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Swindon Urban Traffic Management Control (UTMC) Full Business Case

Swindon Borough Council

July 2020

Notice

This document has 127 pages including the cover.

Document history

Revision	Purpose description	Origin-ated	Checked	Reviewed	Authorised	Date
Rev 1.0	FBC for SBC review	MY/AM	TP	SP	TP	17/06/2020
Rev 2.0	FBC for ITA review	MY/AM	TP	SP	TP	22/06/2020
Rev 3.0	Redacted version	MY/AM	TP	SP	TP	13/07/2020

Client signoff

Client	Swindon Borough Council
Project	Swindon Urban Traffic Management Control (UTMC) Full Business Case
Job number	5190819
Client signature / date	

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1. Introduction

1.1. Background to the Full Business Case

Swindon Borough Council (SBC) is proposing to develop an Urban Traffic Management Control (UTMC) system in Swindon. The proposed UTMC scheme aims to facilitate consistently moving traffic and reliable journey times during peak periods, and to ensure that key junctions are not over-capacity and all available highway space can be utilised. Subject to agreement with the bus operators, the proposed UTMC scheme will be able to formulate strategies by analysing live data such as vehicle position, passenger numbers and journey time information. The decisions made will then be fed back through various output devices, giving priority to public transport where needed and helping SBC to meet its objectives on delivering quality bus corridors.

1.1.1. Policy Context

SBC's Local Transport Plan (LTP)[1] has a number of key elements within it; one of those key elements is the idea of being able to manage the network as a whole, to allow priorities to be adjusted as and when required. A UTMC gives this control and gives the foundations for an expanding network.

Intelligent Transport Systems (ITS) are listed as a key element of the Swindon Transport Strategy, outlining that ITS can provide the Council with a tool to manage the town's transport system. UTMC is seen as one aspect of a successful ITS package, as it can manage traffic flows and facilitate the delivery of traffic information.

The UTMC is an essential component of the Swindon Transport Strategy and as such supports the transport objectives and wider growth agenda contained within local policy documents, which includes the LTP and the Local Plan. This business case presents the need and rationale for the delivery of a UTMC system.

1.1.2. Business Case Development

Development of this business case has involved engagement with the Swindon and Wiltshire Local Enterprise Partnership (SWLEP) Independent Technical Advisor (ITA) from the outset. The evidence base underpinning the business case has been formulated based on guidance in the SWLEP Assurance Framework[2], in consultation with the ITA.

The SWLEP Assurance Framework defines the following four stages in the Value for Money (VfM) assessment of candidate schemes:

- Stage 1 – Initial scheme assessment, sifting and prioritisation;
- Stage 2 – Strategic Outline Business Case (SOBC) to set out the need for intervention (the case for change) and how this will further SWLEP's objectives (its strategic fit);
- Stage 3 – Outline Business Case (OBC) that includes a full economic and financial appraisal, and develops the commercial and management cases; and
- **Stage 4 – Full Business Case (FBC)** that builds on top of the OBC with a far greater emphasis on commercial, financial and management cases, ensuring arrangements are appropriate for effective delivery.

The purpose of this FBC is to unlock Local Growth Fund (LGF) investment for the UTMC scheme. Whilst the original allocation of the LGF was focussed on New Eastern Villages (NEV), the programme for linking the scheme has seen this funding redistributed. The decision was made by the Highways Programme Delivery Board to bring forward a change control to SWLEP. This has been submitted and approved as an agreed scheme and it is now being reported to SWLEP as an agreed scheme with an agreed programme.

1.1.3. Assurance Framework

This business specifically relates to FBC development at Stage 4, focused on schemes with existing funding allocation. Following a recent successful OBC there was a limited amount of technical work remaining to complete Stage 4. Therefore focus is on the procurement process and reflecting the final tendered prices along with other minor updates to the business case taking into account ITA feedback.

[1] Swindon Local Transport Plan (2011 – 2026), page 34. Available at: https://www.swindon.gov.uk/downloads/file/5171/swindon_local_transport_plan_2011_to_2026
[2] https://swlep.co.uk/docs/default-source/governance-documents/governance-framework/assurance-framework-2017.pdf

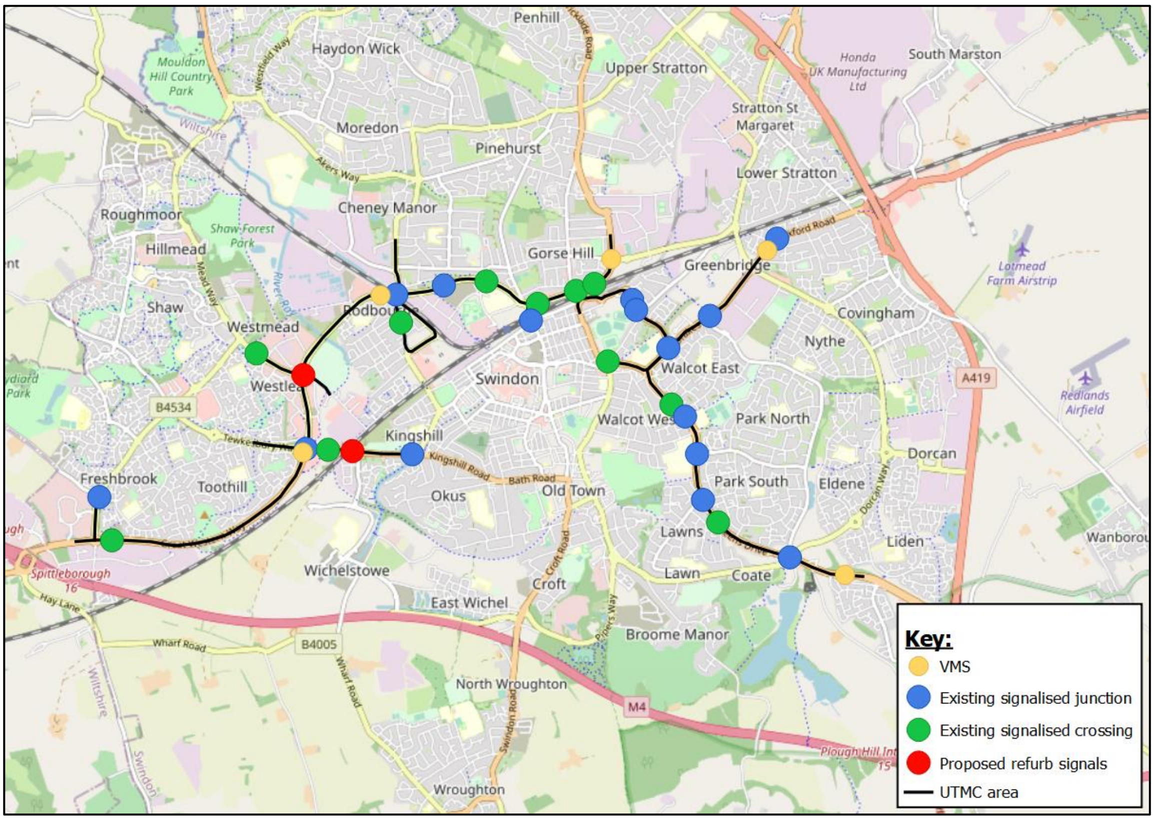
An Appraisal Specification Report[3] (ASR) was prepared in August 2019 detailing the proposed scope and key assumptions for developing a business case for the UTMC scheme. This business case follows the methodology detailed in the ASR, which was agreed in principle by SBC and SWLEP.

This business case has been produced in accordance with the Department for Transport's (DfT's) appraisal guidance, TAG[4], guidance for Transport Business Cases[5] and guidance for Value for Money (VfM) assessment[6].

1.1.4. The Swindon Urban Traffic Management Control (UTMC) Scheme

The core area of the network for the proposed UTMC has been defined as the Great Western Way (GWW) corridor between Mannington and Drakes Way, as shown in the plan of the proposed UTMC scheme in Figure 1-1. This core area is indicated in the figure by the black-coloured links and includes Great Western Way, sections of Drakes Way and Queens Drive, and also sections of adjoining minor links at key junctions. The core network is broadly where the components of the proposed UTMC scheme will be physically installed in the highway network, although its influence will cover a much greater geographical extent including some key strategic routes feeding into this core network.

Figure 1-1 – Great Western Way Corridor – An Illustration of the Proposed UTMC Core Area



The proposed UTMC scheme comprises the following four key elements. Figure 1-2 provides a detailed summary of the key scheme components; these components will be integrated into the UTMC system by linking them via a common database.

- UTC Common Database;
- Journey Time Measuring System (JTMS) and communications network;
- Traffic Signals Compatibility Upgrades; and
- Variable Message Signs (VMS).

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[3] Swindon Urban Traffic Management Control (UTMC) Appraisal Specification Report, Version 2.1, Atkins Ltd (August 2019)
[4] https://www.gov.uk/guidance/transport-analysis-guidance-webtag
[5] https://www.gov.uk/government/publications/transport-business-case
[6] https://www.gov.uk/government/publications/dft-value-for-money-framework

Figure 1-2 – UTMC Key Scheme Components

Common Database

- A hosted system will support the common database central to the UTMC scheme.

JTMS and Communications Network

- Comprises of a sub-network of junctions together with their connecting links.
- Real-time traffic count data would be collected by Bluetooth and/or Wi-Fi and relayed back to the UTMC system.
- Communications will be provided by a mesh network.

Traffic Signals Compatibility Upgrades

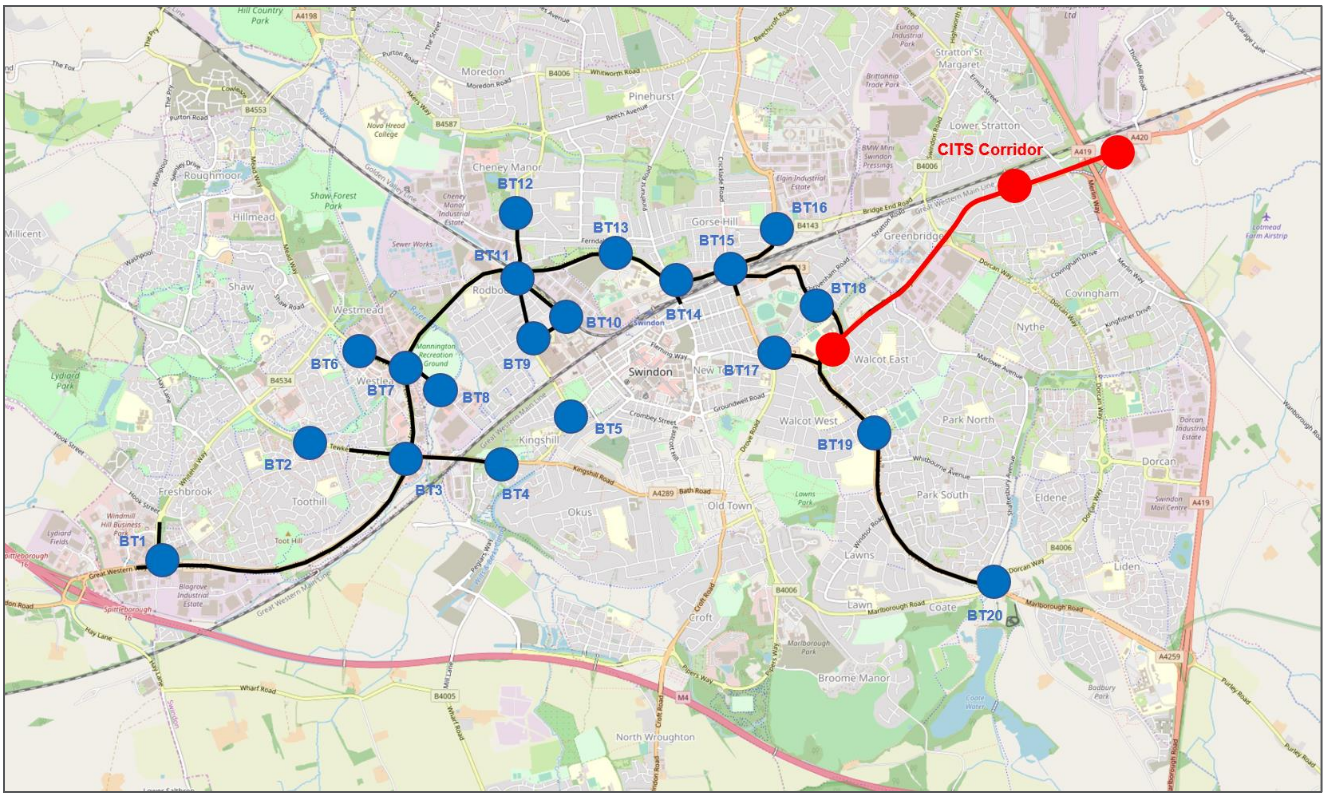
- Upgrading the existing fault reporting system (Remote Monitoring System (RMS)) to an Urban Traffic Control (UTC) system.
- The UTC would be delivered at all key signalised junctions in the core network.
- Critical aspect of the UTMC scheme as it is understood the existing RMS system is based on technology that is due to be switched off in 2025.

Variable Message Signs (VMS)

- VMS will be used to provide information to road users about traffic conditions, enabling re-routing onto less congested parts of the network..
- A mixture of VMS technologies for signing will be used:
  - Full RGB
  - Two-colour matrix
  - Smart Advance Direction Signs (ADS)

The proposed JTMS sub-network is shown in Figure 1-3. The blue circles/labels in the figure identify the key JTMS junctions (‘BT’ denotes Bluetooth) and the main links between these junctions are shown in black. The red-coloured links and junctions (‘CITS Corridor’ (CITS: Cooperative Intelligent Transport Systems)) indicate an existing journey time measurement trial scheme comparing Automatic Number Plate Recognition (ANPR) and Bluetooth methods of journey time capture. The location of this existing scheme is likely to be included in the final UTMC scheme.

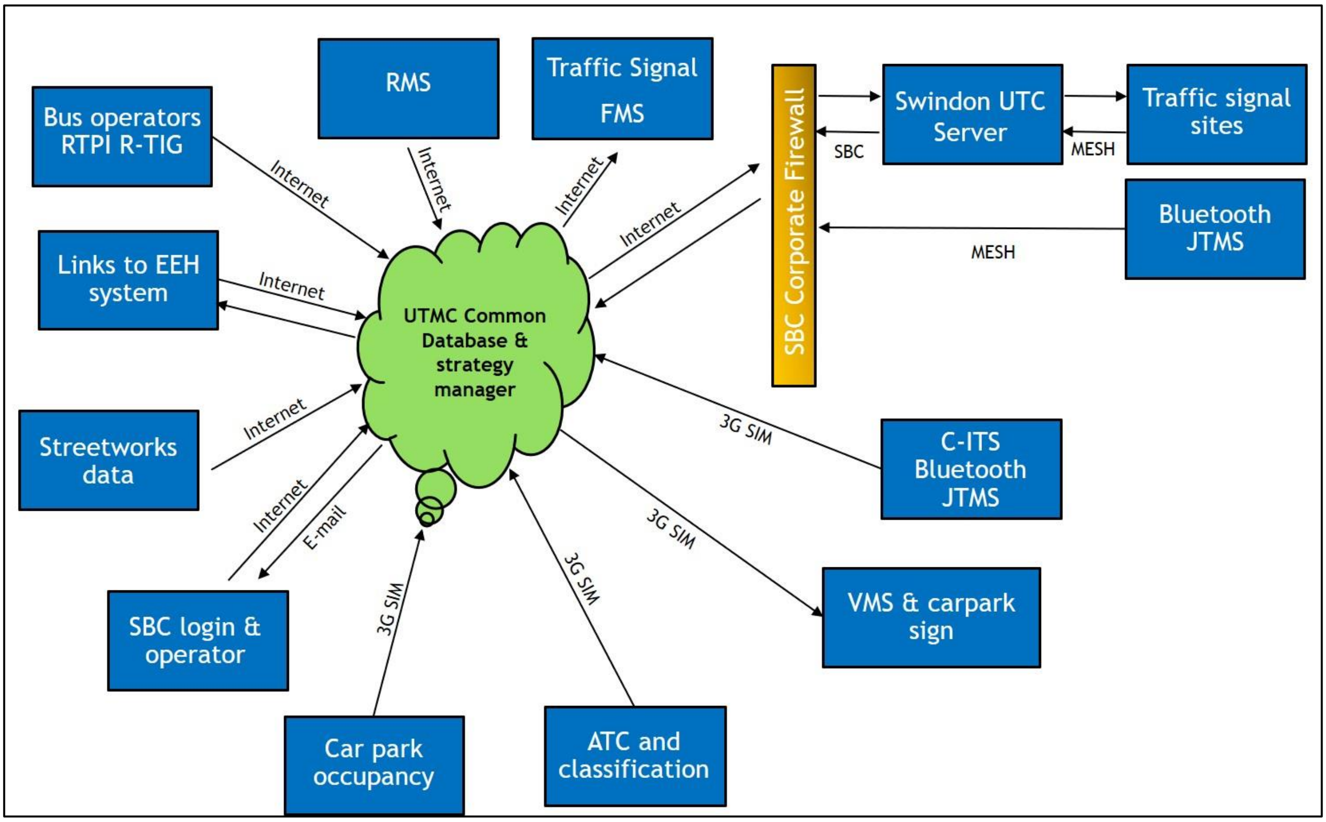
Figure 1-3 – Proposed UTMC Journey Time Measurement System (JTMS) Sub-Network



The JTMS will continuously record and monitor journey times across the UTMC core area. Traffic congestion on the network can therefore be detected where journey times on a particular link(s) exceed a certain pre-determined level. The UTMC system will ‘react’ accordingly by adjusting traffic signal timings at adjacent junctions in order to temporarily hold traffic upstream of the congested junction(s) and/or redistribute traffic demand to neighbouring links within the core area, hence reducing the overall average delay experienced on the local network.

Figure 1-4 summarises the UTMC processes, providing an overview of how the UTMC common database provides information to its various elements.

Figure 1-4 – UTMC Common Database Architecture



UTMC Strategies, configured and operated through UTMC's Strategy Manager module, are an established and effective method for improving the monitoring and management of networks through data and automation. They provide a powerful network management tool which influence groups of traffic control assets, such as traffic signals and Variable Message Signs (VMS), to help manage and improve traffic conditions.

They can be manually activated by operators or, when configured to do so, automatically activated by live traffic data within the UTMC system. Strategies can support network managers through the following means:

- Network performance monitoring;
- Reducing delays in congestion hotspots;
- Information strategies;
- Managing events;
- Diversion routes;
- Air quality; and
- Car park occupancies.

Section 1.1.5 provides examples of how UTMC Strategies can be developed based on different traffic scenarios.

1.1.5. UTMC Strategy Examples

Strategy One – Weekday AM and PM Peaks

The Great Western Way regularly suffers from congestion through Swindon Town Centre during the morning and evening peak periods, causing delays around the wider network.

UTMC can help to alleviate this congestion by utilising data from the Journey Time Monitoring (JTM) and Urban Traffic Control (UTC) systems to trigger a UTMC Strategy, which will adjust traffic signal timings through the UTC system to gate traffic into the town centre, holding vehicles at the Mannington Roundabout and on Queens Drive to allow existing congestion to ease. In addition, the Variable Message Sign (VMS) system can be used to warn travellers of upcoming congestion and show estimated journey times through the town. UTC can also adjust traffic signal timings to help certain traffic movements, such as vehicles traveling through the town centre during the AM peak or those leaving in the PM peak period.

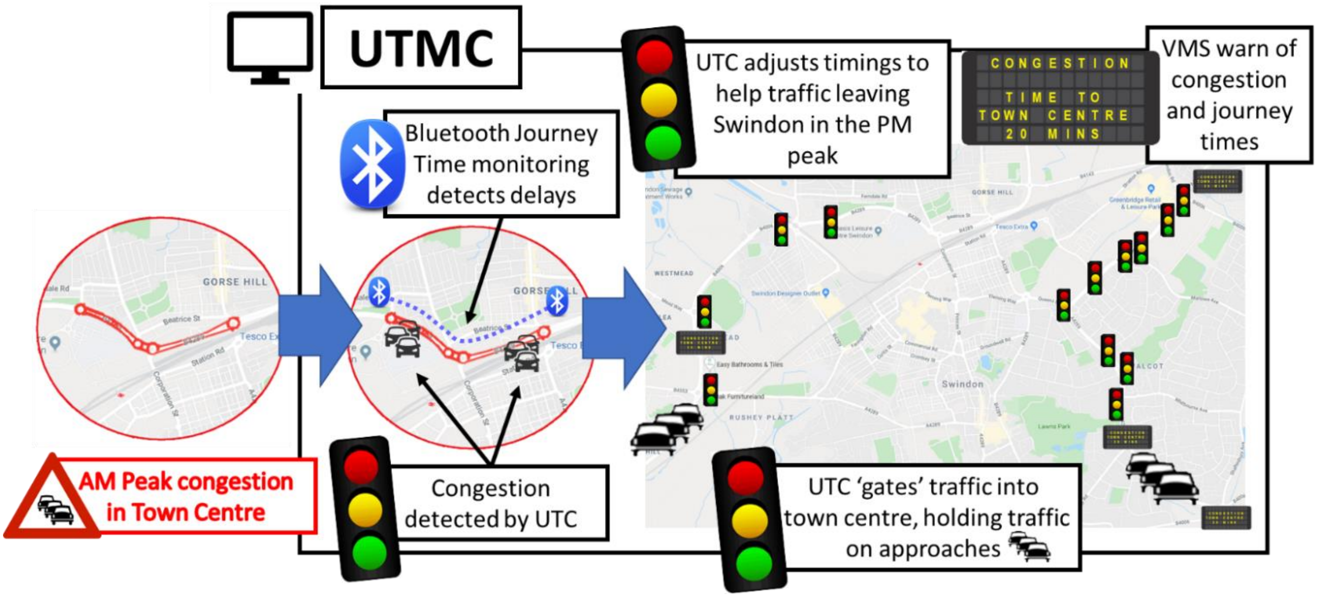


Figure 1-5 – Strategy One

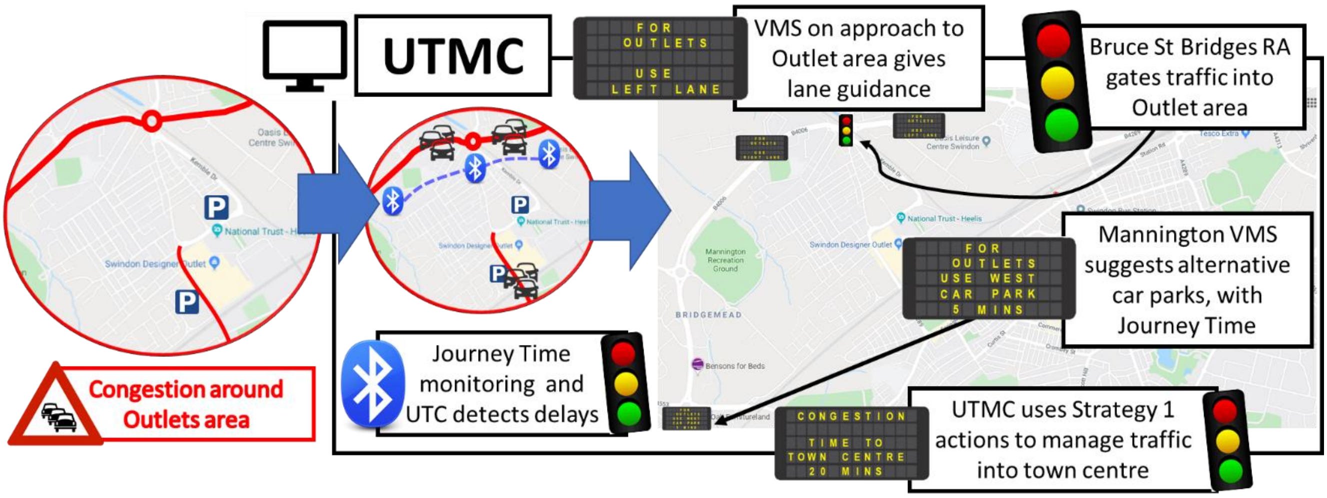
Strategy Two – Weekend Events (Swindon STEAM, Outlets)

The Rodbourne Road area attracts large volumes of traffic during specific events throughout the year, whether they be for Christmas shopping, Outlet events or the Swindon STEAM. These typically occur during weekends, but a UTMC Strategy developed for these could be utilised for any event.

Building upon Strategy One to ensure that differences in traffic flow at different times of day are accounted for, this UTMC Strategy could be triggered by traffic data or timetabled to start on specific times and days. It will be split into two phases; entry into the Outlet area and exit from it.

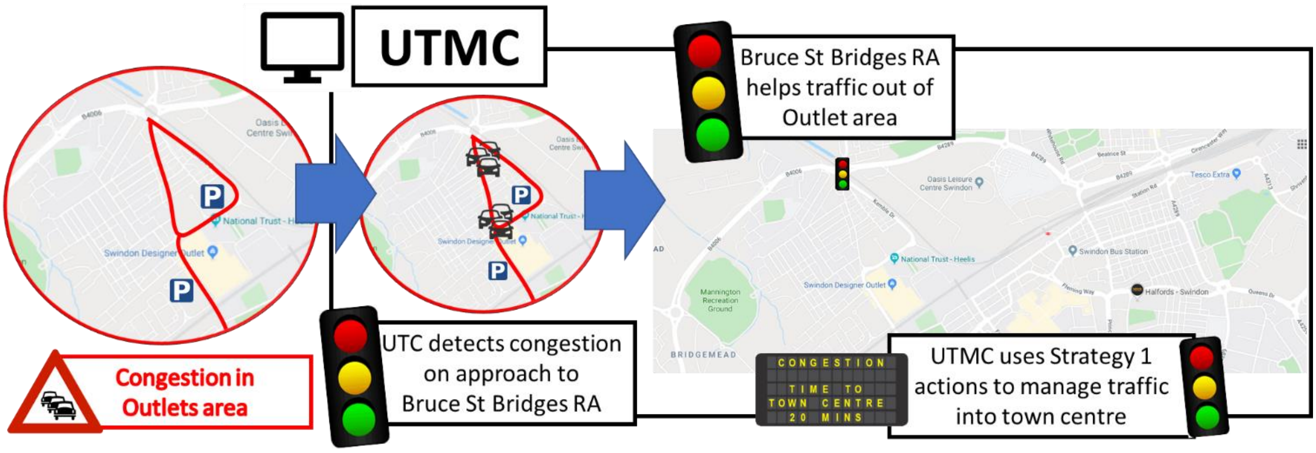
The Entry Phase will be triggered by congestion on the approaches to the Outlet area. As per Strategy One, traffic will be gated into the town centre and informed, via VMS, of congestion and journey times. The strategy will then build on this by using VMS closer to the outlet area to suggest alternative car parks with more capacity and encourage vehicles to be in the correct lanes on the approach to the Bruce Street Bridges roundabout. The timings at the roundabout can also be adjusted to hold traffic on the Great Western Way, preventing congestion on Rodbourne Road itself.

Figure 1-6 – Strategy Two, Entry Phase



The Exit phase will help vehicles to leave the Rodbourne Road area by adjusting timings at Bruce Street Bridges to help vehicles leaving Rodbourne Road via the give-way section of the junction. UTC can also adjust traffic signal timings to help certain traffic movements, such as vehicles travelling eastbound or westbound to leave Swindon Town Centre.

Figure 1-7 – Strategy Two, Exit Phase



1.2. Report Structure

This document is structured around the DfT's recommended five-case model for a transport business case:

- **Strategic case** (Chapter 2), setting out a rationale for the Swindon UTMC scheme, the need for investment, options considered and anticipated benefits of the scheme;
- **Economic case** (Chapter 3), identifying the key economic, environmental and social impacts of the scheme and its overall value for money;
- **Financial case** (Chapter 4), presenting evidence of the scheme's affordability both initially (for the construction phase) and in terms of ongoing operations, maintenance and renewal;
- **Commercial case** (Chapter 5), summarising the approach to scheme procurement and justifying the commercial and legal viability of the approach; and
- **Management case** (Chapter 6), setting out how Swindon Borough Council will ensure that the scheme is delivered successfully – on time and to budget, with suitable governance and risk management processes in place.

2. Strategic Case

2.1. Overview

The strategic case sets out the 'case for change' for the Swindon UTMC scheme. It explains the rationale for making an investment and presents evidence on its strategic fit with the aims and objectives of the following:

- Department for Transport (DfT) Transport Investment Strategy[7];
- Swindon Borough Local Plan (2026)[8];
- SWLEP Strategic Economic Plan (2016 – 2026)[9];
- Swindon Central Area Action Plan (CAAP)[10];
- Swindon Town Centre Movement Strategy (TCMS)[11]; and
- Swindon Local Transport Plan (LTP) (2011 – 2026)[12].

The strategic case comprises the following elements:

- A review of local and national policy, outlining how the scheme may contribute to meeting relevant policies and their objectives;
- Identification and evidencing of current and future transport problems to demonstrate the need for intervention;
- Development of transport objectives which seek to address the problems identified and support existing policy aims and objectives;
- Identification of key constraints, inter-dependencies and stakeholders;
- A summary of the scheme options that were considered for improving network performance in the study area to reduce traffic congestion and journey quality for public transport and other users along the GWW corridor;
- Rationale for selecting the preferred option, including contribution to objectives; and
- Further development and refinement of the intervention as the feasibility study and design progress and different options and/or variants considered before more detailed economic appraisals take place.

2.2. Policy Review

This section reviews the policy and economic context for the scheme, outlining how the scheme relates to relevant local policies and their objectives, summarising key data on employment, population growth and economic output and outlining how the scheme fits into the overall policy and economic aspirations for the area. This section includes a table summarising how well the various policies are considered to fit with the objectives of the UTMC scheme.

Swindon is a growing town with a vibrant economy, drawing on its pivotal location on the M4 and Great Western Rail Line which provide rapid access eastwards via Reading to the London area and westwards towards Bristol and South Wales.

Swindon has one of the most productive economies outside of London[13] and is home to major companies including BMW, Intel, Nationwide Building Society and Npower, as well as seven National Research Councils and the Space Agency. SWLEP is planning to build on these strengths in advanced manufacturing, technology and commerce by making strategic investments in new and existing further and higher education facilities, transport infrastructure and urban regeneration. Through three local growth deals, £169m of government

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[7] https://www.gov.uk/government/publications/transport-investment-strategy
[8] https://www.swindon.gov.uk/downloads/file/3988/swindon_borough_local_plan_2026
[9] https://swlep.co.uk/documents/docs/default-source/strategy/economic-priorities/strategic-economic-plan-january-2016
[10] https://www.swindon.gov.uk/info/20113/local_plan_and_planning_policy/646/swindon_central_area_action_plan
[11] https://www.swindon.gov.uk/downloads/file/4670/draft_town_centre_movement_strategy
[12] https://www.swindon.gov.uk/info/20136/transport_strategy/908/transport_policy
[13] In 2015, it was ranked 11th amongst English NUTS3 areas outside London, and had recovered to a pre-recession level of over £30,000 GVA per capita, comparable with areas such as East Surrey, City of Bristol and North Hampshire (source: www.ons.gov.uk)

funding has been secured to deliver these investments which will trigger further growth and underpin future success.

In 2015, the population of Swindon Borough was estimated to be 217,000 – an increase of 8,000 from the 2011 Census. By 2026, it is projected to increase by a further 21,000 to 238,000 people[14].

2.2.1. DfT Transport Investment Strategy (2017)

The DfT's Transport Investment Strategy (2017) outlines the Government's plan to 'build a stronger, fairer country, with an economy that works for everyone, in which wealth and opportunity are spread across the country and we are set up to succeed in the long-term'. The Government's goals for transport investment as described in the document seek to:

- Create a more reliable, less congested, and better-connected transport network that works for the users who rely on it;
- Build a stronger, more balanced economy by enhancing productivity and responding to local growth priorities;
- Enhance our global competitiveness by making Britain a more attractive place to trade and invest; and
- Support the creation of new housing.

The UTMC scheme aims to positively contribute to the Transport Investment Strategy's objectives through delivering improved reliability across the town centre network, which will reduce congestion and subsequently enhance opportunities for economic growth and the delivery of planned housing growth.

2.2.2. SWLEP Strategic Economic Plan (2016 – 2026)

The SWLEP Strategic Economic Plan (SEP) submitted to government in April 2014 (and revised and updated in January 2016) highlights the priorities and future opportunities for investment through to 2026. The SEP anticipates that the combined population of Swindon and Wiltshire will have increased from 699,000 in 2014 to 764,000 by 2026, with most of this growth located in the Swindon M4 'growth zone'. The SEP also identifies transport infrastructure improvements and place-shaping as part of strategic objectives to support the delivery of economic aspirations for the area:

- **Transport infrastructure improvements**: need a well-connected, reliable and resilient transport system to support economic and planned development growth at key locations; and
- **Place-shaping**: deliver the infrastructure required to deliver our planned growth and regenerate our city and town centres and improve our visitor and cultural offer.

The SEP identified inadequate transport infrastructure as a major barrier to the delivery of expansion and regeneration plans in Swindon and advised that a package of integrated transport schemes is required to support development and regeneration plans for Chippenham, Salisbury, Swindon and Trowbridge.

The UTMC scheme aims to contribute towards the delivery of the SEP through delivering transport infrastructure improvements, which can support a reliable and resilient transport network. The UTMC will also assist in improving accessibility to Swindon town centre, which can in turn support its regeneration.

2.2.3. Swindon Borough Local Plan (2026)

The Swindon Borough Local Plan (2026) is the principal planning policy document for Swindon Borough, providing the development strategy to deliver sustainable growth to the year 2026 in accordance with the Government's planning policies for England that are set out in the National Planning Policy Framework. The Local Plan identifies how much housing, employment and retail development the Borough needs and where this should be located. It was formally adopted by Swindon Borough Council in March 2015.

Overall, the Local Plan identifies a need for over 22,000 new dwellings to be constructed between 2011 and 2026, along with 77.5 hectares of additional employment land, which will support over 10,000 new jobs. The development strategy aims to meet Swindon's development needs whilst protecting the Borough's most important assets. Development is to be concentrated primarily at Swindon as the focal point for the economy, services and facilities and transport for the Borough and the wider area. However, SBC recognises that not all of Swindon's development needs can be met within the existing urban area and is consequently adopting a rational and responsible approach to town expansion to deliver the best and most sustainable outcomes.

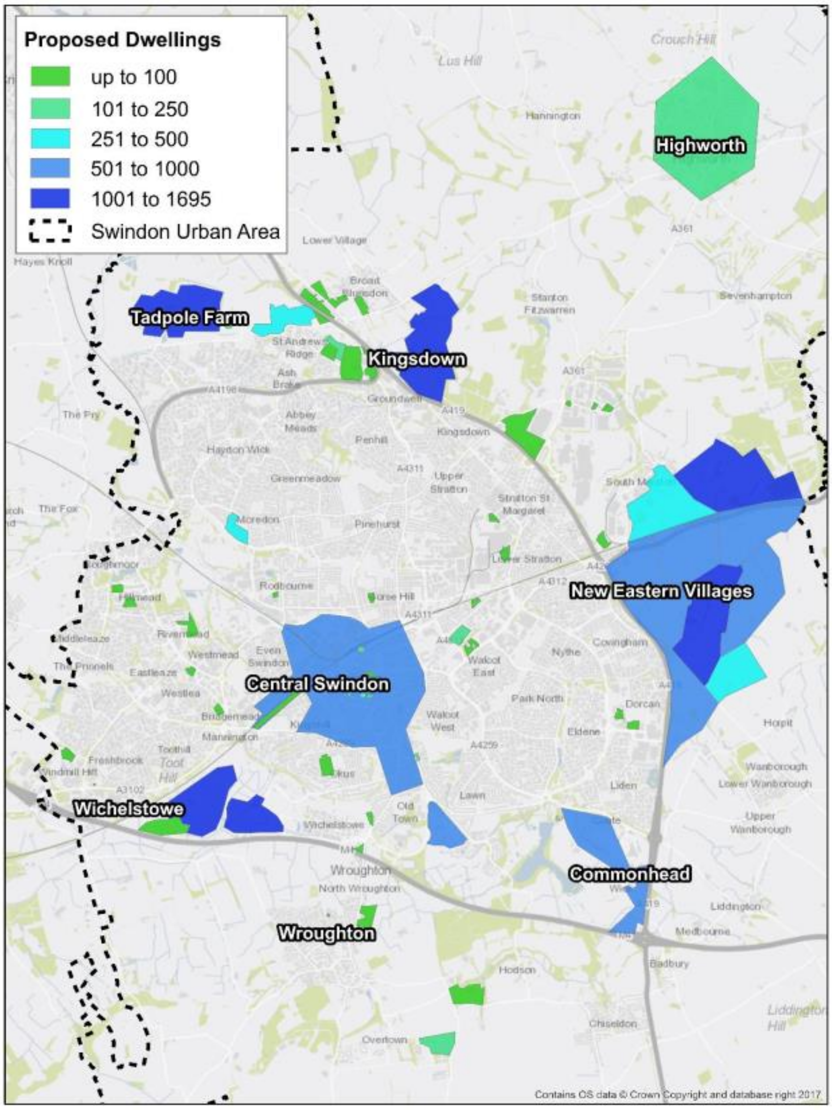
[14] Source: ONS Mid-Year Population Estimates and Subnational Population Projections – www.ons.gov.uk

The main strategic development sites identified in the Local Plan are listed in Table 2-1 and mapped in Figure 2-1.

Table 2-1 – Swindon Borough Local Plan (2026) Strategic Development Allocations

Area	Dwellings (Rounded)	Additional Employment Land and Floorspace Employment
Swindon's Central Area	1,000	-
Remainder of Swindon's Existing Urban Area	3,500	-
New Eastern Villages	8,250	Approximately 40 hectares
Wichelstowe	4,100	12.5 hectares
Tadpole Farm	1,700	5 hectares
Kingsdown	1,650	-
Commonhead	900	15 hectares
Highworth	At least 200	-

Figure 2-1 – Strategic Development Allocations (Swindon Local Plan 2026)



The UTMC scheme can positively contribute towards meeting the Local Plan's development requirements through enhancing Swindon's transport network, ensuring it delivers improvements to journey times and supports additional trips on the network.

2.2.4. Swindon Local Transport Plan 3 (LTP3)

The Swindon Local Transport Plan 3 (LTP3) presents an overarching strategy document setting out the borough's transport goals and priorities over the period 2011 to 2026. The plan sets out six key challenges that it seeks to overcome:

- Optimising the operation of key strategic corridors to allow efficient and reliable movement of people and goods;
- Delivering transport measures and interventions that will accommodate housing and employment growth in a sustainable manner;
- Contributing towards carbon reduction targets by achieving a shift to a more sustainable transport network;
- Overcoming barriers and severance caused by key transport corridors;
- Improving accessibility to/from the town centre to support regeneration of the town; and
- Delivering transport solutions which are sympathetic to the local environment.

The UTMC scheme will deliver against the LTP's objectives through optimising key strategic corridors into and around Swindon; improvements also seek to improve the efficiency and reliability of movements in Swindon. With improved efficiency and reliability of the network, accessibility to the town centre will be improved and subsequently can support regeneration of the town centre.

2.2.5. Swindon Central Area Action Plan (CAAP)

The Swindon CAAP provides a detailed policy framework for delivering the regeneration of central Swindon. The plan is based on a set of four development principles that are considered to be fundamental to the successful regeneration of central Swindon: Design; Sustainability; Public Realm; and Transport and Movement. All planning applications submitted to SBC are assessed against this policy framework within the Action Plan and provides certainty to developers and infrastructure providers in their future investment programmes.

The Transport and Movement Strategy section of the Swindon CAAP is in accordance with and informed by the aims and objectives of 'Swindon's 2030: A Vision for Transport'[15] and the accompanying 'Strategy for Transport in the Town Centre: Swindon 2030'. The guiding principles for transport in Central Swindon are to facilitate ease of movement into, out of and around Central Swindon and to support its economic growth and regeneration. SBC aims to achieve a road network which discourages through-traffic and reduces the amount of circulating traffic, and also seeks to increase the choice of travel options so that the car does not dominate or have a detrimental impact on the environment, or the quality of the experience in the town centre.

The UTMC scheme can support the delivery of the CAAP through delivering enhancements to the Central Area's transport network. It will positively contribute to the Transport and Movement development principles through facilitating movements into and around the town centre.

2.2.6. Town Centre Movement Strategy (TCMS)

The Town Centre Movement Strategy (TCMS) formed part of a masterplan delivery strategy for Swindon town centre to outline development principles and to bring forward many of the development proposals tabled in recent years. The TCMS made several observations regarding circulatory movement of traffic around the town centre and public transport users.

Much of the town centre road network is illegible in terms of the highway layout and is traffic-dominated. The complicated highway layout and the domination of traffic on town centre routes does not provide an accessible, safe and welcoming environment. The current set up acts as a poor gateway to the town, discouraging access by means other than car and detracting from the value of land in the town centre. The reliance on inner orbital routes to accommodate trips within the town centre have raised concerns regarding the air quality along these routes and in high-value town centre locations. The TCMS also suggests that bus routes from the east conflict with key traffic routes providing access to the town centre.

[15] Swindon 2030: A vision for transport, https://www.swindon.gov.uk/vision

A UTMC scheme is listed in a pool of potential interventions for the TCMS and its associated objectives to improve town centre access and travel options. The UTMC scheme will assist in accommodating and managing key traffic movements, designed to manage primary traffic routes and their congestion, and maintain convenient access to the town centre and adjacent destinations.

2.2.7. Swindon Transport Strategy

The Swindon Transport Strategy sets out the town's transport challenges in the context of planned growth across the borough. The current LTP is informed by the Transport Strategy and sets out the schemes required to deliver the planned growth set out in the current Local Plan. The strategy identifies objectives and an integrated package of transport measures to address future travel demand across all modes.

UTMC is listed as a key scheme of the strategy, contributing towards the strategy's identified outcome of reducing congestion at key junctions in the town. This is to be achieved partly through delivering intelligent transport systems, which includes UTMC.

Within the Transport Strategy, the ITS strategy seeks to deliver UTMC to enhance movement through junctions. UTMC can manage traffic flows and facilitate the delivery of travel information; this can consequently contribute to mitigating the impacts of additional traffic demand.

2.2.8. Policy Fit

The strategic outcome and transport objectives are aligned with the Government's Transport Investment Strategy (2017), Swindon Borough Local Plan (2026), Swindon Central Area Action Plan, the Swindon Town Centre Movement Strategy and the Swindon Transport Strategy. The policy fit with relevant objectives in these documents is presented in Table 2-2.

Table 2-2 – Policy Fit with Local Plans and Policies

Policy Document	Relevant Objectives/Themes	Description of Objective/Theme	Contribution from Scheme Objectives*
Department for Transport (DfT) Transport Investment Strategy (2017)	Strategic Objectives	Government goals for transport investment seek to: • Create a more reliable, less congested, and better-connected transport network that works for the users who rely on it. • Build a stronger, more balanced economy by enhancing productivity and responding to local growth priorities. • Enhance our global competitiveness by making Britain a more attractive place to trade and invest. • Support the creation of new housing.	✓✓
Swindon and Wiltshire Strategic Economic Plan	Strategic Objective 2 – Transport Infrastructure improvements: We need a well-connected, reliable and resilient transport system to support economic and planned development growth at key locations	Priority actions include: • Deliver key road junction and infrastructure improvements to support economic and planned development growth; • Deliver packages of integrated transport schemes to support the development and regeneration plans for Chippenham, Salisbury, Swindon and Trowbridge.	✓✓
	Strategic Objective 4 – Place Shaping: We need to deliver the infrastructure required to deliver our planned growth and regenerate our City and Town Centres, and improve our visitor and cultural offer	Priority actions include: • Deliver the investment needed to accelerate the delivery of strategic housing and employment sites to ensure that growth is accommodated sustainably; • Deliver infrastructure improvements to support economic growth, support higher value skilled employment and attract inward investment;	✓
Swindon Borough Local Plan (2026)	Strategic Objective 7 – Transport	Support Swindon's growth through the provision of a comprehensive and sustainable transport network that is efficient, safe, affordable, accessible and easy to understand, and offers a genuine choice of modes	✓✓✓
	Policy TR1: Sustainable Transport Network	The Council will use its planning and transport powers to help reduce the need to travel, and support and encourage the sustainable, safe and efficient movement of people and goods within and through the Borough. Priorities include: • Enabling a reliable and efficient transport network that minimises congestion, maximises consistent journey times, prioritises trips to	✓✓

Policy Document	Relevant Objectives/Themes	Description of Objective/Theme	Contribution from Scheme Objectives*
		and from Swindon town centre; and supports the distribution and logistics employment sector. • Supporting and contributing towards improving Swindon's sense of place and quality of life by minimising the impact of congestion, noise and air quality, improving the legibility and ease of movement within Swindon Town Centre and improving the image and experience of using Swindon's public transport. • Targeted investment to improve key junctions and corridors; • Medium to long distance vehicle movements will be positively encouraged through site access/egress locations, road design, and other highway measures to access the strategic highway network at its nearest point in Swindon rather than rat-run through inappropriate rural roads in the Borough, Wiltshire and adjacent areas.	
Swindon Local Transport Plan (2011 – 2026)	Improve connectivity of movements around Swindon	The LTP seeks to invest in Intelligent Transport Systems (ITS) in order to manage the town's transport system. It mentions that UTMC can manage traffic flows as well as facilitate the delivery of traffic information.	✓✓✓
Swindon Town Centre Movement Strategy	Simplify town centre circulatory routes and manage movements and access to parking	Improve the legibility and quality of town centre streets for all users. Provide simple and convenient access for vehicles to car parks, servicing and circulatory movements. Unlock road-space to facilitate improvements for other street users, public realm improvement and support regeneration aspirations.	✓✓
Swindon Transport Strategy	Strategy interventions and actions	The key components of the bus and rapid transit strategy include: • Bus priority measures on key corridors – bus priority is predominantly provided through the implementation of the UTMC system which allows automatic prioritisation for buses. Great Western Way has been identified as a location where most services cross the dominant traffic flow.	✓✓✓

*Qualitative assessment: ✓ - Minor Contribution, ✓✓ - Moderate Contribution, ✓✓✓ - Major Contribution

2.3. Existing Transport Demand and Level of Service

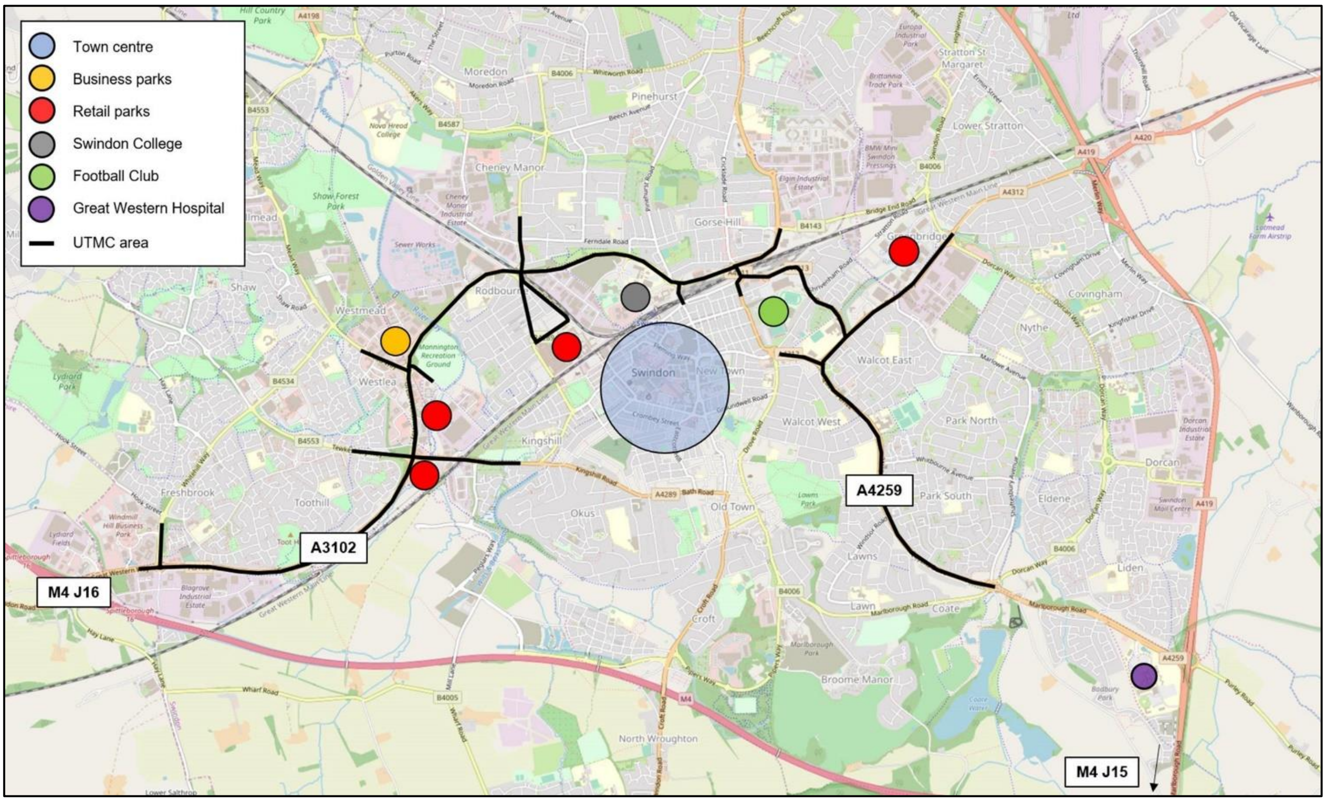
2.3.1. Current Network Performance

Traffic Flows

The core highway network covered by the proposed UTMC scheme carries considerable levels of traffic, performing both distributor and access functions (key locations on the UTMC network are shown in Figure 2-2):

- Distributor function: the A3102 Great Western Way and A4259 Queen's Drive provide access to M4 junctions; and
- Access function: the UTMC route provides direct access to Swindon town centre, retail at Mannington Roundabout, business parks at the Meads Roundabout, Swindon Designer Outlet retail area, Swindon College, Swindon Town Football Club, and Greenbridge Retail Park.

