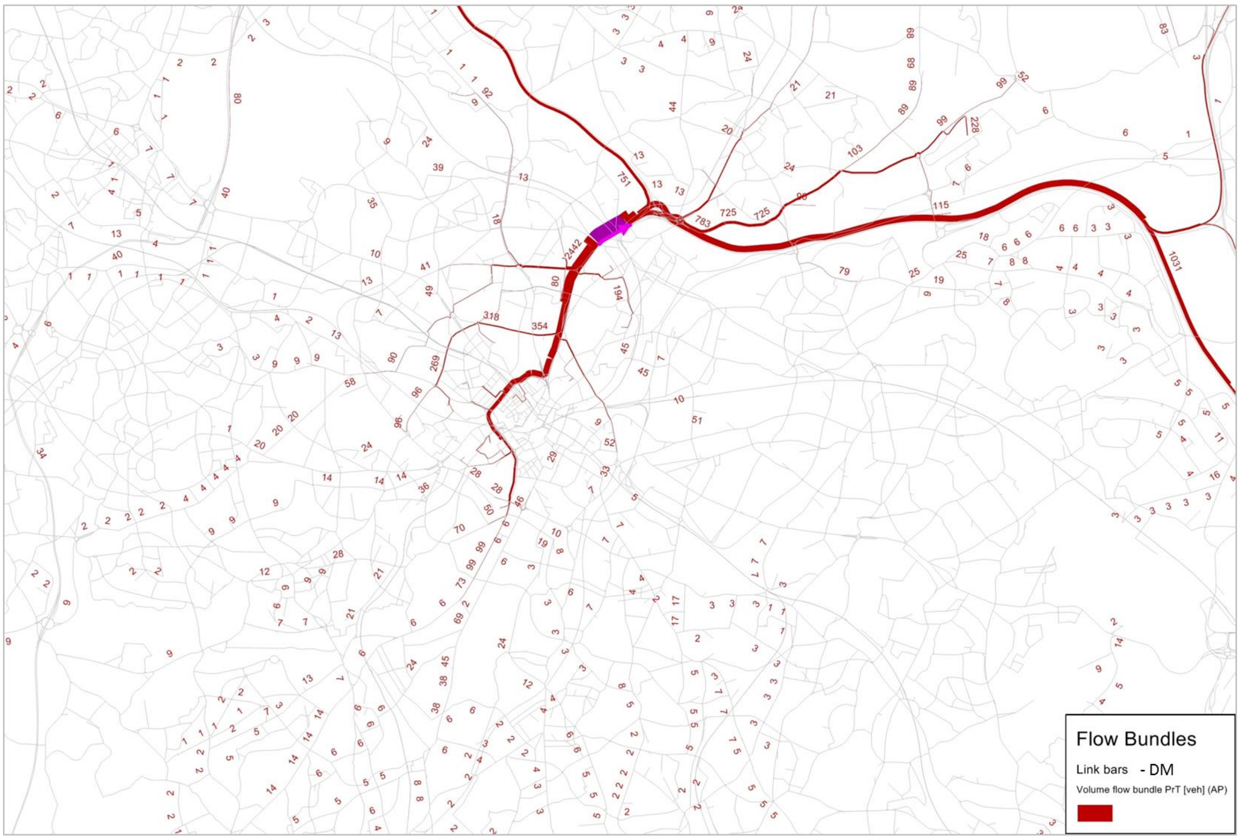


Figure 4-23: Flow bundle Analysis at A38 (M) in NB Direction in DS1 – AM Peak

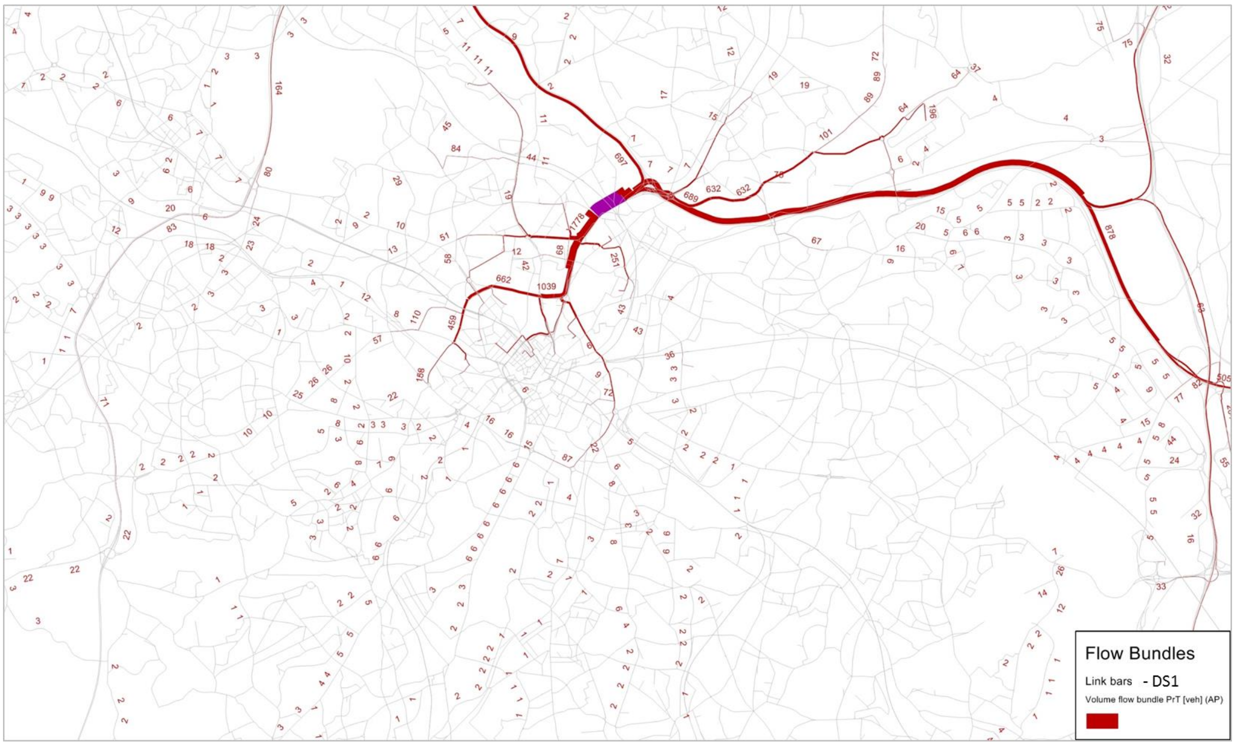


Figure 4-24: Flow bundle Analysis at A38 (M) in NB Direction in DS2 – AM Peak

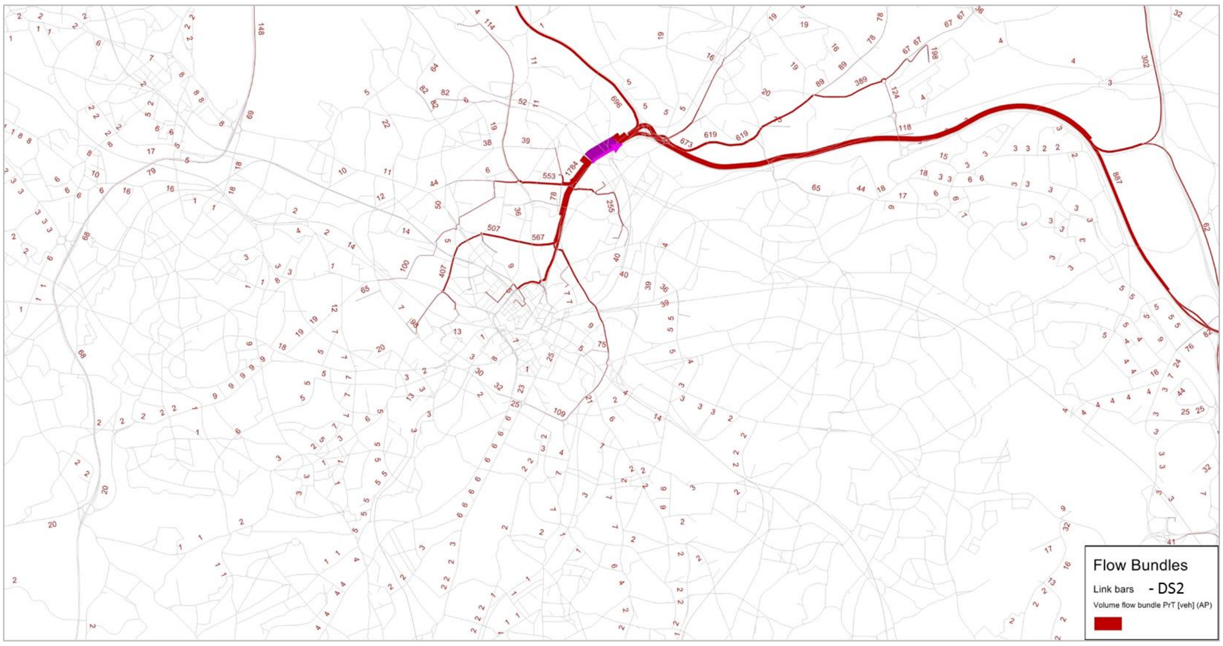


Figure 4-25: Flow bundle Analysis at A38 (M) in NB Direction in DS3 – AM Peak

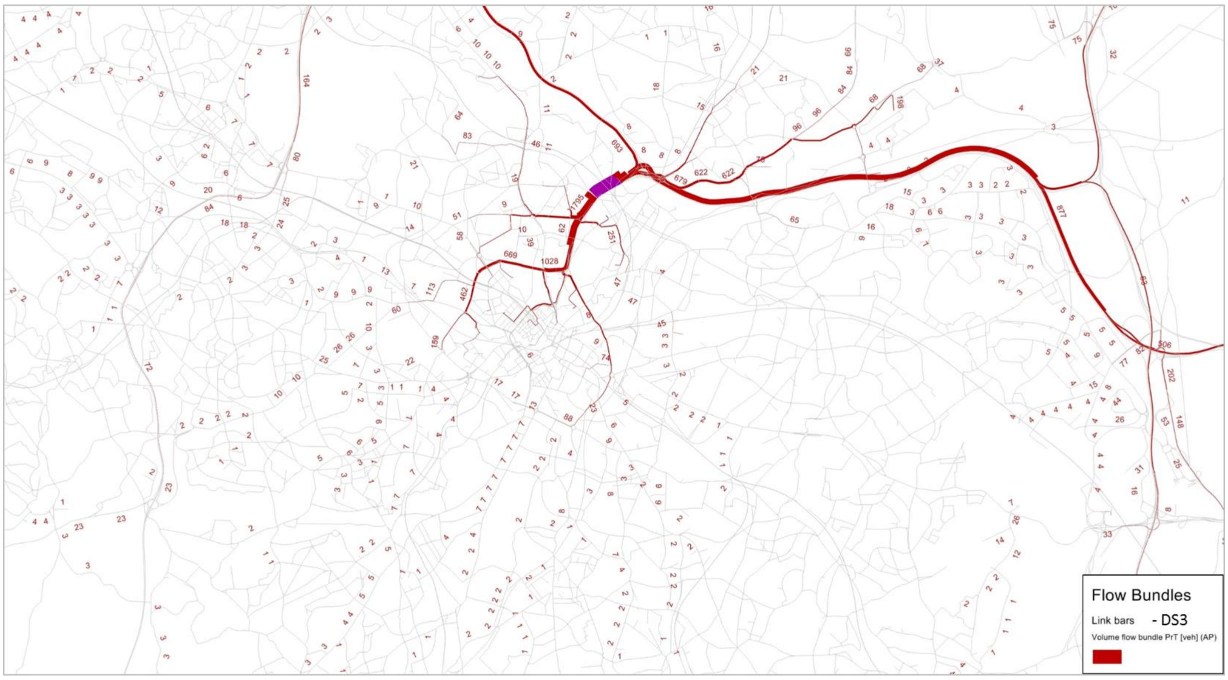


Figure 4-26: Flow bundle Analysis at A38 (M) in SB Direction in DM – AM Peak

Figure 4-27: Flow bundle Analysis at A38 (M) in SB Direction in DS1 – AM Peak

Figure 4-28: Flow bundle Analysis at A38 (M) in SB Direction in DS2 – AM Peak

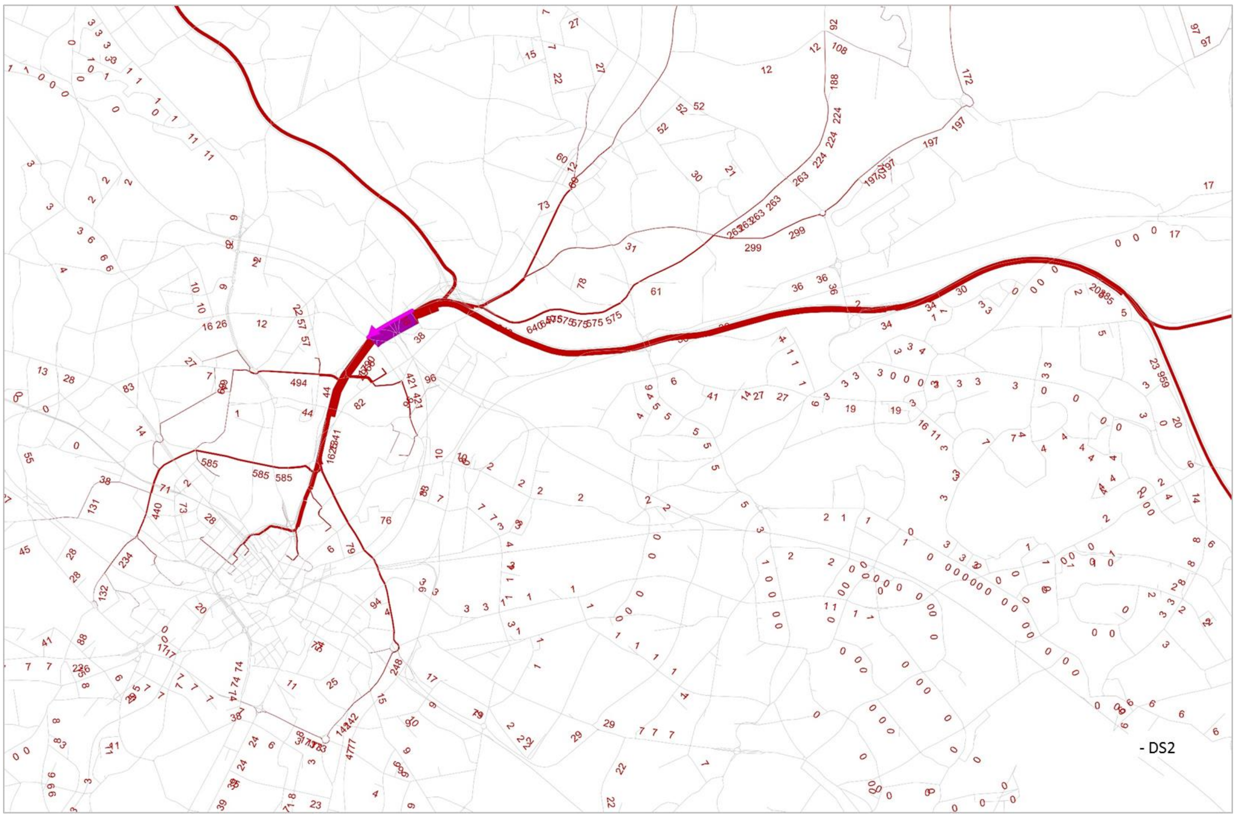


Figure 4-29: Flow bundle Analysis at A38 (M) in SB Direction in DS3 – AM Peak

Figure 4-30: Flow bundle Analysis at A38 Bristol Road in NB Direction in DM – AM Peak

Figure 4-31: Flow bundle Analysis at A38 Bristol Road in NB Direction in DS1 – AM Peak

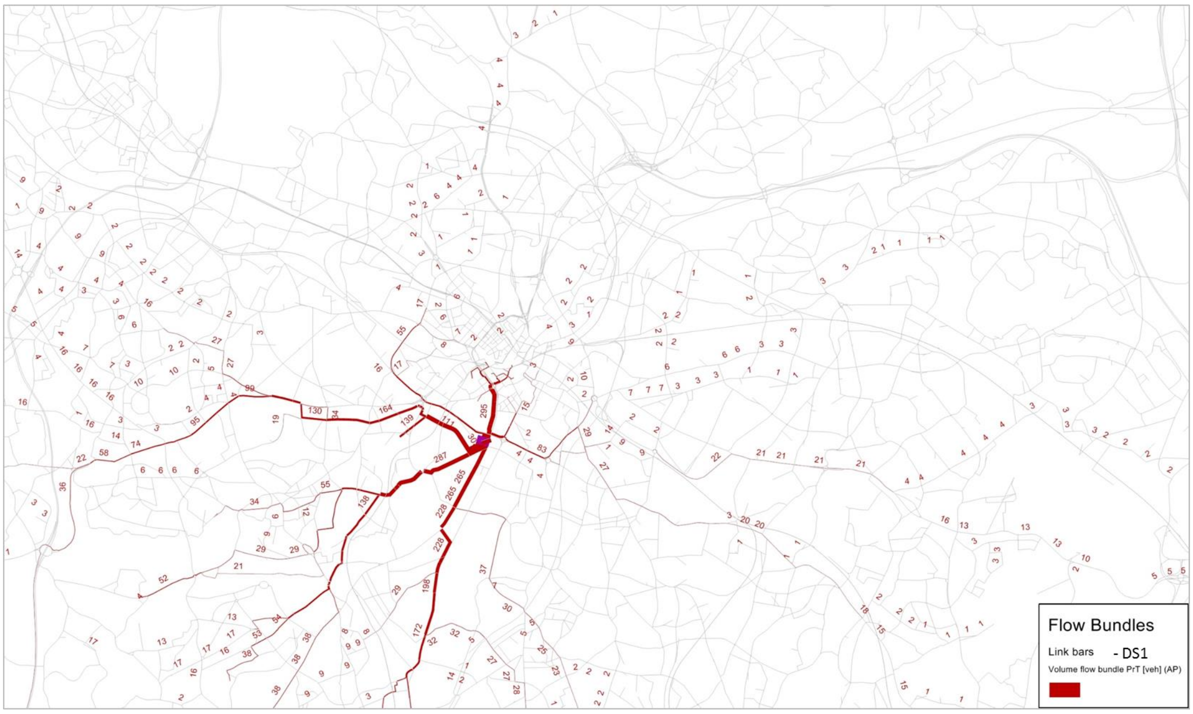


Figure 4-32: Flow bundle Analysis at A38 Bristol Road in NB Direction in DS2 – AM Peak

