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A350 Melksham Bypass (Outline Business Case)

Appraisal Specification Report

Wiltshire Council

16 December 2020

WC_MBP-ATK-GEN-XX-RP-TB-000002

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1. Introduction

1.1. Background

Wiltshire Council is promoting the A350 Melksham Bypass scheme through the Department for Transport's (DfT) Large Local Majors (LLM) fund. The LLM is funded through the National Roads Fund and is intended to support a small number of exceptionally large local highway authority transport schemes that could not be funded through normal routes and would exceed the upper threshold for Major Road Network (MRN) proposals. The government has established five key policy objectives in relation to the fund:

- Reduce congestion – alleviating local and regional congestion, reducing traffic jams and bottlenecks.
- Support economic growth and rebalancing – support the delivery of the industrial strategy, contributing to a positive economic impact that is felt across the regions.
- Support housing delivery – unlocking land for new housing developments.
- Support all road users – recognising the needs of all users, including cyclists, pedestrians and disabled people.
- Support the Strategic Road Network (SRN) – complementing and supporting the existing SRN by creating a more resilient road network in England.

Sub-national Transport Bodies (STB) were tasked with prioritising potential LLM schemes for their area, alongside advice and priorities for the MRN. The Western Gateway STB prioritised the A350 Melksham Bypass scheme to be promoted through the LLM fund (alongside further A350 schemes promoted through the MRN fund). In June 2019, Wiltshire Council (via the Western Gateway STB) submitted a Strategic Outline Business Case (SOBC) to central government (DfT) for the Melksham Bypass scheme. In March 2020, Wiltshire Council was awarded £1.3m funding by the DfT to develop the scheme to the next stage of the business case process – the Outline Business Case (OBC). Atkins has been commissioned by Wiltshire Council to prepare the OBC, with submission to DfT anticipated in Autumn 2021. An Appraisal Specification Report (ASR) was previously produced in support of the SOBC. The opportunity is being taken to review and refresh the ASR for the purposes of the OBC, reflecting the current scheme development and latest thinking on the approach to modelling and appraisal.

1.2. Scheme overview

The A350 Melksham Bypass scheme is of both local and regional significance in relation to the issues and objectives it seeks to address.

1.2.1. Regional significance

At a regional level, the A350 is a primary north-south route between the M4 corridor and the south coast (Figure 1-1). Improved north-south connectivity is a key regional priority, as identified by the Swindon and Wiltshire Local Enterprise Partnership (SWLEP), the Western Gateway Sub-National Transport Body, and the newly formed Western Gateway Powerhouse. These north-south connections between the south coast (the port of Poole in particular) and M4, and onwards to Bristol and the Midlands, are currently dependent upon the A350 (and A35) primary routes or the A36/A46 through Bath. These routes experience considerable congestion and road safety problems, and their increasing unreliability is significantly constraining development and business growth across the region, with an estimated loss of c.£20.5 billion of economic benefit over a 60-year timeframe[1].

The A350 route is not currently part of the Strategic Road Network managed by Highways England (HE). In recent years local authorities in the region, including Wiltshire Council, have collaborated to make a case for investment in improved north-south links. In March 2020 the government confirmed inclusion of the South of England north-south connectivity study in the RIS2 programme. The study is expected to include consideration of the current and future role and function of the existing north-south routes, including the A350.

[1] South of England north-south connectivity (October 2017, B&NES, Dorset County Council and Wiltshire Council)

Figure 1-1 - A350 strategic context

1.2.2. Local significance

At a more local level, the A350 corridor through Wiltshire underpins the A350 Growth Zone identified in the Swindon and Wiltshire Strategic Economic Plan (SWSEP). Transport connectivity provided by the A350, and the rail network, has a major role in supporting the local economy and delivering current planned and future housing and jobs growth within the West Wiltshire area. Sections of the A350 route through Wiltshire suffer from capacity issues and resultant congestion and delays, and some sections are not suitable for the volume and type of traffic that they carry. Significant improvements have been made to the rail network (e.g. TransWilts services serving Melksham), although opportunities for further improvement are more limited.

The section of the A350 through Melksham has been identified as a key constraint on the route, lying at the heart of the A350 corridor between the principal settlements of Chippenham and Trowbridge. It includes 30mph sections through residential areas of Beanacre and northern Melksham and carries a high proportion of HGV traffic. The route suffers from frequent peak period congestion through Melksham, including at several busy junctions. These conditions result in a number of associated adverse impacts on local communities, including severance, noise disturbance, and accidents.

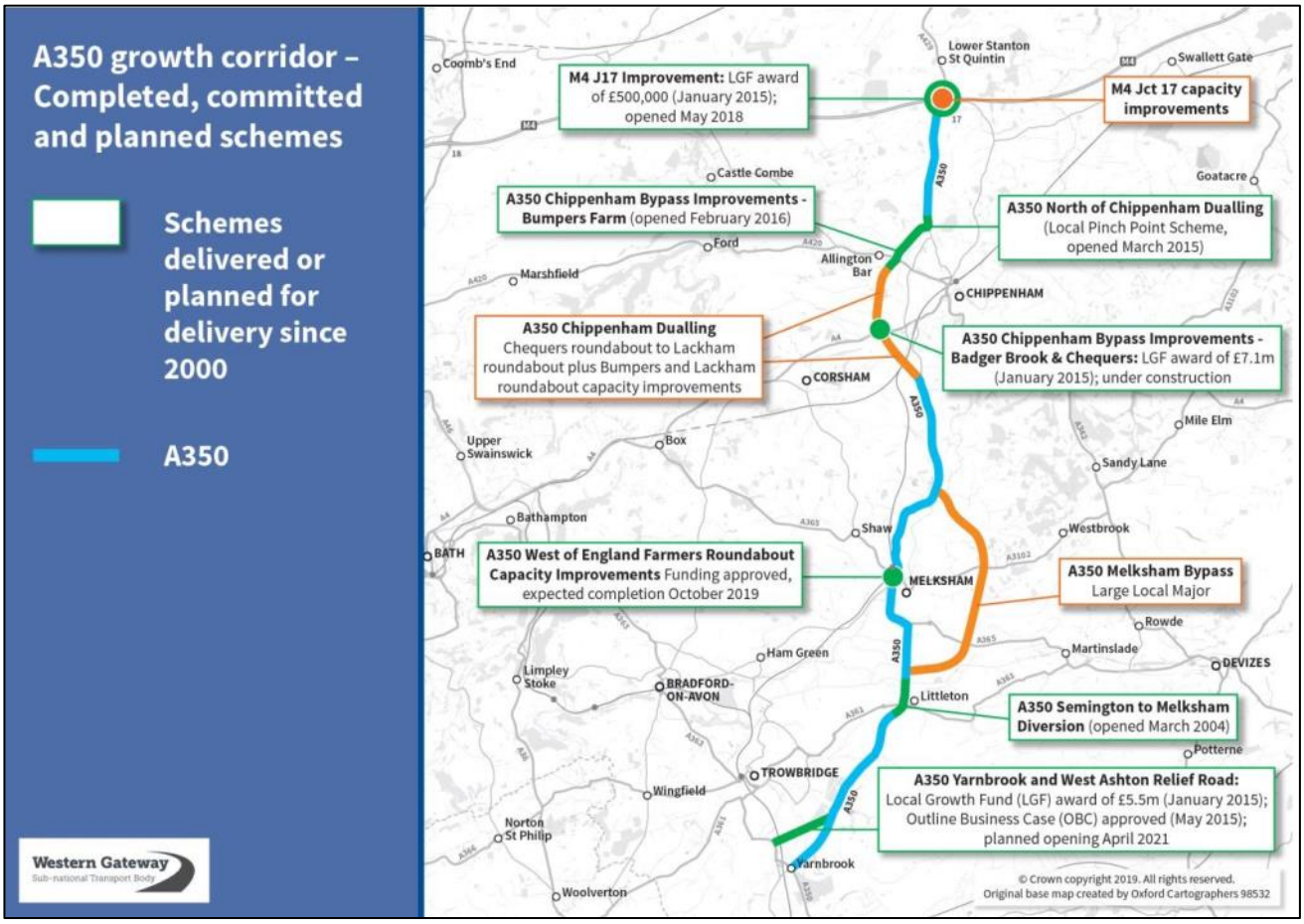
Melksham has seen rapid development in recent years and is expected to be required to accommodate further housing to 2036 through the ongoing Wiltshire Local Plan Review. This further heightens the challenges currently experienced.

1.2.3. Relationship to other A350 schemes

The significance of the A350 in terms of both the local and regional economy has been recognised in recent investment and funding allocations. Wiltshire Council has delivered a number of schemes in recent years intended to provide a co-ordinated approach to addressing current and future issues on the A350 and is developing and promoting several others. These are illustrated in Figure 1-2) and include:

- improvements to M4 Junction 17 – completed May 2018, funded through the Local Growth Fund (LGF);
- upgrades to the A350 at Chippenham – completed, funded through the LGF and Local Pinch Point Fund;
- A350 Farmers Roundabout (Melksham) capacity improvement – completed Autumn 2019, funded through the LGF;
- A350 Yarnbrook and West Ashton Relief Road – currently at Full Business Case stage, promoted through the LGF, with additional developer funding (in relation to the development of the Ashton Park urban expansion at Trowbridge);
- Further upgrade of M4 Junction 17 – currently at OBC stage, promoted through the Major Roads Network (MRN) fund; and
- further dualling on the A350 around Chippenham – currently at OBC stage, promoted through the MRN fund.

Figure 1-2 - Melksham Bypass relationship to wider A350 improvement schemes



1.3. Development of the Outline Business Case

A Strategic Outline Business Case for the Melksham Bypass scheme was developed by Atkins in July 2019. This was an addendum to the SOBC originally developed in 2017, which was accompanied by an Options Assessment Report (OAR) and Appraisal Specification Report (ASR).

At the outset of developing the OBC, an initial review has been undertaken to ensure that the business case progresses on a sound basis. This has included:

- A review of feedback / comments on the SOBC (including from DfT);
- A review of recent policy changes;
- Identification of any key changes to scheme context and business drivers;
- A review of scheme objectives;
- An exercise to refresh the options assessment and (re)confirm the shortlisted options for appraisal within the OBC (including planned stakeholder / public engagement) – an updated OAR will be produced; and
- A review and update of the ASR (this document).

Scheme options are discussed in section 3. The OBC will align with relevant WebTAG guidance. In terms of scheme development, the OBC will include further development of the design specification for the shortlisted options compared to that which informed the SOBC stage. This will also include more refined cost estimates. Furthermore, stakeholder and public engagement activity is planned within the OBC programme to inform the scheme development process and selection of the preferred option. It is currently anticipated that the OBC will be submitted in full in October 2021 (although individual elements may be shared with the DfT in advance).

1.4. Report purpose and structure

1.4.1. Purpose

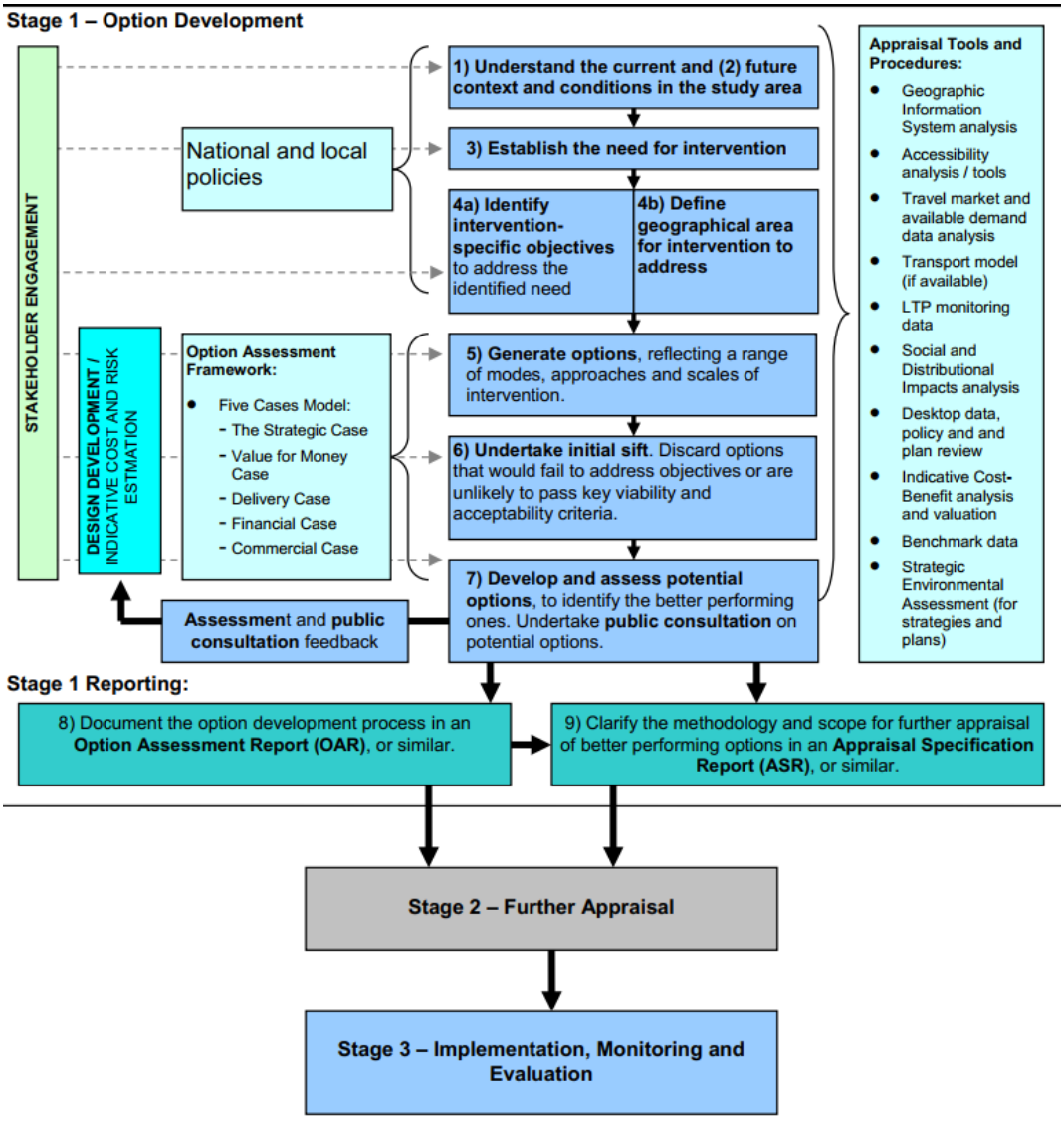
The Appraisal Specification Report forms the final step (Step 9) of Stage 1 (option development) of the DfT's transport appraisal process – see Figure 1-3.

In line with WebTAG guidance the purpose of this Appraisal Specification Report is to set out:

- the proposed approach to transport modelling and forecasting of the scheme;
- the proposed methodology for appraising each of the sub-impacts presented within the Appraisal Summary Table (AST);
- the proposed level of design or specification which will inform the cost estimation, and how better cost information will be obtained; and
- evidence that views on the appraisal methodology have been sought from the statutory environmental bodies and others.

The Options Assessment Report is currently being updated. This provides comprehensive details in relation to the scheme context, identified problems and issues, scheme objectives, and the process for generating and sifting / assessing potential options (including stakeholder input / feedback). It is not the intention to repeat this information in detail within the ASR. Where relevant, a summary of the key points is provided.

Figure 1-3 - DfT transport appraisal process (TAG – the transport appraisal process)



1.4.2. Structure

The remainder of the ASR is set out as follows:

- Section 2 - provides a brief description of the study area, existing issues and challenges, future challenges and scheme objectives;
- Section 3 - introduces the options that were previously considered at SOBC stage, and the process of (re)confirming these for the OBC along with inter-dependencies, timeframe, uncertainty and stakeholders;
- Section 4 - examines the suitability and availability of existing transport models for assessing and appraising alternative scheme options, and sets out the proposed approach to the modelling and any data collection required to support this;
- Section 5 - sets out the proposed approach for the economic appraisal of the scheme in line with guidance in WebTAG and DMRB, including social and distributional impacts;
- Section 6 – sets out the proposed approach for appraising the environmental impacts;
- Section 7 – sets out the proposed approach for operational assessment of the scheme; and
- Section 8 – Summarises the approach of the ASR in an Appraisal Specification Summary Table (ASST).

2. Issues and objectives to be addressed by the scheme

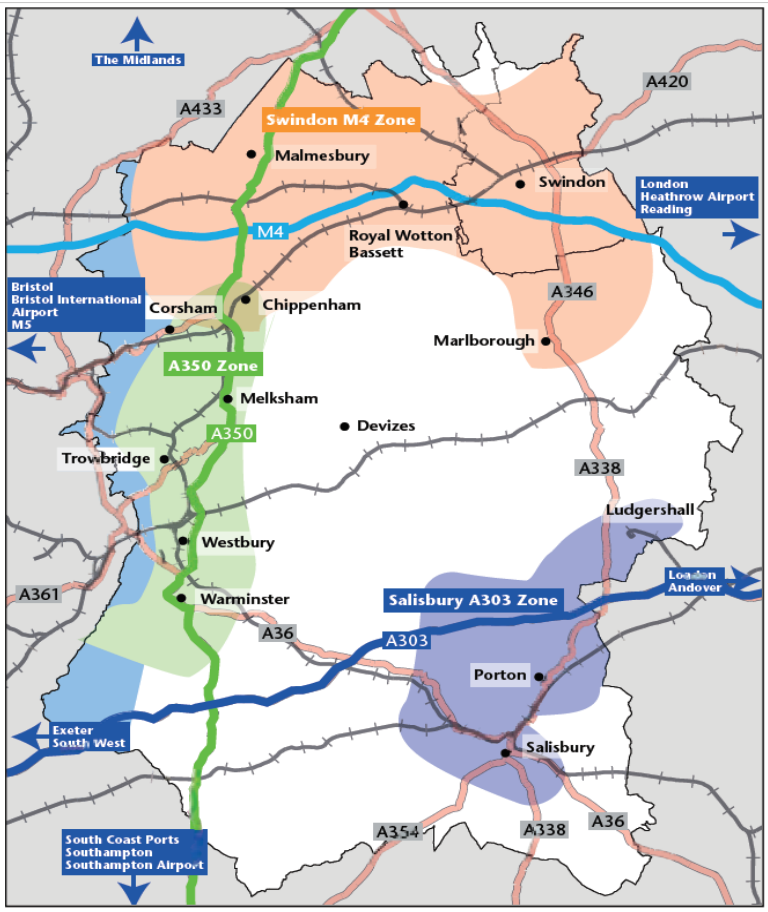
2.1. Local and regional context

The A350 corridor is of local and regional significance (Section 1.2). The Western Gateway Sub-National Transport Body (SNTB) has identified the A350 as a key strategic route in the Western Gateway area. The corridor has the potential to drive change in the Dorset and Wiltshire economies and benefit the whole of the Western Gateway area through better access to its coastal international gateways (e.g. Port of Poole) and providing additional strategic resilience and connectivity for north-south movements in the Western Gateway area.

From the M4 Junction 17 (Chippenham) to the south coast (Poole) the A350 route is approximately 65 miles in length, with approximately half of the route within Wiltshire and half within Dorset. Typical total end to end journey time in the AM peak is in the region of 1hr 40mins to 2hr 20mins. Within Wiltshire, the towns along the A350 corridor create an interlinked series of local employment hubs which, in combination, are a major driver of economic growth (Figure 2-1), as reflected in the designation of the A350 Growth Zone by the SWLEP. Strategic development of the corridor has created an area that, as of 2016, was home to 8,200 businesses (25% of the total business stock in the SWLEP area) and 79,400 employees.

The Wiltshire Core Strategy (WCS) to 2026 was adopted in January 2015 and includes allocations for 20,285 houses and 91 ha of employment land by 2026 for towns along the A350 corridor. The WCS states that sections of the A350 carry the highest volume of traffic and HGV movements on the county's non-trunk primary routes and sets out the intention for the route to be selectively improved to maintain and enhance journey times, with the aim of supporting this employment growth.

Figure 2-1 - Swindon and Wiltshire Strategic Economic Plan Growth Zones



2.1.1. The A350 (Melksham)

The section of the A350 through Melksham is approximately 12 miles south of M4 Junction 17. From Beanacre (to the north of Melksham) to Semington (to the south of Melksham) the A350 is approximately 4.5 miles in length and is predominantly single carriageway.

The layout of the road network means that the A350 at Melksham serves multiple functions. It is not only the main north-south route through the town, but also the main east-west through route (between A365 Western Way and Bath Road) and provides access to the town centre and retail developments along the A350 itself for local traffic. Annual Average Daily Traffic (AADT) is approximately 32,000 vehicles. HGVs account for approximately 7% to 9% of traffic. Based on ANPR survey data (2017), approximately 40% of all traffic entering or leaving Melksham on the A350 via Beanacre is through-traffic, with the remaining 60% starting or ending its journey in Melksham. Of the 40% through-traffic, approximately 25% is north-south movements.

The speed limit is 30mph for much of the route adjacent to the town. A short section between north Melksham and Beanacre has a speed limit of 40mph. The section between the south of Melksham and Semington is national speed limit.

Through North Melksham and Beanacre there are a series of residential areas fronting onto the road. Melksham rail station is located to the west of the A350, providing an hourly service (TransWilts) to Swindon / Westbury. In the route's central section through Melksham there are three key junctions used by local traffic to provide access to major supermarket, household and fast food retailers, and the route intersects the A365 route (towards Bath) and the A3102 / B3102 routes.

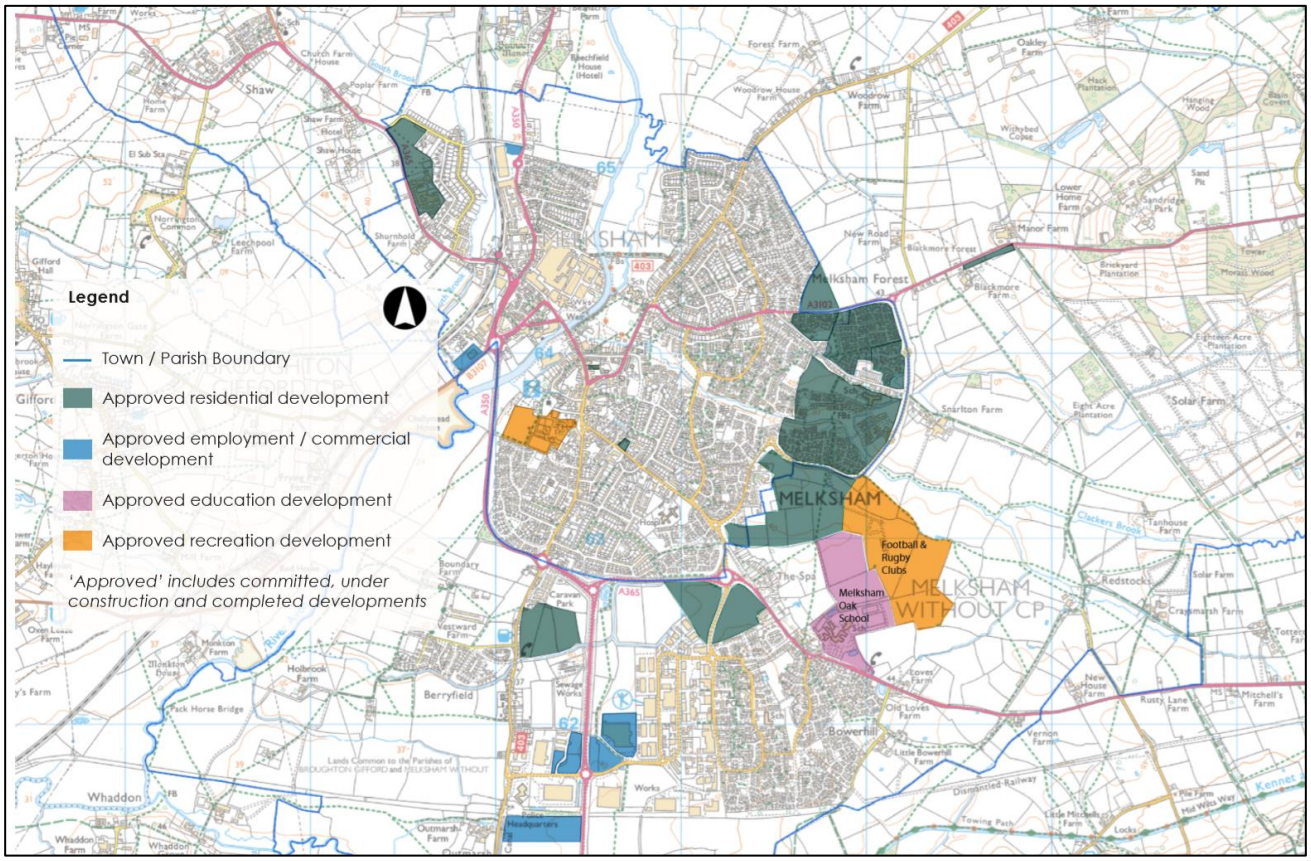
Wiltshire Council completed an improvement scheme at Farmers Roundabout in October 2019. The scheme, delivered through the National Productivity Investment Fund, provides some localised capacity enhancement to address existing congestion issues at this location.