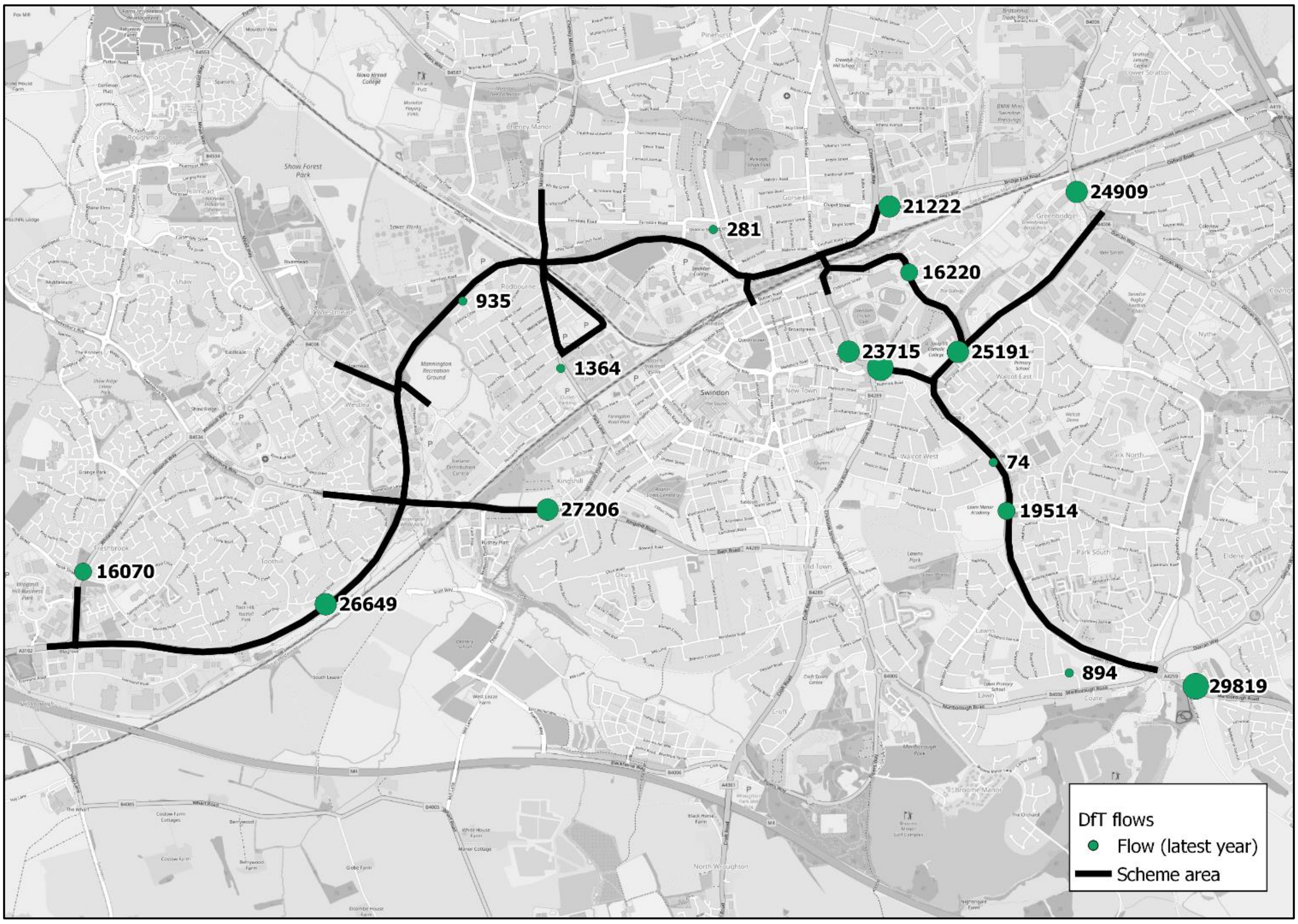
Figure 2-2 – Key Locations on UTMC Route



Average Annual Daily Flow (AADF) traffic count data for the study area and its approaches is presented in Figure 2-3. It highlights the following observations:

- There are flows in excess of 20,000 vehicles at various count sites, including its western and eastern extents (towards M4 Junction 16 and M4 Junction 15 respectively); and
- Flows are relatively high on the A3102 Wootton Bassett Road (27,206 vehicles) which provides access to the town centre.

Figure 2-3 – Traffic Flows (DfT, AADF)[16]



Traffic count data demonstrates the high flows of vehicles using Swindon's road network. Actively managing the road network, through traffic management interventions, such as UTMC, can provide a critical role in ensuring traffic flows smoothly into and around Swindon.

Traffic Speeds

Traffic speed data[17] for the AM peak is presented in Figure 2-4 for two weekdays in 2018. The top diagram is for a neutral weekday while the bottom diagram is for a more congested weekday. The figure highlights that speeds are variable across Swindon town centre and the UTMC scheme area's route network, and there are also significant variations across different days.

Particularly low traffic speeds were recorded at the following locations. These locations are either on the UTMC route network or are directly related to it.

- B4534 Whitehill Way southern approach to Blagrove Roundabout (B4534 / A3102);
- B4553 Tewkesbury Way eastern approach to Mannington Roundabout (B4553 / B4006 / A3102);
- B4006 Rodbourne Road northern and southern approaches to Bruce Street Bridges Roundabout (B4006 / B4289 / B4289); and
- B4289 Great Western Way between North Star Roundabout and the Transfer Bridges Roundabouts.

The marked variation in traffic speeds between the two weekdays indicates the difference in performance across different neutral weekdays and hence highlights the important role of signals in managing traffic flow. Interventions, such as UTMC, can play a role in managing traffic flows to ensure traffic travels on the network in a more efficient manner, and enable journeys to become more reliable.

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16 AADF data is presented at each count site for its latest available year (either 2017 or 2018)

17 Traffic speed data has been sourced from the Highways Analyst Basemap tool.

Figure 2-4 – Variation in Speeds (AM Peak)[18]

Traffic Delay

The UTMC scheme area's route network is subject to delays at peak periods. Figure 2-5 presents traffic delay for the UTMC route and roads connecting to it, displayed in terms of the difference in speed (mph) between the AM peak (weekday average for October 2018, 08:15 – 08:45, excluding school holidays) and free-flow conditions (weekday average for October 2018, 02:00 – 0400). It highlights the following locations with delay issues. These locations are either on the UTMC route network or are directly related to it.

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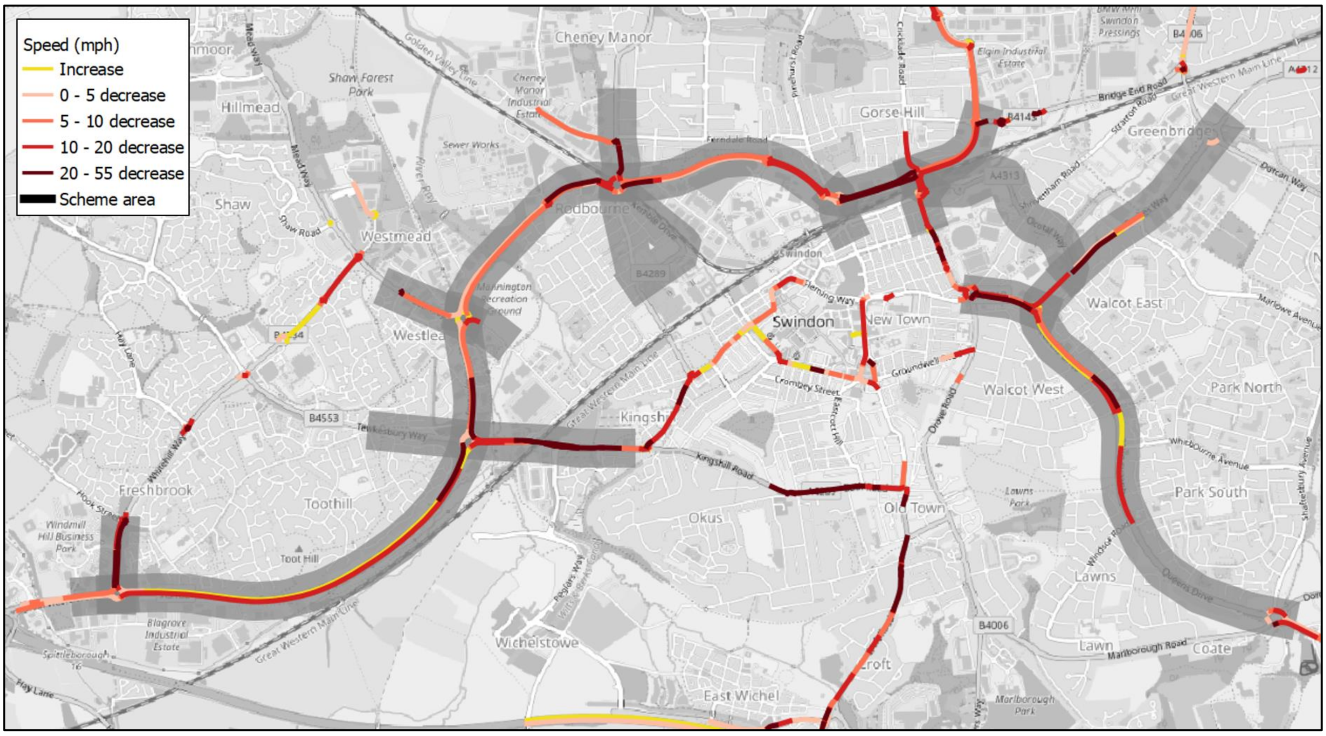
18 Highways Analyst data. AM Peak defined as 08:15 – 08:45. Data represents 2nd October 2018 and 21st November 2018 (both weekdays).

- A3102 Wootton Bassett Road;
- B4006 Mead Way;
- B4289 Great Western Way between Cockleberry and Transfer Bridges Roundabout;
- Shrivenham Road; and
- A4259 Queen's Drive.

Figure 2-5 – Difference in Delay – AM Peak Compared with Free-Flow Traffic Conditions (mph)[19]



Delay affects the scheme area at peak periods. It impacts connectivity and economic performance, where the movement of goods and people become slower. The UTMC scheme seeks to manage traffic flows and reduce delay, leading to a more efficient transport network.

Observed Junction Operation Within UTMC Core Area

Site assessments were carried out at key junctions within the UTMC core area in August/September 2019 by Aspects Traffic Solutions Ltd on behalf of SBC[20]. The primary purpose of the site assessments was to capture controller and any add-on equipment details sufficient to ascertain the upgrade works required to enable connection to the new proposed UTMC system whilst maintaining operational control strategies such as MOVA. The resulting UTMC Site Investigations Report also includes some general observations regarding the operation of key junctions, which provides some anecdotal evidence for the current traffic conditions, albeit only a 'snapshot'.

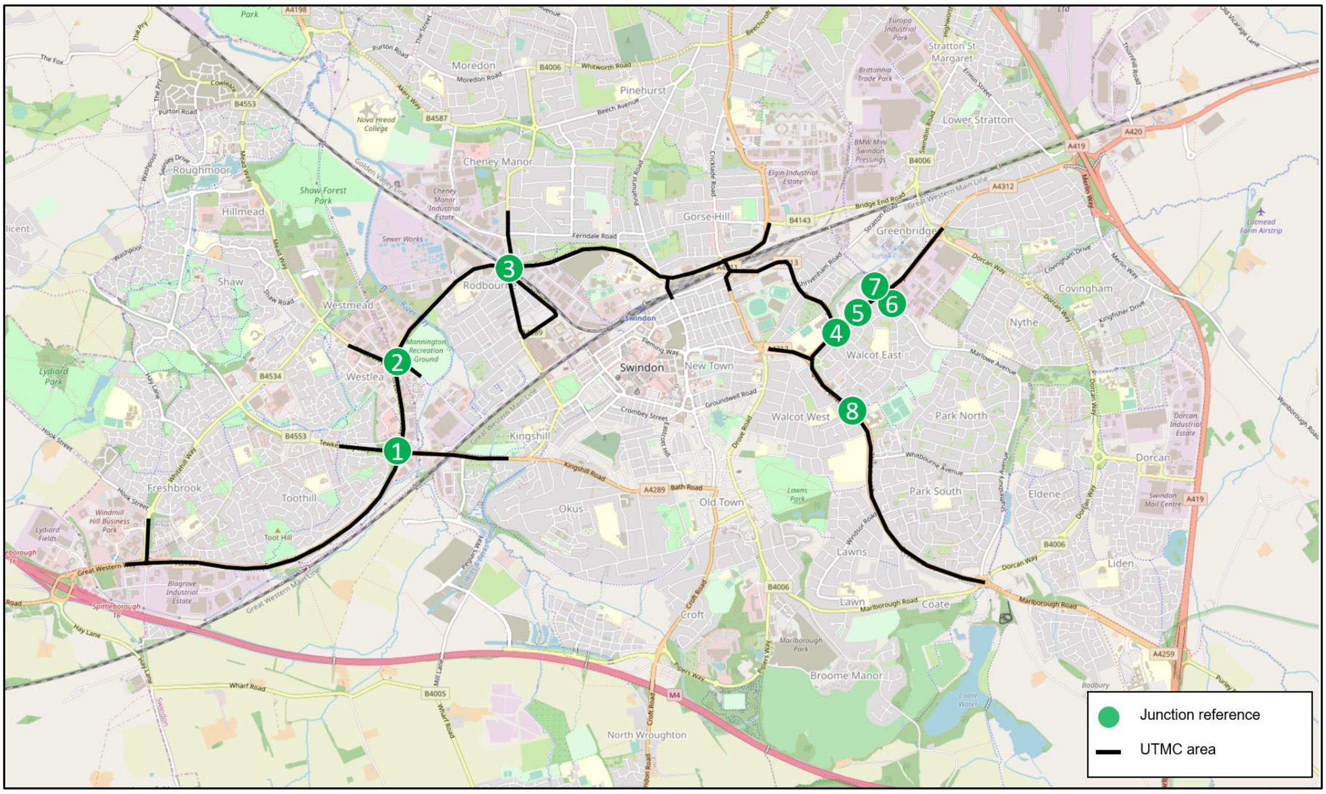
Table 2-3 provides a summary of the relevant observed issues identified in the report; it should be noted that junctions were observed at various times of day both during the school holiday period and within term-time. Figure 2-6 maps the locations of the junctions listed in the UTMC Site Investigations Report.

[19] Highways Analyst data. AM Peak defined as 08:15 – 08:45, October 2018 weekdays (excluding school holidays). AM Peak is compared to off-peak (02:00 – 04:00, October 2018 weekdays)
[20] Swindon Borough Council UTMC Site Investigations, Aspect Traffic Solutions Ltd, September 2019

Table 2-3 – Junction Observations within UTMC Core Area

Ref	Junction	Existing Traffic Control	Observations
1	Mannington roundabout	Part-time traffic signals, operating MOVA	• Traffic signals remained 'off' despite severe congestion observed during peak periods. • Traffic queuing eastbound along the A3102 Wootton Bassett Road causes exit blocking at the roundabout.
2	Meads roundabout	Full-time traffic signals, operating MOVA	• Severe congestion observed, particularly associated with the uncontrolled Paddington Drive entry. • Junction operation is severely compromised by exit blocking associated with the Mead Way northwest-bound exit.
3	Bruce Street Bridges roundabout	Part-time traffic signals, operating MOVA	• Traffic signals illuminate for quite short periods causing confusion and some internal queuing. • Limited benefit to the uncontrolled entry at Rodbourne Drive. Signals were observed to turn off when congestion was still present in Rodbourne Drive. • Junction operation is affected by exit blocking-back from Rodbourne Road (North). • The design of the signals does not follow best practice phase and stage allocation and would therefore potentially benefit from further observation and reconfiguration.
4	Drakes Way / Ocotal Way junction	Full-time traffic signals, operating MOVA	• Junction operates satisfactorily but could benefit from MOVA validation or added to a SCOOT region.
5	Drakes Way / Penny Lane junction	Full-time traffic signals, operating MOVA	• Junction operates satisfactorily but could benefit from being added to a SCOOT region.
6	Drakes Way / Marlowe Avenue junction	Full-time traffic signals, operating MOVA	• Junction operates satisfactorily but could benefit from being added to a SCOOT region.
7	Drakes Way / Garrard Way junction	Full-time traffic signals, operating MOVA	• Junction operates satisfactorily but could benefit from being added to a SCOOT region.
8	Queens Drive / Frobisher Drive junction	Full-time traffic signals, operating MOVA	• Junction could benefit from being added to a SCOOT region.

Figure 2-6 – Location of Junctions (Site Investigations Report)



2.3.2. Accidents

In the five-year period between 2014 and 2018, 327 collisions were recorded along the study area route, causing 416 casualties. The breakdown of collisions is provided in Table 2-4 and mapped in Figure 2-7. Two fatal collisions were recorded in 2018, one at Transfer Bridges Roundabout and the other south of Mannington Roundabout.

Table 2-4 shows a fluctuation in the number of collisions over the five-year period on the study route. 2016 saw the greatest number of collisions (78) whilst 2014 saw the fewest (55) during the study period. The cause of the peak in the Swindon area in 2015-2016 is unknown but it does not appear to be part of a wider national trend. In the two recent years, 2017 and 2018 (the latest available year) have experienced a decrease.

There are notable collision clusters along the route, particularly at junctions. These are set out in Figure 2-7. Clusters include:

- Mannington Roundabout (Great Western Way / A3102 Wootton Bassett Road / Tewkesbury Way);
- Bruce Street Bridges Roundabout (Great Western Way / Rodbourne Road / Kemble Drive);
- Cockleberry Roundabout (Great Western Way / Corporation Street / retail centre);
- Transfer Bridges Roundabout (Great Western Way / Cirencester Way / Cricklade Road / County Road);
- Drakes Way / Ocotal Way junction; and
- Greenbridge Roundabout (Dorcan Way / Slade Drive / Drakes Way).

Table 2-4 – Collisions in Study Area

Year	Number of collisions	% change by year	Severity			Number of casualties
			Fatal	Serious	Slight	
2014	55	-	0	10	45	73
2015	64	16%	0	9	55	79
2016	78	22%	0	11	67	103
2017	74	-5%	0	13	61	93
2018	56	-24%	2	6	48	68
Total	**327**	**2% (average)**	**2**	**49**	**276**	**416**

DfT STATS19 data, 2014-2018. 2018 was the latest available year with full collision data at the time of writing.

Figure 2-7 – Collisions in Study Area (2014 – 2018)[21]

It can therefore be concluded that safety issues may be present in the UTMC scheme area. In particular, Transfer Bridges Roundabout, Mannington Roundabout and Greenbridge Roundabout are all accident cluster sites. The two fatal collisions recorded in 2018 further highlight the need to ensure traffic moves safely in Swindon, although further investigation into the nature of the accidents recorded would be required to establish whether the UTMC scheme could serve to improve safety on the network.

[21] Only collisions on the scheme area routes are mapped and tabulated.

2.3.3. Public Transport Provision

Bus services in Swindon are predominantly run by two companies – Swindon Bus Company and Stagecoach West. The town centre is the hub of the bus network, with secondary hubs at the Orbital shopping centre in north Swindon and the Great Western Hospital in the south-east of Swindon. Buses accessing the town centre are split between two local hubs: Swindon bus station and Fleming Way.

2.3.3.1. Bus Priority Measures in the Core UTMC Network

The core UTMC network includes some existing bus priority measures, comprising bus lanes on links between or on approach to key UTMC junctions, and bus gates, as summarised in Table 2-5.

Table 2-5 – Existing Bus Priority Measures on UTMC Core Network

Location	Priority Type	Description
Wootton Bassett Road	Bus Lane	Eastbound carriageway, to the east of Mannington Roundabout
A4259 Queens Drive	Bus Lane	North-westbound carriageway between Upham Road and the Magic Roundabout
Tewkesbury Way	Bus Lane	Eastbound carriageway between Mannington Lane and Great Western Way
Penzance Drive	Bus Lane	Eastbound carriageway between Swindon Designer Outlet and Wootton Bassett Road
Upham Road	Bus Gate	Both directions, at the junction with Queens Drive
Unnamed Link Road	Bus Gate	Westerly direction, between Great Western Way and Mannington Roundabout
Unnamed Link Road	Bus Gate	Both directions between Penzance Drive and Rodbourne Road

2.3.3.2. Bus Services and Frequencies

Figure 2-8 and Figure 2-9 show the bus route maps for Stagecoach West and Swindon Bus Company within the Swindon central area. Junctions within the UTMC core area have been superimposed onto the route maps, indicated by yellow circles, so that those services operating within the UTMC scheme area can be easily identified. As shown by the route maps, there are some parts of the UTMC core area with no Stagecoach West or Swindon Bus Company services currently operating, most notably Great Western Way between the Bruce Street Bridges roundabout and Transfer Bridges roundabout. A summary of the bus services and frequencies operating within the UTMC core area (as at October 2019) is provided in Table 2-6.

By considering the bus route maps and frequencies in conjunction with Figure 2-5 showing traffic congestion on the local network, the existing situation regarding public transport can be summarised as follows:

- There are numerous bus routes operating within the UTMC study area. Approximately 100 buses operate within the UTMC network during both the AM and PM peak hours, passing through key UTMC junctions and/or routing along key UTMC links such as Great Western Way, Drakes Way and Queen's Drive;
- Bus services operating within the UTMC study area are likely to experience some degree of delay, due to the congested network. There is limited bus priority along the GWW corridor (with some exceptions, e.g. Queen's Drive); hence, congested junctions will impact on buses leading to lengthy and unreliable journeys; and
- Improvements to the local network brought by the UTMC scheme is likely to benefit public transport by reducing delays and therefore improving reliability and punctuality of bus services.

Figure 2-8 – Stagecoach West Bus Route Map and Key UTMC Junctions[22]

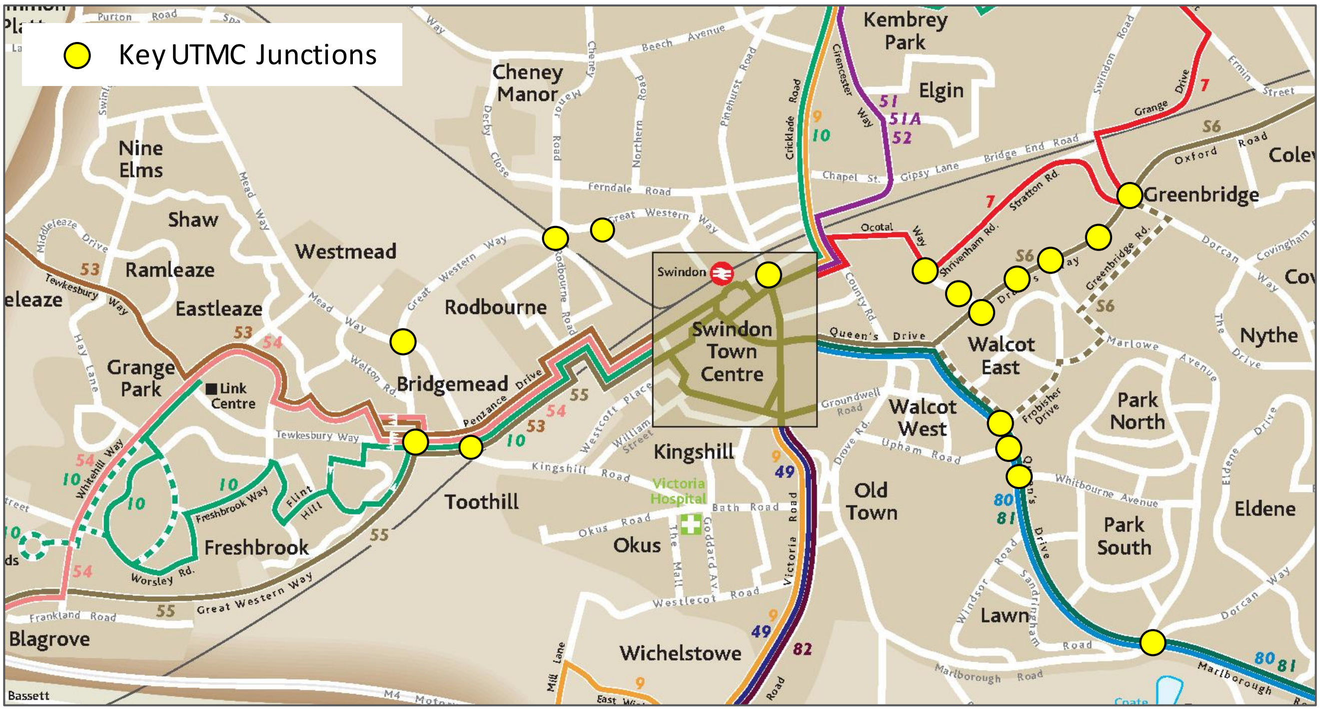
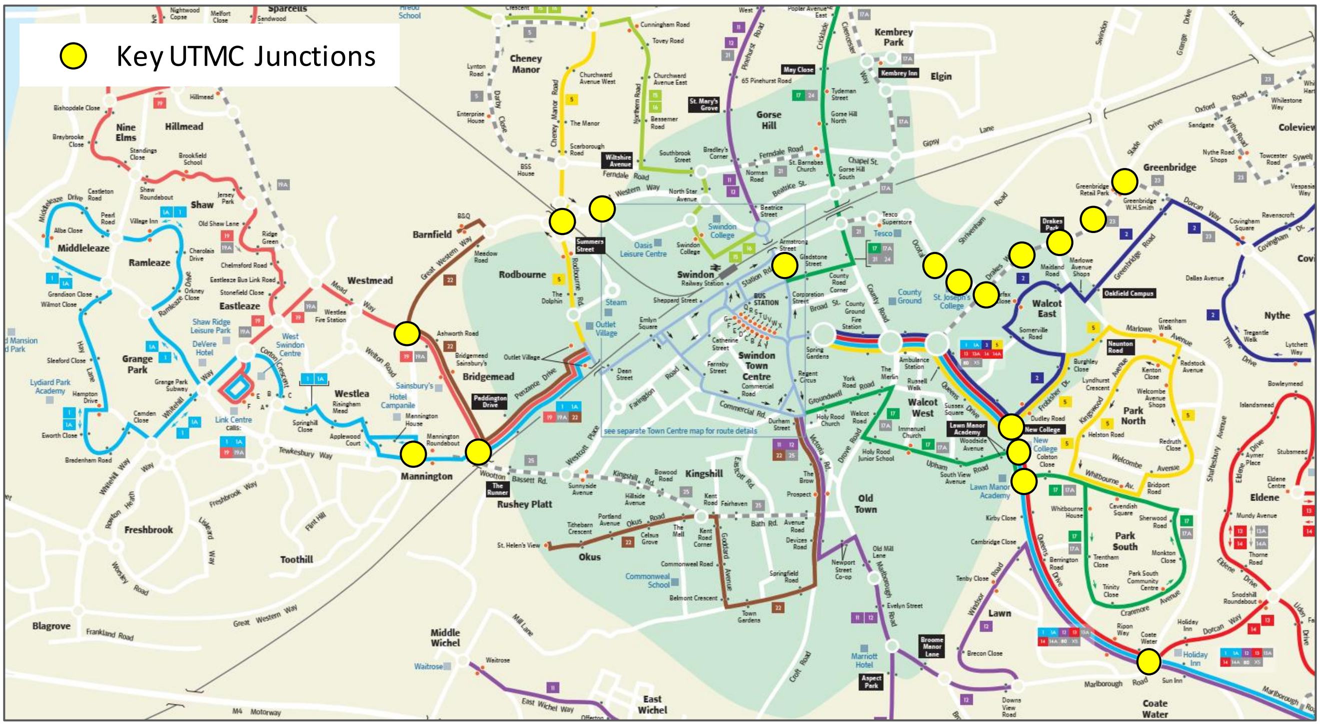


Figure 2-9 – Swindon Bus Company Route Map and Key UTMC Junctions [23]



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22 https://www.stagecoachbus.com/maps
23 https://www.swindonbus.co.uk/services

Table 2-6 – Summary of Bus Services and Frequency within UTMC Core Area

Bus Operator	Service No.	Route Description	Frequency at Peak Periods
Stagecoach West	10 / 53 / 54 / 55	Bus services 10, 53, 54 and 55 all cross Great Western Way at the Mannington roundabout, and route along Wootton Bassett Road and Penzance Drive. A short (300m) section of the no.10 route also runs along Great Western Way, on the northbound approach to the Mannington roundabout.	5 per hour / 1 ph / 1 ph / 4 ph
	80/81	Bus services 80 and 81 operate along the entire length of Queens Drive, to the south-east of Swindon town centre.	1 ph / 1 ph
	S6	Bus service S6 runs along part of Queens Drive, Drakes Way and Oxford Road, between Swindon Town Centre and the A419 White Hart roundabout, to the north-east of the town centre.	4 ph
Swindon Bus Company	1 / 1A	Bus services 1 and 1A cross Great Western Way at the Mannington roundabout, and route along Wootton Bassett Road and Penzance Drive. Services 1 and 1A also operate along the entire length of Queens Drive, to the south-east of the town centre.	3 ph / 3 ph
	19 / 19A	Bus services 19 and 19A cross Great Western Way at the Meads roundabout, and route along Penzance Drive and Paddington Drive.	2 ph / no peak period service
	22	Bus service 22 operates along Great Western Way between the Meads roundabout and Barnfield Road.	2 ph
	15 / 16	Bus services 15 and 16 cross Great Western Way at the North Star roundabout. The route also passes through the Great Western Way/Polaris Way roundabout.	2 ph / 1 ph
	17 / 17A / 21 / 24	Bus services 17, 17A, 21 and 24 all pass through the Transfer Bridges roundabout.	6 ph / 1ph / 1ph / no peak period service
	23	Bus service 23 operates along the length of Drakes Way, to the north-east of the town centre.	No peak period service
	2 / 5 / 13 / 13A / 14 / 14A / 80 / X5	Bus services 2, 5, 13, 13A, 14, 14A, 80 and X5 operate along the entire length of Queens Drive, to the south-east of Swindon town centre. Bus service 5 also crosses Great Western Way at the Bruce Street Bridges roundabout.	4 ph / 7 ph / 3 ph / 1 ph / 3 ph / 1 ph / 1 ph / 1 ph

2.4. Future Challenges

2.4.1. Demand Growth in the Swindon Area

Housing and employment developments will increase travel demand in the Swindon area. The land use allocations included in the Swindon Strategic Highway Model (SSHM) 2036 forecast year, are presented in Table 2-7 identifying the delivery of 24,000 dwellings and 14 million square metres of employment, retail, leisure floor area. This represents an increase in planned housing and employment delivery compared to the Local Plan's Strategic Development Allocations (as per Table 2-1).

Table 2-7 – Major Land Use Developments in Swindon (Post-2014)

Development Area	Dwellings Complete by 2036	Employment Complete by 2036
Tadpole Garden Village	1,695	510
NEV	8,250	4,141
Wichelstowe	3,800	76.7
Commonhead	890	1,328
Kingsdown	1,650	10
Highworth	200	500
Wroughton	179	-
Central Swindon	3,000	1,437
Other Developments	5,312	5,406
Total	**24,354**	**14,066**

Source: Demand Model and Traffic Forecasting Report, November 2017. Employment includes retail, leisure, etc. and is presented in Gross Floor Area (1,000 sqm).

The study area and the key UTMC junctions cover major radial routes into and around Swindon town centre, so they will be influenced and impacted by increased travel demand caused from the planned development, e.g. residents of the new development travelling to access employment, retail and recreation opportunities.

TEMPro Forecasts

TEMPro forecasts demonstrate that Swindon is expected to grow over the period, with an increase in population of 25% by 2036, 34% increase in households and 12% increase in jobs (Table 2-8). Table 2-9 shows that the trips from the Swindon area will increase at a greater rate (13.2%) than trips to the Swindon area (7.5%), but both are expected to grow significantly.

The UTMC scheme presents an opportunity to proactively manage increasing traffic flows across key roads on Swindon's transport network.

Table 2-8 – TEMPro Forecasts for Swindon (2011-36)

	2011	2021	2036
Population	208,300	226,957	260,599
	-	8.96%	25.11%
Households	88,626	99,912	118,695
	-	12.73%	33.93%
Jobs	114,649	122,974	128,259
	-	7.26%	11.87%

Source: TEMPro 7.2 – combined modes

Table 2-9 – TEMPro Trip End Forecasts and Growth Factors for Swindon (2011-36, AM Peak)

		2011	2021	2036
Growth Factor	Origins	-	1.0198	1.132
	Destinations	-	0.9931	1.075
Trip Ends	Origins	127,198	129,717	143,993
	Destinations	124,679	123,820	134,029

Source: TEMPro 7.2 – combined modes

2.4.2. Planned Changes in the Transport Network

There are a number of planned changes to the transport network in Swindon which will directly or indirectly affect the UTMC scheme area. This includes the package of schemes for the NEV development (including changes at White Hart Junction), works at Mead Way and works at Mannington Roundabout.

Other significant works in the borough include remodelling of several highway junctions (Greenbridge, Mannington junction (Phases 1-3), M4 Junction 16), widening of the highway for a section of new build bus lane Pipers Way and the upgrade to key bus interchange facilities at Regent Circus in the town centre. There are currently no committed plans for bus service changes.

The delivery of transport infrastructure will assist in delivering and catering for the planned development. However, Swindon's town centre and UTMC road network will experience a considerable increase in traffic flows, highlighting the rationale for further improvements and integration, such as traffic management interventions, to deal with incidents and variation in travel demand, and manage the performance of the urban network in a concerted manner.

2.4.3. Future Network Performance

Traffic Flows

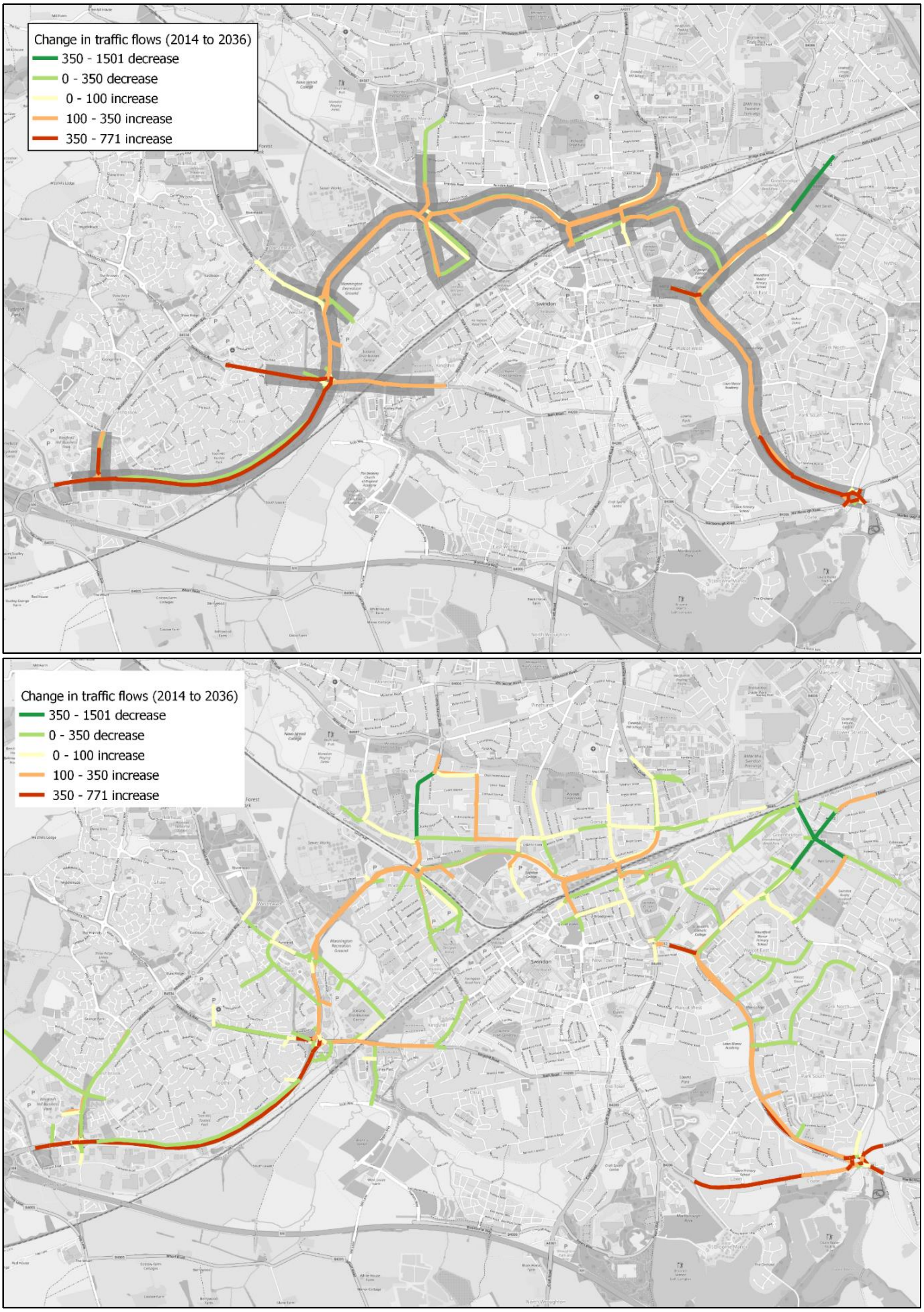
The UTMC's route network will experience an increase in travel demands as planned growth aspirations are realised. The delivery of additional dwellings and employment will result in an increase in travel demand across the network and the wider Swindon area.

Figure 2-10 displays the forecast change in traffic flows along the UTMC network between 2014 and 2036. The forecast change is caused by the delivery of planned employment and housing growth, along with associated transport infrastructure mitigation. It highlights the following observations, particularly in relation to locations which will observe an increase of over 350 PCUs per hour:

- A3102 Great Western Way westbound from Mannington Roundabout towards M4 Junction 16;
- A3102 Great Western Way eastbound and westbound between Bodiam Drive South and Mannington Roundabout;
- A4312 Queen's Drive eastbound and westbound between The Magic Roundabout and Queen's Drive / Drakes Way Roundabout; and
- All approaches to Coate Roundabout.

Flow changes can largely be attributed to the delivery of planned development, which will add traffic flows on the UTMC network, particularly at its south-eastern and south-western extents. This is due to the delivery of large development sites such as NEV, Wichlestowe and Commonhead.

Figure 2-10 – Change in Traffic Flows (AM Peak, 2014 vs 2036)[24]



24 Swindon Transport Model. 2014 base year delay compared to 2036 forecast year.

Delay

The anticipated increase in travel demand (set out in Section 2.4.2) will subsequently place additional demand on the UTMC route network. Figure 2-11 presents the change in delay between 2014 and 2036, and highlights locations that will experience an increase in delay:

- A3102 Great Western Way westbound from Bodiam Drive South towards M4 Junction 16;
- The B4006 and B4289 Great Western Way stretch between The Meads Roundabout and Cockleberry Roundabout;
- A4311 Cirencester Way; and
- A4132 Drakes Way between Ocotal Way and Queen's Drive / Drakes Way Roundabout.

It is important to note that the existing network performance (set out in Figure 2-4) is poor, with lengthy and unreliable journey times. Delay will further increase in the future.

Figure 2-11 – Change in Delay (AM Peak, 2014 vs 2036)[25]

2.5. Summary of Problems Identified and Impact of Not Changing

2.5.1. Identified Problems

Without further intervention, the existing transport network in Swindon will continue to suffer from unreliable journey times at peak periods, with delay threatening the performance of the network.

Future growth will add additional trips to the network once planned housing and employment developments are delivered. This will place added strain on the network, compounding existing congestion and journey time issues.

Table 2-10 summarises the current and future problems.

Table 2-10 – Current and Future Problems

Problem	Commentary
There are accident cluster sites on the UTMC route network.	• There have been two fatalities in the past five years. • Fluctuations in the number of collisions over the past five years. • Collisions have negative impacts on the resilience and reliability of the road network.
The UTMC route network is congested at peak periods with unreliable journeys times. This is due to worsen in the future.	• A lack of a unified traffic management control system means the movement of traffic through Swindon's urban network is not optimised, leading to delays. • There are particular issues with existing journey speeds at Mannington Roundabout and B4289 Great Western Way east of Swindon rail station. • Performance of the network will further deteriorate as planned growth is delivered, despite the delivery of associated infrastructure.
Planned housing and employment growth is forecast to exacerbate the problems identified	• Planned housing and employment growth will result in an increase in trips on the network. • Delay will subsequently increase on the network. This will degrade the performance of the UTMC route network.

2.5.2. Impact of Not Changing

Without change, the performance of Swindon's town centre route network will be sub-optimal. The existing traffic management arrangement comprises a network of signalised junctions that are not-optimised or have out-of-date configurations and are also not coordinated with each other.

As highlighted in Section 2.4.3, journey times will continue to be impacted in the future as travel demands increase with the delivery of planned housing and employment growth. Although infrastructure will be delivered to cater for increased travel demand caused by growth, delay will increase, justifying the need for a proactive approach to traffic management.

2.6. Objectives and Measures for Success

2.6.1. Objectives

To solve the problems outlined in Section 2.5, objectives for the introduction of a UTMC system in Swindon have been identified.

Progress against the objectives is expected by 2022, one year after scheme opening, while strong progress is expected once planned growth has been delivered.

- Ensure **network-wide resilience** at peak periods on the Swindon UTMC route network by 2036 through active management of capacity;
- Improve the operating efficiency of key **junctions on the UTMC network** in peak periods once planned growth has been delivered;
- **Ensure a traffic management intervention is reliable** with continued operation, delivering sustained operational effectiveness longevity; and
- **Improve existing levels of safety** on the UTMC route network through reducing the number of collisions.

2.6.2. Measures for Success

For each objective, at least one 'indicator of success' has been established to determine what constitutes successful delivery of any transport-related improvements. Indicators and related targets are outlined in Table 2-11. Note that some targets cannot be calculated through the spreadsheet modelling approach (see Section 3.5) , but it is assumed could be derived using actual data from the JTMS. Accident data will be obtained from STATS19 database.