Figure 4-33: Flow bundle Analysis at A38 Bristol Road in NB Direction in DS3 – AM Peak

Figure 4-34: Flow bundle Analysis at A38 Bristol Road in SB Direction in DM – AM Peak

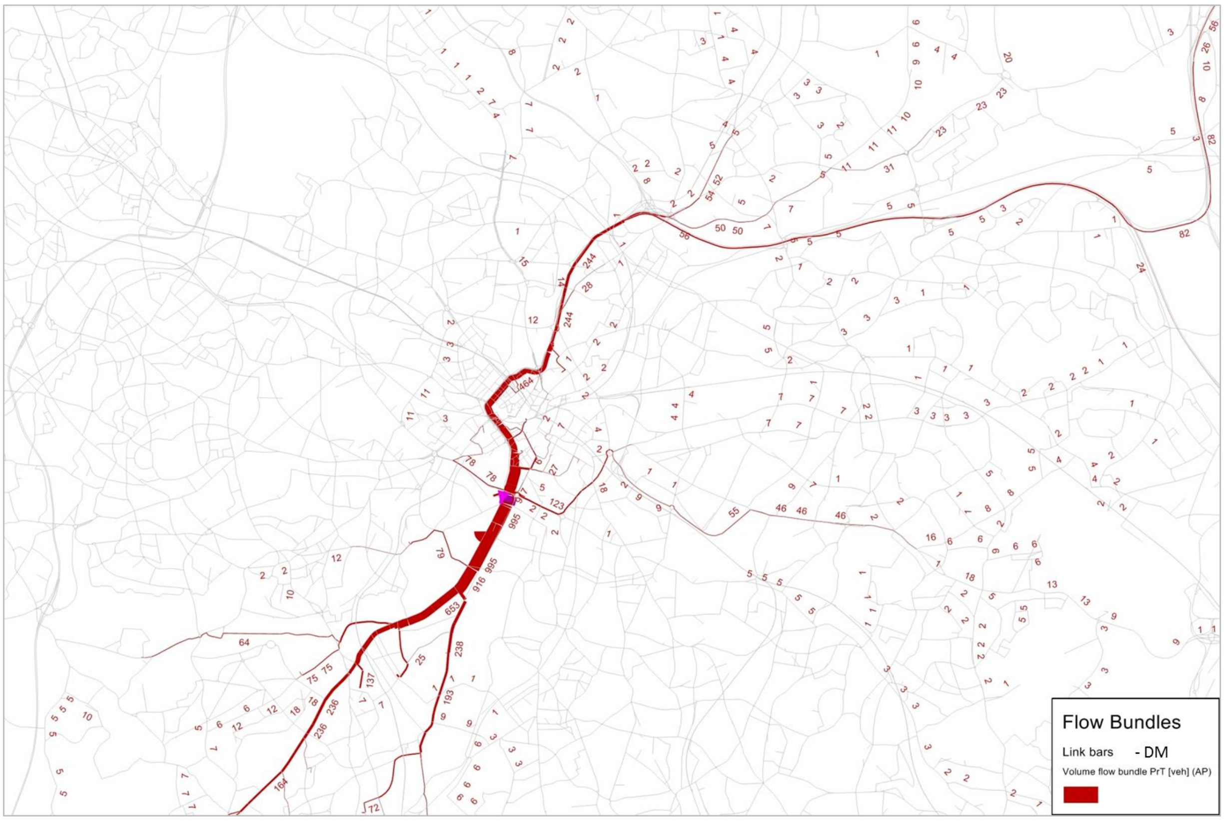


Figure 4-35: Flow bundle Analysis at A38 Bristol Road in SB Direction in DS1 – AM Peak

Figure 4-36: Flow bundle Analysis at A38 Bristol Road in SB Direction in DS2 – AM Peak

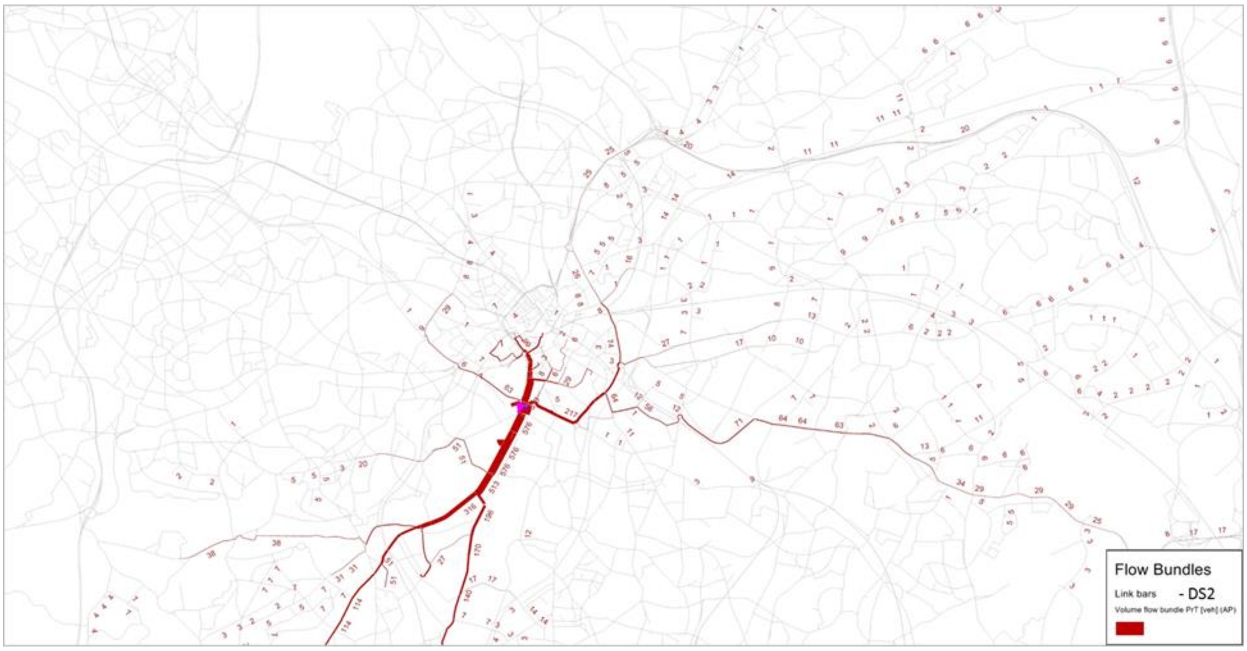
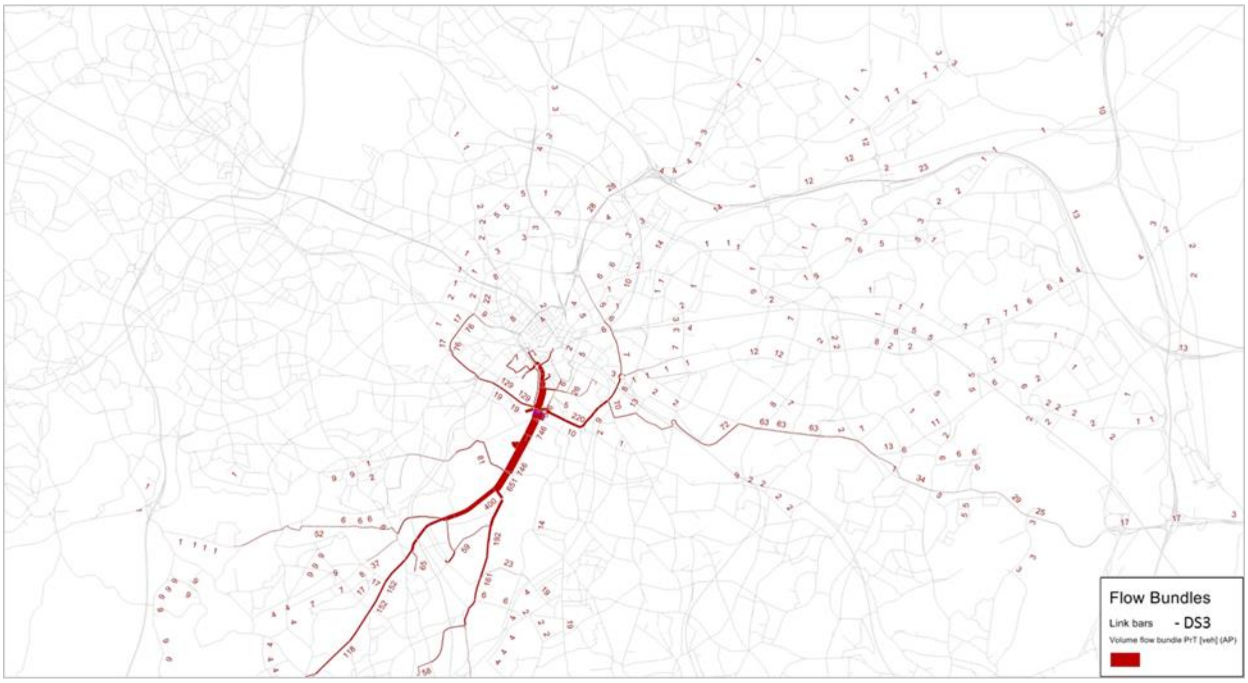


Figure 4-37: Flow bundle Analysis at A38 Bristol Road in SB Direction in DS3 – AM Peak



4.7 Journey Time Comparison

Travel times were analysed between Erdington (Zone 1245) and Selly Oak (Zone 1065) under different peak hours and model scenarios. It is understood that a few numbers of trips travel between these areas and currently use A38 tunnels as their preferred route while travelling by car. Figure 4-38 and Figure 4-39 show the preferred paths under different scenarios in the AM and PM peak respectively.

Figure 4-38: Travel path between Erdington and Selly Oak – AM Peak

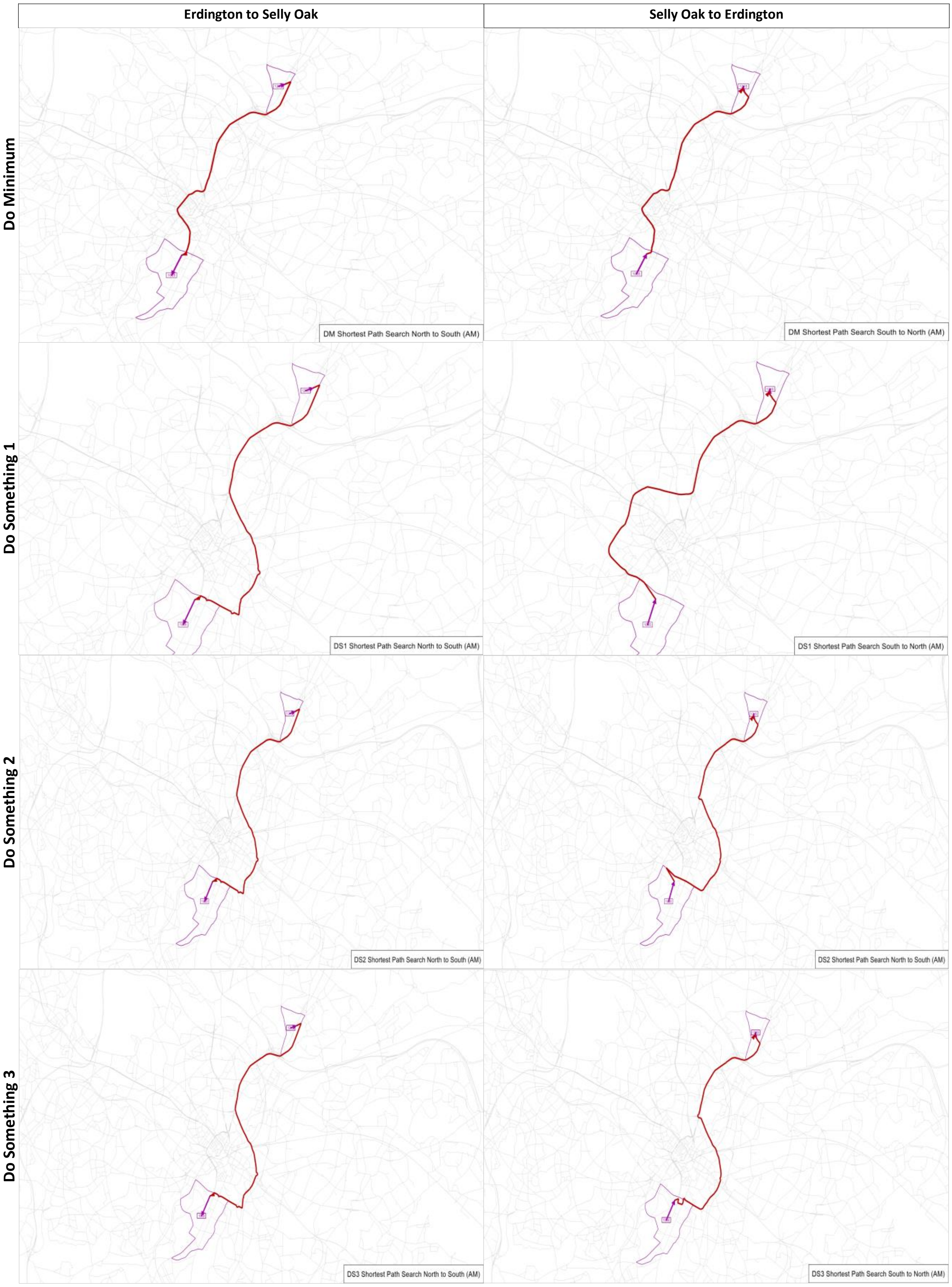


Figure 4-39: Travel path between Erdington and Selly Oak – PM Peak

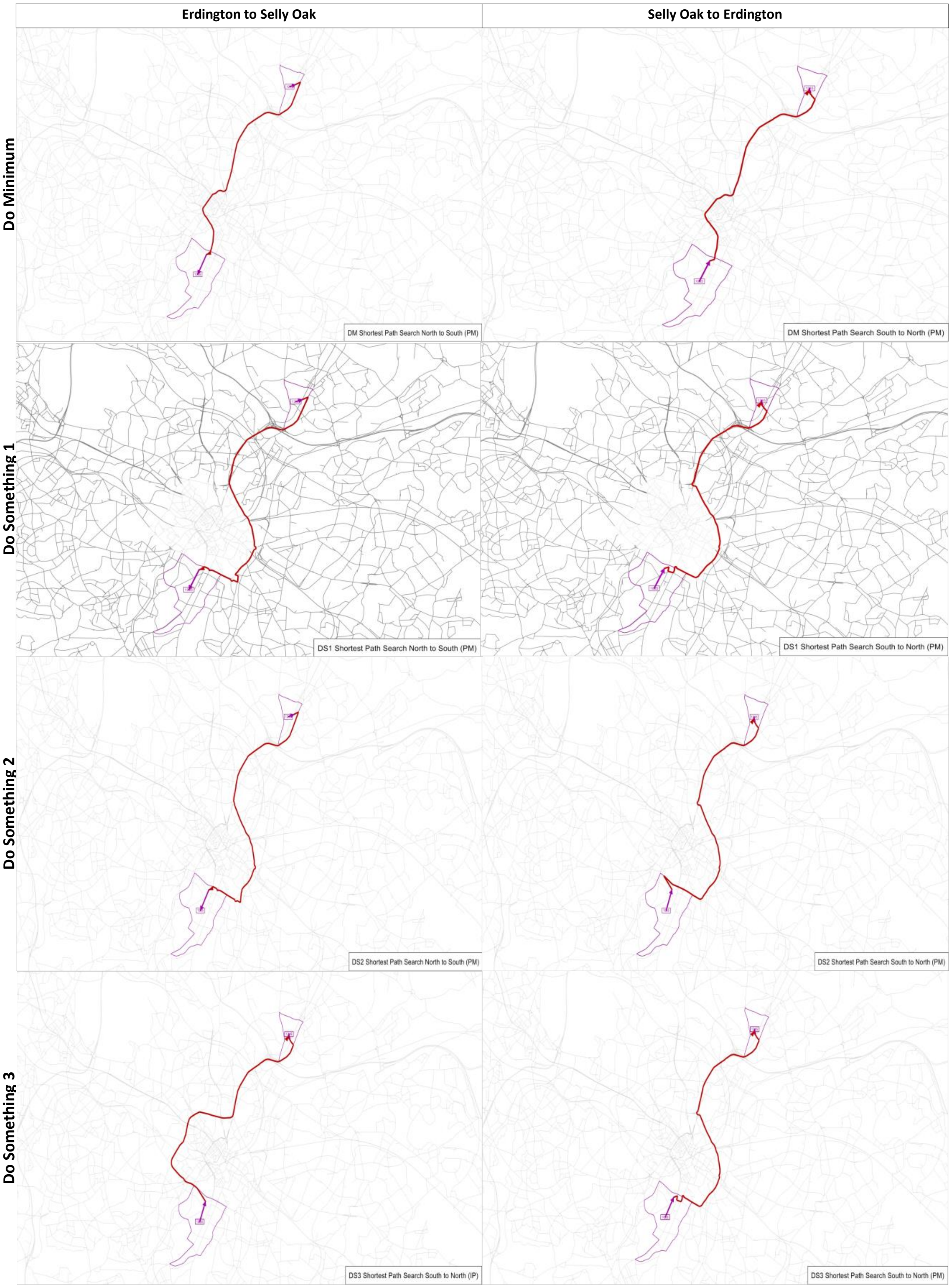


Table 4.14 and Table 4.15 shows the travel time and speed changes for journeys between Erdington and Selly Oak.

