M4 Junction 17 Improvements Outline Business Case (Major Road Network Fund)

Appraisal Specification Report

Wiltshire Council

06/09/22

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Notice

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This document has 80 pages including the cover.

Document history

Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
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V2.0	Final draft for Wiltshire Council approval	AM	NW	SP	MBS	14/05/2021
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Client signoff

Client	Wiltshire Council
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Job number	5205278
Client signature / date	

Contents

Tables

Figures

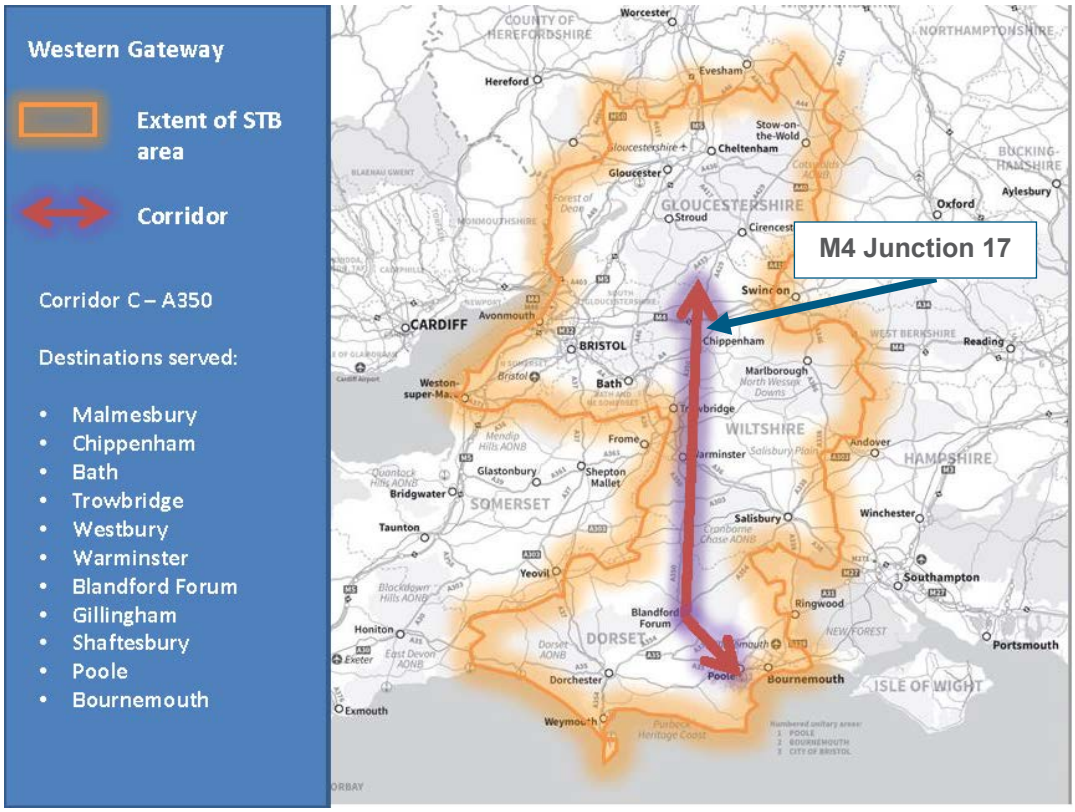
1. Introduction

1.1. Overview

1.1.1. This is the Appraisal Specification Report (ASR) for the M4 Junction 17 improvements scheme Outline Business Case (OBC). M4 Junction 17 is located at the intersection of the M4 and A350, near Chippenham (Wiltshire). The A350 is a key north-south route between the M4 corridor and the south coast, and is a key corridor identified by the Western Gateway Sub-National Transport Body (STB). M4 Junction 17 is located to the north of the A350 Growth Zone identified in the Swindon and Wiltshire Strategic Economic Plan. The significance of the A350 corridor in terms of the local and regional economy has been recognised in recent Local Pinch Point Scheme and Local Growth Fund (LGF) awards for upgrades to sections of the Chippenham Bypass as well as improvements to M4 Junction 17 itself. The location of M4 Junction 17 is shown on Figure 1-1.

1.1.2. The Western Gateway Sub-National Transport Body (WG STB) prioritised the scheme as part of its Regional Evidence Base submission to the DfT in July 2019. An SOBC for the scheme was submitted to the DfT in the same month for Major Road Network (MRN) funding, which forms part of the Government's National Road Fund of £28.8billion for road schemes to be spent between 2020 to 2025. In March 2020, the DfT awarded development funding to Wiltshire Council to progress the scheme to an Outline Business Case submission.

Figure 1-1 - M4 Junction 17 location and Western Gateway A350 Strategic Corridor



1.2. Scheme overview

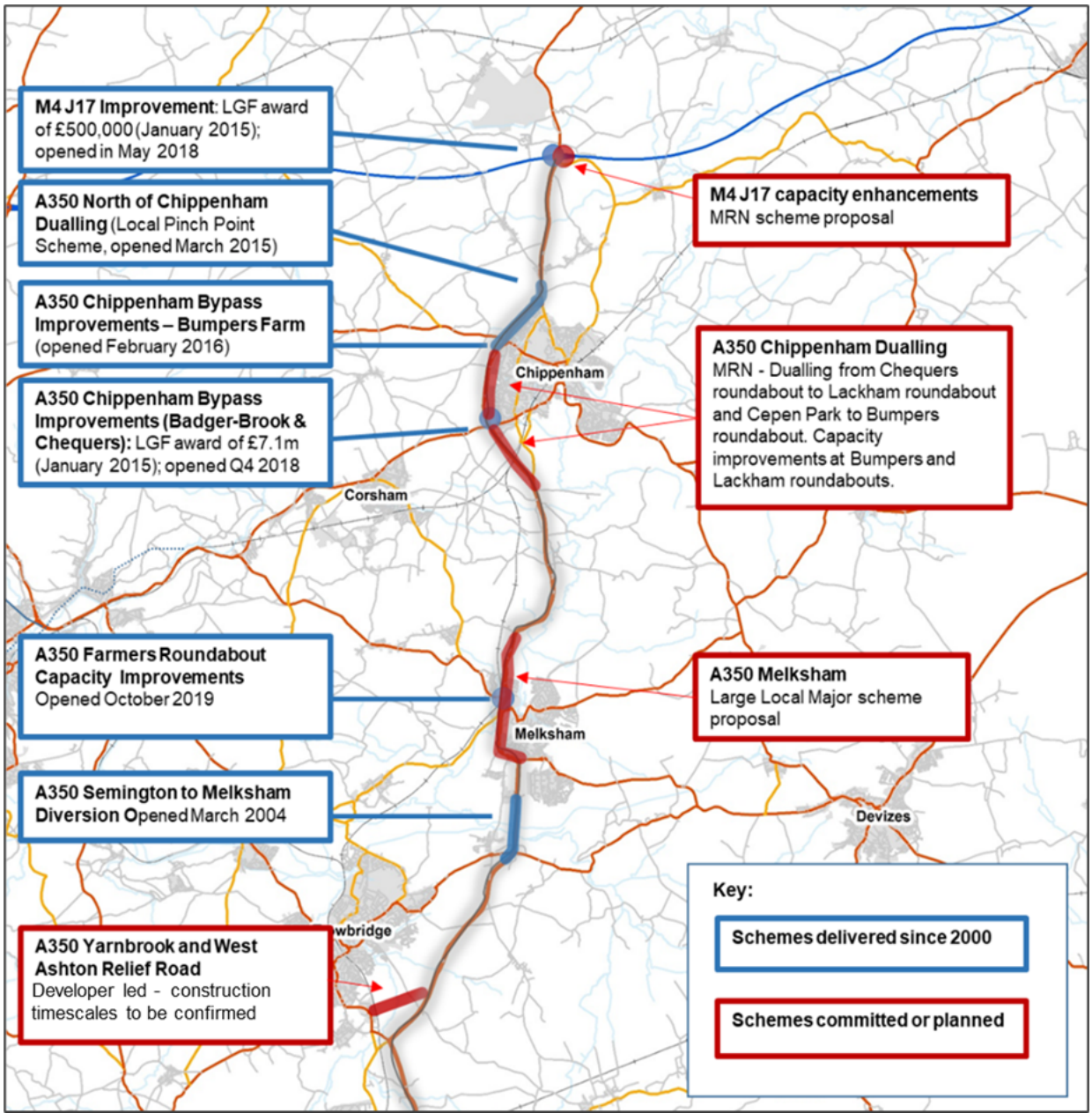
1.2.1. The proposed MRN improvements at M4 Junction 17 are part of Wiltshire Council's progressive improvements to the A350 which have been delivered since 2004 (see the schemes outlined in blue in Figure 1-2). The northern section of the A350 between Melksham and Chippenham has seen substantial investment over the past few years, delivering additional capacity to the corridor. M4

Junction 17 has also recently seen LGF investment in 2018 to improve safety at the junction whilst accommodating increased traffic flows.

1.2.2. This scheme is being brought forward as further upgrading of M4 Junction 17 is required to cater for significant growth planned for the A350 corridor, particularly around Chippenham. The Future Chippenham/Chippenham Urban Expansion has been identified as a potential site to deliver a proportion (7,500 dwellings) of the Chippenham Housing Market Area's (HMA) housing needs. 5,100 of these dwellings are currently proposed in the Local Plan Review to 2036.

1.2.3. The schemes outlined in red in Figure 1-2 have been identified as a priority by the Western Gateway STB for MRN/Large Local Majors (LLM) programmes funding. It is important that the M4 Junction 17 improvements scheme accounts for the other proposed MRN improvements to the A350, since improvements to the south at Chippenham and Melksham are anticipated to slightly increase the volume of traffic using M4 Junction 17.

Figure 1-2 - Completed, committed and planned schemes on the northern A350



1.3. Development of the Outline Business Case

1.3.1. An SOBC for the M4 Junction 17 scheme was developed by Atkins in July 2019. This was accompanied by an Options Assessment Report (OAR) and Appraisal Specification Report (ASR).

1.3.2. 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 submitted to DfT; and
- A review and update of the ASR (this document).

1.3.3. Key changes to the appraisal methodology since the SOBC and original ASR are as follows:

- Conducting the OBC appraisal in the context of dependent development guidance to recognise the strategic development that the M4 Junction 17 scheme supports as well as ensuring all potential benefits of the scheme are recognised in the appraisal.
- The following benefit streams which are additional to the SOBC will now be monetised, again with the intention of ensuring all potential scheme impacts are captured in the appraisal:
  - Construction impacts;
  - Static agglomeration impacts; and
  - Impacts associated with dependent development.
- The following changes and updates to the Wiltshire Transport Model (WTM):
  - Appraisal to be undertaken on the full extent of the WTM as opposed to a cordoned sub-set of the wider model;
  - The average peak hour of the AM and PM time periods (07:00 – 10:00 and 16:00 – 19:00 respectively) will be used in the scheme's economic appraisal as opposed to the peak hour of the AM and PM time periods (08:00 – 09:00 and 17:00 – 18:00 respectively)
  - A third forecast year of 2051 to be incorporated in the low, core and high growth model scenarios; and
  - General ongoing updates and refinements.
- Addition of operational testing to confirm an optimal scheme option which operates within capacity, to ensure that the network would operate safely with the scheme in place.

1.3.4. Scheme options are discussed in Section 3. The OBC will align with relevant TAG guidance. In terms of scheme development, the OBC will include further development of the design specification for the preferred option compared to that which informed the SOBC stage. Furthermore, engagement with Highways England is underway 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 Autumn 2021 (although individual elements may be shared with the DfT in advance). Appraisal will be undertaken using Databook v1.15, in line with latest DfT guidelines.

1.3.5. This creates a slight inconsistency with the modelling, which due to timing has been developed using TAG Databook v1.14. However, the variation in long term growth between these two versions is small and the effect is expected to be marginal.

1.4. Purpose and structure of this report

Purpose of the report

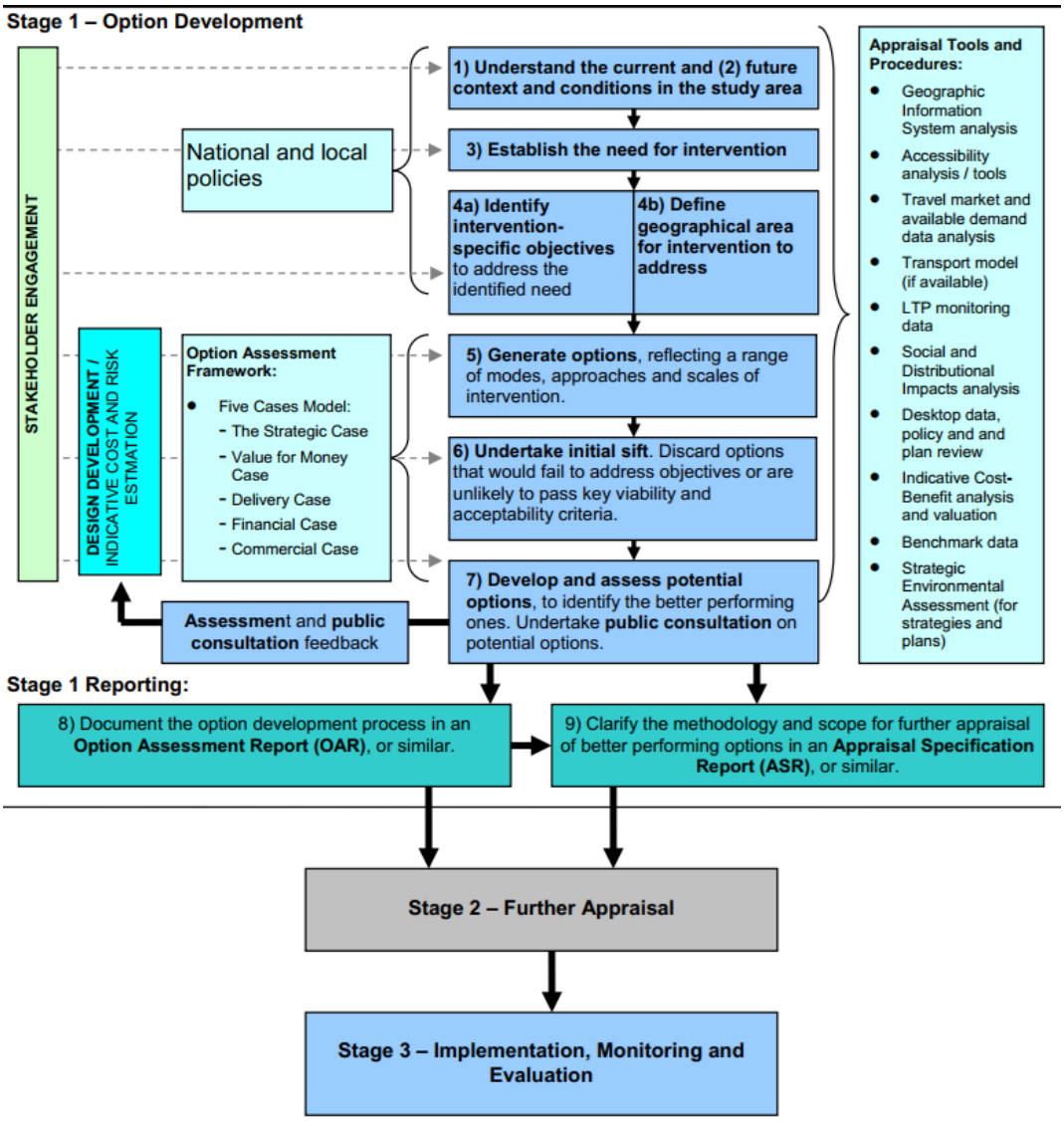
1.4.1. The ASR forms the final step (Step 9) of Stage 1 (option development) of the DfT's transport appraisal process – see Figure 1-3. This ASR has been updated following Clarification Questions received from the DfT on 14th July 2021.

1.4.2. In line with WebTAG guidance the purpose of this ASR 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. Note that the ASR will be sent to the statutory environmental bodies at the same time as DfT.

1.4.3. The OAR Refresh is currently being finalised for issue to DfT. This report will provide 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)



Structure of this report

1.4.4. This report discusses the overall methodology that is to be followed to appraise the M4 Junction 17 improvements scheme.

1.4.5. The remainder of the ASR encompasses the following:

- 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 incorporating dependent development guidance into the OBC;

- Section 6 – sets out the proposed approach for the appraisal of the transport scheme in line with guidance in WebTAG and DMRB, including economic, social, distributional and environmental impacts; and
- Section 7 – sets out the proposed approach for operational assessment of the scheme.

1.4.6. This ASR has three appendices:

- Appendix A presents the Appraisal Specification Summary Table (ASST) which summarises the ASR approach;
- Appendix B contains the Wiltshire Strategic 2018 Base Model - Local Model Validation Report; and
- Appendix C lists the Core Scenario developments in Chippenham.