Table 2-11 – UTMC Success Indicators

Indicator	Targets	Relating to Objectives
Reduction in delays at UTMC junctions compared to a do-nothing scenario	Average overall junction delay at peak periods is lower with the scheme than without the scheme in 2036	1 – Reduce overall junction delay 2 – Junctions operate effectively
Ensure journeys on the UTMC network are more reliable compared to a do-nothing scenario	Lower variation in journey times at peak periods in 2036 compared to without the scheme	1 – Reduce overall junction delay 2 – Junctions operate effectively
Decrease in collisions in the UTMC route network	Absolute reduction in personal injury accidents, comparing the five-year periods before and after scheme opening	3 – Improve existing levels of safety
Reduction in delays caused by signal failures	No UTMC system failures in the five-year period after scheme opening	1 – Reduce overall junction delay 2 – Junctions operate effectively

2.7. Scope

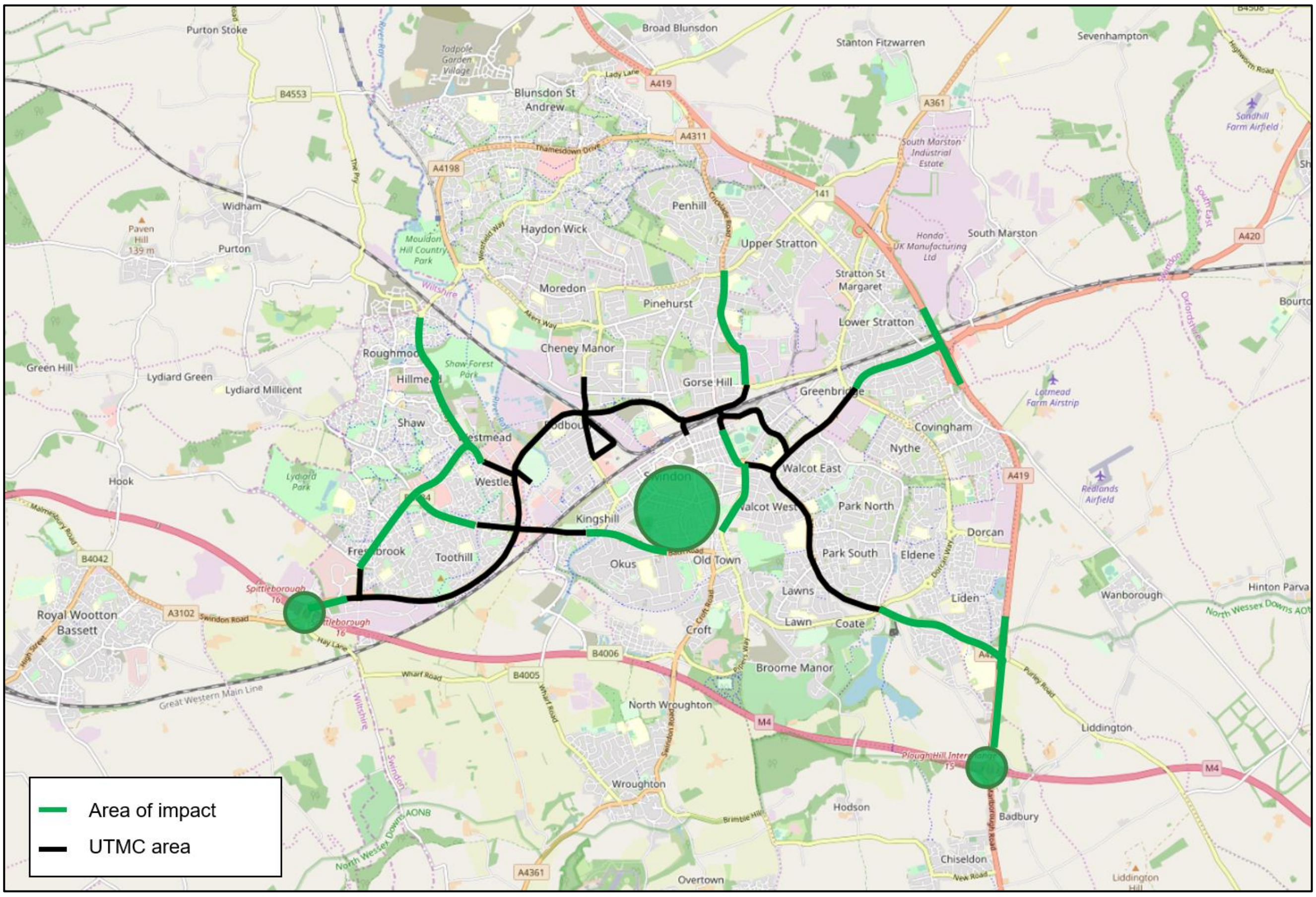
The proposed UTMC scheme aims to facilitate consistently moving traffic and reliable journey times during peak periods, and to ensure that key junctions are not over capacity and all available highway space can be utilised. The core area of the network for the proposed UTMC has been defined as the Great Western Way (GWW) corridor between Mannington and Drakes Way.

Given the problems identified and the stated objectives, the UTMC intervention should aim to have a beneficial impact on the scheme's route as well as the wider road network, as shown in Figure 2-12.

Specifically, the geographic area of impact should encompass the following areas:

- M4 Junctions 15 and 16;
- Swindon town centre;
- Key junctions on the A419 east of Swindon;
- B4534 and B4553 in Freshbrook and Toothill; and
- Planned growth sites in Swindon.

Figure 2-12 – UTMC Area of Impact



2.8. Constraints

The UTMC scheme is a major opportunity to support congestion and journey time reliability benefits on key routes in Swindon. This can assist the delivery of regeneration in the town centre and indirectly support housing and employment growth. Improvements to Swindon's transport network represent an opportunity to build on the town's manufacturing and commerce strengths into a new phase of growth. Opportunities to invest in transport packages to support housing and employment growth as well as the regeneration of Swindon town centre are SWLEP priorities.

The UTMC scheme would link into several recently delivered local highway improvements in Swindon which will work towards alleviating congestion issues and facilitating planned development. Committed and recently delivered schemes include improvements at B4006 Mead Way[26] and Mannington Roundabout[27].

In terms of constraints, Noise Important Areas (NIAs) are present at various points along the UTMC route area. Locations include on A3102 Great Western Way and A4259 Queen's Drive. Flood Zones 2 and 3 also exist adjacent to A3102 Great Western Way and Mannington Roundabout, adjacent to Ocotal Way, and across Coate Roundabout. The presence of NIAs and Flood Zones warrants careful consideration during the scheme's design phase, although the scheme's impact is likely negligible.

An Air Quality Management Area (AQMA) is declared on Kingshill Road in Swindon. Whilst the AQMA is not directly located on the UTMC scheme area, it warrants consideration during the design and construction phases (where roadworks may cause traffic impacts). It is likely that the UTMC scheme will deliver air quality benefits through actively managing traffic flow.

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26 https://www.swindon.gov.uk/info/20136/transport_strategy/853/mead_way_improvements

27 https://www.swindon.gov.uk/info/20136/transport_strategy/892/find_out_about_the_mannington_roundabout_project

2.9. Inter-Dependencies

There are no critical dependencies for the UTMC scheme. The scheme is not dependent upon, and could be delivered in isolation from, other schemes. However, there are planned works that would have an impact; this includes Mead Way and Transfer Bridges junction improvements.

The UTMC scheme will complement other proposed changes to the transport network through actively managing traffic flows in Swindon. Other proposed changes include the New Eastern Villages highway works package, which includes works at White Hart Junction on the A419.

2.10. Stakeholders

SBC has worked closely with key stakeholders to understand the constraints on the network and to develop a Transport Strategy in and around the town centre. Key stakeholders such as local ward Councillors, bus operators and businesses (e.g. the Swindon Designer Outlet) have been contacted to develop the requirements both in terms of equipment design and the potential information to be provided through the VMS signs.

Table 2-12 sets out the key stakeholders relating to the Swindon UTMC scheme and their roles and interests.

Table 2-12 – Key Stakeholders and Roles with Respect to the Swindon UTMC Scheme

Stakeholder	Role
Swindon Borough Council	Planning and highways authority, responsible for scheme delivery and future maintenance of local road infrastructure
Swindon and Wiltshire LEP	Approval authority for LGF - have allocated proposed LGF for the scheme, subject to approval of the Full Business Cases
Bus companies (Stagecoach West and Swindon's Bus Company)	Bus operators are interested across the Swindon network with variety of congestion hotspots across the Great Western Way corridor which affect buses.
Ward Councillors	Interested in their ward, for example the Rodbourne Cheney ward has an interest in the operation of Bruce St Bridges and congestion associated with the Swindon Designer Outlet.
Swindon Designer Outlet	Interested in the management of car park signing and traffic during peak periods when they hold events.

2.11. Options Considered

The options assessment process firstly established the level of ambition that an intelligent transport system intervention would seek to achieve. There were three levels of ambition:

1. **Monitored network** – this is a hands-off approach designed to collate data on the network to inform decisions and future interventions;
2. **Influenced network** – this will relay data back to the user. By giving information to motorists they can make more-informed travel decisions; and
3. **Controlled network** – this network can be directly controlled through connected junctions. This level of control requires a resilient communication system culminating in a single UTMC Common Database.

Whilst all three levels of ambition are viable options in delivering methods to control increasing levels of congestion, the controlled network intervention (level 3 ambition) was selected as it will deliver the greatest benefits through providing the most proactive method of managing traffic.

The controlled network intervention, termed as the UTMC option, was selected as the preferred option, and progressed into detailed optioneering, which assessed the performance of various elements which can together deliver UTMC. Table 2-13 provides the options considered for a UTMC ('controlled network') scheme for each of its elements.

Table 2-13 – Summary of UTMC Options Considered

UTMC Element	Options Considered
Common Database	1. Internal 2. Hosted
JTMS	1. Bluetooth 2. WiFi 3. ANPR 4. Total Data
Communications	1. Private Fibre Optic 2. Mesh 3. SIM
Traffic Signals Compatibility Upgrades (including signal fault reporting)	1. UTC 2. Remote Monitoring System (RMS)
VMS	1. Full RGB 2. Two-Colour Matrix 3. Smart ADS

Each of the options in Table 2-13 has been evaluated by using a 'Low / Medium / High' scoring system against the following eight criteria (where applicable):

- Capital cost;
- Revenue cost;
- Reliability;
- Adaptability;
- Compatibility;
- Accuracy;
- Reactiveness; and
- Longevity.

Table 2-14 below summarises of the outcome of the evaluation process. This sets out the option that has been taken forward to detailed economic appraisal in the economic case (Chapter 3). A 'decision matrix' table describing in more detail the evaluation of each of the UTMC options against the assessment criteria is provided in Appendix A.

Table 2-14 – Summary of UTMC Decision Matrix Evaluation Process

UTMC Element	Option Selected	Decision Matrix Summary
Common Database	Hosted	Although an internal system is much less reliant on revenue commitments, it is also the least flexible option and introduces a third party. Any cost saving made will be lost through reduced benefits in the event of a period of downtime within the system.
Journey Time Measuring System	Bluetooth / Wi-Fi	ANPR was ruled out due to high installation costs, low reliability and ongoing maintenance costs. Bluetooth and Wi-Fi are therefore the choice going forward. Less data is collected than ANPR, but enough is collected to in order to sufficiently run JTMS. Total Data has been ruled out due to ongoing revenue costs.
Communications	Mesh Network	In order to increase reliability on the network, a mesh network will be used, but backed up by small lengths of fibre optic. This will reduce the number of potential points of failure but also ensures no unnecessary cost is spent.
Traffic Signals Compatibility Upgrades (including signal fault reporting)	UTC	All signals included as part of the UTMC need to be upgraded to UTC. With RMS seemingly losing support in the future, this is a key requirement to ensure longevity.
VMS	Mixture, depending on requirements	A mixture of all available technologies will be used for what best suits the situation.

3. Economic Case

3.1. Overview

This chapter presents the economic case for the proposed UTMC scheme along the Great Western Way corridor. It confirms the value for money for the option appraised, considering both monetised and non-monetised impacts in terms of the economic, environmental and social impacts.

A robust analysis and appraisal framework have been developed to assess the impacts of the UTMC scheme in line with requirements in relevant units of TAG. The overarching objective of the Swindon UTMC project is to improve the performance of the local highway network in order to accommodate planned growth in housing and employment, specifically supporting Swindon town centre regeneration. The scheme is expected to offer benefits to existing and new transport users by reducing congestion along the GWW corridor. The scheme will bring journey time savings to both car and public transport users, therefore facilitating planned development growth and wider economic benefits.

An early high-level assessment of the UTMC scheme before and during the strategic case development arrived at a preferred option, which has gone through detailed economic appraisal as documented in this section. The economic case focuses on a single scenario for the UTMC scheme, i.e. the most recent design prior to tendering. Furthermore, the economic assessment methodology also includes sensitivity testing and sense-checking to ensure robustness of the VfM conclusions drawn.

The key findings from comprise:

- Level 1 results demonstrate **High Value for Money and a BCR of 2.8**, with Present Value of Benefits (PVB) of £3.655m, focusing on transport user benefits (highway and public transport). Level 2 impacts assessed are relatively small (based on imperfectly competitive markets only);
- The Present Value of Costs (PVC) for the proposed UTMC scheme is approximately £1.300m in 2010 market prices and values;
- No major significant adverse environmental, social or distributional impacts, with some beneficial impacts forecast for journey quality and physical activity; and
- Various sensitivity tests all demonstrate BCRs of 1.7 or over.

The remainder of this chapter covers the following:

- Key modelling and appraisal principles;
- TAG categorisation of economic impacts;
- Logic map linking the need for intervention, to proposed interventions and outcomes;
- Modelling and appraisal methodologies;
- Traffic impacts;
- Economic, environmental and social appraisal; and
- Value for Money Statement.

3.2. Key Principles

The overall methodology is based on the following key considerations and principles:

- **Outcome-led scoping:** scope of the economic impacts and selection of techniques are based on the transport outcomes outlined in the economic narrative. This forms the basis for assessment of Level 1 and Level 2 impacts;
- **Selection of appropriate transport and economic modelling tools:** The Swindon Strategic Highway Model (SSHM) was used as the starting point for developing a bespoke spreadsheet to analyse the potential journey time benefits of the scheme. Origin-Destination (OD) matrix skims from the model and ‘select link analysis’ model outputs were used within the spreadsheet tool, alongside the following:
    - An assessment of monetised highway user benefits was undertaken using TUBA, in accordance with TAG requirements;
    - An assessment of bus user benefits, using a bespoke spreadsheet model; and

- The impact of imperfectly competitive markets was calculated using TUBA outputs, in line with TAG requirements.

- **Derivation of scheme costs:** Scheme costs were estimated by SBC with appropriate consideration of risks and optimism bias, in accordance with TAG requirements;
- **Value for money assessment following the latest DfT guidelines[28]:** A progressive approach was followed, taking on board quantified impacts with varying analytical certainty as well as qualified impacts;
- **Collation of the Appraisal Summary Table (AST), Transport Economic Efficiency (TEE) Table,** and tables for supporting analyses; and
- **Sensitivity Analysis:** to complete the overall value for money assessment.

The overall methodology is consistent with that set out in the Appraisal Specification Report, which detailed the proposed scope and methodology including key assumptions for developing a business case for the UTMC scheme.

3.3. TAG Categorisation of Economic Impacts

Value for Money (VfM) has been assessed within a framework methodology in line with requirements in TAG. This framework covers a range of economic impact streams, assessed in a progressive manner across all levels defined in TAG as illustrated in Figure 3-1. Selected Level 1 and Level 2 impacts have been quantified for the Swindon UTMC business case as summarised in Table 3-1.

Figure 3-1 – Illustration of Potential Economic Impacts from Transport Investment

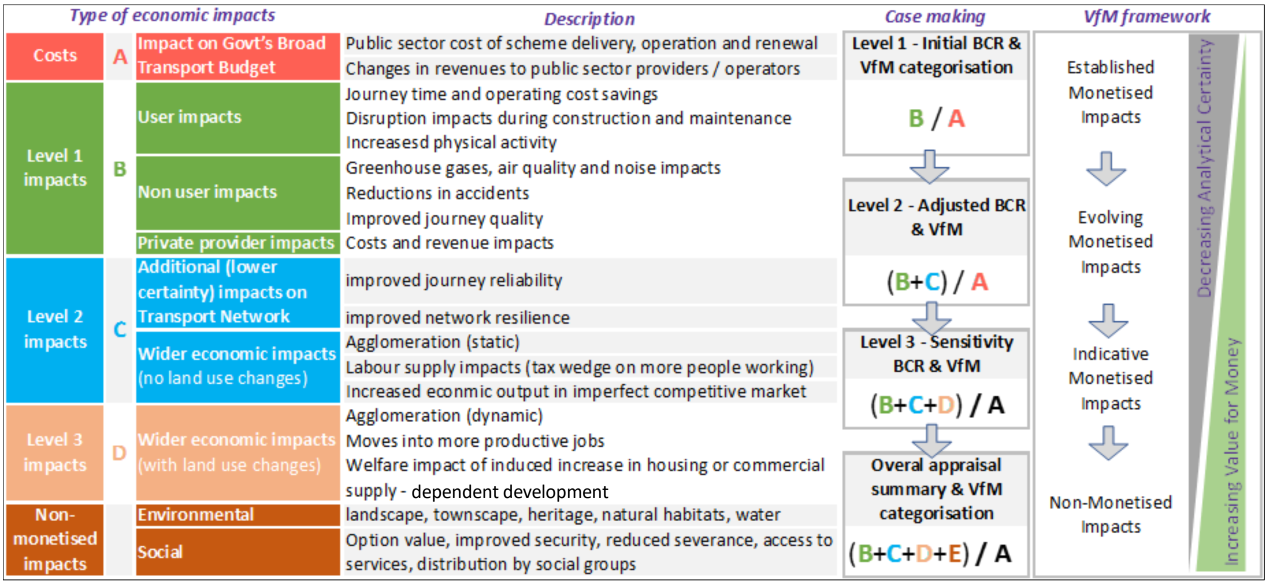


Table 3-1 – Economic Impacts Assessed for Swindon UTMC

Level	Potential Economic Impacts		Assessment
Level 1	User and private sector providers impacts	Highway User Impacts	Monetised
		Bus User Impacts	Monetised
	Non-user impacts	Local air quality and noise impacts	Qualitative
		Greenhouse Gases	Monetised
		Safety Impacts	Qualitative
Level 2	Reliability Impacts		Qualitative

[28] DfT value for money framework, July 2017. https://www.gov.uk/government/publications/dft-value-for-money-framework

	Wider economic impacts	Increased economic output in imperfect competitive market	Monetised
		Agglomeration	Qualitative
Non-Monetised Impacts		Environmental	Qualitative
		Social	Qualitative

3.4. Logic Map

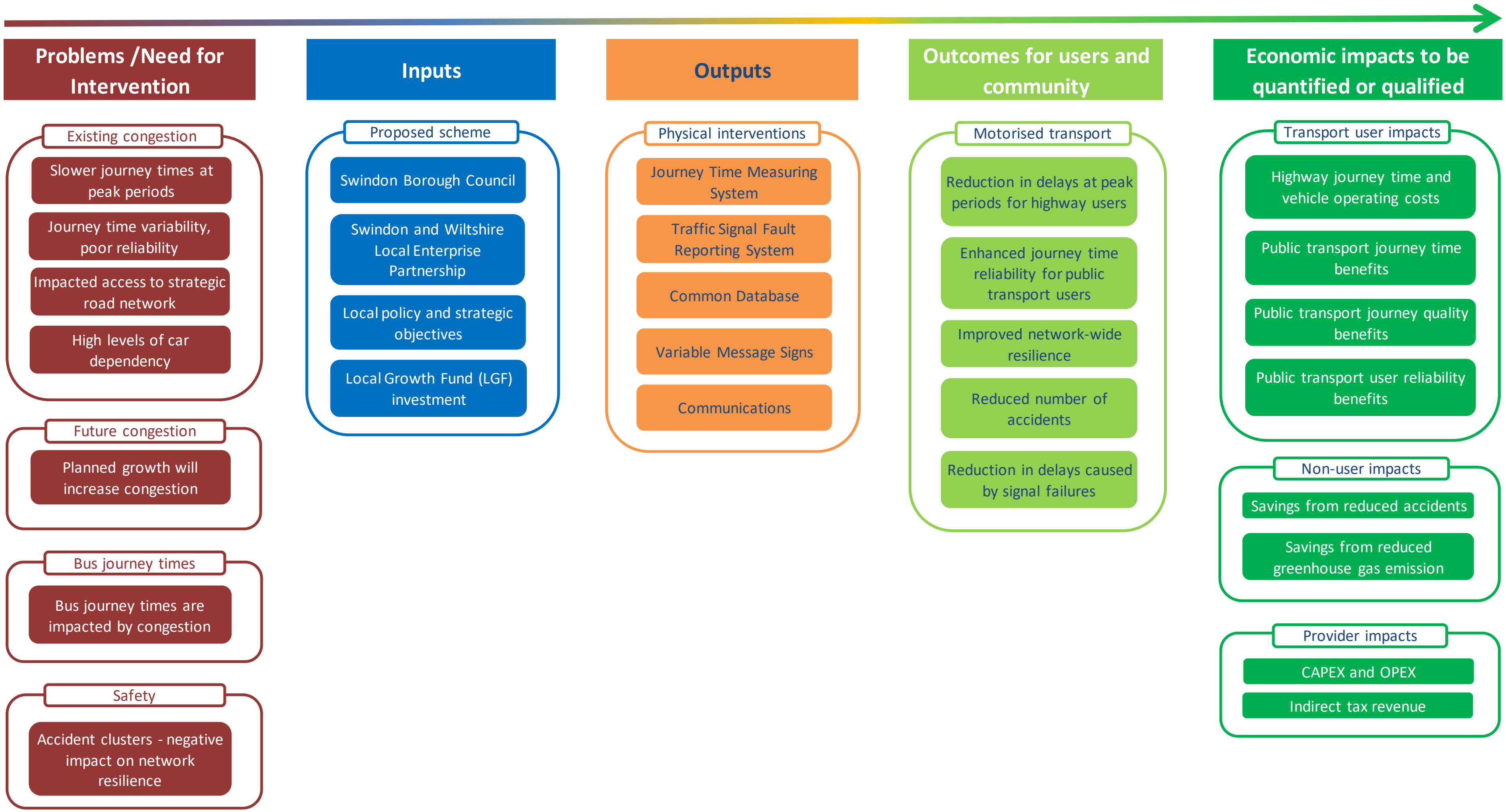
The logic map in Figure 3-2 links the need for intervention, to proposed interventions, to outputs, to outcomes for users and the community. Finally, this informs the economic impacts to be quantified or qualified in the appraisal.

Common issues identified along the GWW corridor include traffic congestion and particularly reliability and quality challenges to public transport operating along the route. Congestion along the corridor has knock-on effects to the wider network due to exit-blocking at several key junctions. It is apparent that future development along the corridor will exacerbate the issue of congestion at peak times. It is evident that more control of the network is required in order manage the traffic and maintain priority for buses along QBC (Quality Bus Corridor) routes.

It is anticipated that the UTMC scheme will ensure consistently moving traffic and reliable journey times for both highway users and public transport users along the GWW corridor during peak periods. The scheme will ensure that key junctions are not over-capacity and that all available highway space on the local network can be utilised effectively.

The economic case for the UTMC scheme should be considered in the wider context of other planned changes to the existing highway network and housing developments in eastern Swindon. The UTMC is an essential component of the Swindon Transport Strategy and as such supports the transport objectives and wider growth agenda contained within local policy documents, which includes the LTP and the Local Plan.

Figure 3-2 – Logic Map



3.5. Modelling Methodology

3.5.1. Review of Existing Traffic Modelling Tools

There are no suitable, readily available modelling tools with sufficient geographic coverage that can also directly model and capture the dynamic traffic impacts from the proposed interventions, particularly variable traffic control. Due to the dynamic nature of the proposed scheme (to include upgrading, optimisation and coordination of signalised junctions), it cannot be effectively modelled using the existing SSHM. Furthermore, the creation of a new microsimulation model with significant coverage is not feasible due to cost and time constraints, which is out of proportion to the relatively small nature of the proposed scheme.

Following discussion with the ITA in May 2019, it was agreed that the existing SSHM would be interrogated to establish key assumptions and input for developing a separate spreadsheet model to assess the likely traffic impacts from the proposed scheme, which would subsequently be used to drive the economic assessments.

The highway assignment model (SATURN current version 11.3.12W) that was used for this purpose was the same model that was recently used for the development of numerous business cases in Swindon (including the successful White Hart Junction submission to DfT for LGF and Southern Connector Road submission to the Ministry of Housing, Communities and Local Government (MHCLG) for Housing Infrastructure Fund (HIF)). The core model for the future year (2036) includes the following key committed developments and highway schemes (further details can be found in the Traffic Forecasting Report for the White Hart Junction Business Case[29]):

- All New Eastern Villages (NEV) infrastructure;
- White Hart Junction improvements;
- Commonhead scheme;
- Gablecross scheme; and
- Southern Connector Road (SCR).

Forecast highway network and demand for 2021 and 2036 was produced based on an Uncertainty Log agreed with SBC, which includes details of committed and planned land use and network developments for the period and controlled to National Trip End Model (NTEM 7.2).

Overall the spreadsheet modelling approach is considered a proportionate means of illustrating how a UTMC system would work. It is a systematic approach to show how journey time savings may distribute across the network, and the resulting journey time benefits. Note that it is not a traffic simulation model and that delay savings by junction are an input to the spreadsheet model. This is reflected in the level of detail in the analysis provided.

3.5.2. Spreadsheet Analysis

A spreadsheet tool ('model') was developed to quantify the anticipated journey time savings from the proposed UTMC intervention along the GWW corridor. The spreadsheet tool was used to analyse only one possible layout of the UTMC scheme, i.e. the most likely geographical extent of the scheme (at the time of writing) as described in the strategic case chapter.

This section provides an overview of the spreadsheet tool that was created. Appendix B includes a Technical Note that explains in detail the methodology and assumptions underpinning the development of the spreadsheet tool. The spreadsheet tool comprises two separate sub-models to enable impacts on highway users and bus passengers to be distinguished, in order to accommodate different assumptions on these two user groups.

Figure 3-3 provides a high-level overview of the highway users' spreadsheet sub-model methodology. Specific key junctions were identified that were considered likely to gain journey time benefits from the UTMC scheme, and assumptions were made as to the amount by which journey times would be reduced at these junctions. Combining the assumed journey time savings with traffic flow data extracted from the SSHM, an overall 'with scheme' journey time saving for all vehicles on the network was calculated (for the peak periods). This total journey time saving was then converted to a monetised value by using the TUBA program.

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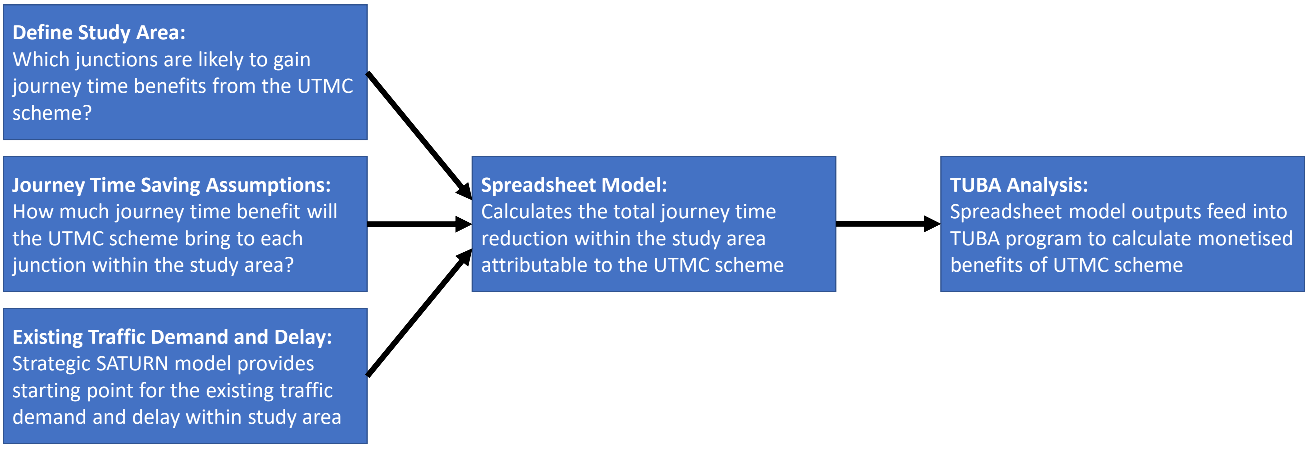
[29] A419/A420 White Hart Junction Improvements, Traffic Forecasting Report, Atkins, July 2019

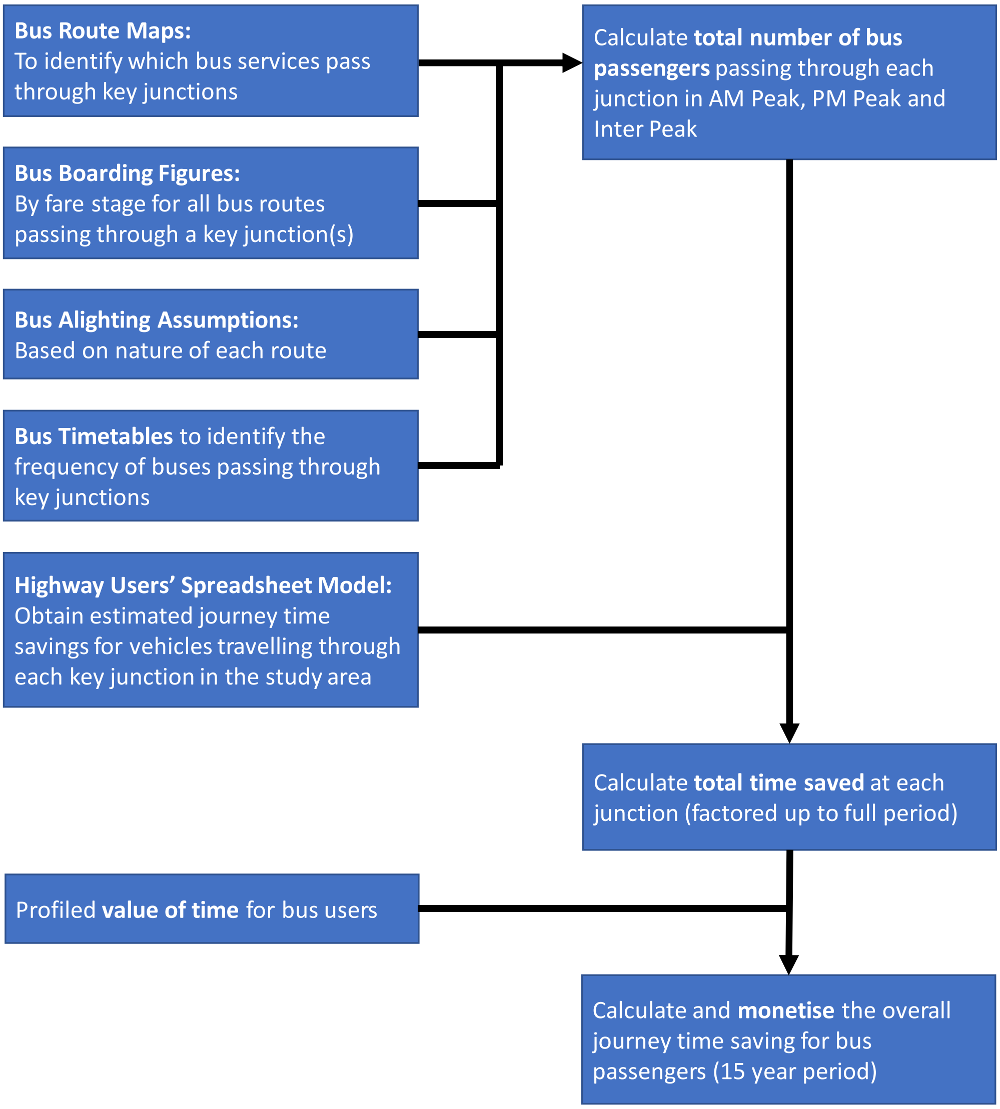
Figure 3-3 – High-Level Overview of Highway Users' Spreadsheet Sub-Model Methodology



Similarly, Figure 3-4 provides an overview of the bus users' spreadsheet sub-model methodology. Bus patronage data, route maps and timetables were used to derive an estimate of the number of passengers thought to pass through each of the UTMC key junctions. In the core scenario, the same journey time savings for each junction as calculated in the highway model is used, and an overall journey time saving for all bus passengers travelling on the network was calculated (for the peak periods). This total journey time saving was then converted to a monetised value by applying an appropriate factor taken from the TAG data book (May 2019)[30].

[30] TAG data book: https://www.gov.uk/government/publications/tag-data-book

Figure 3-4 – High-Level Overview of Bus Users' Spreadsheet Sub-Model Methodology



SSHM outputs (specifically, OD matrix skims of existing traffic flows and journey and traffic delays at the identified junctions) were used as inputs within the spreadsheet tool. The spreadsheet tool was built to enable assessment of the following time periods for both the anticipated scheme opening year 2021 and future year 2036:

- Weekday AM Peak Hour (08:00 – 09:00);
- Weekday PM Peak Hour (17:00 – 18:00); and
- Inter Peak Average Hour (10:00 – 16:00).

As explained in more detail in the Technical Note, it was assumed that the UTMC scheme would bring two 'orders' of impacts in terms of influencing delays at relevant junctions, as follows:

- **'First-order' impacts at isolated junctions**: the UTMC scheme is expected to reduce delay at junctions due to revalidating, updating and refurbishing traffic signal configurations. Particular junctions may also be added to a SCOOT network(s) if appropriate; and
- **Network-wide 'second-order' impacts**: the UTMC scheme may provide further benefits from the management of traffic in a coordinated, efficient way. Overly-congested junctions will be relieved by temporarily preventing some traffic from travelling through adjacent junctions. The approach undertaken recognises the corresponding increase in delay at nearby junctions (where traffic holding occurs) and also the improvement at the junction which is overly-congested. An overall net reduction in total delay on the local network is expected.

To ensure robustness of the spreadsheet analysis, sensitivity testing was carried out by assessing the usual 'low growth' and 'high growth' SSHM scenarios in addition to the main 'core growth' analysis. Furthermore, alternative annualisation factors and varying delay reduction between car and bus users were also tested. Sense-checks were also carried out to ensure that the resulting journey time savings implied by the spreadsheet tool were realistic.

Due to the large number of OD pairs and user classes present within the SSHM matrix skims of traffic flows and journey times, the spreadsheet journey time saving calculations were duplicated by running an equivalent code in the R program, to avoid potential problems with spreadsheet processing capability.

3.5.3. Assumptions

The following assumptions were made for proportionality in the model:

- No adjustment was made to traffic flows due to the scheme, only journey times;
- The method for calculating and redistributing delay was undertaken separately for each time period and both model years (2021 and 2036) in the core scenario. The percentage delay reduction has not been separately calculated for the high and low growth scenarios, and the same percentage reductions were applied to these as in the core scenario; and
- Highway and bus existing delays and delay reductions were assumed to be the same (except for when otherwise noted in sensitivity tests).

3.6. Appraisal Methodology

Overall the appraisal focuses on monetising user benefits. To monetise journey time benefits of a scheme, the TUBA program typically requires 'Without Scheme' and 'With Scheme' journey time, distance and traffic flow data. 'Without Scheme' time, flow and distance skims for 2021 and 2036 were taken from the SSHM, and the time skims were manually amended using the spreadsheet model to produce 'With Scheme' skims. These were then inputted into TUBA to derive monetised journey time benefits for highway users.

3.6.1. Highway User Benefits Appraisal

Transport user benefits is a key part of the conventional transport business case and a significant part of Level 1 impacts shown in Figure 3-1. It has been appraised using TUBA (version 1.9.13, August 2019) which takes account of economic parameters in the TAG data book, using a bespoke spreadsheet tool to calculate changes in highway user travel costs for the 2021 and 2036 scenarios and a 15-year appraisal period. For a UTMC scheme with strong focus on technology, it was deemed more appropriate to appraise costs and benefits over a 15-year period (rather than the default 60-year period), to give a more realistic view on the Value for Money findings.

Benefits (i.e. reduction in traffic delay) were calculated from the spreadsheet analysis of the individual AM Peak, PM Peak and Inter Peak hours. The benefits for each peak hour were converted to peak period benefits using conversion factors. In the absence of suitable data to derive conversion factors particular to the GWW corridor, the following generic Swindon-wide conversion factors were used. There is some limited survey data available at Cockleberry Roundabout on Great Western Way, and alternative conversion factors were calculated using these and evaluated as a sensitivity test:

- AM Peak period (0700 – 1000) = 2.81 x AM Peak Hour;
- Inter Peak period (1000 – 1600) = 6 x Inter Peak Hour; and
- PM Peak period (1600 – 1900) = 2.77 x PM Peak Hour.

An annualisation factor of 253 (i.e. the number of working days in a typical year) was used to convert to the total weekday benefits derived above into annual totals for the two assessment years. No benefits are claimed for either the off-peak period (between 1900hrs and 0700hrs) or weekends. In TUBA, the annual totals were then interpolated between the modelled years (2021 and 2036) to calculate benefits for each of the 15 appraisal years. Note that the 15-year appraisal period only covers 2021 to 2035, so 2036 values were only used for interpolation purposes, and are not a part of the results themselves.

3.6.2. Public Transport User Benefits Appraisal

Once the total journey time saving for bus passengers was calculated for each of the peak periods, this was annualised using the same factors as for the highway user benefits appraisal described above.

Profiled Value of Time for bus passengers was taken from TAG Databook Table A1.3.2, with purpose splits from Table A.1.3.4. These were used to monetise the journey time savings over the 15-year appraisal period.

3.7. Traffic Impacts

3.7.1. Input – Delay Change Assumptions

Overview

Overall the purpose of the spreadsheet model was to illustrate how a UTMC system would work and how journey time savings may distribute across the network, and what the resulting scale of benefit savings would be. It is not a traffic simulation model hence delay changes by junction are input assumptions for the spreadsheet model.

The detailed spreadsheet model input assumptions for the AM Peak, PM Peak and Inter Peak periods are presented in Appendix C for both the scheme opening year 2021 and future year 2036. The diagrams include a bar chart for each of the 17 key UTMC junctions showing the assumed change in delay due to first and second order impacts. The Appendix also includes some commentary to explain the spreadsheet model input assumptions.

Following the process explained in the Spreadsheet Analysis Methodology Technical Note (Appendix B), a first-order reduction in delay of 5% was assumed at all but one of the junctions (as one particular junction was considered to receive no benefit from signal upgrades). Once this first order reduction had taken place, the following redistribution and reallocation affects occurred:

- Redistribution of traffic delay was then permitted from Junction 4 (B4006 / B4289 Kemble Drive / Rodbourne Road 'Bruce Street Bridges' roundabout) and Junction 7 (A4313 Ocotal Way / Shrivenham Road). The redistribution threshold was set at 20 seconds.
- Reallocation of the redistributed traffic delay was permitted at all junctions except for those located between Junctions 4 and 7. Junctions on the periphery of the UTMC sub-network were prioritised for the reallocation of delay.

This second order redistribution and reallocation of delay reflects the likely purpose the UTMC scheme will be used for – reducing traffic congestion on Great Western Way between Bruce Street Bridges roundabout and the Transfer Bridges junction in the central part of the UTMC network by 'holding back' traffic to more peripheral parts of the network.

Core Scenario Input Assumptions

Figure 3-5 and Figure 3-6 illustrate the spreadsheet model input assumptions for the core 2021 scenario. Three charts are shown in each figure, representing the assumptions for the AM peak, PM peak and Inter Peak periods. The teal bars in the charts represent the sum of the 'Without Scheme' average delays on the UTMC sub-network of 17 junctions. The light grey bars represent the assumed total delay reduction gained as a result of first-order impacts of the UTMC scheme (i.e. traffic signal improvements/updating at isolated junctions). The light blue bars represent the assumed total delay *reduction* associated with second-order impacts of the scheme (i.e. management of the traffic on the network in a coordinated way). The medium-shade blue bars represent the corresponding *increase* in delay, at some junctions, associated with the redistribution of traffic delay. The dark blue bars represent the resulting total 'With Scheme' average delay on the UTMC sub-network of 17 junctions.

The redistribution of traffic delay by the spreadsheet model results in some junctions experiencing a reduction in delay while other junctions see a corresponding increase in delay. Overall, the impact of redistribution is beneficial for all scenarios, as can be seen in the charts by comparing the (greater) magnitude of the teal bars with the (smaller) magnitude of the corresponding dark blue bars.

The spreadsheet input assumptions charts appear similar for all of the modelled periods. As expected, there are greater benefits from in the AM peak and PM peak periods than in the Inter Peak period, due to the higher traffic flows and greater delays experienced at these times.

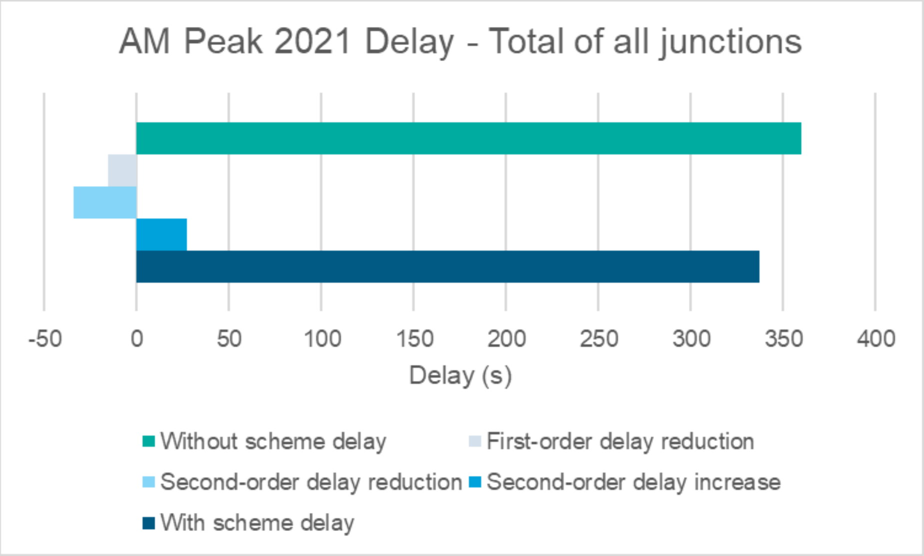
Table 3-2 shows the total delay change over a 12-hour period for highway users and bus users. As expected, total delay changes for highway users is greater in 2036 than 2021 due to forecast increased demand.

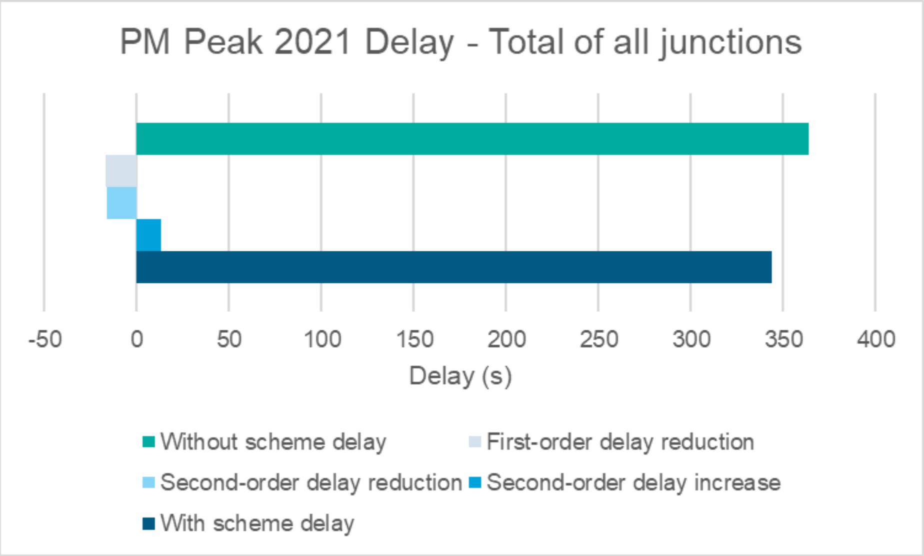
Table 3-2 – Total Delay Change by Forecast Year and Mode

Mode	Total Delay Change 12-Hour (PCU-secs)	
	2021	2036
Highway	-346,265	-454,187
Public Transport	-16,869	-16,290

It is acknowledged that the spreadsheet model is not a complex traffic simulation model, but a relatively simplistic representation of traffic delay savings and redistribution associated with the UTMC scheme. The model may suggest certain pattern of changes to traffic delays at junctions where in reality the impacts may differ, and therefore the model results shown for each junction should not be taken at face value.