Table 4-14: Journey Time Differences Between Erdington and Selly Oak

Scenario	Erdington to Selly Oak			Selly Oak to Erdington		
	AM (sec)	IP (sec)	PM (sec)	AM (sec)	IP (sec)	PM (sec)
DM	904	810	872	836	757	797
DS1	1486	1360	1569	1553	1335	1504
DS2	1477	1351	1543	1588	1374	1512
DS3	1482	1360	1536	1575	1352	1545
Difference (DS1-DM)	582	550	697	717	578	707
Difference (DS2-DM)	573	541	671	752	617	715
Difference (DS3-DM)	578	550	664	739	595	748
% Difference (DS1-DM)	64%	68%	80%	86%	76%	89%
% Difference (DS2-DM)	63%	67%	77%	90%	82%	90%
% Difference (DS3-DM)	64%	68%	76%	88%	79%	94%

Table 4-15: Average Speed Differences Between Erdington and Selly Oak

Scenario	Erdington to Selly Oak			Selly Oak to Erdington		
	AM (km/h)	IP (km/h)	PM (km/h)	AM (km/h)	IP (km/h)	PM (km/h)
DM	37	42	39	38	42	40
DS1	27	29	26	24	28	25
DS2	27	29	26	25	29	26
DS3	27	29	26	24	28	25
Difference (DS1-DM)	-10	-13	-13	-14	-14	-15
Difference (DS2-DM)	-10	-13	-13	-13	-13	-14
Difference (DS3-DM)	-10	-13	-13	-14	-14	-15
% Difference (DS1-DM)	-27%	-31%	-33%	-37%	-33%	-38%
% Difference (DS2-DM)	-27%	-31%	-33%	-34%	-31%	-35%
% Difference (DS3-DM)	-28%	-30%	-34%	-37%	-33%	-39%

The above analysis shows that the traffic movement between North and South through the A38 will experience significant delay in all peaks with travel times increasing by between 63% and 90%. Correspondingly, travel speeds drop by between 27% and 39%.

4.8 Network Statistics

The network statistics has been collected for both highway and PT trips.

4.8.1 Highway Statistics

Because of extents of the highway network and number of trips in the model, using the network wide statistics would mask the impacts of the options assessed. Therefore, the network statistics have been compared for the areas within the outer cordon and inner cordon only as the impacts of the scheme options are mostly in and around Birmingham. Table 4.16 to Table 4.18 shows network performance statistics for AM, IP and PM peak respectively.

Table 4-16: Highway Network Performance in AM Peak

Indicator	DM	DS1	DS2	DS3
	Inner Cordon			
Vehicle-Km	51444	33087	34011	33123
Vehicle-Hr	3716	3006	2985	2981
Speed (kph)	13.84	11.01	11.39	11.11
	Outer Cordon			
Vehicle-Km	100522	84230	83148	83992
Vehicle-Hr	6109	5994	5943	6006
Speed (kph)	16.45	14.05	13.99	13.98
	% change against DM			
	Inner Cordon			
Vehicle-Km		-35.7%	-33.9%	-35.6%
Vehicle-Hr		-19.1%	-19.7%	-19.8%
Speed (kph)		-20.4%	-17.7%	-19.7%
	Outer Cordon			
Vehicle-Km		-16.2%	-17.3%	-16.4%
Vehicle-Hr		-1.9%	-2.7%	-1.7%
Speed (kph)		-14.6%	-15.0%	-15.0%

Table 4-17: Highway Network Performance in Inter Peak

Indicator	DM	DS1	DS2	DS3
	Inner Cordon			
Vehicle-Km	45890	30930	31493	30720
Vehicle-Hr	2867	2317	2351	2321
Speed (kph)	16.01	13.35	13.40	13.24
	Outer Cordon			
Vehicle-Km	91036	79142	78889	78835
Vehicle-Hr	4838	4867	4862	4873
Speed (kph)	18.82	16.26	16.22	16.18
	% change against DM			
	Inner Cordon			
Vehicle-Km		-32.6%	-31.4%	-33.1%
Vehicle-Hr		-19.2%	-18.0%	-19.0%
Speed (kph)		-16.6%	-16.3%	-17.3%
	Outer Cordon			
Vehicle-Km		-13.1%	-13.3%	-13.4%
Vehicle-Hr		0.6%	0.5%	0.7%
Speed (kph)		-13.6%	-13.8%	-14.0%

Table 4-18: Highway Network Performance in PM Peak

Indicator	DM	DS1	DS2	DS3
	Inner Cordon			
Vehicle-Km	53604	35019	36269	34960
Vehicle-Hr	4339	3575	3520	3577
Speed (kph)	12.35	9.80	10.30	9.77
	Outer Cordon			
Vehicle-Km	102742	84760	86234	84882
Vehicle-Hr	6803	6696	6643	6761
Speed (kph)	15.10	12.66	12.98	12.56
	% change against DM			
	Inner Cordon			
Vehicle-Km		-34.7%	-32.3%	-34.8%
Vehicle-Hr		-17.6%	-18.9%	-17.6%
Speed (kph)		-20.6%	-16.6%	-20.9%
	Outer Cordon			
Vehicle-Km		-17.5%	-16.1%	-17.4%
Vehicle-Hr		-1.6%	-2.4%	-0.6%
Speed (kph)		-16.2%	-14.0%	-16.8%

The tables show that the vehicle-kms drop significantly under the DS options compared to the DM across both the inner and outer cordons due to mode shift. Across the inner cordon, the vehicle-hours do not drop as significantly as the vehicle-kms indicating worsening congestion that is reflected in average speeds dropping considerably. Across the inner cordon, the average speeds drop by between 17.7% and 20.4% in the AM and 16.6% and 20.9% in the PM.

Across the outer cordon, the vehicle-hours marginally drop under the DS options compared to the DM despite the significant drop in vehicle-kms. This again indicates significant congestion with speeds anticipated to drop by between 14.6% to 15.0% in the AM peak and by between 14.0% and 16.8% in the PM peak.

4.8.2 PT statistics

Considering the impact of the PT interventions the network passenger statistics were compared across the whole network and the statistics are presented in Table 4-19 to Table 4-21. The tables show that the mean values for the various PT indicators are not affected by the DS options compared to the DM across all model periods. This is expected as the PT costs are not updated in the PRISM demand model through the feedback loop. As a result, the perceived journey times remain similar across all options.

The total values of the various PT indicators increase under the DS options reflecting the impact of increased patronage.

Table 4-19: PT Network Performance in PM Peak

Indicators		DM	DS1	DS2	DS3	DS1-DM	DS2-DM	DS3-DM
Mean Journey Time	in min	60	59	59	59	-1	-1	-1
Men In-Vehicle Time	in min	39	39	39	39	0	0	0
Mean Transfer Wait Time	in min	1	1	1	1	0	0	0
Mean Perceived Journey Time	in min	72	72	71	71	0	-1	-1
Mean Journey Distance	in Km	68	68	68	68	0	0	0
Mean Journey Speed	in kph	68	68	68	68	0	0	0
Mean In-Vehicle Speed	in kph	87	87	87	87	0	0	0
Total Journey Time	in min	11198616	11228072	11235399	11255482	29456	36783	56866
Total In-Vehicle Time	in min	7327999	7343632	7348322	7361960	15633	20323	33961
Total Transfer Wait Time	in min	223789	224225	224302	224916	436	513	1127
Total Perceived Journey Time	in min	13458395	13497513	13505904	13532309	39118	47509	73914
Total Journey Distance	in Km	12767011	12774973	12779225	12785600	7962	12215	18589
Total Number of Transfers		81720	82030	82078	82421	310	358	701

Table 4-20: PT Network Performance in Inter Peak

Indicators		DM	DS1	DS2	DS3	DS1-DM	DS2-DM	DS3-DM
Mean Journey Time	in min	46	46	46	46	0	0	0
Men In-Vehicle Time	in min	28	28	28	28	0	0	0
Mean Transfer Wait Time	in min	1	1	1	1	0	0	0
Mean Perceived Journey Time	in min	58	58	58	58	0	0	0
Mean Journey Distance	in Km	39	39	39	39	0	0	0
Mean Journey Speed	in kph	51	51	51	51	0	0	0
Mean In-Vehicle Speed	in kph	69	69	69	69	0	0	0
Total Journey Time	in min	6519915	6545557	6548099	6551236	25642	28184	31321
TOTALRIDETIME	in min	4478472	4496349	4498088	4501480	17877	19616	23008
Total In-Vehicle Time	in min	3964224	3977709	3979237	3983851	13485	15013	19627
Total Transfer Wait Time	in min	128660	128708	128730	129333	48	70	673
Total Perceived Journey Time	in min	8148145	8177320	8180407	8189183	29175	32262	41038
Total Journey Distance	in Km	5509016	5513179	5514122	5518927	4163	5106	9911
Total Number of Transfers		55816	55566	55585	56263	-250	-231	447

Table 4-21: PT Network Performance in PM Peak

Indicators		DM	DS1	DS2	DS3	DS1-DM	DS2-DM	DS3-DM
Mean Journey Time	in min	58	58	57	58	0	-1	0
Men In-Vehicle Time	in min	37	37	37	37	0	0	0
Mean Transfer Wait Time	in min	1	1	1	1	0	0	0
Mean Perceived Journey Time	in min	70	70	70	70	0	0	0
Mean Journey Distance	in Km	61	60	60	60	0	0	0
Mean Journey Speed	in kph	63	63	63	63	0	0	0
Mean In-Vehicle Speed	in kph	81	81	81	81	0	0	0
Total Journey Time	in min	11972844	12003320	12009812	12003320	30476	36968	30476
TOTALRIDETIME	in min	8553302	8573147	8577113	8573147	19845	23811	19845
Total In-Vehicle Time	in min	7669857	7686401	7689686	7686401	16544	19829	16544
Total Transfer Wait Time	in min	270235	270729	270834	270729	494	599	494
Total Perceived Journey Time	in min	14604020	14644634	14652828	14644634	40614	48808	40614
Total Journey Distance	in Km	12571950	12579674	12582591	12579674	7724	10642	7724
Total Number of Transfers		95994	96342	96393	96342	348	399	348

5. Economic Appraisal

5.1 Approach to calculating BCR

This chapter presents and discusses the economic benefits from the scheme. The benefits of the scheme have been assessed for the Core Scenario only. The approach to calculating the Benefits Costs Ratio (BCR) is based on TUBA and the values in TAG. The outputs from the traffic model covering changes in time and distance skims between the DM and DS options form the inputs to the economic appraisal. The results of the preferred option (DS3) is discussed in detail whilst only summary outputs for DS1 and DS2 options presented.

5.2 Scheme Costs

The costs of the scheme are based on very high-level estimates given the stage of the study. They are not based on any engineering designs and therefore risks not quantified. The outturn costs are summarised in Table 5-1. These costs have been included in the economic appraisal, adjusted accordingly for price base, real cost change and optimism bias.

Table 5-1: Scheme Costs (outturn costs in '000s)

	2019 Q1 Baseline Costs £	
Highway Schemes Costs	Dartmouth Circus	£20,000
	New Town Road and Summer Lane	£40,000
	Summer Lane to Lucas Circus	£6,000
	Lucas Circus	£4,000
	Spring Hill	£10,000
	Five Ways	£60,000
	Belgrave Interchange and Bristol Road	£11,000
	Tunnels and flyover reconfiguration	£150,000
	Sub-Total	**301,000**
	Tipton	£13,125
Public Transport schemes costs	Dudley Port	£4,200
	Smethwick Rolfe Street	£7,000
	Old Hill	£7,000
	Rowley Regis	£31,500
	Four Oaks	£7,000
	Chester Road	£9,450
	Aston	£24,500
	Selly Oak	£3,500
	Bournville	£10,500
	Kings Norton	£3,500
	Sprint P&R – M5 J3	£10,000
	Bus Improvement Corridors	£57,000
	Sub-Total	**188,275**
Total Costs		**489,275**

5.3 Economic Assumptions

The assumptions adopted in the economic appraisal are listed below:

- Appraisal based on results from single model year 2026 and three modelled hours – AM, IP and PM;
- 2026 model outputs assumed for 2036 as second forecast year;
- Optimism Bias at 66% of scheme capital costs;
- Market price adjustment at 1.19;
- Appraisal over 60 years, opening year of 2026;
- Discounting at 3.5% of first 30 years, then 3.0% after;
- Economic Parameters from TUBA economics file 1.9.12 (Jan 2019 release)

Within the economic appraisal there are no benefits for air quality, noise, accidents or journey quality claimed. Benefits due to increase in active mode travel has been calculated and included as part of 'Physical activity' Level 1 impacts. Wider economic impacts of the options have been excluded from this analysis and is reported as a separate note.

5.4 Annualisation of Benefits

Outputs from the model hours (AM, IP and PM) have been taken to generate the economic appraisal results. Annualisation factors in Table 5-2 are those specified in the PRISM LMVR (PRISM5_Reports2_ModelValidationReport_v18_20180531_FINAL). Off-peak and weekend periods have not been modelled nor accounted for in the economic appraisal.

Table 5-2: Annualisation Factors

	Modelled Hour	Factor to Day	Factor to Annual weekday	Total Hours per Annum
Highway	AM Peak Avg-hr	2.5	253	633
	Inter Peak Avg-hr	6	253	1518
	PM Peak Avg-hr	3.5	253	886
Public Transport	AM Peak Avg 2-hr	1.19	253	301*
	Inter Peak Avg 2-hr	4.56	253	1154*
	PM Peak Avg 2-hr	1	253	253*

**Note: TUBA recommends demand inputs represent one hour. Therefore, the average 2-hr public transport matrices were halved to represent hourly demand and the PT annualisation factors doubled*.

5.5 Analysis of Benefits

The modelled benefits for DS3 are summarised in Table 5-3. The highway users will experience significant travel time and Vehicle Operating Cost (VOC) dis-benefits whilst the PT users will experience some travel time benefits. The net user impact is significant travel time dis-benefits across the modelled network.

Table 5-3: TUBA user impacts (£ '000s) – DS3

Item	Business	Commuting	Other	Total
Travel Time (highway)	-413,715	-569,209	-366,221	**-1,349,145**
Travel Time (PT)	3738	27465	79333	**110,536**
Travel Time (Total)	-409,977	-541,744	-286,888	**-1,238,609**
VOC	-57,240	-20,292	-10,678	**-88,210**
Total	-467,217	-562,036	-297,566	**-1,326,819**

5.6 Distribution of Time savings

The distribution of time savings is summarised in Table 5-4. Results are based on the TUBA results. Overall the changes are small in the 0-2 minute bands but increase significantly for longer distance trips in the >5min band.

Table 5-4: Distribution of Time Savings – DS3

Time Change Band	Person Hours ('000s)	Monetised (£ '000s)
0-2 mins	-98,613	-356,962
2-5 mins	-72,092	-308,202
5+ mins	-146,762	-573,443
Total	**-317,467**	**-1,238,607**

Note: values in 000's

Figure 5-1 and Figure 5-2 show the profile of time saving dis-benefits over the 60-year appraisal period.