2. Issues and objectives to be addressed by the scheme

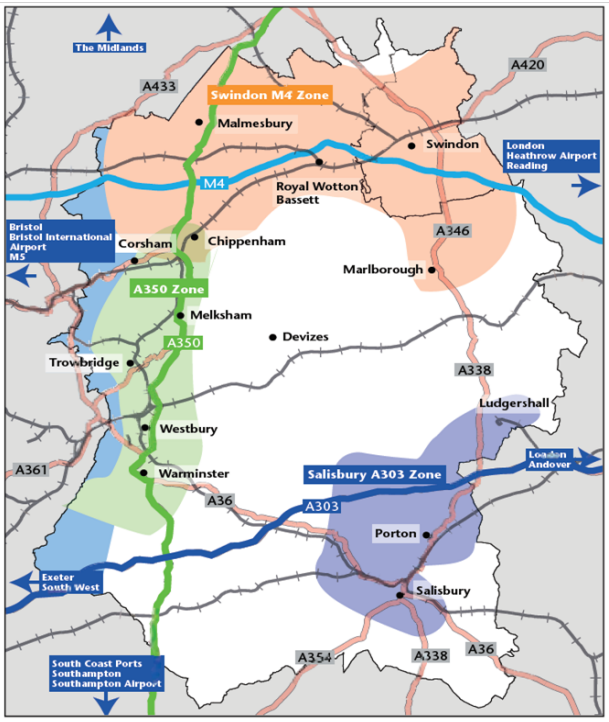
2.1. Local and regional context

2.1.1. The A350 corridor is of local and regional significance. The Western Gateway STB 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 which submitted a Free Port application to Government in February 2021) and providing additional strategic resilience and connectivity for north-south movements in the Western Gateway area. The Western Gateway STB prioritised the M4 Junction 17 scheme for MRN funding in its Regional Evidence Base submitted to the DfT in July 2019.

2.1.2. 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 Swindon and Wiltshire Local Enterprise Partnership (SWLEP).

2.1.3. M4 Junction 17 is located at a key location where the A350 Growth Zone and the Swindon M4 Growth Zone overlap (see Figure 2-1). Therefore, it is important that M4 Junction 17 can accommodate growth along the A350 corridor as well as within the Swindon Growth Zone.

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



[1] Swindon and Wiltshire Growth Zones , Swindon & Wiltshire LEP - https://cms.wiltshire.gov.uk/documents/s111736/SEP%20Appendix%201.pdf

2.1.4. The Chippenham area is a key focus area for growth in Wiltshire, with substantial housing and employment growth planned. The inability of the transport network to accommodate the additional demand will hinder delivery of housing and employment growth as well as inward investment.

2.1.5. A scheme to mitigate Core Strategy growth was delivered at M4 J17 in 2019[2], however, this scheme does not accommodate for development outside of Core Strategy growth. Accordingly, the following three local developments are likely to impact M4 Junction 17 (Figure 2-2):

- Chippenham Gateway – 9.29ha of B8 employment;
- Hullavington – 2ha of B1 employment, 2.42ha of ancillary development; and
- Future Chippenham – 5,100 to 7,500 dwellings, employment, schools, public open space.

2.1.6. Both Chippenham Gateway and Hullavington have planning approval, including highway mitigation (Table 2-1). Chippenham Gateway is expected to come forward before the MRN scheme and the timescales for Hullavington are uncertain. These two key planned employment sites near to M4 Junction 17 will bring considerable levels of additional employment to the local area.

2.1.7. The Future Chippenham/Chippenham Urban Expansion has been identified as a potential site to deliver a proportion (7,500 dwellings) of the Chippenham Housing Market Area's (HMA) housing needs. 5,100 of these dwellings are proposed in the Local Plan Review for delivery by 2036. If the MRN bid is successful the associated Housing Infrastructure Fund (HIF) funding for M4 Junction 17 will form the local contribution for the MRN scheme, rather than funding one in a series of stand-alone junction improvement projects (see Table 2-1).

2.1.8. Overall, a comprehensive solution is needed to cater for future growth, avoiding a piecemeal approach.

[2] M4 Junction 17 Capacity Improvement Scheme FBC, Wiltshire Council - https://swlep.co.uk/docs/default-source/programmes/local-growth-fund-lgf/full-business-cases/m4-junction-17/m4-junction-17-fbc-20-apr-2017.pdf?sfvrsn=c26988bc_42

Figure 2-2 - Key development sites relevant to M4 Junction 17

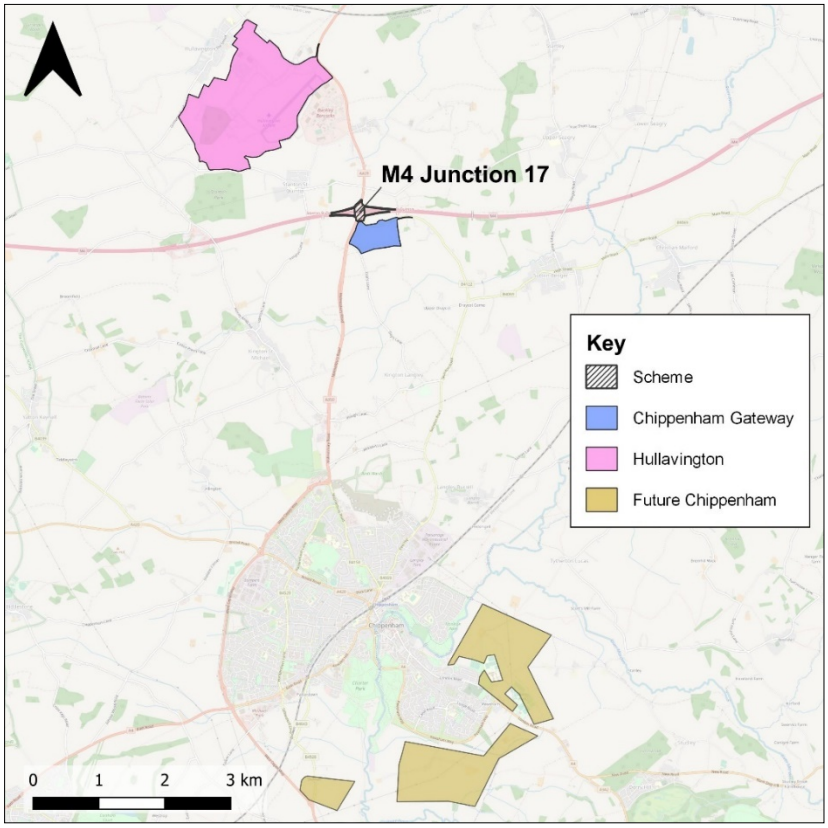
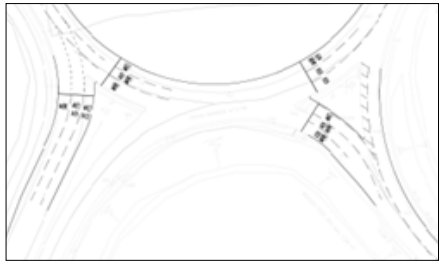
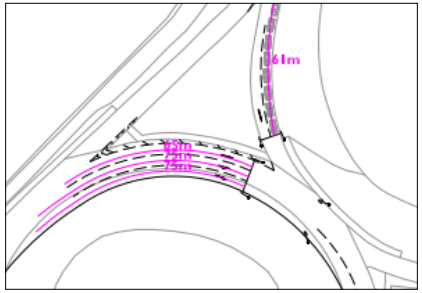
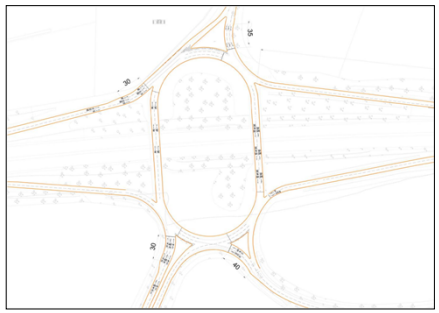


Table 2-1 - Local development M4 Junction 17 mitigations

	Chippenham Gateway	Hullavington (note timescales are uncertain)	Future Chippenham
Development	92,900sqm of employment	44,150sqm of employment	5,100 to 7,500 dwellings, employment, schools
Planning permission	Granted on 23rd August 2018 (with conditions)	Granted 23rd August 2019 (with conditions)	N/A – planning application is yet to be submitted.
Highway mitigation	Widening and signalisation on A350 and B4122 approaches. Widening and signalisation on southern circulatory. 	Widening and signalisation on A429 approach. Widening and signalisation on northern circulatory. 	Widening and signalisation of A350, A429 and B4122 approaches and both northern and southern circulatory. Widening of all M4 on/off-slips. 
Funding	Developer funded.	Developer funded.	Successful HIF bid. If the MRN bid is successful the HIF funding will form the local contribution for the MRN scheme.
Planning condition	To ensure the safe and efficient operation of the SRN, mitigation works to M4 Junction 17 to be completed either prior to the occupation of more than 3.25ha (35%) of floorspace on the site, or 5 years from the enforcement of the development.	No development can be occupied until improvement scheme to A429 arm of M4 Junction 17 has been completed and is open to traffic. No more than 0.5ha (11%) to be occupied before the improvement and signalisation scheme identified for M4 Junction 17 - as part of the Chippenham Gateway development - has been completed and approved by the Local Planning Authority and is open to traffic.	N/A – planning application is yet to be submitted.

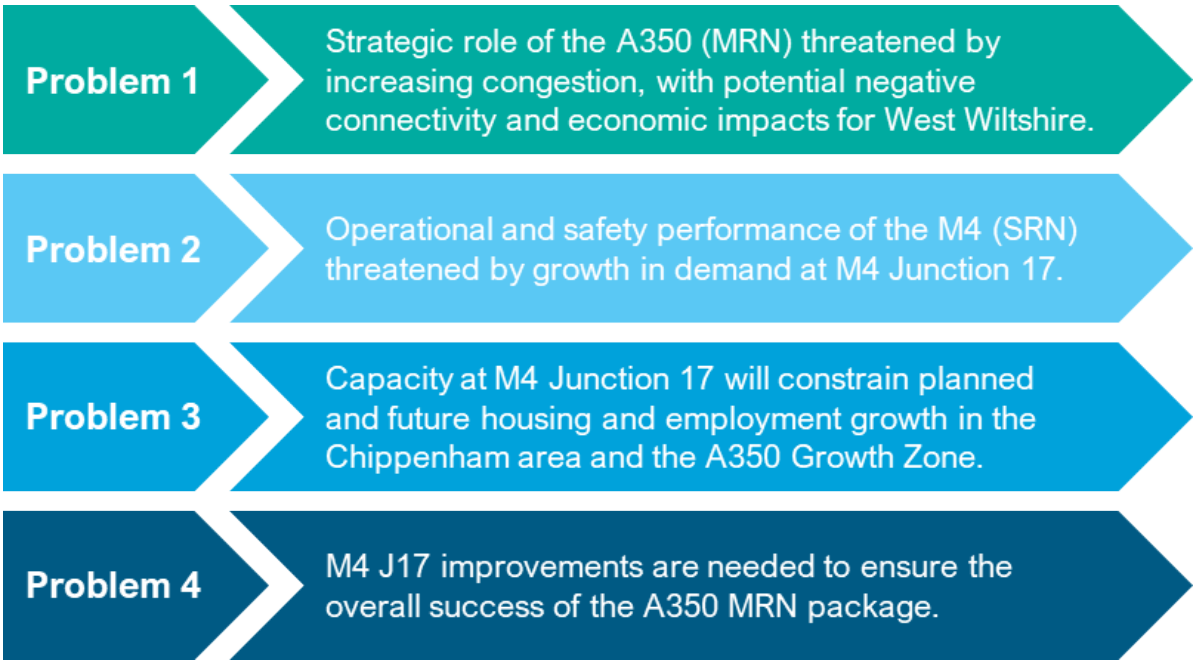
2.2. Issues and challenges

Overview

2.2.1. Figure 2-3 summarises the problems identified – further evidence on current and future transport-related problems impacting M4 Junction 17 will be provided in the OAR Refresh which is due to be issued to DfT.

2.2.2. Overall, whilst the recently delivered LGF scheme delivered a substantial improvement in junction performance at its major arms, planned and future development will contribute to a considerable increase in flows at the junction. Even with the committed Chippenham Gateway mitigation scheme (and Hullavington if it comes forwards) this will place strain on capacity at the junction, creating the rationale for further enhancement at M4 Junction 17.

Figure 2-3 - Summary of issues identified – the need for intervention



Current transport-related problems

2.2.3. Based on the evidence in the OAR Refresh (due to be issued to DfT), the key current transport problems around M4 Junction 17 relate to regional connectivity and safety. Furthermore, issues around operational performance are expected in the short-term.

2.2.4. The need to improve connectivity is a current issue with the need for an effective north-south link between the M4 and the south coast. The need for this strategic route has been identified as a priority by the Western Gateway. The purpose of this route is to make it easier to transport freight from the south coast ports and improve road access to London, Wiltshire and the rest of the Western Gateway area, opening up business opportunities. Increasing congestion at M4 Junction 17 and the surrounding A350 corridor will reduce the attractiveness of Wiltshire for inward investment. Furthermore, it is important to deliver a single comprehensive solution in this MRN scheme to minimise disruption to strategic traffic.

2.2.5. The A350 connects west Wiltshire towns, including Chippenham, Melksham, Trowbridge, Westbury and Warminster to the motorway network. Growing congestion and delay at M4 Junction 17 will hinder the economic relationships between the north and south of the area. Problem 1 is therefore both a current and future issue.

Problem 1 - *Strategic role of the A350 (MRN) is threatened by increasing congestion, with potential negative connectivity and economic impacts for West Wiltshire.*

2.2.6. There are a number of collision clusters at M4 Junction 17. Eight collisions have been recorded between May 2018 and December 2019 since the delivery of the LGF scheme, five of which took place at the junction. All five of these accidents were associated with unsignalised arms of the junction.

Problem 2 - *Operational and safety performance of the M4 (SRN) is threatened growth in demand at M4 J17.*

Future transport-related problems

2.2.7. The inability of the transport network to accommodate the additional demand will hinder delivery of housing and employment growth as well as inward investment. The Chippenham area is a key focus area for growth in Wiltshire, with substantial housing and employment growth planned. The Chippenham Gateway and Hullavington development impacts are closely linked to the performance and accessibility of M4 Junction 17. Future traffic growth will constrain economic performance.

2.2.8. Mitigation will be required to ensure that M4 Junction 17 has the capacity to accommodate planned growth (Core Strategy and Chippenham Site Allocations Plan) and future growth ambitions (emerging Local Plan of which the Chippenham Urban Expansion is a part). Highways England has specified that it would expect the MRN scheme to be able to cater for the full Local Plan Review growth (including 5,100 homes at Chippenham Urban Expansion, rather than the full 7,500).

2.2.9. Flows at M4 Junction 17 will increase as planned and future growth ambitions are realised. Planned growth (Core Strategy and Chippenham Site Allocations Plan) and future growth plans (Chippenham Urban Expansion and emerging Local Plan) will contribute to increased flows at the junction, which will require mitigation.

2.2.10. Significant future growth planned in the Chippenham area could affect the attractiveness of the area to developers and threaten the function of M4 Junction 17 due to queuing on off-slips. Queues could form on the mainline which threatens the M4's efficiency and poses a safety issue.

Problem 2 - *Operational and safety performance of the M4 (SRN) is threatened by growth in demand at M4 J17.*

Problem 3 - *Capacity at M4 J17 will constrain planned and future housing and employment growth in the Chippenham area and the A350 Growth Zone.*

2.2.11. The package of A350 MRN improvements is an opportunity to improve north-south connectivity. It is important that M4 Junction 17 supports the package of MRN improvements. Capacity improvements to the A350 are likely to result in a slight increase in levels of traffic using M4 Junction 17 as the intersection between the SRN and MRN. The increase in capacity on the A350 is likely to attract a proportion of additional traffic due to vehicles re-routing from competitive alternatives. However, route choice in the local highway network is minimal, so a significant increase at M4 Junction 17 is not likely.

Problem 4 - *M4 J17 improvements are needed to ensure the overall success of the A350 MRN package.*

Summary of the need for intervention

2.2.12. Work undertaken for Steps 1 and 2 of the TAG process for option development has highlighted the existing and forecast problems at M4 Junction 17. Table 2-2 categorises the problems identified into current and future timescales.

2.2.13. Without further intervention at M4 Junction 17, junction capacity will present a constraint to planned housing and employment growth at the junction as well as in wider Wiltshire (including at Chippenham and Malmesbury). The additional traffic would have a detrimental impact on the reliable and efficient movement of traffic between the SRN (M4) and the MRN (A350).

2.2.14. The increase in congestion would constrain employment growth, discouraging business expansion and relocation in the area, and as a result, the consequences of the imbalance in homes and jobs

will worsen. Further, increased demand at the junction could impact safety performance through an increase in collisions. Ultimately, this scenario would be detrimental to economic growth.

Table 2-2 - M4 Junction 17 - the need for intervention

	Problem	Current	Future
1	Strategic role of the A350 (MRN) is threatened by increasing congestion, with potential negative connectivity and economic impacts for West Wiltshire.	✓	✓
2	Operational and safety performance of the M4 (SRN) threatened by growth in demand at M4 Junction 17.	✓	✓
3	Capacity at M4 Junction 17 will constrain planned and future housing and employment growth in the Chippenham area and the A350.		✓
4	M4 J17 improvements are needed to ensure the overall success of the A350 MRN package.		✓

2.3. Scheme objectives

2.3.1. The objectives defined in the OAR Refresh (due to be issued to DfT) based on the current constraints and known future challenges outlined above comprise:

- Reduce delay and improve journey time reliability at M4 Junction 17, supporting journeys on the SRN;
- Support the overall success of the A350 improvements programme (including MRN) by delivering complementary improvements at M4 Junction 17;
- Improve north-south connectivity on the A350 through improvements to M4 Junction 17, the gateway to the A350 from the SRN;
- Ensure that M4 Junction 17 has the capacity to accommodate planned and future growth in the A350 Corridor and in the A350 and Swindon M4 SWLEP Growth Zones, including the Chippenham Urban Expansion and the Wiltshire Local Plan Review; and
- Improve safety levels at M4 Junction 17, taking into account forecast traffic growth.

3. Scheme options

3.1. Option development background

3.1.1. The development of scheme options has taken place over a number of years and has been informed by a range of technical studies starting in 2019. In 2019 Atkins produced an OAR which formed the basis of an SOBC. This was updated in 2021 and will inform the OBC. Since the SOBC was submitted LinSig junction modelling has been undertaken to refine the options (2 vs. 3 lanes on the circulatory), and further VISSM testing will be carried out to support OBC scheme design.