Figure 3-5 – 2021 Core Scenario Spreadsheet Model Assumptions Summary (Delays in seconds)





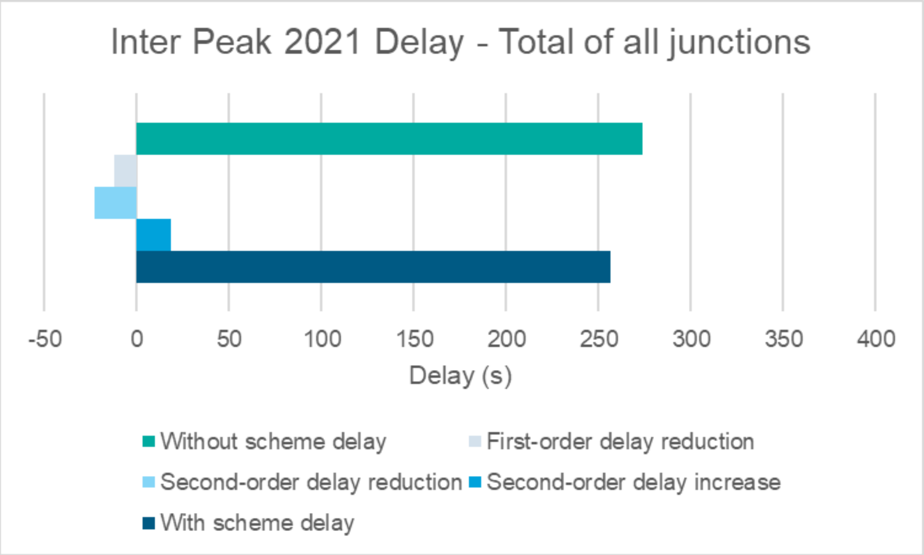
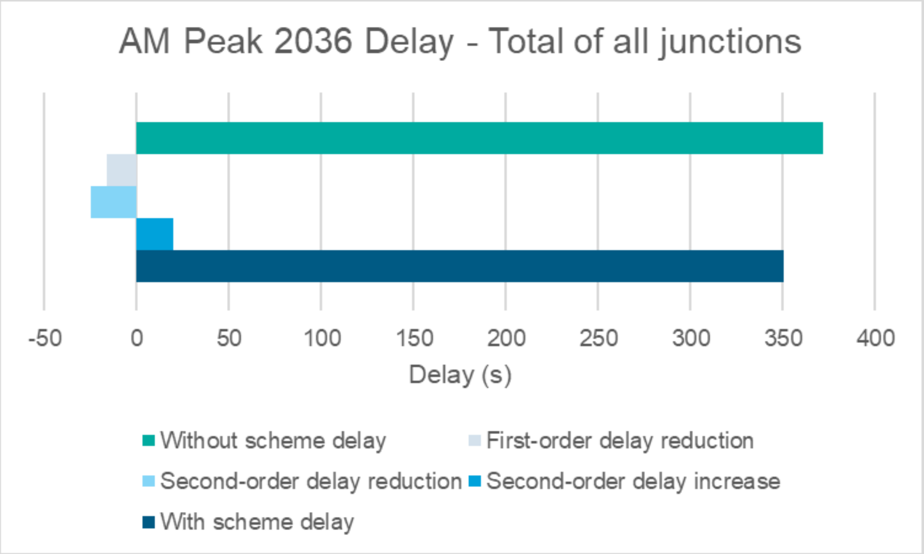
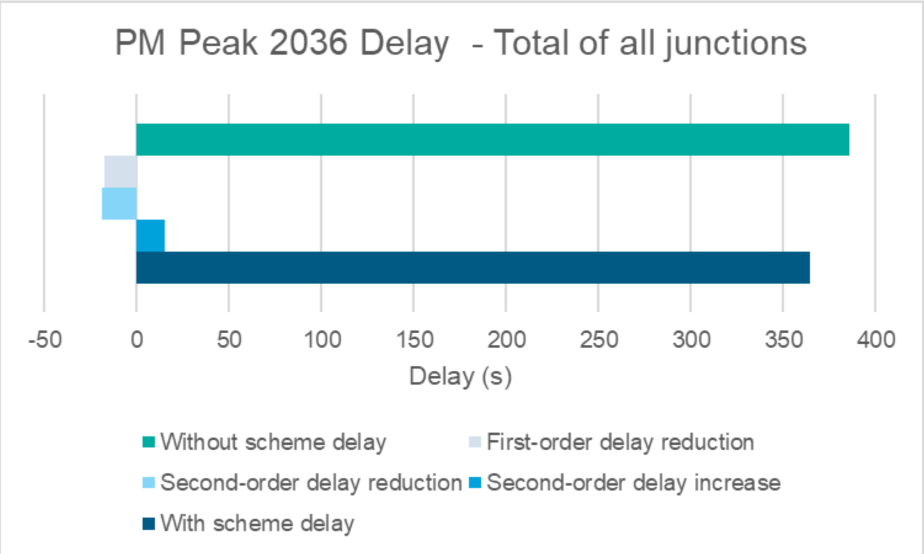
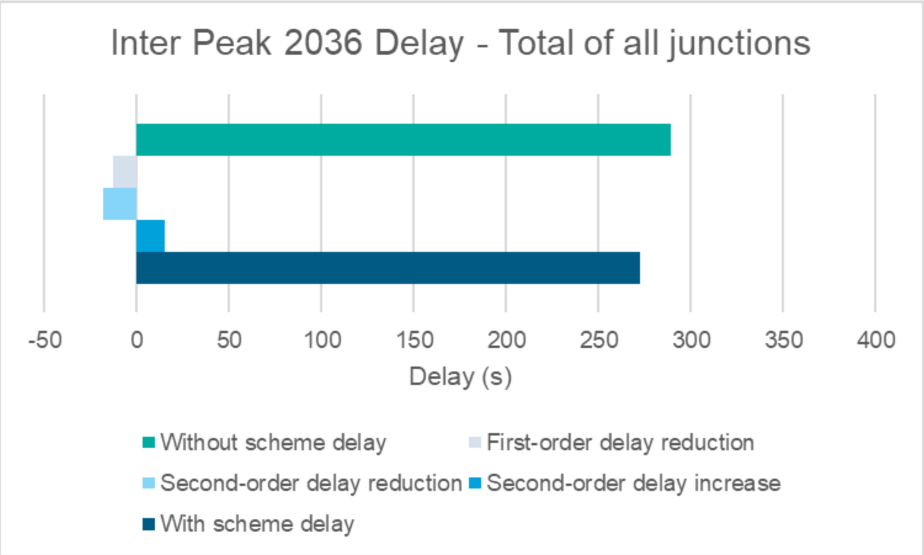


Figure 3-6 – 2036 Core Scenario Spreadsheet Model Assumptions Summary (Delays in seconds)[31]







[31] Note: the 2036 SSHM model includes: All New Eastern Villages (NEV) infrastructure; White Hart Junction improvements; Commonhead scheme; Gablecross scheme; and Southern Connector Road (SCR).

3.7.2. Output - Monetised Benefits

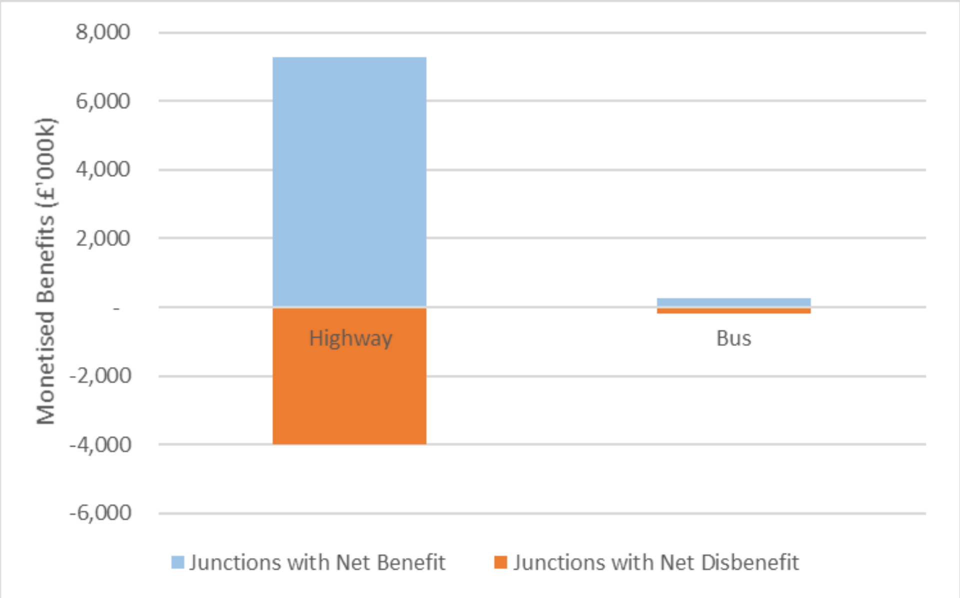
At 10 of the 17 junctions in the UTMC network the model shows an overall benefit. As expected, the greatest benefits are gained at the junctions between 4 and 7 with a relatively high level of delay in the "Without Scheme" scenario, as these junctions are where the spreadsheet model redistributes most of traffic delay away from.

Five of the junctions in the network see an overall disbenefit. Junctions which experience large disbenefits are usually on the periphery of the UTMC network, as delay has been redistributed away from the strategic route (Great Wester Way between Junctions 4 and 7) at the "core" of the network onto more external and less operationally integral junctions.

Figure 3-7 below summarises the output of the spreadsheet model in terms of monetised benefits. For highway users, when comparing the junctions that exhibited a monetary benefit with the junctions exhibiting a disbenefit, the chart shows that overall there is was a net benefit, of approximately £3.29m, over the appraisal period (i.e. £7.28m benefits minus £3.99m disbenefits).

Similarly, Figure 3-7 shows that for bus users, the overall monetary benefit at junctions exhibiting a benefit outweighed the disbenefit at the other junctions, resulting in an overall net benefit of £0.1m.

Figure 3-7 – Summary of Monetised Benefits for Highway and Bus Users



Appendix D illustrates diagrammatically the monetised benefits for both highway and bus users, for the 15-year appraisal period. The charts included in the Appendix show how the monetised benefits are distributed by junction. Also included in the Appendix is a table showing the monetised benefits by junction.

At all junctions, the scale of benefits and disbenefits is much greater for highway users than for bus passengers. This is simply due to the significantly higher number of highway users compared with the number of bus passengers.

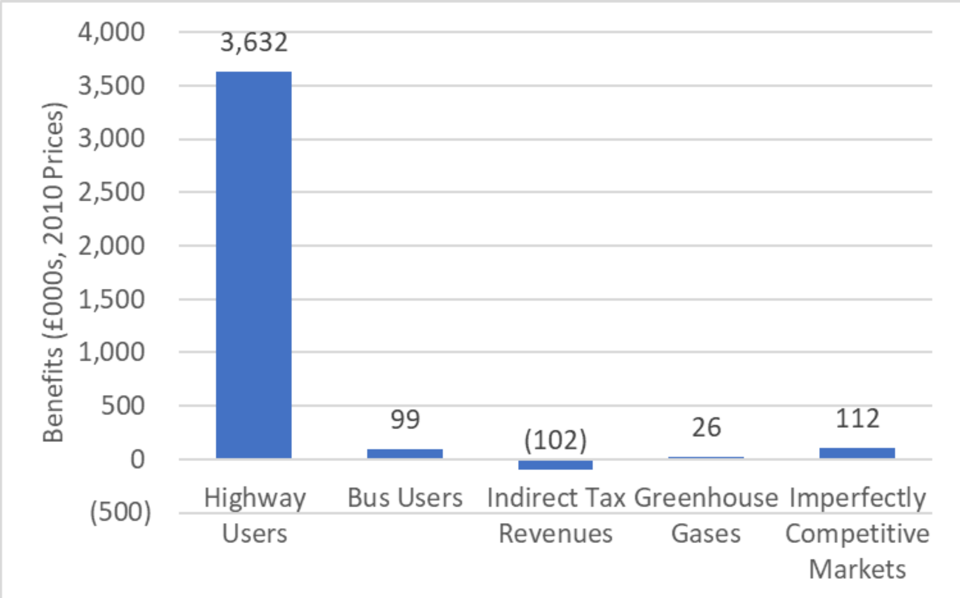
3.8. Economic Impacts

This section presents the economic impacts of the Swindon UTMC, identified in the logic map in Figure 3-2. This section firstly sets out the headline benefits, before covering each benefit stream individually along with the present value of costs (PVC) for the packages. Standard appraisal tables (i.e. Transport Economic Efficiency (TEE), Public Accounts (PA) and Analysis of Monetised Costs and Benefits (AMCB) tables) are included in Appendix E.

3.8.1. Overview of Monetised Economic Impacts

As shown in Figure 3-8, the majority of the benefits come from highway users, with bus user benefits and output change in imperfectly competitive markets being the next strongest benefit streams, albeit much lower. Greenhouse gases provides additional small benefits.

Figure 3-8 – Summary of Core Scenario Benefits (£000s, 2010 Prices)



3.8.2. Level 1 Economic Impacts

3.8.2.1. Highway User Benefits

The spreadsheet model was used to demonstrate the scale of journey time saving benefit arising from conservative assumptions of highway user delay savings at junctions operated under UTMC.

The spreadsheet analysis results for the 2036 core scenario are presented in Table 3-3 for highway users. The table compares the total journey times (i.e. for all vehicles on the SSHM network) with and without the UTMC scheme. The analysis suggests an overall 0.05% reduction in journey time for the whole network in the AM Peak Hour, and 0.02% reduction in the PM Peak Hour and a 0.05% reduction in the Inter Peak period. These numbers are fairly low because the model covers a wide area whereas the scheme impacts are only really felt along the GWW corridor and the immediate surrounding area.

Table 3-3 – Summary of 2021 Core Scenario Spreadsheet Analysis Results (Highway Users)

	AM	IP	PM
Total flow PCU/Hrs	55088	40482	59957
'Without Scheme' Total Journey Time (PCU-hrs)	27217	22762	30862
'With Scheme' Total Journey Time (PCU-hrs)	27203	22757	30845
Difference (PCU-hrs)	-15	-4	-17
Difference (%)	-0.05%	-0.02%	-0.05%

TUBA was used to calculate the monetised highway user benefits for the UTMC scheme from the spreadsheet model results for the 'Without Scheme' and 'With Scheme' scenarios for the 15-year appraisal period. TUBA was run for the years 2021 to 2036 to allow for interpolation from the 2036 numbers, but 2036 benefits were manually removed post-TUBA so only 15 years of results were claimed. The analysis was carried out for the core scenario, as well as the high growth and low growth scenarios. (Note: the same percentage reduction delays were assumed for all three scenarios, and only the traffic volume and 'Without Scheme' journey times changed.) The two main contributing factors to user benefits are travel time savings (across commuter, business and other user classes) and vehicle operating costs reductions.

Table 3-4 presents the present value of highway user benefits and business impacts; these are estimated as £3.63m for the core scenario in 2010 prices and values.

Table 3-4 – Present Value of Highway User Benefits and Business Impacts (2010 Prices and Values)

	Core Scenario Benefits (£000s)
Commuting	1,540
Business	1,016
Other	842
Travel Time: Sub-Total	**3,398**
Vehicle Operating Costs	234
Total	**3,632**

Table 3-5 shows the breakdown of highway user benefits by time period. The highest proportion of benefits is in the PM peak.

Table 3-5 – Present Value of Highway User Benefits by Time Period (2010 Prices and Values)

Time period	Core Scenario Benefits (£000s)
AM Peak	1,181
Inter Peak	990
PM Peak	1,461
Total	**3,632**

3.8.2.2. Bus User Benefits

The spreadsheet model was used to demonstrate the scale of journey time saving benefit arising from conservative assumptions of bus user delay savings at junctions operated under UTMC.

For the purpose of the assessment, only bus journey time savings were considered. The UTMC scheme will not include improvements to bus user journey quality that are over and above what is (or will be) claimed in other business cases being developed for quality bus corridors in Swindon. The benefits are estimated as £99k for the core scenario.

Table 3-6 – Present Value of Bus User Benefits by Time Period (2010 Prices and Values)

Time period	Core Scenario Benefits (£000s)
AM Peak	2
Inter Peak	49
PM Peak	48
Total	**99**

3.8.2.3. Indirect Tax Revenues

Indirect tax revenues are incurred by transport users and providers, in the form of fuel duty and other user charges. TUBA has been used to calculate changes in indirect tax revenues of £102,000 (monetised values in 2010 prices and values, market price unit of account). Negative values represent a higher spending (fuel consumption) as a result of the intervention which will offset a small amount of the forecast user benefits in PVB.

3.8.2.4. Greenhouse Gases

TUBA provides a calculation for estimating changes in fuel and electricity consumption. These are automatically converted into an estimate of greenhouse gas emissions and the net present value of associated damages, following the methodology set out in TAG Unit A3. The TUBA appraisal forecasts a small reduction in non-traded carbon emissions over the 15-year appraisal period, resulting in a net benefit of £26k in the Core Scenario (2010 prices and values).

3.8.2.5. Construction and Maintenance Impacts

Construction of the scheme is planned to take place over an approximate three-month period during the autumn of 2021. This will allow three months for subsequent set-up, testing and validation. SBC will seek to minimise the impacts on both car and public transport users along the GWW corridor during the construction period; this could be achieved with a phased approach to roadworks.

The diverse nature of the proposed UTMC scheme presents difficulties in accurately monetising construction impacts. However, it is considered that the majority of the installation of the UTMC equipment will have little material impact on traffic conditions within the UTMC scheme area, and so a specific quantitative analysis of construction impacts is deemed disproportionate.

3.8.2.6. Accidents

The scheme is expected to have a slight beneficial impact on accidents, taking into account there will be an increase in speed at some junctions but slower speeds at others where delay is redistributed - overall a slight beneficial impact is expected through reduced traveller stress and reduced congestion.

As the bespoke spreadsheet modelling does not capture potential changes to traffic volume, which is a key input to COBA-LT, no COBA-LT assessment over the entire Swindon network was undertaken. Furthermore, no COBA-LT analysis of isolated junctions was undertaken as there are no locations where a significant change in the method of control is proposed as part of the scheme (e.g. give-way to signalisation); hence these impacts cannot be quantified.

3.8.3. Scheme Costs

Capital Costs

Derivation of the Present Value of Costs (PVC) of the retained schemes follows the guidance in TAG Unit A1.2. Base investment costs for the scheme are presented in detail in the Financial Case. Detailed construction costs are based on the tender prices received and agreed with the contractor. Development costs are based on the rates and figures agreed between SBC and its suppliers including sunk costs which to date total £0.3m. As the investment costs are outturn prices based on tendered prices, no inflation has been applied. Since the incorporation of tender prices, a review and adjustment to the risks has also been undertaken (documented in the Management Case), the level of which is informed by a fuller appreciation of the risks, post submission of the OBC, and summarised in Table 3-7.

Table 3-7 – Cost Profile – Outturn Costs

Cost Type	Pre 2019/20	2019/20	2020/21	Total
Development (excluding sunk costs)	£0.300m	£0.030m	-	**£0.330m**
Construction	-	£0.665m	-	**£0.665m**
Risk	-	£0.255m		**£0.255m**
Total	**£0.300m**	**£0.950m**	**£0**	**£1.250m**

Maintenance and Operating Costs to SBC

The maintenance and operational costs of owning the new assets to the council have been considered, this is based on a net increase in operating costs of £30k per year. These costs were adjusted following TAG guidance to take account of inflation, optimism bias, profiled to the expenditure year over the appraisal period, discounted back to 2010 and converted to market prices. The estimated costs are presented in Table 3-8.

Table 3-8 – Operational Costs to the LAs per package (part of PVC) (2010 Prices and Values)

Item	Cost (£000s)
Package operational costs over 15 years	397

Summary of PVC

Based on the streams of costs presented above, the overall PVC for each package is presented in Table 3-9. Costs were converted to 2010 prices and values, and an uplift factor of 1.19 was applied to convert all monetary figures from the factor cost unit of account to the market price. A figure of 10% Optimism Bias has been applied to the overall scheme costs in the Economic Case.

Table 3-9 – PVC in Market Price (2010 Prices and Values)

Item	PVC
Capital Costs (including risk and OB)	£0.973m
Operation, Maintenance and Renewal Costs	£0.327m
Net Revenue to Public Sector	-
PVC	**£1.300m**

3.8.4. Summary of Level 1 Impacts

The monetised benefits of Level 1 transport impacts arising from the Swindon UTMC scheme are summarised in Table 3-10. The initial Benefit-Cost Ratio (BCR) includes all Level 1 monetised impacts including transport user benefits, indirect tax revenues, greenhouse gases and accidents from the COBA-LT analysis.

The majority of the benefits are for highway users – this is because the corridor is predominately highway, with some bus services travelling along or across it in sections. The total number of highway users is far greater than the number of bus users at the affected junctions.

Table 3-10 – Calculation of Initial Benefit-Cost Ratio (BCR) (2010 Prices and Values)

	Core Scenario Benefits (£000s)
Highway Journey Time and Vehicle Operating Costs	3,632
Public Transport Journey Time	99
Indirect Tax Revenues	-102
Greenhouse Gases	26
Present Value of Benefits (Level 1 Impacts)	**3,655**
Present Value of Costs (PVC)	1,300
Net Present Public Value (NPPV)	2,355
	Core Scenario
Initial BCR	**2.8**

3.8.5. Level 2 Economic Impacts

Reliability Benefits

Reliability has currently been assessed qualitatively, taking a proportionate approach for a relatively small scheme. The scheme is expected to deliver reliability benefits in all scenarios, as the UTMC system is designed to reduce overall delay and distribute excessive delay. This will reduce journey time variability and have a beneficial impact on reliability in the impacted area.

Agglomeration Benefits

Agglomeration has currently been assessed qualitatively, taking a proportionate approach for such a small scheme. The scheme is expected to deliver agglomeration benefits in all scenarios, as the UTMC system will lead to a reduction in journey times and therefore generalised costs, leading to increased clustering.

Output Change in Imperfectly Competitive Markets

Output change in imperfectly competitive markets is another level 2 impact that has been estimated using the simplified method set out in TAG unit A2.2 Section 4 by applying a 10% uplift factor to the business and freight user benefits from TUBA, giving £110k in the core scenario.

3.8.6. Summary of Level 2 Impacts

The monetised benefits of Level 2 transport impacts arising from the Swindon UTMC scheme are summarised in Table 3-11.

The BCRs including Level 2 benefits are the same or very slightly higher than Level 1 BCRs, but none of the scenarios change Value for Money.

Table 3-11 – Calculation of Initial Benefit-Cost Ratio (BCR) ()

Impact / measure	Core Scenario Benefits (£000s)
Present Value of Benefits (Level 1 Impacts)	3,655
Output change in imperfectly competitive markets	112
Present Value of Benefits (Level 1 & 2 Impacts)	**3,768**
Present Value of Costs (PVC)	1,300
Net Present Public Value (NPPV)	2,468
Adjusted BCR	**2.9**

3.8.7. Sensitivity Testing (Highway and Bus User Benefits)

In addition to high and low growth scenarios, three further sensitivity tests were undertaken:

- Sensitivity Test 1 – a first-order reduction in delay of 5% was assumed at all but one of the junctions. Then, however, junctions with a delay of over 30 seconds per PCU (after the first-order benefits were applied) were identified, and this surplus delay redistributed by the model to neighbouring junctions with available capacity. Not unlike the core, in this sensitivity test redistribution of delay is no longer restricted to between junctions 4 and 7. High and low growth scenarios were applied to this sensitivity test.
- Sensitivity Test 2 – Sensitivity test 1, with annualisation factors taken from Cockleberry Roundabout surveys; and
- Sensitivity Test 3 – Sensitivity Test 1, with bus priority and no highway disbenefits at key bus junctions.

Sensitivity Test 1: Redistribution of delay possible at all junctions

This sensitivity test involves adjusting the spreadsheet input parameters in order to allow the possibility of redistribution of delay at all junctions in the UTMC network. A first-order reduction in delay of 5% was assumed at all but one of the junctions (as one particular junction was considered to receive no benefit from signal upgrades). Those junctions with a delay of over 30 seconds per PCU (after the first-order benefits were applied) were then identified, and this surplus delay redistributed by the model to neighbouring junctions with available capacity.

This sensitivity test has been developed alongside ‘high growth’ and ‘low growth’ scenarios for sensitivity testing (developed in accordance with guidance in TAG Unit M4). TUBA assessment was undertaken using traffic forecasts for the proposed scheme opening year 2021, and future year 2036.

Table 3-12 summarises the Level 1 and Level 2 economic impacts calculations for the scheme with redistribution of delay possible at all junctions. When compared with Table 3-10 and Table 3-11, it is evident from Table 3-12 that the anticipated BCR of this sensitivity test is less than the core scenario. As expected, higher growth causes an increased BCR whereas lower growth causes a decreased BCR.

Table 3-12 – Economics Impact Summary (2010 Prices and Values)

	Sensitivity Test 1 Benefits (£000s)	High Growth Scenario Benefits (£000s)	Low Growth Scenario Benefits (£000s)
Highway Journey Time and Vehicle Operating Costs	3,226	4,777	1,982
Public Transport Journey Time	291	359	259
Indirect Tax Revenues	-56	-91	-32
Greenhouse Gases	14	23	8
Present Value of Benefits (Level 1 Impacts)	**3,475**	**5,068**	**2,217**
Present Value of Costs (PVC)	1,300	1,300	1,300
Net Present Public Value (NPPV)	2,175	3,768	917
Initial BCR	**2.7**	**3.9**	**1.7**
Output change in imperfectly competitive markets	77	113	48
Present Value of Benefits (Level 1 & 2 Impacts)	**3,552**	**5,181**	**2,265**
Present Value of Costs (PVC)	1,300	1,300	1,300
Net Present Public Value (NPPV)	2,252	3,881	965
Adjusted BCR	**2.7**	**4.0**	**1.7**

Sensitivity Test 2: Sensitivity Test 1 with Amended Annualisation

Alternative annualisation factors were calculated using ANPR surveys undertaken at Cockleberry Roundabout in July 2019 as shown below. These annualisation factors were applied to Sensitivity Test 1:

- AM Peak period (0700 – 1000) = 2.50 x AM Peak Hour;
- Inter Peak period (1000 – 1600) = 6 x Inter Peak Hour; and
- PM Peak period (1600 – 1900) = 2.49 x PM Peak Hour.

Table 3-13 summarises the Level 1 and Level 2 economic impacts calculations for the scheme with the alternative annualisation factors. When compared with Table 3-10 and Table 3-11, the values in Table 3-13 are generally slightly lower as a result of the lower conversion factors. Although the benefits are also slightly lower, the scheme still provides a BCR that suggests a High Value for Money category.

Table 3-13 – Changed Amended Annualisation Factors Sensitivity

		Benefits (£000s)
Costs		1,300
Level 1 Impacts	Highway Users	2,992
	Bus Users	271
	Indirect Tax Revenues	-51
	Greenhouse Gases	13
	Total PVB	**3,225**
	Level 1 NPV	**1,955**
	Level 1 BCR = 2.5	
Level 2 Impacts	Imperfectly Competitive Markets	72
	Reliability	0
	Total PVB	**3,297**
	Level 2 NPV	**1,997**
	Level 2 BCR = 2.5	

Sensitivity Test 3: Sensitivity Test 1 with More Priority for Buses at Key Junctions

A sensitivity test was carried out to determine the potential for giving buses priority at some junctions where benefits could be achieved without the need for additional infrastructure such as bus lanes. For this reason, the directions of travel for the dominant highway and bus movements at each junction was looked at, to determine junctions where the dominant bus flow was different to the dominant highway flow, and so buses may have different needs from the UTMC system.

Four junctions were identified that met this condition, as follows:

- Junction 1 (A3102 / B4006 / B4553 'Mannington Roundabout');
- Junction 2 (A3102 / Penzance Drive);
- Junction 3 (B4006 / Mead Way 'Meads Roundabout'); and
- Junction 4 (B4006 / B4289 'Bruce Street Bridges Roundabout').

Junction 1 and Junction 2 both have annual patronage of around 900,000 passengers (approximately 3,000 per day), and Junctions 3 and 4 both have annual patronage of fewer than 200,000 passengers (1,000 per day). Therefore, only Junction 1 and Junction 2 were chosen for focus as their patronage is significantly higher. At these two junctions, a 10% delay reduction was applied for buses, with zero delay reduction for highway users.

This sensitivity test was applied using sensitivity test 1 as a foundation.

A summary of the Level 1 and Level 2 economic impacts calculations for this sensitivity test is provided in Table 3-14. As the decrease in benefits for highway users outweighs the increase in benefits for bus users, relative to sensitivity test 1, the overall benefits are slightly lower; however, the scheme still provides a BCR with High Value for Money.

Table 3-14 – Increased Bus Priority at Key Junctions Sensitivity (2010 Prices and Values)

		Benefits (£000s)
Costs		1,300
Level 1 Impacts	Highway Users	2,830
	Bus Users	347
	Indirect Tax Revenues	-46
	Greenhouse Gases	12
	Total PVB	**3,143**
	Level 1 NPV	**1,530**
	Level 1 BCR = 2.4	
Level 2 Impacts	Imperfectly Competitive Markets	70
	Reliability	0
	Total PVB	**3,213**
	Level 2 NPV	**1,913**
	Level 2 BCR = 2.5	

Sensitivity Test 4: Lower annualisation factors based on switching values

Further test (in addition to test 2) on alternative annualisation factors has been undertaken. The logic is to identify how low the annualisation factors need to be in order to bring the forecast economic benefit down to a level that is sufficient to alter the Value for Money (VfM) category identified in the core scenario. Subsequently a view can then be taken whether such low annualisation factors are likely to occur in reality and if not, this will demonstrate the robustness of the existing VfM findings.

This test was focused on AM and PM peak period expansion only as an expansion factor of 6 for Inter Peak period is commonly accepted in practice. It was only undertaken based on Level 1 impacts as the scale of Level 2 impacts quantified is negligible.

The first step of the test is to identify how much forecast benefits to 'lose' in order to hit a switching BCR of 2.0, below which the VfM category will fall from High to Medium VfM. Changes in forecast economic benefits required for the suggested switch are highlighted in red in Table 3-15.

Table 3-15 – Anticipated Changes in PVB for a BCR no greater than 2 (2010 Prices and Values)

	Core Scenario Benefits	Anticipated benefits to switch
Highway User TEE Impacts - AM	1,150	574
Highway User TEE Impacts – IP	1,431	1,431
Highway User TEE Impacts - PM	956	477
Public Transport Journey Time	99	99
Greenhouse Gases	26	26
Present Value of Benefits (Level 1 Impacts)	**3,655**	**2,482**
Present Value of Costs (PVC)	1,300	1,300
Net Present Public Value (NPPV)	2,355	1,182
	Core Scenario	Switching value
Initial BCR	**2.8**	**2.0**

The amended forecast benefits for the AM and PM periods in Table 3-15 were derived by factoring down their existing values in the Core scenario proportionally to arrive at a BCR of 2.0.

The second step in this test is then to estimate what the peak period expansion factors need to be in order to match the TUBA forecast benefits for the AM and PM to the highlighted values in Table 3-15. It was found through analysis that significant reduction in the peak period expansion factors is required in order to bring the BCR lower than 2.0. This finding is presented in Table 3-16, which suggests that to approximately hit the switching value (BCR = 2.0), the AM expansion factor has to be brought down from 2.81 to 1.40, and from 2.77 to 1.38 for the PM. Both require approximately 50% reduction. These switching value expansion factors also imply that the traffic volume in the AM or PM peak period shoulder hour is only equivalent to about 19-20% of the peak hour traffic (i.e. 1.40 or 1.38 minus 1 and then divide by 2), which is highly unrealistic.

Table 3-16 – Expansion Factors and Annualisation Factors in Sensitivity Test

	Core Scenario		Switch value test based on 2.0 BCR	
	Expansion factors	Number of hours appraised (annualisation factors)	Expansion factors	Number of hours appraised (annualisation factors)
AM	2.81	711	1.40	355
IP	6	1518	6	1518
PM	2.77	701	1.38	350
Total	**-**	**2930**	**-**	**2,223**

Findings presented for the switching value test suggest that the condition to bring the BCR lower than 2.0 by varying annualisation factors is unlikely to occur in reality, which in turn proves the current annualisation factors, although their values may vary depending on the traffic counts used, are sufficiently robust to guarantee a BCR well above 2.0.

Sensitivity Test 5: Varying optimism bias (OB)

Subsequent to further engagement with the LEP ITA, at OBC stage one additional sensitivity test was carried out to understand how the VfM category may change when different OB is applied. In this test, the alternative OB values were only applied to the capital costs so the 15% OB uplift (at OBC stage) applied to other elements of the PVC (such as maintenance and renewal costs) remains unchanged throughout the test. This sensitivity test was undertaken at OBC stage to capture the uncertainty in the higher risk elements of the capital costs. However, at the current FBC stage, the PVC is based on tender prices, and hence this uncertainty is no longer present. As a result, Sensitivity Test 5 is no longer appropriate or required at FBC stage and hence has been omitted from the analysis.

The assumption of 15% optimism bias at OBC stage has been altered to 10% for the FBC as suggested by Table 8 of TAG Unit A 2.1. For clarity, Table 3-17 details the assumptions concerning optimism bias for the different business case stages and scenarios.

Table 3-17 – Assumed OB at Different Business Case Stages and Scenarios

Item	OB in OBC Core	OB in OBC Sensitivity Test 5	OB in FBC Core
Capital Costs (occurred)	15%	0%	10%
Capital Costs (with less risk)	15%	10%	10%
Capital Costs (with higher risk)	15%	100%	10%

3.9. Environmental Impacts

The assessments for townscape, biodiversity, historic environment and water environment are summarised in this section. The proposed scheme is wholly within the existing highway boundary. The proposed scheme is not within any statutory designated nature conservation sites, or non-statutory designated sites, green belt, designated landscape, historical, cultural, or archaeological area.

Screening of the site and proposed works concluded that a full Environmental Impact Assessment (EIA) was not required. A qualitative assessment has been made of the likely environmental effects from the proposed scheme, in accordance with TAG Unit A3, and relating to the following impacts:

- Townscape, Landscape and Visual Impacts;
- Biodiversity;
- Historic Environment;
- Water Environment
- Air Quality; and
- Noise.

3.9.1. Townscape, Landscape and Visual Impacts

The Swindon UTMC scheme area lies within the Upper Thames Clay Vale National Character Area, but is a large scheme set within the urban environment, and therefore contains a range of townscapes. To the west of the scheme, the highway is a dual carriageway with the landscape comprising wide grassed verges, with retail outlets and sections of dense vegetation tracking the highway as it moves towards central Swindon. The central Swindon area subject to the UTMC scheme is single carriageway, but the landscape generally still incorporates a decent amount of screening vegetation to local property and businesses. As the scheme travels eastward out toward Coate Roundabout, it returns in landscape character to that seen in the west of the scheme area, with wide grassed verges and screening vegetation mixed in with retail developments.

Whilst ducting in the grassed verge may provide a temporary scar from the works, this is unlikely to last a significant period of time. There is minimal vegetation clearance required as part of the scheme, and thus the construction impacts are neutral. In operation, the Swindon UTMC scheme proposes to place new signage and signals at various points through the area. However, bearing in mind the current townscape, the new signage and signals will not cause any change to the existing townscape in the area. The effects therefore are expected to be neutral.

3.9.2. Biodiversity

Traffic signalling works and ducting

For this element of the works, all work would be restricted to existing areas of hardstanding with no vegetation anticipated to be affected by the Scheme (with the exception of areas of short managed grassland verges).

Due to the localised nature of the works (located within the highways boundary) and as no vegetation clearance is required, it was not considered necessary to undertake an ecological walkover of this element.

The desk study review included a search for the following ecological data:

- Statutory designated sites located within 2 km of the Scheme (Site of Special Scientific Interest);
- Non-statutory designated sites located within 500 m of the Scheme (Local Nature Reserve, Local Wildlife Site, Wiltshire Wildlife Trust Reserve);
- Ancient woodlands and veteran trees located within 500 m of the Scheme; and
- Protected and priority habitats and species located within 1 km o the Scheme (extended to 2 km for bats).

The Scheme area is located within an existing transport corridor in an urban environment comprising road surface, hardstanding, grassed roadside verge, street furniture and amenity planting. There are no statutory or non-statutory designated sites within the Scheme area; although, the River Cole Local Wildlife Site (LWS) and Cheney Manor Ponds LWS adjoin the Scheme. Coate Water Site of Special Scientific Interest (SSSI) is located approximately 1 km south of the Scheme at Coate Water County Park, with four Local Nature Reserves (LNRs) and two Wiltshire Wildlife Trust (WWT) Reserves recorded throughout the Borough Council area and within 2 km of the Scheme. Veteran trees have been identified within approximately 500 m of the Scheme; and waterbodies are locally present to the west of the Scheme near Blagrove Roundabout, Rodbourne Road and Mannington roundabout. There are no recorded areas of ancient woodland located within 500 m of the Scheme.

The existing transport corridor provides features of limited suitability that are unlikely to be utilised by protected and priority species, due to regular vehicle use and routine maintenance operations. Bridges and trees within the transport corridor (as well as areas at, and beyond, the highways boundary) are likely to support features that could be utilised more regularly by protected and priority species; however, these features will be excluded from temporary works areas. No vegetation clearance is required to facilitate construction works; therefore, temporary elevation in noise, vibration and visual disturbance will be localised and short in duration.

Provided the working area, including temporary compounds and material storage, will be limited to areas of hardstanding and/or regularly mown roadside verge grassland within the highways boundary, then no further ecological surveys are considered to be required for these elements of the Scheme. The existing road corridor is subject to noise disturbance from commuting traffic and routine maintenance. The temporary works are unlikely to disturb habitat features adjoining the Sites and based on the current scope of works no impact on these receptors are expected.

A summary of mitigation measures which have been recommended to alleviate any potential residual risks to ecological features are provided in the following section.

On this basis, **slight adverse** impacts are expected to occur during the construction phase. Following mitigation and reinstatement of disturbed ground, baseline conditions within the transport corridor will revert to pre-construction levels; therefore, operational impacts are expected to be **neutral.**

Traffic Signalling Works and Ducting Mitigation

The traffic signalling and ducting works will need to be undertaken in accordance with relevant best practice guidelines, with regard to preserving water quality and preventing pollution during the works. All construction works are undertaken with regard to the Guidance for Pollution Prevention (GPPs) [32] and the Construction Industry Research and Information Association (CIRIA) guidance on the control of water pollution from construction sites[33]. These detail good practice advice for undertaking works which may have the potential to cause water pollution including management of fine sediment run-off from construction areas.

All materials are to be stored in areas of existing hardstanding. This will both prevent damage to vegetation and the riverbank (7001) and minimise the risk of pollution from plant and materials.

All trees are to be retained. However, due to the presence of trees located along the road verge or within roundabouts within the Scheme strict adherence to the NJUG Guidelines (Volume 4) and the British Standard BS 5837, particularly with regards to Root Protection Zone (RPZ) guidance provided in both documents in relation to construction work near trees. If the proposed works are altered and trees are to be felled, limbed and/or the RPZ's are not able to be maintained then further surveys may be required.

No night-time working (taken to be 30 minutes before sunset to 30 minutes after sunrise) should be undertaken. If night-time works are required, these should be discussed with an ecologist prior to commencement to establish what mitigation measures are required; and,

All construction works are to be carried out under a Precautionary Method of Working (PMW) in respect to species which have been identified as potentially being present in suitable habitats within and/or adjacent to the Scheme (amphibians, bats, badger, otter, nesting birds, common species of reptile and invasive plant species). All site staff will be made aware of the potential to encounter protected species and provided with written information about what to do if found and how to identify them.

VMS and Ducting

Vegetation clearance is required for this element of the works at Site 1 and 3. This will include removal of areas of dense scrub vegetation that could be utilised by protected and priority species, and the removal of this vegetation could result in a loss of connectivity between adjoining habitats.

Due to the reasons outlined above, an extended Phase 1 habitat survey of these locations is required in advance of the start of works to assess the suitability of these habitats to support protected and priority species. The survey will be undertaken later in 2020. The findings of this survey will be used to inform an assessment of the potential ecological constraints to the Scheme and identify suitable recommendations for further surveys, licensing requirements and/or mitigation measures to be employed during the works.

In the absence of detailed survey information, a precautionary approach has been used to predict a **slight adverse** effect on Biodiversity during the construction phase of these works.

VMS and Ducting Mitigation

General mitigation measures to be employed during the proposed VMS and associated ducting works will mostly follow those outlined in Section 1.1.2 for the traffic signalling and ducting work. However, these

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[32] http://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/

[33]The CIRIA documents are a series of publications developed by the Construction Industry Research and Information Association. Each document is targeted at a particular type of business or activity and covers environmental good practice to minimise pollution. Particular attention should be given to CIRIA C532 (Control of water pollution from construction sites, 2001). The CIRIA publications also make reference to environmental legal obligations and are available from: http://www.ciria.org/CIRIA/Resources/Resource_overview/Resources/Resources_overview.aspx?hkey=a80608d2-a045-4d72-8bb9-5ecf23f8d761“

recommendations will be reviewed following the completion of the extended Phase 1 habitat survey, as this may identify the requirement for further survey work and additional mitigation measures.

Summary

In summary, the Scheme is predicted to have a **slight adverse effect** on Biodiversity. This is based on a precautionary assessment due to the absence of detailed survey information. It is anticipated that with suitable mitigation applied (following the completion of a site survey), effects from the scheme may be reduced.

3.9.3. Historic Environment

Whilst Swindon does contain a wealth of Grade II and II* Listed buildings and Scheduled monuments related to the Late Neolithic to the Middle Bronze Age, very few of these are located within a close proximity to the Swindon UTMC scheme. The three assets within a 100m distance of highways affected by the scheme are listed below:

- Grade II* Listed Building - British rail engineering limited Swindon works no 13 shop (old l2 shop), Rodbourne Road;
- Grade II Listed Building – Brick boundary wall to former GWR works (north), Rodbourne Road; and
- Grade II Listed Building – Church of St Augustine, Summers Street.

All of these assets are designated within the urban environment, and thus their settings are relatively resilient to change. All of these assets are in proximity to an existing signalised crossing that will be connected to the UTMC network. The linking of this signalised crossing to the UTMC network will require minimal construction works, and thus any temporary impacts on the setting of these buildings is unlikely. Further, the likely change in traffic flows is unlikely to cause any significant change in the setting of these heritage assets.

Across the scheme, there are various locations where excavation work is required to lay ducting for cables etc to facilitate the implementation of the UTMC network. Whilst excavation can lead to an increased risk in locating unknown archaeology, the locations where these ducts are generally to be constructed lie within existing highway, in areas of made ground immediately adjacent to the highway, or in areas of land previously excavated and disturbed in the original highway construction. Because of this, the likelihood of identifying unknown archaeological assets is regarded to be very low.

3.9.4. Water Environment

The headwaters of the River Ray cross under the Great Western Way in a south-to-north direction adjacent to Mannington Recreation Ground, whilst Dorcan Stream flows south-to-North from Coate Water over the scheme area at Coate Roundabout. Outside of these watercourses, the Swindon UTMC scheme area does not interact with the water environment due to the urbanised nature of the scheme area.

During construction, there is a risk that, in the absence of mitigation, construction activities such as excavation could lead to track out of organic material into local watercourses, as well as increased risk of oil spills and other pollution events reaching the local drainage network. However, if best practice pollution prevention measures are followed, construction effects on the local water environment are unlikely.

In operation, the scheme itself will not increase the hardstanding area in the locality or reduce existing floodplain storage and is therefore unlikely to lead to any changes in discharge rates to local watercourses and will not influence local flooding. As the scheme is likely to increase traffic flows, there is a slight increase in the risk of pollution events such as oil/fuel leakages into the local drainage system that may eventually drain into local watercourses. However, the increase in flows is unlikely to be significant as such the existing drainage system would be unable to cope with the small potential increase in pollution events.

3.9.5. Air Quality

Air Quality Criteria

The scoping criteria for air quality assessment of road schemes provided in Highways England’s Manual for Roads and Bridges has been utilised as a reference. According to the DMRB an air quality assessment needs to be undertaken where a scheme meets any of the following criteria:

- Road alignment changes by 5m or more;
- Daily traffic flows change by 1,000 AADT or more;
- Heavy Duty Vehicle (HDV) flows will change by 200 AADT or more;
- Daily average speed will change by 10 km/hr or more; or
- Peak hour speed will change by 20 km/hr or more.

Baseline Air Quality

Air Quality in the SBC borough is generally very good, in accordance with their 2018 Annual Status Report. SBC have recently designated an Air Quality Management Area (AQMA) on Kingshill Road, Swindon due to an exceedance of the Air Quality Strategy (AQS) annual mean objective of 40 µg/m3 nitrogen dioxide (NO2). Even though this AQMA is not directly located on the UTMC scheme area, it may be affected by the proposed scheme during the operational phase.

Constraints

The Proposed Scheme is not located within an AQMA. Local monitoring data indicate that existing air quality conditions in the vicinity of the Proposed Scheme are good and do not pose a constraint to the Proposed Scheme.

The proposed scheme is located in an urban area and accordingly road links included in the scheme are in close proximity to sensitive receptors (residential properties).

The nearest designated ecological site is the Coate Water Special Scientific Interest (SSSI), located approximately 250 m to the south east of the scheme , and accordingly it is not anticipated that the Proposed Scheme will materially affect air quality conditions in proximity to this ecological site.

Construction

Potential adverse effects at nearby receptors resulting from dust emissions generated by the construction works are not anticipated, on the basis that construction works at each individual location of the proposed scheme are not expected to last for more than a week. Therefore, a Construction Dust Impact Assessment is not deemed necessary. Nonetheless, good mitigation measures for low risk construction sites are highly recommended to be employed as set out in the IAQM Construction Dust Guidance to ensure the minimum possible impact.

Operation

The assessment of average delay per vehicle at each junction with and without the proposed scheme, presented in section 3.5, indicates that changes to vehicle flows and speeds with the proposed scheme are unlikely to exceed the DMRB scoping criteria for air quality assessment detailed above. In combination with the presence of no constraints to air quality, the potential effect on local air quality due to the proposed scheme may be considered insignificant and further assessment of the air quality effects is not considered necessary.

3.9.6. Noise

Study Area

In accordance with the Design Manual for Roads and Bridges Volume 11, Section 3, Part 7 (LA111 Noise and Vibration) , referred to hereafter as DMRB 11:3:7, the study area for this assessment consists of:

- Construction Noise: the area within approximately 300m of the anticipated construction footprint(s) of the Scheme;
- Construction Vibration: the area within approximately 100m of the anticipated construction footprint(s) of the Scheme; and
- Operational Noise: the area within approximately 600m of the proposed upgraded routes; and the area within 50m of other road links with potential to experience a short-term Basic Noise Level (BNL) change of more than 1.0 dB(A) as a result of the project.

DMRB 11:3:7 furthermore requires that a diversion route study is undertaken for the construction phase where full carriageway closures are required. However, it is understood that no such closures would be required for this project.

Baseline Environment

The various phases of the Scheme are located in predominantly urban/residential areas in central Swindon, with noise levels being driven by existing road traffic. An estimate of baseline noise levels in the vicinity of each development zone was obtained with reference to the UK DEFRA noise mapping, undertaken in accordance with the Environmental Noise (England) Regulations 2006 at Round 3.

Data are not available for all development zones, since they are not all covered by the noise mapping. However, it can be assumed that existing conditions are similar at these zones (3A, 4A, 6 and 9) as those for which data is available (2A and 2B).

The Round 3 noise mapping indicates that baseline ambient noise levels near the Scheme could exceed 70 dB LAeq, 16hr during the daytime, and 60 dB LAeq, 8hr at night. This suggests that noise-sensitive receptors close to the scheme are already be subject to reasonably high noise levels during both daytime and night-time periods, whilst receptors further away from the Scheme are subject to noise levels reducing with distance and screening from the roads.

In accordance with DMRB 11:3:7 the baseline environment for vibration is assumed to be zero (i.e. no significant source of vibration in the baseline).

Noise Important Areas (NIAs)

In accordance with the Environmental Noise (England) Regulations 2006, the DEFRA 'Noise Action Plan for Roads' (2019) requires that relevant highway authorities will be responsible for examining Important Areas and forming a view about what measures, if any, might be taken in order to assist with the implementation of the Government's policy on noise:

"In line with the Government's policy on noise, this Action Plan aims to promote good health and good quality of life (wellbeing) through the effective management of noise. It is intended that this Action Plan will assist the management of environmental noise in the context of Government policy on sustainable development. This means that those authorities responsible for implementing this Action Plan will need to balance any potential action to manage noise with wider environmental, social and economic considerations, including cost effectiveness."