2.1.2. Socio-economic features

Melksham town has a population of just over 20,000. Several smaller villages are located in the surrounding area, including Shaw, Shurnold, Whitley and Beanacre. The vast majority of the town is located to the east of the A350. The town has experienced expansion in recent years. The Wiltshire Housing Site Allocations Plan (WHSAP) was adopted in 2020, and outlines housing completions in the period 2006-17 along with developable commitments to 2026. The report suggests that the requirement set in the WCS is likely to be exceeded in Melksham, with 2,558 houses expected to be completed by 2026 (318 over the required 2,240). This is based on several major planning permissions having been granted for new housing developments on the south and eastern edges of Melksham near Western Way, Spa Road and Eastern Way (see Figure 2-2).

The town centre has been identified as being in need of regeneration, with the regeneration of employment sites being a priority (and associated with a high degree of economic out-commuting). Melksham's main employers include manufacturers of rubber/tyres, furniture and rail vehicle components, with sites located in the town centre and at Bowerhill Trading Estate to the south of the town.

Figure 2-2 - Completed, committed and under construction developments within Melksham



Source: Draft Joint Melksham Neighbourhood Plan, June 2020

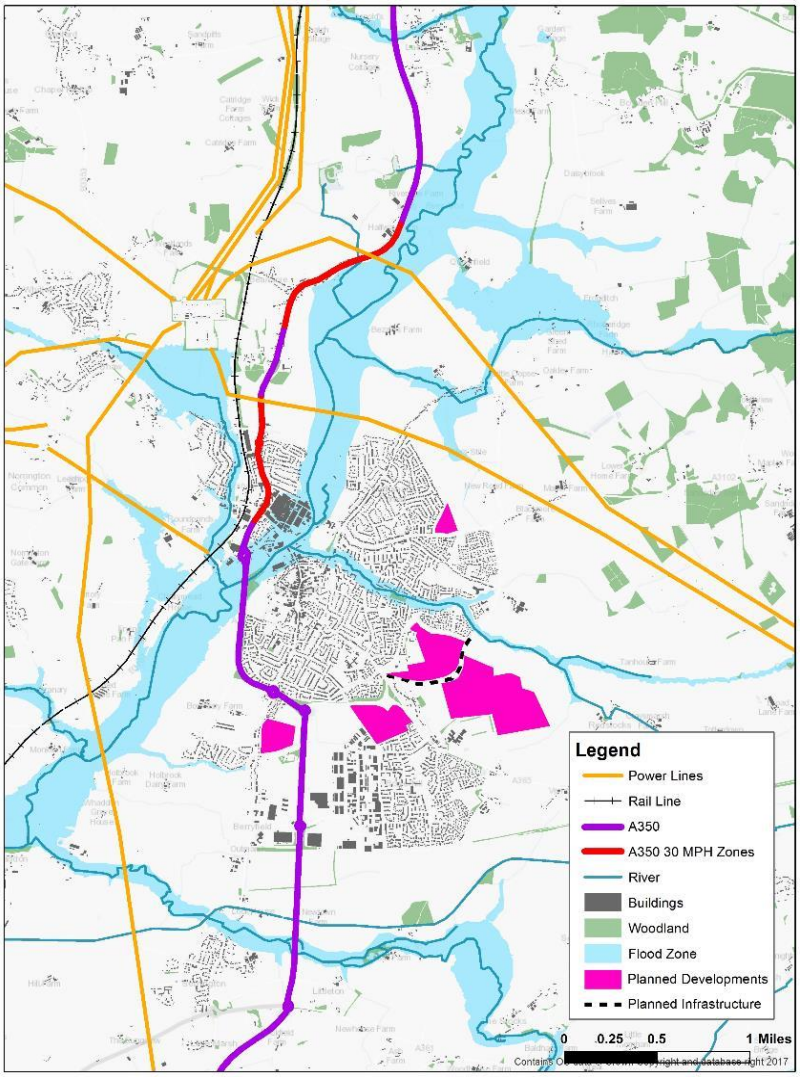
2.1.3. Physical features

Key physical features within the Melksham are illustrated in Figure 2-3). The River Avon floodplain bisects Melksham on a north-south axis and is bridged by the current A350 route immediately south of Farmers Roundabout. A second area of floodplain lies to the north-west of Melksham. The Kennet and Avon canal runs east-west to the south of Melksham town.

The railway line runs to the west of the town. Melksham electricity sub-station is located to the west of Beanacre and the railway line, with a number of power lines running north to south and east to west.

There are some isolated areas of woodland surrounding the town.

Figure 2-3 - Key physical and environmental constraints in the Melksham area



2.2. Issues and challenges

2.2.1. Current issues

A detailed review of problems and issues and associated evidence is presented within the OAR. The A350 through Melksham has been identified as a key constraint on the effective functioning of the corridor. The main associated problems that the scheme seeks to address are summarised below, which result in adverse impacts at a local and regional level.

Journey times / delays and reliability

The route through Melksham includes a number of 30mph sections and parts of it are not suitable for the volume and type of traffic that it needs to accommodate. Congestion and delays are experienced during peak periods, particularly at busy junctions through Melksham (Bath Road, Farmers, Semington Road and Western Way). Typical peak hour delays are in the region of 5 minutes along the 4.5 mile section of route (compared to free flow conditions). A signalisation scheme at Farmers roundabout in 2019 has improved traffic conditions at a local level at this junction - but the scheme was intended to address existing issues in the shorter-term, rather than provide a comprehensive longer-term solution. At a route level, it is the cumulative effect of speed limits, capacity constraints (and traffic volume), road standard / layout and adjacent land uses which result in slow moving traffic and variability in journey time from day to day. Consequently, the network is also sensitive to disruption and incidents. The town centre is not suitable for through-traffic and, with no other route north of Farmers roundabout, the A350 serves as not only the north-south route, but also the main east-west through

route and provides access to the town centre and retail developments. Journey time analysis identifies congestion and delays on the A350 between Farmers roundabout and Leekes on the northern edge of Melksham. Significant delays are experienced along this section in both directions throughout the AM, PM and inter-peak periods. There is also evidence of delays for southbound traffic in the PM peak through Beanacre and Semington and Western Way roundabouts.

Journey time delays and poor reliability affect local residents and businesses, as well as more strategic, longer-distance traffic (e.g. between the south coast and the M4), including HGVs. The route therefore adversely impacts north-south connectivity within the region and is a constraint to local and regional economic growth.

Accidents

Accident analysis shows that 189 accidents were reported in Melksham and Beanacre between 2014 and 2018, with 61 (approximately 32%) of these occurring on the A350. Clusters of accidents are evident around the busiest junctions on the A350 through Melksham, especially Farmers roundabout and Bath Road. As well as the personal injury, social and financial costs associated with accidents, these incidents result in disruption to traffic and expose the poor network resilience, as noted above.

Severance

In the northern and central sections of the A350 through Melksham in particular, the route acts as a barrier to pedestrian and cycle movements between the town centre / east Melksham and west Melksham. The large volume of traffic, with a relatively high proportion of HGVs, impacts significantly on residents living in northern parts of the town. With the rail station located to the west of the A350 route, this also acts as a deterrent to people accessing the station by non-car modes.

Noise disturbance and air quality

The high traffic volumes (including HGVs) and proximity of parts of the route to property frontages and sensitive receptors exposes local communities to noise disturbance and poorer air quality. Whilst there is currently no designated Air Quality Management Area, parts of the route are classified as Noise Important Areas (DEFRA).

2.2.2. Future challenges

Looking to the future, the primary challenge relates to further employment and housing growth along the A350 and around Melksham. Combined with wider regional growth and demand for north-south movements this will result in increased traffic demands on the A350. The Wiltshire Core Strategy (2006-2026) identifies a housing need of 25,000 homes in the North & West Housing Market Area (comprising key A350 corridor settlements: Chippenham, Trowbridge, Warminster, Westbury, Melksham). As at 2017, just over half of these homes had been delivered. An additional 1,100 homes have also been allocated to 2026, resulting in developable commitments of 11,700 homes within the A350 corridor area up to 2026.

Furthermore, Wiltshire Council has initiated a Local Plan review, which extends the planning horizon to 2036. This process is ongoing, but the indications are that it could result in an additional 14,000 homes being allocated up to 2036 (within the A350 corridor).

By 2036 (without Local Plan site allocations, but with background traffic growth), it is predicted that car driver demand during the Inter-Peak period, in the Melksham area, will be as high as current AM peak levels, leading to wider congestion and delays being expected throughout the day. Without intervention, the role and function of the A350 would be severely compromised and the issues identified in Section 2.2.1 relating to congestion, reliability, severance, nose and air quality would be expected to be further exacerbated. This would compromise the local economic strategy centred around the A350 Growth Zone. Regeneration of Melksham town centre could also be adversely affected, especially if traffic diverts to use alternative (less suitable) routes (e.g. through the town centre).

Plans to grow the Port of Poole and Portland Port would generate further regional traffic demand, including HGV traffic in particular. The prevailing and likely future conditions on the A350 could also act as a constraint on the expansion of these economic drivers however.

2.3. Scheme objectives

Scheme objectives from the SOBC stage have been reviewed in light of current policy context and latest data and information. In line with WebTAG guidance a hierarchy of objectives has been identified, along with the identification of measures of success. These are summarised in Table 2:1.

Table 2:1 – Hierarchy of strategic outcomes, objectives and measures for success

Strategic Outcomes	High-level objectives	Transport objectives	Measures for success (to be confirmed)
Sustainable population and economic growth in the A350 corridor, with positive impact on regional and national economic productivity	Improve north-south connectivity between the M4 and South Coast, and provide capacity for growth in the A350 corridor between Trowbridge / Westbury and Chippenham / M4	Reduce journey times and delays on the A350 through Melksham and Beanacre, improving local and regional north-south connectivity, and supporting future housing growth in the A350 corridor	1. Average Inter Peak journey times on A350 between Lacock and Semington reduced by 15% in the year after scheme opening 2. Average Peak journey times experienced on A350 between Lacock and Semington reduced by 30% in the year after scheme opening
	Improve connectivity for other through journeys via Melksham (to/from Bath, Calne and Devizes)	Reduce journey times and delays on the following routes through Melksham, allowing for future growth in demand: - A350 South - A3102 - A365 West - A365 East - A350 South - A365 West	1. Average Peak journey times between Semington (A350) and Sandridge (A3102) reduced by 5% in the year after scheme opening 2. Average Peak journey times between Shaw (A365 W) and Bowerhill (A365 E) reduced by 10% in the year after scheme opening 3. Average Peak journey times between Semington (A350) and Shaw (A365 W) reduced by 10% in the year after scheme opening
Sustainable population and economic growth around Melksham / Bowerhill, supporting a revitalised town centre	Improve connectivity within Melksham / Bowerhill, particularly for walking and cycling journeys to Melksham town centre and along the existing A350 corridor through Melksham	Provide enhanced opportunities for walking and cycling between Melksham town centre and the rail station / Bath Road, and along the existing A350 corridor within Melksham and Beanacre, through the provision of infrastructure and other measures to encourage active travel and reduce the impact of transport on the environment	1. Walking and cycling journeys between town centre and rail station / Bath Road increased by 10% in the year after scheme opening 2. Walking and cycling journeys along the existing A350 corridor (between Bath Road and Leekes) increased by 10% in the year after scheme opening
Improved physical and mental wellbeing for users of the A350 and residents of Melksham	Reduce personal injury accidents on the road network	Reduce personal injury accident rates and severity for the A350 and Melksham as a whole	1. Reduce personal injury accident rates on A350 between Lacock and Semington by 30% with lower average severity in the five years after scheme opening 2. Reduced personal injury accident rates for Melksham overall by 10% with lower average severity in the five years after scheme opening
	Reduce severance impacts of traffic on communities in Melksham / Bowerhill and Beanacre	Reduce the volume of traffic including HGVs passing along the current A350 route in northern Melksham and Beanacre to reduce severance, whilst avoiding negative impacts on other existing or potential residential areas	1. Average daily and peak traffic volumes using existing A350 route in northern Melksham and Beanacre reduced by 30% in the year after scheme opening 2. Average daily HGV numbers using existing A350 route in northern Melksham and Beanacre reduced by 50% in the year after scheme opening 3. No increase to general or HGV traffic on other residential roads in Melksham (Semington Road / King Street, Spa Road (north of Snowberry Lane), Lowbourne / Sandridge Road) in the year after scheme opening

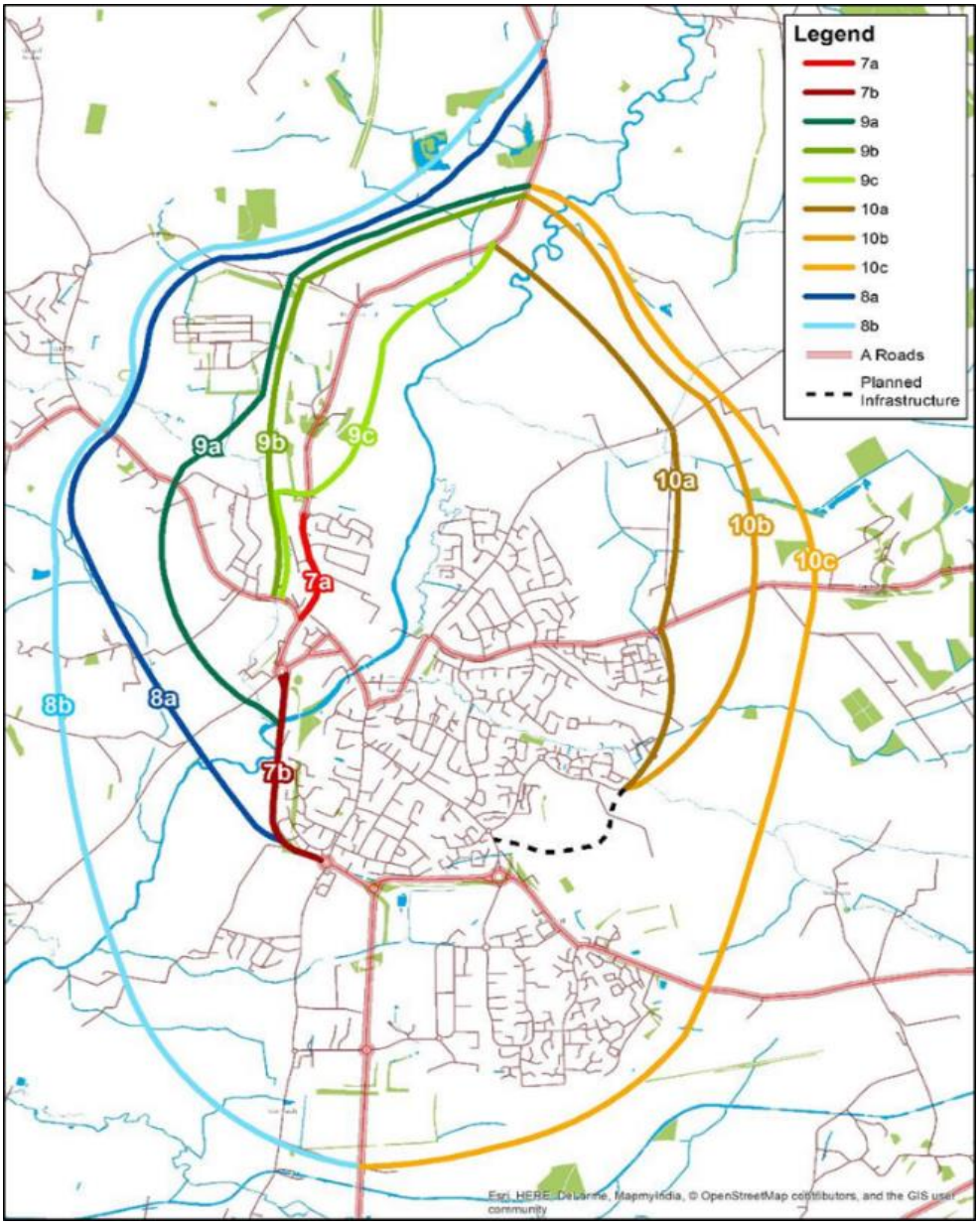
3. Scheme options

3.1. Option development background

The development of scheme options has taken place over a number of years and has been informed by a range of technical studies. In 2016 Atkins produced an Interim Options Assessment Report (OAR). This was updated in 2017 and formed the basis of a Strategic Outline Business Case (SOBC). The OAR considered a full range of options, from non-highways-based solutions to partial bypass options and full bypass options. It concluded that a highways-based solution was the most appropriate to address the specific scheme issues and objectives.

The long list of highways options considered at the 2017 SOBC stage is illustrated in Figure 3-1. This included partial bypass options and full bypass options to the east and west of Melksham, in addition to on-line improvements.

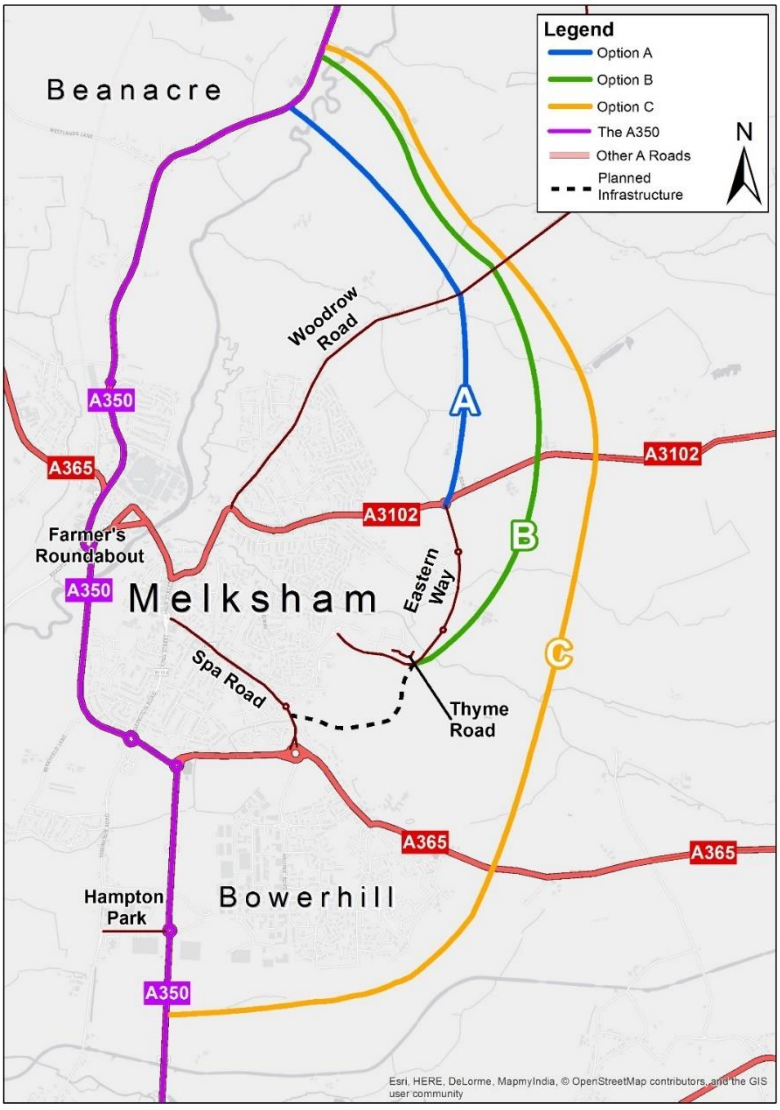
Figure 3-1 - Long-list highways options (OAR, 2017)



An assessment was undertaken within the 2017 OAR which considered a range of criteria across the main elements of the business case – strategic, economic, financial, commercial and management (delivery). The economic assessment included analysis of potential journey times savings and also initial, high-level assessment in relation to environmental impacts. The assessment concluded that three options should be short-listed for further development and investigation (Figure 3-2):

- Option A – a partial bypass comprising a new link between the A350 and A3102, connecting with the existing network at Eastern Way, on the eastern edge of Melksham, and joining Spa Road at the southern end. At the southern end the route would utilise a new link between Eastern Way and Spa Road associated with a housing development.
- Option B – similar to Option A, except rather than joining Eastern Way at its northern end this option provides an additional section of bypass to connect into Eastern Way at its southern end.
- Option C – a full bypass option connecting the A350 north of Melksham to the A350 south of Melksham – a route of approximately 5 miles.

Figure 3-2 - Short-list scheme options (OAR, 2017)



Note: highway corridors are illustrative only, and do not imply any specific alignment of new roads

Options to the west of Melksham generally did not perform as well, predominantly linked to higher costs and deliverability challenges, owing to a number of constraints located to the west such as the railway line, floodplain and other land uses including solar farms and a golf club.

The 2017 SOBC appraised these three options. The headline Value for Money outputs are summarised in Table 3:1. Option C (full bypass) demonstrated the strongest VfM overall.

Table 3:1 – Summary of Value for Money – SOBC, 2017

	Option A	Option B	Option C
NPPV	£28.7m	£26.5m	£65.8m
BCR	1.94	1.69	2.20
VfM Category	Medium	Medium	High

In 2019, an addendum to the SOBC was produced to support the Large Local Majors (LLM) funding submission to DfT. This was also supported by further design development. Relevant parts of the SOBC were updated, including the appraisal. On the basis of the earlier appraisal work (2017), Option B was not appraised due its lower VfM. The overall VfM category for Option A and Option C reduced, mainly due to more robust, but higher, scheme cost estimates. Option C remained the option with the strongest overall VfM.

Table 3:2 – Summary of Value for Money – SOBC, 2019

	Option A	Option B	Option C
NPPV	£9.94m	Not appraised	£88.23
BCR	1.21		1.76
VfM Category	Low		Medium

3.2. Options Assessment Report - review / update for the OBC

3.2.1. Strategic context review

At the outset of the Outline Business Case (OBC) the opportunity has been taken to undertake a strategic context review to confirm the 'starting point', as this:

- ensures that the business case (OBC) progresses on a sound footing and with clear direction based on the latest information;
- identifies key changes / developments in relation to scheme context;
- checks that the scheme objectives are still relevant and appropriate; and
- identifies any areas where additional evidence or data may be required.

Some of the key points arising from this review of relevance to further development of the scheme through the OBC include:

- The need to further consider the role of the scheme in facilitating opportunities for local walking and cycling trips, including incorporating complementary measures within the scope of the scheme;
- The need to consider the scheme in the context of Wiltshire Council's climate emergency and commitment to achieve carbon neutrality by 2030;

- The need to consider the direction of the emerging Wiltshire Local Plan Review, in terms of potential future housing and employment sites;
- The need to undertake stakeholder engagement on emerging scheme proposals; and
- The need to consider the relationship of the scheme with other planned and potential schemes / strategies for the A350 corridor.