3.1.2. The original OAR and its ongoing refresh considered a full range of options including non-highways-based solutions. It concluded that a highways-based solution was the most appropriate to address the specific scheme issues and objectives.

3.1.3. The three highways options assessed in the original OAR comprised:

- Option A: Widen the A429 and B4122 approaches to M4 Junction 17 and deliver full signalisation;
- Option B - Widen all approaches to M4 Junction 17 and M4 slip roads, and deliver full signalisation (remains 2 lanes on the gyratory); and
- Option C - Widen overbridges at M4 Junction 17 and deliver an upgrade to 3 lanes on the gyratory. Widen approaches to M4 Junction 17 and deliver full signalisation.

3.1.4. The previously shortlisted option (Option B) was subject to modelling and economic appraisal in the SOBC. An OAR Refresh is being finalised to reflect the latest policy position and evidence, as well as introduce a refined additional option for the scheme: Option B+. The key difference between these options is that Option B has two lanes on the circulatory, whereas Option B+ has three narrow lanes to cater for a higher level of growth without significantly increasing the scheme costs.

3.1.5. Table 3-1 outlines the Benefit Cost Ratio (BCR) estimated for Option B in the SOBC appraisal. It is noted that the core growth scenario has an adjusted BCR of below 1, which places it in the “Poor” Value for Money category as per DfT guidance. It is recognised that the OBC should build upon the SOBC, including a more comprehensive and refined approach to appraisal capturing all potential economic impacts associated with the scheme. Following a review of the SOBC, it has been concluded that dependent development impacts and other wider economic impacts should be assessed in the OBC as outlined in 1.3.3. Note that the scheme option has changed since the SOBC was submitted (see section 3.2).

Table 3-1 - SOBC Adjusted BCR results (Option B)

Impact / measure	Emerging Growth (2036)	Emerging Growth (2051)	Core Scenario (2036)
Present Value of Benefits (Level 1 impacts)	£48.80m	£69.04m	£18.65m
Reliability	£1.22m	£1.35m	£0.36m
Agglomeration impact	£2.22m	£3.35m	£0.76m
Present Value of Benefits (Level 1 and 2 impacts)	£52.24m	£73.74m	£19.77m
Present Value of Costs (PVC)	£25.06m	£25.06m	£25.06m
Net Present Public Value (NPPV)	£27.18m	£48.69m	-£5.29m
Adjusted BCR	2.1	2.9	0.8

3.2. OAR Refresh

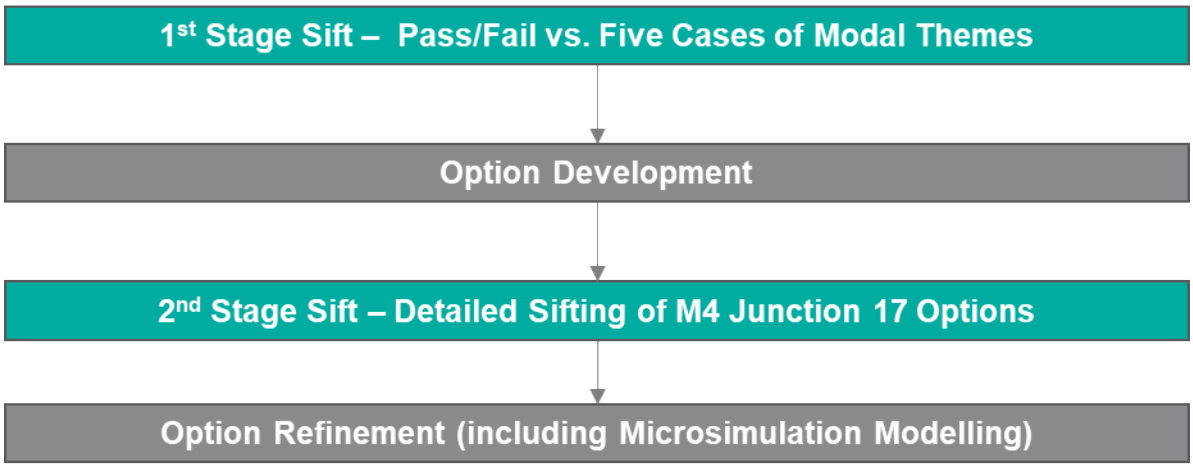
3.2.1. Work undertaken in the OAR Refresh for Steps 1 and 2 of the TAG process for option development has highlighted the existing and forecast problems at M4 Junction 17. Without further intervention, capacity at M4 Junction 17 will present a constraint to planned housing and employment growth surrounding the scheme as well as in wider Wiltshire (including at Chippenham and Malmesbury). The additional traffic would have a detrimental impact on the reliable and efficient movement of traffic between the SRN (M4) and the MRN (A350).

3.2.2. The increase in congestion would constrain employment growth, discouraging business expansion and relocation in the area, and as a result, the consequences of the imbalance in homes and jobs will worsen. Ultimately, this scenario would be detrimental to economic growth.

Option development, sifting and refinement

3.2.3. A two stage sift was undertaken (see Figure 3-1). The first stage was a high-level sift of the four modes (bus, rail, cycling and highway). This was followed by further option development and the detailed second stage sifting of the developed options. The final stage of the process will be option refinement informed by microsimulation modelling in VISSIM to inform the scheme design. The VISSIM work will be reported with the OBC.

Figure 3-1 - Sifting overview



3.2.4. Following the 1st stage sift, three potential options were developed under the highway modal theme:

- Option B - Widen all approaches to M4 Junction 17 and M4 slip roads, and deliver full signalisation (remains 2 lanes on the gyratory); and
- Option C - Widen overbridges at M4 Junction 17 and deliver an upgrade to 3 lanes on the gyratory. Widen approaches to M4 Junction 17 and deliver full signalisation.

3.2.5. A previous option in the original OAR, Option A, comprises the mitigation for Chippenham Gateway and Hullavington only, without providing for further capacity enhancements. Option A comprised of widening the A429 and B4122 approaches to M4 Junction 17 and delivering full signalisation. These measures do not meet the full scheme objectives of catering for Local Plan Review growth and therefore Option A has been omitted from the updated sifting.

3.2.6. The 2nd stage sift was informed by LinSig modelling to assess the performance of different scheme options at M4 Junction 17 under different demand scenarios. The modelling assessed the difference between options with 2-lanes and 3-lanes on the overbridges on the circulatory. The demand scenarios tested include 2036 Core (including core growth only), 2036 High (including core growth with demand from Chippenham Urban Expansion and Hullavington developments) and 2051 Core (with core growth only).

3.2.7. With a 2-lane circulatory M4 Junction 17 exceeds practical reserve capacity in the PM peak in 2036 under high-growth demand conditions, resulting in high levels of delay. In comparison a 3-lane circulatory continues to operate efficiently in both the AM and PM peak periods in both core-growth and high-growth demand scenarios.

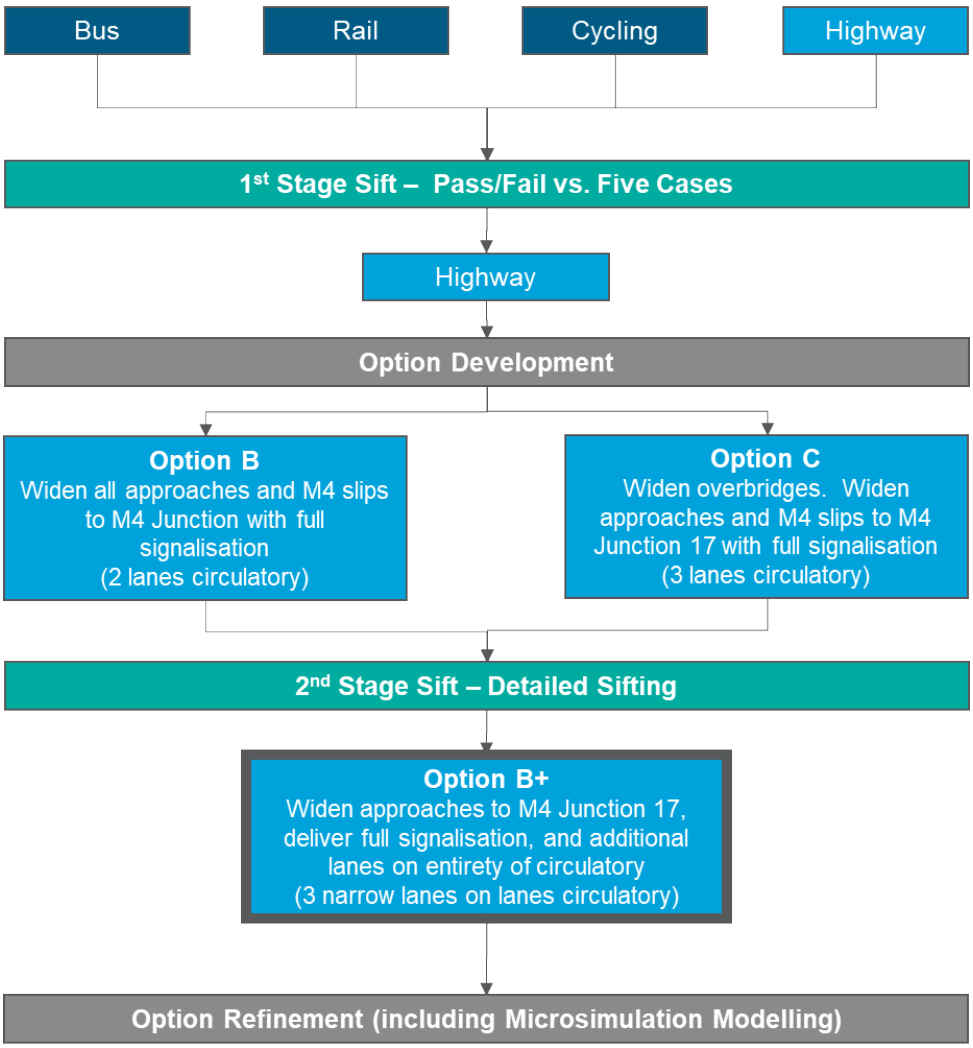
3.2.8. Based on the sifting and option refinement process summarised in Figure 3-2, the identified the option to progress is Option B+:

> **Option B+ (and design refinements of):** Widen approaches to M4 Junction 17 and deliver full signalisation as well as an additional lane on the entirety of the gyratory (3 narrow lanes to remove requirement to widen the overbridges).

3.2.9. This option presents an optimal solution which balances the benefits of three lanes on the circulatory with the lower cost of running narrow lanes rather than delivering structural alterations.

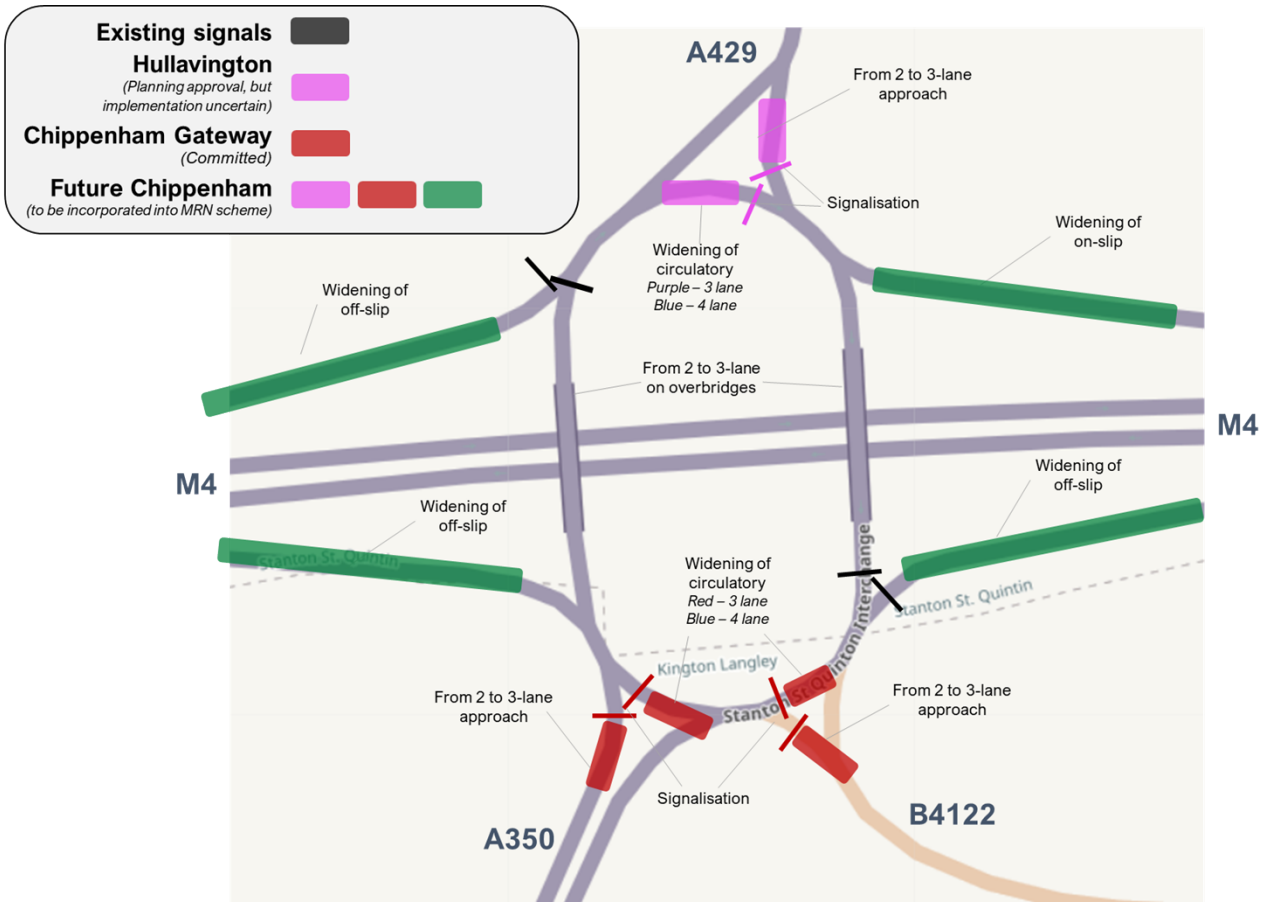
3.2.10. Further work will be undertaken in collaboration with Highways England to confirm the feasibility of three narrow lanes. The option of three narrow lanes has been implemented recently at M4 Junction 16. From a review of as-built and recent inspection information the Junction 16 overbridges are identical and in a similar condition to those at Junction 17.

Figure 3-2 - Sifting summary



3.2.11. The overall proposal for M4 Junction 17 is presented in Figure 3-3. Note that the planned HIF scheme associated with Future Chippenham would be subsumed into the M4 Junction 17 improvements scheme (MRN) as a financial contribution. Chippenham Gateway is a committed scheme and will therefore be in the Core Scenario (Do-Minimum) for the OBC. In the event that the MRN scheme comes forward prior to the Chippenham Gateway scheme, the MRN scheme would deliver all improvements associated with the gateway scheme; A Section 106 contribution towards the MRN delivery from the Chippenham Gateway developer would be included in this scenario.

Figure 3-3 - Overall proposal for M4 Junction 17 (planned and committed)



Interdependencies

3.2.12. The key interdependencies for M4 Junction 17 relate to future growth and the other A350 MRN schemes.

3.2.13. Supporting future growth is a key driver for this scheme. The planned growth in north Wiltshire, particularly at the 'principal' settlement of Chippenham, will increase pressure on the M4 Junction 17. Improvements to the junction would subsequently be required through improving capacity to mitigate the impacts of the additional trips on the network. The relationship between the scheme and the emerging Wiltshire Local Plan Review (LPR) will be monitored throughout development of the OBC (and beyond).

3.2.14. Whilst not directly interdependent, the M4 Junction 17 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 A350 Melksham Bypass and A350 Chippenham Bypass improvements).

Timeframe

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

- 2021: Development and submission of OBC and identification of preferred option;
- 2022-2023: Detailed design of preferred option, planning approval process and land acquisition;
- 2023: Procurement and production of Full Business Case;
- 2023-2024: Construction; and

- 2024: Scheme opening.

Uncertainties

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

- Implications of the emerging Wiltshire Local Plan Review;
- Land requirements - The base data for the existing junction layout includes 2D Ordnance Survey mapping. The highway option designs for the OBC assume that carriageway widening and associated earthworks are feasible within the available highway boundary. Engineered, reinforced earthworks embankment slopes may be required in some widening areas. Temporary easements are likely to be required to construct the scheme;
- Scope and definition of complementary walking and cycling measures (subject to the finding of a Walking, Cycling and Horse-riding Assessment Report);
- Associated improvements required to the existing / adjacent network (e.g. to optimise the performance of options);
- Changes to DfT appraisal guidance (TAG) and implications on the scheme Value for Money; and
- Condition of the structures at M4 Junction 17 – further work will be undertaken in collaboration with Highways England to confirm the feasibility of three narrow lanes.

Stakeholders

3.2.17. Wiltshire Council is the promoter for the scheme, and it has been recognised as an investment priority by the Western Gateway STB. The scheme is located on Highways England's network and Wiltshire Council is working collaboratively with Highways England to agree on a preferred option. A Stakeholder Engagement and Communications Plan will be developed as part of the OBC. No formal engagement or consultation exercise has been undertaken on the scheme to date, although Wiltshire Council has engaged with Highways England over the last year.

3.2.18. In terms of land acquisition, the scheme would be delivered in partnership between Wiltshire Council and Highways England as permitted development; additional land would only be used for temporary easement for construction, if required.

3.2.19. The DfT will be engaged throughout development of the OBC, and this ASR represents an important stage in this process.