It is only reasonable to consider Important Areas within the potential control of the project (i.e. those in the vicinity of the Scheme for which the project has a realistic opportunity of providing improvements by mitigation). The following Important Areas within the potential control of the project were identified based on a desktop review of the Round 3 noise mapping undertaken by DEFRA in 2017:

Zone 2A

- NIA 3985, a small local authority (SBC) Important Area, located north of Frobisher Drive on Queens Drive.
- NIA 3986, a large local authority (SBC) Important Area, located along the A4289 between Transfer Bridges and the Magic Roundabout.
- NIA 3988, a large local authority (SBC) Important Area, located along the A4312 between the ambulance station and A4312/A4259 junction, and along the A4259 between the same junction and Texaco garage (approximate).

Zone 2B

- NIA 3987, a small local authority (SBC) Important Area, located south of Bedford Road on Drakes Way.

Other Zones

- Zones 3A, 4A, 6 and 9 have no NIAs.

Potential Effects

The Scheme has the potential to affect noise and vibration levels at sensitive receptors within the Study Area. The potential effects of the Scheme are summarised as follows:

- Increase in noise and vibration levels during the construction phase due to activities such as:
  - trenching/installation of underground services;
  - demolition/removal of existing signage and signalling; and
  - installation of new signage and signalling.
- Increase in road traffic noise levels during the operational phase due to the combined effects of:
  - an anticipated increase in road traffic volumes (greater throughput) on completion of the scheme;
  - an anticipated increase in average road traffic speeds on affected routes.

Potential increases in noise and vibration levels during the construction phase are not considered likely to be significant however, due to the relatively high levels of existing ambient noise in the baseline, and the likely duration of activities. DMRB 11:3:7 indicates that a significant effect would be unlikely to occur where construction activities do not exceed a duration of 10 or more days or nights in any 15 consecutive days or night; and/or a total number of exceeding not exceeding 40 in any 6 consecutive months. Based on current information and professional judgement it is considered unlikely that construction activities would exceed these durations at any sensitive areas in the vicinity of the Scheme.

Likewise, potential increases in road traffic noise are unlikely to be significant in either the short-term (i.e. between the Do Minimum Opening Year and Do Something Opening Year scenarios), or in the long-term (i.e. between the Do Minimum Opening Year and Do Something Design Year scenarios).

Whilst it should be noted that any increases in noise within the Important Areas 3985, 3986, 3987 and 3988 should not be considered desirable, these are likely to be of minor or negligible magnitude.

Mitigation

As outlined above, it is not considered likely that the scheme would result in significant environmental effects. Nonetheless, the effects of construction noise and vibration could be reduced and minimised by following relevant guidance in BS 5228:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise' and 'Part 2: Vibration'. These standards provide methodologies for reducing and minimising construction noise and vibration emissions by the application of various technical, management and supervisory measures.

With respect to operational road traffic noise there are unlikely to be any significant opportunities for mitigation associated with the Scheme. However, as outlined above any adverse effects as a result of the Scheme are not likely to be significant.

3.10. Social Impacts

3.10.1. Physical Activity

The scheme is likely to result in improved journey times, reliability and punctuality for buses travelling within the UTMC scheme area and beyond, which may encourage some people to use the bus rather than cars. There are numerous bus services currently operating in and around Swindon town centre that could benefit from improved journey times. In theory a modal shift from car to bus will slightly increase physical activity as public transport users generally walk further than car users to gain access to transport, but it is acknowledged that the UTMC scheme may not have a significant effect on modal shift. Reduced traffic congestion within the UTMC core area may encourage people to cycle instead of using cars, but this effect is likely to be small.

Taking these factors into account, it is expected that the scheme will have a **neutral** impact in relation to physical activity.

3.10.2. Journey Quality

The UTMC scheme will improve journey quality for highway users throughout the UTMC scheme area. Journey times will be improved for car users, with VMS further improving journey quality. Bus users will also benefit from more reliable journey times. The anticipated reduction in queueing at key junctions along the GWW corridor should result in reduced driver stress.

The proposed UTMC scheme is not considered to bring material improvement to bus user journey quality that is over and above what is to be claimed in other business cases being developed for quality bus corridors in Swindon, and so facility benefits for bus passengers are not quantified in this assessment.

Based on this qualitative assessment, the impact of the UTMC scheme on journey quality is expected to be **moderately beneficial**.

3.10.3. Security

The UTMC scheme is not likely to include any enhancements to public transport provision, public realm or lighting that would be considered to improve security. The overall impact is therefore considered to be **neutral**.

3.10.4. Accessibility

The provision of bus services does not form part of the UTMC scheme, but numerous existing services will benefit from more reliable journey times along the GWW corridor. Many employment and leisure facilities are located along the key routes benefitting from the UTMC scheme and hence bus users travelling to and from these destinations will benefit. The overall impact on accessibility is therefore expected to be **slight beneficial**.

3.10.5. Affordability

There are no expected changes to parking costs, direct road user charges, public transport fare charges or availability associated with the UTMC scheme. There will be some change to vehicle operating costs for non-business road users, but the TUBA assessment indicates that these are likely to be below £200k over the 15-year appraisal period. At an individual level, changes in personal transport costs will not therefore be discernible.

The overall impact on personal affordability is therefore considered to be **neutral**.

3.10.6. Severance

Community severance is defined in TAG Unit A4.1 as the 'separation of residents from facilities and services they use within their community caused by substantial changes in transport infrastructure or by changes in traffic flows'. Severance impacts are primarily concerned with non-motorised users, especially pedestrians.

No significant impact is expected as the UTMC scheme is unlikely to result in a material change to traffic flows in residential areas in proximity to the GWW corridor. The overall impact is therefore considered to be **neutral**.

3.10.7. Option and Non-Use Values

TAG (Unit A4.1, Section 7) states that 'monetisation should be restricted to the opening or closure of local rail stations and the introduction or loss of good quality bus services'.

The UTMC scheme is not likely to significantly alter the availability of transport services. Although the scheme will contribute towards more reliable bus journey times, it is acknowledged that bus services do not run along some sections of the GWW corridor but rather traverse some of the key junctions in the UTMC scheme area. Hence the scheme may provide an improved alternative mode of travel for regular car users, which may have an associated option or non-use value, although this is likely to be very small.

Based on this qualitative assessment of option and non-use values the overall impact is therefore considered to be **neutral**.

3.11. Value for Money Statement

This section contains the Value for Money Statement in line with the DfT's Value for Money Assessment guidance. It follows the HM Treasury Green Book method of cost-benefit analysis, by weighing the benefits against the costs to indicate whether the scheme offers 'value for money'. Qualitative, quantitative and monetised information are used in preparing the statement.

The Value for Money Statement in this section should be read in conjunction with the Transport Economic Efficiency table, Public Accounts Table and Analysis of Monetised Costs and Benefits tables in Appendix E. The Appraisal Summary Table for the scheme is contained in Appendix F and identifies the full set of scheme impacts across the economic, environmental, social and public accounts categories for the Core scenario appraised. For alternative growth scenarios (High and Low), quantified impacts have already been covered in 3.8.7, while impacts assessed qualitatively are not expected to vary materially by growth scenario.

The aim of the Value for Money assessment is to help decision makers judge whether the expected cost of the transport intervention is justified by monetising the expected benefits to the public and society. The proposed UTMC scheme is judged against the categories shown in Table 3-18 to determine the Value for Money assessment.

Table 3-18 – Value for Money Categories

Value for Money category	Implies
Very High	BCR greater than or equal to 4
High	BCR between 2 and 4
Medium	BCR between 1.5 and 2
Low	BCR between 1 and 1.5
Poor	BCR between 0 and 1
Very Poor	BCR less than or equal to 0

The key findings from the assessment comprise:

- Level 1 results demonstrate **High Value for Money** (also High Value for Money with Level 2 impacts);
- Level 1 impacts Present Value of Benefits (PVB) generate £3.655m, focusing on transport user benefits (highway and public transport) with a **BCR of 2.8**;
- Inclusion of Level 2 impacts (PVB) slightly increases benefits to £3.768m, which arise from imperfectly competitive markets, with a **BCR of 2.9**;
- The Present Value of Costs (PVC) for the proposed UTMC scheme is approximately £1.300m in 2010 market prices and values; and

- No major significant adverse environmental, social or distributional impacts, with some beneficial impacts forecast for journey quality and physical activity.
- Various sensitivity tests all demonstrate BCRs of 1.7 or above. This demonstrates that no matter the future growth scenario, the scheme will still generate benefits. The sensitivity tests suggest that the choice of annualisation factors has not significantly inflated the benefits, and there is also some potential for introducing targeted bus priority at key junctions without reducing the Value for Money.

Value for Money: Sensitivity and Risk Profile

The scheme costs are based on detailed design drawings and bills of quantities. Risk has been allocated as a proportion of scheme costs and a quantified risk budget of £255,000 allocated to it. A figure of 10% Optimism Bias has been applied to the overall scheme costs as suggested for IT schemes at FBC stage in Table 8 of TAG Unit A 2.1.

Table 3-19 – Value for Money Assessment Table

	Assessment Type	Core Scenario	Detail
Level 1 Impacts / Initial BCR	Present Value of Benefits (PVB)	£3.655m	Includes user benefits (highway and public transport), indirect tax revenues, accidents, greenhouse gas, noise and air quality, impacts during construction.
	Present Value of Costs (PVC)	£1.300m	Includes investment costs based on SBC estimates, risk based on percentage estimate and Optimism Bias at 10% as suggested for IT schemes at FBC stage in Table 8 of TAG Unit A 2.1
	Net Present Public Value (NPPV)	£2.355m	
	Initial BCR	**2.8**	**Indicates High VfM Category most likely**
Level 1 + 2 Impacts / Adjusted BCR	Present Value of Benefits (PVB)	£3.768m	Adding imperfectly competitive markets impacts.
	Present Value of Costs (PVC)	£1.300m	As above.
	Net Present Public Value (NPPV)	£2.468m	
	Adjusted BCR	**2.9**	**Indicates High VfM Category most likely**
Qualitative Assessment	Social Impacts	Social impacts are assessed as **moderate beneficial** (journey quality) and **neutral** (physical activity, accessibility, security, severance, option and non-use values and personal affordability)	
	Environmental Impacts	Environmental impacts are assessed as **neutral** (air quality and noise, townscape and visual, historic environment, biodiversity) other than water environment which is assessed as **slight adverse**.	
	Key Risks, Sensitivities	Tests have been undertaken to look at smaller annualisation factors, and prioritising buses over other vehicles at certain junctions, and still deliver a High Value for Money	
	VfM Category	**Overall assessment is that most likely outcome is High**	

4. Financial Case

4.1. Introduction

The financial case provides evidence on the affordability of the proposal, how it is to be funded and any technical accounting issues. It includes the financial profile for the scheme and the impact of the proposed investment on budgets and accounts. The financial case may be developed and finalised within a single phase subject to a single gateway sign-off of the business case being agreed between SBC and the LEP.

The financial case includes the following key elements:

- The expected whole life costs of the scheme, including the base cost and risk allowance in outturn prices;
- A cost profile showing year on year costs, and breakdown by cost type and parties on whom they fall;
- Details of key financial risks (including any risk allowance quantification) and the risk management strategy;
- Demonstration that sufficient funding is available to cover the identified costs in each year;
- Details of any sources of third party / alternative funding contributions, including associated conditions and consideration of the financial risks / contingencies that would result should any particular stream fail to materialise; and
- Consideration of the long-term financial sustainability of the scheme, including robust plans to ensure the affordability of any ongoing costs for operation, maintenance and major capital renewals.

4.2. Scheme Costs and Funding

Scheme costs have been derived from the tender prices received for the main construction elements of the scheme, plus SBC estimates for project management and risk not included in the contracted cost. A summary of scheme implementation costs for each element is shown in Table 4-1.

Table 4-1 – Scheme Implementation Costs Summary (Outturn)

Cost Type	Cost (£)
Preparatory[34]	£330,000
Construction (Including Preliminaries)	£665,000
Site Supervision[35]	£0
Land	£0
Risk Budget	£255,000
Total (Outturn Prices)	**£1,250,000**

Overall the Swindon UTMC package has been developed within a budget envelope of £1.25M outturn prices. This is based on tendered prices for the UTMC Common Database and VMS, framework prices for Strategy Setup, JTMS & Comms Network and Traffic Signals Compatibility Upgrades, and elements of installation by SBC's DLO.

4.2.1. Development Costs

Development costs include all the necessary preparatory costs associated with the scheme, including project management, design, surveys and technical approvals. A breakdown of development costs is provided in Table 4-2. Overall, development costs are forecast as £330,000 in outturn prices.

[34] Preparatory cost in this table is part of the capital cost claimed as the cost to develop the scheme.
[35] Site supervision is included within the PM responsibilities. Cost shown within the PM row. The only package with element of site supervision is VMS.

Table 4-2 – Scheme Development Costs in Outturn Prices

Cost Type	Cost (£)
Feasibility and Business Case	£85,000
Design fees	£75,000
Project Management	£170,000
Total	**£330,000***

4.2.2. Construction Costs

Table 4-3 breaks down the construction costs by package element based on tender prices. [redacted] Costs have been rounded to the nearest £1,000.

The Common Database costs also include one year of operation, setup and the installation fee.

Table 4-3 – Construction costs by Package Element in Outturn Prices

Package Element		Cost (£)
Common Database		[redacted]
Strategy setup		[redacted]
JTMS & Comms. Network	Equipment and installation	[redacted]
	SBC installation (on lamp columns only)	[redacted]
Traffic Signals Compatibility Upgrades	Traffic Signal Upgrade	[redacted]
	Meads Roundabout Refurbishment	[redacted]
	Wootton Bassett Road Controller Upgrade	[redacted]
Variable Message Signs	Equipment	[redacted]
	Installation	[redacted]
	Construction costs sub-total	**£665,000**

4.2.3. Risk and Inflation

The purpose of the risk budget is to cover any increased costs that may result from the full set of identified scheme risks, whether direct cost increases or indirectly as a result of scheme delays. Risks to the delivery of the infrastructure have been assessed and appraised in line with the HMT Green Book and as part of Swindon Borough Council's ongoing programme management.

The most likely value of these risks has been quantified by SBC and is estimated at **£255,000**, equating to 20% of total scheme cost. Further information on the key risks and how these risks will be managed throughout scheme development and implementation is provided in the management case.

4.2.4. Outturn Cost Profile

The forecast scheme expenditure profile is shown in Table 4-4. By the end of the 2019/20 financial year, £276,000 was spent on scheme development, with the remaining £54,000 due to be spent within the 2020/21 financial year. In line with the projected construction period from August 2020 to March 2021, most of the construction costs are expected to occur in the 2020/21 financial year.

Table 4-4 – Scheme Outturn Expenditure Profile (£)

Cost Type	2017/18 to 2019/20	2020/21	2021/22	Total
Development Costs (including PM)	£276,000	£54,000	-	**£330,000**
Construction Costs	-	£665,000	-	**£665,000**
Risk	-	£255,000		**£255,000**
Total	**£276,000**	**£974,000**	**£0**	**£1,250,000**

4.2.5. Funding Status and Breakdown

The anticipated funding profile is shown in Table 4-5.

Table 4-5 – Scheme Funding Profile (£)

Funding Source	2016/17-2018/19	2019/20	2020/21	2021/22	Total
LGF	£0	£0	£1,250,000	£0	**£1,250,000**
SBC Capital Funding	£0	£0	£0	£0	**£0**
Total	**£0**	**£0**	**£1,250,000**	**£0**	**£1,250,000**

4.3. Whole Life Costs and Funding

The scheme will give rise to additional revenue liabilities for capital renewals and maintenance, when compared to a future situation without these highway improvements having been made. The additional liabilities will amount to £30k per year, comprising:

- Operation of the UTMC system;
- Maintenance and capital renewals of traffic signals; and
- Maintenance and capital renewals of UTMC infrastructure, including journey time measuring equipment, communications database.

Operating costs are accounted for in the PVC, but not maintenance which will come from SBC's existing signals maintenance budget. SBC will be responsible for the maintenance and operation of all new infrastructure created by the scheme, which will be funded through future highway revenue budgets.

4.4. Accounting Implications: Cash Flow Statement

The Swindon UTMC Scheme is expected to have the following implications on public accounts:

- The Local Growth Fund is requested to fund £1.25m (100%) of the total scheme implementation costs. This includes the first year of maintenance and operating costs; and
- After the first year, ongoing whole life maintenance and operating costs will be £30k per year to be funded by SBC revenue budgets.

5. Commercial Case

5.1. Introduction

The commercial case provides evidence on the commercial viability of a proposal and the procurement strategy that will be used to construct the scheme. It also presents evidence on risk allocation and transfer.

The commercial case includes the following key elements:

- A proposed procurement strategy, including details of how different options have been assessed to arrive at the preferred procurement approach(es);
- An outline of the proposed payment mechanisms and pricing framework;
- Identification of the commercial risks (based on the wider risk assessment) and how different types of risk might be addressed and shared between the parties involved (including whether the risk transfer is supported by any incentives that prompt the intended outcomes);
- Demonstration that the risk allocation is consistent with the cost estimate;
- Details of the contract timescales; and
- Details of the proposed contract management and implementation timescale.

Based on soft market testing and a review of procurement options, the Council carried out five procurements [redacted] (three are on existing frameworks) [redacted]:

Common Database	Strategy set-up	Traffic Signals Compatibility Upgrades	JTMS & Comms. Network	VMS
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

5.2. Procurement Objectives

Swindon Borough Council is committed to undertaking high quality procurement, setting rigorous quality standards and monitoring both performance and procedures to ensure the Best Value delivery of goods, works and services. All procurement must be based upon the principles of Best Value and measurable outcomes for services to the Swindon community of goods, works and services.

All procurement activities should contribute, either directly or indirectly, to the implementation of the Corporate Strategy including:

- Sustainability;
- Equality;
- Health and Safety;
- Effective Partnerships;
- Economic Prosperity;
- Risk Management;
- Electronic Government; and
- Best Value.

SBC is complying with all statutory and legislative requirements, both from Central Government and the European Union. All procurement decisions are made on an ethical basis and take into account SBC Corporate and Social Responsibilities. Due regard is paid in all procurement decisions to the protection of the environment, and the appropriate use of natural resources and local economic prosperity.

Table 5-1 provides an overview of SBC's procurement process. The procurement process followed is dependent upon both the nature of the requirement (e.g. goods and services, works) and its value.

Table 5-1 – SBC Procurement Pathways

Requirement	Value	Procurement Process
All requirements	Up to £25,000	Under £1,000 - at least one verbal quotation. Over £1,000 - at least one written quotation. All requirements in excess of £5,000 must be recorded using the Procurement Authorisation Document. Best Value must be evidenced if only one quotation sought or received and the reasons recorded on self-certified Procurement Authorisation Document (PAD).
Goods and Services	Between £25,000 and EU threshold (£181,302)	Invite at least three written quotations from the relevant industry (one if 'direct call off' only from an approved framework agreement). Recommend advertising to ensure suitable competition. Best Value must be evidenced if only one quotation or tender received or advertising is not applied and the reasons recorded on self-certified PAD.
Works	Between £25,000 and £500,000	Invite at least three written quotations from relevant industry (one if 'direct call off' from an approved framework agreement). Recommend advertising to ensure suitable competition. Best Value must be evidenced if only one quotation or tender received or advertising is not applied and the reasons clearly recorded on self-certified PAD.
Goods and Services	Above EU threshold (£181,302)	EU Compliant Tender process, procurement strategy must be approved through Gateway procedure prior to tender. PAD must also be completed.
Works	Between £500,000 and EU threshold (£4,551,413)	Advertising is strongly advised. Alternatively, and if justification to not advertise can be evidenced, invite at least five written quotations from relevant industry. Best Value must be evidenced and the reasons recorded on self-certified PAD if advertising not undertaken. For all works contracts in excess of £500,000 Procurement strategy must be approved through Gateway procedure prior to tender.
Works	Above EU threshold (£4,551,413)	EU Compliant Tender process, procurement strategy must be approved through Gateway procedure prior to tender. PAD must also be completed.

5.2.1. SBC Gateway Procedure

Gateway Stage A is the business case and procurement strategy for the project. A business case is a demonstration that the benefits of proceeding with a project exceed the costs.

In developing the appropriate procurement strategy to deliver a project the following questions should be considered:

- What kind of contractor would be best at delivering the works (large or small, specialised or general)?

- Would it be more effective to combine these works with another contract (e.g. to make it large enough to attract big contractors)?
- Would splitting the contract into lots help attract the right sort of contractor (e.g. smaller or specialised contractors)?
- What is the relative importance of price and quality?
- How can quality best be assessed from the tender returns?

Gateway Stage B is the contract award recommendation.

No procurement exercise can be commenced without full authorisation of Gateway Stage A. No contract award can be progressed without full authorisation of Gateway Stage B. Approval required from:

- Procurement;
- Legal Services; and
- Finance.

5.3. Output-Based Specification

This section of the commercial case considers what skills and services are required to deliver the Swindon UTMC scheme. The development and assessment of the scheme utilises staff resources from a number of sources, including the developer, local authority and consultants. Table 5-2 sets out an overview of the project output specification for the UTMC scheme based on the outcome of the tendering process.

Table 5-2 – Project Output Specification for the Swindon UTMC Scheme

Stage of Scheme Development	Work Stream	Output
Preparation	Project Management Support	Provision of sufficient project management capacity.
	Traffic Signals design	Review of existing operation of junctions, MOVA/SCOOT, rework TR2500 forms for controllers, to amend junction operation.
	Traffic signals comms and JTMS design	Site surveys to assess site locations and best form of IP communications to allow sites to communicate with Swindon UTC server traffic signal comms.
	VMS and carpark guidance	Review of existing VMS and design of new VMS and car park guidance in new locations where required.
	UTMC concept strategy & Common database spec	Writing network strategies to meet SBC's goal to manage the network. Detailed specification to provide procurement documentation.
	Business Case development	Development of Full Business Case for LEP approval.
	Communications	Provision of support for stakeholder management and in connection with planning and legal processes
	Commercial	Approach for procurement of construction and operation of scheme as set out below
Construction	Common Database	1 new UTMC hosted system to be supplied. With JTMS module, car park management module, VMS module, and traffic signal module.
	JTMS & Comms	21 JTMS units to be installed at traffic signal sites and 29 mesh aerials to be installed.

Stage of Scheme Development	Work Stream	Output
	Traffic Signals Compatibility Upgrades	24 new controller PROMS installed and 19 new OTUs installed. Existing controller at Wootton Bassett Road / Paddington Drive to be upgraded. Existing traffic signals to be refurbished at Meads Roundabout.
	VMS	5 new VMS and car park guidance signs to be installed.
Maintenance	Ongoing Operating and Maintenance of UTMC system.	Maintenance and operation to be undertaken in accordance with SBC's policies/asset management plan

5.4. Procurement Strategy

5.4.1. Sourcing Options

The procurement options considered are outlined in Table 5-3:

- Common Database;
- JTMS & Comms Network;
- Traffic Signals Compatibility Upgrades; and
- VMS.

Table 5-3 sets out the procurement options for UTMC. Procurement options have been reviewed against the SBC Gateway process. The Common Database is above the EU threshold for OJEU, whereas the VMS is a selected list for tender via direct-invitation RFQ. Traffic Signals Compatibility Upgrades and JTMS & Comms Network will be delivered via the existing Siemens framework.

Table 5-3 – Procurement Options for UTMC Work Streams

UTMC Work Stream	Procurement Options	Rational for Procurement Option Selection
Common Database	OJEU open tender. SBC Gateway process to reflect tender routes where applicable. 30-day tender period.	[redacted]
Strategy set-up	Atkins via existing framework.	[redacted]
JTMS & Comms. Network	Framework - equipment to be procured and add onto the network already being operated by Siemens. Installation on lamp columns: via by SBC DLO.	[redacted]
Traffic Signals Compatibility Upgrades	Hardware/controllers: Siemens via existing call-off framework (variation to existing contract). Civils (trenching/ducting to link up signals): Siemens via existing framework schedule of rates.	[redacted]

UTMC Work Stream	Procurement Options	Rational for Procurement Option Selection
VMS	Supply and installation: selected list for tender via direct-invitation RFQ. 20-day tender period. Civils: via by SBC DLO.	[redacted]

5.4.2. Contract Length

Table 5-4 sets out the period and length of each contract.

Table 5-4 – Contract Lengths

UTMC Work Stream	Contract Period	Contract Length (months)
Common Database	August 2020 – March 2026	5.5 years (3.5 years + 2 years optional)
JTMS & Comms. Network	*Order on existing contract.*	*Order on existing contract.*
Traffic Signals Compatibility Upgrades	*Order on existing contract.*	*Order on existing contract.*
VMS	August 2020 – March 2026	5.5 years (1.5 years + 4 years maintenance)

5.4.3. Tender Process

Overall two tendering processes were carried out:

- UTMC Common Database: OJEU open tender , with SBC Gateway process to reflect tender routes where applicable; and
- VMS: Selected list tender with RFQ via the SBC Portal as an eTender.

Both procurements were one stage tenders with no pre-qualification stage. In terms of assessment of submissions, the Common Database used a 60/40 split on price/quality, whilst the VMS used a 65/35 split; both sets of figures being in accordance with SBC procurement guidelines. With the quality submissions, it was important that equipment has low maintenance requirements and will be compatible with existing systems. Tenderers were asked to demonstrate reliability and not require different companies to be involved in the ongoing operation and maintenance. The quality part of tendering included questions about what SBC is looking for

5.5. Achieving Value for Money

SBC has gone through a process of soft market testing to ensure the UTMC package delivers value for money. Early soft market testing confirmed no supplier covers all elements of the UTMC package. Within each of the UTMC elements suppliers are able to install their equipment on behalf of SBC. For example for VMS, historically SBC would have purchased signs and appointed a contractor for the electrics but suppliers are able to provide a service including installation.

To achieve value for money, soft market testing was carried out as follows:

- Common Database: four soft market testing meetings were held based on scripted questions. Suppliers were able to demonstrate their software in action and the interface that would be used, present their capabilities;
- JTMS & Comms Network: soft market testing was informal through SBC's signal engineer's role in liaison with various companies. SBC has a framework concept with Siemens who have developed initial concepts based on the existing contract. A decision was then made to procure Siemens through the framework;
- Traffic Signals Compatibility Upgrades: this is being procured through the existing framework contract with Siemens based tendered framework rates, hence no soft market testing was carried out; and
- VMS: three soft market testing meetings were held. Discussions included the nature of the suppliers offer, whether they could deliver within the timeline, what was in/out of scope (e.g. civils or traffic management).

5.6. Risk Allocation and Transfer

With a modest budget for the UTMC project of £1.25m, risk management is key to avoiding cost overruns. The risk budget in the OBC was considered to be low and therefore the risks were reassessed. For example, the installation of VMS now needs to have an initial site visits to agree exact locations and specification. This risk now sits with SBC however it provide greater flexibility to deliver the scheme as required by the client and enables minor amendments to optimise the scheme. However the risk financially now sit with SBC although still relatively low.

Furthermore, as is common practice, tenderers were asked to address risk in their submissions; this provided SBC with a fuller appreciation of their type and potential impact, prompting a reassessment of their cost and apportionment.

5.7. Contract Management

The four contracts will be managed by the SBC Project Manager, supported by SBC's Traffic Signal Engineer. Any variation in cost elements will need to go to UTMC Project Board for approval outside of agreed tolerances. Project Managed internally.

Each element will have contract along with design and bill of quantities. Suppliers will be asked to cost risks into the submissions to avoid cost increases.

5.8. Procurement Timescales

The Swindon UTMC scheme will be let as four contracts (noting that two will be via an existing SBC framework). The overall procurement timescales for Common Database and VMS are set out in Table 5-5 and Table 5-6 respectively.

Table 5-5 – Procurement Timescales for Common Database

	Date
Tender Process	
OJEU Issue	20/04/2020 – 24/04/2020
6 Week Return Period	27/04/2020 – 05/06/2020
Evaluation of supplier submissions	08/06/2020 – 12/06/2020
Presentation by suppliers	15/06/2020
Moderation	16/06/2020
Contract Award	
Contract Award	23/07/2020
Standstill (10 Days)	24/07/2020 – 06/08/2020
Contract Start	07/08/2020

Table 5-6 – Procurement Timescales for VMS

	Date
Tender Process	
RFQ Issue	04/05/2020 – 06/05/2020
4 Week Return Period	06/05/2020 – 02/06/2020
Evaluation of supplier submissions	03/06/2020 – 09/06/2020
Presentation by suppliers	22/06/2020
Moderation	23/06/2020
Contract Award	
Contract Award	23/07/2020
Contract Start	07/08/2020

5.9. Summary of Commercial Case

The commercial case has shown that SBC has the necessary contracts and procurement processes in place to deliver the scheme. The early soft market testing confirmed no supplier can covers all four elements of the project. Therefore, SBC carried out five procurements as follows (three are on existing frameworks):

- Common database (OJEU);
- Strategy set-up (framework)
- JTMS and communications network (framework);
- Traffic Signals Compatibility Upgrades (framework); and
- VMS (RFQ).

Procurement options have been reviewed against the SBC Gateway process. Only the Common Database element was expected to be above the EU threshold for OJEU. The VMS element was a selected list tender with RFQ via the SBC Portal as an eTender. Traffic Signals Compatibility Upgrades and JTMS & Comms. Network are via the existing Siemens framework.

6. Management Case

6.1. Introduction

Clear and effective management arrangements are key to successful delivery of a major scheme. The management case ensures that the project is deliverable. It demonstrates that timescales and phasing are well established and realistic, that an appropriate governance structure is in place to oversee delivery, that risks have been identified and suitable management processes developed, and that there are robust plans for communications and stakeholder management. The management case also ensures that the benefits set out in the economic case are realised and will include measures to assess and evaluate this.

The management case includes the following key elements:

- A governance / organisational structure - identifying key roles and responsibilities (and their skills and experience), including a Senior Responsible Owner (SRO), defined through a suitable structure which includes arrangements for reporting and decision making;
- A project plan for the further development, roll-out and implementation of the scheme - key outputs and milestones and critical path will be identified in the form of a GANTT chart;
- Details of the reporting, assurance and approval process (including key stage-gates in scheme development / delivery);
- A risk management strategy, setting out how risks have been identified, their likely impact, appropriate mitigation, and how the risks will be managed (and by who);
- A communications strategy – including identification of key stakeholders, their level of participation and the means of involving them;
- A benefits realisation plan setting out the approach to ensuring that the stated benefits are delivered; and
- A monitoring and evaluation plan - identifying suitable performance indicators to monitor progress against the identified scheme outcomes and the means of evaluating the overall effectiveness of the scheme.

6.2. Examples of Similar Projects

SBC has recent experience of delivering major highway infrastructure schemes with the LGF funding provided by SWLEP. The successful completion of the improvement schemes detailed below demonstrate that SBC has the resources and capability required to deliver the UTMC scheme. Whilst the nature of these schemes may be different to UTMC, the governance principles still apply to delivery of the UTMC scheme. Examples provided comprise junction improvement packages, some of which include the introduction of signals.

6.2.1. Greenbridge Roundabout

The scheme was part of the NEV transport mitigation infrastructure package focusing on a key junction between the NEV and the town centre. Its aim was to improve traffic flows by installation of signals, improved drainage, landscaping and improving pedestrian and cycle infrastructure. The scheme was delivered within the NEV governance structure on budget at a cost of £5.4m over a 9-month construction period in 2016-17.

6.2.2. Bruce Street Bridges, Great Western Way

This scheme was the first of a number of junction improvement schemes along Great Western Way, a key arterial route in Swindon. The scheme was required in response to wider growth and development in Swindon, leading to strains on its transport system and the need to accommodate displaced town centre trips on the more appropriate strategic network. The main objectives of the project was to increase capacity on the junction in order to deal more effectively with current traffic demands, as well as those that will be placed on the junction in future years. In addition to this, the junction suffered historic flooding (namely in 2007, 2008, 2009 and 2012) and providing increased protection to local properties and to the road network was also a priority. The Newcome Drive junction was required to future proof access to the industrial estate in advance of potential development at the Oasis, which may sever transport links between Hawksworth Way and Newcome Drive.

Design options were produced for each junction following feasibility studies which led through to detailed design and then construction. The scheme was constructed between 2014 and 2016 at a cost of £4.734m.

The project experienced several delays to the completion of the contract due to uncharted services, causing further delay for residents and motorists in the area and delay to other schemes on the same route. The project team took a number of corrective actions including: improvement of response times to resolve design issues, reducing resultant cost or delay to the programme; close management of the design team; and closer working with the contractor to mitigate issues.

6.2.3. Mannington Roundabout

Mannington roundabout is a key intersection in Swindon's strategic road network, connecting the M4 Junction 16 to the town centre and beyond. It is the second junction improvement on the Great Western Way programme. Due to the increase in traffic on Swindon's roads this junction has, over the years, become heavily congested at peak times. The objective of the £3.2m scheme was to alleviate the congestion and improve conditions for those using the roundabout. Work on the initial phases began in February 2018 and was completed in February 2019.

6.2.4. Lessons learned

Experience from delivering previous schemes has provided lessons which will be applied to the UTMC scheme. The most pertinent lessons are collated in Appendix G1 of the White Hart Junction business case. A similar process will be adhered to for the UTMC scheme to inform future projects.

6.3. Project Dependencies

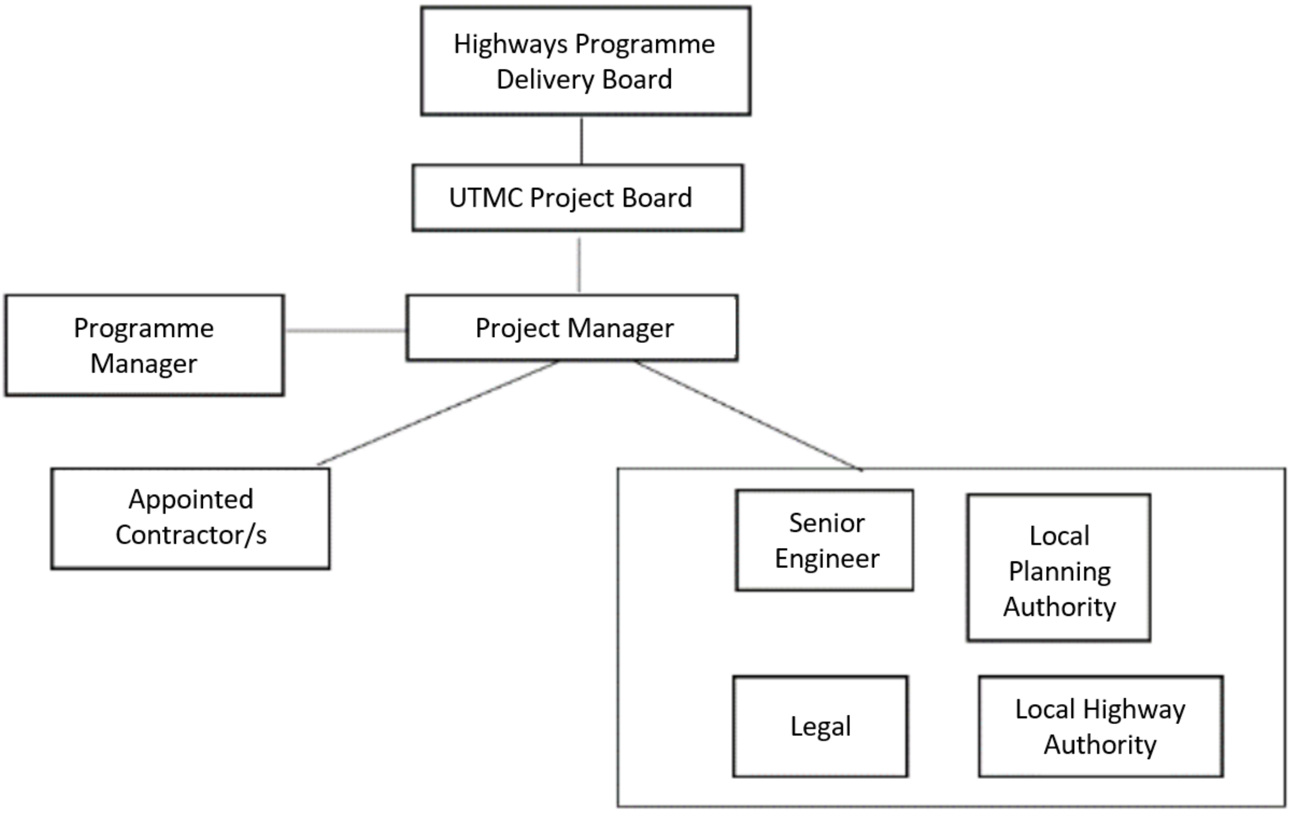
The Swindon UTMC project depends on utilising the high-speed wireless comms network for the C-ITS project.

Whilst no projects are directly dependent on the UTMC scheme, it would benefit other schemes including White Hart Junction.

6.4. Governance, Organisational Structure, Roles and Reporting

The project team structure is presented in Figure 6-1 which shows the dedicated team that will be working on the scheme. The governance arrangements have been specifically tailored to meet the requirements of the scheme.

Figure 6-1 – Project Team Structure



The key roles are as follows:

Senior Responsible Officer

The role of the Responsible Officer is to lead the management and delivery teams and provide the interface with the executive team. In this instance, the Responsible Officer is required to:

- Report to and receive feedback from the Programme Board;
- Ensure the appropriate resources, project management and technical expertise are in place for the project;
- Make decisions and approve changes within agreed tolerances or seek authorisation if required;
- Monitor and evaluate project progress against milestones and assess outcomes; and
- Provide guidance, support and direction to the Project Manager and project team.

Project Manager

The role of the Project/Delivery Manager is to:

- Lead and co-ordinate the project team and its work streams;
- Procure consultants and contractors;
- Prepare and report project budgets;
- Manage project risks and issues;
- Report to and receive feedback from the Responsible Officer; and
- Produce periodic progress reports to relevant committees.

Project Board

The Project Board is responsible for agreeing the objectives of the project and then overseeing the design, development, facilitation, procurement and implementation of the project to meet those objectives.
The Project Board is also responsible for the project team ensuring that the project is focused on achieving its objectives and delivering outputs and outcomes that will achieve the projected benefits.
The Project Board is responsible for ensuring that the needs and expectation of the users of the relevant services are understood and managed appropriately and ensuring that the actions of the project do not result in demand being simply shifted elsewhere.

Specific responsibilities include:

- Ensure robust Project Initiation Document (PID) is in place;
- Make sure that progress towards the agreed outcomes always remain consistent and on track to promote and maintain focus;
- Ensure that the resources required for the project are clearly articulated and secured;
- Ensure service user needs and risks are understood and factored into any decision making;
- Ensure performance reporting to SRO is completed and accurately reflects the status of the programme;
- Monitor and control the progress of the project team at a strategic level and a continual review of the Business Case (e.g. at each end stage assessment);
- Ensure that any proposed changes of scope, cost or timescale are checked against their possible effects on the Business Case and PID;
- Ensure that risks are being tracked and mitigated as effectively as possible;
- Brief corporate or programme management about progress;
- Recommend future action to HPDB if a project tolerance is exceeded;
- Approve the Lessons Learned Report and ensure that any outstanding issues are documented and passed on to the Highways Programme Delivery Board; and
- Ensure that the benefits have been realised by holding a post-project review and forward the results of the review to the appropriate stakeholders.

Project Team

The Council's project team will be responsible for delivering the project.

The project team comprises a Project Manager and an Assistant Project Manager. They are supported by the Council's Highways & Transport Project and Programme Manager, acting in a Project assurance role, and selected Consultants and Contractors. These are:

Alongside the project team within SBC are the internal service areas, which include:

- Highways Transport Development Management (approvals including technical approval, with Atkins as their partner);
- A range of advisors from the legal team;
- Property, procurement and finance teams; and
- Additional project support from the Highways Project and Programme Delivery team.

Responsibilities of the project team include:

- Oversight of the detailed design and construction of the scheme;
- Planning and designing the programme and proactively monitoring its overall progress;
- Reporting project progress through the governance framework;
- Managing and resolving any risks and other issues that may arise;
- Managing the project budget, monitoring the expenditures and costs against approved spend profile;
- Ensuring compliance with all health and safety matters in the Council's role as Client under the Construction Design Management regulations; and
- Managing stakeholder communications.

Atkins Project Team

Atkins is the framework contractor for SBC, responsible for producing preliminary scheme design and engineering assessment, transport modelling, economic appraisal, environmental assessment and business case development. The Atkins project team reports to the SBC project team and provides input required to inform key decisions regarding scheme development.

6.4.1. Reporting Arrangements

For each phase of the scheme development, a Project Initiation Document (PID) is established and approved by the Project Board. This is a 'working document' which defines:

- What the project intends to achieve;
- Who is responsible;
- How it will be achieved; and
- When it will be delivered.

The PID document includes a detailed project plan, which captures the key tasks to be achieved prior to the project proceeding to the next stage.

The Project Board's role is to ensure that the project is developed and managed in accordance with the PID and to provide oversight and advice to the Project Manager to enable progress in a timely fashion.

The Project Board typically meets every four weeks and its decisions are recorded and communicated to provide appropriate corporate governance for the project and its development. In advance of the Programme Board, the Project Manager submits a monthly highlight report, detailing progress in accordance with the PID. The Project Board occasionally invites a wider audience to attend when deemed beneficial to the current stage of the project. Whilst these bodies will not have responsibility for the project, their attendance and participation are key to the successful delivery. The Project Board also reports to the Highway Programme Delivery Board (consisting of the Director of Housing and Communities and the Head of Highways and Transport) which also meets every month.

6.5. Programme

A detailed project plan has been produced by SBC for the delivery of the UTMC scheme. The key project milestones for the UTMC scheme are summarised in Table 6-1. Table 6-2 summarises the programme for delivery of each of the elements of the UTMC scheme, with further programme detail provided in Appendix G.

Table 6-1 – Swindon UTMC Scheme Key Project Milestones

Milestone	Date
Preliminary Design Completion	November 2019
Working Draft of Business Case	March 2020
Detailed Design Completion	March 2020
Communications (good news/press release, etc)	August 2020
Procurement Completion	June 2020
FBC preparation after tender award and ITA comments on working draft	June 2020
FBC submitted	June 2020
LEP approval	July 2020
Works Start	August 2020
Works Completion	March 2021
1 Year Monitoring & Evaluation Review	*March 2022*
5 Year Monitoring & Evaluation Review	*March 2026*

Table 6-2 – Programme for Delivery of Key UTMC Elements

UTMC Element	Milestone	Date
Common Database	Technical Specification	November 2019 – December 2019
	Evaluation Framework	November 2019 – March 2020
	Tender Process	April 2020 – June 2020
	Contract Award	July 2020
Connection of Traffic Signals to UTC	Design	November 2019 – February 2020
	Installation and Test of Equipment	September 2020 – November 2020
	Meads Roundabout Refurbishment (Installation)	August 2020 – September 2020
JTMS and Communications Network	Design	November 2019 – February 2020
	Installation	August 2020 – March 2021
VMS	Design	November 2019 – April 2020
	Tender Process	April 2020 – June 2020
	Contract Award and Installation	July 2020 – February 2021

6.6. Assurance and Approvals Plan

6.6.1. SWLEP

As stated in Section 1.1.2, the business case development is following the guidance in SWLEP's Assurance Framework, which defines the following four stages in the Value for Money assessment of candidate schemes:

- Stage 1: Initial scheme assessment, sifting and prioritisation;
- Stage 2: Strategic Outline Business Case (SOBC) to set out the need for intervention (the case for change) and how this will further the SWLEP's objectives (its strategic fit);
- Stage 3: Outline Business Case (OBC) that includes a full economic and financial appraisal, and develops the commercial and management cases; and
- Stage 4: Full Business Case (FBC) that builds on top of the OBC with a far greater emphasis on commercial, financial and management cases, ensuring arrangements are appropriate for effective delivery.

This document represents Stage 4 of the process (submission of the FBC).

6.6.2. SBC

Within SBC, the Programme Board will continue to be responsible for Project Assurance, ensuring that the project remains on target in terms of business, user and technical objectives. This responsibility includes conducting Gateway Reviews at key stages in the project life cycle, in order to determine whether or not the project can proceed to the next stage.

Gateway Reviews have been incorporated within the project programme and include a Stage Gate Assessment prior to Final Approval submission. The key stages are as follows:

- Gateway Review 1: Business Justification – Strategic Highways Project Board;
- Gateway Review 2: Procurement Strategy – procurement group (consists of legal, finance, head of
- procurement and head of highway assets & project delivery);
- Gateway Review 3: Investment Decision; and
- Gateway Review 4: Benefits Evaluation.

Programme Board members receive regular Highlight Reports from the Project Manager, to aid them in the assurance process.

6.7. Communication and Stakeholder Management

Key stakeholders include local residents and businesses, local bus companies (including Stagecoach and Swindon Bus Company), bus users, ward councillors, Parish Councils, and community groups.

6.7.1. Consultation

SBC has worked closely with key stakeholders to understand the constraints on the network and to develop a Transport Strategy in and around the town centre (see Section 2.2.7). The use of UTMC is considered an essential element of the Swindon Transport Strategy. UTMC is listed as a key scheme of the strategy, contributing towards the strategy's identified outcome of reducing congestion at key junctions in the town. This is to be achieved partly through delivering intelligent transport systems, which includes UTMC.

UTMC provides management of the network giving flexibility to the signal operation and providing information to drivers. The key component of the visible infrastructure is the VMS. Key stakeholders such as local ward Councillors, bus operators and businesses (e.g. the Swindon Designer Outlet) have been contacted to develop the requirements both in terms of equipment design and the potential information to be provided through the VMS signs.

6.7.2. Communications

Going forward the UTMC strategies being developed and tested will require close collaboration with all the key stakeholders. The various strategies will allow SBC to adjust the network, using the equipment to deliver the desired outcomes, e.g. reliable journey times, carpark guidance and optimal network management. The intention is for a 'soft launch' of the UTMC scheme, enabling refinement of its operation as well as consulting bus operators for input when developing the strategies. SBC also plans to hold an informal drop-in session with stakeholders to share information.

6.8. Contract Management

A single project Manager has been overseeing the project since 2016 and will administer the contracts. This will include overseeing all aspects of programme, construction, risk management and cost control. Additional support will be provided by a Contracts Manager who will include the assessment of compensation events and auditing of accounts on a monthly basis. Due to the complexity of the project it has been agreed that the administration of the contract will be through the CEMAR shared IT management system. This will be run daily by the project management team. The Project Manager will be supported by SBC's resident Signals Engineer who will oversee implementation.

The Project Manager of each supplier will be required to attend monthly progress meetings (or more frequently where considered appropriate) with the appropriate SBC representatives throughout the duration of the contract, commencing with an inception meeting. The outcomes of these meetings will be reported to the Programme Board within the same cycle.