As a result of the review, some refinements were made to scheme objectives (reflected in section 2.3).

3.2.2. Options assessment review

A process is also being undertaken to review and (re)confirm the options sifting and assessment process (in light of all the latest context and information). This will verify the short-listed options for full appraisal within the OBC. The process seeks to build upon the previous OAR work, in particular through:

- Reviewing the long list of options to ensure all relevant options have been captured;
- Refining the definition of scheme options, supported by additional high-level engineering and feasibility work;
- Refining the cost estimates of scheme options, and ensuring that they are prepared on a consistent basis;
- Utilising new and/or updated data and evidence, including additional land information; and
- Using the planned stakeholder engagement to inform the process.

The assessment will reflect the refined scheme objectives and all parts of the previous assessment will be reviewed and updated where appropriate. The assessment criteria will remain similar to the previous work, although the level of detail will be expanded to include consideration against each sub-objective under the main appraisal impacts - economic, environmental and social. A desktop environmental assessment will be undertaken.

3.2.3. Short-listed options for the OBC

The OAR review process is ongoing. To inform this, Wiltshire Council is undertaking a non-statutory consultation exercise on the potential scheme options between November 2020 and January 2021. Confirmation of the short-listed options will be subject to the outcomes of this consultation. For the purposes of this ASR report it is assumed that the short-listed options from the 2019 SOBC remain relevant (Option A and Option C above), and that a complementary walking / cycling package will be included within the scheme scope. It is considered that the proposed appraisal approach would still be appropriate for other options should the short-listed options change. The main exception would be if a public transport or other non-highway-based option were short-listed. However, based upon previous options work this is considered to be unlikely.

3.2.4. Option development through the OBC

Once (re)confirmed, the short-listed options will go through a process of refinement and further development. This will include progression of the scheme design to investigate details of route alignment, land impacts, structures, drainage and junction configurations and other necessary changes to the highway network and walk / cycle routes, public footpaths and bridleways. This will be an iterative process with transport planning, environment and planning teams. Opportunities will be sought to further optimise the options.

The option refinement process will result in a better-defined scope and specification of the short-listed options, sufficient to underpin the OBC appraisal.

3.3. Interdependencies

Whilst not directly interdependent, the A350 Melksham Bypass scheme is considered to be complementary to other improvements that have recently been undertaken or are planned with respect to the A350 (e.g. in the Chippenham and Trowbridge areas – see section 1.2.3), and to the development of the A350 Growth Zone set out in the Swindon and Wiltshire Strategic Economic Plan.

The planned development of 450 dwellings on land east of Spa Road includes provision of an extension to the existing Eastern Way distributor road (shown by the dotted line in Figure 3-2) linking it to a new roundabout to be constructed on Spa Road between the existing Spa and Snowberry Lane roundabouts. This has received

planning permission and is expected to be delivered in phases up to 2026. It would form part of Option A and may also require design changes to enable it to accommodate higher traffic volumes and to mitigate potential noise impacts on nearby housing. This would not be necessary under Option C, as it bypasses the entire length of Eastern Way.

The relationship between the scheme and the emerging Wiltshire Local Plan Review (LPR) will be monitored throughout development of the OBC (and beyond). The LPR is still at a relatively early stage and preferred sites have not yet been announced. Of particular relevance will be the location (and scale) of any potential sites within the Melksham area in the context of the scheme options under consideration. If sufficient details emerge within the timeframe of the OBC, this would be further explored (e.g. through use of additional sensitivity tests).

3.4. Timeframe

The current indicative key milestones for scheme development are as follows:

- 2020/21; Development of OBC and stakeholder engagement
- 2021: Submission of OBC and identification of preferred option
- 2022-2024: Design of preferred option, planning approval process and land acquisition
- 2024: Procurement and production of Full Business Case
- 2025-2028: Construction
- 2028: Scheme opening

3.5. Uncertainties

At this stage, the main uncertainties in relation to the scheme are considered to include:

- Implications of the emerging Wiltshire Local Plan Review;
- Delivery of the new link road connecting Eastern Way to Spa Road (Option A only);
- Detailed route alignment (to be developed through the OBC stage);
- Land acquisition;
- Environmental mitigation;
- Scope and definition of complementary walking and cycling measures;
- Associated improvements required to the existing / adjacent network (e.g. to optimise the performance of options); and
- Changes to DfT appraisal guidance (TAG) and implications on the scheme Value for Money (see section 5.9.2).

3.6. Stakeholders

There are many interested parties in this project from a local to regional level, many of whom have an active part in the scheme development and delivery process. Wiltshire Council is currently developing a Stakeholder Engagement and Communications Plan to inform the scheme development throughout the OBC stage and beyond. No formal engagement or consultation exercise has been undertaken on the scheme to date, although Wiltshire Council has engaged with a number of key local stakeholders about the A350 Melksham Bypass over several years.

Wiltshire Council is undertaking a non-statutory consultation exercise on the potential scheme options between November 2020 and January 2021. Further rounds of public consultation are anticipated as design work progresses. Engagement with key stakeholders and key landowners will be undertaken through the OBC stage to inform scheme design and development. Early engagement with statutory environmental bodies will be sought to identify any key issues that will need to be addressed, including the requirement for mitigation measures such as compensatory flood storage.

The Department for Transport (DfT) will be engaged throughout development of the OBC, and this ASR represents an important stage in this process.

4. Approach to traffic modelling

This section sets out the proposed methodology for the development of the transport modelling to underpin the transport appraisal within the Outline Business Case (OBC) for the A350 Melksham Bypass scheme.

4.1. Existing knowledge and data

Existing guidance on transport modelling appraisal and assessment comprises of the following resources:

- TAG Units M1 to M5 on transport modelling, and the TAG Databook v1.13 (May 2020).
- Highways England guidance on developing the regional transport models, for example the network coding manual.

Table 4:1 summarises the availability of existing models for use in the development of a suitable model for the A350 Melksham Bypass OBC. All are highway models only.

Table 4:1 – Existing potential models

Model	NTEM	Modelled years	Description
South West Regional Transport Model (SWRTM)	7.0	2015, 2021, 2031, 2041	Highways England Regional Transport Model (SATURN / DIADEM)
A303 Stonehenge Model	7.2	2015, 2026, 2041, 2051	Variant of the SWRTM with greater detail in Wiltshire (SATURN / DIADEM)
Melksham Transport Model (MTM)	7.2	2024, 2036	Derived from a cordon of the A303 Stonehenge model with extra detail in Melksham (SATURN only)
Wiltshire Transport Model (WTM)	7.2	2018, 2024, 2036	Variant of the A303 Stonehenge model with further refinement in Wiltshire (SATURN / DIADEM)

NB - Dynamic Integrated Assignment and Demand Model (DIADEM)
- National Trip End Model (NTEM)

The 2017 version of the SOBC was informed by the Melksham Transport Model (MTM). This model was cordoned from the A303 Stonehenge Model (which was itself derived from the SWRTM). Extra refinement within the Melksham urban area was required, based on additional surveys, more detailed network coding and highway demand refinement. Whilst the MTM was sufficiently well calibrated within the Melksham area, outside of this region there was considerable model noise and uncertainty inherited from the SWRTM. The A350 Melksham Bypass SOBC study recommended that a new base model should be created with appropriate geographical scope, scale and detail.

In 2018, Wiltshire Council commissioned Atkins to acquire the additional traffic data required to enhance the existing A303 Stonehenge model (developed for Highways England) to develop a model which could be used to assess and appraise infrastructure schemes and development planning within the Wiltshire region. Subsequently, Atkins was commissioned to develop the Wiltshire Transport Model. The SOBC update / addendum in July 2019 was based on the use of the Wiltshire Transport Model.

4.1.1. Proposed modelling tool for the OBC

The existing Wiltshire Transport Model is considered to be the most suitable tool for the OBC. The Wiltshire Transport Model, a full Variable Demand Model (VDM), has been examined in terms of attributes, coverage, segmentation and level of detail in respect of the scheme area of focus. This has included zoning granularity around Melksham, confirming the model network reasonably represents the configuration of the actual highway network, and reviewing the model calibration and validation where possible.

Further refinement to the Wiltshire Transport Model will be required to provide a greater focus on the Melksham area.

4.2. Assessment of the need for VDM and proportionate modelling and design considerations

One of the key principles of TAG modelling and forecasting is that: “Evidence should be of adequate quality to make decisions, compiled using proportionate resources” and that “it may not be necessary to use the most sophisticated or detailed models, nor is it likely to be appropriate to invest the highest proportion of resources to develop the best quality model at the expense of interpreting its outputs carefully and communicating its limitations”.

TAG guidance provides key model design considerations, which are essentially trade-offs between model complexity and sophistication of outputs, versus constraints on resources, computer run-times, data requirements and availability. The considerations when reviewing existing model or specifying the design of a new transport model are as follows:

- The nature of identified problems and their likely solutions;
- The definition and size of the study area;
- The availability of data and existing models;
- The need to update and (re)calibrate models (including data collection);
- The timescale for model development; and
- The required precision and robustness of results/recommendations.

The current Wiltshire Transport Model is a full VDM. At present, it is *assumed* that there will be a need to undertake a full variable demand response in the model. The proposed modelling approach set out is based on this assumption. TAG Unit M2.1 (section 2.2) will be utilised to verify the need for a VDM for this scheme: “in order to establish a case for omitting variable demand in the model, preliminary quantitative estimates of the potential effects of variable demand on both traffic levels and benefits should be made.”

Should this test actually demonstrate that VDM is not required (contrary to the working assumption) then we would revisit our methodology considering the most proportionate approach (a fixed demand assignment of an appropriately sized cordon model). In these circumstances, DfT will be informed and any revised approach would be agreed.

4.3. Proposed area of detailed modelling

4.3.1. Wiltshire Transport Model – Area of Detailed Modelling

Figure 4-1 highlights the Area of Detailed Modelling (ADM) currently within the Wiltshire Transport Model. To fully capture the network impacts of changes within Wiltshire, the ADM encompasses the whole of Wiltshire, Swindon, Bath, parts of South Gloucestershire and parts of the Cotswolds. The current modelling suite assumes a fully simulated network.

The approach within this section is presented on the assumption that a full VDM approach is taken (see section 4.2) with the proposed use of the Fixed Cost Function (FCF) feature within the SATURN software, primarily to keep model run times to a reasonable duration and to reduce model noise (see section 4.4.2 for further details). As noted above, in the event that VDM is shown to not be required this approach would be reviewed and the FCF approach is unlikely to be necessary.

4.3.2. Scheme area of influence

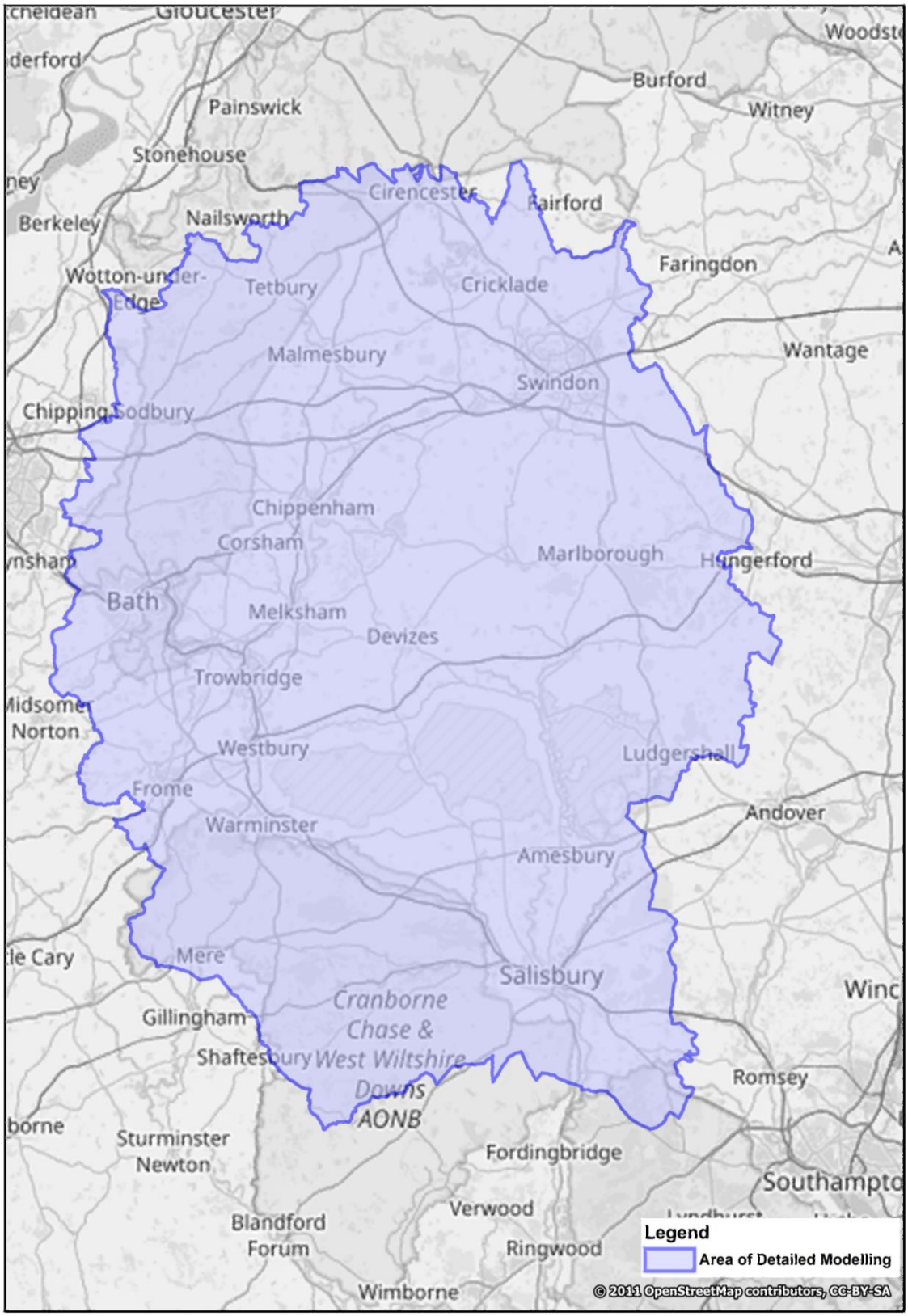
Flow difference plots from an early iteration of the scheme testing with the model are presented in Appendix A. These compare the 2036 DM against a 2036 DS scenario incorporating option 10c of the Melksham Bypass. These initial outputs suggest that the area of influence is largely defined by the M4 (J17) to the north, and Warminster to the south - this is well within the ADM.

The actual extent of the FCF network would be confirmed through further analysis of the extent of expected scheme impacts, particularly in terms of flow and delay, whilst considering key strategic highway corridors and neighbouring towns. This process will be aided by adherence to the Affected Road Network (ARN) criteria

specified in the Design Manual for Roads and Bridges (DMRB) LA105 air quality guidance (November 2019) - see section 4.4 for full details.

During the development of the Wiltshire Transport Model the network was significantly refined in the Melksham area. As a result, greater network detail is not expected to be required in the wider study area.

Figure 4-1 – Wiltshire area of detailed modelling



4.4. Proposed modelling approach

The transport modelling for the OBC will be undertaken in a cordoned region of the Wiltshire Transport Model, through the utilisation of the FCF in SATURN, following TAG guidance on model calibration and validation. The purpose of developing the original Wiltshire Transport Model was to be a donor for localised scheme testing. This resulted in a product suitable for multiple sensitivity and scheme tests, whilst reducing error resulting from model noise and wider regional uncertainty.

Key features and parameters of the Wiltshire Transport Model will be retained. This includes the following:

Modelled time periods

Highway assignment average peak hours as follows:

- AM peak average hour (07:00-10:00)
- Inter peak average hour (10:00-16:00)
- PM peak average hour (16:00-19:00)

The modelled time periods are considered to be suitable for the appraisal of the scheme impacts. Appendix C shows the time of day profile for vehicles on the A350 north of Melksham (Avon Road / Beanacre Road junction). This shows two distinct periods in the morning (07:00-09:00) and evening (16:00-19:00) peak periods, with the IP flow (10:00-16:00) approximately two-thirds of the AM and PM peak flows.

Analysis of the time of day distribution of traffic is further documented in the 2017 Melksham Bypass OAR, based on 2017 ATC data. This will remain in the updated OAR when this is issued to DfT.

Highway assignment model user purpose

The user classes are as follows:, which is explained further in section 4.4.3.

- Car (commute)
- Car (business)
- Car (other)
- LGV
- HGV

VDM demand segmentation and setup.

The demand segmentation structure of the VDM differs from the highway only assignment. Greater details of the VDM setup are provided in section 4.4.3.

4.4.1. Model cordon

A cordon of the Wiltshire Transport Model is proposed to reduce the ADM to a more localised study area, relevant for the Melksham Bypass scheme. The benefits of this approach are as follows:

- Reduced run times - a full DIADEM VDM run of the Wiltshire Transport Model takes over 24 hours per scenario;
- Improved model convergence; and
- Reduced model noise - large geographic areas and convergence issues tend to result in greater levels of model ‘noise’ that may result in spurious economic assessment results.

As such, three cordoning techniques have been evaluated for their suitability in defining a cordon model for the OBC. Table 4:2 summarises the advantages and disadvantages of each cordon technique considered.

- Conventional cordoning - where the full model detail is retained in the identified study area and the rest of the model reduced to a skeletal external network and zoning system.
- Simulation Buffer Transformation (SBT) method in SATURN - where the full model detail is retained in the identified study area and the rest of the model network reduced to SATURN buffer coding without simulation.

- Fixed Cost Function (FCF) method in SATURN - where the full model detail is retained but the simulation outside the identified study area is based upon a (user) defined existing model run (e.g. the Do-Something scenario uses information from the Do-Minimum scenario).

Table 4:2 - Model cordon techniques

Cordon Type	Advantages	Disadvantages
Conventional cordon	• Significant reduction in run times. • Significant reduction in model noise.	• A new VDM will need to be developed. • Full trip lengths no longer available for economic analysis. • Removes opportunity for scheme effects outside of the immediate study area.
Simulation Buffer Transformation (SBT)	• Reduction in run times. • Existing VDM can be retained. • Full trip lengths retained for economic analysis.	• Removes all forms of model simulation. • Locks in whatever the simulation junction had calculated (good or bad) and will therefore be sensitive to large changes in demand. • Every buffer flow-delay curve is assignment specific (i.e. they will vary by year, scenario and time period). Therefore, considerations need to be made concerning: - which assignment(s) to use for forecast years and scenarios and how they may vary over time; - Network structure differences between scenarios. • VDM realism tests need to be re-run and adjustments made if necessary. • Assignments will differ to fully simulated assignments.
Fixed Cost Function (FCF)	• Long established technique. • Fully compatible with existing VDM. • Reduction in run times. • Retains the benefits of simulation (blocking back, downstream flow metering and modelling of individual junctions). • Assignments will be similar to assignments without FCF. • Improves convergence. Significantly reduces convergence noise between DM and DS in peripheral areas. • Reduces noise in economic analysis.	• Minimal disadvantages from a technical standpoint.

In consideration of the cordon techniques discussed above and the requirement to retain the demand response of the VDM, the FCF approach is deemed to be the most appropriate method for the Melksham Bypass OBC transport modelling.

4.4.2. Fixed Cost Function (FCF)

The FCF methodology involves the importation of individual turn flow-delay curves from another (user-defined) network, rather than calculating individual turn flow-delay curves based on current network flows and vehicle interactions. For example, the Do-Something network would use the (previously calculated) turn-flow delay curves from the Do-Minimum network.

As such, the FCF process involves the following sequential steps applied for each forecast year and time period:

1. Run the forecast year Do-Minimum scenario without FCF to full convergence (DIADEM run).
2. Identify Do-Minimum junctions for FCF operation (methodology to define FCF junctions is outlined in section 4.4.2.1).
3. Run the forecast year Do-Minimum scenario with specified (Do-Minimum) FCF junctions to full convergence (DIADEM run).
4. Run the forecast year Do-Something scenario with specified (Do-Minimum) FCF junctions to full convergence (DIADEM run).

4.4.2.1. Definition of Fixed Cost Function (FCF) extent

The extent of the FCF network will be determined by an initial forecast year run of the existing Wiltshire Transport Model, with the inclusion of a 'full bypass' option (e.g. Option C, Figure 3-2 - Short-list scheme options (OAR, 2017)). This will be subject to a full DIADEM VDM run, permitting demand response as a result of implementing the Melksham Bypass scheme.

Consistent with the DMRB LA105 air quality guidance (November 2019), the criteria for the Affected Road Network (ARN) is proposed to be adopted to define the extent of the FCF network. The ARN is defined at the link level by calculating the difference between the Do-Minimum and Do-Something scenarios, based on the following criteria:

- Annual average daily traffic (AADT) >=1,000 (two-way link values combined); or
- Heavy duty vehicle (HDV) AADT >=200 (two-way link values combined); or
- A step change in speed band for the daily average and modelled hour speeds (AM, IP, PM, OP).
  - Heavy congestion (5-20 kph).
  - Light congestion (20-45 kph).
  - Free flow (45-80 kph).
  - High speed (80+ kph).

The likelihood of any 'significant impacts' in the peak periods being masked by the DMRB ARN criteria is considered to be low. For a link to be included in the ARN, the change in two-way flow only needs to amount to 1,000 vehicles, which is very low considering it is recorded over a 24-hour period on a two-way link.

For example, if there was a two-way change of 100 vehicles recorded in the modelled peak hours (which is not deemed significant in a strategic model) and an immaterial two-way change of 25 vehicles in the other 18 hours of the day, the ARN criteria would still be triggered. It is also worth noting that the ARN criteria is used to inform the environmental assessment of highway schemes, so will have been sufficiently scrutinised to avoid the possibility of 'masking' specific time period dependent issues. The use of the ARN criteria to inform the FCF also ensures compatibility between the transport modelling and the environmental assessment.

In addition to the DMRB ARN definition, the impact of the scheme will be monitored to inform the required extent of the cordon model. The following factors will also be considered in determining the extent of the FCF network:

- Observations of flow difference caused by the implementation of the scheme that do not meet the ARN criteria.
- Consolidate the modelling to focus on the scheme area, whilst considering key strategic highway corridors and neighbouring towns.

4.4.3. Variable Demand Model (VDM)

Any change to (forecast) transport conditions will, in principle, cause a change in demand. The purpose of variable demand modelling is to predict and quantify these changes. Therefore, a road traffic forecast would be expected to include estimated changes in reference case demand (i.e. demographic change in travel demand prior to changes in costs) and any changes to the highway network supply which may alter the capacity and affect journey times and costs. This can lead to car trip redistribution, trip generation, modal switch and changes in macro time period choice which need to be calculated outside the highway assignment (SATURN) model.

The VDM structure (24-hour incremental PA VDM, with macro time period, public transport and trip redistribution choice), parameters and inputs of the Wiltshire VDM will be retained for the Melksham Bypass OBC transport modelling. The output from the VDM runs will be used to calculate incremental changes between the base year and the forecast year, which are then applied to the validated base year 'assignment' matrices. This methodology is consistent with Appendix B of TAG Unit M2.

The Wiltshire VDM is an incremental model, which updates the validated base year trip matrices and costs for forecast year scenarios. The VDM modelling process uses trip demand matrices in production / attraction (PA) format which are converted to origin / destination (O/D) for highway assignment.

The application of VDM requires that a supply model represents the whole route costs as well as wide area reassignments, both of which are provided by the highway base model. The model suite includes a VDM utilising DIADEM (v6.3.3) which enables a link between the Highway Assignment Model (SATURN v11.4.07H) and the VDM. DIADEM also provides a means of achieving convergence between demand and supply models.