4. Approach to traffic modelling

4.1. Overview

4.1.1. 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 M4 Junction 17 scheme.

4.1.2. Note that the modelling approach outlined below has been developed with the intention of achieving consistency across all MRN and LLM funding applications submitted on behalf of Wiltshire Council. The ASR document for the Melksham Bypass OBC LLM funding application presents a very similar methodology and has already been subject to DfT review.

4.1. Existing knowledge and data

4.1.1. 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 v1.14 (May 2020); and
- Highways England guidance on developing the regional transport models, for example the network coding manual.

4.1.2. Table 4-1 summarises the availability of existing models for use in the development of a suitable model for the M4 Junction 17 OBC.

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)
Chippenham Urban Expansion Strategic Highway Model	7.2	2018, 2024, 2041	Derived from a cordon of the WTM and converted to peak hour (SATURN only)

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

4.1.4. 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 were commissioned to develop the Wiltshire Transport Model (WTM).

4.1.5. The SOBC submitted in July 2019 was based on an application of the WTM.

Proposed model foundation for M4 Junction 17 OBC

4.1.6. The existing WTM is considered to provide the most suitable basis for developing a model to underpin the transport appraisal within the OBC. The WTM, a full Variable Demand Model (VDM), has been examined in terms of attributes, coverage, segmentation and level of detail in respect to the area of influence of the scheme. This has included a review of the zoning granularity within the vicinity of M4 Junction 17, confirming that the model network reasonably represents the configuration of the observed highway network, and a review of model calibration and validation.

4.2. Proportionality of modelling approach

4.2.1. 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*".

4.2.2. 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 models 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.

4.2.3. The current WTM is a full VDM. The proposed modelling approach specified in this document assumes that the scheme assessment will be required to include variable demand.

4.2.4. However, 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*".

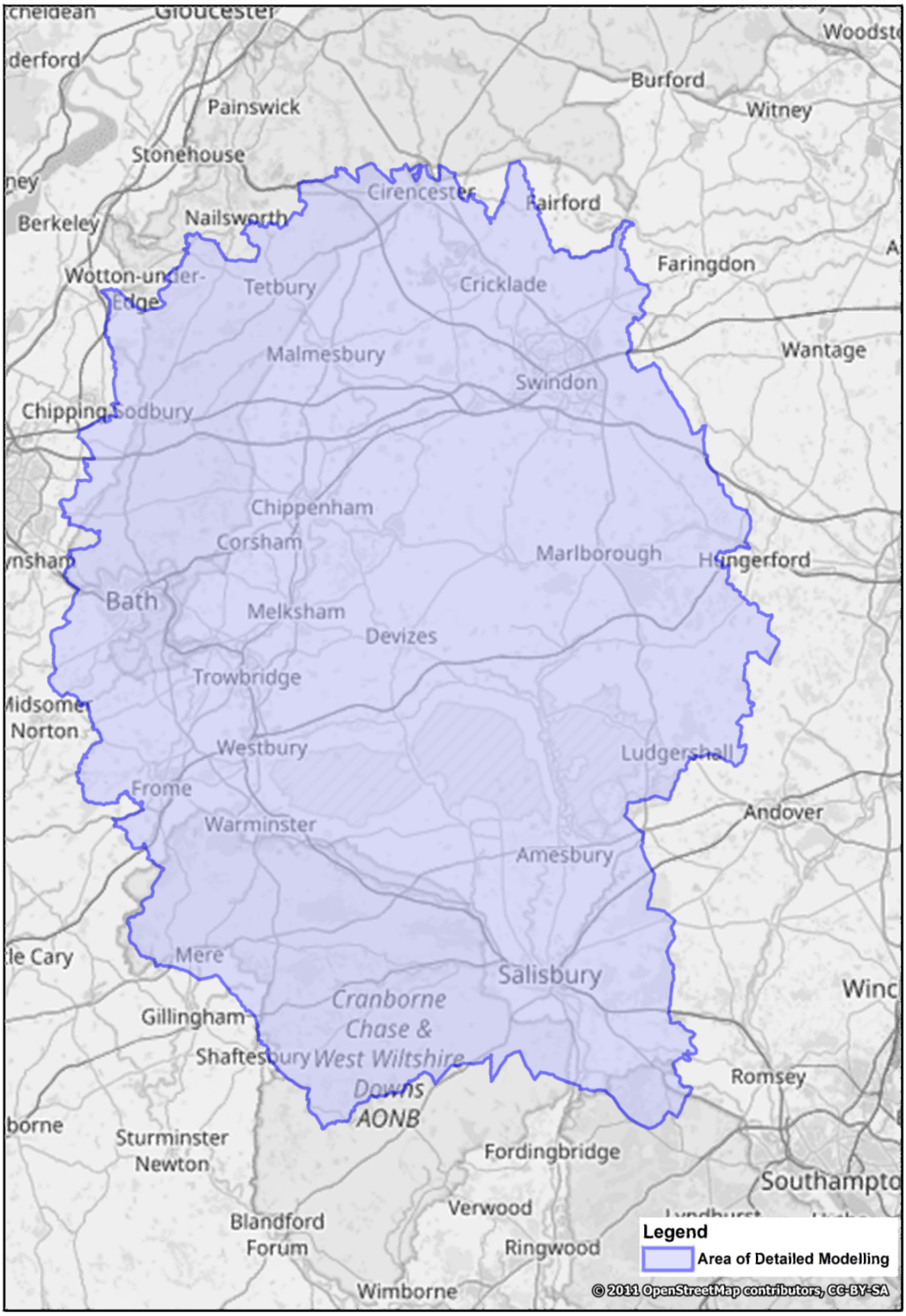
4.2.5. Should this test demonstrate that VDM is not required (contrary to the working assumption), then the methodology would be re-evaluated in consideration of the most proportionate approach (i.e. a fixed demand assignment of an appropriately sized cordon model). Under these circumstances, any revised approach would be agreed with the DfT.

4.3. Definition and size of study area

4.3.1. Figure 4-1 highlights the Area of Detailed Modelling (AoDM) currently within the WTM. To fully capture the network impacts of changes within Wiltshire, the AoDM 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.

4.3.2. During the development of the WTM the network was significantly refined in the vicinity of M4 Junction 17. As a result, greater network detail is not expected to be required.

Figure 4-1 - Wiltshire Transport Model area of detailed modelling



4.4. Proposed modelling approach

4.4.1. The transport modelling for the OBC will be undertaken in a cordoned region of the WTM through the utilisation of the FCF in SATURN, following TAG guidance on model calibration and validation. The purpose of developing the original WTM 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 WTM will be retained. This includes the following:

Modelled time periods

Average peak hour model based on the following time periods:

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

Highway assignment model user purpose

The user classes are as follows:

- Car (commute);
- Car (business);
- Car (other);
- LGV; and
- 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 4.4.10.

Runtime, noise reduction and convergence considerations

4.4.2. Various techniques are proposed to reduce the AoDM to a more localised study area, relevant for the M4 Junction 17 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.

4.4.3. As such, three techniques have been evaluated for their suitability in altering the model for its use in the OBC. Table 4-2 summarises the advantages and disadvantages of each 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 noise reduction 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.

4.4.4. 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 M4 Junction 17 OBC transport modelling.

Fixed Cost Function (FCF)

4.4.5. 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.

4.4.6. 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 the next section - 4.4.7).
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).

Definition of Fixed Cost Function (FCF) extent

4.4.7. 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 scheme option agreed with Wiltshire Council. This will be subject to a full DIADEM VDM run, permitting demand response as a result of implementing the M4 Junction 17 scheme.

4.4.8. Consistent with the DMRB LA105 air quality guidance (November 2019), the criteria for the Affected Road Network (ARN) is 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 (<20 kph).
  - Light congestion (20-45 kph).
  - Free flow (45-80 kph).
  - High speed (80< kph).

4.4.9. 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.

Variable Demand Model (VDM)

4.4.10. 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.

4.4.11. The VDM structure (24-hour incremental Production-Attraction (PA) VDM, with macro time period, public transport and trip redistribution choice), parameters and inputs of the Wiltshire VDM will be retained for the M4 Junction 17 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.

4.4.12. 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.

4.4.13. 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.

4.4.14. 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.

4.4.15. 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 disutility of travel.

VDM demand segments: trip and person types

4.4.16. Table 4-3 shows the demand segmentation, matrix type and choice response mechanisms of the Wiltshire VDM. These will be retained for the M4 Junction 17 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.

Realism testing

4.4.17. 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.

4.4.18. 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.

4.4.19. 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).

Convergence

4.4.20. 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 M4 Junction 17 OBC, TAG convergence guidance will be adhered to.

4.4.21. 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.

Highway Assignment Model (HAM) convergence

4.4.22. 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

4.4.23. 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.

Variable Demand Model (VDM) convergence

4.4.24. 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'.

4.4.25. 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.

4.4.26. 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 (AoDM, see Figure 4-1).

4.4.27. 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%

Base model calibration and validation

4.4.28. A localised calibration exercise will be undertaken on the Wiltshire Transport Model to ensure the model validates in the local area.

4.4.29. 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.

4.4.30. The prior matrices developed for the WTM use the SWRTM prior matrices as a basis. The SWTRM prior matrices were derived from mobile phone data and have undergone a rigorous checking process, providing a consistent basis across the south west region of England. 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.

4.4.31. Matrix estimation will use the WTM 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 M4 Junction 17 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.

Traffic count data

4.4.32. The locations 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 presents the location of the 2018 Wiltshire 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); and
- ANPR data (2018) (Figure 4-3).

4.4.33. 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 accordance with TAG requirements.

Figure 4-2 - Available traffic count data – Wiltshire

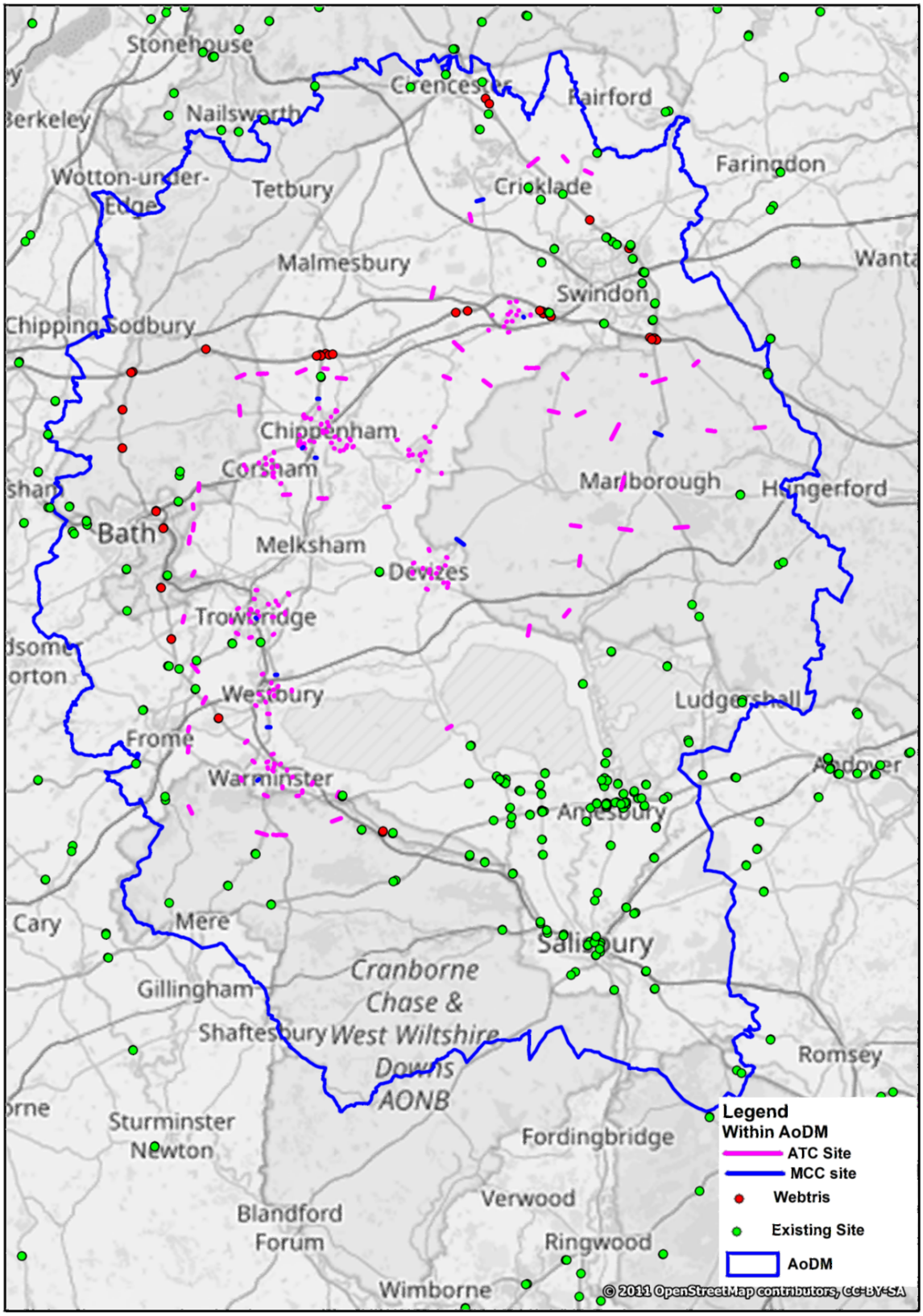


Figure 4-3 - ANPR survey locations

4.5. Forecasting approach

4.5.1. This section details the forecasting assumptions associated with the M4 Junction 17 OBC transport modelling. The forecasting approach applied draws on the guidance from TAG unit M2 (Variable demand modelling) & M4 (Forecasting & Uncertainty). The forecasting scenarios will be built within the context of dependent development testing, full details of which are presented in Section 5.

4.5.2. The forecasting approach adopted for the development of the WTM 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 travel costs were held constant into the future.

4.5.3. 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.

Forecast years

4.5.4. It has been proposed that the following forecast years are to be modelled, based upon information available at the time of preparation of the ASR. These will be kept under review considering 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 2024 (assuming scheme completion in October 2024):

  - Localised changes will be made to ensure that the housing quantum of development sites in vicinity of the scheme is reflective of 2024 build-out plans. Trip totals will be constrained to TEMPro (v7.2).
  - The 2024 network will include any transport infrastructure to be built by 2024.
- Scheme design year of 2036:
  - This is consistent with the 2036 core scenario of the Wiltshire Local Plan.
- Horizon year of 2051:
  - 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).

Forecasting data sources

4.5.5. The key data sources required for the development of the M4 Junction 17 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.

Treatment of uncertainty

4.5.6. 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*".

4.5.7. 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.

Local uncertainty

4.5.8. 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.

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

Wiltshire Local Plan to 2036

4.5.10. 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.

4.5.11. A significant proportion of the additional sites are likely to be within the A350 Growth Zone (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 M4 Junction 17 scheme in terms of future traffic demands and traffic distribution.

4.5.12. Adoption of the Local Plan Review is not anticipated until 2023 (following an Examination in Public). However, preferred sites for Chippenham and Trowbridge were announced in January / February 2021.

Defining the core scenario

4.5.13. Transport modelling for the M4 Junction 17 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 M4 Junction 17 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.

4.5.14. 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.

High and low growth alternative scenarios (national uncertainty)

4.5.15. 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 v1.14 (July 2020).

4.5.16. 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.

4.5.17. To understand the potential impacts of the emerging Local Plan, it is currently intended to reflect the Local Plan Review sites in a supplementary alternative growth sensitivity test. The details of exactly how this scenario would be developed would need to be confirmed in due course considering the level of information available from the Local Plan Review at the point of undertaking the exercise.

Dependent developments

4.5.18. The M4 Junction 17 OBC will be undertaken in the context of dependent development relating to the Future Chippenham development. Section 5 outlines how the transport model scenarios used in the appraisal will be developed.

4.6. Option testing

4.6.1. 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. The forecasting approach and subsequent option testing will be undertaken in consistency with the requirements for the dependent development assessment. The following scenarios are to be developed as part of the M4 Junction 17 OBC:

- Do-Minimum: highway network with committed schemes, plus growth from the Core scenario of the Wiltshire Transport Model.
  - Including network amendments to M4 Junction 17 as part of Chippenham Gateway.
- Dependent development scenarios P, Q, R and S: Do-Minimum scenario, plus variations with / without dependent development and the relevant M4 Junction 17 short-listed scheme option. Full details of the proposed option testing in the context of dependent development are presented in Section 5.7.
- Core, high and low growth scenarios for each of the above.

4.7. Additional data requirement and survey approach

4.7.1. 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 M4 Junction 17 OBC is not recommended. Nevertheless, additional surveys and data are not deemed to be a requirement, as there is adequate data readily available to undertake the appraisal.

4.8. Risks

4.8.1. Table 4-8 summarises specific risks associated with the development of the transport model for M4 Junction 17 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 disciplines (e.g. environmental team, design team) and key stakeholders (e.g. decision makers).	High	Liaison with Wiltshire Council to ascertain requirements and inform model specification. Regular coordination meetings between discipline team leaders.	Low
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. Approach to dependent development

5.1. Introduction

5.1.1. The transport modelling and economic appraisal will be undertaken in the context of dependent development analysis, where a strong case will be developed showing a dependency between the M4 Junction 17 MRN scheme and a certain quantum of local development. Details of how this dependency will be established are presented in sections 5.2, 5.3 and 5.5.

5.1.2. In establishing this dependency, the P, Q, R and S transport model scenarios defined in Table 5-1 will be developed as specified by TAG Unit A2-2 Induced Investment.