The contracts will be overseen by the Project Board in order to manage change. Contracting parties must notify the Project Board of any matter through an Early Warning, which could increase the prices, delay completion or impair the performance of the works in use. Contract management meetings are risk reduction meetings which will motivate both parties to identify problems as early as possible. It creates a proactive approach to finding a joint solution. Decisions and directions will be dealt with directly by the Project Board through the appointed Project Manager/Service Managers and the successful contractor.

6.9. Key issues for implementation

The following key issues for implementation are highlighted in Table 6-3 along with the planned mitigation:

- VMS foundations and installation - Design and installation costs subject to ground investigation risks; possibility of utilities requiring diversion;
- Covid-19 pandemic - Potential impact on resource availability to undertake / complete scheme;
- VMS signs - Cost variation subject to site acceptance and finalisation of VMS specification and sizes. There could be possible delays from the supplier in the Far East impacting on delivery programme;
- Existing services / utilities - Damage to known existing services as a result of construction activities. Utilities required to be moved; and
- Lighting/signal installation contractor performance - Contractors do not comply with the programme for installation and associated works.

6.10. Risk Management Strategy

The accurate evaluation and pro-active mitigation of risk is critical to the success of the project. A programme-wide risk register was compiled to identify risks that are likely to affect the delivery of the UTMC scheme. The risks covered legislative, policy, construction, planning and design risks. The risk register is provided in Appendix I.

The risk register and mitigations will continue to be reviewed at key points in the planning and design process, and throughout the construction stage. Delivery and contractor teams will be responsible for managing their risks and reporting any newly identified risks to the project owner and board. Risks escalated to medium or high that could impact on the progress of the project will be referred to the Responsible Officer.

A reassessment of the risk budget, post submission of the OBC to the ITA, has necessitated an increase in the risk budget. Much of this increase stems from a fuller appreciation of the risks associated with the installation of the foundations for the VMS sign posts; whilst SBC has conducted a thorough desk-top investigation of ground conditions at each of the five VMS locations, actual locations are to be agreed with the VMS sign supplier post tender award and therefore the specifics will only be fully understood when this is confirmed and ultimately the excavations take place. There is a risk that some utilities will require costly diversion work (especially in the case of fibre optic cables) to accommodate the VMS foundations. There will also be a lengthy lead-in times for utility suppliers to provide these diversion works. Alternatively, revised (possibly sub-optimal) locations may need to be sought for the VMS signs. Both scenarios could potentially result in UTMC programme delays, although most likely additional cost to overcome this by paying for additional resource for installation.

There is a risk that there are unidentified costs associated with UTMC implementation compatibility and strategy development, which will result in future change control and related increases in costs. SBC will be working with the successful bidder through the award process to clarify the detail as part of the award and contract negotiation. To ensure we cover the worst case scenario is covered SBC have put in a reasonably large risk cost for this item.

Of the 24 risks identified in the risk register in Appendix H, seven are rated high or medium risk prior to mitigation actions being developed. The residual risk rating (i.e. following implementation of mitigation actions) of all of the three high risks was medium. Table 6-3 provides a summary of these seven high or medium risks and their mitigation actions, with the full risk register developed by SBC provided in Appendix I.

Table 6-3 – Summary of High and Medium Risks Based on Risk Score[36]

Risk Ref	Risk Description	Effect of Risk Occurring	Action to Control or Mitigate Risk
3	Common Database - Costs come in lower than budget allocation; subsequent risk of unidentified costs associated with implementation incompatibility and strategy development.	Tendered cost may be exceeded and additional change control required.	Post-tender clarification and on-going liaison with multiple stakeholders.
8	VMS foundations and installation - Design and installation costs subject to ground investigation risks; possibility of utilities requiring diversion..	Significant cost increase / relocation of sign locations.	Feasibility and early site inspection undertaken to minimise the risk of this. Consider the use of cantilever posts at certain / all VMS locations.
23	Covid-19 pandemic -Potential impact on resource availability to undertake / complete scheme..	Possible delays to construction delivery programme and availability of kit.	Continual review of Govt. advice and SBC Bronze, Silver and Gold recommendations.
7	VMS signs - Additional VMS identified as being necessary to improve overall efficiency / effectiveness of UTMC scheme.	Significant cost increase / possible delays to programme.	On-going liaison with planning and implementation phase with key stakeholders.
6	VMS signs - Cost variation subject to site acceptance and finalisation of VMS specification and sizes.	Number and type of signs to be bought.	Research into site location issues; early liaison with relevant third-parties.
11	Existing services / utilities - Damage to known existing services as a result of construction activities. Utilities required to be moved.	Significant delay and/or significant costs.	Sites selected base on feasibility and assessment of C2 surveys.
21	Lighting/signal installation contractor performance - Contractors do not comply with the programme for installation and associated works..	Possible delays to construction programme and possible increased cost.	Ensure that the contractors tender is robust and deliverable. Cover by tender assessment process.

[36] High and medium risks before mitigation.

6.11. Contingency Plan

Key risks to scheme delivery and mitigations required have been identified above. A number of measures have been applied to protect the scheme in case of major failure by any of the contractors:

- Evidence of any health and safety breaches or prosecutions are requested during tender stage. If any emerge the contractor will be disqualified from the bid;
- Financial due diligence to assess the contractor's financial stability is carried out during the tender process;
- The SBC legal team will work through T&Cs for the individual contracts to comply with SBC's procurement rules; and
- During construction a robust site supervision regime will be implemented. Any health and safety issues are always passed to the HSE.

If necessary, it will be possible to re-tender any of the scheme elements through the same approach outlined in this chapter.

6.12. Benefits Realisation

The key benefits anticipated from the UTMC scheme as identified in the Strategic Case are reduced delay at key junctions on its network in the AM and PM peak periods. The scheme will actively manage traffic flows, seeking to deliver improved journey time reliability and reduce collisions.

The scheme has been subject to detailed modelling and appraisal so that its forecast impacts are well understood. It will also be important that the benefits arising from them are tracked and that other actions required to realise the full benefits are planned and resourced appropriately.

The overall approach to benefits realisation will include the monitoring and evaluation of traffic flows, congestion and journey times following construction, as well as cost and timescales associated with scheme delivery, as set out in the following section. Figure 3-2 in the Economic Case presents the logic map for the Swindon UTMC scheme which links inputs outputs to outcomes and impacts – key outcomes comprise:

- Reduction in delays at peak periods for highway users;
- Enhanced journey time reliability for public transport users;
- Improved network-wide resilience;
- Reduced number of accidents; and
- Reduction in delays caused by signal failures.

Monitoring of these outcomes is focused on data from the JTMS and the STATS19 database.

6.13. Monitoring and Evaluation

Overall the scheme evaluation is based on the outputs, outcomes and impacts in the logic map in Figure 3-2. Scheme monitoring will follow advice from the DfT, broadly following the 'standard monitoring' approach set out in the Monitoring and Evaluation Framework for Local Authority Major Schemes. The effort will be adjusted accordingly to be appropriate, proportionate and cost effective.

For the scheme, it is proposed that the evaluation broadly considers the following questions:

- Was the scheme delivered to cost and timescale?
- Has the scheme delivered the type and scale of benefits forecast?
- Has the scheme delivered the desired outcomes?

Project delivery is strongly linked to monitoring and evaluation. The system will be under continual review - the equipment will be implemented and UTMC strategies will be developed and updated. Data will be collected regarding actual scheme outturn costs and delivery, traffic flows and journey times and accidents. Data will also be collected regarding the change in journey times caused by the scheme; monitoring journey times across the UTMC network and routes leading to the network will be integral to monitoring and evaluating the relative success and performance of the scheme.

Data collection and reporting will be undertaken prior to scheme construction, and one year and five years following completion of the schemes.

Table 6-4 – Monitoring and Evaluation

Objective	Data to be used	Data collection methods	Frequency of data collection	Reporting
Scheme build	Completion of project on time and within budget, including: 1. Common Database 2. Journey Time Measuring System and Communications 3. Traffic Signals Compatibility Upgrades 4. Variable Message Signs	1. Outturn costs 2. Delivery timescales 3. Scope	Data provided by SBC project delivery team	During scheme construction
Ensure network-wide resilience at peak periods	Journeys on the UTMC network are more reliable when compared to a do-nothing scenario	Average AM/PM peak period and Inter Peak journey times along the UTMC network	Data collected by UTMC system	Pre-construction 1-year post-opening 5-years post-opening
Improve and futureproof the operating efficiency of key junctions in peak periods	Reduction in delays at UTMC junctions when compared to a do-nothing scenario	Queue lengths at key junctions in the UTMC core network	Data collected by UTMC system	Pre-construction 1-year post-opening 5-years post-opening
Ensure the traffic management intervention is reliable	Reduction in delays caused by signal failures	Number of signal failure events	Data collected by UTMC system	Pre-construction 1-year post-opening 5-years post-opening
Improve existing levels of safety	Decrease in collisions in the UTMC route network	Number and severity of personal injury accidents on UTMC route network	Data collected from STATS19 database	5-years pre-construction 5-years post-opening

6.14. Summary of Management Case

The Management Case demonstrates that SBC, supported by SWLEP, has the necessary resources and proven expertise to deliver the UTMC scheme in accordance with the programme and budget. It also shows that SBC has the necessary processes to ensure that decisions are made at the appropriate level and ensure that agreed assurance procedures are followed.

The scheme will be overseen by a Project Board and by a project team. A plan for consultation and engagement is in place which includes key stakeholders including businesses directly affected by the scheme. Key risks have been identified and strategies agreed to reduce or mitigate the impact of these. Monitoring and evaluation will be co-ordinated through a single Monitoring and Evaluation Plan to assess the impacts and outcomes of the UTMC scheme.

Appendix A. TMC Options Evaluation ‘Decision Matrix’

		Capital Cost	Revenue Cost	Reliability	Adaptability	Compatibility	Accuracy	Reactiveness	Longevity	Summary
Journey Time Measuring System (JTMS)	Blutooth	Low - Cost of instillation, assets can be mounted on existing lamp columns, signal poles and signal cabinets	Low - Little to no maintenance, cheap to replace	High - Easy to identify if failure does occur.	Low - Point to point measuring, with little use outside of primary function	High - Compatible with all UTMC systems and database	Low - Number of 'hits' recorded journeys can be relatively low when compared to other methods	High - Real time data being relayed back to system	Medium - Needs asset manager. Dependent on power source & comms	ANPR has been ruled out due to high installation costs, low reliability and on-going maintenance costs. Bluetooth and Wifi are therefore the choice going forward. Less data is collected than ANPR, but enough is collected to in order to sufficiently run JTMS. Total Data has been ruled out due to on-going revenue costs
	Wifi	Low - Cost of instillation, assets can be mounted on existing lamp columns, signal poles and signal cabinets	Low - Little to no maintenance, cheap to replace	High - Easy to identify if failure does occur.	Low - Point to point measuring, with little use outside of primary function	High - Compatible with all UTMC systems and database	Medium - Higher than Blutooth, but lower than other methods	High - Real time data being relayed back to system	Medium - Needs asset manager. Dependent on power source & comms	
	ANPR	High - Numerous assets required ,1 per lane, more expensive per unit than other methods	Medium - Often fail, require significantly more maintenance than other methods	Low - Often breaking and highly susceptible to damage	Low - Point to point measuring, with little use outside of primary function	High - Compatible with all UTMC systems and database	High - Counts every vehicle that passes, provides more accurate journey times	High - Real time data being relayed back to system	Medium - Needs asset manager. Dependent on power source & comms	
	Total Data / Floating Point	Low - Subscription service	High - Yearly subscription that needs to be paid in order to access data	High - Subscription service managed by external company	High - Data for all roads and routes provided, numerous teams could benefit	High - Compatible with all UTMC systems and database	High - GPS Data recorded from every elidgable vehicle	High - Real time data being relayed back to system	High - New technology, and no assets on site to be managed	
Signal Faults	UTC	Low - Per unit cost is low when compared to overall budget	Low - Costs associated with communications, revenue can be saved by combining comms	High - Instantly know when connection is lost	High - UTC I.P communications can be shared for UTMC and other ITS equipment	High - Two way communication allowing monitoring and control of signal junctions	High - Data is passed instantly and if there is a fault it is known straight away	High - Can be used for monitoring and cotrol of junction	High - Uses I.P communications which is compatiable with any modern computer network	All signals included as part of the UTMC need to be upgraded to UTC. With RMS seemingly losing support in the future, this is a key requirement to ensure longevity
	RMS	Low - Per unit cost is low when compared to overall budget	Medium - Costs associated with communications, revenue cannot be saved by combining comms	Low - Can take upto a month to know whether conncetion has been lost	Low - Communications medium can only be used for RMS	Low - One way communication only allows for fault monitoring and not junction control	Low - Faults are passed via dial up, this can lead to delays in faullts being received	Low - System only monitors for faults and can't control a junction	Critical - Uses 'dial up' analogue communications which uses the BT PSTN network, BT state this will be switched off in 2025	
Common Database	Internal	Low - Cost of database is low in reelation to overall project spend	Low - Cost of database is low in reelation to overall project spend	Low - Common database vulrable to SBC IT issues.	Low - Changes to the system will require permissions from SBC IT	Low - Connections will have to bypass SBC Firewall settings	N/A	N/A	Medium - Reliant on SBC Systems to remain up-to-date and secure	Although an internal system is much less reliant on revenue commitments, it is also the least flexible option and introduces a third party. Any cost saving made will be lost through reduced benefits in the event of a period of downtime within the system
	Hosted	Low - Cost of database is low in reelation to overall project spend	High - Having the database in the cloud requires yearly subscription fees	High - Will not be affected by SBC IT issues	High - Full control over the system, and ease of making changes	High - Full access with no restrictions	N/A	N/A	High - Latest updates and systems continually applied	

Variable Message Signs	Full RGB	High - Most expensive of the options	Low - Once asset is purchased, revenue is dicatated by communications (see below)	Medium - Complexity is offset with relaibility, more complex processess have greater chance of failure	High - Full RGB range allows for any combination of signs/colours/ messages to be displayed at any time	High - Fully compatible with UTMC Systems	N/A	N/A	N/A	A mixture of all available technologies will be used for what best suits the situation
	2-Colour Matrix	Medium - Widely supplied industry standard for most road signage	Low - Once asset is purchased, revenue is dicatated by communications (see below)	High - Less complex display, low chance of failure with 2 LED colours	Medium - Limited signs and messages can be displayed with 2 colour range (Red/White or Red/Yellow)	High - Fully compatible with UTMC Systems	N/A	N/A	N/A	
	Smart ADS	Low - Least of exspensive of the options	Low - Once asset is purchased, revenue is dicatated by communications (see below)	High - Small propertion of the sign digital, less chance of failure	Low - Only small alpha/numerical inputs can be programmed	High - Fully compatible with UTMC Systems	N/A	N/A	N/A	
Comms	Private Fibre Optic	High - Installation requires excavation and heavy TM/plant	Low - SBC owned asset	High - Most robust network that has the lowest chance of losing communcations	Low - Physcial assets in fixed underground location	High - Fully compatible with UTMC Systems	N/A	N/A	High - Long lsating and reliable	In order to increase reliability on the network, a Mesh network will be used, but backed up by small lengths of fibre optic. This will reduce the number of potential points of failure but also ensures no unesscary cost is spent
	Mesh	Low - Small units can be mounted to existing infrastructure	Low - SBC owned asset	Medium - Wireless connections susceptible to interference, external units vulnerable to damage	High - Assets can be relocated with reletive ease	High - Fully compatible with UTMC Systems	N/A	N/A	Medium - New technology but may need updates and/or replacements	
	SIM	Low - Small units can be mounted to existing infrastructure	Low - SBC owned asset	Medium - Wireless connections susceptible to interference, external units vulnerable to damage	High - Assets can be relocated with reletive ease	High - Fully compatible with UTMC Systems	N/A	N/A	Medium - New technology but may need updates and/or replacements	

Appendix B. Technical Note: Spreadsheet Analysis Methodology

B.1. Spreadsheet Analysis Overview

This Technical Note details the methodology followed to create a bespoke spreadsheet tool that was used to evaluate the potential benefits of the proposed Swindon UTMC scheme.

The main purpose of the spreadsheet analysis was to quantify the anticipated journey time savings from the proposed UTMC intervention along the GWW corridor. The spreadsheet was created to enable impacts on car users and bus passengers to be distinguished in order to accommodate different assumptions on these two user groups.

The spreadsheet analysis comprises two separate sub-models; one model evaluating the journey time benefits of the UTMC scheme for car users and another model evaluating the benefits for bus users.

Overall the spreadsheet modelling approach is considered a proportionate means of illustrating how a UTMC system would work. It is a systematic approach to show how journey time savings may distribute across the network, and the resulting journey time benefits. Note that it is not a traffic simulation model and that delay savings by junction are an input to the spreadsheet model.

B.1.1. UTMC Scheme Overview

The proposed UTMC scheme is described in detail in the strategic case chapter of the business case document. In short, the proposed UTMC scheme encompasses the following three key elements:

- UTC Common Database;
- JTMS and communications network;
- Traffic Signals Compatibility Upgrades; and
- Variable Message Signs (VMS).

The JTMS will continuously record and monitor journey times across the UTMC core area. Traffic congestion on the network can therefore be detected where journey times on a particular link(s) exceed a certain pre-determined level. The UTMC system will 'react' accordingly by adjusting traffic signal timings at adjacent junctions in order to temporarily hold traffic upstream of the congested junction(s) and/or redistribute traffic demand to neighbouring links within the core area, hence reducing the overall average delay experienced on the local network.

The UTMC scheme will also incorporate upgrades to the traffic signalised junctions, e.g. revalidation, updating, refurbishing, and/or adding to a SCOOT region(s), thereby providing some journey time benefit at specific junctions along the GWW corridor.

The spreadsheet tool evaluates the journey time benefits that the UTMC scheme is likely to bring to the GWW corridor as a result of the combined effect of revalidation, updating and refurbishment of specific traffic signalised junctions, and the more general coordination of traffic signalised junctions within the local network.

B.1.2. Spreadsheet Analysis Scenarios

The spreadsheet analysis considered the weekday AM Peak Hour (08:00 – 09:00), PM Peak Hour (17:00 – 18:00) and Inter Peak average hour (10:00 – 16:00). The key outputs obtained from the spreadsheet analysis were figures representing the monetised value of the reduction in total vehicle delay on the local network, for an average weekday.

The spreadsheet analysis was carried out for 2021 and 2036 scenarios (with and without the UTMC scheme). Sense-checks were carried out to ensure that the overall journey time benefits suggested by the spreadsheet analysis was realistic; for instance, by comparing with relevant research papers and varying input parameters to ensure robustness of the model assumptions.

B.2. Car Users' Spreadsheet Model

B.2.1. Methodology Overview

The following key information formed the basis for the car users' spreadsheet sub-model:

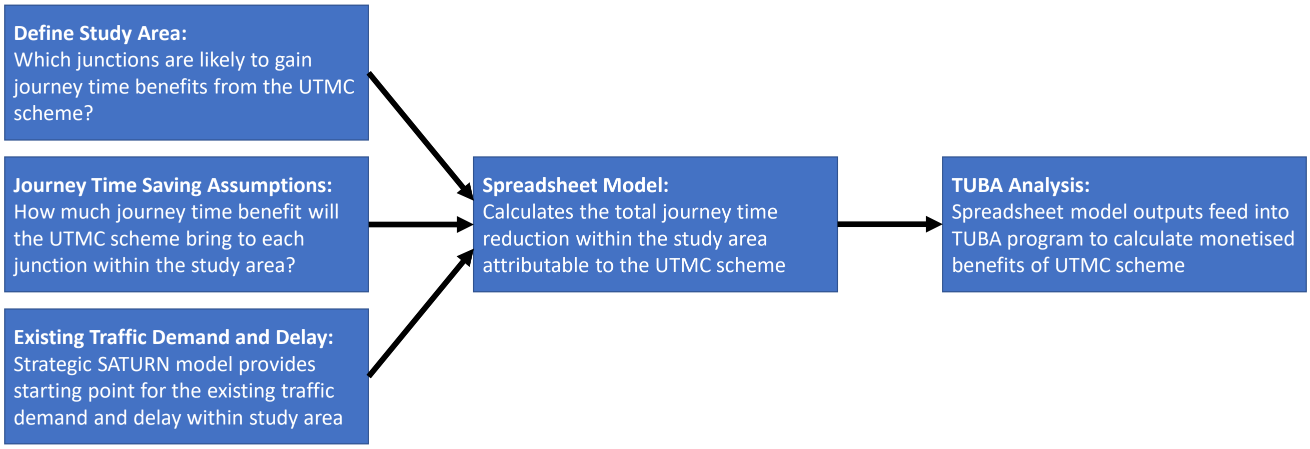
- **Study Area**: identification of the particular junctions along the GWW corridor that are likely to benefit from the UTMC scheme improvements, in terms of improved operation;
- **Journey Time Saving Assumptions**: for each junction within the study area, assumptions were made as to the expected reduction in queuing delay resulting from the UTMC scheme; and
- **Existing Traffic Demand and Delay**: Origin-Destination matrices and average junction (queuing) delay information were extracted from Swindon Borough Council's (SBC's) strategic SATURN model to form the starting point for the spreadsheet tool.

The spreadsheet tool used this key information to calculate, for each junction within the study area, an estimate of the anticipated total reduction in queuing delay that could realistically be attributed to the UTMC scheme. An overall journey time saving for the local network was calculated by adding together the journey time savings for all junctions within the study area.

The 'without scheme' and 'with scheme' journey time data, together with traffic flow data were inputted into the TUBA program to derive a monetised value for the journey time saving benefits attributed to the scheme.

The car users' spreadsheet sub-model methodology described above is shown by the diagram in Figure 6-2. Subsequent sections of this Technical Note describe in more detail how the spreadsheet model was developed, including the justification of the assumptions made.

Figure 6-2 – Car Users' Spreadsheet Model Methodology Overview



B.2.2. Study Area and Journey Time Savings

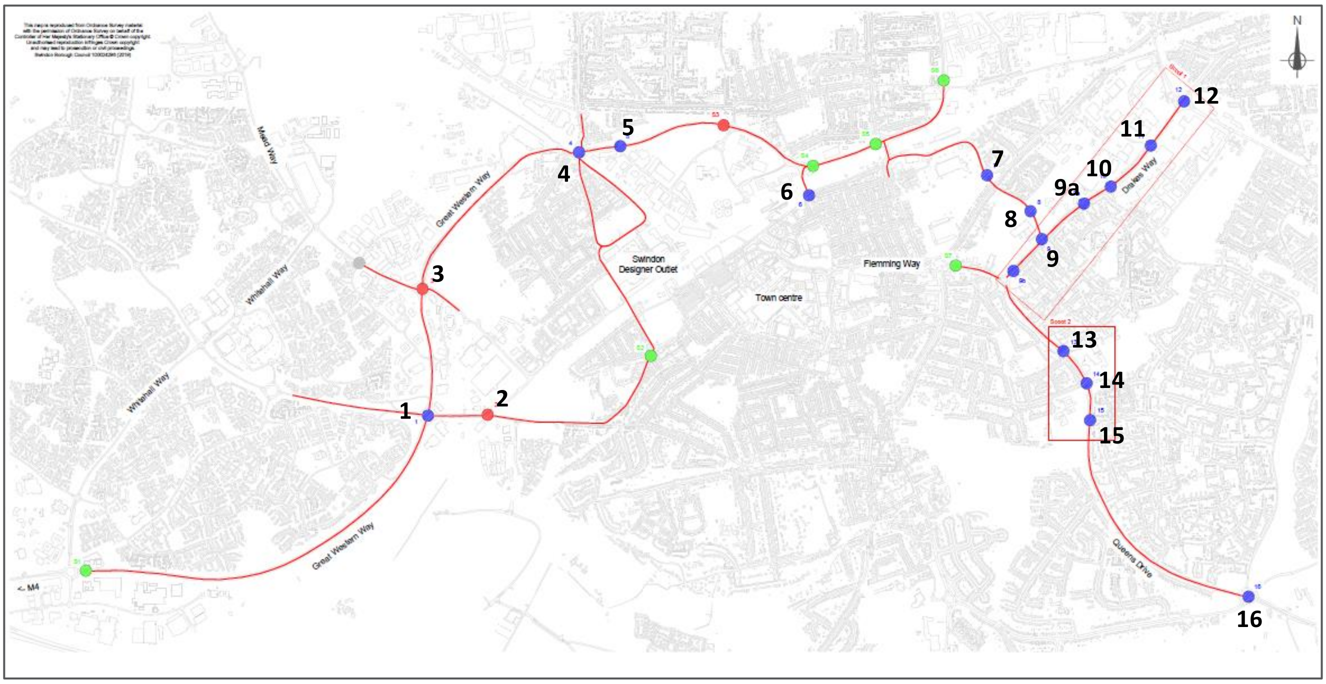
It is understood that the UTMC scheme is likely to bring two 'orders' of benefits in terms of reducing journey times, as follows:

- **'First-Order' Impacts at Isolated Junctions**: the UTMC scheme will reduce delay at junctions due to revalidating, updating and refurbishing traffic signal configurations. Particular junctions may also be added to a SCOOT network(s) if appropriate; and
- **Network-Wide 'Second-Order' Impacts**: the UTMC scheme will provide journey time benefits from the management of traffic in a coordinated, efficient way. Overly-congested junctions will be relieved by temporarily preventing some traffic from travelling through adjacent junctions. Although this will lead to a corresponding increase in delay at nearby junctions, it is likely to result in an overall reduction in total delay on the local network as a whole.

Note that as the redistribution method considers the average delay at each junction regardless of the traffic flow, a scenario can occur where delay could be redistributed from a junction with a high average delay and relatively low traffic flow to a neighbouring junction(s) with lower average delay but higher flow. This reduces the overall second-order benefits because the increase in delay experienced by the neighbouring junction(s) applies to a greater number of vehicles. Conversely, a scenario may occur where delay could be redistributed from a junction with a high average delay and relatively high traffic flow to a neighbouring junction(s) with lower average delay and lower flow. This has the opposite effect of increasing the second-order benefits, as the increase in delay experienced by the neighbouring junction(s) applies to fewer vehicles.

SBC has identified 17 key junctions where traffic signal improvements are planned as part of the UTMC scheme, as shown in Figure 6-3 and hence will experience some degree of journey time benefit from the scheme (i.e. first-order benefits). The proposed JTMS network (i.e. where journey time measuring equipment is to be located) covers a slightly greater extent than that shown in Figure 6-3, but for the purposes of the spreadsheet model it was considered that the network-wide benefits would realistically (and conservatively) be experienced across this sub-network of 17 junctions only, and therefore this core network constitutes our study area.

Figure 6-3 – Great Western Way Corridor – An Illustration of the Proposed UTMC Core Area



B.2.2.1. Journey Time Savings at Isolated Junctions (First-Order Benefits)

Traffic signal upgrades to be included as part of the UTMC scheme are likely to involve:

- Updating and refurbishing existing out-of-date traffic signal equipment;
- Reconfiguring existing out-of-date MOVA configurations; and
- Including particular junctions within SCOOT regions.

Evidencing of Journey Time Savings

The spreadsheet considered the potential reduction in traffic delay arising from the revalidation, updating and refurbishing of traffic signals, adding junctions to a SCOOT network(s). Relevant research papers were reviewed to assist in forming the assumptions for estimating the potential reduction in journey times at key junctions along the GWW corridor, as summarised below.

DfT Advisory Leaflet: The 'SCOOT' Urban Traffic Control System

Key findings from the 1999 DfT Advisory Leaflet outlining the benefits of SCOOT are summarised as follows:

- Journey time surveys in specific locations found that SCOOT control reduced delays substantially compared with Vehicle Actuation (VA) signal operation, by between 23% and 30%;
- As fixed-time traffic signal settings tend to go out of date as traffic patterns change, the benefits of SCOOT over an older fixed-time are greater. On average, it is estimated that SCOOT could reduce delays by approximately 12% against up-to-date signal settings and 20% over a typical fixed-time system;
- SCOOT is able to 'react' to unusual traffic conditions (for example, large traffic volumes caused by a nearby sports event), leading to large reductions in delay over fixed-time signal settings (61% reduction in delay in example cited); and

SCOOT can include facilities to prioritise selected vehicles such as buses. Trials in London showed additional average reductions in delay to buses of 3 to 5 seconds per bus per junction. At other particular sites, much larger benefits were found.

DfT Advisory Leaflet: The 'MOVA' Signal Control System

Key findings from the 1997 DfT Advisory Leaflet outlining the benefits of MOVA are summarised as follows:

- Trials have shown that MOVA reduces delays by an average of 13% compared with VA signal operation. Benefits are likely to be largest when compared with VA signal control that has not been recently validated; and
- Analysis of personal injury accidents at MOVA sites showed a small overall reduction in accidents compared with the period prior to installation, which was not statistically significant. However, when major, high-flow, high-speed junctions were examined as a separate group, a notable reduction in injury accidents was found.

Survey of MOVA and SCOOT Operation at M42 Junction 6

Key findings from the 2007 TRL Report comparing MOVA and SCOOT are summarised as follows:

- A comparison of MOVA versus SCOOT at a large motorway junction roundabout showed that MOVA reduced delay at the roundabout (compared with SCOOT) by 6% in the weekday Inter Peak period and by 10% on Sundays.
- Reductions in delay at the roundabout were measured at other times of day surveyed but these were not statistically significant.

West Yorkshire Integrated Urban Traffic Management Control (UTMC) Scheme Summary

Key findings from the West Yorkshire Integrated Urban Traffic Management Control (UTMC) Scheme Summary document are summarised as follows:

As part of the economic case for the West Yorkshire UTMC scheme, journey time savings were calculated for the AM, PM and Inter Peak based on Trafficmaster data for defined routes. Delay at junctions was captured as the difference between the overnight period and the peak period. A 12% reduction in delay for SCOOT or 13% delay saving for MOVA upgrades was calculated at particular junctions to identify the journey time saving.

First-Order Journey Time Saving Assumptions

An assumption of the journey time (i.e. queuing delay) reduction associated with traffic signal improvements was chosen for each junction, using the above research as a guide. The research provides a useful indication of the potential benefits of introducing MOVA/SCOOT to traffic signalised junctions. However, the delay percentages quoted in the research typically apply to junctions where MOVA/SCOOT replaced Vehicle Actuation (VA) signal operation; this is not typically the same situation as with the Swindon UTMC scheme, where the majority of junctions in the study area are already operating with MOVA. Therefore, it is likely that the delay reduction achieved from upgrading and reconfiguring the traffic signals in the UTMC core area will be somewhat less than that quoted in the above research.

Anecdotal evidence (i.e. observations of junction operation) was also used to assist the journey time reduction assumptions. Aspect Traffic Solutions Ltd was commissioned by SBC to undertake audits of key junctions in August/September 2019 to inform the development of the UTMC scheme; these audits recorded the existing traffic signal operation method (e.g. MOVA, VA, etc.), observations on the current junction operation and some recommendations as to how junction operation could be improved.

Worked examples in this chapter are based on Sensitivity Test 1. The assumed first-order journey time savings for each junction that were used in the spreadsheet tool are summarised in Table 6-5. For simplicity, it was assumed that the same percentage reduction in delay applied to all vehicles passing through the junction, regardless of the turning movement undertaken. The junction references in the table correspond to the plan shown in Figure 6-3. In the vast majority of cases, a journey time reduction of 5% was considered realistic for junctions seeing an upgrade or reconfiguration of MOVA, based on the above evidence.

Table 6-5 – First Order Junction Delay Reduction Assumptions Example for Sensitivity Test 1

Junction No.	Junction Name	Junction Type	Existing Traffic Control	UTMC Traffic Control (Proposed)	Assumed Delay Reduction			Comments
					AM Peak	PM Peak	Inter Peak	
1	A3102 / B4006 / B4553 'Mannington' roundabout	Roundabout	Part-Time Traffic Signals, MOVA	Update MOVA installation	5%	5%	5%	-
2	A3102 / Penzance Drive junction	T-Junction	VA with RTEM Bus Priority	VA with RTEM Bus Priority	0%	0%	0%	Assume no benefits due to bus priority requirements
3	B4006 / Mead Way / Paddington Drive 'Meads' roundabout	Roundabout	Full-Time Traffic Signals, MOVA	Update MOVA installation	5%	5%	5%	-
4	B4006 / B4289 / Kemble Drive / Rodbourne Road ' Bruce St Bridges' roundabout	Roundabout	Part-Time Traffic Signals, MOVA	Update MOVA installation	5%	5%	5%	-
5	B4289 / Newcombe Drive junction	T-Junction	Full-Time Traffic Signals, MOVA	Update MOVA installation	5%	5%	5%	-
6	Corporation Street / Station Road junction	Crossroads	Traffic Signals? (Google Maps)	Not known	5%	5%	5%	-
7	A4313 Ocotal Way / Shrivenham Road junction	T-Junction	Full-Time Traffic Signals, MOVA	Upgrade traffic signal equipment	5%	5%	5%	-
8	A4313 Ocotal Way / St Joseph's College junction	T-Junction	Full-Time Traffic Signals, MOVA	Upgrade traffic signal equipment	5%	5%	5%	-
9	A4312 Drakes Way / Ocotal Way junction	T-Junction	Full-Time Traffic Signals, MOVA	Add to SCOOT region	5%	5%	5%	-
9a	A4312 Drakes Way / Penny Lane junction	T-Junction	Full-Time Traffic Signals, MOVA	Add to SCOOT region	5%	5%	5%	-
10	A4312 Drakes Way / Marlowe Avenue junction	T-Junction	Full-Time Traffic Signals, MOVA	Add to SCOOT region	5%	5%	5%	-
11	A4312 Drakes Way / Garrard Way junction	T-Junction	Full-Time Traffic Signals, MOVA	Add to SCOOT region	5%	5%	5%	-
12	A4312 Drakes Way / B4006 / Swindon Road 'Greenbridge' roundabout	Roundabout	Full-Time Traffic Signals, MOVA	Add to SCOOT region	5%	5%	5%	-
13	A4259 Queens Drive / Frobisher Drive junction	T-Junction	Full-Time Traffic Signals, MOVA	Add to SCOOT region	5%	5%	5%	-
14	A4259 Queens Drive / New College Drive junction	Crossroads	Full-Time Traffic Signals, MOVA	Add to SCOOT region	5%	5%	5%	-
15	A4259 Queens Drive / Whitbourne Avenue junction	T-Junction	Full-Time Traffic Signals, MOVA	Add to SCOOT region	5%	5%	5%	-
16	A4259 / B4006 / Shaftesbury Avenue 'Coate' roundabout	Roundabout	Full-Time Traffic Signals, MOVA	Update MOVA installation	5%	5%	5%	-

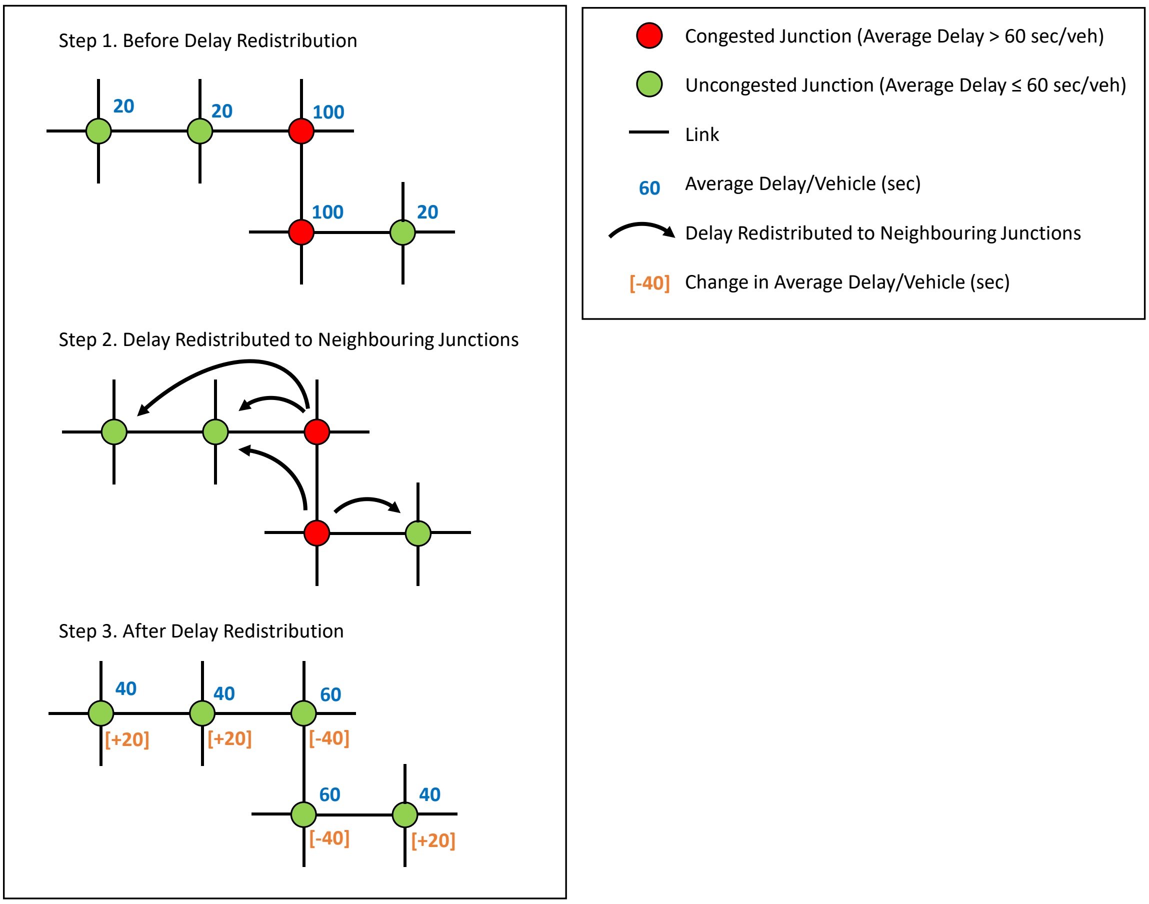
B.2.2.2. Network-Wide Journey Time Savings (Second-Order Benefits)

The proposed JTMS is intended to continuously record and monitor journey times across the UTMC core area; hence, traffic congestion on the network can therefore be detected where journey times along a particular link(s) increase significantly. The UTMC system will react accordingly by adjusting traffic signal timings at adjacent junctions in order to temporarily hold traffic upstream of the congested junction(s) and/or redistribute traffic demand to neighbouring links within the core area, thereby reducing the overall average delay experienced on the local network. In the absence of a sophisticated model to quantify the network-wide benefits of the scheme arising from this responsive re-distribution of traffic queues across the network, a simplified method was developed to estimate this network-wide reduction in delay.

The UTMC system would function by controlling traffic flows at any combination of junctions within the core area, depending on the prevailing traffic conditions. For the purposes of the spreadsheet analysis it was considered appropriate to assume that network-wide benefits from coordinated traffic signals could be achieved at the 17 junctions already identified as within the study area. In the absence of any available evidence that quantifies the benefits of coordinated traffic signals within a UTMC scheme, the assumed overall reduction in delay associated with network-wide benefits was conservatively limited to less than 2% across the study area.

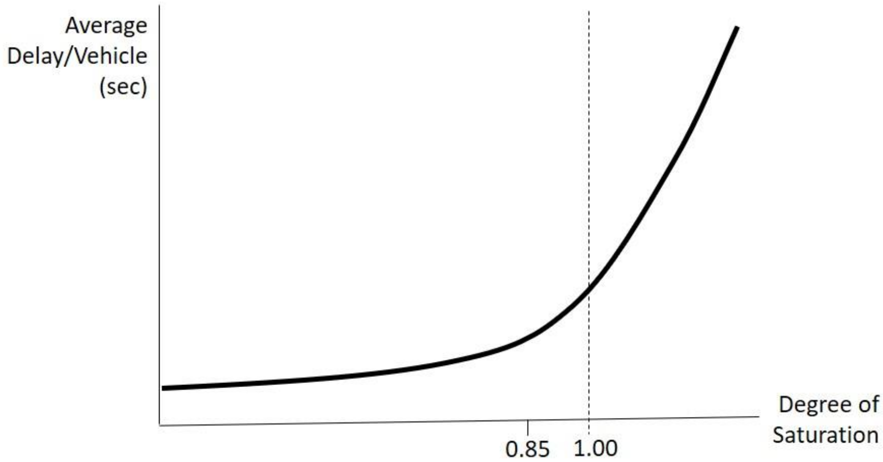
The schematic diagram of Figure 6-4 shows how the spreadsheet model represented network-wide journey time savings associated with the UTMC scheme. The spreadsheet first identifies which junctions are 'congested', i.e. those junctions where the average delay per vehicle (according to SBC's strategic SATURN model) exceeded a predetermined threshold. In Figure 6-4, the threshold is arbitrarily set at 60 seconds per vehicle and so two of the junctions are 'congested' (and are coloured red in Step 1 of the diagram). The spreadsheet then attempts to redistribute a proportion of this 'excess delay' to neighbouring junctions (Step 2), resulting in a reduction in delay at the congested junctions and a corresponding increase in delay at the neighbouring junctions (Step 3). It was assumed that the overall impact on the sub-network would be an overall reduction in the total delay – in this example, the delay reduces by a total of 80 seconds per vehicle at the congested junctions with a corresponding total delay increase of 60 seconds per vehicle at neighbouring junctions. This step is explained in more detail in the following paragraphs.

Figure 6-4 – Schematic Representation of Delay Redistribution in the Spreadsheet Tool



Queuing delay at junctions is not linearly proportional to demand but is a function of the degree of saturation (i.e. ratio of demand to junction capacity) of the junction approach. According to traffic queuing theory[37], the average delay per vehicle tends to increase markedly beyond a degree of saturation of approximately 0.85, as shown by the schematic chart of Figure 6-5. The redistribution of delay from congested to uncongested junctions, as shown in Figure 6-4, effectively transfers some demand from the high-gradient part of the curve (i.e. where the degree of saturation is over 0.85) to the low-gradient part of the curve, resulting in a more efficient distribution of traffic and subsequently an overall reduction in average delay across the local network.

Figure 6-5 – Schematic Chart – Average Delay per Vehicle v Degree of Saturation



The spreadsheet model attempts to redistribute some of the delay from congested junctions to uncongested junctions in a simplified way. To carry out this redistribution, the spreadsheet requires the following two input parameters:

- **Delay Threshold** (seconds/vehicle) – delay redistribution from congested to uncongested junctions is attempted only for junctions where the average delay exceeds this level; and
- **Delay Reduction Ratio** – a number between 0 and 1 indicating the ratio of the change in delay before and after it is redistributed from congested to uncongested junctions. In the worked example above (Figure 6-4) a delay reduction ratio of 0.75 was assumed, (i.e. total increase in delay at uncongested junctions (60 seconds) = 0.75 x total reduction in delay at congested junctions (80 seconds)).

It is acknowledged that attempting to model this redistribution effect within a spreadsheet is oversimplifying the complexity of the situation, as the value of these two input parameters are unknown, will change constantly depending on the prevailing traffic conditions, and will be different for each junction approach. The spreadsheet was automated so that numerous combinations of the parameters could be tested, resulting in a conservative assumption for the overall network-wide delay that could be achieved. This approach attempts to mimic (albeit in a simplified way) how the UTMC scheme would operate, in that it does show a greater benefit the more congested the network becomes, as the UTMC scheme would do in reality.

Figure 6-6 provides a worked example to explain in detail the calculation steps involved when the spreadsheet attempts to redistribute surplus delay from congested junctions to uncongested junctions on the local network.

[37] Transport and Road Research Laboratory (TRRL) Report: ‘Traffic Queues and Delays at Road Junctions’, R M Kimber, E M Hollis (1979)

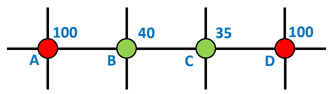
Figure 6-6 – Spreadsheet Model Network-Wide Delay Redistribution Worked Example

Worked Example for Sensitivity Test 1

Input Parameters:
Delay Reduction Threshold: X = 60 sec/veh
Delay Redistribution Factor: Y = 0.75

↓

Average Junction Delay Before 'Delay Redistribution' Attempted:
Junction A: D_A = 100 sec/veh
Junction B: D_B = 40 sec/veh
Junction C: D_C = 35 sec/veh
Junction D: D_D = 100 sec/veh



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Consider Congested Junction A:
Average Delay at Junction A exceeds Delay Reduction Threshold (DA > X)
Delay to redistribute from Junction A = DA – X = 100 – 60 = 40 sec/veh
Delay to transfer to neighbouring uncongested junctions = (DA – X) x Y = (100 – 60) x 0.75 = 30 sec/veh

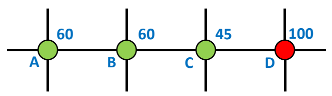
↓

Attempt Transfer of Excess Delay at Junction A to Junction B (nearest neighbouring junction):
Spare Capacity of Junction B = X – DB = 60 – 40 = 20 sec/veh.
Therefore we can transfer 20 seconds of delay from Junction A to Junction B.

↓

Attempt Transfer of Remaining Excess Delay at Junction A to Junction C (next nearest neighbouring junction):
Spare capacity of Junction C = X – DC = 60 – 35 = 25 sec/veh
Therefore we can transfer remaining 10 seconds of delay from Junction A to Junction C

We now have the following delay on the network:
Junction A: DA = 60 sec/veh
Junction B: DB = 60 sec/veh
Junction C: DC = 45 sec/veh
Junction D: DD = 100 sec/veh



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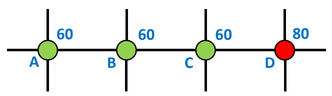
Now Consider Congested Junction D:
Average delay at Junction A exceeds Delay Reduction Threshold (DD > X)
Delay to redistribute from Junction D = DD – X = 100 – 60 = 40 sec/veh
Delay to transfer to neighbouring uncongested junctions = (DD – X) x Y = (100 – 60) x 0.75 = 30 sec/veh

↓

Attempt Transfer of Excess Delay at Junction D to Junction C (only remaining junction with spare capacity):
Spare Capacity of Junction C = X – DC = 60 – 45 = 15 sec/veh
We can transfer 20 sec/veh to Junction C (as this becomes 20 x 0.75 = 15 sec/veh)
The remaining 20 sec/veh has to remain with Junction D, as there is no spare capacity on the network

↓

We end up with the following redistributed delay:
Junction A: 60 sec/veh
Junction B: 60 sec/veh
Junction C: 60 sec/veh
Junction D: 80 sec/veh



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Across the network we have:
Total delay before redistribution = 100 + 45 + 35 + 100 = 280 sec/veh
Total delay after redistribution = 60 + 60 + 60 + 80 = 260 sec/veh
Total reduction in delay across network = 280 – 260 = 20 sec/veh

B.2.2.3. Combined Journey Time Savings

By simply adding together the assumed first and second-order, we derived an assumed level of delay reduction for each junction in the study area. This process was carried out for the AM peak, PM peak and Inter Peak periods, for base year 2021 and future year 2036.