The mode choice between car and public transport (in this case only rail) is considered in the DIADEM model through modelling the Car Available (CA) portion of public transport demand. The impact on Non-Car Available (non-CA) demand would be through indirect mechanisms such as crowding on public transport services or changes in highway delay. Changes in the demand patterns of non-CA trips would not result in changes to highway demand. Therefore, these would not directly affect the design or assessment of highway schemes in the study area. Consequently, the non-CA trips are not modelled in the Wiltshire Transport Model. Data on rail services including routes, frequencies and fare information are taken from skims derived from the public transport component of the SWRTM.

The VDM model uses a hierarchical logit formulation, in which the choice between travel alternatives (mode choice, macro time period choice and destination choice) depends upon an exponential function of the generalised cost or disutility. The appropriate hierarchy or sequence of choice mechanisms must be determined by the relative sensitivities (the lambdas of a logit model) of the choices to the generalised costs or disutilities of travel.

4.4.3.1. VDM demand segments: trip and person types

Table 4:3 shows the demand segmentation, matrix type and choice response mechanisms of the Wiltshire VDM. These will be retained for the Melksham Bypass OBC transport modelling.

Table 4:3 – Wiltshire VDM demand segmentation

Demand segment	Tour and purpose	Main mode choice	Macro time period choice	Trip distribution constraint
1. HBW	Incremental PA	Car / Rail	24 Hr	Doubly
2. HBEB				Singly
3. HBO				
4. NHBEB	Incremental OD		Fixed - Peak Period only	
5. NHBO				
6. Fixed W	Ports / Airports / Other	Fixed		-
7. Fixed EB				-
8. Fixed O				-
9. LGV	-			-
10. HGV	-			-

HB = Home Based, NHB = Non-Home Based; W = Work (Commute), EB = Employers Business, O = Other, LGV = Light Goods Vehicle, HGV = Heavy Goods Vehicle; PA = Production/Attraction, OD = Origin/Destination

24 hour car and rail PA demand is derived from SWRTM matrices which were developed using MPD and other sources, Active and sub-mode choice (i.e. walk, cycle, bus, light rail, P&R) is not included, hence trip frequency is not included.

Peak spreading / micro time period choice, whilst considered 2nd only to route choice in the model hierarchy is not included as the current implementation of HADES in DIADEM is only available in an absolute demand model.

4.4.3.2. Realism testing

Realism testing is used to ensure that the model responds rationally to changes in travel costs, behaves realistically and with acceptable elasticities. This involves changing various components of travel costs to check whether the response of the VDM is consistent with general experience. Part of the calibration process involves adjusting the parameters in the VDM model until more acceptable results are obtained from such realism tests.

These tests start with the logit parameters (i.e. the spread, sensitivity or scaling parameters - lambda and theta) which were based on median values in TAG Unit M2, section 5.6 and without cost damping.

It should be noted that, in accordance with TAG advice, output elasticities are based on trips within the internal simulated area. The calculations are carried out for a 10% fuel cost increase. Car fuel elasticities are calculated using a matrix test (note that network-based outputs are similar).

4.4.4. Convergence

It is crucial that the whole model system converges to a satisfactory degree to provide confidence that the model results are as free from error and model 'noise' as possible. To ensure the robustness of the modelling undertaken for the Melksham Bypass OBC, TAG convergence guidance will be adhered to.

The convergence of both the VDM and the highway assignment components of the Wiltshire donor model are well within the acceptable parameters recommended in TAG. This provides a robust basis for the derivation of a cordon model to inform the OBC.

4.4.4.1. Highway Assignment Model (HAM) convergence

The advice on model assignment convergence is set out in TAG Unit M3.1 (Table 4) and is reproduced below in Table 4:4.

Table 4:4 – Summary of highway assignment convergence criteria

Convergence measures	Type	Base model acceptance values
Delta & %GAP	Proximity	Less than 0.1% or at least stable with convergence fully documented and all other criteria met
Percentage of links with flow change (P1) < 1%	Stability	Four consecutive iterations greater than 98%

Source: TAG Unit M 3.1 Table 4

Table 4:5 indicates that the Wiltshire Transport Model achieves a good level of assignment convergence that complies with the recommended TAG criteria.

Table 4:5 – Highway assignment - convergence statistics

Scenario	Period	Convergence Statistics			%Flows - Last 4 iterations			
		Loops	% Flows	%GAP	N-4	N-3	N-2	N-1
Base (2018)	AM	14	99.7	0.003	97.7	98.4	99.4	99.7
	IP	14	99.5	0.003	99.0	98.3	99.0	99.5
	PM	15	99.4	0.002	98.9	99.0	99.2	99.4
Core Scenario (2024)	AM	15	99.1	0.003	98.2	98.5	99.0	99.1
	IP	14	99.2	0.001	98.1	98.8	99.0	99.2
	PM	16	99.1	0.003	98.3	98.9	98.9	99.1
Core Scenario (2036)	AM	16	99.1	0.002	98.3	98.5	98.9	99.1
	IP	14	98.4	0.004	98.0	98.8	98.5	98.4
	PM	17	98.8	0.005	98.1	98.9	99.2	98.8

Source: Wiltshire forecasting report (v5.0), section 4.3.

4.4.4.2. Variable Demand Model (VDM) convergence

DIADEM has been used to undertake the variable demand modelling process in response to changing travel times or costs. The process is iterative and modifies the model demand matrices between SATURN assignments until a balance is achieved between demand and the capacity of the road network. The success in achieving this balance, or equilibrium, is defined using convergence criteria commonly termed '%Gap'.

The objective of this process is to achieve a well converged VDM. TAG recommends, where possible, to achieve a demand / supply gap of less than 0.1%. If this criterion cannot be met, then a demand / supply gap of no greater than 0.2% is recommended.

The Wiltshire Transport Model utilised a criterion of a %Gap of less than 0.1% for the fully modelled area and 0.2% for the sub-area (ADM, see Figure 4-1).

Table 4:6 shows that the VDM component of the Wiltshire Transport Model achieves the recommended convergence requirement.

Table 4:6 – Core VDM - convergence statistics

Year	Scenario	Final Loop	% GAP Full Model Area	%GAP Subset Area
2024	Core	7	0.07%	0.17%
2036		8	0.03%	0.15%

4.4.5. Base model calibration and validation

A localised calibration exercise will be undertaken on the Wiltshire Transport Model to ensure the model validates in the local area. A 'localised' LMVR will be produced to complement the main WTM LMVR.

The initial model will be established using the network and prior matrices from the 2018 Base year Wiltshire Transport Model, which will then be subject to a matrix estimation process.

The SWRTM / A303 prior matrices were derived from mobile phone data and are considered to be a suitable starting point for the WTM prior matrices, as they were developed by Highways England, have undergone a rigorous checking process and are consistent throughout the region. As documented in the WTM LMVR (section 5.4), an exercise was undertaken to identify how well the prior WTM assignment validates against observed count data.

Appendix B presents the flow validation of the 2018 WTM prior assignments on the Melksham and Chippenham cordons. When looking at the screenlines on the localised highway network in isolation, the level of validation is reasonable for a prior assignment. Both cordons are within 7% of observed flows in the AM peak, and 17% in the PM peak.

This suggests that the prior matrices are an appropriate basis for Melksham Bypass OBC but require further controlled refinement through matrix estimation.

Matrix estimation will use the Wiltshire Transport Model count data (and the equivalent calibration / validation screenlines) for the study area. Due to the outbreak of Covid-19 in the UK during early 2020, the collection of new count data to aid the development of a transport model for the Melksham Bypass OBC is not recommended. As such, the development of the model is dependent on existing available data used in the development of existing transport models.

4.4.5.1. Traffic count data

The location of the available traffic count sites across the entire study area of the Wiltshire Transport Model are presented in Figure 4-2, whilst Figure 4-3 provides the location of Automatic Traffic Counts (ATC) collected as part of the Melksham Bypass SOBC and Figure 4-4 presents the location of the Melksham Automatic Number Plate Recognition (ANPR) surveys. Available data consists of the following:

- Manual Classified Counts (2018) (Figure 4-2)
- TRIS count data (2018) (Figure 4-2)
- Existing counts previously collected for SWRTM (2015) (Figure 4-2)
- Existing ATC previously collected for Melksham SOBC (2017) (Figure 4-3)
- ANPR data (2018) (Figure 4-4)

Calibration will be undertaken using the above count dataset, in addition to Trafficmaster journey time data. Calibration will focus on adjustments to the networks and matrix estimation data set. If possible, independent count data will be retained to enable flow validation to be undertaken. Results of the calibration process and validation will be presented in a Power BI dashboard in accordance with TAG requirements.

Figure 4-2 – Available traffic count data – Wiltshire

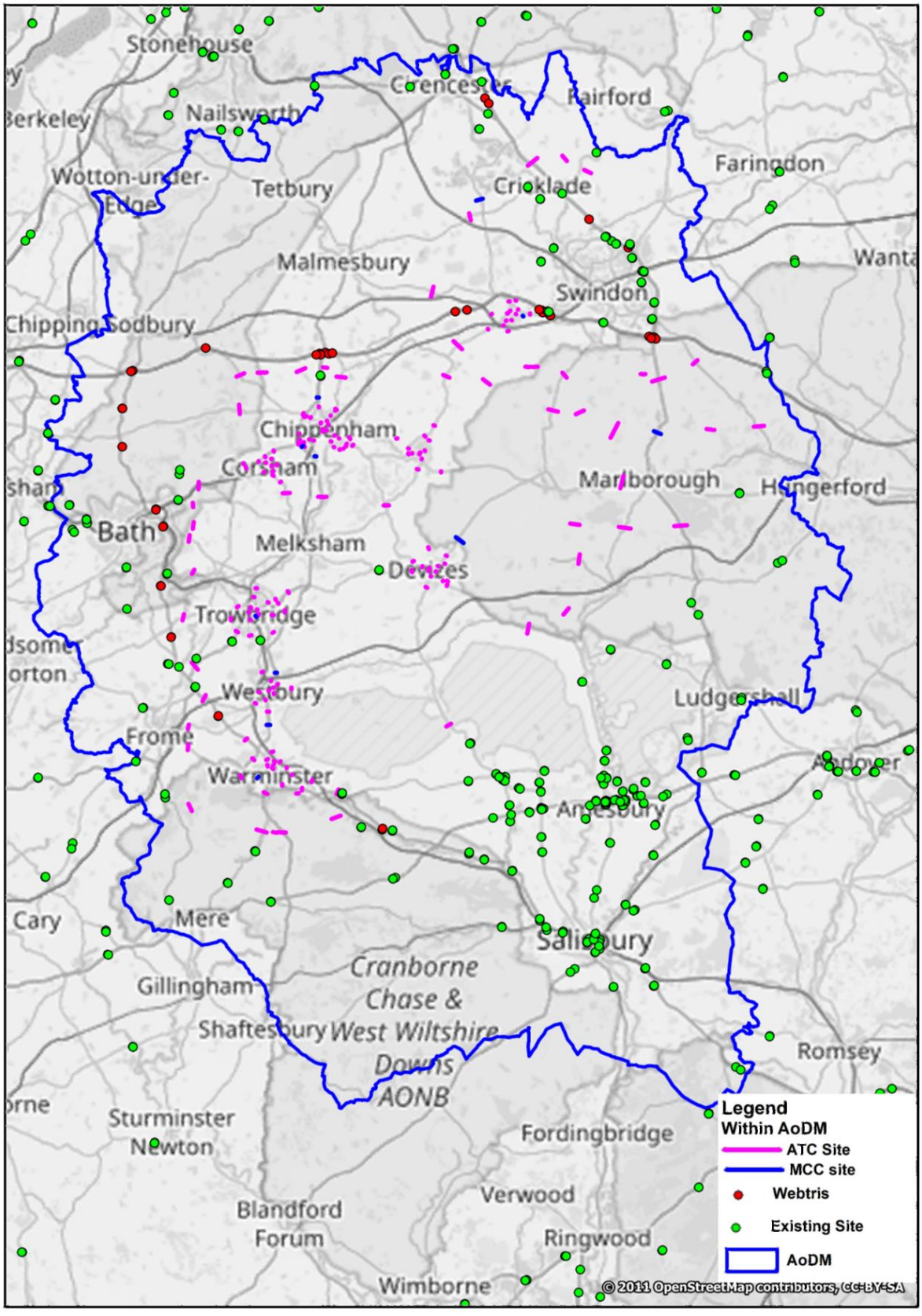


Figure 4-3 – Available traffic count data – Melksham

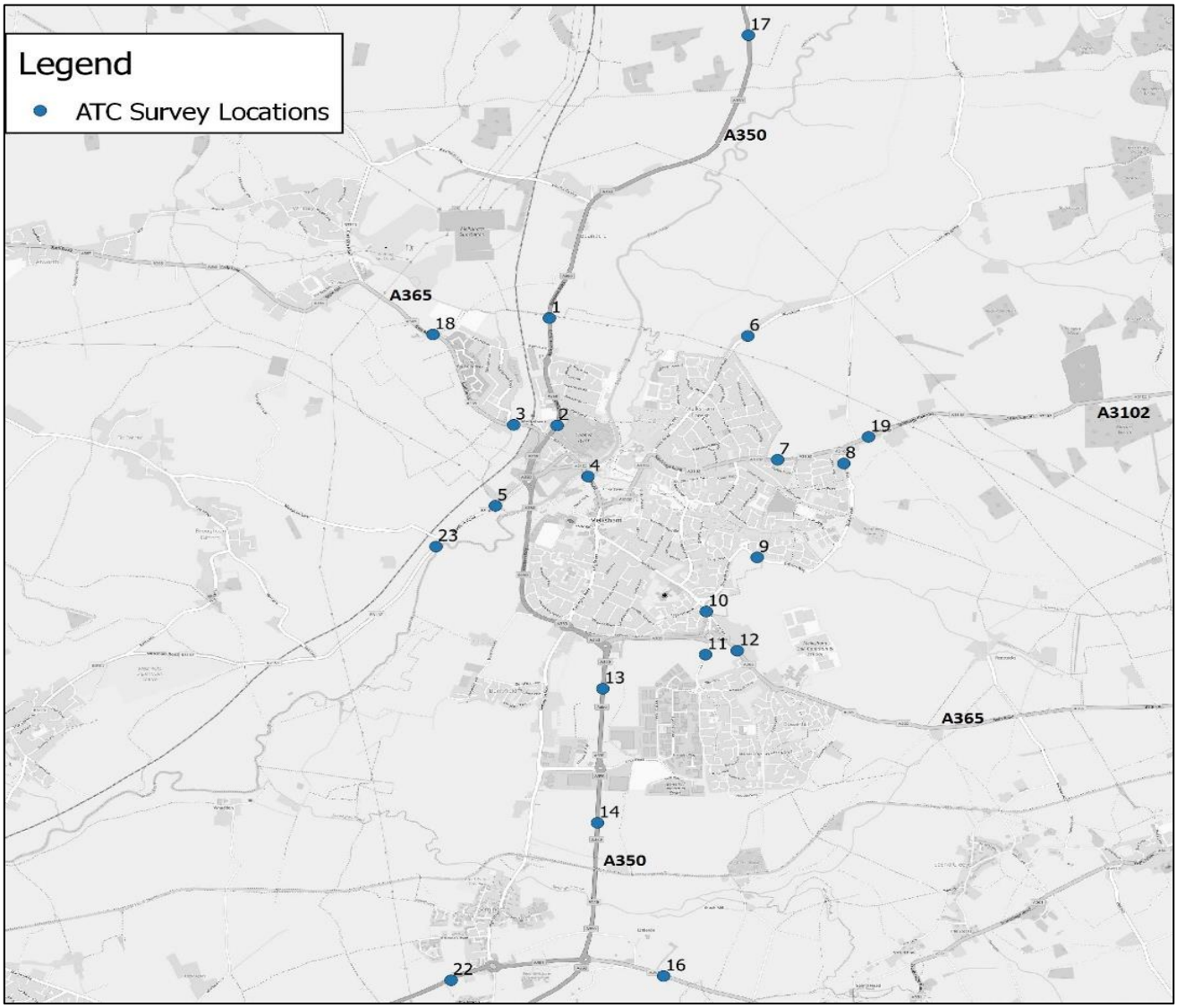
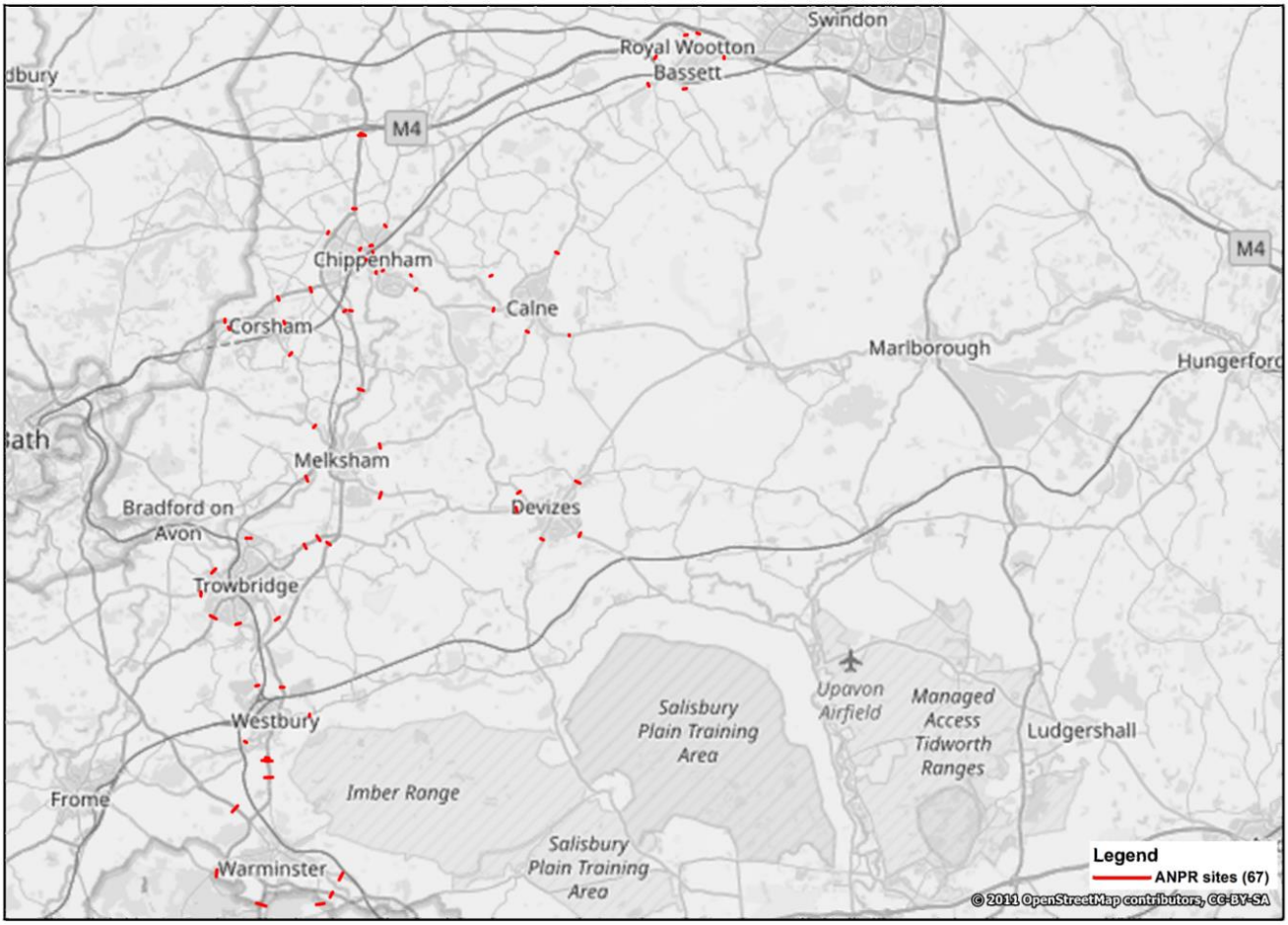


Figure 4-4 – ANPR survey locations



4.5. Forecasting approach

This section details the forecasting assumptions associated with the Melksham Bypass OBC transport modelling. The forecasting approach applied draws on the guidance from TAG unit M2 (Variable demand modelling) & M4 (Forecasting & Uncertainty).

The forecasting approach adopted for the development of the Wiltshire Transport Model was to create a (fixed) reference case travel demand which reflects changes in population, employment, car ownership and other demographic and economic factors. The reference case forecasts do not account for induced changes in travel demand and patterns (in response to changes in future traffic conditions). However, they provide a useful indication of how traffic demand would likely grow if network conditions and travel costs were held constant into the future.

The changes in generalised cost between the base year and the reference case are then taken through the VDM. The VDM process modifies the reference case forecasts to reflect the impacts of changes in congestion on the road network.

4.5.1. Forecast years

The following forecast years are currently proposed to be modelled, based upon information available at the time of preparation of the ASR. These will be kept under review in light of any potential changes to the scheme timescales as the OBC develops. DfT will be notified should the proposed forecast years set out in this ASR change:

- Opening year of 2026 (assuming a construction period of September 2024 to September 2026)
  - Localised changes will be made to ensure that the housing quantum of development sites in the Melksham area is reflective of 2026 build-out plans. Trip totals will be constrained to TEMPro (v7.2).

  - The 2026 network will be updated to include any transport infrastructure which will be built between 2024 and 2026 (e.g. A303 Stonehenge tunnel).
- Scheme design year of 2036 (consistent with the Wiltshire Local Plan).
  - This is consistent with the 2036 core scenario of the Wiltshire Local Plan.
- Horizon year of 2051 (subject to agreement with Wiltshire Council).
  - Forecasts for the scheme opening year and one final modelled year only permits a linear assessment of the costs and benefits attributable to the scheme. As such, an additional horizon year is recommended.
  - The horizon year is limited to the extent of the standard forecasting datasets (e.g. NTEM v7.2).
  - Growth for the horizon forecast year will be derived using NTEM (v7.2).

4.5.2. Forecasting data sources

The key data sources required for the development of the Melksham Bypass OBC forecast year models are as follows:

- Land use data - committed and potential household and employment developments incorporated in the Core scenario of the Wiltshire Transport Model, reviewed against the uncertainty log provided by Wiltshire Council.
- Network scheme data - committed and potential highway and public transport schemes as incorporated in the Core scenario of the Wiltshire Transport Model, reviewed against the uncertainty log provided by Wiltshire Council.
- National Trip End Forecasts (NTEM) - in addition to the specific development growth in the study area, car growth will be constrained to trip end forecasts provided by the DfT (v7.2).
- DfT Road Traffic Forecasts (2018 RTF) - used to constrain the overall growth of freight (LGV & HGV) traffic in a similar way to constraints using NTEM.

4.5.3. Treatment of uncertainty

TAG Unit M4 sets out the guidance for the treatment of uncertainty in transport model forecasting. It states that "uncertainty in forecasting derives from the possibility of more than one outcome occurring during the period being forecasted and the forecast materially differing under these different outcomes".

The guidance anticipates that a 'core' scenario will be developed, and a range of sensitivity tests and/or alternative scenarios will also be developed to account for future uncertainty. The process of identifying uncertainty is necessary for the specification of the 'core' scenario, as well as alternative scenarios.

4.5.3.1. Local uncertainty

To analyse uncertainty it is necessary to create an uncertainty log. This log highlights all local and external uncertainties and factors likely to affect the traffic / patronage, revenues and delivery of scheme benefits.

As defined in Table 4:7, the uncertainty log includes an assessment of the uncertainty of each individual input by placing it into one of four categories (taken from TAG M4 Appendix A). The uncertainty log identifies those developments and schemes which do not form part of the 'core scenario'. The high growth scenario includes some of the most likely sources of growth that had not been included in the core scenario, whilst the low growth scenario excludes some of the less likely sources of growth that were included in the core scenario.