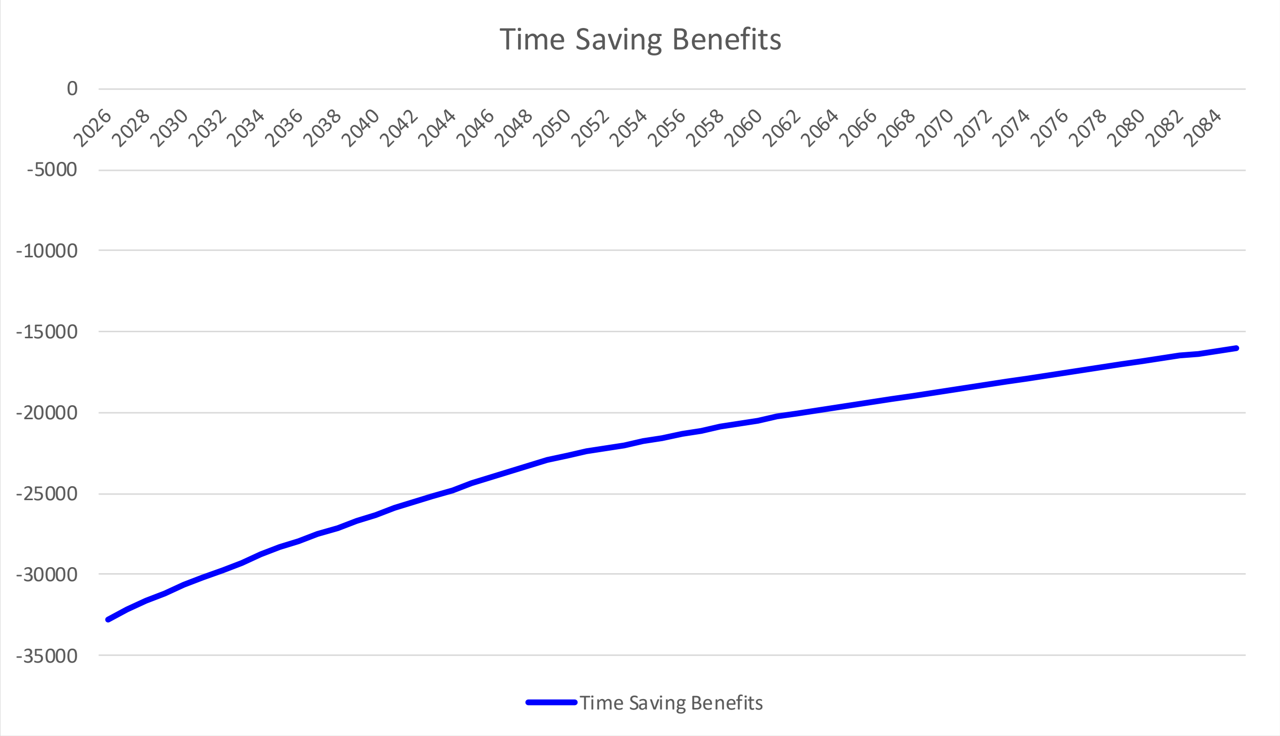


Figure 5-1: Highway users Time Saving (dis) Benefits over Time (values in 2010 prices and values) – DS3

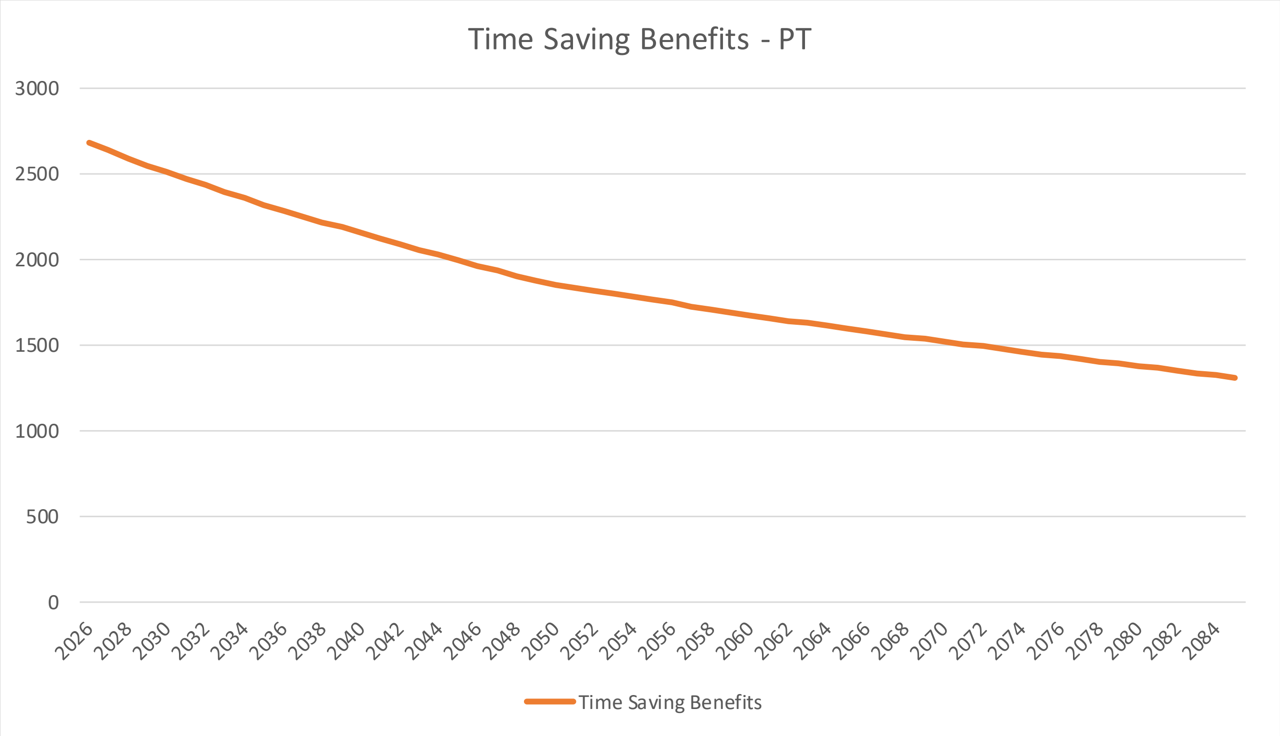


Figure 5-2: PT users Time Saving Benefits over Time (values in 2010 prices and values) – DS3

5.7 Economic Tables

The results of the economic analysis are reported in the standard TAG tables, namely the Transport Economic Efficiency (TEE), Public Accounts (PA) and Analysis of Monetised Costs and Benefits (AMCB) tables. The cost analysis for the appraisal and the total values reported in the PA Table (Table 5-8) are summarised in Table 5-5 below.

Table 5-5: Appraisal Costs Summary – DS3

Appraisal Analysis £000s	Highway	PT	Total
Investment Costs	212,342	160,408	372,750
Developers Contribution	0	0	0
Broad Transport Budget	212,342	160,408	372,750
Wider Public Finances	-7,659	8,322	663

Note: Values in £'s 000 at 2010 Prices and Values

The economic analysis tables (TEE, PA and AMCB) for the DS3 option are given in Table 5-7 to Table 5-15. Level 1 Active mode benefits have been included in the AMCB table under Physical Activity.

The **Initial BCR** (combined) for the DS3 scheme is estimated to be **-3.31** with an **NPV** of **£-1,605.4m**. The values exclude wider impacts benefits of the scheme. The summary of key economic outputs for the different scenarios are given in Table 5-6. It shows the highway schemes do not provide any positive benefit in all of the options whereas the PT option provides some positive benefit. On its own, the DS3 PT option provides an initial BCR of just under 1.0 due to travel time benefits as a result of public transport corridor improvements.

Table 5-6: Summary of the Economic Case by Scenarios

Scenarios		PVB*	PVC*	NPV*	BCR
DS1	Highway	-1,413,470	212,342	-1,625,812	-6.66
	PT	22,636	0	22,636	-
	Combined	-1,390,834	212,342	-1,603,176	-6.55
DS2	Highway	-1,279,443	96,538	-1,375,981	-13.25
	PT	24,251	249,839	-225,588	0.10
	Combined	-1,255,192	346,377	-1,601,569	-3.62
DS3	Highway	-1,387,986	212,342	-1,600,328	-6.54
	PT	155,264	160,408	-5,144	0.97
	Combined	-1,232,722	372,750	-1,605,472	-3.31

* *values in £'000s at 2010 Prices and Values*

Table 5-7: Transport Economic Efficiency (TEE) – DS3 Highway

Non-business: Commuting	ALL MODES		ROAD	BUS and COACH	RAIL	OTHER
User benefits	TOTAL		Private Cars and LGVs	Passengers	Passengers	
Travel time	-569,209		-569,209	0	0	
Vehicle operating costs	-20,292		-20,292	0	0	
User charges	0		0	0	0	
During Construction & Maintenance	0		0			
COMMUTING	-589,501	*(1a)*	-589,501	0	0	

Non-business: Other	ALL MODES		ROAD	BUS and COACH	RAIL	OTHER
User benefits	TOTAL		Private Cars and LGVs	Passengers	Passengers	
Travel time	-366,221		-366,221	0	0	
Vehicle operating costs	-10,678		-10,678	0	0	
User charges	0		0	0	0	
During Construction & Maintenance	0		0			
NET NON-BUSINESS BENEFITS: OTHER	-376,899	*(1b)*	-376,899	0	0	

Business					BUS and COACH		RAIL	
User benefits			Goods Vehicles	Business Cars & LGVs	Passengers	Freight	Passengers	Freight
Travel time	-413,715		-195,829	-217,886	0		0	
Vehicle operating costs	-57,240		-31,007	-26,233	0		0	
User charges	0		0	0	0		0	
During Construction & Maintenance	0		0	0				
Subtotal	-470,955	*(2)*	-226,836	-244,119	0	0	0	0

Private sector provider impacts			Road	Bus	Rail
Revenue	0		0	0	0
Operating costs	0		0	0	0
Investment costs	0		0	0	0
Grant/subsidy	0		0	0	0
Subtotal	0	*(3)*	0	0	0
Other business impacts			Road	Bus	Rail
Developer contributions	0	*(4)*	0	0	0
NET BUSINESS IMPACT	-470,955	*(5) = (2) + (3) + (4)*			
TOTAL					
Present Value of Transport Economic Efficiency Benefits (TEE)	-1,437,355	*(6) = (1a) + (1b) + (5)*			

Notes: Benefits appear as positive numbers, while costs appear as negative numbers.
All entries are discounted present values, in 2010 prices and values

Table 5-8: Public Accounts (PA) – DS3 Highway

	ALL MODES		ROAD	BUS and COACH	RAIL	OTHER
Local Government Funding	TOTAL		INFRASTRUCTURE			
Revenue	0		0			
Operating Costs	0		0			
Investment Costs	0		0			
Developer and Other Contributions	0		0			
Grant/Subsidy Payments	0		0			
NET IMPACT	0	*(7)*	0			
Central Government Funding: Transport						
Revenue	0		0			
Operating costs	0		0			
Investment Costs	212,342		212,342			
Developer and Other Contributions	0		0			
Grant/Subsidy Payments	0		0			
NET IMPACT	212,342	*(8)*	212,342			
Central Government Funding: Non-Transport						
Indirect Tax Revenues	-7,659	*(9)*	-7,659	0	0	
TOTALS						
Broad Transport Budget	212,342	*(10) = (7) + (8)*				
Wider Public Finances	-7,659	*(11) = (9)*				

Notes: Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.

All entries are discounted present values in 2010 prices and values.

Table 5-9: Associated Monetised Costs and Benefits (AMCB) – DS3 Highway

Noise	0	*(12)*
Local Air Quality	0	*(13)*
Greenhouse Gases	-3,792	*(14)*
Journey Quality	0	*(15)*
Physical Activity	45,502	*(16)*
Accidents	0	*(17)*
Economic Efficiency: Consumer Users (Commuting)	-589,501	*(1a)*
Economic Efficiency: Consumer Users (Other)	-376,899	*(1b)*
Economic Efficiency: Business Users and Providers	-470,955	*(5)*
Wider Public Finances (Indirect Taxation Revenues)	7,659	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	-1,387,986	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*
Broad Transport Budget	212,342	*(10)*
Present Value of Costs (see notes) (PVC)	212,342	*(PVC) = (10)*
OVERALL IMPACTS		
Net Present Value (NPV)	-1,600,328	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)	-6.537	BCR=PVB/PVC

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

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Table 5-10: Economic Efficiency of the Transport System (TEE) - DS3 PT

Non-business: Commuting	ALL MODES		ROAD	BUS and COACH	RAIL	OTHER
User benefits	TOTAL		Private Cars and LGVs	Passengers	Passengers	
Travel time	27,465		0	27465	0	
Vehicle operating costs	0		0	0	0	
User charges	0		0	0	0	
During Construction & Maintenance	0		0			
COMMUTING	27,465	(1a)	0	27465	0	

Non-business: Other	ALL MODES		ROAD	BUS and COACH	RAIL	OTHER
User benefits	TOTAL		Private Cars and LGVs	Passengers	Passengers	
Travel time	79,333		0	79333	0	
Vehicle operating costs	0		0	0	0	
User charges	0		0	0	0	
During Construction & Maintenance	0		0			
NET NON-BUSINESS BENEFITS: OTHER	79,333	(1b)	0	79333	0	

Business					BUS and COACH		RAIL	
User benefits			Goods Vehicles	Business Cars & LGVs	Passengers	Freight	Passengers	Freight
Travel time	3,738		0	0	3738		0	
Vehicle operating costs	0		0	0	0		0	
User charges	0		0	0	0		0	
During Construction & Maintenance	0		0	0				
Subtotal	3,738	(2)	0	0	3,738	0	0	0

Private sector provider impacts			Road	Bus	Rail
Revenue	53,050		0	53050	0
Operating costs	0		0	0	0
Investment costs	0		0	0	0
Grant/subsidy	0		0	0	0
Subtotal	53,050	(3)	0	53050	0

Other business impacts			Road	Bus	Rail
Developer contributions	0	(4)	0	0	0
NET BUSINESS IMPACT	56,788	(5) = (2) + (3) + (4)			
TOTAL					
Present Value of Transport Economic Efficiency Benefits (TEE)	163,586	(6) = (1a) + (1b) + (5)			

Notes: Benefits appear as positive numbers, while costs appear as negative numbers.
All entries are discounted present values, in 2010 prices and values

Table 5-11: Public Accounts (PA) Tables – DS3 PT

	ALL MODES		PT	BUS and COACH	RAIL	OTHER
Local Government Funding	TOTAL		INFRASTRUCTURE			
Revenue	0		0			
Operating Costs	0		0			
Investment Costs	0		0			
Developer and Other Contributions	0		0			
Grant/Subsidy Payments	0		0			
NET IMPACT	0	*(7)*	0			
Central Government Funding: Transport						
Revenue	0		0			
Operating costs	0		0			
Investment Costs	160,408		160,408			
Developer and Other Contributions	0		0			
Grant/Subsidy Payments	0		0			
NET IMPACT	160,408	*(8)*	160,408			
Central Government Funding: Non-Transport						
Indirect Tax Revenues	8,322	*(9)*	0	8,322	0	
TOTALS						
Broad Transport Budget	160,408	*(10) = (7) + (8)*				
Wider Public Finances	8,322	*(11) = (9)*				

Notes: Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.

All entries are discounted present values in 2010 prices and values.

Table 5-12: Analysis of Monetised Costs and Benefits (AMBC) – DS3 PT

Noise	0	*(12)*
Local Air Quality	0	*(13)*
Greenhouse Gases	0	*(14)*
Journey Quality	0	*(15)*
Physical Activity	0	*(16)*
Accidents	0	*(17)*
Economic Efficiency: Consumer Users (Commuting)	27,465	*(1a)*
Economic Efficiency: Consumer Users (Other)	79,333	*(1b)*
Economic Efficiency: Business Users and Providers	56,788	*(5)*
Wider Public Finances (Indirect Taxation Revenues)	-8,322	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	155,264	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*
Broad Transport Budget	160,408	*(10)*
Present Value of Costs (see notes) (PVC)	160,408	*(PVC) = (10)*
OVERALL IMPACTS		
Net Present Value (NPV)	-5,144	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)	0.968	BCR=PVB/PVC

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

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Table 5-13: Economic Efficiency of the Transport System (TEE) - DS3 Combined Highway and PT

Non-business: Commuting	**ALL MODES**		**ROAD**		**BUS and COACH**	**RAIL**		**OTHER**
User benefits	**TOTAL**		**Private Cars and LGVs**		**Passengers**	**Passengers**		
Travel time	-541,744		-569,209		27465	0		
Vehicle operating costs	-20,292		-20,292		0	0		
User charges	0		0		0	0		
During Construction & Maintenance	0		0					
COMMUTING	-562,036	*(1a)*	-589,501		27465	0		
Non-business: Other	**ALL MODES**		**ROAD**		**BUS and COACH**	**RAIL**		**OTHER**
User benefits	**TOTAL**		**Private Cars and LGVs**		**Passengers**	**Passengers**		
Travel time	-286,888		-366,221		79333	0		
Vehicle operating costs	-10,678		-10,678		0	0		
User charges	0		0		0	0		
During Construction & Maintenance	0		0					
NET NON-BUSINESS BENEFITS: OTHER	-297,566	*(1b)*	-376,899		79333	0		
Business					**BUS and COACH**		**RAIL**	
User benefits			**Goods Vehicles**	**Business Cars & LGVs**	**Passengers**	**Freight**	**Passengers**	**Freight**
Travel time	-409,977		-195,829	-217,886	3738		0	
Vehicle operating costs	-57,240		-31,007	-26,233	0		0	
User charges	0		0	0	0		0	
During Construction & Maintenance	0		0	0				
Subtotal	-467,217	*(2)*	-226,836	-244,119	3,738	0	0	0
Private sector provider impacts								
			Road	Bus	Rail			
Revenue	53,050		0	53050	0			
Operating costs	0		0	0	0			
Investment costs	0		0	0	0			
Grant/subsidy	0		0	0	0			
Subtotal	53,050	*(3)*	0	53050	0			
Other business impacts								
			Road	Bus	Rail			
Developer contributions	0	*(4)*	0	0	0			
NET BUSINESS IMPACT	-414,167	*(5) = (2) + (3) + (4)*						
TOTAL								
Present Value of Transport Economic Efficiency Benefits (TEE)	-1,273,769	*(6) = (1a) + (1b) + (5)*						

Notes: Benefits appear as positive numbers, while costs appear as negative numbers.
All entries are discounted present values, in 2010 prices and values

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Table 5-14: Public Accounts (PA) Tables – DS3 Combined Highway and PT

	ALL MODES TOTAL		ROAD INFRASTRUCTURE	PT Infrastructure		OTHER
Local Government Funding						
Revenue	0		0			
Operating Costs	0		0			
Investment Costs	0		0			
Developer and Other Contributions	0		0			
Grant/Subsidy Payments	0		0			
NET IMPACT	0	*(7)*	0			
Central Government Funding: Transport						
Revenue	0		0			
Operating costs	0		0			
Investment Costs	372,750		212,342	160,408		
Developer and Other Contributions	0		0			
Grant/Subsidy Payments	0		0			
NET IMPACT	372,750	*(8)*	212,342	160,408		
Central Government Funding: Non-Transport						
Indirect Tax Revenues	663	*(9)*	-7,659	8,322	0	
TOTALS						
Broad Transport Budget	372,750	*(10) = (7) + (8)*				
Wider Public Finances	663	*(11) = (9)*				

Notes: Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.

All entries are discounted present values in 2010 prices and values.

Table 5-15: Analysis of Monetised Costs and Benefits (AMBC) – DS3 Combined Highway and PT

Noise	0	*(12)*
Local Air Quality	0	*(13)*
Greenhouse Gases	-3,792	*(14)*
Journey Quality	0	*(15)*
Physical Activity	45,502	*(16)*
Accidents	0	*(17)*
Economic Efficiency: Consumer Users (Commuting)	-562,036	*(1a)*
Economic Efficiency: Consumer Users (Other)	-297,566	*(1b)*
Economic Efficiency: Business Users and Providers	-414,167	*(5)*
Wider Public Finances (Indirect Taxation Revenues)	-663	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	-1,232,722	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*
Broad Transport Budget	372,750	*(10)*
Present Value of Costs (see notes) (PVC)	372,750	*(PVC) = (10)*
OVERALL IMPACTS		
Net Present Value (NPV)	-1,605,472	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)	-3.307	BCR=PVB/PVC

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

6. Summary and conclusions

6.1 Summary

As part of the development of different options for the central section of the A38 route through Birmingham city centre, a series of options have been considered for providing a degree of mitigation on alternative routes. These packages of measures were tested using the West Midlands PRISM model to determine benefits and impacts, to support the development of a business case for the significant transport change.