B.2.3. The Spreadsheet Tool

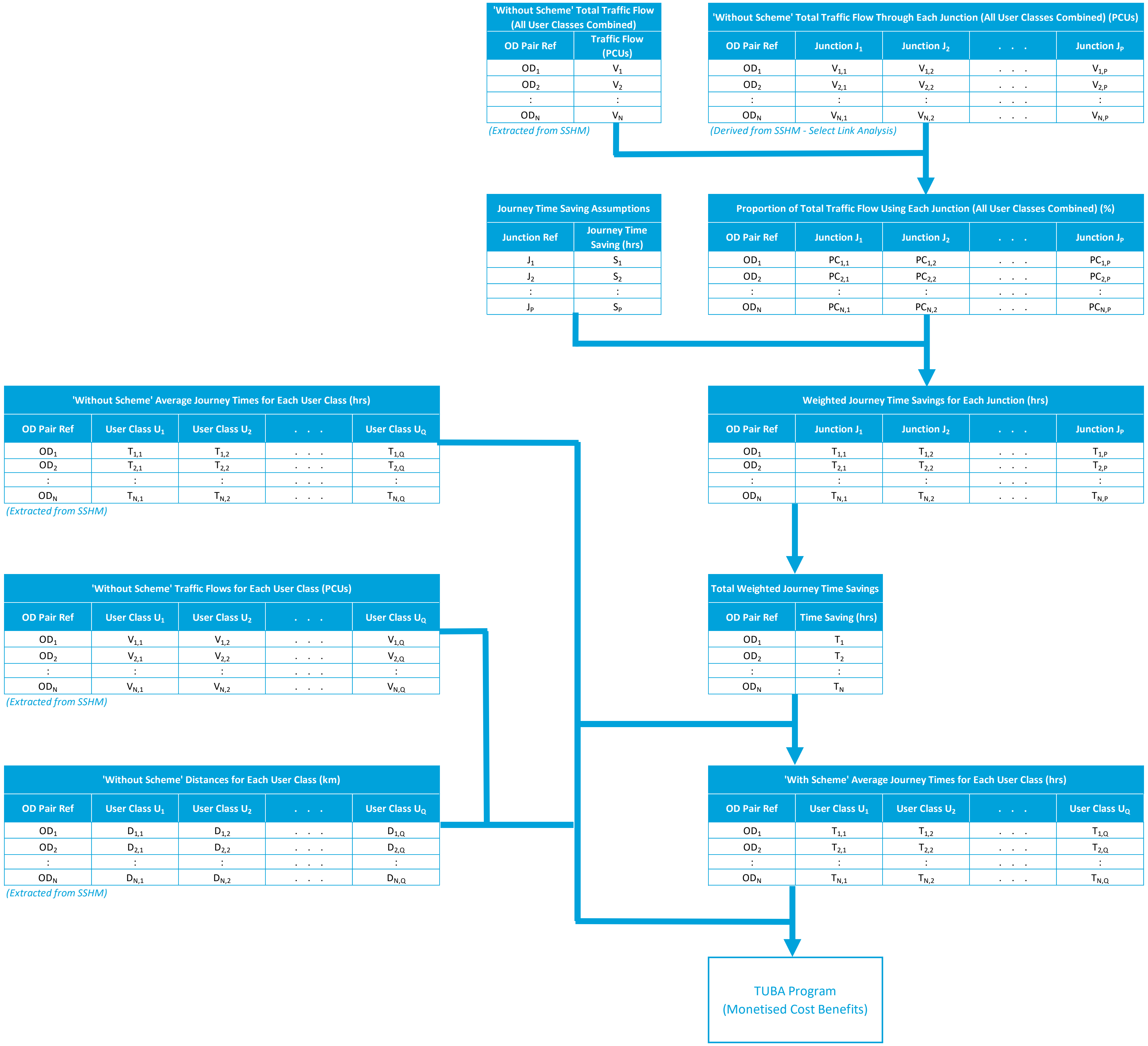
A spreadsheet tool was developed to analyse the potential journey time benefits of the UTMC scheme. Due to the large amount of data processing required for the tool (2 years, 3 time periods, 11 user classes and 164,025 origin-destination pairs), the tool was reproduced and run in R, although a tool for checking the process was also produced in Excel for transparency, with a subset of outputs from R reproduced to be put through Excel.

Figure 6-7 provides a diagram showing the logic behind the highway spreadsheet calculations. Journey time savings for car users are monetised within the TUBA program, which requires the following input files for both the 'Without Scheme' and the 'With Scheme' scenarios:

- Traffic flows for all Origin-Destination (OD) pairs within the strategic highway model network;
- Average journey times for all OD pairs within the strategic highway model network; and
- Distances between for all OD pairs within the strategic highway model network.

For the 'Without Scheme' scenario, these were skimmed directly from the SSHM. For the 'With Scheme' scenario, flows and distances were not amended, and journey time skims were amended according to the process in Figure 6-7. Journey time savings assumptions were made for each junction according to the process in Section B.2.2B.2.2, with the proportion of flow for each origin-destination pair passing through each junction used to weight the savings appropriately, and then the overall saving for each origin-destination pair was applied to the 'Without Scheme' values to give the 'With Scheme' values.

Figure 6-7 – Highway Spreadsheet Model



B.3. Bus Users Spreadsheet Model

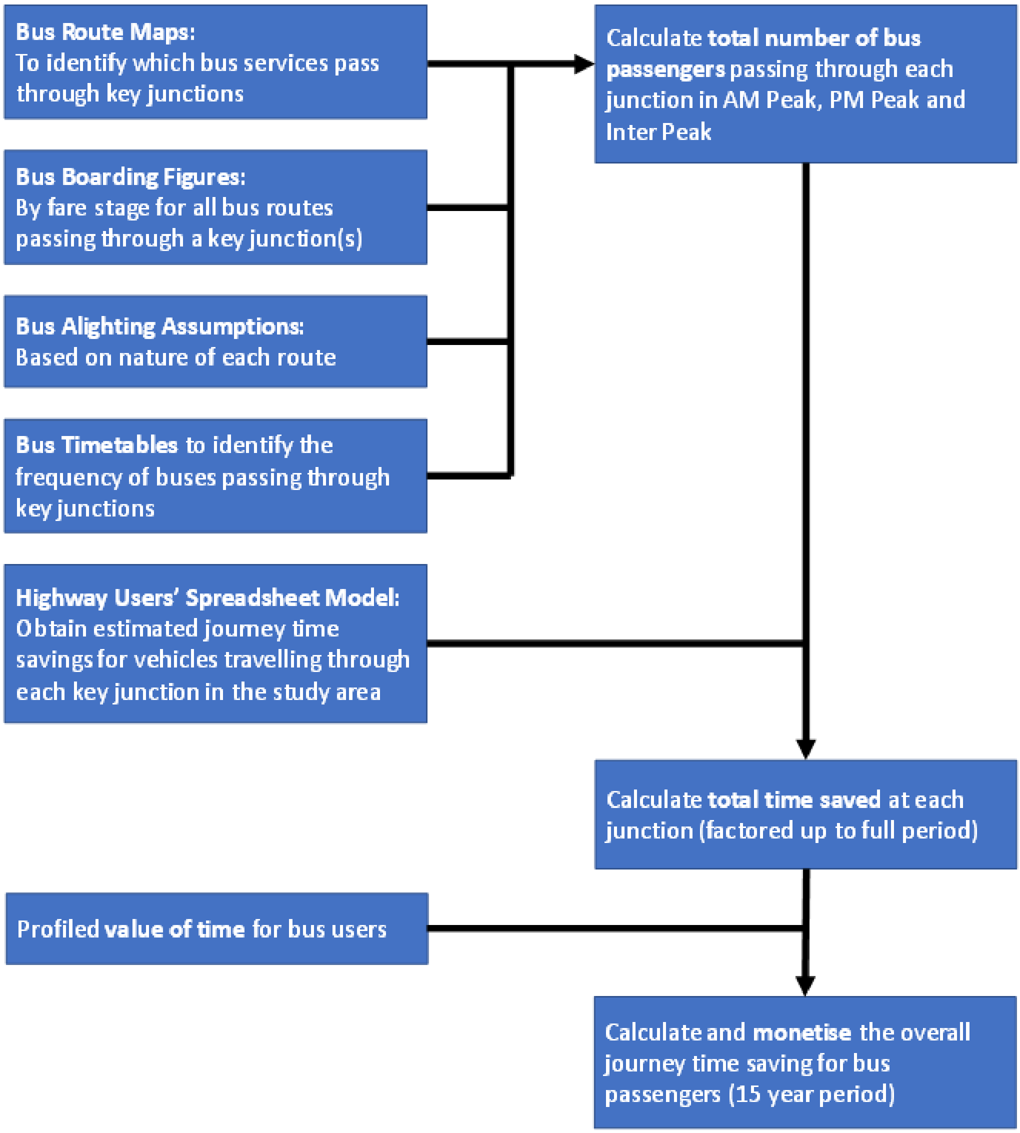
B.3.1. Methodology Overview

The bus users' spreadsheet sub-model involves a relatively simple estimation of the number of bus passengers likely to benefit from the UTMC scheme in terms of reduced journey times. Firstly, the highway sub-model as described in Section B.2B.2 was used to derive estimates for the delay reduction that would be experienced by vehicles passing through each key junction in the study area.[38] Bus patronage data obtained from bus operators combined with publicly available bus frequency and route maps was used to derive an estimate for the total number of bus passengers passing through each junction during the AM Peak, PM Peak and Inter Peak periods and hence an overall journey time saving for bus passengers was calculated.

In order to estimate the number of bus passengers passing through each junction it was necessary to make assumptions as to where passengers alight, as this could not be ascertained from the data, which only consisted of boarding numbers per fare stage. Sense-checks were also carried out to ensure that the calculated average bus occupancy assumed was possible and realistic (i.e. not exceeding or close to 100% occupancy).

The bus users' spreadsheet sub-model methodology described above is shown by the diagram in Figure 6-8.

Figure 6-8 – Bus Users' Spreadsheet Model Methodology Overview



[38] Note that in sensitivity tests, some journey time savings were then amended manually to test bus priority.

B.3.2. Study Area and Assumptions

For the bus users' spreadsheet model, the same study area as defined for the car users' model was used, as shown in Figure 6-3. It was also assumed that the journey time benefits calculated for each of the key 17 junctions in the highway model applied to buses passing through these junctions.

B.3.2.1. Bus Passenger Assumptions

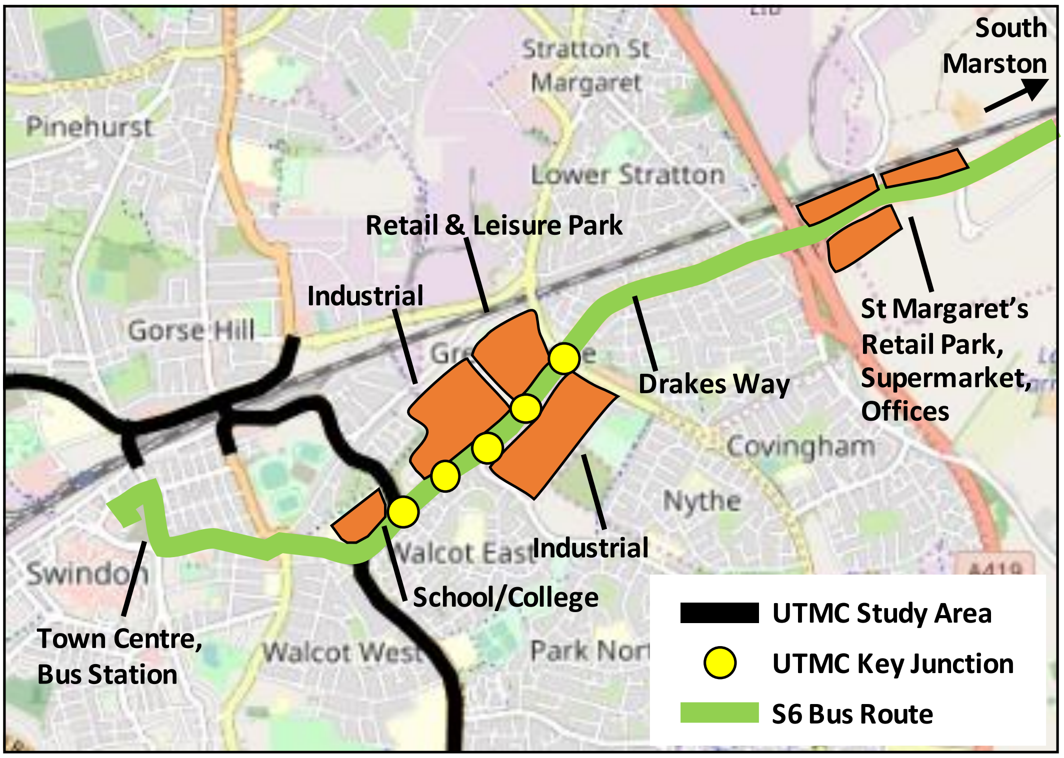
Stagecoach West

Passenger boarding data was obtained from Stagecoach West for all bus routes that were identified to pass through at least one of the 17 junctions comprising the study area. The data showed the annual (August 2018 – August 2019) number of passengers recorded boarding at each fare stage along each route, for each of the AM Peak, PM Peak and Inter Peak periods. This data was used as the starting point for calculating an estimate for the total number of bus passengers that would benefit from the UTMC scheme in terms of reduced traffic delay.

The bus data provided by Stagecoach West did not include alighting data; therefore, it was necessary to make some assumptions for the proportions of passengers alighting at each fare stage. Considering each bus route and each fare stage separately, we examined the nature of the bus route to make a speculative estimate of the proportion of passengers that would alight at different points along the route.

For example, consider Stagecoach West service S6 between South Marsden and Swindon Town Centre, as shown schematically in Figure 6-9. Of the passengers boarding at the first fare stage in the village of South Marsden (to the north-east of Swindon) and travelling inbound towards the town centre, it would be reasonable to assume that a notable proportion of passengers would alight at St Margaret's Retail Park and adjacent supermarket/offices on the outskirts of the town. A large proportion of passengers would also alight at various points along Drakes Way, as there are numerous retail/leisure/industrial sites, a school and a college on this section of the route. We could assume that all remaining passengers would continue on board until they reach Swindon Town Centre or Swindon bus station.

Figure 6-9 – Example of Alighting Assumptions on S6 Bus Route (South Marston - Swindon)



By carrying out the above process for all relevant bus routes, estimates for the total (annual) number of passengers passing through each of the key junctions (in any direction) was derived.

Annualised bus boarding data is limited because it does not indicate the proportion of passengers alighting at each fare stage. We therefore have to make an 'educated guess' for the alighting profile. However, we were able to sense-check our results to some degree by calculating the average bus occupancy (for all services passing through a particular junction) and considering if this was realistic; for example, Figure 6-10 provides a worked example showing how we checked the derived passenger numbers passing through the Mannington Roundabout junction. We used publicly available bus timetables to calculate the number of buses passing through the junction and used this to estimate the average bus occupancy over the year. A range of average occupancies were calculated, with 35% (as in the worked example) being the highest; it is not possible to determine if the calculated occupancies are accurate but as they are fairly low this gives us some confidence that the bus figures are conservative and therefore not overestimating the benefits of the UTMC scheme.

Figure 6-10 – Worked Example: Bus Average Occupancy Check for Sensitivity Test 1

Junction Name: Mannington Roundabout
Bus Route: 10 (Freshbrook to Kingstown)
Annual No. Passengers Passing Through Junction (AM Peak Hour): 22,101
(see table below for calculation)

Fare Stage	No. Boarding Passengers [A]	% Passengers Travelling Through Junction [B]	No. Passengers Travelling Through Junction [A] x [B]
Windmill Hill	126	80%	101
Link Centre	777	80%	622
Freshbrook	18,152	90%	16,337
Toothill Tavern	5,601	90%	5,041
TOTAL			22,101

Typical No. Buses Passing Through Junction in Peak Hour:
Weekdays (253 in a year): 5
Saturdays, Sundays and Bank Holidays (106 in a year): 3
Annualised No. Buses Passing Through Junction in Peak Hour:
(253 x 5) + (106 x 3) = 1,583
Assumed Bus Capacity: 40 (single-decker bus)
Average Bus Occupancy: 22,101 / (1,583 x 40) = 35%

Swindon Bus Company

Passenger boarding data was not available for bus services operated by Swindon Bus Company. Publicly available data (i.e. route maps and timetables) were therefore used as a starting point to derive estimates for the number of passengers on these services travelling through each of the key junctions in the study area.

Bus timetables and route maps were examined to calculate the number of Swindon Bus Company services passing through each junction (in any direction) in the AM Peak, PM peak and Inter Peak periods. Swindon Bus Company operates a fleet of single-decker buses; assuming a capacity of 40 passengers and conservatively assuming an average occupancy of 13% (i.e. the median of the occupancies calculated for the Stagecoach West services, as per the example calculation above), we calculated for each junction, an estimate number of passengers passing through.

Factoring Passenger Numbers for Spreadsheet Model

Stagecoach West bus data was combined as a single annualised figure for weekdays and weekends. An estimate for the weekday only passenger numbers was derived by considering the proportion of days in a year that are weekdays (i.e. 253 out of 365) and the relative frequency of services on weekdays and weekends.

For example, suppose 10,000 passengers passed through a particular junction each year during the AM Peak Hour, with typically 4 services per hour running weekdays and 2 services per hour on weekends and Bank Holiday Mondays. We would assume that the number of passengers travelling on a weekday was:

(4 x 253) / ((4 x 253) + (2 x 106)) = 8,268 passengers (i.e. 83% of 10,000)

From this, we then calculated the average weekday number of bus passengers passing through each junction in the AM, PM and Inter Peak hours.

B.3.3. The Spreadsheet Model

Once the assumed number of passengers passing through each key junction was derived, as described above, the calculation of monetised bus users' benefits within the spreadsheet tool was relatively straightforward.

Firstly, total bus journey time benefits for all users was calculated by multiplying the journey time saving for 2021 by the patronage for each modelled hour, then this figure was factored up to the full period and annualised to calculate the total weekday bus passenger journey time benefits into an annual total. No benefits were claimed for either the off-peak period (between 1900 and 0700) or weekends.

This total journey time savings for 2021, was then multiplied by a Value of Time for bus passengers, taken from TAG Databook Table A1.3.2, with purpose splits from Table A.1.3.4, to give monetised journey time savings over the 15-year appraisal period to 2035.

Sensitivity testing for bus user benefits was also straightforward as the monetised value of bus passenger benefits is proportional to the assumed number of bus passengers. A reduction in bus passenger numbers by (say) 10% would lead to a corresponding 10% reduction in the monetised benefits.

Appendix C. Core Scenario - Spreadsheet Model Input Assumptions

The figures included in this Appendix present the spreadsheet model input assumptions for the core scenario. There are six figures which present the input assumptions separately for the AM Peak Hour, PM Peak Hour and Interpeak Average Hour, for both the scheme opening year 2021 and future year 2036. A bar chart is provided for each of the 17 key UTMC junctions to show the following:

- 'Without Scheme' average delay;
- Assumed change in delay due to 'first order' impacts i.e. due to changes at isolated junctions;
- Assumed change in delay due to 'second order' impacts i.e. due to benefits from the management of traffic in a coordinated, efficient way; and
- 'With Scheme' average delay i.e. the 'Without Scheme' delay combined with the change in delay due to first and second order impacts.

The borders of the bar charts are coloured green to indicate a net reduction in delay at a junction, red to indicate a net increase in delay and grey to show no change in delay.

In both forecast year and in all time periods, significant amounts of delay are redistributed from the core junction 7 to junctions on the periphery of the network such as junctions 11, 12, 14 and 15.

A description of the key points shown by the figures is provided as follows:

AM Peak Hour 2021

Junctions 1, 11, 12, 14 and 15 all experience increases in delay most of which are slight. These junctions are largely on the periphery of the network and associated with the large decrease in delay at junction 7 (-28 sec/PCU) which is at the core of the network.

PM Peak Hour 2021

There is an increase in delay at Junction 12 (+3 sec/PCU) and Junction 15 (+7 sec/PCU), this is due to a corresponding decrease in delay at junction 7 (-28 sec/PCU).

Inter Peak Average Hour 2021

There is an increase in delay at Junction 12 (+4 sec/PCU) and Junction 15 (+10 sec/PCU), this is due to a corresponding decrease in delay at junction 7 (-15 sec/PCU).

AM Peak Hour 2036

Junctions 1, 11, 14 and 15 all experience increases in delay most of which are slight. These junctions are largely on the periphery of the network and associated with the large decrease in delay at junction 7 (-21 sec/PCU) which is at the core of the network.

PM Peak Hour 2036

There is an increase in delay at Junction 12 (+2 sec/PCU), Junction 14 (+3 sec/PCU) and the Junction 15 (+6 sec/PCU), this is due to a corresponding decrease in delay at junction 7 (-21 sec/PCU).

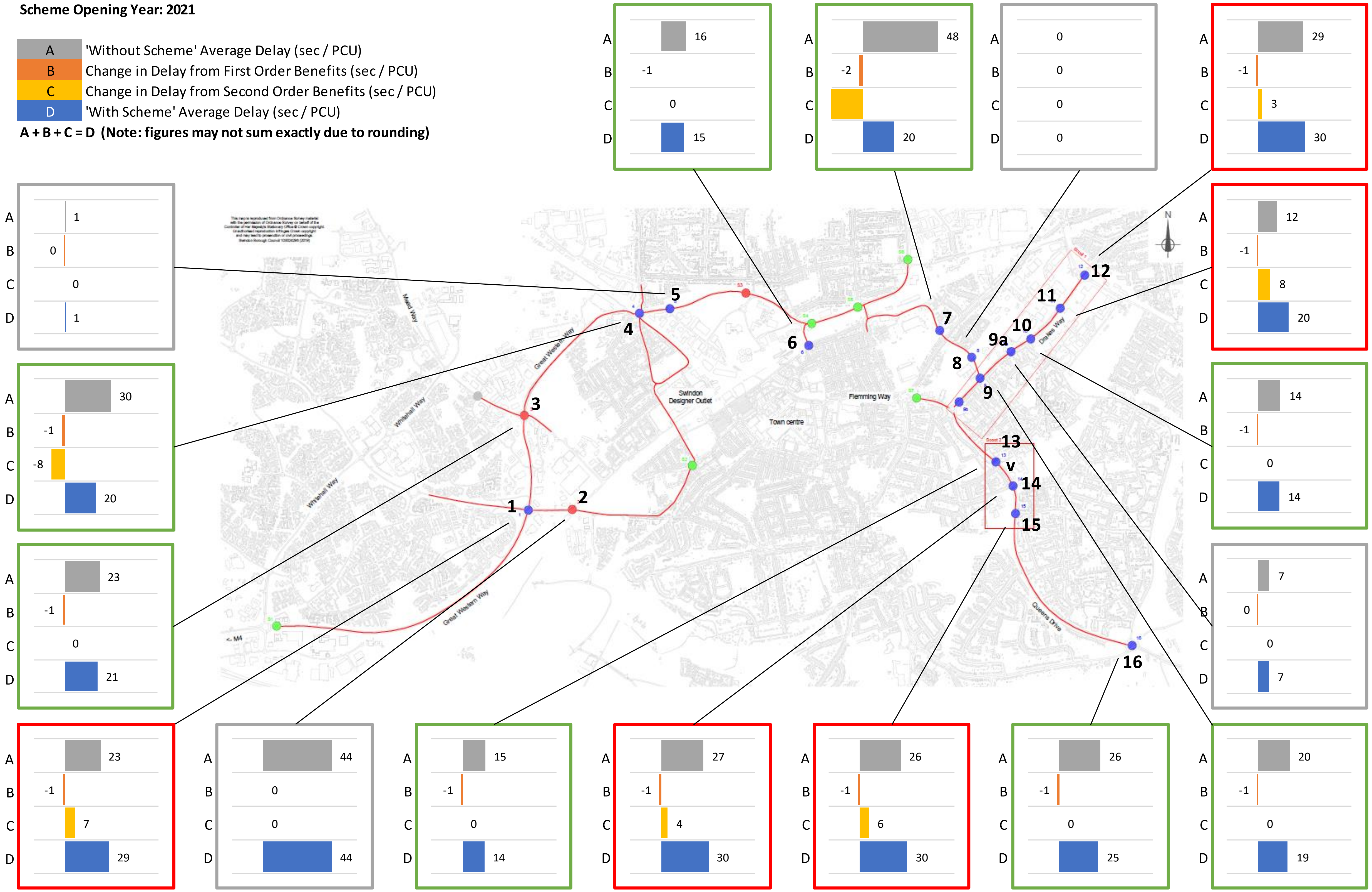
Inter Peak Average Hour 2036

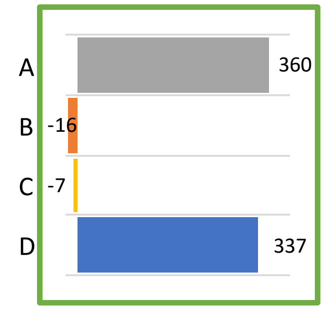
There is an increase in delay at Junction 12 (+1 sec/PCU) and Junction 15 (+11 sec/PCU), this is due to a corresponding decrease in delay at junction 7 (-21 sec/PCU).

AM Peak Hour Journey Time Saving Assumptions
Scheme Opening Year: 2021

A	'Without Scheme' Average Delay (sec / PCU)
B	Change in Delay from First Order Benefits (sec / PCU)
C	Change in Delay from Second Order Benefits (sec / PCU)
D	'With Scheme' Average Delay (sec / PCU)

A + B + C = D (Note: figures may not sum exactly due to rounding)

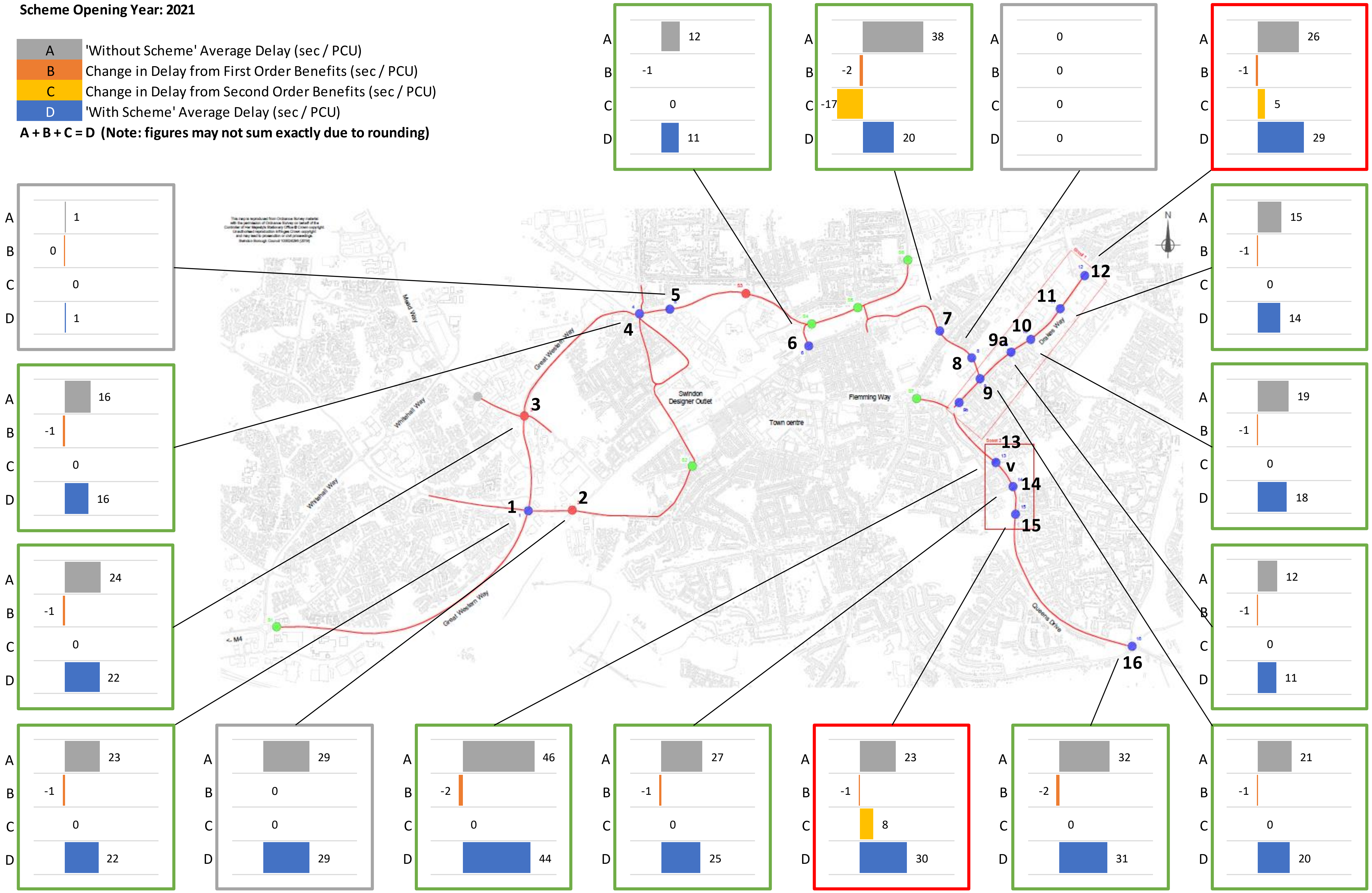


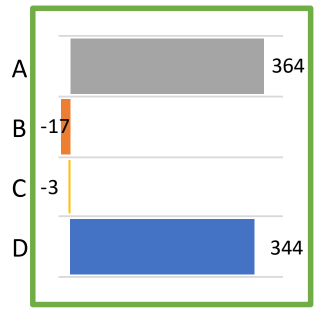


Total for all 17 Junctions

1	A3102 / B4006 / B4553 'Mannington' roundabout
2	A3102 / Penzance Drive junction
3	B4006 / Mead Way / Paddington Drive 'Meads' roundabout
4	B4006 / B4289 / Kemble Drive / Rodbourne Road ' Bruce St Bridges' roundabout
5	B4289 / Newcombe Drive junction
6	Corporation Street / Station Road junction
7	A4313 Ocotal Way / Shrivenham Road junction
8	A4313 Ocotal Way / St Joseph's College junction
9	A4312 Drakes Way / Ocotal Way junction
9a	A4312 Drakes Way / Penny Lane junction
10	A4312 Drakes Way / Marlowe Avenue junction
11	A4312 Drakes Way / Garrard Way junction
12	A4312 Drakes Way / B4006 / Swindon Road 'Greenbridge' roundabout
13	A4259 Queens Drive / Frobisher Drive junction
14	A4259 Queens Drive / New College Drive junction
15	A4259 Queens Drive / Whitbourne Avenue junction
16	A4259 / B4006 / Shaftesbury Avenue 'Coate' roundabout

PM Peak Hour Journey Time Saving Assumptions
Scheme Opening Year: 2021





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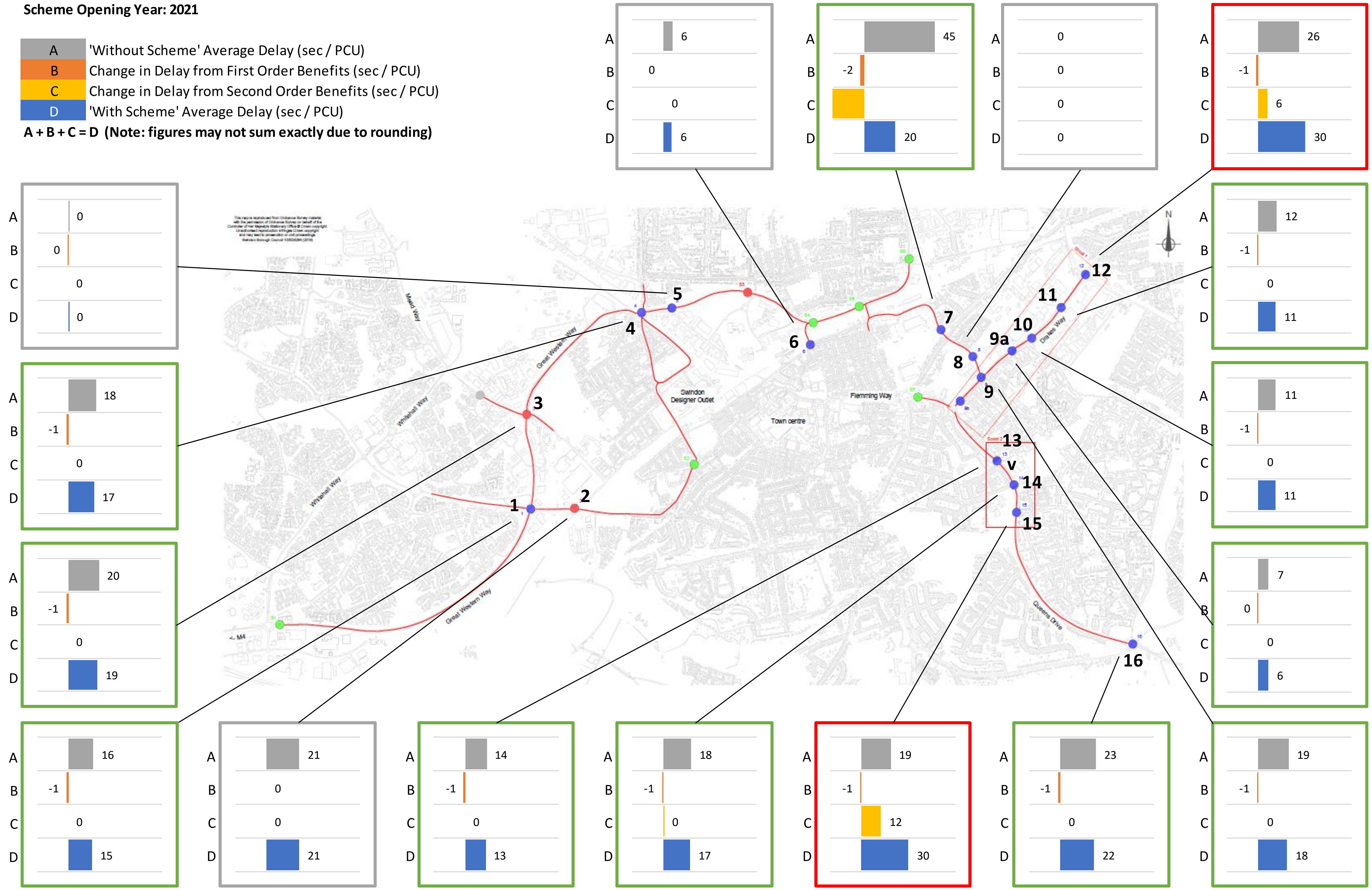
14	A4259 Queens Drive / New College Drive junction
15	A4259 Queens Drive / Whitbourne Avenue junction
16	A4259 / B4006 / Shaftesbury Avenue 'Coate' roundabout

Inter Peak Average Hour Journey Time Saving Assumptions
Scheme Opening Year: 2021

A	'Without Scheme' Average Delay (sec / PCU)
B	Change in Delay from First Order Benefits (sec / PCU)
C	Change in Delay from Second Order Benefits (sec / PCU)
D	'With Scheme' Average Delay (sec / PCU)

A + B + C = D (Note: figures may not sum exactly due to rounding)



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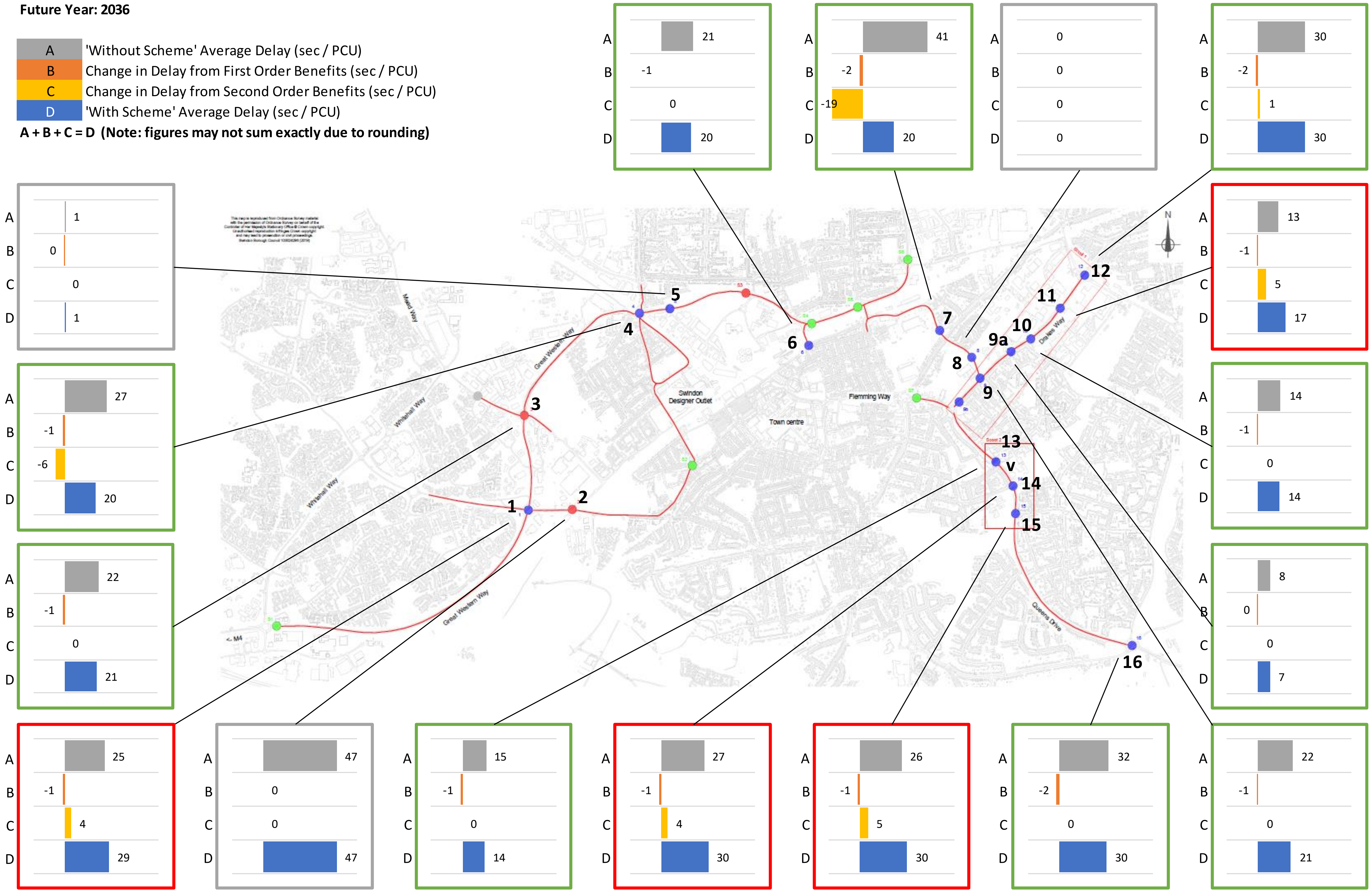
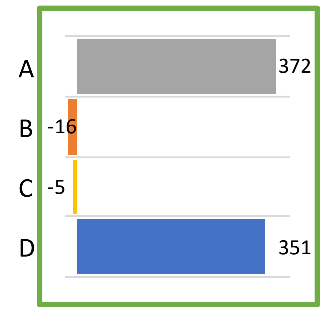
12	A4312 Drakes Way / B4006 / Swindon Road 'Greenbridge' roundabout
13	A4259 Queens Drive / Frobisher Drive junction
14	A4259 Queens Drive / New College Drive junction
15	A4259 Queens Drive / Whitbourne Avenue junction
16	A4259 / B4006 / Shaftesbury Avenue 'Coate' roundabout

AM Peak Hour Journey Time Saving Assumptions
Future Year: 2036

A	'Without Scheme' Average Delay (sec / PCU)
B	Change in Delay from First Order Benefits (sec / PCU)
C	Change in Delay from Second Order Benefits (sec / PCU)
D	'With Scheme' Average Delay (sec / PCU)

A + B + C = D (Note: figures may not sum exactly due to rounding)





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15	A4259 Queens Drive / Whitbourne Avenue junction
16	A4259 / B4006 / Shaftesbury Avenue 'Coate' roundabout

PM Peak Hour Journey Time Saving Assumptions
Future Year: 2036

A	'Without Scheme' Average Delay (sec / PCU)
B	Change in Delay from First Order Benefits (sec / PCU)
C	Change in Delay from Second Order Benefits (sec / PCU)
D	'With Scheme' Average Delay (sec / PCU)

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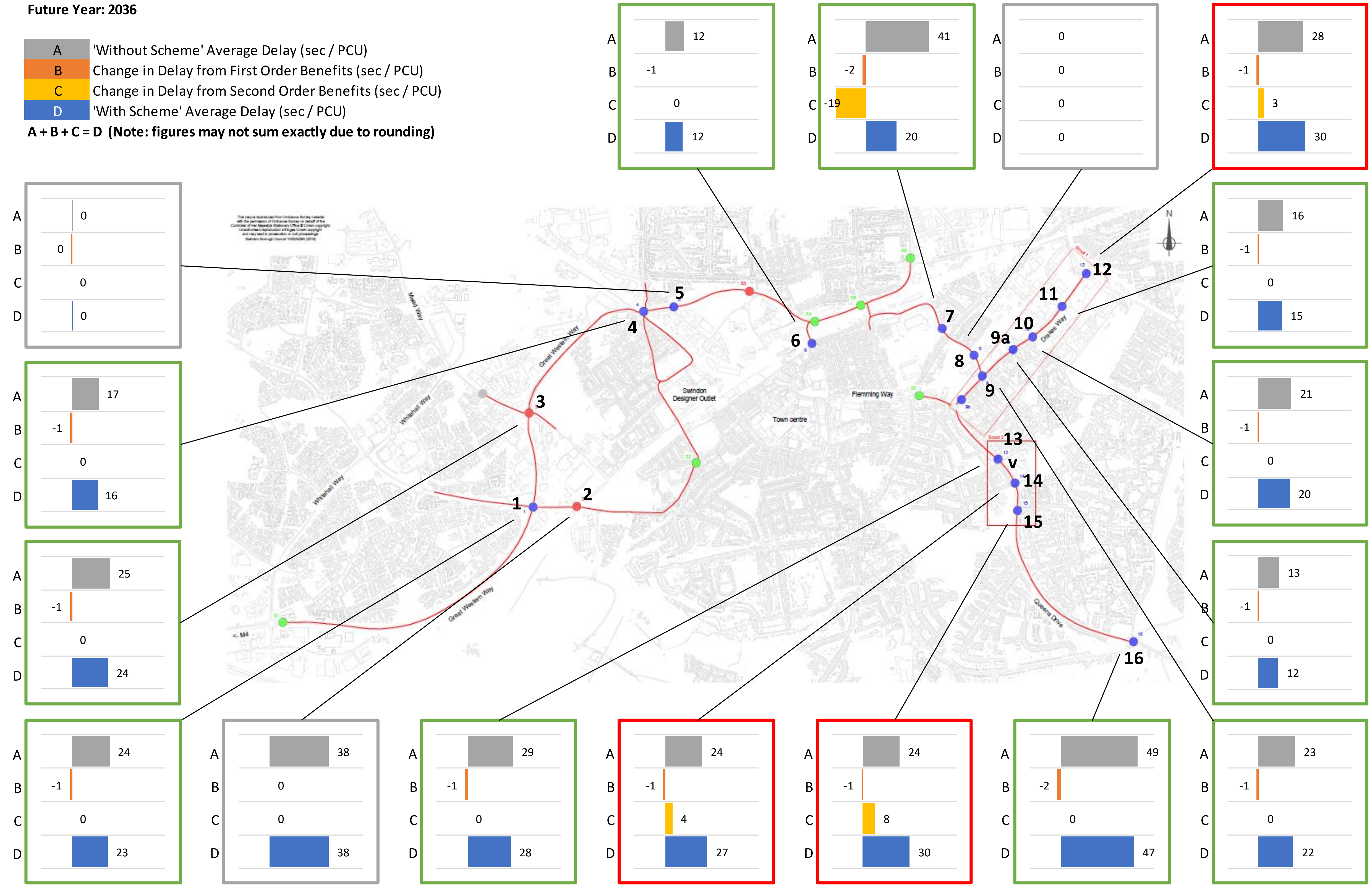

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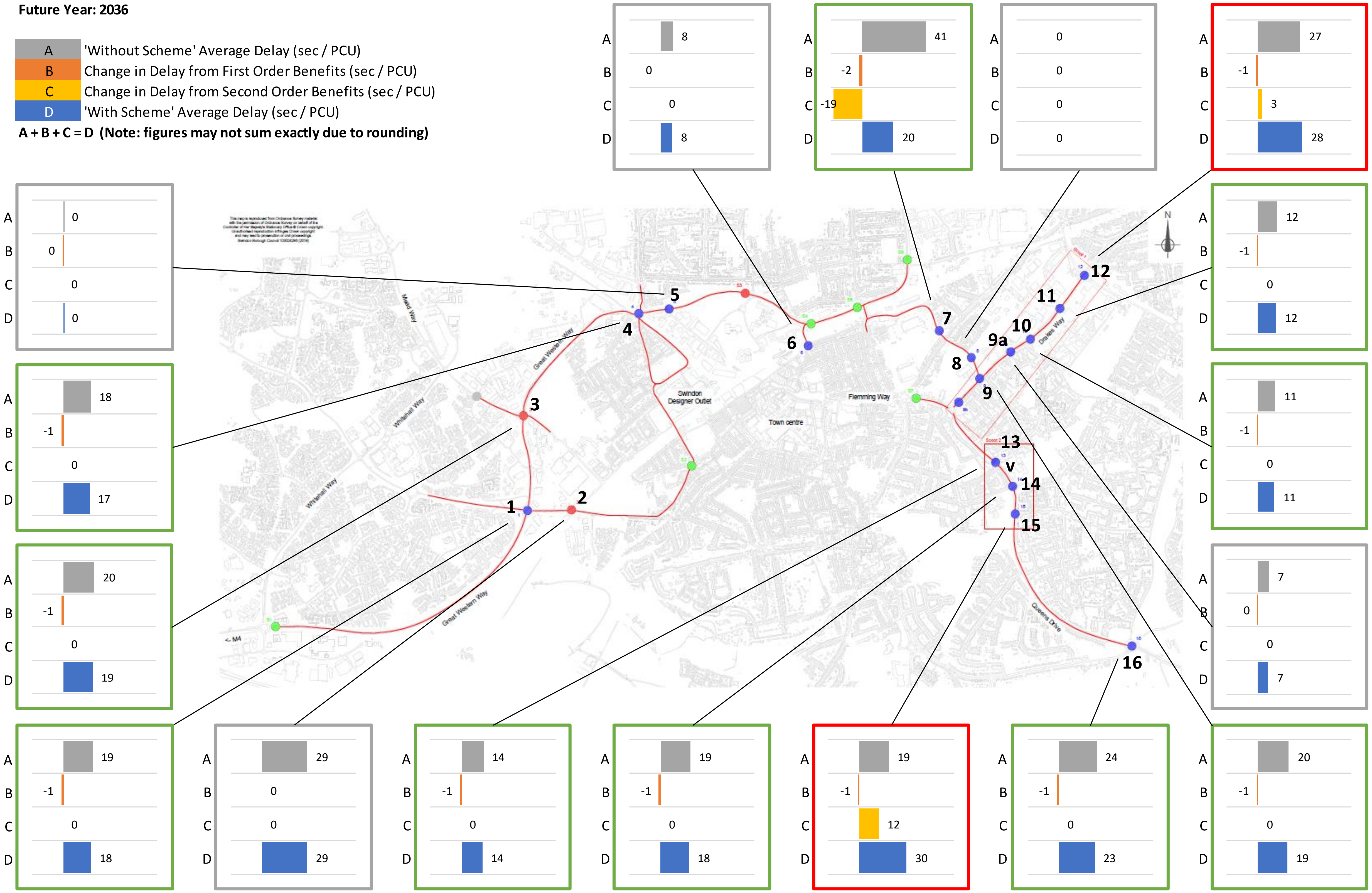
Inter Peak Average Hour Journey Time Saving Assumptions
Future Year: 2036



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Appendix D. Monetised Benefits by Junction and Mode

Table 6-6 provides a summary of the monetised benefits by junction for both highway users and bus users, for the 15-year appraisal period (core scenario). The figure below displays this information within a map, with bar charts to show how the monetised benefits are distributed by junction.