Table 4:7 – Classification of future inputs

Probability of the input	Status	Core scenario assumption
Near Certain: • The outcome will happen or there is a high probability that it will happen.	• Intent announced by proponent to regulatory agencies • Approved development proposals; and • Projects under construction	• This should form part of the core scenario
More than likely:	• Submission of planning or consent application imminent;	• This could form part of the core scenario

• The outcome is likely to happen but there is some uncertainty.	• Development application within the consent process.	
Reasonably Foreseeable: • The outcome may happen, but there is significant uncertainty.	• Identified within a development plan; • Not directly associated with the transport strategy/scheme, but may occur if the strategy/scheme is implemented; • Development conditional upon the transport strategy/scheme proceeding; • Or, a committed policy goal, subject to tests (e.g. of deliverability) whose outcomes are subject to significant uncertainty.	• These should be excluded from the core scenario but may form part of the alternative scenarios
Hypothetical: • There is considerable uncertainty whether the outcome will ever happen.	• Conjecture based upon currently available information; • Discussed on a conceptual basis; • One of several possible inputs in an initial consultation process; • Or a policy aspiration.	• These should be excluded from the core scenario but may form part of the alternative scenarios

4.5.3.2. Wiltshire Local Plan to 2036

One area of local uncertainty relates to future housing and employment sites. The current Wiltshire Core Strategy covers the period up to 2026 and identifies site allocations to meet the identified need. Wiltshire Council is currently undertaking a Local Plan Review, which seeks to establish the requirement for additional housing and employment sites in Wiltshire up to 2036. A significant proportion of the additional sites are likely to be within the A350 Growth Zone (e.g. potentially accounting for up to 12,000 additional dwellings). Whilst these sites would not be reflected within the core scenario (as not being classified as 'near certain' or 'more than likely') they could be a pertinent consideration in relation to the Melksham Bypass scheme in terms of future traffic demands and traffic distribution. Furthermore, it is expected that additional sites would be allocated within Melksham itself, potentially of a similar scale to those allocated previously in the Core Strategy (e.g. around 2,000 dwellings).

Adoption of the Local Plan Review is not anticipated until 2023 (following an Examination in Public). However, preferred sites are likely to be announced in the first half of 2021.

4.5.4. Defining the core scenario

Transport modelling for the Melksham Bypass OBC will be based on the core forecast year scenario of the Wiltshire Transport Model. The uncertainty log will be reviewed for suitability for the Melksham Bypass OBC and agreed with Wiltshire Council to confirm the core scenario assumptions. This review will consider the following data sources:

- Land use data - committed and potential household and employment developments.
- Network scheme data - committed and potential highway and public transport schemes.

The forecast models for each future year will include committed highway schemes and development sites ('near certain' / 'more than likely') in addition to background growth derived from NTEM (v7.2). Background growth will be adjusted to compensate for the number of explicitly modelled households and jobs using the standard methodology outlined in TAG Unit M4. Overall growth will be constrained to NTEM forecasts.

Linear interpolation between the two Wiltshire Transport Model forecast years (2024 and 2036) has been assumed to establish a 2026 forecast year representative of the scheme opening year. Therefore, a review of the uncertainty log will be undertaken to identify the specific build-out dates for which major developments and transport infrastructure schemes are due for implementation in the study area. This will ensure important developments are not significantly distorted through the application of linear interpolation, whilst ensuring the network supply is not misrepresented.

4.5.5. High and low growth alternative scenarios (national uncertainty)

National uncertainty involves national projections of demographic changes, GDP growth and fuel price trends. In the core scenario, the impact of changes in demographic and traveller behaviour is based on the NTEM 7.2 dataset. The assumptions regarding national costs of travel (value of time and fuel costs) are based on the TAG Databook v1.13 (July 2020).

Regarding the treatment of national growth uncertainty, TAG guidance M4 states that the uncertainty in NTEM traffic growth should be considered. It states that an appropriate way to do this would be to look at a range about the central forecast of ±2.5% for forecasts one year ahead, then rising by the square root of the number of years (±2.5*√years) to ±15% for forecasts 36 years ahead (i.e. 5% four years ahead, 7.5% nine years ahead, 10% sixteen years ahead, 12.5% twenty-five years ahead). It should be noted that this is a percentage of the base year demand matrix which is added or subtracted from the forecast matrices.

TAG Unit M4 (e.g. Section 4.2.8) advises that it may be appropriate to vary local assumptions about demand in the high (and low) growth scenarios. It is currently intended to reflect the Local Plan Review sites through the high growth scenario. The details of exactly how this scenario would be developed would need to be confirmed in due course and in light of the level of information available from the Local Plan Review at the point of undertaking the exercise.

4.5.6. Other alternative scenarios

Additional alternative scenarios can occasionally be used to consider other significant local uncertainty. In line with TAG M4, in considering further alternative scenarios “it is important that analysis of alternative scenarios is proportionate as well as sufficiently comprehensive.”.

Beyond the high / low growth scenarios, there would be many possible permutations of sources of local uncertainty. The main areas of local uncertainty are considered to relate to prospective future housing site allocations (associated with Wiltshire Council’s ongoing Local Plan Review) and other proposed schemes on the A350 corridor (at a similar stage in the business case process to the Melksham Bypass scheme).

Transport supply

In relation to supply, the MRN schemes are currently considered to be part of the overall strategy to support future growth in Wiltshire. On this basis they would play an important role in supporting future Local Plan delivery for instance. However, it is accepted that they are independent and therefore it is proposed that an alternative scenario is undertaken to include the A350 Chippenham Bypass Phases 4&5 and M4 J17 together (in the interests of proportionality) – with no change in demand from the core scenario.

Transport demand

In relation to demand, it is felt that the main consideration would be around whether specific potential Melksham site allocations (identified through the emerging LPR) should be subject to a separate alternative scenario. This may have a role in considering the risks / impacts associated with housing site(s) in closer proximity of the scheme – albeit identification / confirmation of these may not be forthcoming within the planned timescales for the OBC economic appraisal. Given this, it is suggested that this needs to be monitored and reviewed alongside the progress of the LPR. It would be appropriate for the position to be established following the Regulation 18 LPR consultation. However, this could still be subject to change as the LPR approaches Reg 19 Public Consultation on the preferred plan.

Additional sensitivity in relation to recent DfT guidance on TAG updates is proposed to be undertaken on an ‘appraisal only’ basis – hence not directly impacting the modelling scope – see section 5.9.2 for further details.

4.5.7. Dependent developments

No dependent developments have been identified for inclusion in the Melksham Bypass OBC. Therefore, it has been assumed that it will not be necessary to undertake any dependent development tests as part of the appraisal of this scheme.

4.6. Option testing

The purpose of the model is to both aid scheme design and to compare the relative performance of the different scheme options against a ‘without intervention’ scenario. As outlined above, TAG advises that near certain and

more than likely schemes are included in the core scenario. For clarity, the following scenarios are to be developed as part of the Melksham Bypass OBC:

- Do-Minimum: highway network with committed schemes, plus growth from the Core scenario of the Wiltshire Transport Model.
- Do-Something: Do-Minimum scenario, plus the relevant Melksham Bypass short-listed scheme options (see section 3).
- Core, high and low growth scenarios for each of the above.

4.7. Additional data requirement and survey approach

Due to the outbreak of Covid-19 in the UK during early 2020, the collection of new count data to aid the development of a transport model for the Melksham Bypass OBC is not recommended. Nevertheless, additional surveys and data are not deemed to be a requirement, as there is considered to be sufficient recent and relevant information which is readily available to undertake this appraisal.

4.8. Risks

Table 4:8 summarises specific risks associated with the development of the transport model for Melksham Bypass OBC, including the subsequent supply of model outputs.

Table 4:8 – Transport model risks

Ref.	Risk description	Impact	Mitigation	Residual risk
01	Additional data required if model validation issues arise.	High	No option to collect new data due to Covid-19 pandemic. However, additional surveys and data are not deemed to be a requirement.	Medium
02	Problems identified with local model input data (e.g. traffic counts) impacting on validation.	High	Independent review of model input data to ensure data has been processed correctly.	Low
03	Programme delays affecting downstream users of the model, including forecasting, design team and environmental teams.	High	Continuous programme monitoring. Additional resources to be made available if required.	Low
04	Model may not achieve TAG validation standards, requiring additional development time and resources.	High	Enough time provided within the programme. Automated systems used to test a range of parameters. Good communication with Wiltshire Council.	Low
05	The interplay of impacts from other schemes may not be accounted for.	High	Early engagement with other disciplines to identify model requirements. Thorough review of the highway scheme uncertainty log to ensure all required schemes are accounted for. Use of sensitivity testing as appropriate.	Low
06	Model fails to satisfy requirements of other	High	Liaison with Wiltshire Council to ascertain requirements	Low

	disciplines (e.g. environmental team, design team) and key stakeholders (e.g. decision makers).		and inform model specification. Regular coordination meetings between discipline team leaders.	
07	Model run times of the DIADEM VDM reducing capacity in ensuring the model more accurately predicts the impact of the scheme.	Medium	Application of the FCF to cordon the Wiltshire Transport Model.	Low
08	Key stakeholders do not support the proposed modelling approach and methods adopted.	Medium	Agree approach at project inception. Agree ASR. Good communication with Wiltshire Council, DfT and statutory environmental bodies.	Low
09	Re-work due to change in guidance (e.g. TAG).	Medium	Monitor guidance changes and provide early warning to Wiltshire Council of potential implications through sensitivity tests.	Low
10	Traffic growth during forecasting may identify model issues that do not arise in the base year.	Medium	The Wiltshire Transport Model has been scrutinised in depth, so should not pose a significant risk.	Low

5. Transport appraisal (economic, environment and social impacts)

5.1. Introduction

The transport appraisal process provides decision makers with key information regarding the ultimate viability and value for money of the scheme proposals and the relative performance of alternative options.

In line with TAG, the Melksham Bypass OBC will appraise the short-listed options against economic, environmental and social impacts.

A key principle to be adopted for the appraisal is that the level of rigour applied and focus of effort will reflect the Melksham Bypass scheme objectives and the expected scale and type of impacts (beneficial and adverse) anticipated (see Section 2 for instance). It further seeks to enhance areas of the appraisal which were not addressed in detail at SOBC and to utilise knowledge gained from the initial appraisal work at that stage.

The Appraisal Specification Summary Table (Section 7) summarises the intended approach to appraisal under each of the three main impacts and associated sub-impacts. This includes identification of whether the intended approach against each sub-impact involves full monetisation, quantitative assessment or qualitative assessment. A single ASST has been produced, on the basis that the nature of the options under consideration at OBC are similar, and hence the proposed approach to appraisal does not differ between them.

The following sections provide further details in relation to the proposed approach to appraisal, including across the relevant economic, environmental and social impacts.

5.1.1. Forthcoming updates to TAG

It is recognised that in July 2020 DfT published its 'Appraisal and modelling strategy: a route map for updating TAG'. This has been published due to unexpected events (including COVID-19) which have occurred that have the potential to have a significant impact on scheme appraisals. A definitive, consolidated TAG update is planned for February 2021. Some of the key changes relate to:

- updated economic and population projections produced by the Office for Budget Responsibility (OBR);
- new carbon values; and
- various other updated parameters.

Until these updates are definitive, DfT advises that scheme promoters should undertake a sensitivity test (with an alternative version of the TAG data book) unless it is immaterial or disproportionate to do so. The full technical appraisal work for the Melksham Bypass OBC is scheduled to be undertaken in Summer 2021, and hence it is expected that this will be based upon the consolidated TAG update. For any interim appraisal (e.g. to inform option development) in advance of the February 2021 update, it would be intended to undertake the combined sensitivity test against the core scenario on an 'appraisal-only' basis (i.e. no changes in demand). This is considered to be a proportionate approach.

5.2. Value for Money (VfM) process and categories

The appraisal will inform an overall Value for Money (VfM) assessment. This is carried out as a staged process to ensure that a complete and robust analysis is undertaken. The VfM categories and their relationship with benefit-cost ratios (BCRs) generated through cost-benefit analysis are presented in Table 5:1. Figure 5-1 summarises the steps and levels in the VfM assessment process and how they make use of the appraisal outputs.

An initial BCR will be calculated based on the Level 1 transport user benefits. For the Melksham Bypass scheme, it is expected that the majority of benefits will be accrued at this stage, driven by highway journey time savings.

Following the assessment of Level 2 benefits, such as reliability and wider economic impacts, an adjusted BCR will then be produced.

Reporting of the appraisal and VfM assessment is addressed in section 5.10.

Figure 5-1 - Incremental value for money assessment framework

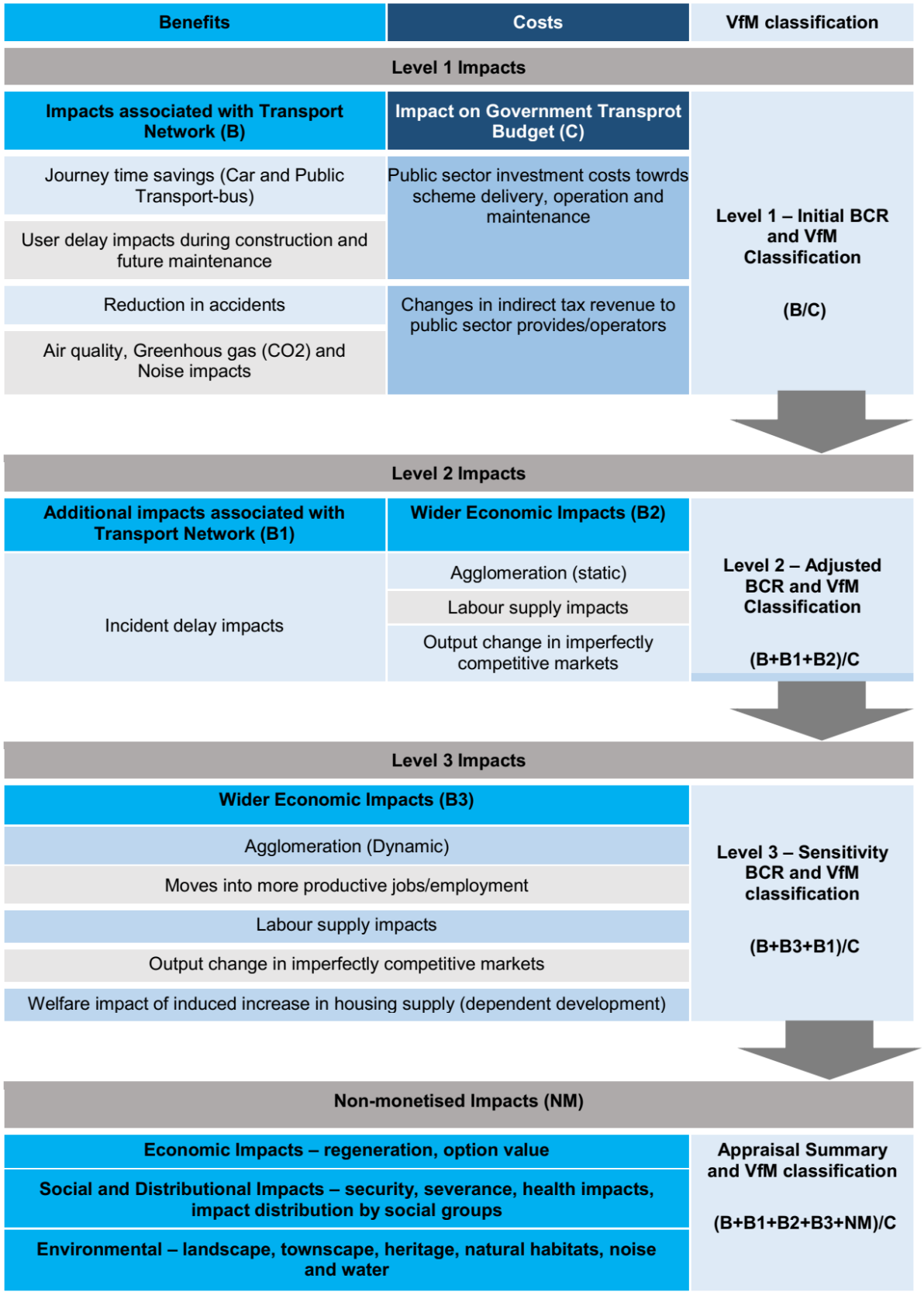


Table 5:1 – DfT value for money categories

DfT Value for Money Categories	
BCR	**Level**
Less than 1.0	Poor
1.0 to 1.5	Low
1.5 to 2.0	Medium
2.0 to 4.0	High
Greater than 4.0	Very High

5.3. Appraisal inputs and data requirements

The key inputs, tools and other associated data requirements for the appraisal will include:

- Strategic transport model outputs (see section 4) – e.g. future year forecasts of travel demand and costs;
- Construction costs and spend profiles supplied from the design teams;
- Quantified Risk Assessment (QRA);
- Whole life costs;
- Construction and maintenance profiles, supplied by the design teams;
- DfT's TUBA tool – Transport User Benefits Appraisal
- Environmental surveys;
- Noise and air quality modelling (with inputs from the strategic transport model);
- Other environmental assessment (e.g. Preliminary Environmental Assessment Report); and
- GIS analysis of various datasets.

These are addressed in more detail in the relevant sections below.

The strategic transport model (section 4) underpins much of the transport appraisal and is considered to be a suitable and proportionate tool for the purposes of the Melksham Bypass scheme. The model is highways only. The scheme does include complementary walking and cycling measures within Melksham – the strategic transport model is not a suitable tool to assess the impacts of these. Alternative, proportionate approaches will be adopted for these components, drawing upon relevant TAG guidance (e.g. TAG A5.1) where appropriate. The appraisal methodology set out in this section predominantly focuses on the main highway element of the scheme. This reflects the fact that the vast majority of the impacts will be associated with the main highway element, and also that the complementary walking and cycling measures are at quite a high level of scope definition at this stage in the process. As the details evolve, the proportionate appraisal approach for these elements will be developed and refined accordingly.

5.4. Design specification and scheme costs

Realistic and accurate scheme costs are an integral component of the scheme appraisal process and the overall VfM assessment. This is further linked to the level and robustness of scheme design. Through the OBC stage the short-listed options will be developed to a greater level of detail. This will be informed by:

- more extensive survey information such as topographical surveys;
- 3D highways design;
- geotechnical investigations;
- structures design (and associated flood modelling);
- environmental mitigation; and
- junction design.

Cost estimates based on the scheme designs will be developed by quantity surveyors (Faithful & Gould) using Bill of Quantities and appropriate rates to develop construction costs, and estimated costs for preliminaries and scheme preparation. A consistent approach will be adopted for each option. Risk cost will be based upon a Quantified Risk Assessment (QRA) adopting a monte-carlo approach.

Costs will be prepared for input to the appraisal using the standard TAG template. In general, this comprises:

- The base cost, which is the basic construction costs of a scheme before allowing for risks, but including realistic assumptions of changes in inflation over time (i.e. cost increases above the growth in 'economy-wide' inflation).
- Adjustment for risk, which should cover all the risks that can be identified, most of which then need to be assessed and quantified through a QRA – the outcome of this is the risk-adjusted cost estimate (the P50 value will be used for the purposes of appraisal).
- Adjustment for optimism bias, to reflect the well-established and continuing systematic bias for estimated scheme costs and delivery times to be too low and too short respectively, and results in the risk and optimism bias-adjusted cost estimate.

In relation to optimism bias, a review of the proposed level (%) to be applied will be undertaken in conjunction with the QRA exercise. In line with TAG, the optimism value to be applied, and any deviation from the standard values (if applicable), will be clearly justified.

Whole life costs will also be incorporated into the appraisal to reflect in particular ongoing liability in relation to new sections of carriageway and other highways assets. Representative maintenance values based on local data from Wiltshire Council will be sought.

5.5. Economic impacts

The appraisal of economic impacts will be carried out using standard procedures and economic parameters as defined by TAG Unit A1- Cost Benefit Analysis. The sub-impacts to be covered are:

- Transport Economic Efficiency (TEE) benefits - savings relating to travel times, vehicle operating costs and user charges;
- Safety impacts – due to changes in the future number and/or severity of accidents;
- Construction and maintenance impacts – impacts on road user travel time and vehicle operating costs during scheme construction;
- Journey time reliability impacts – due to changes in journey time related to incidents; and
- Wider economic impacts.

5.5.1. Transport Economic Efficiency (TEE) benefits

Key objectives of the Melksham Bypass scheme include to address existing and forecast congestion and delays on the existing A350 route, and hence to generate journey time saving benefits. These benefits are expected to relate to local and longer-distance trips, with the greatest benefits in the AM and PM peak periods.

Software

The current version of TUBA (at the time of undertaking) will be used to estimate the Transport Economic Efficiency (TEE) benefits. This includes estimation of benefits relating to travel times, vehicle operating costs, user charges, and private sector revenues, all of which contribute to the Present Value of Benefits (PVB) for the scheme proposals, as presented in the TEE table.

TUBA also calculates the Present Value of Costs (PVC), based on the scheme investment and maintenance data, and indirect tax revenues to central government. These data are presented in the form of the Public Accounts (PA) table.

The TEE benefits and Public Accounts information are combined (along with benefits from reductions in accidents and carbon emissions) to produce an overall value for money assessment, as presented in the Analysis of Monetised Costs and Benefits (AMCB) table.

TUBA is an industry-recognised software package, recommended by the DfT for the appraisal of highway and public transport schemes such as this. It is of particular use where variable demand responses have been included in the transport modelling, as TUBA is based on the 'rule of half', which allows for explicit calculation of changes in demand between the 'Do-Minimum' and 'Do-Something' scenarios.

Appraisal period

For this scheme, it is proposed that a 60-year economic appraisal will be undertaken. Prices will be discounted over the 60-year appraisal period to 2010 prices using prevalent rates. The modelled years will be as noted in Section 4.5.

Annualisation factors

The forecast model consists of three modelled periods:

- AM peak average hour (07:00-10:00)
- Inter peak average hour (10:00-16:00)
- PM peak average hour (16:00-19:00)

The following time slices will be used in TUBA:

- Single 1 hour time slice representing an AM peak average hour (07:00-10:00)
- Single 1 hour time slice representing an inter peak average hour (10:00-16:00)
- Single 1 hour time slice representing an PM peak average hour (16:00-19:00)

Therefore, assuming 253 normal weekdays, 52 weekends and 8 bank holidays in a year, the annualisation factor for AM, IP and PM are 759, 1518 and 759 consecutively.

To obtain benefits for weekday periods outside 0700-1900 and at weekends, the benefits accrued in the inter-peak will be scaled up by a factor which reflects the number of off-peak and weekend hours that have flows comparable with the weekday inter-peak flows.

Travel time savings

Travel time savings are calculated using the rule of half applied to time skims from the highway model. Travel times in the traffic model are represented in seconds. These are converted to vehicle hours and annualised for each modelled period, so that annual morning peak, inter-peak and evening peak period travel time savings can be calculated.

Annual time savings are calculated for each modelled year. Benefits for non-modelled years are calculated via linear interpolation between modelled years, and flat-line extrapolation beyond the final modelled year. However, the impact of discounting on estimated benefits means that the annual benefits decline toward the end of the 60-year project lifetime.

Default economic assumptions will be applied, as contained in the TUBA software and based on guidance contained in the DfT's TAG Unit A1.3 and TAG data book v1.13.1 (July 2020). It is recognised, however that DfT is proposing a consolidated set of changes to TAG in February 2021. As per section 5.1.1 it is proposed to undertake the recommended combined sensitivity test using the alternative TAG data book values to be published by DfT.

Vehicle operating cost savings

Vehicle operating costs are calculated for both fuel and non-fuel elements of the journey, based on formulae set out in the DfT's TAG Unit A1.3. The rule of half formula is applied with vehicle operating costs being based on distance travelled (vehicle-kilometres) and average vehicle speeds.