The following packages will be tested:

- DS 1 – Highway Package with improvements to western side of ring road
- DS 2 – Public transport package with limited highway changes
- DS 3 – Preferred Hybrid option with highway improvements to western side of ring road and selected public transport package improvements

The models' results demonstrated that all the DS options bring about significant mode shift away from cars to public transport and active modes. The options result in significant increase in congestion on the existing transport network in Birmingham city centre, including the ring road. The DS options reduce the through traffic travelling via the city centre and in some cases disappear altogether as car users divert to other modes or change their destination.

The vehicle-kms on the highway network across the inner cordon drops significantly across all DS options by up to 35.7%. The vehicle-hours do not drop as significantly indicating worsening congestion with average speeds dropping by between 17.7% and 20.4% in the AM and 16.6% and 20.9% in the PM.

Across the outer cordon, the vehicle-kms drop across all DS options by up to 17.5%. The vehicle-hours marginally drop under the DS options compared to the DM again indicating significant congestion with speeds anticipated to drop by between 14.6% to 15.0% in the AM peak and by between 14.0% and 16.8% in the PM peak.

The economic appraisal of transport user benefits was undertaken using TUBA for the 3 DS options. Due to the significant delays the closure of the A38 imposes on the road users, the highway options results in significant dis-benefits over the 60-year appraisal period with the NPV for all options in excess of -£1,300 million. The NPV for DS3 is over -£1,600 million and the initial BCR for the highway option being -6.54 and that for the combined option being -3.3.

6.2 Conclusions

The highway and transport interventions tested to radically reconfigure the A38 in Birmingham city centre by closing the tunnels and developing alternative transport infrastructure shows it leading to significant transport user dis-benefits. However, it is expected that the schemes will have significant benefits to air quality and noise, and lead to a reduction in accidents due to the decrease in traffic that have not been analysed at this stage of the study. Likewise, wider economic impacts due to the schemes have been analysed separately and documented in a separate note.

It is recommended that further detailed modelling and economics be undertaken to understand the full impacts of the scheme options to support any decision on refining the recommended hybrid scheme option.

Appendix A. Additional Information

Appendix D. Economics Forecasting Note

Snow Hill Growth Strategy

Economics Forecasting Note

6th September 2019

Birmingham City Council

Snow Hill Growth Strategy

Project No:	Project Number
Document Title:	Economic Forecasting Note
Document No.:	JETT Number
Revision:	1
Date:	6th September 2019
Client Name:	Birmingham City Council
Project Manager:	
Author:	Dan Chung
File Name:	Economics Forecasting Note

Jacobs Engineering Group Inc.

Document History and Status

Revision	Date	Description	By	Review	Approved

Introduction

Background

Birmingham City Centre currently has a high proportion of car-based access. Equally, the A38, including the tunnels, have a high volume of through traffic. The Snowhill Transport Connectivity Project aims to facilitate to displace traffic towards the Ring Road by providing significant additional capacity and encourage more sustainable modes of travel to access the City Centre. Equally, the growth of Birmingham City Centre appears to be significantly constrained by the physical presence of A38, acting as a significant severance. The project also aims to facilitate expansion of Birmingham City Centre by removing the A38 severance.

Purpose of Report

This technical report seeks to estimate active mode impacts of the project, including:

- Active mode impacts related to intensification of activity amongst existing commuters within impacted City Centre and edge of City Centre areas
- Active mode impacts related to existing road users in the wider impacted area displaced to active modes
- Active mode impacts to existing road users in the wider impacted area displaced to public transport and park and ride services
- Active mode impacts related to higher activity amongst new commuters (from enabled development) within impacted City Centre and edge of City Centre areas

Furthermore, the report forecasts the following operational stage wider impacts, including:

- Development, homes and jobs enabled by the project
- Land value uplift enabled by the project
- GVA enabled by the project.

Structure of Report

The report includes the following sections:

- Scheme description
- Transport benefits (specifically Active Mode)
- Wider economic benefits: homes, jobs and GVA enabled
- Wider economic benefits: land value uplift.

Scheme Description

Scheme Need

Development within the study area comprises of a vast number of empty or derelict buildings. These development sites are currently being served by a poor pedestrian flow, with the highway acting as a severance to accessing the development sites. It is envisaged that by providing improved/new walking and cycling infrastructure the barriers to accessing these development sites would be removed. Thereby increasing the attractiveness of these properties, subsequently leading to the re-development or refurbishment of said properties.

Currently no pedestrian modelling has been undertaken at the Strategic Outline Business Case, in the absence of this market-based intelligence has been used to estimate the scale of the development dependent on the scheme.

Dependency test

It is proposed that, as the scheme progresses to an Outline Business Case, a formal WebTag dependent development test, in accordance with TAG Unit A2.2, will be undertaken. For this project, the dependency test undertaken at the Outline Business Case stage will focus on the provision of active mode infrastructure and how much of the development proposed is dependent on it.

The scenarios that will be modelled as per guidance are as follows:

Combinations of Scenario – with/without dependent development and the transport scheme		
	Without Dependent Development	With Dependent Development
Without transport scheme	P	Q
With transport scheme	S	R

Table 1 - Dependent Development Scenarios. Source: TAG Unit A2.2

The dependent development test seeks to establish the quantum of development that will prevent a “reasonable level of service” being provided on the transport network. The first step in assessing this to create a baseline scenario. This scenario excludes any transport scheme as well as the trips related to the development proposals. The baseline exercise will be used to demonstrate the level of service that is currently being provided on the network, in the absence of the development proposals.

Scenario Q is then modelled, this is where the transport model includes the dependent development but does not include the transport scheme. Comparison between the baseline and scenario Q reveals the key locations at which the level of service on the network is impacted the most. To ascertain dependency, the increase in travel costs at the key locations will be investigated, with an exceptional increase in travel costs being taken as evidence of dependency.

Once it has been established that the development being proposed is dependent, the analysis will then assess what level of that development is dependent. This will be done through a trial and error process to identify the quantum of development that can be accommodated on the network without the level of service provided being compromised. This is represented by scenario P – otherwise known as the do minimum scenario.

Development Sites

The map below provides a visual representation of the development sites identified as part of the Snow Hill connectivity scheme.

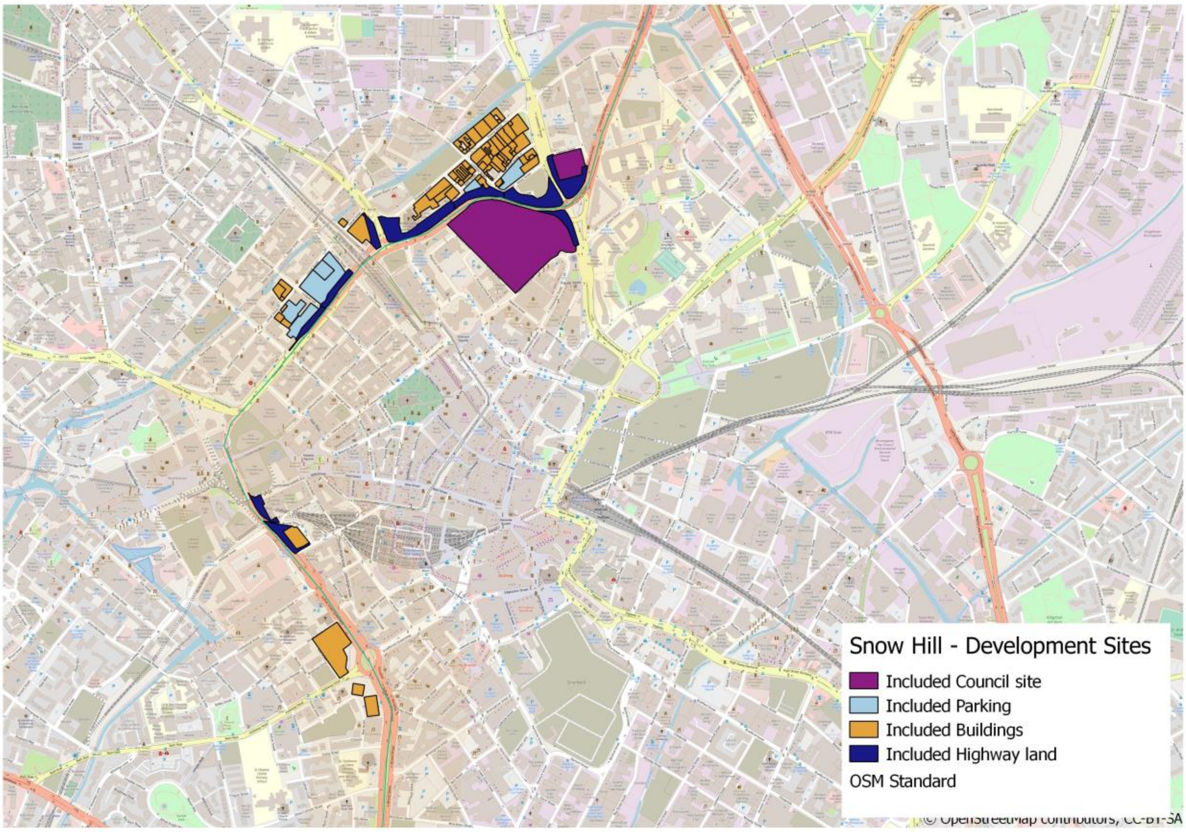

Figure 1 - Snow Hill Potential Redevelopment Sites

Transport Benefits

Active Mode Benefits

A.1.1 Introduction

Active mode benefits are estimated for three different groups: existing commuter trips, additional commuter trips after scheme delivery and non-work-related trips (shopping and leisure) in the Snow Hill area. The commuter analysis considers a 15-year appraisal period:

- from 2025 to 2040 representing the growth of existing commuters trips due to infrastructure provision, and;

- from 2040 to 2055 representing the additional commuting trips generated and attracted after the development of the area providing new offices, apartments and retail activities.

Further analysis is conducted to estimate the impact on the wider city based on mode shift from car to active modes. The reduction of capacity on the A38 and the potential closure of the tunnels will prevent cars crossing the city by this link forcing car trips using the ring road. The appraisal period considered for the wider impact analysis is 60 years.

Active Mode Benefits Analysed

The assessment undertaken in this analysis is conducted through the DfT's Active Mode Toolkit, which is based on DfT's Tag Unit A5.1 Active Mode Appraisal guidance. The impacts monetised through DfT's Active Mode Toolkit are presented in this report.

DfT's Tag Unit A5.1 Active Mode Appraisal provides guidance on how to estimate and report the impacts related to walking and cycling. DfT's toolkit which is based on Tag Unit A5.1 applies the appraisal techniques and best practice assumptions outlined within Tag Unit A5.1. The toolkit thus allows the monetisation of the impacts related to active mode travel. DfT's active mode toolkit monetises the following impacts in line with guidance from Tag Unit A5.1:

1. **Journey Quality Impacts**

Journey quality is an important consideration in scheme appraisal for cyclists and walkers. It includes fear of potential accidents and therefore the majority of concerns are about safety (e.g. segregated cycle tracks greatly improve journey quality over cycling on a road with traffic). Journey quality also includes infrastructure and environmental conditions on a route. TAG Unit A4.1 contains relevant guidance for the calculation of journey quality benefits.

DfT's Active Mode Toolkit captures impacts related to journey quality in the benefit category journey ambience.

2. **Physical Activity Impacts**

Physical activity impacts typically form a significant proportion of benefits for active mode schemes. In order to derive the impact, the toolkit requires an estimate of the number of new walkers or cyclists as a result of the scheme; the time per day they will spend active; and mortality rates applicable to the group affected by the scheme. TAG Unit A4.1 provides details on the estimation of these benefits.

DfT's Active Mode Toolkit captures changes in the physical activity benefits through both the category of absenteeism as well as reduced risk of premature death.

3. **Collision Impacts**

Collision benefits (or dis-benefits) are calculated from changes in the usage of different types of infrastructure by different modes and the accident rates associated with those modes on those types of infrastructure. Therefore, collision analysis should take account of changes in collisions involving pedestrians and cyclists, resulting from changes in walking and cycling and the infrastructure used, and the impact of mode switch on accidents involving other road users. Collision benefits can be estimated using the Marginal External Cost method. Details can be found in TAG Unit A5.4. As collision impacts are calculated through changes in walking and cycling numbers, said impacts accrue across all beneficiary groups.

DfT's Active Mode Toolkit presents the collision benefits (or dis-benefits) under the category accident.

4. Environmental Impacts

The environmental benefits from a walk or cycling scheme are achieved through a reduction in motorised traffic and hence a reduction in the associated externalities. Environmental benefits can be estimated using the Marginal External Cost method. Details can be found in TAG Unit A5.4. As environmental impacts are calculated through changes in motorised traffic, environmental impacts accrue across all beneficiary groups.

The environmental impacts are presented within DfT's Active Mode Toolkit through the categories: local air quality, noise and greenhouse gases.

5. Decongestion and Indirect Tax Impacts

Mode switch from car to active modes will benefit those who continue to use the highways (decongestion benefit), but also impacts the state's indirect tax revenues. Decongestion and changes in indirect tax revenue can be estimated using the Marginal External Cost method. Details can be found in TAG Unit A5.4. As these impacts are calculated through changes in motorised traffic, the impacts accrue across all beneficiary groups.

DfT's Active Mode Toolkit presents the changes in decongestion and indirect tax impacts under the categories congestion benefit and indirect taxation respectively.

Existing commuters (2025 – 2039):

Method of travel to work data (Census 2011), for the LSOAs identified as covering the Snow Hill context area, demonstrates that an estimated 0.5% of individuals commute to work using a bicycle, whilst over 20.8% of individuals commute on foot. The data estimates the average distance cycled to be 5.52 km, whilst the average distance walked is 3.23 km.

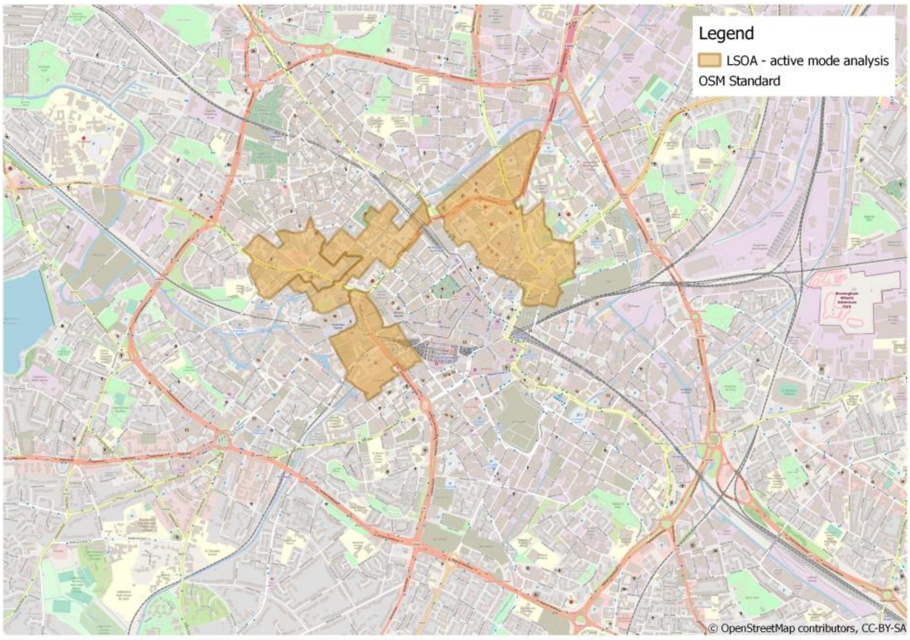

Figure 2 – LSOAs selected for the Census data analysis

Method of travel to work data (Census 2011) for the context area also illustrates that there are 7,191 commuters within the area. Application of the active travel by mode percentages, derived above, to the commuters in the context area estimates the pre-intervention number of cyclists and walkers to be 39 and 1,498 respectively.

The demand uplift factors used to grow the demand post-scheme delivery are based on the assumption that by providing additional cycling infrastructure and improved public realm, the levels of walking and cycling will reach the same levels as in the city centre. It is estimated that the number of individuals cycling to work will increase by 50% whilst the number of individuals walking to work will increase by 17%. Based on this approach, the number of cyclists is expected to increase from 39 to 59 post-intervention, whilst the number of number pedestrians is expected to increase from 1,498 to 1,753.

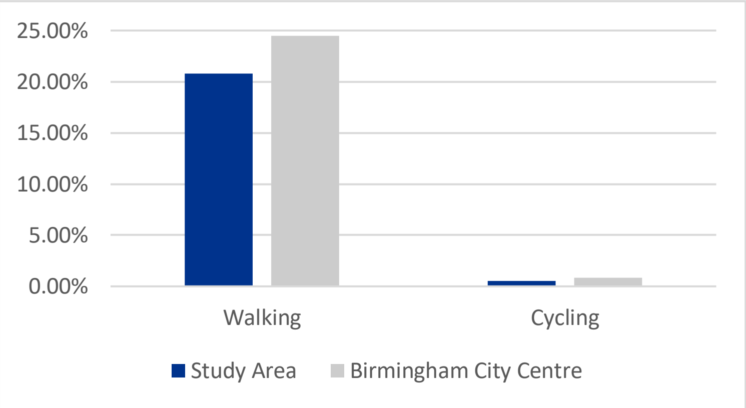

Figure 3 - Active mode level comparison between the study area and the city centre

To populate DfT's Active Mode Toolkit, the number of journeys per day for both pre- and post-intervention is required. To generate the number of journeys per day, it is assumed that 100% of cyclists and pedestrians commuting to work in the context area will undertake a return trip. Thus, pre-intervention the 39 cyclists and 1,498 walkers relate to 78 cycling trips per day and 2,996 walking trips per day. Post intervention the 59 cyclists and 3,505 walkers are envisaged to correspond to 117 cycling trips per day and 7,011 walking trips per day.