Table 5-1 - Economic appraisal scenarios

Infrastructure \ Development	Without Dependent Development	With Dependent Development
Without Transport Scheme	P	Q
With Transport Scheme	S	R

5.1.3. This section outlines the approach for how the P, Q, R and S model scenarios are to be established. Once established, details of how these model scenarios are incorporated into the economic case are included in Section 6.

5.2. Initial scoping of methodology

5.2.1. As part of the production of the Appraisal Specification Report (ASR), a scoping exercise was undertaken to understand the feasibility and desirability of conducting the OBC in the context of the dependent development guidance outlined in TAG Unit A2.2.

5.2.2. The scoping exercise reviewed the planning and policy context of a number of local developments and helped build an understanding on the dependency relationship these developments have with the operations of M4 Junction 17. Upon reviewing the information collected, four options for possible methodologies of how dependent development could either be incorporated or omitted from the OBC were developed.

5.2.3. These four options were presented to Wiltshire Council in a teleconference on 23rd February 2021 where collectively a decision was made on a preferred option. The methodology for this preferred option is described in the subsequent subsections.

5.2.4. This preferred option was then also presented to the Department for Transport (DfT) in a teleconference on 2nd March 2021 and to Highways England in a teleconference on 10th March 2021. Comments on the methodology from Wiltshire Council, DfT and Highways England have been given consideration.

5.3. Dependent development narrative

Identifying possible dependent developments

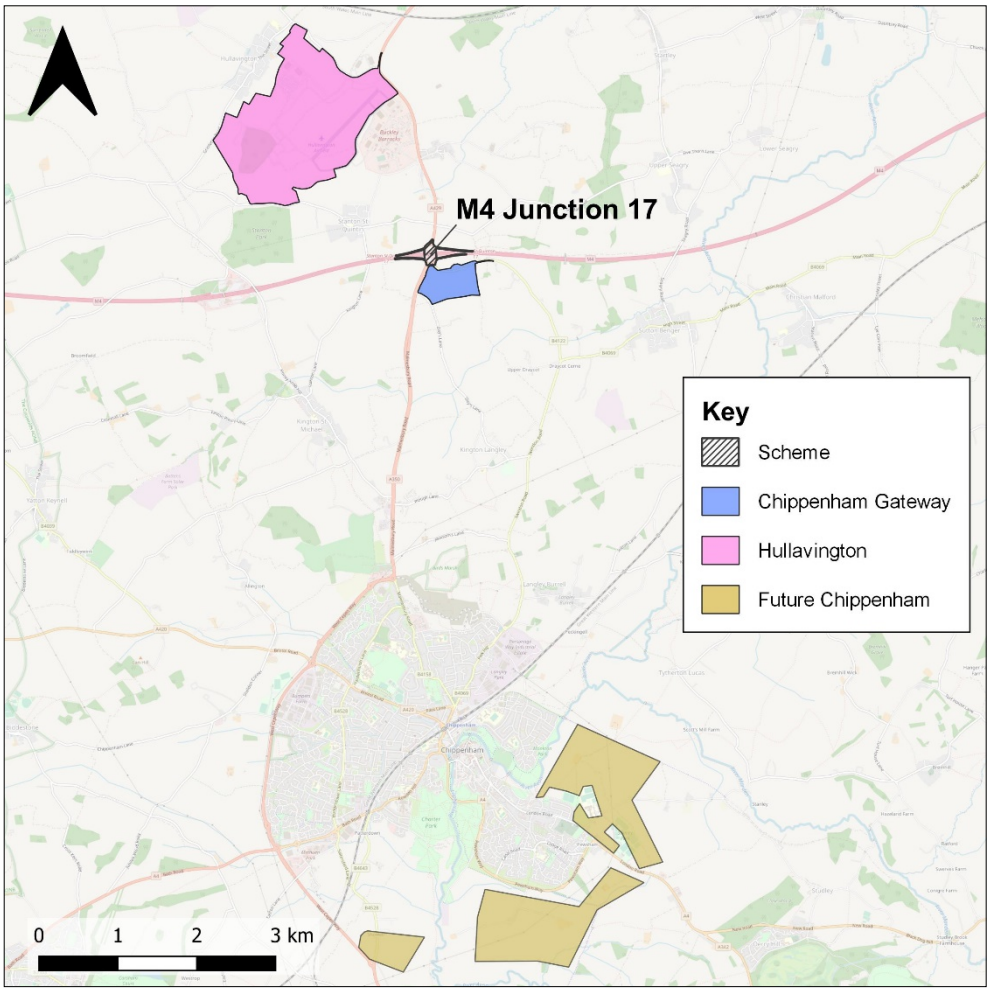
5.3.1. As part of the initial scoping exercise outlined in section 5.2, a number of developments were considered which, to a greater or lesser extent, could be considered dependent upon the effective operations of M4 Junction 17. The developments considered are presented in Figure 5-1, with justification as to whether they will or will not be taken forward in the dependent development analysis:

- **Chippenham Gateway** – 9.29 ha of B8 Employment immediately to the southeast of M4 Junction 17. Planning permission has been approved on the condition of improvements being made to the A350 and B4122 arms and corresponding gyratory of M4 Junction 17. Development build out has already commenced and the M4 Junction 17 intervention is planned in September 2021. Given the certainty of the development and the ability for its associated

highway intervention at M4 Junction 17 to be funded solely through the developer it was not considered as appropriate to develop a dependency relation between Chippenham Gateway and the M4 Junction 17 MRN scheme. The Chippenham Gateway development and scheme are included in the Wiltshire Transport Model core scenario.

- **Hullavington Airfield –** 2ha of B1 Employment and 2.42ha of ancillary development to the north west of M4 Junction 17. Planning permission was granted in August 2019 with the condition of an improvement scheme to the A429 arm and corresponding gyratory of M4 Junction 17. The planning permission expires in August 2022. It is public knowledge that Dyson have walked away from the electric car project, for which they originally sought the 2018 planning permission to accommodate. Due to this uncertainty the Hullavington development and associated mitigation will not be included within any scenarios of the OBC modelling.
- **Future Chippenham –** In March 2019 Atkins on behalf of Wiltshire Council submitted an application to the HIF for the construction of a transport package comprising of a mitigation scheme at M4 Junction 17 and an Eastern Distributor Road (EDR) around Chippenham facilitating the implementation of 7,500 houses to the east of Chippenham. Transport modelling analysis for the HIF application was undertaken in the context of dependent development. It was decided that the M4 Junction 17 OBC should be conducted in the context of dependent development relating to the Future Chippenham housing for the reasons outlined in 5.3.3 and 5.3.4.

Figure 5-1 - Possible dependent developments considered



5.3.2. Further consideration will be given as to whether it is appropriate to frame the dependent development narrative in the context of Future Chippenham housing (Future Chippenham being a project lead by Wiltshire Council to deliver 7,500 houses to the east of Chippenham) or the emerging Local Plan housing allocation within Chippenham. The emerging Wiltshire Local Plan has

confirmed the preferred site allocation for Chippenham as the same geographical boundaries as those from the Future Chippenham project. Therefore although “Future Chippenham” and “emerging Local Plan housing in Chippenham” essentially refer to the same collection of houses, the most suitable referencing for the dependent development narrative will be confirmed in due course. From herein, for simplicity the development will be referred to as the “Chippenham Urban Expansion” (CUE).

Justifying the selected dependent development

5.3.3. The HIF analysis demonstrated that the identified package of transport interventions – comprising of the EDR, a scheme at M4 Junction 17 (a lesser version of the MRN scheme) and a number of smaller mitigation schemes within Chippenham funded through other means – were successful in mitigating against the entirety of the CUE (assumed in the HIF analysis to be 7,500 houses in 2041). As such it follows that a proportion of the CUE development is dependent upon the M4 Junction 17 HIF scheme.

5.3.4. In the event that MRN funding is successfully secured, then the M4 Junction 17 HIF scheme will no longer be progressed, but the relevant HIF funding will be transferred towards the MRN scheme to bolster delivery options and to provide surety against the MRN Local Contribution. Therefore, the dependency relationship can be drawn between a proportion of the CUE and the M4 Junction 17 MRN scheme.

5.3.5. Further research into the planning, policy and context of the CUE and will be undertaken to build a strong narrative between the CUE and the M4 Junction 17 MRN scheme

CUE housing quantum

5.3.6. It is noted that the CUE housing numbers have been altered since the original HIF application and are continually being developed as the CUE passes through the planning process. In the HIF application the CUE was assumed to be 7,500 houses by 2041, whereas the emerging Local Plan allocation commits to 5,100 houses by 2036 within the same sites as Future Chippenham. Research will be undertaken to determine the most appropriate assumption for the CUE housing quantum in the OBC.

5.4. Establishing the deadweight development quantum (P and S)

5.4.1. As part of the transport modelling analysis included in the HIF application, it was determined that 1,050 houses of the CUE could be constructed by 2041 without the resulting trips causing unacceptable levels of service in the highway network. Multiple junctions – including M4 Junction 17 – crucial to the operations of the Chippenham highway network were considered as part of this analysis.

5.4.2. Since the production of the HIF application, the Rawlings Green development consisting of 650 dwellings was previously considered a part of the 1,050 CUE dwellings in the HIF application. This is no longer included in the CUE and is instead considered committed growth.

5.4.3. The result of this altered assumption is that the CUE deadweight figure is now assumed as 400 dwellings instead of the 1,050 dwellings stated initially in the HIF application because the 650 dwellings at Rawlings Green are no longer considered CUE housing (as shown in Figure 5-2).

5.4.4. The 400 CUE dwellings will be incorporated into the Wiltshire Transport Model core matrices. These matrices are then assigned to the without-scheme and with-scheme networks respectively to produce the final P and S models

5.5. Establishing the dependent development quantum (R and Q)

5.5.1. As described in section 5.3, a dependency relationship has been established between the M4 Junction 17 MRN scheme and a proportion of the CUE. Analysis will be undertaken to determine exactly what that proportion is. Note it cannot be the entirety of the non-deadweight CUE housing quantum which is dependent solely on the M4 Junction 17 MRN scheme, as other transport interventions (such as the Eastern Distributor Road) are required to unlock the full CUE.

5.5.2. The analysis will mainly consist of the production and interrogation of trip distribution patterns for the CUE development. This will help to build an understanding of the proportion of trips, both to and from the development which travel through M4 Junction 17. Hence this will give an early indication for the proportion of non-deadweight CUE housing dependent on the M4 Junction 17 MRN scheme.

5.5.3. This proportion will be used in conjunction with other factors to determine the finalised dependent development quantum. The other factors considered will include:

- The extent to which other transport interventions secured under HIF funding unlock CUE housing. For example, if it is determined that some x% of CUE trips travel through M4 Junction 17, it is recognised that other HIF interventions such as the EDR also facilitate such trips.
- The scheme cost of the M4 Junction 17 HIF intervention in relation to the total cost of all HIF transport interventions which together facilitate all the CUE development (this would be used as a form of sense check).
- Any other relevant policy, planning and context information identified when developing the dependent development narrative.

5.5.4. Once the dependent development quantum has been finalised, this quantum will be incorporated into the P and S matrices to produce the R and Q matrices. The R and Q matrices will be constrained to overall TEMPRO growth, before being assigned to the with-scheme and without-scheme networks respectively to produce the finalised R and Q matrices.

5.5.5. Further investigations will take place, to establish further the methodology for incorporating the dependent development into the R and Q matrices. The possibility of creating R and Q matrices where all the dependent development trips travel through M4 Junction 17 will be investigated as this would align with the narrative of the M4 Junction 17 MRN scheme facilitating those trips from the (non-deadweight) CUE which require use of this junction.

5.6. Eastern Distributor Road and other mitigation

5.6.1. It is noted that further investigation has been undertaken to understand the suitability of including any transport infrastructure related to the CUE over-and-above the M4 Junction 17 scheme in the various transport model scenarios. It has been concluded that no additional infrastructure should be included within this assessment beyond that introduced by the M4 Junction 17 scheme itself.

5.7. Summary of methodology

5.7.1. The final transport model scenarios to be developed (based on the methodology described previously), and their underlying assumptions, are outlined in Table 5-2. The overarching approach to dependent development is illustrated in Figure 5-2; the rectangle in the centre of the diagram represents the CUE. Note the y value in Table 5-2 and Figure 5-2 are equivalent.

Table 5-2 - Summary of transport model assumptions

Model Scenarios	Demand Assumptions			Network Assumptions					
				M4 Junction 17				Other	
	CG	Hul.	CUE	CG	Hul.	HIF	MRN	EDR	Other HIF Mitigation
Do-Minimum	✓	×	×	✓	×	×	×	×	×
P	✓	×	400	✓	×	×	×	×	×
Q	✓	×	400 + y	✓	×	×	×	×	×
R	✓	×	400 + y	-	-	-	✓	×	×
S	✓	×	400	-	-	-	✓	×	×

Figure 5-2 - Dependent development methodology

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

6.1. Purpose of economic appraisal

6.1.1. 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 M4 Junction 17 OBC will appraise the short-listed option against economic, environmental and social impacts.

6.1.2. A key principle to be adopted for the appraisal is that the level of rigour applied and focus of effort will reflect the M4 Junction 17 scheme objectives and the expected scale and type of impacts (beneficial and adverse) anticipated (see Section 6.6 for instance). It further seeks to enhance areas of the appraisal which were not addressed in detail at SOBC (for example dependent development) and to utilise knowledge gained from the initial appraisal work at that stage.

6.1.3. The Appraisal Specification Summary Table (Appendix A) 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.

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

6.2. Forthcoming updates to TAG

6.2.1. It is recognised that in May 2021 DfT published its 'TAG appraisal and modelling strategy update report along with a series of forthcoming guidance updates. A definitive, consolidated TAG update has been introduced on 30th July 2021. This set out some key changes to the appraisal process including:

- Updated economic and population projections produced by the Office for Budget Responsibility (OBR);
- Revised treatment of optimism bias and risk;
- A variation to treatment of health benefits;
- Alternative appraisal period assumptions;
- Extended monetisation of landscape benefits and
- Various other updated parameters.

6.2.2. Recent communication from the DfT (30th July 2021) states that the modelling and appraisal forming the core scenario should now be undertaken using TUBA 1.9.15, data book v1.15, taking account of the updated economic projections. The economics parameters file "Economics_TAG_db1_15.txt" should be used in TUBA analysis for the core scenario. This approach will be adopted in the OBC appraisal.

6.3. Value for Money (VfM) process and categories

6.3.1. 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 BCRs generated through cost-benefit analysis are presented in Table 6-1. Figure 6-1 summarises the steps and levels in the VfM assessment process and how they make use of the appraisal outputs. Note that Figure 6-1 gives an illustrative and generic overview of the VfM process, however not all economic impacts included in the figure will be monetised as part of the M4 Junction 17 OBC appraisal. See Table 6-2 for a summary of the economic impacts monetised in the OBC.

6.3.2. An initial BCR will be calculated based on the Level 1 transport user benefits. For the M4 Junction 17 MRN scheme, it is expected that the majority of benefits will be accrued at this stage, driven by highway journey time savings.

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

6.3.4. A final "sensitivity" BCR will be produced which captures Level 3 impacts related to dependent development such as land value uplift and transport external costs.

6.3.5. Reporting of the appraisal and VfM assessment is addressed in Section 6.14.

Figure 6-1 - Incremental value for money assessment framework

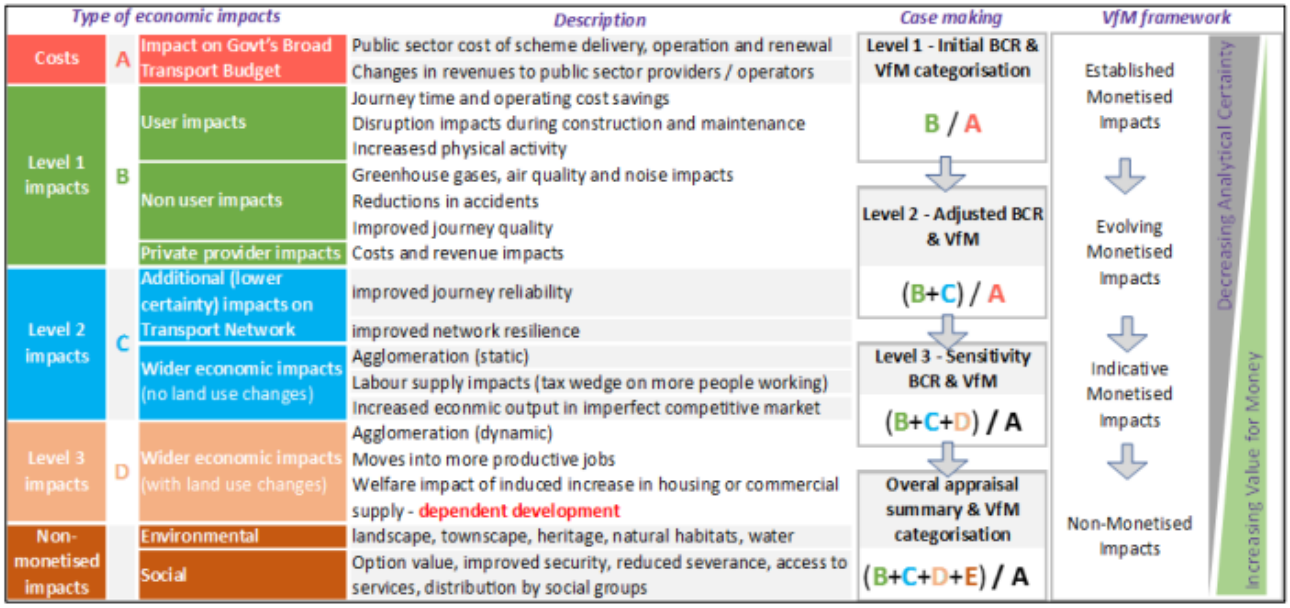


Table 6-1 - DfT value for money categories

DfT Value for Money Categories	
BCR	**Level**
Less than 0.0	Very Poor
0.0 to 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

6.4. Overarching context of economic appraisal

6.4.1. As mentioned in section 5, the OBC will be conducted in the context of dependent development in relation to the CUE development. Therefore, the economic appraisal will be developed using both the standard procedures and economic parameters as defined by TAG Unit A1-1 - Cost Benefit Analysis as well as the guidance outlined in TAG Unit A2-2 Induced Investment.