All assumptions relating to fuel costs, duty and vehicle efficiency are those contained in the default TUBA economics file. The same annualisation factors as defined above are applied to derive VOC benefits.

5.5.2. Construction & maintenance user impacts

Transport users incur additional costs when the transport network is undergoing construction and/or maintenance works. There are four typical costs associated with these works: delay (value of time), vehicle operating costs, carbon emissions and accidents.

The Melksham Bypass scheme involves the construction of new highways infrastructure – including new / upgraded carriageway and associated highways / drainage structures. 'Full bypass' options comprise approximately 5 miles of new carriageway construction (predominantly off-line), with works required at the tie-ins to the existing network at the northern and southern ends. Construction impacts would largely be confined to these areas. Based on an eastern option, there would be no impacts on the rail network during construction (e.g. no rail possessions required). Some footpaths and cycle routes may be temporarily disrupted.

The 'lower cost' option would involve additional on-line work at intermediate points along the route and may have more impact on the operation of the network. Scheme options also include complementary walking and cycling infrastructure on, and surrounding, the existing A350 route.

It is anticipated that the strategic transport model (SATURN) will be used to estimate the impacts of construction on affected links and junctions by assuming traffic management changes in link and junction layout and operations in terms of lane widths, speed restriction, traffic management length during construction. Details of the expected construction management approach will be obtained and used to inform the analysis. Runs of the assignment model would be used to determine the effects of likely traffic management changes in junction layout and operation during construction. The construction disbenefit will then be estimated by undertaking a TUBA assessment for the period of construction, with the monetary value to be included within the level 1 impacts of the VfM assessment.

The approach is considered proportionate as it will sufficiently distinguish the relative impact of the options on the operation of the network.

5.5.3. Journey time reliability impact

The scheme aims to improve journey time reliability and resilience on the A350 route. The scheme impact on reliability will be assessed in line with WebTAG Unit A1.3, Section 6.3 (Reliability – urban roads) and based on the calculation of the standard deviation of journey times and distance for each O-D (origin-destination) pair. As per WebTAG Unit A1.3, journey time reliability refers to variations in journey times that individuals are unable to predict (journey time variability, or JTV). Such variation could come from recurring congestion at the same period each day (day-to-day variability, or DTDV) or from non-recurring events, such as incidents. It excludes predictable variation relating to varying levels of demand by time of day, day of week, and seasonal effects which travellers are assumed to be aware of.

The urban road method is deemed appropriate since drivers response to incidents are likely to be similar to urban roads since Melksham is a built-up area and the road network provides some alternatives for drivers to divert away from incidents that may reduce capacity on routes. The A350 is mainly single carriageway so the method for inter urban motorways and dual carriageway does not apply. WebTAG suggests that the other roads method be used only where other approaches are not feasible.

A monetary value will be produced for inclusion in the level 2 impacts of the VfM assessment.

5.5.4. Wider economic impacts

WebTAG defines Wider Impacts (WI) as a set of impacts on net national productivity (agglomeration impacts, additional output in imperfectly competitive markets and labour market impacts). These are not captured in the conventional economic appraisal based on journey time savings and so need to be calculated separately using a defined set of calculations drawing on travel cost and trip matrices and economic data and parameters.

The scheme aims to address local and regional issues, including north-south connectivity which is of strategic regional significance in terms of economic strategy. The A350 Growth Zone is a central component of the Swindon and Wiltshire Strategic Economic Plan. Therefore, a full range of level 2 wider impacts will be quantified in line with TAG Unit A2.1 (May 2018) and the DfT's Wider Economic Benefits and Transport Appraisals: A Guidance Framework, as follows:

Output change in imperfectly competitive markets

The welfare effects which arise due to the presence of imperfect competition (the market structure distorts the efficient operation of the market), is estimated by applying a 10% uplift factor to the business and freight user benefits in line with WebTAG Unit A2.2 (May 2018).

Labour supply impact

The assessment of benefits associated with labour supply impacts and the movement to more productive jobs over-and-above user benefits will utilise the methodology/assumptions set out in TAG unit A2.3. The benefits are expected to be small relative to the overall benefits of the transport scheme and so to be proportionate, no land use change will be quantified explicitly.

Agglomeration impact

The assessment of agglomeration impact associated with the scheme will utilise the methodology/assumptions set out un TAG unit A2.4 and will captures total productivity impacts of the transport scheme which arise through static clustering assuming land-use is fixed with displacement assumed to be zero.

The productivity impacts for each industry and Local Authority District area will be calculated (in line with TAG Unit A2.4 – Equation 2.3) as a function of the percentage change in effective density, total employment in the sector and the average GDP per worker of the LADs. The effective density will be calculated (in line with TAG Unit A2.4 – Equation 2.2) as a function of the number of trips and average generalised costs of travel between LADs for each scenario by mode and by purpose.

The labour supply impact from better labour participant will be calculated (in line with TAG Unit A2.3 – Equation 2) as a function of the generalised costs for commuting, annualised number of commuting trips, average round-trip generalised costs of commuting between LADs for each scenario and by mode.

The generalised costs for highway will be estimated using baseline travel costs extracted from the strategic transport model. For rail, there are a few potential approaches. The all station to all station costs could be estimated using baseline costs obtained from MOIRA, or the HS2 Planet framework model. In addition, it may be possible to obtain similar rail travel costs from a database being developed by Atkins for DfT (subject to agreement with DfT).

5.6. Environmental impacts

5.6.1. Introduction

Guidance published by the Government for the preparation of environmental assessments of road schemes is contained in the Department of Transport's (DfT) Design Manual for Roads and Bridges (DMRB) LA 101 which sets out both the general process and the methods for assessing individual environmental topics. The proposed methodology also considers TAG Unit A3 – Environmental Impact Appraisal.

Environmental Impact Appraisal is undertaken as part of the transport appraisal process. The appraisal process builds on the baseline data and impact assessment work carried out as part of the environmental impact assessment.

The sections below outline the scope for the Environmental Impact Appraisal which will be reported in the Appraisal Summary Table. The scope includes the methodology including baseline, significance of effects and scope for mitigation. The environmental topics that are impacted by changes in traffic (noise, air quality and greenhouse gases) or new or improved transport infrastructure and associated development (landscape, townscape, biodiversity, heritage and water environment) are described in more detail below and are the topics that are used to inform the appraisal of the environmental performance of the scheme options which are included in the Appraisal Summary Table.

A Preliminary Environmental Assessment Report (PEAR) will also be prepared which will outline the environmental impact assessment of the shortlist options and will include further environmental topics including geology and soils, materials and waste, population and human health and climate.

5.6.1.1. Environmental scoping

Prior to starting work on the environmental assessment, it is best practice to establish the scope of the environmental assessment (DMRB LA 103). The objective of this is to identify the environmental topics to be considered in respect of the transport option variants and to set out the methodology for assessment.

Existing data and knowledge is based on current available information. This report presents policy and information on baseline conditions and designations available at the time. Sources of information will be kept under review as the project progresses and as additional data becomes available.

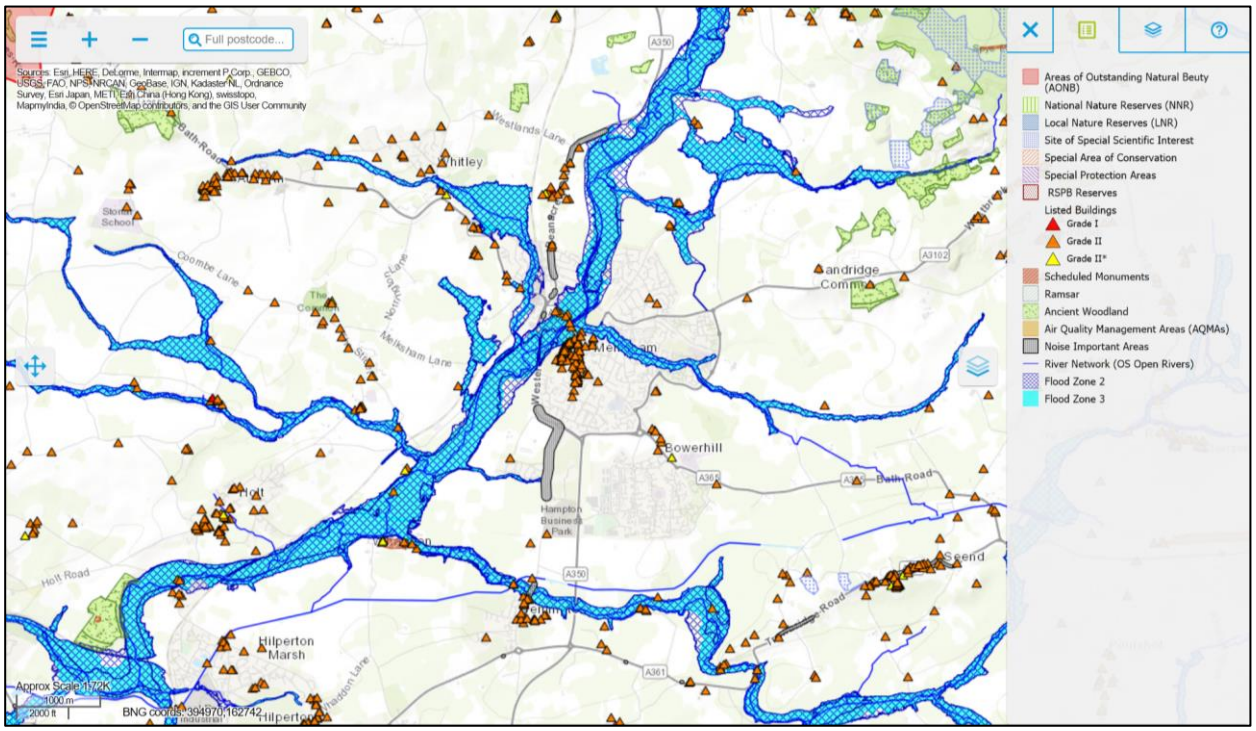
This appraisal will ascertain which environmental traffic and transport-related topics are to be examined in greater detail i.e. a simple or detailed assessment, and which can be 'scoped out' (basic assessment) for the Appraisal Summary Table. For each topic, the following sections will be considered:

- Baseline conditions and need for further assessment;
- Significance of effects; and
- Scope for mitigation.

5.6.1.2. Baseline conditions and need for further assessment

The baseline conditions for each of the environmental topics covered by the environmental assessment report will include a review of available information using various methods, including literature research, site surveys/investigations, consultations and a desktop review of previous reports and studies.

Figure 5-2 - Key environmental constraints



5.6.1.3. Significance of effects

The assessment will identify the potential impacts that might occur due to the construction and operation of the scheme options. Impacts may be adverse/negative or beneficial/positive, direct, indirect, secondary or cumulative, temporary or permanent, short, medium or long term. Impacts can affect the environment in a variety of ways. The differing parts of the environment affected by a scheme are known as receptors, i.e. those things that receive an impact from a scheme. Receptors can range from individual plants, animals or human beings living in or passing through the area, through to the landscape as a whole, and the physical, ecological and cultural elements within it.

The assessment of the impacts of the option variants will be based on agreed mitigation measures being designed into the scheme, taking account any change in effectiveness over time, such as growth of planting, the establishment of new habitats or the change in noise generation from older road surfaces.

DMRB LA 104 introduces the general principle underlying the assessment process, which can be summarised generally, although not necessarily for every topic, as a three-step process:

- The evaluation of the value, importance or sensitivity of the receptors;
- Assessment of the magnitude of the impact of the scheme on the receptor, be it adverse or beneficial; and
- Determination of the significance of the effect resulting from combining the impact (of a certain magnitude) on a receptor (of a particular value).

Significance criteria will be set out for each assessment topic following this three-step approach. The assessment matrix presented in Table 6.1 below will be used to determine the value of the sensitivity of a receptor and the magnitude of impact to determine the significance of the effect.

Table 5.2 - Significance matrix

		Magnitude of impact (degree of change)				
		No change	**Negligible**	**Minor**	**Moderate**	**Major**
Environmental value (sensitivity)	**Very high**	Neutral	Slight	Moderate of large	Large or very large	Very large
	High	Neutral	Slight	Slight or moderate	Moderate of large	Large or very large
	Medium	Neutral	Neutral or slight	Slight	Moderate	Moderate of large
	Low	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
	Negligible	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

5.6.1.4. Scope for mitigation

The following list summarises the basic principles which road design should seek to adhere to:

- Biodiversity: avoid key sites and help create new habitats through careful use of trees, hedgerows and ground cover;
- Land use: avoid high grade agricultural land, where possible;
- Noise: use design to avoid noise at sensitive locations, e.g. careful choice of horizontal and vertical alignment; use of low noise surfaces. If problems persist, consider the use of noise fences or bunds, and as a last resort use double glazing to cut down noise levels inside dwelling;
- Water and flooding: to avoid rapid discharge of rainwater into watercourses, the use of balancing ponds is proposed. This and other forms of sustainable urban drainage systems (SUDS) could benefit water quality, and in turn foster improvements to biodiversity quality;
- Landscape: use of planting and topography to 'hide' development from public view; and
- Pedestrians, cyclists, equestrians and community effects: use design to ensure that the local network fosters walking, horse-riding and cycling.

5.6.1.5. Environmental impacts

For each environmental assessment topic, the relevant DMRB process is followed. The environmental assessment is used to inform the appraisal of the environmental performance of the scheme options for each of the WebTAG environmental sub-objectives which are included in the Appraisal Summary Table. The sub-objectives include:

- Noise;
- Air Quality;
- Greenhouse Gases;

- Landscape and Townscape;
- Historic environment;
- Biodiversity; and
- Water Environment.

5.6.2. Noise

The assessment of potential road traffic noise, construction and vibration impacts will be carried out according to established prediction and assessment methodologies that are governed or guided by the following key documents:

- DMRB LA111, which includes guidance on the assessment methods for noise and vibration from new highways;
  - The Calculation of Road Traffic Noise 1998 (CRTN)
  - Noise Insulation Regulations 1975 (as amended)
  - The Highways Noise Payments and Movable Homes (England)Regulations 2000 (as amended)
  - Environmental Protection Act 1990

Any assessment of construction noise and vibration will also be carried out according to assessment methodologies that are governed or guided by the following key documents:

- BS 5228-1:2009+A1:2014 Noise and Vibration Control on Construction and Open Sites, Noise
- Control of Pollution Act 1974

Baseline

The main receptors in the vicinity of the scheme options are residential receptors along the existing route of the A350 through Melksham and Beanacre, and at the following locations around the eastern and southern fringes of Melksham and Bowerhill that may be impacted by the route of a bypass:

- Existing housing at Woodrow Road, and between Woodrow Road and Sandridge Common (the area known as Forest)
- Existing housing in the Eastern Melksham urban expansion located to the west of Eastern Way, and Snarlton Farm to the east of Eastern Way
- Planned housing in the area between Eastern Way and Spa Road
- Existing housing to the north of Western Way (between Western Way and Spa Roundabouts)
- Planned housing to the south of Western Way
- Existing housing on the eastern and southern fringes of Bowerhill

Other non-residential receptors that may be impacted by noise include:

- Melksham Oak Secondary School
- The planned Melksham Health and Wellbeing Centre (including sports pitches)
- The Kennet and Avon Canal to the south and south-east of Bowerhill

Based on desk-based observations of the area surrounding the proposed scheme options, the predominant noise source affecting existing noise-sensitive receivers is likely to be the existing A350 route through Melksham and Beanacre. Other relevant noise sources are the other main roads in the area:

- A3102 Sandridge Road
- Eastern Way / Snowberry Lane
- Spa Road
- A365 Bath Road / Western Way

Likely scale of impact

The scheme is anticipated to have a slight to moderate beneficial impact overall in the operational phase, with a significant redistribution of noise impacts away from the existing A350 corridor in Melksham and Beanacre to the areas on the eastern and southern fringes of Melksham and Bowerhill listed above. The extent of adverse

impacts in these areas will depend on the bypass alignment option that is chosen, with significant scope for mitigation at this stage through choice of alignment and design of the bypass.

Temporary large adverse impacts are expected during construction phase.

Methodology

The objective of an assessment at this scoping stage is to establish an appreciation of the likely noise and vibration consequences associated with the scheme and to establish whether further assessment is necessary to fully appraise the impacts of the proposed scheme.

Scoping assessments shall be undertaken on the basis of the information available at the time of appraisal. The four key considerations for deciding if an appraisal should progress beyond scoping stage for further assessment are:

- Is the project likely to cause a change in the Basic Noise Level (BNL) of at least 1dB(A) LA10, 18hr in the short-term, i.e. the Do-Something Opening Year (DSOY) compared to the Do-Minimum Opening Year (DMOY)?
- Is the project likely to cause a change in the Basic Noise Level (BNL) of at least 3dB(A) LA10, 18hr in the long-term, i.e. the Do-Something Future Year (DSFY) compared to the Do-Minimum Opening Year (DMOY)?
- Does the project involve the construction of new road links within 600m of Noise Sensitive Receptors (NSRs)?
- Would there be a reasonable stakeholder expectation that an assessment would be undertaken?

These key considerations will be undertaken for each of the proposed alignment options. Where the response to one or more of these considerations would be a ‘yes’ then the scoping assessment shall make a recommendation on the scope of further assessment.

In order to robustly assess the scheme options with regard to the considerations above, details of the traffic flows on the local road network and the proposed scheme links will be used. Information regarding expected potential % change in flows on key road links in the vicinity of each of the scheme options will be used as a minimum if possible, and the following information will be provided for links within the study area for each of the scheme option alignments in opening and future years, both do-minimum and do-something scenarios:

- Traffic Flow in AAWT (18hr, combined for 2-way single carriageway links)
- Traffic Composition (% HGV)
- Traffic Speeds (in kph, speed pivoted)

Any further appraisal required post scoping stage will require detailed traffic flow data outlined above as a minimum requirement, and further appraisal will be undertaken in accordance with the approach outlined in DMRB LA 111.

5.6.3. Air quality

Baseline

The main air quality receptors that may be impacted by the scheme include the same residential and non-residential receptors listed for noise above, but within 200m rather than 600m of affected roads – and for a different set of affected roads. Affected roads are defined in DMRB guidance (LA 105); the criteria for definition are provided below in the data requirements and methodology section. There are no Air Quality Management Areas (AQMAs) within the scheme extent, but two AQMAs are located at Calne (15km northeast of Melksham) and Devizes (12km southeast of Melksham), and are within the area covered by the traffic model.

The diffusion tube monitoring undertaken by Wiltshire Council showed that concentrations were below the annual mean Air Quality Strategy objective for NO_2 at three sites in Melksham in 2017 and 2018, two sites of which are adjacent to the A350.

Likely scale of impact

The scheme is expected to have a decrease in pollutant concentrations at receptors in Melksham, with a redistribution of traffic emissions away from the existing A350 corridor in Melksham and Beanacre to the areas on the eastern and southern fringes of Melksham and Bowerhill. The extent of impacts in these areas will depend on the scheme option. There is significant scope for mitigation at this stage, particularly in relation to a

'full bypass' option - through choice of specific alignment and design of the bypass away from existing receptors.

No impacts are expected on the AQMAs in Calne and Devizes, but the scheme should reduce NO_2 concentrations near the existing A350 route in Melksham.

Methodology.

The need for an air quality assessment is determined in accordance with traffic change criteria set out in DMRB LA 105.

The air quality assessment will use road traffic flow data from the traffic model for a base year, and without and with the scheme in the opening year, termed the Do Minimum and Do Something scenarios respectively. Data will also be used for a further future year (design year), with and without the scheme. Data for future year traffic scenarios will account for traffic associated with all committed developments in the local authority area.

The study area for air quality will be determined based on the comparison of traffic data for the Do Minimum and Do Something scenarios in the opening year. Where the comparison indicates that the traffic change criteria, as set out in DMRB LA 105, are met for a road link, then that road is deemed to be part of the affected road network will be included in the study area.

The following data are the minimum required for each road link where traffic is expected to change as a result of the scheme in each scenario:

- 24-hour annual average daily traffic (AADT) flow (combined for 2-way roads).
- Percentage heavy duty vehicles (HDVs). An HDV is any vehicle with a gross weight in excess of 3.5t, including heavy goods vehicles and coaches.
- Average daily speed for each road link in km/hour traffic model data for flow, composition and speed.

For this assessment, the same study area for each option will be used for consistency.

The air quality assessment will follow the guidance in DMRB LA 105, and a detailed assessment will be undertaken using the ADMS-Roads dispersion model to determine the likely effect on sensitive receptors.

In addition, an assessment following guidance in DfT's TAG Unit A3 Air Quality will be undertaken. As this scheme will affect people's exposure to pollutant concentrations, the Impact-Pathways approach will be followed, which consists of determining pollutant concentrations at distance bands from the affected roads. This will be reported in the Outline Business Case.

Ongoing air quality monitoring surveys (passive diffusion tube) are undertaken by Wiltshire Council. No additional air quality surveys are proposed.

5.6.4. Greenhouse Gases

Baseline

Baseline greenhouse gas emissions data specifically for the proposed interventions are not currently available.

Likely scale of impact

The greenhouse gases assessment is concerned with changes in emissions of carbon dioxide (CO_2). The scheme is likely to result in increases in journey distances (and hence vehicle kilometres) due to traffic re-routing to the proposed new / improved route (dependent upon the option) – increases in average vehicle speed and a reduction in congestion would be anticipated compared to the existing route. A reduction in traffic congestion within Melksham may help to offset increases in emissions relating to changes to journey distance.

Methodology

The procedure for the greenhouse gas assessment is given in TAG unit A3, May 2019.

The TUBA programme provides a calculation for estimating changes in fuel consumption that automatically produces an estimate of the carbon emissions and the net present value of the associated damages, as described in TAG. TAG Unit A3 stipulates that if TUBA is used to estimate the change in carbon emissions it is important that all 8760 hours of the year are represented in the analysis.

In addition, DMRB guidance urges caution when using TUBA to calculate emissions as it uses trip average speeds rather than link average speeds. For the economic assessment, therefore the alternative methodology offered in TAG Unit A3 will be adopted - whereby carbon emissions will be estimated using the DMRB

Screening Method and the costs have been calculated using the TAG global emissions excel spreadsheet, as provided by DfT. The valuation of greenhouse gas emissions will use the latest Department for Energy and Climate Change guidance. These values are estimated by target-consistent marginal abatement costs consistent with the Government's commitments on greenhouse gas emissions

In addition, DMRB LA 114 sets out the methodology for assessing the effects of the whole scheme lifecycle on climate. The assessment will estimate the scale of greenhouse gas emissions during construction and operation, for each of the route options. For the purposes of the PEAR, it will not be possible to conduct a full quantitative assessment due to the unavailability of design data and construction plans. For this reason, the options assessment will focus on key bulk materials and wastes (e.g. fill / aggregate, asphalt) which can be estimated at early design stages and use these as a proxy for whole scheme emissions.

5.6.5. Landscape and Townscape

Baseline

Based upon a 'full bypass' option and 'lower cost' option to the east of Melksham, the relevant landscape area is rural - classified within National Character Area 117; Avon Vales, and within Wiltshire Landscape Character Areas 12B: Avon Open Clay Vale, and 7C: Bowood Greensand Hills.

The landform is very flat with higher ground only forming over 2km to east and 5km to west of the route corridor. There are small valleys of tributaries of the River Avon and pastoral slopes with hedgerow networks to the north and more open fields to the south, with occasional blocks of woodland. Fields are mainly pastoral and arable farmland but there is also a Solar Farm to the east of the 'full bypass' options corridor. Willow lined waterways include the River Avon and associated tributaries and along the Avon and Kennet Canal to the south of the route.

The eastern route corridor passes close to the outskirts of Melksham and Bowerhill and between outlying villages; as well as individual farms, houses and estates. The corridor is crisscrossed by several public rights of way. Sections of the eastern route corridor remain rural and tranquil despite the existing A roads through the area.