The impacts are summarised in Table 2 below:

Table 2 - Benefits by Category

Impact Drivers	Estimates, present value in 2010 prices £ 000's
Congestion benefit	51.60
Infrastructure	0.48
Accident	14.48
Local Air Quality	0.05
Noise	0.97
Greenhouse Gases	2.47
Reduced risk of premature death	998.46
Absenteeism	1,602.41
Journey Ambience	1,678.42
Indirect Taxation	-8.98
PVB	**4,339.88**

Table 2 - Existing Commuter Benefits by Category

The analysis suggests that from a commuter cyclist/walker perspective the scheme could deliver a present value of benefits (PVB) of £4.3 million over an appraisal period of twenty years. The benefits generated are as a result of commuters within the context area switching to an active mode of travel to work.

Additional commuters (2040 – 2054):

The analysis for additional commuters is based on the existing floorspace and the change in land use after the Snow Hill regeneration according to the information provided by Cushman & Wakefield. It is estimated that a total of 150,088 sqm will be redeveloped, and the land use will be distributed as follows: 5% retail, 15% pub, 40% office and 40% apartment.

TRICS has been used as a tool to estimate the new trips generated and attracted according to the information on land uses, local environment and surroundings. TRICS data gives trip rates for a 12-hour period by type of land use. Trip rates are normally presented in trips per 100sqm but in the case of apartment and residential floorspace the rate is in trips per dwelling. A conversion of sqm to dwellings is applied following the "Strategic Housing Land Availability Assessment Report (2018)" for Birmingham that states that the developments in the city centre should take a place at a minimum of 100 dwellings per hectare.

Census 2011 data gives the mode split for the area of study at a LSOA level: 0.5% of commuters get to work cycling and 20.8%. Applying these figures to TRICS data results in trip rates by land use for pedestrians and cyclists which are the groups of interest for this analysis.

Trip rates	Pedestrians		Cyclists	
	Pedestrian arrival	Pedestrian departs	Cyclists arrival	Cyclists departs
Retail (trips per 100 sqm)	35.131	36.498	0.0120	0.0127
Pub (trips per 100 sqm)	3.186	3.123	0.0025	0.0006
Office (trips per 100 sqm)	0.870	0.882	0.0008	0.0007
Apartment (trips per dwelling)	0.342	0.348	0.0004	0.0004

Table 3 - Trip rates by land use and transport mode in Snow Hill (Birmingham) for all purposes. Source: TRICS data base

Land Use (2040)	Total Area(sqm)	Pedestrians		Cyclists	
		Arrives	Departs	Arrives	Departs
Retail	7,544	2,650.42	2,753.49	0.90	0.96
Pub	22,263	721.17	706.94	0.57	0.13
Office	60,354	525.16	532.33	0.45	0.45
Apartment	60,354	206.57	209.84	0.24	0.21
Total	150,886	8,306		3.92	

Table 4 - Trips attracted and generated after the regeneration of Snow Hill

Therefore, the total daily walking trips will be 11,009 and the total daily cycling trips will be 215 due to new development coming forward by 2039.

Baseline demand for the second phase of the analysis is the existing commuters grown to 2039 demand. After the delivery of the new developments around Snow Hill, the demand will increase to the levels estimated in the previous table. Annualisation factor considered for this analysis is 229 days which accounts for all weekdays in a year minus bank holidays and 24 days of annual leave.

Average trip distances are assumed to be the same as for the first phase: distance cycled is 5.52 km, whilst the average distance walked is 3.23 km. As an estimation, it is expected that the average proportion of the trips which will use the scheme infrastructure is 30%. As the level of detail on this project progress, this assumption will be refined.

The impacts are summarised in Table 5 below:

Impact Drivers	Estimates, present value in 2010 prices £ 000's
Congestion benefit	494.72
Infrastructure	4.52
Accident	135.59
Local Air Quality	0.47
Noise	9.04
Greenhouse Gases	24.41
Reduced risk of premature death	10,970.76
Absenteeism	14,949.25
Journey Ambience	3,099.94
Indirect Taxation	-70.89
PVB	**29,613.28**

Table 5 - Additional Commuter Benefits by Category

The analysis suggests that from a commuter cyclist/walker perspective the scheme could deliver a present value of benefits (PVB) of £29.6 million over an appraisal period of twenty years. The benefits generated are as a result of new commuters choosing to travel sustainably to work.

A.1.2 Road user trips displaced:

The Snow Hill redevelopment and associated transport schemes will lead to a change in route times, destinations and mode shift based on the perception of users due to the new infrastructure provision and constraints along the A38 and wider network. The impacts are modelled using the PRISM model. Do Minimum scenario (reference case) accounts for a few road closures around Digbeth. Three different Do-Something scenarios have been defined according to the improvement of the level of service of some of the junctions along the Ring Road and the improvements in Park&Ride and Public Transport around the city centre. These are described in the table below:

	Highway	Public Transport
DS1	Do Minimum + Tunnel closed & Ring road improvements (8 schemes)	-
DS2	Do Minimum + Tunnel Closed	Park and Ride improvements
DS3	Do Minimum + Tunnel Closed + Ring road improvements (8 schemes)	Best of Park and Ride improvements + PT corridor improvements

Table 6 - Definition of Do-Something Scenarios

Reduced road capacities in the city centre, new sustainable infrastructure provision and investment in public transport strategies will make car trips less attractive. The alternative options for users shifting from car mode include:

a. Walking or cycling from origin to destination.

b. Combination of Park&Ride and Public Transport and walking to the destination.

c. Purely Public Transport accessed by foot at both origin and destination.

All three alternatives involve active modes to different proportions along the trip. The benefits of the trips displaced in terms of active modes are monetised using the Active Mode Toolkit across an appraisal period of 60 years.

Trips displaced from car to:	Additional DS1	Additional DS2	Additional DS3
A.1.Walking	508	401	427
A.2 Cycling	50	40	39
B. PnR (Rail)	233	2106	1635
C. WnR (Rail+Bus)	1955	1325	2047

Table 7 - Additional demand (Do something – Do minimum scenarios)

Walking and cycling

In order to be consistent with the previous analysis, the average walking and cycling distance to work is based on the NTS data: distance cycled is 5.52 km whilst the average distance walked is 3.23 km. As an estimation, it is expected that the average proportion of the trips which will use the scheme infrastructure is 30%.

Impact Drivers	Estimates, present value in 2010 prices £ 000's		
	DS1	DS2	DS3
Congestion benefit	802.81	634.95	666.43
Infrastructure	7.41	5.86	6.15
Accident	222.38	175.88	184.61
Local Air Quality	0.79	0.63	0.66
Noise	14.83	11.73	12.31
Greenhouse Gases	39.11	30.93	32.47
Reduced risk of premature death	3,551.19	2,810.53	2,933.42
Absenteeism	4,159.63	3,285.84	3,482.89
Journey Ambience	0.00	0.00	0.00
Indirect Taxation	-126.12	-99.74	-104.68
PVB	**8,664.64**	**6,850.7**	**7,208.3**

Table 8 - Walking and Cycling Benefits by Category

P&R and Public Transport

These trips comprise of three parts: Car access to the main train/bus station, in-vehicle public transport journey and walking access to the final destination. The benefits estimated in the section are related to the last portion of the trip.

The average walked distance from the stop/station to their destination is assumed to be 0.795 km. This figure is the average between the mean walked distance to a bus stop and the mean walked distance to a train station[1] in the UK, excluding London.

Impact Drivers	Estimates, present value in 2010 prices £ 000's		
	DS1	DS2	DS3
Congestion benefit	77.6	701.2	544.6
Infrastructure	0.7	6.5	5.0
Accident	21.5	194.2	150.9
Local Air Quality	0.1	0.7	0.5
Noise	1.4	12.9	10.1

[1] How far people work? – Gareth Wakenshaw & Dr Nick Bunn (July 2015)

Greenhouse Gases	3.8	34.2	26.5
Reduced risk of premature death	1,312.9	11,860.9	9,212.6
Absenteeism	444.9	4,019.1	3,121.7
Journey Ambience	0.0	0.0	0.0
Indirect Taxation	-12.2	-110.1	-85.6
PVB	**1,850.0**	**16,713.1**	**12,981.4**

Table 9 - P&R and Public Transport Benefits by Category

W&R and Public Transport

These trips are composed of three parts: Walking access to the nearest rail station/bus stop, in-vehicle travel and walking access to final destination. The benefits estimated in this section are related to the access portions of the trip.

The average walked distance per trip is double the distance of the previous scenario as the access by active modes is both at origin and destination. Therefore, the average estimated distance is 1.59 km.

W&R and Public Transport Benefits by Category

Impact Drivers	Estimates, present value in 2010 prices £ 000's		
	DS1	DS2	DS3
Congestion benefit	1,302.4	882.7	1,363.7
Infrastructure	12.0	8.2	12.6
Accident	360.8	244.5	377.7
Local Air Quality	1.3	0.9	1.3
Noise	24.1	16.3	25.2
Greenhouse Gases	63.5	43.0	66.4
Reduced risk of premature death	11,015.7	7,465.9	11,534.1
Absenteeism	7,465.4	5,059.7	7,816.7
Journey Ambience	0.0	0.0	0.0
Indirect Taxation	-204.6	-138.7	-214.2
PVB	**20,028.5**	**13,574.3**	**20,971.0**

Table 10 - W&R and Public Transport Benefits by Category

Wider Economic Benefits – Operational Stage: Land Value Uplift

Introduction

Land value uplift is an economic impact stemming from a change in land towards higher valued uses. It is envisaged that the Snow Hill connectivity scheme would lead to land value uplift as a result of reducing highways land and improving pedestrian flows to the identified context areas over a pragmatic 15-year build profile period of 2025 - 2039. This is only for development enabled by the scheme proposals, which take the A38 severance away for expanding the city centre[2]. This is a recognised WebTAG impact with additional guidance found in TAG Unit A2.2.

Land Value Uplift Methodology

The identified study areas were mapped out site by site on GIS and key details assigned to the respective sites. This includes names (where available), the current use of the sites and also the size of the sites. To establish which sites have more potential for re-development, Cushman & Wakefield were consulted to provide market-based intelligence. The majority of these comprise of derelict, under-utilised or vacant buildings. These sites are then taken to form the reference case for this scheme i.e. the value of proposed land if the scheme does not materialise.

Reference Case Land Value

The respective land identified for potential redevelopment totals to approximately 15 hectares. A breakdown of site classifications can be seen below in Table 10:

Existing Classification	Site Area (Hectares)
Residential	0.579021091
Office	1.499015469
Highway	3.18997461
Industrial	9.82058068
Total	**15.08859185**

Table 11 - Quantum of Potential Redevelopment Sites

To quantify the land value of the 15 hectares, regional estimates have been collated by the Ministry of Housing, Communities & Local Government (MHCLG, 2017). A number of assumptions have been made to tailor the land value estimates to the development sites.

Professional judgement was used where we considered that a proxy would be a more applicable land value estimate than the unadjusted MHCLG figures for a selection of classifications. As residential land values for Birmingham (£1,270,000 per hectare) reflects an average of the whole city and not specifically referring to high-value, city centre developments, it was assumed to not be representative of the residential sites scoped above.

For existing residential sites, 50% of office “Central Business District” (CBD) land value estimate has been used as a proxy to reflect the higher value associated with its central location. The analysis does not consider the full office CBD land value estimate to account for the under-utilised characteristics of the reference case sites. Note that the same approach will be used for existing office sites.

[2] Current transport modelling follows fixed land-use assumptions to compute level 1 transport user impacts. Variable land-use assumptions reflecting the additional development enabled by the scheme proposals have not been considered in the transport model.

For industrial land, the MHCLG value was taken for Birmingham without any adjustments. Highways land has been assumed to carry a land value of £0 for this analysis in the absence of any established benchmarks. Table 11 details the land value estimates used for the reference case:

Existing Classification	Site Area (Hectares)	Land Value Estimate per Hectare (2017 Prices)	Source
Residential	0.579021091	£6,000,000	50% of Office CBD land value estimate (MHCLG)
Office	1.499015469	£6,000,000	50% of Office CBD land value estimate (MHCLG)
Highway	3.18997461	£0	Assumption
Industrial	9.82058068	£1,000,000	MHCLG
Total	**15.08859185**		

Table 12 - Land Value Estimates per Hectare

For consistency purposes, all benchmarks are converted into 2019 price base at this stage. This process was done using WebTAG's GDP Deflators Data Book (May 2019), as seen in table 13:

Year	GDP Deflator
2010	100.00
2011	101.92
2012	103.51
2013	105.44
2014	107.25
2015	107.72
2016	109.93
2017	112.36
2018	114.49
2019	116.76

Table 13 - GDP Deflator. Source: WebTAG DataBook May 2019

Applying the 2019 price base adjustments produces the following estimates:

Existing Classification	Site Area (Hectares)	Land Value Estimate per Hectare (2017 Prices)	Land Value Estimate per Hectare (2019 Prices)
Residential	0.579021091	£6,000,000	£6,235,217
Office	1.499015469	£6,000,000	£6,235,217
Highway	3.18997461	£0	£0
Industrial	9.82058068	£1,000,000	£1,039,203
Total	**15.08859185**		

Table 14 - Reference Case Land Value Estimate per Hectare, 2019 Prices

These benchmarks derive the final estimated reference case figures below:

Existing Classification	Site Area (Hectares)	Land Value Estimate per Hectare (2019 Prices)	Current Land Value
Residential	0.579021091	£6,235,217	£3,610,322
Office	1.499015469	£6,235,217	£9,346,687

Highway	3.18997461	£0	£0
Industrial	9.82058068	£1,039,203	£10,205,576
Total	**15.08859185**		**£23,162,586**

Table 15 - Reference Case Land Value, 2019 Prices

The reference case land value was apportioned evenly over 15 years to demonstrate when the gradual change in land use will be realised.

Year	Residential	Office	Highway	Industrial	Total
2025	£240,688	£623,112	£0	£680,372	£1,544,172
2026	£240,688	£623,112	£0	£680,372	£1,544,172
2027	£240,688	£623,112	£0	£680,372	£1,544,172
2028	£240,688	£623,112	£0	£680,372	£1,544,172
2029	£240,688	£623,112	£0	£680,372	£1,544,172
2030	£240,688	£623,112	£0	£680,372	£1,544,172
2031	£240,688	£623,112	£0	£680,372	£1,544,172
2032	£240,688	£623,112	£0	£680,372	£1,544,172
2033	£240,688	£623,112	£0	£680,372	£1,544,172
2034	£240,688	£623,112	£0	£680,372	£1,544,172
2035	£240,688	£623,112	£0	£680,372	£1,544,172
2036	£240,688	£623,112	£0	£680,372	£1,544,172
2037	£240,688	£623,112	£0	£680,372	£1,544,172
2038	£240,688	£623,112	£0	£680,372	£1,544,172
2039	£240,688	£623,112	£0	£680,372	£1,544,172
Total	**£3,610,322**	**£9,346,687**	**£0**	**£10,205,576**	**£23,162,586**

Table 16 - Reference Case Land Value Across the Appraisal Period 2025 - 2039

Intervention Case Land Value

At the current stage of the project, a future use development profile is yet to be established. As such, it has been assumed that all potential sites will be converted to mixed-use development, with office CBD land value estimate used as a proxy in the absence of site-specific values. A more detailed future profile will be provided as the scheme matures. It is assumed that this profile captures all development dependent on the Snow Hill connectivity scheme, however we note that there is scope for adjustment for this element of the assessment along with the identified reference case sites.

For the intervention case, it is also assumed that the development will be realised evenly over the 15-year appraisal period 2025 – 2039 in the same way as the reference case.

As mixed-use development is envisaged for the intervention case scenario, the full land value estimate for office CBD will be used as a proxy. This equates to £12,000,000 per hectare (2017 prices) for Birmingham. Applying the 2019 price base adjustments produces a figure of £12,470,435.

Land Value Estimate per Hectare (2017 Prices)	Land Value Estimate per Hectare (2019 Prices)	Source
£12,000,000	£12,470,435	Land value estimates for policy appraisal, MHCLG (2017)

Table 17 - Mixed-Use Development Proxy Land Value

The 2019 land value estimate per hectare is then applied to the total hectarage to determine the intervention case land value.