6.4.2. Through the analysis described in section 5, the proportion of CUE housing dependent upon the OBC intervention at M4 Junction 17 will be determined and used to create the P, Q, R and S model scenarios defined in Table 5-1. The model scenarios utilised in the appraisal are dependent upon

the benefit stream being assessed. In the subsequent descriptions of the methodologies used to assess each benefit stream, the model scenarios utilised will be stated.

6.4.3. Section 5 gives further details of the approach to dependent development and how the P, Q, R and S scenarios will be developed

6.5. Key technical principles

6.5.1. There are a number of key technical principles which affect all areas and benefit streams of the economic appraisal and hence are required to be clearly defined and established.

Appraisal period

6.5.2. Unless otherwise stated, a 60-year appraisal period commencing from the scheme opening year of 2025 will be used in assessing the monetised benefits.

6.5.3. The model has been developed with a forecast year of 2024 - at the time this reflected the opening year of the scheme. However, the opening year has since changed to 2025. The 2024 modelled year will be used to represent 2025 to avoid errors in the TUBA assessment.

Annualisation factors

6.5.4. For certain benefits streams, outputs from the Wiltshire Transport Model are required to be augmented to cover the required assessment period. Given the model being utilised represents an average hour in the weekday peak periods of AM (07:00 – 10:00), IP (10:00 – 16:00) and PM (16:00 – 19:00), it can be assumed that factors of 3, 6 and 3 respectively can be used to scale up model outputs to cover a 12 hour period.

6.5.5. A simplified off-peak model has been developed to represent the impact of the scheme outside of the core AM, IP and PM periods. This has been based on taking 25% of the IP flow as a broad average of the off peak and weekend flow levels. The result of this generates a very low level of benefit which is not considered to be representative, based on the level of variation in flow at different times over this period and it so has been excluded from the economic analysis.

Economic parameters

6.5.6. All benefits and costs will be assessed over the construction period and a 60-year post-opening appraisal period, and then discounted to a common base year of 2010. Discount rates of 3.5% will be applied to benefits and costs for the initial 30 years from the current year and rates of 3.0% are to be applied to subsequent years. All present values will be quoted in the market price unit of account unless otherwise stated.

6.5.7. The price base will also be 2010, therefore all prices in the appraisal will be adjusted for inflation and presented in 2010 prices, after allowing for real growth above standard inflation.

6.5.8. The current most up to date versions of any guidance and economic parameters will be used. Any updated guidance, economic parameters or software which are released during the development of the OBC will only be incorporated if it is feasible considering the progression and timescales of the OBC.

Origin-destination sector masking

6.5.9. Masking of economic results on an origin-destination sector basis may be appropriate if transport model noise is significantly affecting the results.

6.5.10. If required, a matrix mask will be developed using professional judgment to determine the sector O-D pairs whose trips will not be significantly affected by introduction of the scheme and can therefore be masked out.

6.5.11. The intention will be to keep the matrix mask consistent across the various impact streams defined in section 6.6.

6.5.12. Details of any matrix masking applied will be clearly set out in the modelling and appraisal documentation supporting the OBC.

6.6. Overview of impacts appraised

6.6.1. A number of different of impacts will be appraised to understand the complete (dis)benefits of the scheme. These impacts and the appraisal tools to be utilised are summarised in Table 6-2.

6.6.2. The subsequent subsections give further details of the methodologies used to appraise various scheme impacts, highlighting which of the scenarios from Table 5-1 are to be utilised.

Table 6-2 - Summary of economic impacts assessed.

Level	Potential Economic Impacts		Appraisal Tools		
			Software	Assessment Type	Guidance followed
1	Highway user impacts		TUBA	Monetised	TAG Unit A1-3 User and Provider Impacts
	Impacts on indirect taxation revenue		TUBA	Monetised	TAG Unit A1-3 User and Provider Impacts
	Impacts on greenhouse gases		TUBA	Monetised	TAG Unit A1-3 User and Provider Impacts
	Collision impacts		COBA-LT	Monetised	TAG Unit A1-3 User and Provider Impacts
	Construction impacts		TUBA	Monetised	TAG Unit A1-3 User and Provider Impacts
	Business impacts (developer contributions to scheme cost)		Bespoke spreadsheet	Monetised	TAG Unit A1-2 Scheme Costs
	Air Quality and Noise Impacts		Marginal External Costs	Monetised, supported by qualitative	TAG A5.4 Marginal External Costs TAG A3 Environmental Impact Appraisal
2	Journey time reliability		Bespoke python script	Monetised	TAG Unit A1-3 User and Provider Impacts – Urban Roads Method
	Wider economic impacts	Increased economic output in imperfectly competitive market	TUBA	Monetised	TAG Unit A2-1 Wider Economic Impacts Appraisal and TAG Unit A2-2 Induced Investment
		Labour supply impacts	-	Qualitative	TAG Unit A2-1 Wider Economic Impacts Appraisal
		Static agglomeration impacts	WITA	Monetised	TAG Unit A2-1 Wider Economic Impacts Appraisal and TAG Unit A2-4 Productivity Impacts
3	Impacts of	Land value uplift (LVU)	Bespoke spreadsheet	Monetised	DCLG Appraisal Guidance 2016[3]

[3] MHCLG (2016) The DCLG Appraisal Guide, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/576427/161129_Appraisal_Guidance.pdf

Level	Potential Economic Impacts		Appraisal Tools		
			Software	Assessment Type	Guidance followed
	dependent development	Distributional impacts (associated with LVU)	Bespoke spreadsheet	Monetised	DCLG Appraisal Guidance 2016
		Health impacts	Bespoke spreadsheet	Monetised	DCLG Appraisal Guidance 2016
		External impact of housing development (net amenity)	Bespoke spreadsheet	Monetised	DCLG Appraisal Guidance 2016
		Transport external costs	TUBA	Monetised	TAG Unit A1-3 User and Provider Impacts and TAG Unit A2-2 Induced Investment
Non-monetised	Social impacts		-	Qualitative	TAG Unit A4-1 Social Impact Appraisal
	Distributional impacts		-	Qualitative	TAG unit A4-2 Distributional Impact Appraisal
Costs	Base costs		Bespoke spreadsheet	Monetised	TAG Unit A1-2 Scheme Costs
	Risk		Bespoke spreadsheet	Monetised	TAG Unit A1-2 Scheme Costs
	Inflation		Bespoke spreadsheet	Monetised	TAG Unit A1-2 Scheme Costs
	Maintenance		Bespoke spreadsheet	Monetised	TAG Unit A1-2 Scheme Costs
	Optimism Bias		Bespoke spreadsheet	Monetised	TAG Unit A1-2 Scheme Costs

Level 1 impacts

Highway user impacts

6.6.3. The DfT's Transport User Benefit Analysis (TUBA) software (v1.9.15) will be used to calculate the direct impacts of the scheme to highway users which comprise of journey time and vehicle operating cost impacts.

6.6.4. To understand the direct impacts of the scheme on existing highway users the P and S scenarios will be assumed as the do-minimum and do-something scenarios respectively in the TUBA analysis.

6.6.5. TUBA provides a complete set of default economic parameters in its standard economics file, including values for variables such as values of time, vehicle operating cost data, tax rates and economic growth rates. Following advice from the DfT, the "Economics_TAG_db1_15.txt" economic parameters file will be used throughout the appraisal. As described in 6.5.4, as the transport model used covers average hours within the peak periods, standard annualisation factors can be assumed.

Impacts on indirect taxation revenue

6.6.6. The TUBA analysis described in 6.6.3 to 6.6.5 will also be used to estimate the impacts on indirect taxation revenue directly resulting from the scheme.

Impacts on greenhouse gases

6.6.7. The TUBA analysis described in 6.6.3 to 6.6.5 will also be used to estimate the monetised impacts of changes in greenhouse gas emissions resulting from the scheme.

Collision impacts

6.6.8. The DfT's Cost and Benefit to Accidents – Light Touch (COBA-LT) spreadsheet model will be used to monetise the safety impacts of the transport scheme with the P and S scenarios assumed as the do-minimum and do-something scenarios respectively. The latest version of the COBA-LT parameters file will be used with values updated using the latest available release of the TAG Databook.

6.6.9. Observations of flow difference between the Do-Something and Do-Minimum scenarios will be used to determine a scheme impact area and thus a selection of model links to be analysed in COBA-LT. A selection of junctions directly altered by the scheme and in a close vicinity to the scheme will be modelled in greater detail within COBA-LT to increase the robustness of the analysis. The assessment will make use of local accident rates to inform the frequency of collisions within the assessed area.

6.6.10. The COBALT assessment will identify an appropriate section of the modelled network over which to perform analysis of safety impacts of the scheme. This will be based on flow changes resulting from the scheme with a proportionate area defined to capture all significant impacts, while excluding areas of the model over which noise is considered the main contributing factor in flow differences.

Construction impacts

6.6.11. Economic impacts can occur during the period the scheme is being constructed, due to the changes in travel costs caused by the implementation of traffic management measures. The economic impacts arising from scheme construction that will be monetised are as follows:

- Changes in journey time;
- Changes in vehicle operating costs;
- Changes in indirect taxation revenue; and
- Changes in greenhouse gas emissions.

6.6.12. The proposed traffic management arrangements during construction will be obtained and a scenario reflecting these will be incorporated into the Wiltshire Transport Model.

6.6.13. The economic impacts listed above will then be estimated using TUBA software comparing the model scenarios with and without the traffic management measures.

6.6.14. The economic impacts arising from construction will only be monetised for the period that traffic management measures are planned to be in place during construction. Therefore, any impacts arising from regular maintenance to the junction over the 60 year appraisal period will not be monetised.

Business Impacts

6.6.15. Any proportion of the scheme cost which includes contributions from the private sector as opposed to central government funding will be captured in the analysis as a negative level 1 impact of the scheme. Collaboration with Wiltshire Council and local developers will occur to establish the proportion of scheme costs covered by the private sector.

Level 2 impacts

Journey time reliability

6.6.16. The method outlined in TAG Unit A1.3 for forecasting reliability impacts in urban areas will used to assess the journey time reliability impacts of the scheme, with the P and S scenarios assumed as the do-minimum and do-something scenarios respectively. This methodology is considered as suitable for the following reasons:

- In comparison to a more comprehensive “Motorway Reliability Incidents and Delays” (MyRIAD) analysis, the efforts associated with the urban roads methodology is proportionate to the size and cost of the scheme; and
- The A429, B4122 and A350 approaches to the junction offer alternative routes in close proximity to the junction for drivers to divert away from incidents, as of the requirement outlined in 6.3.1 of TAG Unit A1.3.

Wider economic impacts

6.6.17. 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 and the DfT’s Wider Economic Benefits and Transport Appraisals: A Guidance Framework, as follows.

Output change in imperfectly competitive markets

Output change in imperfectly competitive markets will be estimated using the method set out in TAG unit A2.2 section 4 by assuming this impact as 10% of the business and freight user impacts derived from TUBA. The P and S scenarios will be assumed as the do-minimum and do-something scenarios respectively.

Static agglomeration impacts

Monetisation of static agglomeration impacts for the appraisal will be justified in the economic narrative. The P and S scenarios will be assumed as the do-minimum and do-something scenarios respectively.

The assessment of agglomeration impacts associated with the scheme will utilise the methodology/assumptions set out un TAG unit A2.4 and will capture 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 (LAD) 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 LAD. 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 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).

Level 3 impacts

Land value uplift

6.6.18. The economic appraisal of land value uplift will follow MHCLG's recommended and preferred approach[4] to valuing the benefits of development. This approach is also set out in TAG Unit A2.2. The impact of the dependent development brought forward or unlocked by the transport scheme will be reflected through the comparison of the land value with and without the dependent development.

6.6.19. Land Value Uplift (LVU) from changes in land use is defined as a private benefit accruing to private developers. The approach to LVU will only be concerned with housing and residential land and will be estimated as a function of the land price in its new use compared to the land price in its existing use. Developer costs, fees and profit from the new housing development will be informed from financial viability assessments which will be available through work undertaken as part of the HIF submission.

6.6.20. Unlike other benefits steams, LVU is not assessed over an appraisal period, rather the one-off uplift in land value caused by the introduction of the dependent development being captured.

Social impacts from housing development

6.6.21. The appraisal of external impacts from additional housing units brought forward or unlocked by the transport scheme will also be used to determine the net present value (NPV) from the infrastructure investment and includes the following elements;

- Health impacts (as a result of the affordable housing element of the dependent development); and
- Distributional impacts include apportioning land value uplift as an implicit subsidy to tenants in social rented housing. This requires an assessment of the number of affordable housing units defined as 'dependent' on the infrastructure investment. Assumptions concerning the proportion of the development comprising of affordable housing will be confirmed with the appropriate stakeholders. This will be presented as an economic transfer from private developers to social/welfare recipients.

These external impacts are in addition to Land Value Uplift (LVU) and are included in the economic appraisal.

6.6.22. External impacts should be accounted for separately and summed with net private impacts to give the net social impact of the resulting development.

Land amenity value

6.6.23. The impacts of the change in level of pleasantness of the area as a result of the dependent development will be monetised following DfT guidance.

Displacement assumptions

6.6.24. The following factors will be considered in determining an appropriate level of displacement caused by the unlocking of the dependent development:

- Housing demand;
  - Population and demographics;
  - Internal migration; and
  - Median house prices and median rent.
- Housing supply; and

4 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/576427/161129_Appraisal_Guidance.pdf

  - Population and household led dwelling projections; and
  - Displacement through planning.
- Housing need;
  - Affordability ratios - house price to workplace-based earnings ratio; and
  - Vacancy rate and housing stock.

Other non-transport complementary interventions

6.6.25. The viability and appropriateness of including in the assessment any non-transport complementary interventions for which the development is dependent upon will be investigated as part of the dependent development analysis.

6.7. Calculation of scheme costs

6.7.1. 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;
- Environmental mitigation; and
- Junction design.

6.7.2. In calculating the overall cost of the scheme, there are a number of components as detailed below. The means by which these components link to the economic and financial case will be made clear in the OBC.

Base costs

6.7.3. Base costs incorporate the direct costs associated with implementation of the scheme such as; preparatory, construction, site supervision, land purchase and scheme development costs. 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.

Risk

6.7.4. Any risks associated with the delivery of the scheme will be captured in a Quantified Risk Assessment (QRA) workshop, along with the likelihood and associate costs of risks occurring. Following the workshop, Monte-Carlo analysis will be undertaken to produce a number of risk-adjusted cost estimates. The P-80 value from the analysis will be assumed as the risk-adjusted cost as part of the Financial Case but will not be used for the Economic Case or BCR assessment.

Optimism bias

6.7.5. Uplifting the scheme cost to account for optimism bias reflects the well-established and continuing systematic bias for estimated scheme costs and delivery times to be too low and too short respectively.

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

Maintenance

6.7.7. Representative maintenance values based on local data from Wiltshire Council will be sought to estimate the whole-life maintenance costs of the scheme over the 60-year appraisal period. The

final estimation of maintenance cost incorporated into the economic case will capture the net increase in costs for maintenance of the scheme in comparison to maintenance of the junction in its existing conditions.

Price base

6.7.8. In the financial case, costs are presented as Outturn costs. For the economic case, costs are required to have a consistent price base to the monetised scheme impacts to enable calculation of the BCR. As such in the economic case scheme costs will be presented with a 2010 price base using the methodology outlined in 6.5.6 - 6.5.8.

6.8. Environmental appraisal

Overview

6.8.1. In undertaking the environmental appraisal of the M4 Junction 17 scheme, there will be full consideration for each of the TAG environmental sub objectives included in the Appraisal Summary Tables, in accordance with TAG Unit A3 (May 2019):

- Noise;
- Air Quality;
- Greenhouse Gases;
- Landscape;
- Townscape;
- Heritage of Historic resources;
- Biodiversity; and
- Water Environment.

6.8.2. Although not a TAG topic, a qualitative assessment of the potential effects of the scheme on geology and soils will also be undertaken in accordance with the Design Manual for Roads and Bridges (DRMB) and detailed in the OBC.

Baseline environmental conditions

6.8.3. The following sections provide a high-level baseline review of the environmental sensitivity of the scheme. This review includes the study of publicly available datasets and does not take account of environmental features that were not publicly available and also does not consider social and wider sustainability principles.

Biodiversity

6.8.4. Stanton St Quinton Quarry and Motorway Cutting Site of Special Scientific Interest (SSSI) is located within the footprint of the works area, which crosses both carriageways of the M4 at Junction 17. This is a SSSI designated for geological reasons (GSSSI) and there is the potential for the engineering works associated with the scheme to have an adverse effect on the GSSSI, but is not considered further in respect of biodiversity.

6.8.5. There are no statutory designated sites of nature conservation importance within 2 km of the scheme. The scheme lies within a Priority Species area for Countryside Stewardship for lapwing habitat.

6.8.6. There are several areas of ancient woodland within 2km of the scheme but none in the immediate vicinity. These are located approximately 1.6km to the west of the scheme and 1.8km to the east. Ancient woodland are irreplaceable features which have had woodland cover for centuries and have been relatively undisturbed by human activity, dating back to 1600 in England. These areas can be high in biodiversity or cultural value. As a habitat type, ancient woodland has no statutory protection *per se*, but it is explicitly mentioned in planning policy in the UK and as irreplaceable habitats should be avoided completely.