There are no internationally or nationally designated landscape sites (National Parks, Area of Outstanding Natural Beauty) or Green Belt within 2km of the eastern route corridor although other landscape features present, which may be affected, would include National Cycle Route 403, Public Rights of Way, the Registered Parks and Gardens of Spye Park and Lacock Abbey and the Avon and Kennet Canal.

Likely scale of impact

Initial assessment identified a moderate adverse effect. This is due to the predominantly rural and tranquil landscape setting through which the proposed scheme would travel, with the proposed route being out of scale with the local pattern and landform, as well as potentially being visually intrusive and not possible to fully integrate within the landscape.

The visual amenity and setting of the registered parks and gardens may experience slight to moderate adverse impacts.

The route would cut through relatively flat agricultural land with landscape elements such as mature hedgerows and trees, and water meadows, and pass close to individual residential receptors as well as crossing/passing close to public rights of way resulting in slight to moderate adverse impacts on the landscape elements, patterns and visual amenity.

Methodology

If the scoping confirms the need for further assessment, this will be based on a combination of The Landscape Institute's Guidelines for Landscape and Visual Impact Assessment (GLVIA3) and DMRB LA 107 Landscape and Visual Effects Assessment that aligns the landscape, townscape and visual assessments. The DMRB approach requires an appreciation of the landscape context, as a basis to evaluate the sensitivity of the surroundings to visual change and the constraints placed upon the design of the highway scheme and its environmental measures. This process will be aligned with the requirements of TAG Unit A3 and completion of the associated Landscape/Townscape Appraisal Worksheet.

The methodology for the assessment will involve undertaking a desk-based scoping study including an assessment of properties and local views potentially affected by the options (appraisal of the environmental capital).

Work includes identification of landscape character areas and assessment of the visual impact of the proposals on public visual receptors including residential property, public rights of way and public open space in the area. This analysis is carried out concurrently with the scheme design and forms part of a continuing process of design refinement, ensuring that the landscape proposals are developed as an integral part of the project. This includes consideration of landscaping mitigation and options will be assessed on the basis of known or likely mitigation at the time of undertaking.

The assessment will consider the impact of the scheme options against each of the identified landscape features. Following completion of the Landscape/Townscape Appraisal Worksheet an overall assessment score will be determined.

5.6.6. Historic environment

Baseline

The historic environment resource encompasses designated and non-designated assets including Scheduled Monuments, Listed Buildings (statutorily listed and locally listed), Conservation Areas, World Heritage Sites, Registered Parks and Gardens, Registered Historic Battlefields, historic buildings (unlisted), known archaeological sites and areas of archaeological potential.

There are no assets of International Significance (namely World Heritage sites or buildings of International Significance) within 2km of the scheme options. There are assets of High Value and potentially High Value, including a Scheduled Monument at Whaddon Grove Farm, to the southwest of Melksham, five Grade II* Listed Buildings, and Conservation Areas in Melksham, Broughton Gifford, Lacock, Bowden Hill, Gastard and Seend. There are no Grade I Listed Buildings, Registered Parks and Gardens, Protected Wreck Sites, Registered Historic Battlefields within the study area.

There are numerous assets of Medium value, comprising Grade II Listed Buildings.

The Historic Environmental Records (HER) has not been studied at this stage, and so the existence of undesignated archaeological sites of High or Medium Value is unknown.

Likely scale of impact

Initial assessment indicates potential for slight to moderate adverse impact on known designated assets to the north, east and south of Melksham, including to Melksham Conservation Area. Impacts would be more significant in relation to a ‘full bypass’ option to the east of Melksham. Where the scheme has potential to directly impact on Listed Buildings (most relevant to designated assets scattered within rural locations to the east and in the settlement of Bowerhill, south of Melksham), those specific impacts have the potential to be of Moderate to Large adverse impacts.

Initial appraisal identified Slight Adverse impacts on the setting of known historic features outside the 2km of the scheme such as Grade I, II* and II Listed Buildings and Conservation Area at Lacock, Lacock Abbey Grade II Registered Park and Garden, Grade II Listed Buildings at Spye, and Spye Park Grade II Registered Park and Garden. This may also extend to Grade I, II* and II Listed Buildings at Bowden Hill and Bewdley Court.

Methodology

Modelling work on the route options for the scheme will be undertaken towards the end of 2020. As part of this work, a desk-based heritage assessment will be carried out, in order to consider the character and quality of the study area and the likely impacts of the scheme on both known and unknown assets.

The methodology for the assessment will involve undertaking a desk based scoping study.

If the scoping study deems it necessary, a holistic assessment of the historic environment will be undertaken as part of the environmental assessment, which use the methodology as laid out within LA 104 and LA 106 of the DRMB, comprising:

- Archaeology: the potential effects on known and unidentified archaeological remains
- Built heritage: potential physical impact on designated and non-designated built heritage assets and changes to the setting of designated heritage assets in the landscape (including long views)
- Historic landscape character: potential visual alterations of the integrity of the historic landscape character within which the proposal site is situated

This approach will be aligned with the requirements of TAG Unit A3 and completion of the associated Historic Environment Appraisal Worksheet.

If the full assessment is required, baseline information would be collected from several sources, including (but not limited to):

- Wiltshire and Swindon HER
- National Heritage List for England maintained by English Heritage
- Cartographic (including superseded Ordnance Survey maps and other relevant historic mapping)
- Aerial photographic data held by Wiltshire Council (if available)
- Historic Landscape Characterisation data
- Relevant secondary sources to inform the archaeological and historic background of the assessment

Following the initial data collection, a walkover survey would be carried out in relation to relevant scheme elements as part of the environmental assessment process, with the aim to identify known constraints and their condition, to assess the potential for survival of as yet unidentified constraints (i.e. buried archaeological remains), and to assess the setting and sensitivity of any visual receptors identified. This will establish the significance of the key historic environment resources.

The assessment will consider the impact of the scheme options against each of the identified historic environment features. Following completion of the Historic Environment Appraisal Worksheet an overall assessment score will be determined.

5.6.7. Biodiversity

Baseline

Within the Zone of Influence (ZoI) of important areas of biodiversity the Bath and Bradford on Avon Bats Special Area of Conservation[2] (SAC) is located approximately 7km north-west of Melksham.

In addition, Spye Park Site of Special Scientific Interest (SSSI), Seend Cleeve Quarry SSSI, and the Seend Ironstone Quarry and Road Cutting SSSI are all located within 2km of the scheme options. A further assessment of the impacts on biodiversity features will be required as part of the next stage of the project.

Likely scale of impact

It is anticipated, based on an early evaluation, that the overall impact on biodiversity features has the potential to be moderate adverse[3] - based on a 'full bypass' option, or slight adverse – based on a 'lower cost' option. This includes potential for direct impact through loss or disturbance of habitats and land use in close proximity to the route. This evaluation will be revised as further assessment is carried out.

With regards to designated sites, potential impacts could include loss of commuting or foraging habitats for bats within the local area linked to the Bath and Bradford on Avon Bats SAC and therefore further evaluation/ assessment is required in relation to bats associated with this SAC. Although no direct impacts to SSSIs are anticipated, the eastern route corridor is located within the Impact Risk Zone (IRZ) for Skype Park SSSI, therefore indirect impacts to this site will need to be considered.

The bypass route may result in direct loss and disturbance of priority habitats, including deciduous woodland, as well as a range of agricultural habitats. Crossings of rivers and watercourses, including the River Avon may result in loss of bankside habitat and impacts to aquatic floral and faunal species.

In addition, the route is likely to have both direct and indirect impacts on protected and notable species (such as great crested newt and bats etc) that are likely to be located along the scheme.

Methodology

The extent to which the study areas extend beyond the footprint of road construction will be determined by the likely spatial scale of potential significant effects for each type of biodiversity feature, i.e. the ZoI. These are based on good practice guidance (where available), but in most cases are determined by professional judgement. Details of these feature-specific study areas that are likely to be used are provided below (these will be reviewed and refined as the project progresses):

[2] Designated as it comprises 15% of the UK greater horseshoe bat population and is selected on the basis of the importance of this exceptionally large overwintering population, as well as small numbers of Bechstein's bats hibernating in abandoned mines.

[3] Based on the summary within the Strategic Outline Business Case (SOBC) for the A350 Melksham Bypass scheme, a report to Wiltshire Council, December 2017.

- 30 km from the road construction for identification of European Sites where bats are one of the qualifying features4;
- 2 km from the road construction (extended to any distance where there is a direct hydrological connection) for identification of all other statutory designated nature conservation sites, including European Sites5, SSSIs, National Nature Reserves (NNRs) and Local Nature Reserves (LNRs);
- 2 km from the construction footprint for identification of non-statutory designated nature conservation sites (e.g. Local Wildlife Sites);
- 1 km from the construction footprint for identification of records of priority habitats6 and ancient woodland;
- 1 km from the construction footprint for identification of any protected or notable7 species records. Where a watercourse has been identified within 150 m of the construction footprint, the study area for aquatic species is extended up to 2 km upstream and downstream to identify any species records for the specific watercourse; and
- 250m from the construction footprint for identification of ancient and veteran trees.

A scoping study will consider the nature of the scheme options and decide on an appropriate area to survey (this will consider the scheme footprint itself - the road plus construction area, access routes and storage areas – plus a given distance around this, as detailed above, and refined as appropriate). In addition, the surveys that will be recommended will be proportionate to the stage of assessment (e.g. a full suite of species surveys will not be conducted on all options, this will be restricted where possible until a final option has been selected).

The assessment and characterisation of impacts for the purposes of an environmental assessment, if required according to the scoping study, would be carried out following the approach set out in WebTAG Unit A3[8] and DMRB LA 108. As set out in LA 108[9], the valuation of receptors and characterisation of ecological impacts would be considered to determine the significance of impacts of the proposed works. The approach would align with the requirements of the Biodiversity Appraisal Worksheet.

The nature conservation value or potential value of an ecological feature (or receptor) is determined within a defined geographic context:

- International importance (e.g. Special Areas of Conservation, Special Protection Areas, Ramsar sites)
- National importance (e.g. Sites of Special Scientific Interest in England, Scotland and Wales and Areas of Special Scientific Interest in N Ireland)
- County importance (e.g. Sites of Importance for Nature Conservation)
- Important within the District/ Borough
- Local (parish) importance (e.g. significant ecological features such as old hedges, woodlands, ponds)
- Important within the site and immediate environs e.g. habitat mosaic of grassland and scrub (i.e. within the zone of influence only)
- Negligible importance would usually be applied to areas such as built development or areas of intensive agricultural land

It should be noted that it is usual to consider habitats and species together when ascribing a value to a feature using this geographic context. However, there are circumstances where an ecologist may feel it necessary to assign a value to a particularly valuable species. In assigning value to species, it is necessary to consider the species distribution and status including a consideration of trends based on available historical records and to make use of any relevant published evaluation criteria. For instance, the presence of a significant population of European protected species such as bats may be worth separate consideration.

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[4] Design Manual for Roads and Bridges. March 2020. LA 108 DMRB | Standards for Highways. [Online]. Available from: file:///C:/Users/RIEG3016/Downloads/LA%20108%20revision%201%20Biodiversity-web.pdf

[5] Also referred to as Natura 2000 sites, these should be taken as including: Sites of Community Importance (SCIs), Special Protection Areas (SPAs), potential SPAs (pSPAs), Special Areas of Conservation (SACs), candidate SACs (cSACs), possible SACs (pSACs) and Ramsar sites.

[6] Priority habitats are those habitats listed in accordance with Section 41 of the Natural Environment and Rural Communities Act 2006 (the NERC Act) as being of principal importance for the conservation of biodiversity in England.

[7] Notable species in this context comprise species listed in accordance with Section 41 of the NERC Act; IUCN Red List species; Red and Amber Birds of Conservation Concern; and species that are Nationally Scarce or Rare.

[8] Department for Transport WebTag (Unit A.3, Chapter 9, Environmental Impact Appraisal, May 2019)

[9] Design Manual for Roads and Bridges; Sustainability and Environment Appraisal, LA108 Biodiversity, Revision 1, March 2020

If required as per the scoping study, an assessment of the potential impacts of the A350 Melksham bypass scheme would need to take into account both on-site impacts and those that may occur to adjacent and more distant ecological features. Impacts can be positive or negative. Negative impacts can include:

- Direct loss of wildlife habitats
- Fragmentation and isolation of habitats
- Disturbance to species from noise, light or other visual stimuli
- Changes to key habitat features
- Changes to the local hydrology, water quality and/or air quality

Negative and positive impacts on nature conservation features have been characterised based on predicted changes because of the proposed activities. To characterise the impacts on each feature, the following parameters are taken into account:

- The magnitude of the impact
- The spatial extent over which the impact would occur
- The temporal duration of the impact
- Whether the impact is reversible and over what timeframe
- The timing and frequency of the impact

The assessment will consider the impact of the scheme options against each of the identified biodiversity features. The assessment would identify those positive and negative impacts which would be 'significant', based on the integrity and the conservation status of the ecological feature. Impacts are unlikely to be significant where features of local value or sensitivity are subject to small scale or short-term impacts. However, where there are several small-scale impacts that are not significant alone, it may be that, cumulatively, these may result in an overall significant impact.

The assessment would consider ecological mitigation that would then be incorporated into the detailed design of the A350 Melksham bypass scheme and the programme and methods for site works, particularly any works involving vegetation clearance. Mitigation will be designed to take account of legal requirements regarding protected species as well as any significant impacts indicated by the environmental assessment.

Following completion of the Biodiversity Appraisal Worksheet an overall assessment score will be determined.

5.6.8. Water environment

Baseline

The River Avon floodplain north of Melksham is of relevance to the scheme options. Generally known as the Bristol Avon, the catchment drains over 2,800 km^2 of Wiltshire, Gloucestershire and Somerset, and flows via the Avon Gorge into the Severn Estuary. The route corridors to the east of Melksham cross the River Avon, Forest Brook and Clackers Brook Water Framework Directive (WFD) assessed waterbodies. While the Avon has an ecological status of moderate the Forest Brook and Clackers Brook are both classed as having poor ecological status.[10] The route does not cross Semington Brook to the south of Melksham, however this waterbody may also be impacted by the project. This has a WFD ecological status of moderate.

Likely scale of impact

The initial appraisal identified that the overall impact on the water environment had the potential to be 'large adverse' duet to the 'full bypass' option being a new section of road crossing several watercourses, passing through areas of high flood risk, and increasing surface water run-off.

Both 'full bypass' and 'lower cost' options would cross the channels and floodplains of the River Avon, Clackers Brook and Forest Brook as well as other small watercourse and drains. The route will include several watercourse crossings. This will reduce the length of open river and may have impacts on the hydromorphology and aquatic ecology of the watercourses. Therefore, channel improvements work may be required to offset this impact. The route is within Environment Agency Flood Zone 2 and 3 in different areas. The scheme may affect flood flows in the watercourses and on the floodplains, therefore the scheme will potentially require compensatory flood storage as a result of the loss of or impact on the floodplains. The

[10] http://environment.data.gov.uk/catchment-planning/

scheme will lead to an increase in surface water run-off due to its reduced permeability and this will have a subsequent reduction of water quality.

Methodology

The methodology for the assessment will involve a desk-based review of available data to produce the scoping study, including an assessment of potential impacts on water quality, hydromorphology and flood risk.

At the scoping stage, identification of the likely significance of effects will be qualitative and will follow the requirements of WebTAG Unit A3 and the DMRB process as set out in the DMRB LA 113 and LA 104. The study area for the water environment is defined as 1 km from the centre line of the scheme and will include all waterbodies shown on the OS Master map and associated assets (abstraction points, discharges etc.).

If confirmed as required, the full assessment will follow the requirements of WebTAG Unit A3 and the DMRB process as set out in the DMRB LA 113 and LA 104. This includes identifying / defining key water environment resources and assessing their value and significance. Impacts will subsequently be appraised for each feature identified. This will involve completion of the Water Environment Appraisal Worksheet and finally deriving an overall assessment score.

This assessment will also include consideration of potential works (e.g. culverting (or extensions to culverting), river re-alignment) to meet any requirements for WFD 2000/60/EC compliance assessment.

5.6.9. Summary

An environmental assessment of the options will be undertaken using DMRB and TAG guidance which will be presented in the PEAR and AST reports. At this stage it is assumed that none of the topics described above will be scoped out and will all be included in the assessments within the Appraisal Summary Table.

5.7. Social impacts

Social impacts cover the human experience of the transport system and its impact on social factors, not considered as part of economic or environmental impacts. The social impacts of the scheme will be assessed in line with TAG Unit A4.1. A number of the social impacts are relevant to the appraisal of Distributional Impacts (see section 5.8).

There are eight social impacts, namely:

- Accidents
- Physical activity
- Journey quality
- Security
- Severance
- Option and non-use values
- Accessibility
- Personal affordability

5.7.1. Accidents

One of the scheme objectives relates to improving safety through reducing the number, occurrence and severity of accidents, particularly on the existing A350 through Melksham. Accident data analysis identifies a number of accident clusters on sections of the existing A350. The anticipated traffic relief and re-assignment of traffic to more suitable routes as a result of the scheme aims to reduce the overall adverse impacts from accidents. Potential changes in total traffic volume and speed as a result of the scheme may also influence accident occurrence and severity.

Given the relevance of this impact to the scheme objectives the estimation of accident benefits will be undertaken using COBA-LT, the industry-recognised software for this type of analysis. The area for the COBA-LT analysis will be determined according to the links for which traffic flows change by more than 5% between the Do Minimum and Do Something situations for the scheme.

Existing network accident rates

Guidance specifies that local accident rates can be defined for all, some or none of the links involved in or affected by the scheme. Where available, local accident data will be obtained for links (A roads and B roads) that are within the vicinity of the scheme and are involved in or affected by the scheme. A map of the strategic links where local accident rates will be defined where available will be provided.

Each link in the network will be assigned an accident rate based on the characteristics of that link. For the key strategic links, a local accident rate will be calculated using 5 years of observed personal injury accident data obtained from the Local Authority. The accident rate is calculated by dividing the number of accidents by the number of vehicle-kilometres travelled. These rates are then used to forecast the number of accidents in the future based on changes in traffic volumes and the design of new roads.

For more minor roads COBA-LT default accident rates will be used, which ensures that the accident rates are not skewed by limited flow information on minor roads.

Outputs

COBA-LT presents results in the form of changes in the number of personal injury accidents (PIAs) and disaggregates this further by severity of injury: fatal, serious and slight. A monetised value is assigned to the accidents, so that total accident costs can be calculated for the situation before (the 'Do Minimum') and after (the 'Do Something') the implementation of the scheme.

Accident costs are summed across the same 60-year project lifetime as used in the calculation of TEE benefits and discounted back to 2010 values. The difference between the discounted 60-year accident costs represents the accident benefits related to the scheme.

5.7.2. Physical activity

Whilst the scheme is predominantly highway-based, the objectives include to improve opportunities for local walking and cycling trips, particularly facilitated by traffic relief to the existing A350 route. In this regard, the scope of the scheme options includes complementary walking and cycling measures within Melksham. At this stage, the specific nature of these measures is not known (e.g. potential new infrastructure, reallocation of road space, changes to speed limits etc).

Whilst the scope of walking and cycling measures is currently uncertain, it is assumed that a proportionate appraisal will be undertaken to provide a monetised benefit from changes in mortality and absenteeism associate with changes in levels of walking and cycling activity. This would be based on methods from TAG Unit A5.1 and TAG Unit A4.1, such as the active travel health benefits toolkit. Key to the approach will be estimating the scale of likely change in active users as a result of the complementary measures package. Consideration will also be given to the impact of scheme options on existing walking and cycling facilities and the potential for changes in physical activity as a result, plus the impact of the scheme on easing travel by motorised modes (and any associated impact on active travel demand). The approach to estimating changes in active travel will be informed by any available baseline demand data and analysis of local trip patterns and propensity to change modes. The estimated changes in active user demand will be input to the DfT's active travel health benefits toolkit, with the recommended process applied to derive the monetary value.

A similar method will be adopted to estimate impacts on absenteeism.

5.7.3. Security impacts

Security is not a key issue or objective addressed by the scheme. Impacts on security are not expected to be significant based on the nature of the scheme and study area.

A qualitative assessment will be undertaken for the OBC against the security indicators identified within TAG A4.1, taking into account potential impacts on users of the proposed and existing routes – this will include non-motorised users. This will utilise the Security Impacts Worksheet.

5.7.4. Severance

Reducing community severance issues is one of the scheme objectives, particularly for communities in north Melksham and Beanacre. Providing an alternative route for A350 traffic would provide traffic relief to the existing route, and is proposed to be supported by complementary walking and cycling measures to lock in the opportunities this provides. This may include improved crossing facilities, reducing the width of sections of existing carriageway, or reducing speed limits, for instance. Material impacts are anticipated on both the

existing A350 route and potentially elsewhere in the Melksham area. A further key consideration will be the potential impact of the scheme options on existing desire lines and facilities for pedestrians and cyclists. In most instances it would be expected that the scheme design would mitigate or minimise any impacts in these circumstances, where feasible to do so.

Because of the potential for a variety of possible positive and adverse impacts, severance impacts will be assessed at a number of different locations. This will include along the existing A350 route in addition to other routes impacted by new infrastructure and / or substantial changes in traffic volumes.

The assessment will be presented in line with the Severance Impacts Worksheet, leading to a qualitative assessment within the AST.

5.7.5. Option values and non-use values

The scheme is not proposing to substantially change the availability of transport services within the study area. No new bus or rail services will be included as part of the scheme, nor will any services be removed. Whilst option and non-use values can be applied to road infrastructure, this particular scheme is not anticipated to have any implications on whether users choose to undertake a journey they would not have done using existing routes.

The impact of the scheme options on option and non-use values is therefore assumed neutral and will not be appraised in the development of the OBC.

5.7.6. Accessibility

Accessibility relates to the range of opportunities and choices people have in connecting with jobs, services and friends and families.

TAG generally considers accessibility in terms of public transport access. In relation to the Melksham Bypass scheme, the main potential impacts are considered to be:

- Any changes to bus stop provision as a result of changes to the network;
- Any changes to bus service routing (and run times or frequency) as a result of changes to the network;
- Any changes to bus service run times or frequency as a result of changes to traffic volumes / conditions arising due to the scheme.

TAG A4.2 advises that accessibility is primarily a distributional issue, and hence the methodology to derive an appraisal score should be covered within the Distributional Impacts Appraisal (section 5.8).

5.7.7. Journey quality

Journey quality is a measure of the real and perceived physical and social environment experienced while travelling. The assessment under social impacts addresses those aspects not covered elsewhere (e.g. journey times, reliability). Journey quality is not a specific issue or objective addressed by the scheme, but the scheme is likely to produce indirect impacts in this regard. The approach to assessing journey quality considers the three main factors, as per TAG A4.1 – traveller care, traveller stress and travellers' views. The latter two factors are likely to be relevant to the scheme in particular.

TAG A4.1 recommends a qualitative appraisal for road users. This is therefore the current proposed approach, although further consideration will be given to the potential for monetisation. If a feasible approach is subsequently identified and proposed this will be discussed and agreed with DfT.

In relation to journey quality impacts for non-motorised users it is proposed to provide a monetary valuation. Impacts would relate to traffic relief on existing routes and the provision of complementary walking and cycling measures. Values within the TAG data book will be used. It is acknowledged that this requires an element of judgement as to where the likely benefits sit on a sliding scale, relative to the maximum benefit value. Assumptions will be clearly set out and sense checks undertaken to ensure that the monetisation value is a reasonable representation of the expected impacts.