Future Classification	Site Area (Hectares)	Land Value Estimate per Hectare (2019 Prices)	Future Land Value (2019 Prices, undiscounted)
Mixed-use development	15.08859185	£12,470,435	£188,161,300

Table 18 - Intervention Case Land Value

Profiling the future land value over the 15-year appraisal period produces Table 18:

Year	Mixed-Use Land Value
2025	£12,544,087
2026	£12,544,087
2027	£12,544,087
2028	£12,544,087
2029	£12,544,087
2030	£12,544,087
2031	£12,544,087
2032	£12,544,087
2033	£12,544,087
2034	£12,544,087
2035	£12,544,087
2036	£12,544,087
2037	£12,544,087
2038	£12,544,087
2039	£12,544,087
Total	**£188,161,300**

Table 19 - Intervention Case Land Value Over the Appraisal Period 2025 - 2039

Subtracting the reference case land value from the intervention case land value will give us the land value uplift in 2019 prices:

Year	Intervention Case Land Value	Reference Case Land Value	Total
2025	£12,544,087	£1,544,172	£10,999,914
2026	£12,544,087	£1,544,172	£10,999,914
2027	£12,544,087	£1,544,172	£10,999,914
2028	£12,544,087	£1,544,172	£10,999,914
2029	£12,544,087	£1,544,172	£10,999,914
2030	£12,544,087	£1,544,172	£10,999,914
2031	£12,544,087	£1,544,172	£10,999,914
2032	£12,544,087	£1,544,172	£10,999,914
2033	£12,544,087	£1,544,172	£10,999,914
2034	£12,544,087	£1,544,172	£10,999,914
2035	£12,544,087	£1,544,172	£10,999,914
2036	£12,544,087	£1,544,172	£10,999,914
2037	£12,544,087	£1,544,172	£10,999,914
2038	£12,544,087	£1,544,172	£10,999,914

2039	£12,544,087	£1,544,172	£10,999,914
Total	**£188,161,300**	**£23,162,586**	**£164,998,715**

Table 20 - Land Value Uplift, 2019 Prices

These figures are also subject to deflating and discounting back to 2010 as per WebTAG guidance, with a discount rate of 3.5% (Green Book) yearly from 2010 for the first 30 years of the appraisal and the difference between the appraisal start date to 2010. This annual granularity is paramount as discounting and deflating factors will vary depending on the year(s) a site has been converted into better land use. Discounting addresses the fact that individuals prefer to consume goods and services now, rather than in the future even after accounting for inflation. To allow for cross-comparisons for other WebTAG compliant schemes, guidance recommends discounting to 2010 present value (PV). As all benchmarks and values in this analysis so far are in 2019 price base, deflating (using WebTAG's GDP deflator Table 12) is also conducted to convert the figures into 2010 price base as per WebTAG guidance.

Year	Discounting Factor	Undiscounted 2019	2010 PV, 2019 prices	2010 PV, 2010 prices
2025	0.596890619	£10,999,914	£6,565,746	£5,623,221
2026	0.576705912	£10,999,914	£6,343,716	£5,433,064
2027	0.557203779	£10,999,914	£6,129,194	£5,249,337
2028	0.538361140	£10,999,914	£5,921,926	£5,071,823
2029	0.520155690	£10,999,914	£5,721,668	£4,900,312
2030	0.502565884	£10,999,914	£5,528,182	£4,734,601
2031	0.485570903	£10,999,914	£5,341,238	£4,574,494
2032	0.469150631	£10,999,914	£5,160,617	£4,419,801
2033	0.453285634	£10,999,914	£4,986,103	£4,270,339
2034	0.437957134	£10,999,914	£4,817,491	£4,125,932
2035	0.423146989	£10,999,914	£4,654,581	£3,986,407
2036	0.408837671	£10,999,914	£4,497,179	£3,851,601
2037	0.395012242	£10,999,914	£4,345,101	£3,721,354
2038	0.381654340	£10,999,914	£4,198,165	£3,595,511
2039	0.368748155	£10,999,914	£4,056,198	£3,473,924
Total		**£164,998,715**	**£78,267,104**	**£67,031,722**

Table 21 - Discounted & Deflated Gross Land Value Uplift

Sensitivity testing

To understand how impacts might differ if more applicable, relevant land value information becomes available for existing residential / office land, a second assumption has been incorporated separately into the analysis for sensitivity testing. Instead of using a figure of £6,000,000 per hectare (50% of office CBD as a proxy) for the aforementioned classifications, £4,000,000 (2017 prices) has been used instead. This equates to £4,156,812 in 2019 prices.

The comparison of benefits between the two land value estimates used can be seen below:

Gross Land Value Uplift	Undiscounted, 2019 Prices	2010 PV, 2019 Prices	2010 PV, 2010 Prices
Using £6m (2017 prices) land value proxy per ha for existing residential & office sites	£164,998,715	£78,267,104	£67,031,722
Using £4m (2017 prices) land value proxy per ha for existing residential & office sites	£169,317,718	£80,315,822	£68,786,343

Table 22 - Sensitivity Testing - Gross LVU

Gross to Net Factors

Following the guidance presented regarding valuing dependent development in WebTAG TAG Unit A2.2 Induced Investment, this section presents a summary assessment of the Land Value Uplift associated with the development enabled by the project. TAG Unit A2.2 illustrates that the following approach should be undertaken to quantify the net land value uplift:

$$Total\ Benefits = LVU_D + Other_V - TEC_V - LAV - NTCI$$

Out of the elements above, we have attained the following:

- Displacement factor reduction of 37.4% relating to regeneration through physical infrastructure (Amion Consulting market-based research)
- Transport External Costs (see below for detailed section) of c.£20.5m (2010 Prices, 2010 PV)

In addition, the benefits have been adjusted for market prices using an indirect taxation multiplier of 1.19 (sourced from WebTAG databook May 2019 Table A1.3.1) as per best practice.

The analysis currently does not account for other positive benefits (including environmental, social and distributional impacts) and also Non-Transport Complementary Interventions (NTCIs). This information is envisaged to become available during the latter stages of the scheme. Whilst redeveloping largely derelict spaces into new high-quality developments would result in positive land amenity benefits, it is also not quantifiable at this stage of the scheme.

Applying the gross to net factors identified produces the following LVU figures for both sensitivity proxies:

Land Value Uplift	Undiscounted 2019 Prices	2010 PV, 2019 Prices	2010 PV, 2010 Prices
Gross (using £6m land value proxy per ha for existing residential & office sites)	£164,998,715	£78,267,104	£67,031,722
Net (using £6m land value proxy per ha for existing residential & office sites)	£31,723,939	£34,420,240	£29,478,927
Gross (using £4m land value proxy per ha for existing residential & office sites)	£169,317,718	£80,315,822	£68,786,343
Net (using £4m land value proxy per ha for existing residential & office sites)	£34,941,338	£35,946,413	£30,786,015

Table 23 - Gross to Net LVU Impacts

Dependent development testing will be undertaken as the scheme progresses further.

Transport External Costs

There are a vast number of derelict or underutilised buildings within the study area. Proposals as part of the Snow Hill connectivity project seek to regenerate the buildings and wider area by facilitating a change in existing land use to a city centre mixed use development. Further, portions of highways land will be utilised to facilitate development sites.

This change in land use and provision of new developments will generate additional trips onto the highways network. To estimate this impact on congestion the marginal economic cost approach has been followed. In the absence of an established traffic model at the time this analysis was conducted, Transport External Cost (TECs) inputs have been assumed and proxied via a number of sources. TECs ultimately feed into the net calculation of Land Value analysis.

This approach has been suggested in WebTag TAG UNIT A2.2 and is set out in TAG UNIT A5.4. A key component of this analysis is the change in congested vehicle kilometres along the route that the development driven traffic would utilise. A 60-year transport external costs appraisal period has been adopted. The appraisal period is across 2025 – 2084.

Prior to undertaking the transport external costs analysis discussions were held with developers Cushman and Wakefield to establish which sites had redevelopment potential within the study area. Once these sites were identified, each site was plotted onto a map using GIS. Interrogation of the sites revealed the respective floorspace associated with the sites. These sites were then grouped into broad land use categories. Given that a change in land use will occur, and subsequently a change in the number of trips on the highways network, desktop-based research was undertaken to establish whether the sites identified for development were currently generating/attracting trips. Sites that have redevelopment potential and currently generate/attract trips are summarised by broad land uses in Table xx.

The spatial analysis undertaken reveals that Hospitals occupy the largest floorspace in the context area. Across all land use categories there is an estimated 74,271 sq m of development land that generates trips currently.

Current Development characteristics	Floor space (sq m)
Industrial	7,167
Apartments/Residential	3,088
Bar and Restaurant	446
Office	8,972
Radio Broadcaster	171
Religious Building	835
Social Services	1,320
Wholesale retail	3,416
Hospital	48,516
Education	340
Total	74,271

Table 24 - 12-hour trip rates by land use (current trips). Source: Cushman and Wakefield, Jacobs Calculations

Part of the proposals of the connectivity project also include utilising portions of the highway land for development purposes. Summation of the above along with un-utilised industrial and various other derelict buildings below generates a total of 150,886 sq m of land available for development.

Land use	Floorspace (sq m)
Industrial	2,957
Wholesale retail	985
Office	6,018
Apartment	2,702
Highway	31,900
Car Parks	31,880
Total	76,442[3]

Table 25- 12-hour trip rates by land use (no current trips)

Mixed-use city centre development has been proposed for the 150,886 sq m of developable land. This will comprise of a blended mix of offices, residential, retail and bars and restaurants. The analysis currently assumes that 40% of the floor space outlined for redevelopment would be converted to offices, 40% to residential, 15% to bars and restaurants and 5% for retail. Table 25 below summarises the distribution of the development floorspace across the proposed land uses.

Development characteristics	Value
Office	60,354
Retail	7,544
Residential	60,354
Bar and restaurant	22,633
Total	150,886

Table 26 - Total sq m of Potential Redevelopment Land

To establish the additional trips that would materialise on the highways network, TRICS data has been obtained for the varying land uses. TRICS data for a 12-hour period of 0700 – 1900 shows the number of vehicles arriving and departing from different land uses in an average city centre. This data is presented below.

Development characteristics	Units	Trip rates – Arrive (12 hour 0700 – 1900)	Trip rates – Depart (12 hour 0700 – 1900)	Total (12 hour 0700 – 1900)
Apartments & residential	per dwelling	0.5	0.5	1.0
Bar & Restaurant	per 100 sqm	8.4	7.1	15.5
Education (university)	per 100 sqm	2.5	2.3	4.8
Hospital with A&E	per 100 sqm	6.3	5.9	12.2
Industrial (inc. Radio broadcaster & telecommunications)	per 100 sqm	0.9	1.0	1.9

[3] Values across table may not add up to 150,886 due to rounding.

Local shops (inc. Musical instrument repair)	per 100 sqm	39.8	38.8	78.6
Office	per 100 sqm	2.4	2.3	4.7
Religious building	per hectare	171.5	150.5	322.0
Retail (Convenience store)	per 100 sqm	30.8	30.4	61.1
Sheltered accommodation (proxy for social services)	per dwelling	1.0	1.0	1.9
Wholesale retail	per 100 sqm	7.6	7.8	15.3

Table 27 - 12-hour trip rates by land use. Source: TRICs

Data from TRICS presents the trip rates for apartments/residential buildings per dwelling. However, the data gathered only contains information surrounding floorspace. To estimate the number of apartments from the floorspace, the minimum dwellings density per hectare set out by Birmingham City Council for City Centre development has been adopted. The policy requires that per hectare 100 dwellings are built i.e. 0.01 dwellings per sq m. Applying this to the floorspace for apartments/residential land uses generates the estimate number of dwellings/apartments.

To establish the trips generated onto the highways network by the development sites currently, trip rates have been applied to the respective land use categories. Doing so generates the number of trips in the 12-hour period, these have been taken as a proxy for the daily trip rates. This works on the premise that congestion is not experienced outside these hours. To annualise the number of trips, annualization factors have been chosen based on the respective land use categories. This is summarised in Table 27 below.

Existing Trips Land use	Floorspace	Total Trip Rates	Number of Vehicle Trips	Annualisation Factor	Annual Trips
Industrial	7,167	1.9	136.4	253	34,507
Apartments	2,325	1.0	22.6	365	8,250
Bar and Restaurant	446	15.5	68.9	365	25,157
Office	8,972	4.7	418.2	220	92,000
Radio Broadcaster	171	1.9	3.3	365	1,189
Religious Building	835	322	26.9	365	9,813
Social Services	1,320	1.9	25.4	365	9,256
Wholesale retail	3,416	15.3	524.3	364	190,834
Hospital	48,516	12.2	5,894.7	365	2,151,552
Education	340	4.8	16.2	195	3,152
Residential	763	1.0	7.4	365	2,707
Total	74,271	N/A	8191	N/A	2,528,416

Table 28 - Existing Trips Generated in a 12-hour Period. Source: TRICS, Cushman and Wakefield Proposals & Jacobs Calculations

The analysis estimates that the developments sites that could be redeveloped generates an estimated annual 2.5 million trips. Children's hospital ,which is part of the study area, is deemed to be biggest trip attractor/generator across all land uses. The analysis estimates that across the parking areas there are spaces for 1,047 cars. These cars and the subsequent vehicle trips have not been included in the analysis to avoid double counting. As it is not possible to establish how many of the vehicles arriving/departing from various land uses park in these pay and display car parking sites.

A total of 150,886 sq m has been highlighted for redevelopment to a mixed-use city centre development. This change in land use will give to an estimated 3.8 million trips onto the highways network across the land uses presented in the Table 28 below.

Future Land use	Floorspace	Trip rates	Number of vehicle trips	Annualisation factor	Annual trips
Office	60,354	4.7	2,813	220	618,886
Retail (convenience store)	7,544	61.1	4,613	364	1,678,980
Residential	60,354	1.0	587	365	214,125
Bar and restaurant	22,633	15.5	3,501	365	1,277,729
Total	150,886	N/A	11,513	N/A	3,789,721

Table 29 - Future Trips Generated in a 12-hour Period

The marginal external costs are applied to the additional trips generated onto the network. To establish these, the trips associated with the future mixed-use development are subtracted from the current trip generating development sites. This estimates that there will be an additional 1,261,304 additional trips on the network.

To monetise the impact of the additional vehicle trips the marginal economic cost of congestion parameters are obtained from WebTag data book (May 2019). The WebTag Databook ,Table A5.4.2, also presents the marginal external costs in pence per car km by road classification, congestion band and FORGE areas. The category of inner and outer conurbation (other) has been selected. As congestion costs are also grouped in bands, an average was taken across the five bands for this analysis. The data is presented in Table 29 below.

	Horizon Periods		
Impact	2025	2030	2035
Congestion (2010 prices, undiscounted)	£0.36	£0.43	£0.53

Table 30 - Marginal external costs (pence per vehicle km) inner connurbation (other) roads. Source: WebTAG DataBook Table A5.4.2

To reflect West Midlands specific congestion values across the 12-hour period, WebTag Table A5.4.4 is also used. The data presents the marginal external costs per vehicle km across the AM, IP, PM peak, which Table 29 does not account for.

	Time periods			
Horizon years	AM (07.00 - 10.00)	IP (10.00 - 16.00)	PM (16.00 - 19.00)	Weekly Average
2025 (2010 prices, undiscounted)	£0.31	£0.23	£0.34	£0.22

2030 (2010 prices, undiscounted)	£0.36	£0.30	£0.42	£0.27
2035 (2010 prices, undiscounted)	£0.47	£0.40	£0.54	£0.35

Table 31 - Marginal External Congestion Costs in (pence per vehicle km) for West Midlands. Source: WebTAG DataBook Table A5.4.4

By dividing the various time periods by the weekly average, an adjustment factor can be derived for each time period. This factor is applied to their respective horizon years to produce the adjusted congestion costs across AM, IP and PM. This is presented in Table 31 below. The analysis also generates a blended average reflecting the proportion of the AM, IP and PM in the 12-hour period.

Horizon years	AM (07.00 - 10.00)	IP (10.00 - 16.00)	PM (16.00 - 19.00)	Weighted average across 12 hours
2025 (2010 prices, undiscounted)	£0.52	£0.39	£0.57	£0.47
2030 (2010 prices, undiscounted)	£0.57	£0.48	£0.67	£0.55
2035 (2010 prices, undiscounted)	£0.70	£0.60	£0.80	£0.68

Table 32 - Weighted 12-hour Average Marginal External Congestion Costs (pence per vehicle km) for West Midlands. Source: WebTag Databook Table A5.4.2, Table A5.4.2, Jacobs Calculation

Following the derivation of the marginal economic cost of congestion per car km, the next step in the analysis is to estimate the additional vehicle kilometres as a result of the development being proposed at Snow Hill station. To estimate the change in vehicle kilometres Census (2011) Journey to Work data has been analysed. The data indicates that the average commute by vehicle to work is 10 km in Birmingham. Currently, it is assumed that 25% of this trip is congested. Thus, the congested vehicle kilometres can be generated by multiplying the vehicle trips by the length of trip that is congested. This is summarised in Table 32.

ID	Description	Value
A	Annual Vehicle Trips	1,261,304
E	Average trip distance	10 km
F	Proportion of trip assumed to be congested	25%
G	Congested Vehicle Kilometres	3,170,148

Table 33 - Congested Vehicle-km Added onto the Network. Source: Census (2011), TRICS, Cushman & Wakefield and Jacobs Calculations

An estimated 3,170,148 annual congested vehicle kilometres will be added onto the network. Multiplying the vehicle kilometres by the weighted marginal economic cost of congestion in Table 31 generates annual transport external costs for the various horizon years. To present figures in pounds rather than pence, the values are divided by 100. The annualised transport external costs in each horizon year are presented in Table 33 below.

	2025	2030	2035
Congestion impacts (2010 prices, undiscounted)	£1,483,478	£1,749,469	£2,145,452

Table 34 - Transport External Costs for Modelled Years. Source: Jacobs Calculation

To estimate the transport external costs across the appraisal period interpolation has been applied between the modelled years. The congestion value of 2035 has then been assumed to be constant across the remainder of the appraisal period. Doing this generates the transport external costs as summarised in Table 34. The transport external costs presented in Table 34 have been discounted to 2010 present values as per WebTag guidance. The analysis estimates that the development would generate transport external costs of c.£33m in 2010 prices and present values. The analysis also presents the transport external costs in 2019 prices, the GDP deflator from the WebTag Databook (May 2019) has been used to uplift the price base from 2010 to 2019.