At nearly all junctions, the scale of benefits and disbenefits is much greater for highway users than for bus passengers. This is simply due to the significantly higher number of highway users compared with the number of bus passengers. The highest benefits for bus users can be seen at Junction 7 (A4313 Ocotal Way / Shrivenham Road), which is also where the highest benefits for highway users are gained.

At 10 of the 17 junctions in the UTMC network the model shows an overall benefit. As expected, the greatest benefits are gained at the junctions between 4 and 7 with a relatively high level of delay in the “Without Scheme” scenario, as these junctions are where the spreadsheet model redistributes most of traffic delay away from.

Five of the junctions in the network see an overall disbenefit. Junctions which experience a high levels of disbenefit are usually on the periphery of the UTMC network, as delay has been redistributed away from the strategic route (Great Wester Way between Junctions 4 and 7) at the “core” of the network onto more external and less operationally integral junctions

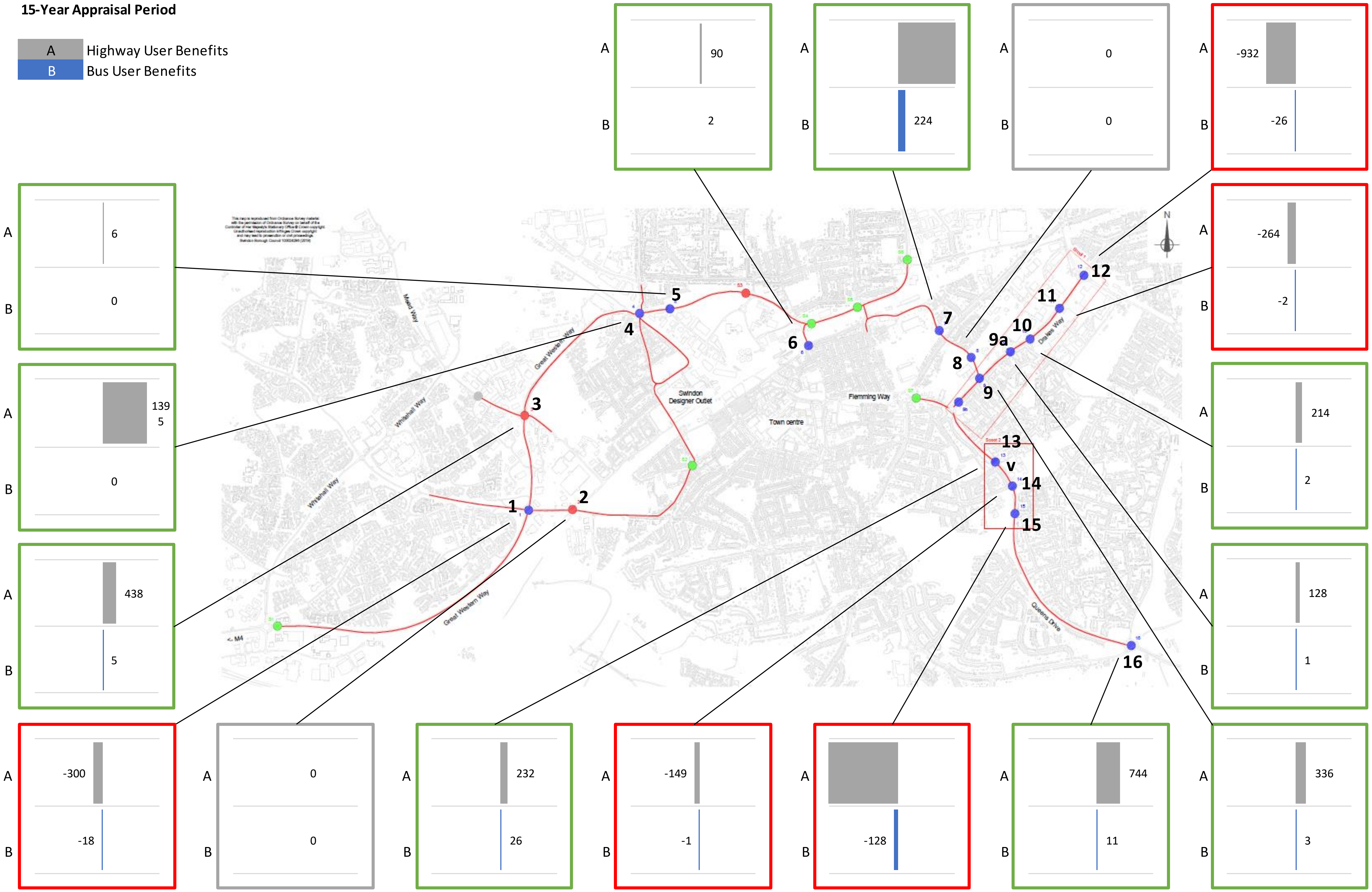
For example a significant amount of delay is redistributed away from Junction 7 (A4313 Ocotal Way / Shrivenham Road) to Junction 12 (A4312 Drakes Way / B4006 / Swindon Road 'Greenbridge' roundabout) and Junction 15 (A4259 Queens Drive / Whitbourne Avenue junction). The former junction represents a junction at the core of the UTMC network, whereas the latter represent junctions at the periphery.

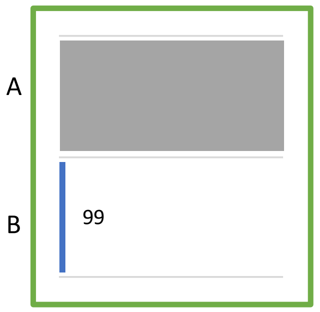
Note that as the redistribution method considers the average delay at each junction regardless of the traffic flow, a scenario can occur where delay could be redistributed from a junction with a high average delay and relatively low traffic flow to a neighbouring junction(s) with lower average delay but higher flow. This reduces the overall second-order benefits because the increase in delay experienced by the neighbouring junction(s) applies to a greater number of vehicles. Conversely, a scenario may occur where delay could be redistributed from a junction with a high average delay and relatively high traffic flow to a neighbouring junction(s) with lower average delay and lower flow. This has the opposite effect of increasing the second-order benefits, as the increase in delay experienced by the neighbouring junction(s) applies to fewer vehicles.

Table 6-6 – Summary of Monetised Benefits by Junction

Junction	Highway User Benefits (£m)	Bus User Benefits (£m)	Total Benefits (£m)
Junction 1 – A3102 / B4006 / B4553 'Mannington' roundabout	-0.300	-0.018	-0.318
Junction 2 – A3102 / Penzance Drive	0.000	0.000	0.000
Junction 3 – B4006 / Mead Way / Paddington Drive 'Meads' roundabout	0.438	0.005	0.443
Junction 4 – B4006 / B4289 / Kemble Drive / Rodbourne Road ' Bruce St Bridges' roundabout	1.395	0.000	1.395
Junction 5 – B4289 / Newcombe Drive	0.006	0.000	0.006
Junction 6 – Corporation Street / Station Road	0.090	0.002	0.092
Junction 7 – A4313 Ocotal Way / Shrivenham Road	3.700	0.224	3.924
Junction 8 – A4313 Ocotal Way / St Joseph's College	0.000	0.000	0.000
Junction 9 – A4312 Drakes Way / Ocotal Way	0.336	0.003	0.339
Junction 9a – A4312 Drakes Way / Penny Lane	0.128	0.001	0.129
Junction 10 – A4312 Drakes Way / Marlowe Avenue	0.214	0.002	0.215
Junction 11 – A4312 Drakes Way / Garrard Way	-0.264	-0.002	-0.266
Junction 12 – A4312 Drakes Way / B4006 / Swindon Road 'Greenbridge' roundabout	-0.932	-0.026	-0.958
Junction 13 – A4259 Queens Drive / Frobisher Drive	0.232	0.026	0.258
Junction 14 – A4259 Queens Drive / New College Drive	-0.149	-0.001	-0.150
Junction 15 – A4259 Queens Drive / Whitbourne Avenue	-2.343	-0.128	-2.471
Junction 16 – A4259 / B4006 / Shaftesbury Avenue 'Coate' roundabout	0.744	0.011	0.754
TOTAL (All Junctions)	3.294	0.099	3.394

Appraisal Benefits by Junction (£000s)
15-Year Appraisal Period





Total for all 17 Junctions

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6	Corporation Street / Station Road junction
7	A4313 Ocotal Way / Shrivenham Road junction
8	A4313 Ocotal Way / St Joseph's College junction
9	A4312 Drakes Way / Ocotal Way junction
9a	A4312 Drakes Way / Penny Lane junction
10	A4312 Drakes Way / Marlowe Avenue junction
11	A4312 Drakes Way / Garrard Way junction
12	A4312 Drakes Way / B4006 / Swindon Road 'Greenbridge' roundabout
13	A4259 Queens Drive / Frobisher Drive junction
14	A4259 Queens Drive / New College Drive junction
15	A4259 Queens Drive / Whitbourne Avenue junction
16	A4259 / B4006 / Shaftesbury Avenue 'Coate' roundabout

Appendix E. Appraisal Tables

E.1. Transport Economic Efficiency (TEE) Table (£000’s)

Non-business: Commuting	**ALL MODES TOTAL**		**ROAD Private Cars and LGVs**	**BUS and COACH Passengers**	**RAIL Passengers**	**OTHER**
User benefits						
Travel time	£ 1,560		£ 1,540	£ 20	£ -	£ -
Vehicle operating costs	£ 69		£ 69	£ -	£ -	£ -
User charges	£ -		£ -	£ -	£ -	£ -
During Construction & Maintenance	£ -		£ -	£ -	£ -	£ -
NET NON-BUSINESS BENEFITS: COMMUTING	£ 1,629	*(1a)*	£ 1,609	£ 20	£ -	£ -

Non-business: Other	**ALL MODES TOTAL**		**ROAD Private Cars and LGVs**	**BUS and COACH Passengers**	**RAIL Passengers**	**OTHER**
User benefits						
Travel time	£ 919		£ 842	£ 77	£ -	£ -
Vehicle operating costs	£ 60		£ 60	£ -	£ -	£ -
User charges	£ -		£ -	£ -	£ -	£ -
During Construction & Maintenance	£ -		£ -	£ -	£ -	£ -
NET NON-BUSINESS BENEFITS: OTHER	£ 978	*(1b)*	£ 901	£ 77	£ -	£ -

Business								
User benefits			**Goods Vehicles**	**Business Cars & LGVs**	**Passengers**	**Freight**	**Passengers**	
Travel time	£ 1,018		£ 89	£ 927	£ 2	£ -	£ -	£ -
Vehicle operating costs	£ 106		£ 45	£ 61	£ -	£ -	£ -	£ -
User charges	£ -		£ -	£ -	£ -	£ -	£ -	£ -
During Construction & Maintenance	£ -		£ -	£ -	£ -	£ -	£ -	£ -
Subtotal	£ 1,124	*(2)*	£ 134	£ 988	£ 2	£ -	£ -	£ -
Private sector provider impacts						**Freight**	**Passengers**	
Revenue	£ -				£ -	£ -	£ -	£ -
Operating costs	£ -				£ -	£ -	£ -	£ -
Investment costs	£ -				£ -	£ -	£ -	£ -
Grant/subsidy	£ -				£ -	£ -	£ -	£ -
Subtotal	£ -	*(3)*			£ -	£ -	£ -	£ -
Other business impacts								
Developer contributions	£ -	*(4)*	£ -		£ -	£ -		£ -
NET BUSINESS IMPACT	£ 1,124	*(5) = (2) + (3) + (4)*						
TOTAL								
Present Value of Transport Economic Efficiency Benefits (TEE)	£ 3,732	*(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

E.2. Public Accounts (PA) Table (£000's)

	ALL MODES TOTAL		ROAD INFRASTRUCTURE	BUS and COACH	RAIL	OTHER
Local Government Funding						
Revenue	£ -		£ -			£ -
Operating Costs	£ 327		£ 327			£ -
Investment Costs	£ -		£ -			£ -
Developer and Other Contributions	£ -		£ -	£ -	£ -	£ -
Grant/Subsidy Payments	£ -		£ -	£ -	£ -	£ -
NET IMPACT	£ 327	*(7)*	£ 327	£ -	£ -	£ -
Central Government Funding: Transport						
Revenue	£ -		£ -			£ -
Operating costs	£ -		£ -			£ -
Investment Costs	£ 973		£ 973			£ -
Developer and Other Contributions	£ -		£ -	£ -	£ -	£ -
Grant/Subsidy Payments	£ -		£ -	£ -	£ -	£ -
NET IMPACT	£ 973	*(8)*	£ 973	£ -	£ -	£ -
Central Government Funding: Non-Transport						
Indirect Tax Revenues	-£ 102	*(9)*	-£ 102	£ -	£ -	£ -
TOTALS						
Broad Transport Budget	£ 1,300	*(10) = (7) + (8)*				
Wider Public Finances	-£ 102	*(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.

E.3. Analysis of Monetised Costs and Benefits (AMCB) Table (£000's)

Noise	£	-	*(12)*
Local Air Quality	£	-	*(13)*
Greenhouse Gases	£	26	*(14)*
Journey Quality	£	-	*(15)*
Physical Activity	£	-	*(16)*
Accidents	£	-	*(17)*
Economic Efficiency: Consumer Users (Commuting)	£	1,629	*(1a)*
Economic Efficiency: Consumer Users (Other)	£	978	*(1b)*
Economic Efficiency: Business Users and Providers	£	1,124	*(5)*
Wider Public Finances (Indirect Taxation Revenues)	£	102	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	£	3,656	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*
Broad Transport Budget	£	1,300	*(10)*
Present Value of Costs (see notes) (PVC)	£	1,300	*(PVC) = (10)*
OVERALL IMPACTS			
Net Present Value (NPV)	£	2,356	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)		2.8	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.

Appendix F. Appraisal Summary Table

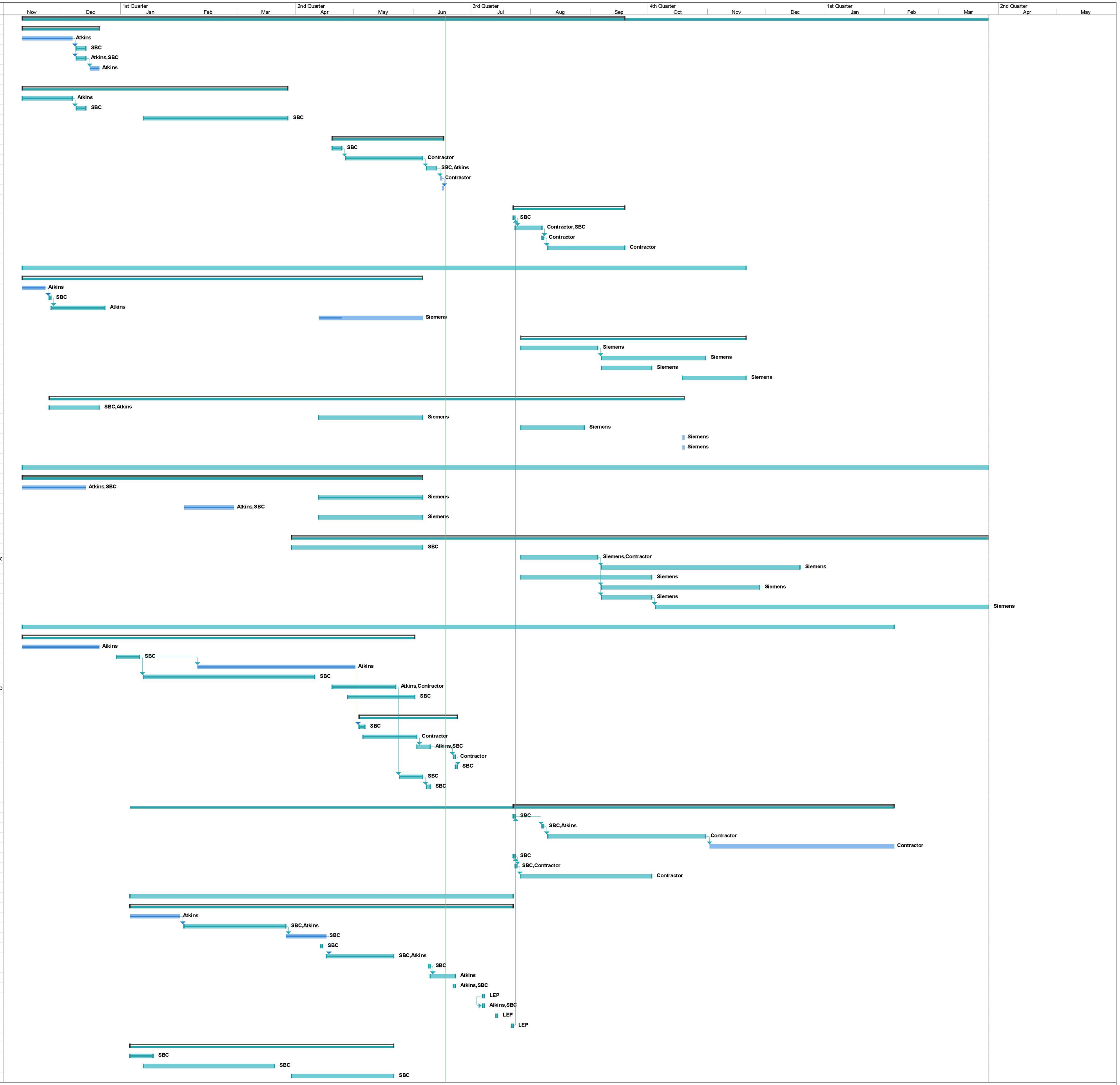
Appraisal Summary Table	Atkins Version 2.0	**Date produced:** 22 6 20	**Contact:**
Name of scheme:	Swindon Urban Traffic Management Control (UTMC)		**Name:** James Jackson
Description of scheme:	The core area of the network for the proposed UTMC has been defined as the Great Western Way (GWW) corridor between Mannington and Drakes Way. The proposed UTMC scheme will be able to formulate strategies by analysing live data such as vehicle position, passenger numbers and journey time information. The decisions made will then be fed back through various output devices, giving priority to public transport where needed.		**Organisation:** Swindon Borough Council **Role:** Promoter

	Impacts	Summary of key impacts	Assessment: Quantitative	Qualitative	Monetary £(NPV)	Distributional 7-pt scale/ vulnerable grp
Economy	Business users & transport providers	Highways business users experience benefits from reduced travel time and vehicle operating costs. Reduced travel time is expected at junctions due to the revalidating, updating and refurbishing of traffic signal configurations. The scheme is also expected to provide further benefits from the management of traffic in a coordinated, efficient way. Benefits are likely to be higher in the AM and PM peaks as traffic flows are greater. The majority of the installation of the UTMC equipment will have little material impact on traffic conditions within the UTMC scheme area	Value of journey time changes(£): £1.018m Net journey time changes (£): 0 to 2min: £1.018m 2 to 5min: £0m > 5min: £0m	-	£1.124m	-
	Reliability impact on Business users	The scheme is expected to deliver reliability benefits in all scenarios, as the UTMC system is designed to reduce overall delay and distribute excessive delay.	-	-	-	
	Wider Economic Impacts	The scheme will bring journey time savings to users, therefore facilitating planned development growth. Imperfectly competitive markets provide additional small benefits.	-	-	£0.112m	
	Dependent Development	N/A	-	-	-	
Environmental	Noise	The presence of Noise Impact Areas (NIAs) at various points along the UTMC route warrants careful consideration during the scheme's design phase, although the scheme's impact is likely negligible.	-	Neutral	-	-
	Air Quality	It is likely that the UTMC scheme will deliver air quality benefits through actively managing traffic flow.	-	Neutral	-	-
	Greenhouse gases	The appraisal forecasts a small reduction in non-traded carbon emissions over the 15-year appraisal period, resulting in a small net benefit.	Change in non-traded carbon over 60y (CO_2e): £0.26m Change in traded carbon over 60y (CO_2e): -	-	£0.026m	
	Landscape	The Swindon UTMC scheme area lies within the Upper Thames Clay Vale National Character Area, but is a large scheme set within the urban environment. To the west of the scheme, the highway is a dual carriageway with the landscape comprising wide grassed verges, with retail outlets and sections of dense vegetation tracking the highway as it moves towards central Swindon. Whilst ducting in the grassed verge may provide a temporary scar from the works, this is unlikely to last a significant period of time.	-	Neutral	-	
	Townscape	The UTMC scheme area is located within an urban/sub-urban setting broadly within 2km of Swindon town centre. In operation, the Swindon UTMC scheme proposes to place new signage and signals at various points through the area. However, bearing in mind the current townscape, the new signage and signals will not cause any change to the existing townscape in the area. The effects therefore are expected to be neutral.	-	Neutral	-	
	Historic Environment	Few historic assets are located within a close proximity to the UTMC scheme. There are three assets within 100m of the scheme which includes one Grade II* and two Grade II Listed Buildings. All of these assets are in proximity to an existing signalised crossing that will be connected to the UTMC network. The linking of this signalised crossing to the UTMC network will require minimal construction works, and thus any temporary impacts on the setting of these buildings is unlikely.	-	Neutral	-	
	Biodiversity	The Scheme is predicted to have a slight adverse effect on Biodiversity. This is based on a precautionary assessment due to the absence of detailed survey information. It is anticipated that with suitable mitigation applied (following the completion of a site survey), effects from the scheme may be reduced.	-	Slight adverse	-	
	Water Environment	The headwaters of the River Ray cross under the Great Western Way, whilst Dorcan Stream flows from Coate Water over the scheme area at Coate Roundabout. During construction, there is a risk that, in the absence of mitigation, construction activities such as excavation could lead to track out of organic material into local watercourses, as well as increased risk of oil spills and other pollution events reaching the local drainage network. However, if best practice pollution prevention measures are followed, construction effects on the local water environment are unlikely. In operation, the scheme itself will not increase the hardstanding area in the locality or reduce existing floodplain storage and is therefore unlikely to lead to any changes in discharge rates to local watercourses and will not influence local flooding.	-	Slight adverse	-	
Social	Commuting and Other users	Highways business users experience benefits from reduced travel time and vehicle operating costs. Reduced travel time is expected at junctions due to the revalidating, updating and refurbishing of traffic signal configurations. The scheme is also expected to provide further benefits from the management of traffic in a coordinated, efficient way. Benefits are likely to be higher in the AM and PM peaks as traffic flows are greater. The majority of the installation of the UTMC equipment will have little material impact on traffic conditions within the UTMC scheme area. Bus users will also benefit from more reliable journey times and the scheme will also have the capability of giving priority to public transport where needed.	Value of journey time changes(£): £2.479m Net journey time changes (£): 0 to 2min: £2.479m 2 to 5min: £0m > 5min: £0m	-	£2.608m	-
	Reliability impact on Commuting and Other users	The scheme is expected to deliver reliability benefits in all scenarios, as the UTMC system is designed to reduce overall delay and distribute excessive delay. This will reduce journey time variability.	-	-	-	-

	Physical activity	The scheme is likely to result in improved journey times, reliability and punctuality for buses travelling within the UTMC scheme area and beyond, which may encourage some people to use the bus rather than cars. There are numerous bus services currently operating in and around Swindon town centre that could benefit from improved journey times. In theory a modal shift from car to bus will slightly increase physical activity as public transport users generally walk further than car users to gain access to transport, but it is acknowledged that the UTMC scheme may not have a significant effect on modal shift. Reduced traffic congestion within the UTMC core area may encourage people to cycle instead of using cars, but this effect is likely to be small.	-	Neutral	-	
	Journey quality	The UTMC scheme will improve journey quality for highway users throughout the UTMC scheme area. Journey times will be improved for car users, with VMS further improving journey quality. Bus users will also benefit from more reliable journey times. The anticipated reduction in queueing at key junctions along the GWW corridor should result in reduced driver stress.	-	Moderate beneficial	-	
	Accidents	The scheme is expected to have a slight beneficial impact on accidents, taking into account there will be an increase in speed at some junctions but slower speeds at others where delay is redistributed. There will be two orders of safety benefit, firstly through reduced traveller stress and reduced congestion, and secondly through increased flow due to improved performance.	-	Slight beneficial		-
	Security	The UTMC scheme is not likely to include any enhancements to public transport provision, public realm or lighting that would be considered to improve security.	-	Neutral	-	-
	Access to services	The provision of bus services does not form part of the UTMC scheme, but numerous existing services will benefit from more reliable journey times and real-time passenger information along the GWW corridor. Many employment and leisure facilities are located along the key routes benefitting from the UTMC scheme and hence bus users travelling to and from these destinations will benefit.	-	Slight beneficial	-	-
	Affordability	There are no expected changes to parking costs, direct road user cha.rges, public transport fare charges or availability associated with the UTMC scheme	-	Neutral	-	-
	Severance	No significant impact is expected as the UTMC scheme is unlikely to result in a material change to traffic flows in residential areas in proximity to the GWW corridor.	-	Neutral	-	-
	Option and non-use values	The UTMC scheme is not likely to significantly alter the availability of transport services. Although the scheme will contribute towards more reliable bus journey times, it is acknowledged that bus services do not run along some sections of the GWW corridor but rather traverse some of the key junctions in the UTMC scheme area. Hence the scheme may provide an improved alternative mode of travel for regular car users, which may have an associated option or non-use value, although this is likely to be very small.	-	Neutral	-	
Public Accounts	Cost to Broad Transport Budget	Total scheme investment costs have been calculated including scheme construction costs and risk from QRA. Whole life costs have been calculated based on maintenance and operating costs of £30k per year. 10% Optimism Bias is applied.	-	-	£1.300m	
	Indirect Tax Revenues	Indirect tax revenues are forecast to decrease.	-	-	£-0.102m	

Appendix G. Programme

ID	Task Name	Duration	Start	Finish	Predecessors	Resource Names
1	**UTMC Common Database**	**225 days**	**Mon 11/11/19**	**Fri 18/09/20**		
2	**Technical Specification**	**30 days**	**Mon 11/11/19**	**Fri 20/12/19**		
3	Draft System Technical Specification	4 wks	Mon 11/11/19	Fri 06/12/19		Atkins
4	Comments on draft Specification by SBC	5 days	Mon 09/12/19	Fri 13/12/19	3	SBC
5	Costed Specification	5 days	Mon 09/12/19	Fri 13/12/19	3	Atkins,SBC
6	Revised System Technical Specification	5 days	Mon 16/12/19	Fri 20/12/19	5	Atkins
7						
8	**Evaluation Framework**	**100 days**	**Mon 11/11/19**	**Fri 27/03/20**		
9	Draft Evaluation Framework	4 wks	Mon 11/11/19	Fri 06/12/19		Atkins
10	Review Evaluation Framework	5 days	Mon 09/12/19	Fri 13/12/19	9	SBC
11	Investigate reduction in cost through partnership (e.g. Oxfordshire)	11 wks	Mon 13/01/20	Fri 27/03/20		SBC
12						
13	**Tender Process**	**42 days**	**Mon 20/04/20**	**Tue 16/06/20**		
14	OJEU Issue	5 days	Mon 20/04/20	Fri 24/04/20		SBC
15	6-week return period	6 wks	Mon 27/04/20	Fri 05/06/20	14	Contractor
16	Evaluation of supplier submisions	5 days	Mon 08/06/20	Fri 12/06/20	15	SBC,Atkins
17	Presentation by suppliers	1 day	Mon 15/06/20	Mon 15/06/20	16	Contractor
18	Moderation	1 day	Tue 16/06/20	Tue 16/06/20	17	
19						
20	**Contract Award**	**42 days**	**Thu 23/07/20**	**Fri 18/09/20**		
21	Contract Award	1 day	Thu 23/07/20	Thu 23/07/20	102	SBC
22	Standstill (10 days)	10 days	Fri 24/07/20	Thu 06/08/20	21	Contractor,SBC
23	Contract Start	1 day	Fri 07/08/20	Fri 07/08/20	22	Contractor
24	UTMC Common Database supply / installation	6 wks	Mon 10/08/20	Fri 18/09/20	23	Contractor
25						
26	**Connection of Traffic Signals to UTC**	**270 days**	**Mon 11/11/19**	**Fri 20/11/20**		
27	**Design**	**150 days**	**Mon 11/11/19**	**Fri 05/06/20**		
28	Initial Design	10 days	Mon 11/11/19	Fri 22/11/19		Atkins
29	SBC check	1 day	Mon 25/11/19	Mon 25/11/19	28	SBC
30	Detailed Design	4 wks	Tue 26/11/19	Mon 23/12/19	29	Atkins
31	Costs	8 wks	Mon 13/04/20	Fri 05/06/20		Siemens
32						
33	**Installation and test of equipment**	**85 days**	**Mon 27/07/20**	**Fri 20/11/20**		
34	Maintenance Contract (no procurement)	6 wks	Mon 27/07/20	Fri 04/09/20		Siemens
35	Installation of equipment	8 wks	Mon 07/09/20	Fri 30/10/20	34	Siemens
36	UTC Database preparation	4 wks	Mon 07/09/20	Fri 02/10/20		Siemens
37	MOVA validation	5 wks	Mon 19/10/20	Fri 20/11/20		Siemens
38						
39	**Mead Roundabout - Refurbishment**	**236 days**	**Mon 25/11/19**	**Mon 19/10/20**		
40	Detailed Design	4 wks	Mon 25/11/19	Fri 20/12/19		SBC,Atkins
41	Costs	8 wks	Mon 13/04/20	Fri 05/06/20		Siemens
42	Installation	5 wks	Mon 27/07/20	Fri 28/08/20		Siemens
43	UTC Database preparation	1 day	Mon 19/10/20	Mon 19/10/20		Siemens
44	MOVA validation	1 day	Mon 19/10/20	Mon 19/10/20		Siemens
45						
46	**JTMS and Communications Network**	**360 days**	**Mon 11/11/19**	**Fri 26/03/21**		
47	**Design**	**150 days**	**Mon 11/11/19**	**Fri 05/06/20**		
48	Detailed Design (JTMS)	5 wks	Mon 11/11/19	Fri 13/12/19		Atkins,SBC
49	Costing (JTMS)	8 wks	Mon 13/04/20	Fri 05/06/20		Siemens
50	Detailed Design (Civils)	4 wks	Mon 03/02/20	Fri 28/02/20		Atkins,SBC
51	Costing (Civils)	8 wks	Mon 13/04/20	Fri 05/06/20		Siemens
52						
53	**Installation**	**260 days**	**Mon 30/03/20**	**Fri 26/03/21**		
54	Check lamp columns	10 wks	Mon 30/03/20	Fri 05/06/20		SBC
55	Equipment manufacture / supply	6 wks	Mon 27/07/20	Fri 04/09/20		Siemens,Contrac
56	UKBB backhaul installation	15 wks	Mon 07/09/20	Fri 18/12/20	55	Siemens
57	Civils work (ducting)	10 wks	Mon 27/07/20	Fri 02/10/20		Siemens
58	Installation on lamp columns	12 wks	Mon 07/09/20	Fri 27/11/20	55	Siemens
59	Installation of equipment at signals	4 wks	Mon 07/09/20	Fri 02/10/20	55	Siemens
60	Testing and Validation	25 wks	Mon 05/10/20	Fri 26/03/21	59	Siemens
61						
62	**Variable Message Signs**	**325 days**	**Mon 11/11/19**	**Fri 05/02/21**		
63	**Design**	**146 days**	**Mon 11/11/19**	**Mon 01/06/20**		
64	Detailed Design (VMS)	6 wks	Mon 11/11/19	Fri 20/12/19		Atkins
65	Costing (VMS)	10 days	Mon 30/12/19	Fri 10/01/20		SBC
66	Contract Specification (VMS)	12 wks	Mon 10/02/20	Fri 01/05/20	65	Atkins
67	Soft-Market Testing (Round 2)	13 wks	Mon 13/01/20	Fri 10/04/20	65	SBC
68	Detailed Design & Specification (Civils)	5 wks	Mon 20/04/20	Fri 22/05/20		Atkins,Contracto
69	Feeder Pillars / electrical connections quotation (DLO)	5 wks	Tue 28/04/20	Mon 01/06/20		SBC
70						
71	**Tender Process**	**37 days**	**Mon 04/05/20**	**Tue 23/06/20**		
72	RFQ issue (VMS)	3 days	Mon 04/05/20	Wed 06/05/20	66	SBC
73	4-week return period	4 wks	Wed 06/05/20	Tue 02/06/20		Contractor
74	Evaluation of supplier submisions (VMS)	5 days	Wed 03/06/20	Tue 09/06/20	73	Atkins,SBC
75	Presentation by suppliers	1 day	Mon 22/06/20	Mon 22/06/20	74	Contractor
76	Moderation	1 day	Tue 23/06/20	Tue 23/06/20	75	SBC
77	RFQ issue (Civils)	2 wks	Mon 25/05/20	Fri 05/06/20	68	SBC
78	Evaluation of supplier submisions (Civils)	2 days	Mon 08/06/20	Tue 09/06/20	77	SBC
79						
80	**Contract Award**	**142 days**	**Thu 23/07/20**	**Fri 05/02/21**		
81	Contract Award (VMS)	1 day	Thu 23/07/20	Thu 23/07/20	102	SBC
82	Contract Start (VMS)	1 day	Fri 07/08/20	Fri 07/08/20	81	SBC,Atkins
83	VMS manufacture / supply	12 wks	Mon 10/08/20	Fri 30/10/20	82	Contractor
84	Installation (VMS)	14 wks	Mon 02/11/20	Fri 05/02/21	83	Contractor
85	Contract Award (Civils)	1 day	Thu 23/07/20	Thu 23/07/20	102	SBC
86	Contract Start (Civils)	1 day	Fri 24/07/20	Fri 24/07/20	85	SBC,Contractor
87	Installation (Civils)	10 wks	Mon 27/07/20	Fri 02/10/20	86	Contractor
88						
89	**Strategy Testing and Validation**	**143 days**	**Mon 06/01/20**	**Wed 22/07/20**		
90	**Business Case**	**143 days**	**Mon 06/01/20**	**Wed 22/07/20**		
91	OBC circulated to SBC	4 wks	Mon 06/01/20	Fri 31/01/20		Atkins
92	OBC updated	39 days	Mon 03/02/20	Thu 26/03/20	91	SBC,Atkins
93	OBC submission to ITA for comment	15 days	Fri 27/03/20	Thu 16/04/20	92	SBC
94	Submit OBC (minus costs) to LEP	1 day	Tue 14/04/20	Tue 14/04/20		SBC
95	Refine and update OBC in response to ITA comments	5 wks	Fri 17/04/20	Thu 21/05/20	93	SBC,Atkins
96	Submit FBC (with final tendered costs) to Atkins	1 day	Tue 09/06/20	Tue 09/06/20		SBC
97	Update FBC with latest costs and resolve any ITA comments	9 days	Wed 10/06/20	Mon 22/06/20	96	Atkins
98	Submission of FBC to ITA	1 day	Mon 22/06/20	Mon 22/06/20		Atkins,SBC
99	Full comments provided by ITA on FBC	1 day	Tue 07/07/20	Tue 07/07/20		LEP
100	Submission of FBC to LEP	1 day	Tue 07/07/20	Tue 07/07/20	99SS	Atkins,SBC
101	LEP Board papers released	1 day	Tue 14/07/20	Tue 14/07/20		LEP
102	LEP Board decision	1 day	Wed 22/07/20	Wed 22/07/20		LEP
103						
104	**Budget Allocation**	**99 days**	**Mon 06/01/20**	**Thu 21/05/20**		
105	HPDB approval to procees with scheme	10 days	Mon 06/01/20	Fri 17/01/20		SBC
106	Allocation of Revenue Budget	10 wks	Mon 13/01/20	Fri 20/03/20		SBC
107	Confirmation of Revenue Budget	39 days	Mon 30/03/20	Thu 21/05/20		SBC



Appendix H. Risk Register

Swindon UTMC Scheme

Risk Register

					Initial risk score				Financial Impacts				
Risk ID	Risk category	Description	Description of potential risk	Effect of risk occurring	Impact	Likelihood	Risk Score	Risk Owner	Lowest Cost Estimate	Highest Cost Estimate	Probability (matching likelihood)	Current Estimated Risk Value	Action to control or mitigate risk2
1	Feasibility	Specification for VMS.	Specifications not adequate for suppliers to price accurately.	Price variation in tender submissions. Additional cost at a later date.	2	1	2	SBC	£10,000.00	£30,000.00	0.025	£500.00	Staff time will be reviewed through the duration of the project to manage spend.
2	Corporate	Programme not delivered by March 2021.	Delay across work streams means funding no longer provided by LEP.	Funding GAP and liability for SBC.	3	1	3	SBC	£20,000.00	£122,000.00	0.025	£1,775.00	Number of signs and amount of civils reduced pending to bring in under budget.
3	Commercial	Common Database	Costs come in lower than budget allocation; subsequent risk of unidentified costs associated with implementation incompatibility and strategy development.	Tendered cost may be exceeded and additional change control required.	5	3	15	SBC	£10,000.00	£175,000.00	0.35	£32,375.00	Post-tender clarification and on-going liaison with multiple stakeholders.
4	Lighting/Signal works	Upgrade signals to be compatible with system.	Delay in supply of essential parts.	Delay in elements of the system coming into operation.	2	2	4	SBC	£5,000.00	£20,000.00	0.125	£1,562.50	Use existing contract so significant lead time possible.
5	Accommodation works	Comms and JTMS.	Potential supply issues.	Delay in elements of the system coming into operation.	2	3	6	SBC	£5,000.00	£25,000.00	0.35	£5,250.00	Significant lead time, so early procurement planned.
6	Resources	VMS signs.	Cost variation subject to site acceptance and finalisation of VMS specification and sizes.	Number and type of signs to be bought.	2	4	8	SBC	£20,000.00	£60,000.00	0.65	£26,000.00	Research into site location issues; early liaison with relevant third-parties.
7	Resources	VMS signs.	Additional VMS identified as being necessary to improve overall efficiency / effectiveness of UTMC scheme.	Significant cost increase / possible delays to programme.	3	3	9	SBC	£25,000.00	£50,000.00	0.35	£13,125.00	On-going liaison with planning and implementation phase with key stakeholders.
8	Construction	VMS foundations and installation.	Design and installation costs subject to ground investigation risks; possibility of utilities requiring diversion.	Significant cost increase / relocation of sign locations.	5	3	15	SBC	£20,000.00	£500,000.00	0.35	£91,000.00	Feasibility and early site inspection undertaken to minimise the risk of this. Consider the use of cantilever posts at certain / all VMS locations.
9	Strategic	Setup strategies.	Continued adjustment of strategies required. Internal resource no longer available.	System becomes unused and continues to have revenue costs.	3	1	3	SBC	£5,000.00	£24,000.00	0.025	£362.50	Internal resource dedicated and will build on consultant strategies put in place.
10	Accommodation works	Road space.	Make sure no clash in road space/works going on at the same time.	Delay on network or delay to implementation of scheme.	1	1	1	SBC	£5,000.00	£15,000.00	0.025	£250.00	Early liaison with SBC Street Works team to coordinate activities.
11	Statutory Undertakers	Existing services / utilities.	Damage to known existing services as a result of construction activities. Utilities required to be moved.	Significant delay and/or significant costs.	4	2	8	SBC	£5,000.00	£150,000.00	0.125	£9,687.50	Sites selected base on feasibility and assessment of C2 surveys.
12	Accommodation works	Traffic Management	Manage network performance while works underway	Only small chance of delays to construction programme. Possible increased cost and poor public relations.	1	3	3	SBC	£5,000.00	£8,000.00	0.35	£2,275.00	Working off peak / off carriageway for majority of sites.
13	Accommodation works	Power supply required for signs.	Booking works and linking to existing assets. Time and cost depending on existing situation.	Increase cost and time could be critical.	3	2	6	SBC	£5,000.00	£50,000.00	0.125	£3,437.50	Prelim design and feasibility will mitigate risk.
14	Funding	Scheme cost exceeds estimated budget.	Shortfall in funding. Possible threat to receipt of funding from LEP.	Additional funding from Council required or abandonment of scheme. Reputational impact if not delivering on advertised scheme.	3	1	3	SBC	£5,000.00	£50,000.00	0.025	£687.50	PM to baseline programme and costs monitored monthly. Construction cost estimate robust with appropriate level of contingency. Residual risk quantified.
15	Funding	LEP application late.	Deadline of business case submission missed.	Submission is not submitted before deadline and is rejected.	1	3	3	SBC	£0.00	£0.00	0.35	£0.00	Plan activities for business case submission. Monitor progress and complete actions on time. Draft business case to be regularly reviewed at least 2 weeks prior to submission.
16	Planning/Legal	Environmental considerations.	Delays due to unforeseen environmental considerations.	Additional cost to scheme and delay.	2	1	2	SBC	£0.00	£5,000.00	0.025	£62.50	Scheme is in urban built up area with limited areas of amenity grassland and trees. Sensitive approach to construction works. Prior investigatory work minimises 'unforeseen'.
17	Political	Complaints from local residents and/or commuters.	Objections to the scheme or extensive complaints as a result of disruption/noise/pollution.	Adverse publicity for SBC and Contactor(s). Reputational risk.	2	2	4	SBC	£1,000.00	£5,000.00	0.125	£375.00	Manage public expectations sensitively and notify stakeholders of site activities appropriately well in advance. Contractor to comply with all environmental constraints.
18	Ecological/Environmental	Archaeology, flora/fauna, air-quality, noise & vibration, contaminated land.	Encountering archaeology not recorded in advance investigations. Vegetation clearance within bird nesting season. Protected trees (TPOs). Disturbance of protected species. Contractor's plant exceeds noise and vibration constraints. Encountering unexpected contaminated land.	Additional archaeological investigations required with possible delays to construction programme and possible increased cost. Expert advice from ecologist required before proceeding; possible delays to construction programme and increase in costs. Possible restrictions placed upon extent and duration of works. Additional site investigations required with possible delays to construction programme and possible increases in cost.	3	2	6	SBC	£5,000.00	£50,000.00	0.125	£3,437.50	Consult with SBC archaeology team; compile desktop scoping report. Undertake early ecological surveys to detect the presence of any protected species. Compile an air quality risk assessment, with procedures for prevention/mitigation. Ensure constraints are included in the contractor conditions of contract. Monitor noise/vibration and enforce regulations. Undertake GI to detect the presence of any contaminated land.
19	Ecological/Environmental	Severe weather events.	Weather conditions during the construction period resulting in delays.	Possible delays to construction programme and possible increased cost.	2	2	4	SBC	£1,000.00	£7,000.00	£0.13	£500.00	Ensure contractors makes provision for weather delay in their programme and is not a 'surprise'.
20	Design	Alterations to elements of the design.	Design changes required during the construction phase.	Possible delays to construction programme and possible increased cost.	2	3	6	SBC	£20,000.00	£50,000.00	£0.35	£12,250.00	Carry out robust detailed design and technical checks prior to commencing on site.
21	Lighting/Signal works	Lighting/signal installation contractor performance.	Contractors do not comply with the programme for installation and associated works.	Possible delays to construction programme and possible increased cost.	2	4	8	SBC	£20,000.00	£50,000.00	£0.65	£22,750.00	Ensure that the contractors tender is robust and deliverable. Cover by tender assessment process.
22	Resources	Key resources.	Proposed resources are not or are no longer available for whatever reason.	Shortage of SBC resources for the scheme and disruption to communications and programme.	3	2	6	SBC	£5,000.00	£15,000.00	£0.13	£1,250.00	Clear hand-over policy and establish communications regarding all potential issues immediately.
23	Operational	Covid-19 pandemic.	Potential impact on resource availability to undertake / complete scheme.	Possible delays to construction delivery programme and availability of kit.	5	3	15	SBC	£20,000.00	£120,000.00	£0.35	£24,500.00	Continual review of Govt. advice and SBC Bronze, Silver and Gold recommendations.
24	Commercial	Availability of contractors / sun-contractors.	Contractors/sun-contractors included at tender stage are not likely to be available at the revised start date.	Uncertainty in supply chain for some elements of the works and in target setting.	2	2	4	SBC	£10,000.00	£15,000.00	£0.13	£1,562.50	Establish clear and robust contingency plans with contractors at contract stage.
									Risks Costed			£254,975.00	

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