5.7.8. Personal affordability

The monetary costs of travel can be a major barrier to mobility for certain groups of people. In general, the main impact of the Melksham Bypass scheme in relation to affordability would be expected to be a marginal reduction (at an individual level) in vehicle operating costs, associated with freer flowing traffic conditions. However, this may not affect all parts of society equally. For this reason, TAG A4.1 advises that personal

affordability is predominantly a distributional issue, and hence the methodology to derive an appraisal score should be covered within the Distributional Impacts Appraisal (section 5.8).

If screening under the DIA does identify a need for further appraisal of affordability a Strategic Affordability Review and Personal Affordability Worksheet will be completed as part of the DIA process, leading to a qualitative assessment in the AST.

5.8. Distributional impacts

DI appraisal is concerned with the variance of transport intervention impacts across different social groups. The DI analysis considers the following indicators and sits closely with the associated appraisal activity undertaken of each (as outlined in the sections above):

- User benefits
- Noise
- Air quality
- Accidents
- Security
- Severance
- Accessibility
- Affordability

The DI appraisal will be undertaken in line with TAG A4.2, following the three stage process outlined below.

5.8.1. Step 1

Step 1 is a screening process which identifies the likely impacts for each indicator. The results of this process will be entered into a screening proforma. Following this, agreement will be made on which indicators to proceed to step 2 and step 3 assessments.

5.8.2. Step 2

Step 2 is the assessment process which includes:

- Confirmation of the area impacted by the transport intervention (impact area);
- Identification of social groups in the impact area; and
- Identification of amenities in the impact area.

5.8.3. Step 3

Step 3 is the appraisal of impacts which completes a full appraisal of the DI and completion of the Appraisal Summary Table (AST).

5.9. Sensitivity tests

Sensitivity and scenario analyses will be undertaken to test the robustness of the modelling and appraisal framework, and to assist with decision making by establishing the level of confidence around the core business case for the Melksham Bypass scheme. These tests will be broken down into two areas, as set out below.

5.9.1. Cost sensitivity

The cost-based sensitivity tests consider variation around the calculated scheme cost estimate and will include:

- 20% increase in scheme investment costs
- 20% reduction in scheme investment costs

The above tests assume TEE benefits (travel time and vehicle operating cost savings) from the core scenario, so that no further modelling will be required. Instead, changes will be made directly to the TEE table.

5.9.1. Demand sensitivity

The demand-side scenario tests consider uncertainty in relation to national trends such as economic and traffic growth. Two tests will be undertaken as follows:

- Low growth scenario
- High growth scenario

The approach to defining these scenarios will be in accordance with TAG Unit M4 and is described further in section 4.5.5 of this report. As noted in this section, the main areas of local uncertainty relate to prospective future housing site allocations (associated with Wiltshire Council's ongoing Local Plan Review) and other proposed schemes on the A350 corridor (at a similar stage in the business case process to the Melksham Bypass scheme). In the interests of proportionality, it is currently proposed to reflect these as part of the high growth scenario, rather than producing an additional alternative scenario.

The scenario tests feed through to changes in travel costs and, consequently, TEE benefits. Whilst scheme investment costs and construction/maintenance costs are held constant in line with the core scenario, there will be a change to the scheme PVC through the indirect taxation effect.

5.9.2. TAG update sensitivity

As explained in section 5.1.1, forthcoming updates to TAG are expected to be made definitive in February 2021. Recent guidance from DfT advises that, until then, there is a need to undertake a combined sensitivity test in respect of the forthcoming updates. As the full appraisal for the OBC is currently scheduled for Summer 2021, the sensitivity testing is only likely to affect any interim appraisal (e.g. to inform options development). It would be intended to apply this in a proportionate manner for the core scenario on an 'appraisal only' basis.

5.10. Reporting of the transport appraisal

The key appraisal findings will be summarised in the Appraisal Summary Table (AST) which brings together all monetised, quantitative and qualitative impacts of the scheme and presents them as a coherent package. One AST will be produced for each option. This will be supported by the standard TEE, PA, and Analysis of Monetised Costs and Benefits (AMCB) tables.

A Value for Money statement will be produced using the information within the AST to provide a summary of the conclusions from the Value for Money assessment (for each option), including the outcomes from the sensitivity tests undertaken.

Full details of the appraisal methodology and outcomes will be reported in an Economic Appraisal Report, with key details presented in the OBC itself (Economic Case).

A separate report will be produced on the Distributional Impacts Appraisal.

The standard DfT checklist for the Economic Case will be appended to the OBC to ensure that key aspects of the modelling and transport appraisal are clearly signposted.

6. Operational assessment

6.1. Introduction

The strategic network modelling (specified in Section 4) provides high-level operational assessment of the scheme options. However, its primary purpose is in support of economic and environmental appraisal. Greater clarity on how the scheme options will impact on the road network can be provided through an operational assessment using local junction and/or microsimulation modelling.

6.2. Scale of impacts

Of particular relevance for the operational assessment is the operation of the bypass route itself (including tie-ins with the existing network and new / modified intermediate junctions), in addition to any existing junctions on the wider network that would be subject to significant changes in traffic volumes and/or distribution as a result of the scheme. The fully modelled area would contain these junctions.

Junction locations of particular interest are expected to include:

- New junctions formed between the bypass and the existing road network (A350 north of Beanacre, Woodrow Road, A3102 Sandridge Common, Eastern Way, A365 east of Bowerhill, A350 south of Bowerhill – as required for each option);
- Existing junctions along Eastern Way, Spa Road and Western Way that would become part of the A350 and experience an increase in traffic volumes with the scheme in place; and
- Existing junctions along the current A350 route, including Bath Road junction, Farmers Roundabout and Semington Road roundabout that would experience a reduction in traffic volumes, to consider options to improve pedestrian and cycle crossing facilities.

Further investigation of forecast scheme impacts will determine the extent of any junctions in a wider area requiring assessment.

6.3. Existing knowledge and data

Several previous traffic studies within Melksham have been undertaken in recent years, primarily focusing on the operation of the Farmers Roundabout and immediate network. The National Productivity Investment Fund (NPIF) Application (June 2017) submitted to the DfT assessed a partial signalisation scheme at the Farmers Roundabout. The development of this scheme was supported by a microsimulation (VISSIM) model of the local network. The delivery of this scheme was completed in October 2019.

There are no other known existing local junction models within the Melksham area.

Existing appraisal and assessment methodology and guidance comprises DMRB guidance on highway link and junction design in volume 6.

6.4. Traffic data requirements

Traffic data will be taken from the forecast model runs to produce forecast AADTs as well as peak flows for design purposes. Any observed base traffic data (such as turning counts) will be utilised to enhance the accuracy of the local junction modelling where this is available.

Highway layout information will be provided by the design team for proposed new road links and junctions. For existing junctions, detailed geometric data and junction counts (where available) will be obtained from the highway authority as part of the information gathered to construct the local traffic models.

6.5. Proposed methodology

6.5.1. Software

The following software will be used for junction assessments:

- ARCADY – roundabouts
- PICADY – priority junctions

- LINSIG – signals

6.5.2. Operational assessment and design process

The preliminary highway and junction designs will be assessed making use of the appropriate software tools listed above and in accordance with the DMRB processes (for example for merge/diverge designs). The operational assessment may be undertaken at different stages throughout scheme development and used to consider modifications to the scheme design so that an acceptable performance is achieved in terms of minimising queues and delays, for example by adding lanes at junctions. These refinements would then be fed back into the strategic model for inclusion in the model runs to underpin the transport appraisal.

For any new signalised junctions, testing of signal staging and timings will be required to find optimal solutions.

The main findings from the operational assessment will be included within the OBC.

7. Appraisal Specification Summary Table

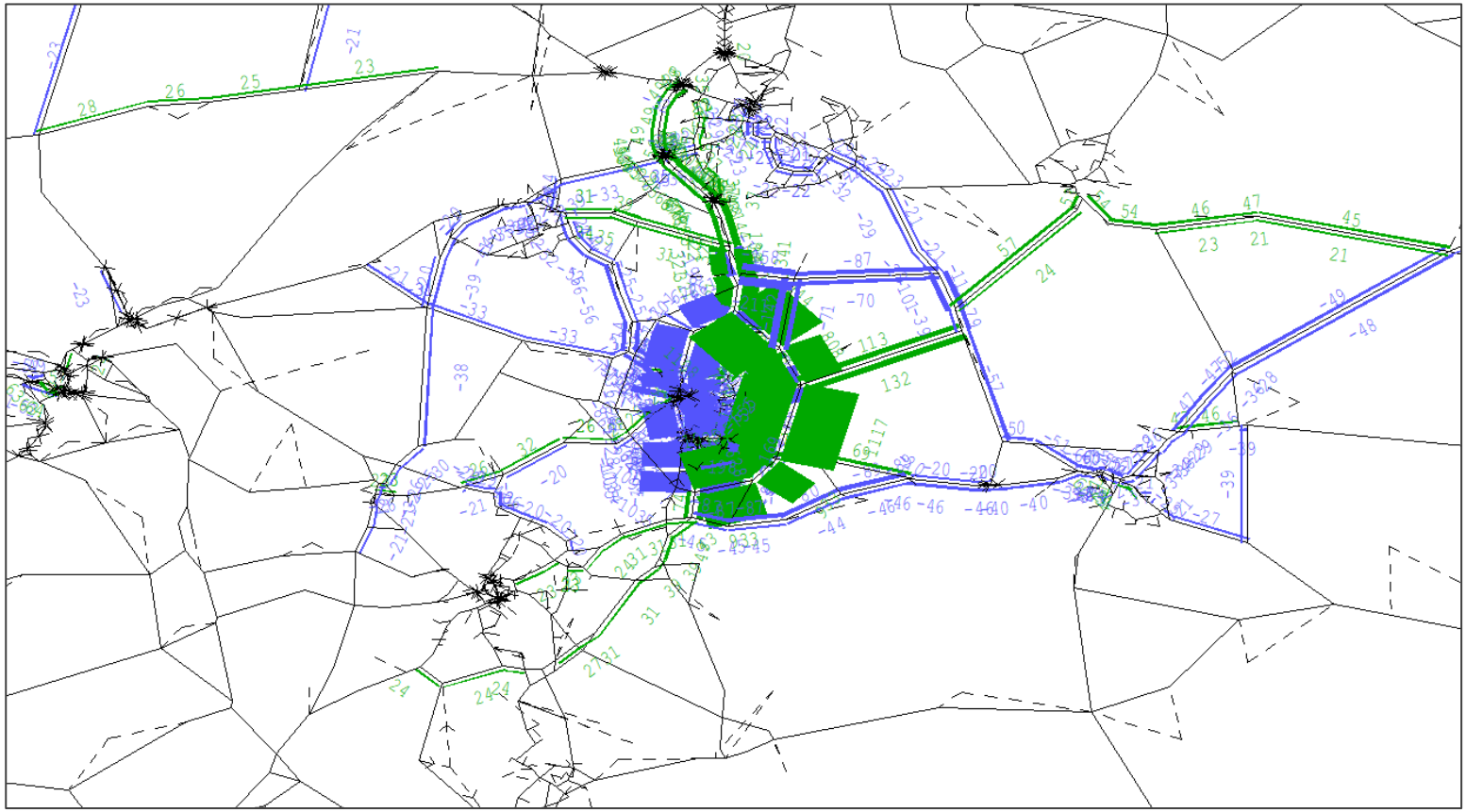
Impacts	Sub-impacts	Estimated Impact in OAR	Level of uncertainty in OAR	Proposed proportionate appraisal methodology	Reference to evidence and rationale in support of proposed methodology	Type of Assessment Output (Quantitative/ Qualitative/ Monetary/ Distributional)
Economy	Business users & transport providers	Slight - moderate beneficial	Medium	Modelled in SATURN and benefits will be monetised using TUBA	WebTAG guidance (A1.3)	Monetary
	Reliability impact on Business users	Slight - moderate beneficial	Medium	Standard deviation approach	WebTAG guidance (A1.3)	Monetary
	Regeneration	Neutral	Low	N/A	WebTAG guidance (A2.2)	N/A
	Wider Impacts	Slight - moderate beneficial	Medium - High	Level 2 analysis, as in WebTAG A2.1	WebTAG guidance (A2.1)	Monetary
Environmental	Noise	Slight - moderate beneficial	Medium - High	Calculated as given in DMRB Volume 11, Part 3, Section 7	WebTAG guidance (A3/A4.2)	Monetary/Distributional
	Air Quality	Slight - moderate beneficial	Medium - High	Calculated as given in DMRB Volume 11, Part 1, Section 3	WebTAG guidance (A3/A4.2)	Monetary/Distributional
	Greenhouse gases	Slight adverse	Medium	Emissions estimated using DMRB Screening Method and costs are calculated using TAG global emissions spreadsheet	WebTAG guidance (A3/A4.2)	Monetary
	Landscape	Assumed moderate adverse	Medium	Desktop & appraisal study	WebTAG guidance and desktop study	Qualitative
	Townscape	Assumed slight/moderate adverse	Medium	Desktop & appraisal study	WebTAG guidance and desktop study	Qualitative
	Heritage of Historic resources	Assumed moderate adverse	Medium	Desktop & appraisal study	WebTAG guidance and desktop study	Qualitative
	Biodiversity	Assumed moderate adverse	Medium	Desktop & appraisal study	WebTAG guidance and desktop study	Qualitative

	Water Environment	Assumed major adverse	Medium	Level 1 Flood Risk Assessment / Desktop study	WebTAG guidance and desktop study	Qualitative
Social	Commuting and Other users	Slight - moderate beneficial	Medium	Modelled in SATURN and benefits will be monetised using TUBA	WebTAG guidance (A1.3)	Monetary / Distributional
	Reliability impact on Commuting and Other users	Slight - moderate beneficial	Medium - High	Stress-based approach	WebTAG guidance (A1.3)	Qualitative
	Physical activity	Slight beneficial	Medium	Calculated based on changes in mortality and absenteeism	WebTAG Unit A5.1	Monetary / Distributional
	Journey quality	Slight - moderate beneficial	Medium - High	PERS will be used to measure the benefits and VURT will monetise this	WebTAG guidance (A4.1)	Monetary / Distributional
	Accidents	Slight positive	Medium	COBALT and accident statistics	WebTAG guidance (A4.1/A4.2)	Monetary / Distributional
	Security	Not yet assessed	High	Security Impacts Worksheet	WebTAG guidance (A4.1)	Qualitative/Distributional
	Access to services	Not yet assessed	High	Screening / strategic accessibility assessment worksheets	WebTAG guidance (A4.1/A4.2)	Qualitative/Distributional
	Affordability	Slight beneficial	Medium	Completion of Strategic Affordability Review / Affordability worksheet	WebTAG guidance (A4.1/A4.2)	Qualitative/Distributional
	Severance	Moderate beneficial	Medium	Severance Impacts Worksheet	WebTAG guidance (A4.1/A4.2)	Qualitative/Distributional
	Option values	Neutral	Low	N/A	N/A	N/A
Public Accounts	Cost to Broad Transport Budget	Moderate adverse	Medium	Calculation of scheme costs using preliminary design	WebTAG guidance A1.2	Monetary
	Indirect Tax Revenues	Slight adverse	Medium	Modelled in SATURN and benefits will be monetised using TUBA	WebTAG guidance (A1.3)	Monetary

Appendices

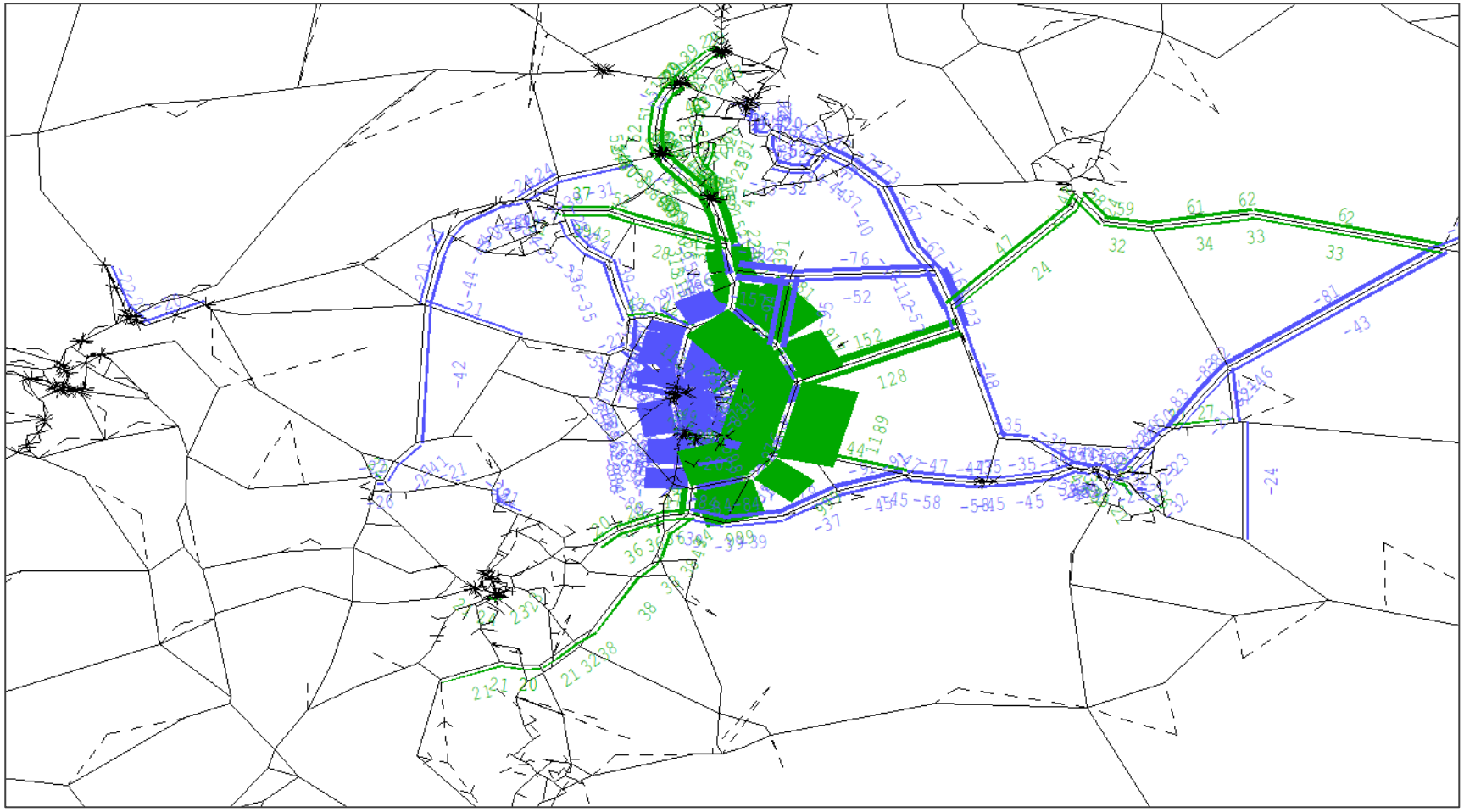
Appendix A. Scheme impact area

A.1. Difference in Actual Flow (PCUs): 2036 DS (Option 10c) – 2036 DM (AM Peak)



NB absolute differences greater than 20 PCUs are shown.

A.2. Difference in Actual Flow (PCUs): 2036 DS (Option 10c) – 2036 DM (PM Peak)



NB absolute differences greater than 20 PCUs are shown.

Appendix B. WTM prior assignment flow (vehicles) validation – cordons

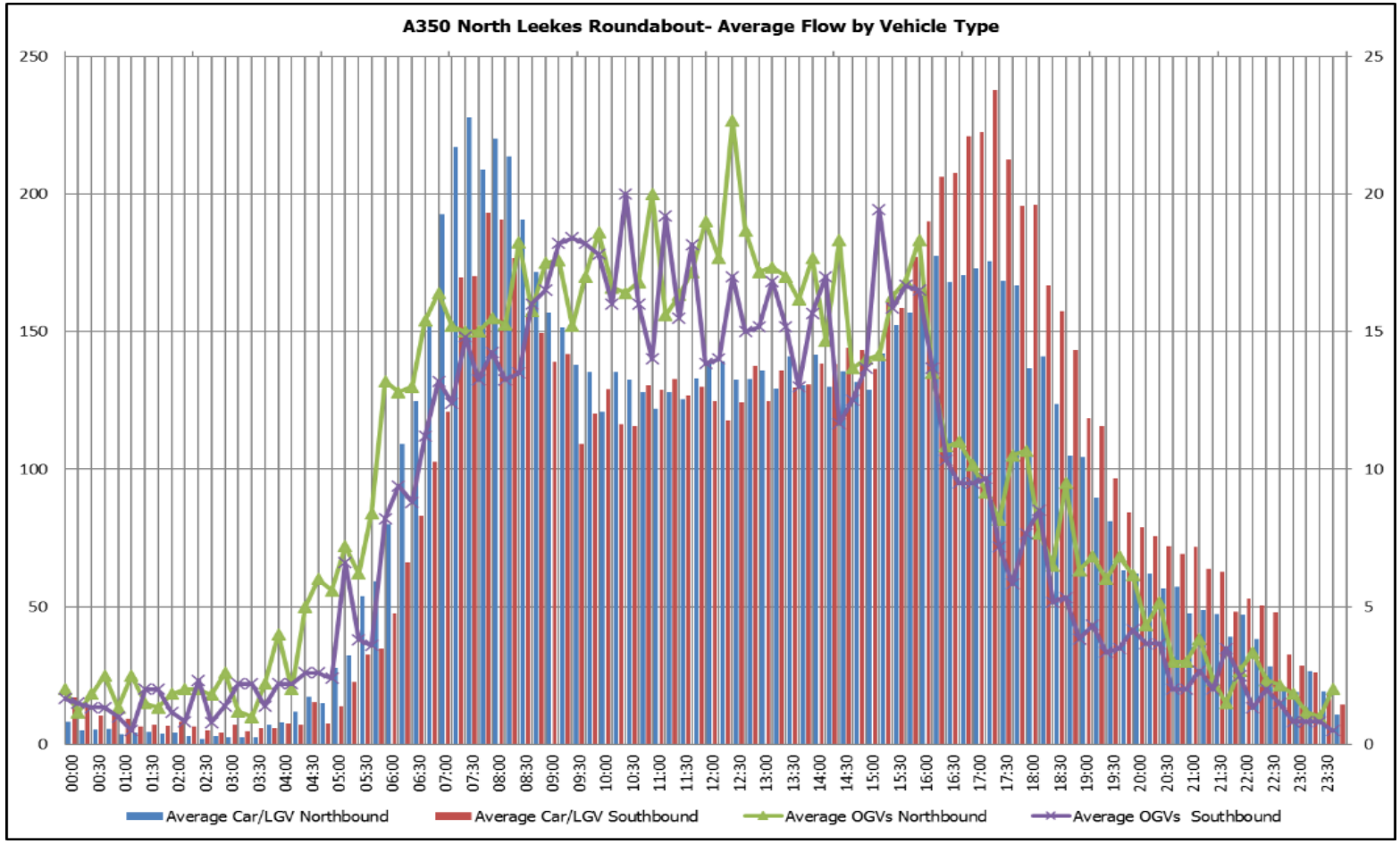
B.1. 2018 prior assignment flow validation (vehicles): AM peak

Screenline	Observed Flow	Modelled Flow	Difference (%)	Pass/Fail
Chippenham Inbound	4,779	4,530	-5%	Near
Chippenham Outbound	4,498	4,466	-1%	Pass
Melksham Inbound	3,903	3,650	-7%	Near
Melksham Outbound	4,173	4,022	-4%	Pass

B.2. 2018 prior assignment flow validation (vehicles): PM peak

Screenline	Observed Flow	Modelled Flow	Difference (%)	Pass/Fail
Chippenham Inbound	4,748	4,591	-3%	Pass
Chippenham Outbound	4,718	4,393	-7%	Near
Melksham Inbound	4,610	3,821	-17%	Fail
Melksham Outbound	4,072	3,661	-10%	Fail

Appendix C. Distribution of weekday traffic on the A350 immediately north of Melksham (2017 ATC)



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