Development proposal	2010 prices, 2019 present value	2010 prices, 2010 present value	2019 prices, 2010 present value	2019 prices, 2019 present value
Congestion disbenefit	£124,761,263	£32,676,811	£38,153,444	£145,671,251

Table 35 - Transport External Costs Across Appraisal Period. Source: Jacobs Calculation

The analysis presented above assumes that all trips generated by the development will be new trips and that all trips will be along the study area. However, this is likely to result in an overestimate of the impact of the development on congestion. To account for this, displacement has been taken into account. The displacement figure of 37.4% has been adopted. This factor has been obtained from the HCA Additionality Guide and relates to regeneration through physical infrastructure. Applying the displacement value generates a transport external cost of £20.5m in 2010 prices and present values. Table 35 below:

	Transport External Costs Adjusted for Displacement 2010 prices, 2019 present value	Transport External Costs Adjusted for Displacement 2010 prices, 2010 present value	Transport External Costs Adjusted for Displacement 2019 prices, 2010 present value	Transport External Costs Adjusted for Displacement 2019 prices, 2019 present value
25% of route is congested	£78,100,551	£20,455,684	£23,884,056	£91,190,203

Table 36 - Transport External Costs Adjusted for Displacement. Source: Jacobs Calculation

1.1.1 Sensitivity Testing

As a sensitivity, the proportion of the trip that is congested has been changed from 25% - 50%. The impact this has on the transport external costs is summarised in Table 36. The analysis estimates that if 50% of the trip is congested then congestion disbenefits of £40m could be generated across the respective development proposal, the impacts are in 2010 prices and present values.

	Transport External Costs Adjusted for Displacement 2010 prices, 2010 present value	Transport External Costs Adjusted for Displacement 2019 prices, 2010 present value
50% of route is congested	£40,911,367	£47,768,112

Table 37 - 50% Congestion of Average Distance Travelled. Source: Jacobs Calculation

Summary Impacts

Core Options & Core Results (2010 Prices, 2010 Present Value)

The table below presents the summary of active mode and land value impacts related to the three intervention options.

Impact Category	Impact Level	DS1	DS2	DS3
Active mode: Existing Commuters. Intensification in City Centre Areas	Level 1	£4,339,883	£4,339,883	£4,339,883
Active mode: Road users displaced to active modes	Level 1	£8,664,636	£6,850,738	£7,209,201
Active mode: Road users displaced to PT	Level 1	£20,028,504	£13,574,306	£20,971,022
Active mode: Road users displaced to Park and Ride	Level 1	£1,849,951	£16,713,076	£12,981,415
Active mode: New Commuters. Intensification in City Centre Areas	Level 3	£29,613,282	£29,613,282	£29,613,282
Land Value Uplift	Level 3	£29,478,927	£29,478,927	£29,478,927
Fixed Land Use Based - Conventional wider benefits (static clustering, labour supply impacts and output change in imperfectly competitive markets)	Level 2	Impact not estimated	Impact not estimated	Impact not estimated

Table 38 - Core Impacts (2010 Prices, 2010 Present Value)

Preferred Option LVU Transformational Impact Sensitivity (2010 Prices, 2010 Present Value)

The table below presents the transformational land value uplift sensitivity impacts associated with the preferred option. The table also presents other active mode impacts already identified for the preferred option in the table above.

Impact Category	Impact Level	DS3 – Sensitivity Testing
Active mode: Existing Commuters. Intensification in City Centre Areas	Level 1	£4,339,883
Active mode: Road users displaced to active modes	Level 1	£7,209,201
Active mode: Road users displaced to PT	Level 1	£20,971,022
Active mode: Road users displaced to Park and Ride	Level 1	£12,981,415
Active mode: New Commuters. Intensification in City Centre Areas	Level 3	£85,460,776
Land Value Uplift	Level 3	£504,930,816
Fixed Land Use Based - Conventional wider benefits (static clustering, labour supply impacts and output change in imperfectly competitive markets)	Level 2	Impact not estimated

Table 39 - DS3 LVU Sensitivity Testing Impacts (2010 Prices, 2010 Present Value)

Appendix A: Active Mode Assumptions

Active mode toolkit assumptions table: Existing commuters

	Modelling Criteria	Value	Commentary
Scheme Details	Opening Year	2025	As required by funding competition
	Last year of Initial Funding	2027	As required by funding competition
	Decay Rate	0.00%	Assumption from illustrative case study in WebTAG
Do Nothing Scenario	Estimated number of cycle journeys	79	This is based on the analysis of the total commuters in Birmingham LSOAs E01033617, E01033565, E01033622, E01033625 that have been used to represent the study area. Census 2011 data indicates that there are 7,191 commuters. The 2011 Census data for Birmingham City estimates that 0.5% of trips in were undertaken by cycling to work. This metric is applied to the total number of commuters in Birmingham city Centre to estimate the number of individuals cycling to work. Each commuter is assumed to create two journeys.
	Average cycle journey length (km)	5,52	This is based on Table journey to work information in LSOAs outside city centre. The data is for the average distance cycled.
	Average Cycle Speed (km/h)	15	The National Travel Survey Data 2016 suggests that commuter cycling speeds are approximately 15km/h.
	Average proportion of cycle trips which use the scheme infrastructure	30.00%	Scheme design remains unclear. Professional judgement used to estimate this.
	Estimated number of walk journeys	2,996	This is based on the analysis of the total commuters in Birmingham LSOAs E01033617, E01033565, E01033622, E01033625 that have been used to represent the study area. Census 2011 data indicates that there are 7,191 commuters. The 2011 Census data for Birmingham City estimates that 20.8% of trips in were undertaken on foot to work. This metric is applied to the total number of commuters in Birmingham city Centre to estimate the number of individuals walking to work. Each commuter is assumed to create two journeys.

	Average walk journey length (km)	3.23	This is based on the LSOAS previously mentioned. The data is for the average distance walked.
	Average Walk Speed (km/h)	5	The average adult walking speed is 5 km/h according to the National Travel Survey Data 2016.
	Average proportion of walk trips which use the scheme infrastructure	30.00%	Scheme design remains unclear. Professional judgement used to estimate this.
	Estimate for the number of return journeys	100%	All work journeys are assumed to involve a return
Do Something Scenario	Estimated number of cycle journeys	117	It is assumed that through the provision of the scheme the number of cyclists will increase by 50% in the area to match the cycle mode share in the city centre.
	Estimated number of pedestrian journeys	3,505	It is assumed that through the provision of the scheme the number of cyclists will increase by 17% in the area to match the walking mode share in the city centre.
Journey Quality Impacts	Improvements for cyclists	Yes	On-road segregated cycle track
	Improvements in walking infrastructure	Yes	Kerb Level, Crowding, Pavement evenness, information panels, benches.
Decongestion benefit	Proportion of cyclists attracted from car	11.00%	Literature Review carried out by RAND Europe/Systra for DfT
	Proportion of cyclists attracted from taxi	8.00%	Literature Review carried out by RAND Europe/Systra for DfT
	Proportion of pedestrians attracted from car	11.00%	Literature Review carried out by RAND Europe/Systra for DfT
	Proportion of pedestrians attracted from taxi	8.00%	Literature Review carried out by RAND Europe/Systra for DfT
	Area Type	Other Urban	Most suitable category for the scheme as a whole
Additional Information	Background Growth	0.00%	National Travel Survey Data 2006-2016
	Appraisal Period (years)	15	Assumption from illustrative case study in WebTAG
	Number of days in analysis period	229	Number of working days in a year

Active mode toolkit assumptions table: Additional commuters.

	Modelling Criteria	Value	Commentary
Scheme Details	Opening Year	2040	Once the development sites are delivered.
	Last year of Initial Funding	2027	As required by funding competition
	Decay Rate	0.00%	Assumption from illustrative case study in WebTAG
Do Nothing Scenario	Estimated number of cycle journeys	117	Number of cycle journeys made by 2040 before new development delivery by existing commuters.
	Average cycle journey length (km)	5.52	This is based on Table journey to work information in LSOAs outside city centre. The data is for the average distance cycled.
	Average Cycle Speed (km/h)	15	The National Travel Survey Data 2016 suggests that commuter cycling speeds are approximately 15km/h.
	Average proportion of cycle trips which use the scheme infrastructure	30%	Scheme design remains unclear. Professional judgement used to estimate this.
	Estimated number of walk journeys	3,505	Number of walking journeys made by 2040 before new development delivery by existing commuters.
	Average walk journey length (km)	3.23	This is based on the LSOAS previously mentioned. The data is for the average distance walked.
	Average Walk Speed (km/h)	5	The average adult walk speed of 5 km/h according to the National Travel Survey Data 2016.
	Average proportion of walk trips which use the scheme infrastructure	30%	Scheme design remains unclear. Professional judgement used to estimate this.
	Estimate for the number of return journeys	100%	All work journeys are assumed to involve a return
Do Something Scenario	Estimated number of cycle journeys	121	150,9 ha reconverted into retail, pub offices and apartments will be generated additional trips. TRICS data provides trip rates per sqm by land use type and all purposes. These are proportioned according to Census mode share data to estimate walking and cycling trip rates. In total 214 additional trips will be added to the existing 117.

	Estimated number of pedestrian journeys	11,811	150,9 ha reconverted into retail, pub offices and apartments will be generated additional trips. TRICS data provides trip rates per sqm by land use type and all purposes. These are proportioned according to Census mode share data to estimate walking and cycling trip rates. In total 8,305 additional trips will be added to the existing 3,505.
Journey Quality Impacts	Improvements for cyclists	Yes	On-road segregated cycle track
	Improvements in walking infrastructure	Yes	Kerb Level, Crowding, Pavement evenness, information panels, benches.
Decongestion benefit	Proportion of cyclists attracted from car	11.00%	Literature Review carried out by RAND Europe/Systra for DfT
	Proportion of cyclists attracted from taxi	8.00%	Literature Review carried out by RAND Europe/Systra for DfT
	Proportion of pedestrians attracted from car	11.00%	Literature Review carried out by RAND Europe/Systra for DfT
	Proportion of pedestrians attracted from taxi	8.00%	Literature Review carried out by RAND Europe/Systra for DfT
	Area Type	Other Urban	Most suitable category for the scheme as a whole
Additional Information	Background Growth	0.00%	National Travel Survey Data 2006-2016
	Appraisal Period (years)	20	Assumption from illustrative case study in WebTAG
	Number of days in analysis period	229	Number of working days in a year

Active mode toolkit assumptions table: Road users displaced to active modes (DS3)

	Modelling Criteria	Value	Commentary
Scheme Details	Opening Year	2025	As required by funding competition
	Last year of Initial Funding	2027	As required by funding competition
	Decay Rate	0.00%	Assumption from illustrative case study in WebTAG
Do Nothing Scenario	Estimated number of cycle journeys	0	Toolkit based on additional trips. Baseline scenario demand assumed as 0.
	Average cycle journey length (km)	5.52	This is based on Table DC7701EWla Method of travel to work for the Local Authority of Birmingham.
	Average Cycle Speed (km/h)	15	The National Travel Survey Data 2016 suggests that commuter cycling speeds are approximately 15km/h.
	Average proportion of cycle trips which use the scheme infrastructure	30%	Scheme design remains unclear. Professional judgement used to estimate this.
	Estimated number of walk journeys	0	Toolkit based on additional trips. Baseline scenario demand assumed as 0.
	Average walk journey length (km)	3.22	This is based on Table DC7701EWla Method of travel to work for the Local Authority of Birmingham.
	Average Walk Speed (km/h)	5	The average adult walk speed of 5 km/h according to the National Travel Survey Data 2016.
	Average proportion of walk trips which use the scheme infrastructure	30%	Scheme design remains unclear. Professional judgement used to estimate this.
	Estimate for the number of return journeys	100%	All work journeys are assumed to involve a return
Do Something Scenario	Estimated number of cycle journeys (per day)	38	Additional cyclists and former car users in DM scenario. Output from the PRISM model
	Estimated number of pedestrian journeys (per day)	428	Additional pedestrians and former car users in DM scenario. Output from the PRISM model.
Journey Quality Impacts	Improvements for cyclists	No	No improvements are considered. Change in demand is driven by highways and PT supply.

	Improvements in walking infrastructure	No	No improvements are considered. Change in demand is driven by highways and PT supply.
Decongestion benefit	Proportion of cyclists attracted from car	100.00%	All do-something scenario trips are displaced from car mode
	Proportion of cyclists attracted from taxi	0.00%	All do-something scenario trips are displaced from car mode
	Proportion of pedestrians attracted from car	100.00%	All do-something scenario trips are displaced from car mode
	Proportion of pedestrians attracted from taxi	0.00%	Literature Review carried out by RAND Europe/Systra for DfT
	Area Type	Other Urban	Most suitable category for the scheme as a whole
Additional Information	Background Growth	0.00%	National Travel Survey Data 2006-2016
	Appraisal Period (years)	60	Assumption from illustrative case study in WebTAG
	Number of days in analysis period	253	Number of days per year minus weekends and bank holidays.

Active mode toolkit assumptions table: Road users displaced to Public Transport

	Modelling Criteria	Value	Commentary
Scheme Details	Opening Year	2025	As required by funding competition
	Last year of Initial Funding	2027	As required by funding competition
	Decay Rate	0.00%	Assumption from illustrative case study in WebTAG
Do Nothing Scenario	Estimated number of cycle journeys	0	Toolkit based on additional trips. Baseline scenario demand assumed as 0.
	Average cycle journey length (km)	0	This is based on Table DC7701EWla Method of travel to work for the Local Authority of Birmingham.
	Average Cycle Speed (km/h)	15	The National Travel Survey Data 2016 suggests that commuter cycling speeds are approximately 15km/h.
	Average proportion of cycle trips which use the scheme infrastructure	30%	Scheme design remains unclear. Professional judgement used to estimate this.
	Estimated number of walk journeys	0	Toolkit based on additional trips. Baseline scenario demand assumed as 0.
	Average walk journey length (km)	1.59	Average between average distance to bus stop and average distance to train station is 0.795 km. This trip length is multiplied by 2 to reflect access at both origin and destination.
	Average Walk Speed (km/h)	5	The average adult walk speed of 5 km/h according to the National Travel Survey Data 2016.
	Average proportion of walk trips which use the scheme infrastructure	30%	Scheme design remains unclear. Professional judgement used to estimate this.
	Estimate for the number of return journeys	100%	All work journeys are assumed to involve a return
Do Something Scenario	Estimated number of cycle journeys (per day)	0	Assumed that 100% of the access trips to a bus/rail station are done walking
	Estimated number of pedestrian journeys (per day)	2047	Additional Bus/Rail users and former car users in DM scenario accessing by foot. Output from the PRISM model.

Journey Quality Impacts	Improvements for cyclists	No	No improvements are considered. Change in demand is driven by highways and PT supply.
	Improvements in walking infrastructure	No	No improvements are considered. Change in demand is driven by highways and PT supply.
Decongestion benefit	Proportion of cyclists attracted from car	100.00%	All do-something scenario trips are displaced from car mode
	Proportion of cyclists attracted from taxi	0.00%	All do-something scenario trips are displaced from car mode
	Proportion of pedestrians attracted from car	100.00%	All do-something scenario trips are displaced from car mode
	Proportion of pedestrians attracted from taxi	0.00%	Literature Review carried out by RAND Europe/Systra for DfT
	Area Type	Other Urban	Most suitable category for the scheme as a whole
Additional Information	Background Growth	0.00%	National Travel Survey Data 2006-2016
	Appraisal Period (years)	60	Assumption from illustrative case study in WebTAG
	Number of days in analysis period	253	Number of days per year minus weekends and bank holidays.

Active mode toolkit assumptions table: Road users displaced to Park&Ride

	Modelling Criteria	Value	Commentary
Scheme Details	Opening Year	2025	As required by funding competition
	Last year of Initial Funding	2027	As required by funding competition
	Decay Rate	0.00%	Assumption from illustrative case study in WebTAG
Do Nothing Scenario	Estimated number of cycle journeys	0	Toolkit based on additional trips. Baseline scenario demand assumed as 0.
	Average cycle journey length (km)	0	This is based on Table DC7701EWla Method of travel to work for the Local Authority of Birmingham.
	Average Cycle Speed (km/h)	15	The National Travel Survey Data 2016 suggests that commuter cycling speeds are approximately 15km/h.
	Average proportion of cycle trips which use the scheme infrastructure	30%	Scheme design remains unclear. Professional judgement used to estimate this.
	Estimated number of walk journeys	0	Toolkit based on additional trips. Baseline scenario demand assumed as 0.
	Average walk journey length (km)	0.795	Average between average distance to bus stop and average distance to train station is 0.795 km. Users access by car to the station and walk to
	Average Walk Speed (km/h)	5	The average adult walk speed of 5 km/h according to the National Travel Survey Data 2016.
	Average proportion of walk trips which use the scheme infrastructure	30%	Scheme design remains unclear. Professional judgement used to estimate this.
	Estimate for the number of return journeys	100%	All work journeys are assumed to involve a return
Do Something Scenario	Estimated number of cycle journeys (per day)	0	Assumed that 100% of the access trips to a bus/rail station are on foot.
	Estimated number of pedestrian journeys (per day)	2047	Additional Park&Ride (driver or passengers) and former all-way car users in the DM scenario. Output from the PRISM model.

Journey Quality Impacts	Improvements for cyclists	No	No improvements are considered. Change in demand is driven by highways and PT supply.
	Improvements in walking infrastructure	No	No improvements are considered. Change in demand is driven by highways and PT supply.
Decongestion benefit	Proportion of cyclists attracted from car	100.00%	All do-something scenario trips are displaced from car mode
	Proportion of cyclists attracted from taxi	0.00%	All do-something scenario trips are displaced from car mode
	Proportion of pedestrians attracted from car	100.00%	All do-something scenario trips are displaced from car mode
	Proportion of pedestrians attracted from taxi	0.00%	Literature Review carried out by RAND Europe/Systra for DfT
	Area Type	Other Urban	Most suitable category for the scheme as a whole
Additional Information	Background Growth	0.00%	National Travel Survey Data 2006-2016
	Appraisal Period (years)	60	Assumption from illustrative case study in WebTAG
	Number of days in analysis period	253	Number of days per year minus weekends and bank holidays.