6.8.7. There are several areas of deciduous woodland (Priority Habitat) within 2km, 13 of which are within 1km, with two small areas within 200m, one of which is within the central area of the junction on the

north side of the M4. Priority Habitats are locations under the Natural Environment and Rural Communities Act (2006) Section 41 Habitats of Principal Importance. Species and habitats have been identified in these areas as being of principal importance for the conservation of biodiversity in England and Wales and therefore require conservation action. Priority Habitats and Species need to be protected from development through avoidance where practicable.

6.8.8. The motorway soft estate within the scheme includes linear belts of trees and shrubs, and areas of open grassland. There are hedgerows present within surrounding agricultural habitats. These habitats may support protected species such as bats, badger and dormice. A Phase 1 survey and a Preliminary Ecological Appraisal Report will be produced for the scheme to provide more detail of the Biodiversity sensitivity of the scheme in the Outline Business Case.

Noise

6.8.9. There are no Noise Important Areas (NIA) adjacent to the scheme but there are two NIA within approximately 1km of Junction 17, one to the south on the A350 and one to the north on the A429. NIAs are locations where the 1% of the population most affected by the highest noise levels from major roads and railways are located according to the strategic noise mapping undertaken by the Department of Environment, Food and Rural Affairs (DEFRA). Therefore, NIAs are those with existing high noise levels. Exacerbating noise levels in these areas may adversely impact sensitive human receptors and populations (e.g. young and elderly in concentrations such as schools and hospitals). Areas designated as NIAs should therefore be avoided where the proposed development could further exacerbate noise and vibrations levels. There are approximately 15 noise sensitive receptors (NSR) within 600m of the proposed scheme.

Air Quality

6.8.10. The scheme is not located within an AQMA. There are less than 10 human health receptors within 200m of the proposed scheme. There are no designated ecological sites within 200m of the scheme.

Landscape

6.8.11. The scheme is located within the rural landscape of the Thames and Avon Vales National Character Area, approximately 3.8km to the north of the urban edge of Chippenham. The scheme is located within the existing road corridors and contained within the existing highway boundaries to the A429, the A350 and B4122. There are existing hedgerows, woodland and linear tree and shrub belts in close proximity to the scheme that provide screening for the close by urban areas and surrounding villages.

6.8.12. The site does not lie within or adjacent to a national Landscape Designation (e.g. Area of Outstanding Natural Beauty) and there are none within 2km of the site. There are no registered Parks & Gardens within 2km of the site. The Stanton St Quintin Quarry and Motorway Cutting SSSI (geological reason for designation) is within the central area of the junction itself, with the designation continuing under the M4 carriageway.

6.8.13. There are trees covered by TPOs approximately 550m, 840m and 1.2km to the east, and 1.1km to the west of the site but none in the immediate vicinity.

Heritage

6.8.14. There are no World Heritage Sites, Registered Parks and Gardens, Registered Battlefields, or Conservation Areas within 1km of the scheme.

6.8.15. There is one Scheduled Monument, Dovecote at The Manor (1018612), located approximately 1km west of the scheme.

6.8.16. There is one Grade II* and eight Grade II listed buildings located in the village of Stanton St. Quintin, approximately 1km west of the scheme.

Water Environment

6.8.17. An unnamed Environment Agency main river crosses the M4 approximately 500m west of Junction 17. Flood Zone 3 (1% Annual Probability (AP)) of this river is 300m west of Junction 17, and Flood

Zone 2 (0.1% AP) extends onto the M4 at Junction 17, underneath the proposed works on the A350/A429 (the M4 runs approximately 7m underneath the junction).

6.8.18. A minor, unnamed watercourse 100m to the south of Junction 17 flows east to join the Avon but has no flood zones for its uppermost reach. The River Avon and its Flood Zone 3 extent lie approximately 3.3km and 3km to the east, respectively.

6.8.19. There is one minor watercourse and drainage ditch within 500m of the scheme located approximately 300m west and 230m south within agricultural fields. There are two small ponds located approximately 360m to the northeast of the scheme within an agricultural field and separated from the scheme by a minor road.

6.8.20. At the scheme location surface water flood risk is Very Low. There is no fluvial flood risk to the scheme. Groundwater plays an important role in both flood risk and water supply. The Environment Agency publishes groundwater protection zone and groundwater vulnerability maps. The are no Groundwater Source Protection Zones underlying the scheme. Although there are no recorded flood events caused solely by groundwater in the study area, groundwater flows still play an important role during wet weather periods.

Geology and Soils

6.8.21. The bedrock geology underlying the scheme is mudstone, siltstone and sandstone (Kellaways and Oxford Clay formations - undifferentiated). There is also fault line (fault at rock head) running through the central area of the junction on the south side of the M4. There are no superficial geological deposits underlying the scheme. The Stanton St Quinton Quarry and Motorway Cutting Site of Special Scientific Interest (SSSI) is located within the footprint of the works area, which crosses both carriageways of the M4 at Junction 17.

Scope for mitigation

6.8.22. No environmental mitigation is considered at this stage of scheme development

Need for further environmental assessment

Noise

6.8.23. Whilst the scheme may result in a change in the pattern of vehicle speed on the approach to the junction, there are no sensitive receptors within 200m of the scheme.

6.8.24. For the noise assessment, a review of links from the traffic model will be undertaken to confirm that a detailed quantitative modelling approach is not required for the scheme at this stage. Following this, a qualitative input to the AST will be produced in accordance with DMRB LA 111 Noise and Vibration.

6.8.25. To supplement the qualitative noise assessment, a Marginal External Cost (MEC) approach using a bespoke spreadsheet will provide a quantitative assessment of the noise impacts on the scheme in line with TAG A5.4.

Air quality

6.8.26. It is anticipated that the scheme will minimise delay and queueing compared with a Do-Nothing scenario. This would reduce fuel consumption and emissions.

6.8.27. A qualitative TAG assessment will be undertaken for the air quality assessment based on identifying constraints within 200m of the scheme in terms of designated sites of ecological value and human health receptors, in line with DMRB LA 105 Air Quality.

6.8.28. A review of the available traffic data will take place to determine the extent of changes in traffic when the scheme is in operation. Where changes in traffic are more extensive than expected, further assessment work may be recommended.

6.8.29. To supplement the qualitative air quality assessment, a Marginal External Cost (MEC) approach using a bespoke spreadsheet will provide a quantitative assessment of the air quality impacts on the scheme in line with TAG A5.4.

Greenhouse gases

6.8.30. The TAG approach to estimations of impact on greenhouse gases will be derived using TUBA outputs. TAG A3 requires all hours at the intervention site to be accounted for, therefore a factor based on local flows will be applied to convert TUBA peak hours to incorporate off-peak and weekend hours.

Landscape and townscape

6.8.31. There are no designated landscape sites within 2km of the works area. The Cotswolds AONB is approximately 5km to the west.

6.8.32. Motorway soft estate contains narrow linear belts of trees and shrubs and areas of open grassland and some species rich grassland, there are hedgerow field boundaries present on the outer edges of the works area. These features may be affected by excavations for ducting or cabling, however, providing excavations are carried out in accordance with an approved methodology, impacts on these features are likely to be minimal.

6.8.33. Trees covered by TPOs approximately 550m, 840m and 1.2km to the east and 1.06km to the west of the site.

6.8.34. There are no sensitive residential receptors within 200m of the works area. Sensitive receptors on PRoW KLAN26 are within 200m, at 130m from the works area. Vegetation and intervening road will reduce possible impacts, but some construction operations will be visible.

6.8.35. Signals may be perceptible for a greater distance across the landscape, but widely screened by woodland blocks and linear woodland belts. Greater visibility for motorists along the motorway and approaches along the A429.

6.8.36. Initial appraisal at SOBC stage identified likely neutral - slight adverse impact on the landscape and on receptors within 200m of the scheme.

6.8.37. For townscape, the scheme is not within an urban area, therefore there no impacts are anticipated on the urban fabric.

6.8.38. The SOBC appraisal identified no likely adverse impacts on the townscape or on receptors within 200m of the scheme within the urban realm.

6.8.39. The landscape and townscape appraisal will be updated for this OBC stage.

Heritage of historic resources

6.8.40. There are no World Heritage Sites (WHS) within 2km; 3 Scheduled Ancient Monuments (SAM) within 2km none of which are within 1km.

6.8.41. 2 Conservation Areas within 2km, 1 within 1km at approx. 750m. 42 Listed Buildings within 2km, none within 500m.

6.8.42. Buried Archaeological features may be present, however disturbed and made ground of the motorway slip roads and junction are likely to have removed any features.

6.8.43. Initial appraisal at SOBC did not identify any likely direct adverse impacts on the Cultural Heritage resources within the footprint of the scheme or within 750m. Impacts on archaeological resource are unlikely due to previous disturbance.

6.8.44. The historic environment appraisal will be updated for the OBC.

Water environment

6.8.45. No major watercourses within 2km. River Avon is approximately 3km to the east. Flood Zone 3 of River Avon is approximately 2.4km to the east.

6.8.46. Minor un-named watercourses at approximately 100m to the south and 350m to the west. Flood Zone 2 of watercourse to south is approximately 590m to south east and Flood Zone 3 is approximately 150m to the west.

6.8.47. The SOBC appraisal identified potential slight impacts on the water environment within and close to the footprint of the scheme. The appraisal will be updated for the OBC.

Geology and soils

6.8.48. Due to the proximity of the M4 Junction 17 to the Stanton St Quinton Quarry and Motorway Cutting SSSI, a qualitative assessment will be undertaken at the OBC stage in accordance with DMRB.

6.9. Social and distributional impacts appraisal

Social impacts

6.9.1. TAG Unit A4-1 Social Impact Appraisal outlines eight social impacts which should be considered as part of the scheme appraisal. Following a screening process, it may be considered that the scheme has such a negligible effect on certain social impacts that they will not be assessed as part of the OBC. Each non-monetised social impact is required to be assessed as part of the appraisal and an assessment incorporated into the Appraisal Summary Table (AST). The eight social impacts provided by TAG are as follows, with text outlining the proposed methodology for each:

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

Accidents

6.9.2. The affect of the scheme on accident rates will be captured as part of the COBA-LT analysis outlined in Section 6.6.8.

Physical activity

6.9.3. It is generally understood that there is no significant demand for walking, cycling and horse-riding at the junction. This will be confirmed by the Walking, Cycling and Horse-riding Assessment Report (WCHAR). For the OBC a screening exercise for physical activity will be undertaken although it is expected that it will not be taken forward for assessment in the AST.

Security impacts

6.9.4. The scheme proposes no changes which would improve or degrade security on the highway network. For the SOBC a screening exercise for Security will be undertaken although it is expected that it will not be taken forward for assessment in the AST.

Severance

6.9.5. Whilst there is a footway on the outside of the circulatory carriageway at the junction, there is no continuation of provision on any of the five arms. In practice, the footway is intended for use by highway maintenance staff only. There are no signalised pedestrian facilities on or close to the junction and the scheme does not propose to introduce any.

6.9.6. For the OBC a screening exercise for severance will be undertaken although it is expected that it will not be taken forward for assessment in the AST.

Journey quality

6.9.7. Improved junction capacity has the potential to lower driver stress and fear of potential accidents. For the OBC a screening exercise will be undertaken to determine whether journey quality should be taken forward for assessment in the AST.

Option values and non-use values

6.9.8. 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.

6.9.9. For the OBC a screening exercise for option and non-use values will be undertaken although it is expected that it will not be taken forward for assessment in the AST.

Accessibility

6.9.10. Features of the scheme which are likely to affect public transport accessibility and access to services have not been confirmed at this stage, although it is not expected to result in significant changes to public transport routes or access to key services.

6.9.11. If screening indicates that there are likely to be accessibility impacts, then these will be appraised at OBC stage following the approach set out in WebTAG Units A4.1 and A4.2, including completion of strategic accessibility assessment worksheets as appropriate, leading to a qualitative assessment in the AST.

Personal affordability

6.9.12. Whilst the scheme will reduce queuing and delay (and therefore the amount of time that vehicles are sat idle) which will result in marginal reductions in expenditure on fuel, the scale of the scheme means that this will be negligible, particularly on public transport. For the OBC a screening exercise for Strategic Affordability will be undertaken although it is expected that it will not be taken forward for assessment in the AST

Distributional impacts

6.9.13. 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; and
- Affordability.

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

Step 1

6.9.15. 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 should proceed to step 2 and step 3 assessments.

Step 2

6.9.16. 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.

Step 3

6.9.17. Step 3 is the appraisal of impacts which completes a full appraisal of the DI and incorporation to the AST.

6.10. Appraisal tables (TEE, PA and AMCB)

6.10.1. For the core scenario, an Economic Efficiency of the Transport System (TEE), Public Accounts (PA) and Analysis of Monetised Costs and Benefits (AMCB) table will be produced in line with TAG guidance.

6.11. Sensitivity tests

6.11.1. A number of sensitivity test will be undertaken to understand how the altering of assumption relating to matters of uncertainty affect the economic viability of the scheme. Sensitivity tests which will be reported in the OBC and given a full appraisal and BCR are:

- Low growth scenario; and
- High growth scenario;

6.11.2. Other sensitivity tests may be developed and reported in the OBC as a result of stakeholder requirements or if their need is established as a result of initial transport modelling and economic analysis.

6.12. Appraisal Summary Table

6.12.1. Once the economic, social, distributional, and environmental impacts associated with the scheme have been assessed the results will be summarised in an Appraisal Summary Table (AST). The production of the AST will follow TAG guidance.

6.13. Value for money assessment

6.13.1. The AST will inform the Value for Money (VfM) statement which will be produced in line with DfT's Value for Money framework[5].

6.13.2. The scheme will be given a VfM category dependent on the BCR calculated at the various economic impact levels as outlined in Table 6-1.

6.13.3. Any significant non-monetised impacts such as social, distributional, and environmental impacts will also be considered in the VfM statement.

6.14. Reporting of the transport appraisal

6.14.1. 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.

6.14.2. 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.

6.14.3. 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).

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

6.14.5. 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.

[5] https://www.gov.uk/government/publications/dft-value-for-money-framework

7. Operational assessment

7.1. Introduction

7.1.1. It is proposed to carry out an operational assessment of the predicted highway impacts of the M4 Junction 17 scheme. The need for an operational assessment of the proposed scheme has been discussed and agreed between Wiltshire Council and Highways England. The operational assessment is intended to:

- Provide evidence to Wiltshire Council and Highways England to inform consideration around the optimal M4 Junction 17 MRN scheme option;
- Provide assurance that the scheme is expected to operate within capacity based on an appropriate planning horizon, and
- Provide supporting information to ensure that the SRN and local road network would operate safely with the scheme in place.

7.1.2. The approach to the operational assessment has been discussed and agreed in principle with Wiltshire Council and Highways England based on a number of scoping notes, emails and meetings. The methodology in this section of the ASR builds upon the methods presented previously, and aims to package the methodology in a single location.

7.2. Operational model

7.2.1. A 2019 based Vissim model of M4 Junction 17 has been prepared by Jacobs on behalf of Highways England and made available for use on this project. The model has been developed to cover two temporal periods 07:00 – 10:00; and 16:00 – 19:00, with all but the first 15 minutes in the models to be used for assessment purposes. For this assessment it is proposed to only use output from the models for the middle hours (08:00 - 09:00 and 17:00 – 18:00).

7.2.2. The 2019 Vissim model, and its accompanying Local Model Validation Report, have been reviewed by Atkins to determine the suitability for its use on this project. The model review identified a number of concerns with the model development which have been presented to the model developed, Jacobs who in turn have provided an updated model for use on the project. Atkins confirm that the updated model is deemed suitable for use.

7.2.3. The WTM, as discussed in Section 4, is being used on this project to provide strategic traffic modelling input to the economic appraisal. The WTM will be used to provide traffic forecasting for the operational assessment. The version of the WTM used for the operational assessment forecasting is a peak hour variation of the model, which differs from the economic assessment model which is a peak period model. Both models have been developed with the same uncertainly log, with the peak hour WTM using peak hour trip generation rates. The peak hour WTM is also a fixed assignment model and therefore has no variable demand element. The peak hour WTM has a base year of 2018 and a forecast year of 2036. For the purposes of input into the Vissim model, the 2036 forecast model has been developed for three spatial planning scenarios as follows:

- **2036 Core:** current Core Strategy growth, plus committed development and infrastructure;
- **2036 Local Plan Review:** emerging Local Plan development quantum and potential sites, plus associated transport infrastructure. This scenario includes 5,100 dwellings (within the Local Plan Review period) associated with the Chippenham Urban Extension and coincides with the 'preferred sites' for the Local Plan Review (based on the Wiltshire Council Cabinet Report dated 01/12/2020); and
- **2036 Local Plan Review + full Chippenham Urban Extension:** the 'Local Plan Review' scenario, plus a further 2,400 dwellings associated with the Chippenham Urban Extension, thereby totalling 7,500 dwellings (including housing beyond the Local Plan Review period) as per the approved Housing Infrastructure Fund submission for infrastructure funding.

7.2.4. To provide a robust operational assessment it is proposed to develop operational assessment forecasts based upon the demands from scenario 3.

7.2.5. It is recognised that the average peak hour and peak hour versions of the WTM may generate different outturn traffic growth at M4 Junction 17 and therefore once the updated forecast average peak hour SATURN model has been prepared, we propose to review the updated demand forecasts and, if required, complete a sensitivity test within the Vissim model. To overcome the temporal difference between the peak and average peak SATURN models at this stage the intention is to apply factors from the 2018 traffic surveys to pivot the average peak hour demands to peak hour demands.

7.3. Operational modelling forecasting method

7.3.1. It is proposed to develop a Do-Minimum Vissim model to compare the scheme model against, but only to have a single forecast demand set. This approach will provide a Do Minimum scenario with full demand through the junction and assist in the design process. The aim of the Vissim modelling process is to optimise the design and to demonstrate that the MRN design works in its own right, i.e. working in operational terms with as high a level of growth as possible.

7.3.2. As base model developer Jacobs will be preparing the forecast Do Minimum Vissim model for Atkins to use for scheme assessment. The Do Minimum model will be updated to represent the committed highway scheme associated with the Chippenham Gateway development, and will not include any scheme associated with the Hullavington proposals due to the uncertainty with the development.

7.3.3. The Vissim forecast matrices will be developed from the WTM peak hour ‘scenario 3’ forecasts with the WTM cordoned around M4 Junction 17 to provide a five-zone matrix to align with the Vissim zoning system. The SATURN model has five user classes (UC), with UC1-4 mapped to the lights matrix in Vissim and UC5, representing HGVs, mapped to the heavies matrix. The UC5 demand will be divided by 2.5 to convert from Passenger Car Units (PCU) to vehicles.

7.3.4. The Vissim model demands cover three-hour periods, spilt into 15-minute matrices, while the SATURN cordon matrices will cover only the single peak hour in each period. To convert these flows to full Vissim demands, the base Vissim shoulder hour proportions to the peak hours will be applied to the peak hour matrix. The growth in the SATURN model, as mapped and profiled to the Vissim system, will be added to the Vissim base demands using the general formula:

Vissim forecast = 2018 Survey + (SATURN forecast - SATURN base)

7.3.5. As the SATURN model is a 2018 base year, it is proposed that the 2018 survey data will be utilised as the pivot point to calculate forecast year traffic growth, rather than the 2019 Vissim base model.

7.3.6. Table 7-1 to Table 7-6 displays the SATURN matrices to be used in the forecast Vissim assessment for the 2036 DS3 scenario which is the “2036 Local Plan Review + full Chippenham Urban Extension” scenario described in 7.2.3.

Table 7-1 - 2036 DS3 M4 J17 matrix (08:00 – 09:00 Car Veh's/hr)

	A350 South	M4 West	A429 North	M4 East	B4122	**Total**
A350 South	0	689	458	458	324	**1,929**
M4 West	370	0	192	1,803	183	**2,547**
A429 North	362	342	0	103	71	**878**
M4 East	602	2,947	76	0	96	**3,721**
B4122	48	92	127	148	0	**415**
Total	**1,382**	**4,070**	**853**	**2,512**	**674**	**9,490**

Table 7-2 - 2036 DS3 M4 J17 matrix (08:00 – 09:00 LGV Veh's/hr)

	A350 South	M4 West	A429 North	M4 East	B4122	**Total**
A350 South	0	125	100	108	49	**383**
M4 West	141	0	48	157	59	**405**
A429 North	76	49	0	13	9	**147**
M4 East	131	95	20	0	12	**259**
B4122	6	18	7	16	0	**48**
Total	**355**	**288**	**175**	**294**	**130**	**1,241**

Table 7-3 - 2036 DS3 M4 J17 matrix (08:00 – 09:00 HGV Veh's/hr)

	A350 South	M4 West	A429 North	M4 East	B4122	**Total**
A350 South	0	86	27	28	10	**150**
M4 West	48	0	12	153	26	**239**
A429 North	32	13	0	3	1	**49**
M4 East	31	188	8	0	6	**233**
B4122	11	10	7	9	0	**37**
Total	**123**	**296**	**53**	**193**	**43**	**709**

Table 7-4 - 2036 DS3 M4 J17 matrix (17:00 – 18:00 Car Veh's/hr)

	A350 South	M4 West	A429 North	M4 East	B4122	**Total**
A350 South	0	552	491	495	203	**1,741**
M4 West	574	0	202	2,972	243	**3,990**
A429 North	418	344	0	86	69	**916**
M4 East	731	2,195	104	0	54	**3,084**
B4122	171	74	84	142	0	**471**
Total	**1,894**	**3,164**	**881**	**3,695**	**569**	**10,203**

Table 7-5 - 2036 DS3 M4 J17 matrix (17:00 – 18:00 LGV Veh's/hr)

	A350 South	M4 West	A429 North	M4 East	B4122	**Total**
A350 South	0	82	76	88	22	**268**
M4 West	71	0	27	69	32	**200**
A429 North	67	49	0	8	10	**134**
M4 East	68	163	12	0	4	**247**
B4122	15	12	7	12	0	**46**
Total	**221**	**306**	**121**	**177**	**69**	**895**

Table 7-6 - 2036 DS3 M4 J17 matrix (17:00 – 18:00 HGV Veh's/hr)

	A350 South	M4 West	A429 North	M4 East	B4122	**Total**
A350 South	**0**	**55**	**16**	**19**	**6**	**97**
M4 West	**40**	**0**	**7**	**157**	**26**	**229**
A429 North	**15**	**8**	**0**	**4**	**4**	**31**
M4 East	**23**	**190**	**2**	**0**	**20**	**235**
B4122	**2**	**5**	**1**	**7**	**0**	**16**
Total	**81**	**258**	**26**	**188**	**56**	**609**

7.3.7. The forecast 'with scheme' model will be used to test the predicted operational impacts of the M4 Junction 17 scheme based on the current design. The assessment will feedback to further design iterations as required and produce an updated scheme design. Any updated scheme will be run through the WTM to understand if there is a demand response prior to completing a final Vissim assignment.

7.4. Modelled scenarios

7.4.1. It is proposed that the following modelled scenarios be developed for operational traffic modelling for both morning and evening periods:

- 2019 Base;
- 2036 Do Minimum – The 2019 base model with traffic growth from the peak hour Wiltshire Traffic model. The network to reflect the Chippenham Gateway scheme;
- 2036 Do Something – the 2036 do minimum model and demand with the currently proposed M4 Junction 17 scheme (Option B+); and
- 2036 Do Something revised – the 2036 do something with an updated scheme based on the results of the do something scenario (a refined version of Option B+).

7.5. Linkage to the wider team

7.5.1. The Vissim model will be used to assess the operational impacts of the scheme proposals and assist in the scheme development through feedback to the scheme designers and strategic and economic modelling teams.

7.6. Reporting method

7.6.1. It is proposed that the following reports will be prepared for the M4 Junction 17 operational assessment:

- Local Model Validation Report – prepared by Jacobs;
- Operational Assessment Report – containing detail on the forecasting and assessment of the M4 Junction 17 scheme using the Vissim model. The report will provide results from the Vissim model in the form of:
  - Acceptable speed plots;
  - Modelled queues – average and maximum (including the slip roads); and
  - Origin / destination journey times.

Appendices

Appendix A. Appraisal Specification Summary Table (ASST)

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 and transport providers	Moderate beneficial	Medium	Modelled in SATURN and benefits monetised in TUBA	Follow guidance in WebTAG Unit A1.3 and A2.2 using output from TUBA.	Monetary
	Reliability impact on Business users	Slight beneficial	Low	Monetised using TAG method for urban road networks.	TAG Unit A1.3 Section 6.	Monetary
	Regeneration	N/A	N/A	N/A	N/A	N/A
	Wider Impacts	Moderate beneficial	Medium	Wider Impacts of increased output in imperfectly competitive markets will be assessed by applying a factor of 10% of business user impacts. Static agglomeration impacts will be monetised using WITA software. Labour Supply Impacts (LSI) will be assessed qualitatively.	TAG Units A2.1, A2.3 and A2.4	Monetary (LSI)
Environment	Noise	Neutral	Medium	• Quantified using a bespoke spreadsheet model using change in vehicle km travelled to calculate the marginal external cost by road type and congestion.	WebTAG guidance (A3/A4.2)	Qualitative/ distributional
	Air Quality	Slight beneficial	Medium	• Quantified using a bespoke spreadsheet model using change in vehicle km travelled to calculate the marginal external cost by road type and congestion.	WebTAG guidance (A3/A4.2)	Qualitative
	Greenhouse gases	Moderate beneficial	Medium	• Modelling SATURN and benefits will be calculated in TUBA v1.9.12	WebTAG guidance (A3/A4.2)	Qualitative
	Landscape	Neutral – slight adverse	Medium	• Desktop and appraisal study	WebTAG guidance and desktop study	Qualitative
	Townscape	Neutral	High	• Desktop and appraisal study	WebTAG guidance and desktop study	Qualitative
	Heritage of Historic resources	Neutral	Medium	• Desktop and appraisal study	WebTAG guidance and desktop study	Qualitative
	Biodiversity	Slight / Moderate adverse	Medium	• Desktop and appraisal study	WebTAG guidance and desktop study	Qualitative
	Water Environment	Slight adverse	Medium	• Desktop and appraisal study	WebTAG guidance and desktop study	Qualitative

Social	Commuting and Other users	Moderate beneficial	Medium	Modelled in SATURN and benefits monetised in TUBA	Follow guidance in WebTAG Unit A1.3 and A2.2 using output from TUBA	Monetary
	Reliability impact on Commuting and Other users	Slight beneficial	Low	Monetised using TAG method for urban road networks.	TAG Unit A1.3 Section 6.	Monetary
	Physical activity	Neutral	High	The scheme proposes no changes which would improve or degrade physical activity. For the OBC a screening exercise for physical activity will be undertaken although it is expected that it will not be taken forward for assessment in the AST.	Follow guidance in WebTAG Unit A4.1	Qualitative/ distributional
	Journey quality	Beneficial	Low	Improved junction capacity has the potential to lower driver stress and fear of potential accidents. For the OBC a screening exercise will be undertaken to determine whether journey quality should be taken forward for assessment in the AST.	Follow guidance in WebTAG Unit A4.1	Qualitative/ distributional
	Accidents	Slight beneficial	Low	Accident data will be sourced for the latest five-year period, mapped and analysed. The impact on accidents will then be assessed in COBA-LT.	Follow guidance in WebTAG Unit A4.1	Qualitative/ distributional
	Security	Neutral	High	The scheme proposes no changes which would improve or degrade security on the highway network. For the OBC a screening exercise for Security will be undertaken although it is expected that it will not be taken forward for assessment in the AST.	Follow guidance in WebTAG Unit A4.1	Qualitative/ distributional
	Access to services	Neutral	Medium	Only one bus service, the 92, is routed through the junction. However, the nearest stop is 1km to the north in Lower Stanton and there is only one service per hour in peak times. The scheme does not propose any changes which would improve or hinder users' access to this service. For the OBC a screening exercise for Access to Services will be undertaken although it is expected that it will not be taken forward for assessment in the AST	Follow guidance in WebTAG Unit A4.1	Qualitative/ distributional
	Affordability	Neutral	Medium	Whilst the scheme will reduce queuing and delay (and therefore the amount of time that vehicles are sat idle) which will result in marginal reductions in expenditure on fuel, the scale of the scheme means that this will be negligible, particularly on public transport. For the OBC a screening exercise for Strategic Affordability will be undertaken although it is expected that it will not be taken forward for assessment in the AST	Follow guidance in WebTAG Unit A4.1	Qualitative/ distributional
	Severance	Neutral	High	Whilst there is a footway on the outside of the circulatory carriageway at the junction, there is no continuation of provision on any of the five arms. For the OBC a screening exercise for severance will be undertaken although it is expected that it will not be taken forward for assessment in the AST.	Follow guidance in WebTAG Unit A4.1	Qualitative/ distributional

	Option values	Neutral	High	The scheme is not proposing to substantially change the availability of transport services within the study area. For the OBC a screening exercise for option and non-use values will be undertaken although it is expected that it will not be taken forward for assessment in the AST.	Follow guidance in WebTAG Unit A4.1	Qualitative/ distributional
Public Accounts	Cost to Broad Transport Budget	Adverse	Medium	Costs provided by Atkins design team, to include QRA, Optimism Bias, and maintenance, and profiled to allow conversion to PVC.	Follow guidance in WebTAG Unit A1.3.	Monetary
	Indirect Tax Revenues	Slight adverse	Medium	Modelled in SATURN and benefits will be monetised using TUBA	Follow guidance in WebTAG Unit A1.3.	Monetary

Appendix B. Wiltshire Strategic 2018 Base Model - Local Model Validation Report

This will be provided separately.

Appendix C. Core developments in Chippenham

Table C-1 - Core land use developments in Chippenham

Model Sector	Development site name	Planning Permission	No. of dwellings (2018 onwards)	Non-resi land use	Employment (ha)	Uncertainty Category	Completion Date	Comments	Inc ?
Chippenham	East of Farrells Field	-	30	-	-	NC	2026	HSAP	Y
Chippenham	Birds Marsh	N/12/00560/OUT	750	A1, B1, B2, B8	2.7	NC	2027	Under construction	Y
Chippenham	Rawlings Green	15/12351/OUT	650	A1-A4, B1, B2, B8	5	MTL	2027	-	Y
Chippenham	Rowden Park	14/12118/OUT	1000	A1-A5, C3, C3	18	MTL	2030	-	Y
Chippenham	Hunters Moon	16/12493/FUL	450	B1, B2, B8	2.3	MTL	2027	-	Y
Chippenham	Langley Park	16/04269/FUL	0	A1	0.0174	NC	Unknown	Aldi store - under construction	Y
Chippenham	Langley Park - Additional	16/03515/OUT	400	A1, A3, C1, C3	1.3656	MTL	2026	This is an outline application for the wider site	Y
Chippenham	Land South-East of Junction 17 of M4	17/03417/OUT	0	B8	9.290304	MTL	Unknown	-	Y
Chippenham	Hullavington Airfield	18/08271/OUT	0	B1	4.415	MTL	Unknown	Site not included as design not agreed for Junction 17	N
Chippenham	Land at Hungerdown Lane	17/09445/FUL	35	A1	Unknown	NC	Unknown	-	Y
Chippenham	Land at Showell Farm	N/13/00308/OUT	0	B1 (a), (b) and (c), B2, B8	5	MTL	Unknown	Employment allocation in Chippenham Site Allocations Plan	Y
Chippenham	Forest Farm	15/11153/OUT	200	B1	Unknown	Hypothetical	Unknown	Permission refused and appeal dismissed	N
Chippenham	Land at Patterdown Road	16/09277/OUT	72	-	-	MTL	2022	-	Y
Chippenham	Riverside	15/12363/OUT	1500	A1-A4, B1-B2, C2-C3, D1-D2	5	Hypothetical	Unknown	Site deleted from draft Chippenham Site Allocations Plan	N
Chipp Rural	Land west of Salisbury Road	15/02026/OUT	175	C1	-	NC	2023	Under construction	Y

Table C-2 - Core infrastructure developments in Chippenham

Area	Transportation intervention/name	Source / Link	Description of the intervention	Estimated opening year	Uncertainty Category	Included in Core Scenario?	Comments
Melksham	A350 Farmers Roundabout Improvements	WC	Signalisation introduced at the roundabout which will be linked to traffic signals at the Asda entrance and A365 junction. Alterations to entry traffic lanes and circulatory carriage.	2019	NC	Yes	None
Chippenham	A350 Chippenham Phase 3 - Bypass Improvements	WC	Additional widening for approximately 250m north of Cepen Park South roundabout and 250m south of Chequers roundabout, widening of A4 approach and exit to Chequers roundabout, widening of the A350 to dual two lane between Badge and Brook roundabout.	2018	NC	Yes	None
Chippenham	A350 Chippenham Phase 4 and 5 - Bypass Improvements	Early MRN 'pen picture'	Further dualling and junction improvements	2023	RF	No	To be considered as part of (early) MRN proposals.
Chippenham	Bumpers Farm Roundabout Improvements	WC	Signalisation of Bumpers Farm Roundabout.	2022	NC	Yes	Planned
Chippenham	Little George Roundabout Improvements	WC	Signalisation of Little George roundabout.	Unknown	NC	Yes	Committed - To be delivered as part of the Lidl application (16/04269/FUL) of the Langley development
Chippenham	Pew Hill and Foundry Lane through road	WC	New through road between Pew Hill and Foundry Lane	Unknown	NC	Yes	Committed - To be delivered as part of the Langley redevelopment application (16/03515/OUT)
Chippenham	Pheasant Roundabout capacity improvement	Hunter's Moon, Chippenham TA - Appendix B	Introduction of toucan crossing and new turn allocations.	2026	NC	Yes	Committed - To be delivered as part of Hunters Moon application (16/12493/FUL)
Chippenham	Malmesbury Road roundabout - Bird's Marsh Access	Drawing	New arm for Bird's Marsh Development	2026	NC	Yes	Committed - part of Birds Marsh development (N/12/00560/OUT)
Chippenham	A350 - B4258 Link Road	Chippenham Design Sketches v2	New junction on A350 and link road through to B4528	Unknown	NC	Yes	Committed - Delivered as part of Showel Farm development (N/13/00308/OUT)

Area	Transportation intervention/name	Source / Link	Description of the intervention	Estimated opening year	Uncertainty Category	Included in Core Scenario?	Comments
Chippenham	Roundabout on B4528	-	Delivered as part of Rowden Park - to link to Showel Farm access road	2026	NC	Yes	Committed - Part of Rowden Park Development
Chippenham	Station Hill/New Road Junction	Chippenham Design Sketches v2	Conversion of mini-roundabout to signalised T-junction.	Unknown	MTL	Yes	Planned - Chippenham Transport Strategy
Chippenham	Rowden Hill roundabout improvements	Chippenham Design Sketches v2	Flare on approach from south	Unknown	MTL	Yes	Planned - Chippenham Transport Strategy
Chippenham	Pewsham Way/Ave La Fleche roundabout improvements.	Chippenham Design Sketches v2	2 lane exit on Ave la Fleche	Unknown	MTL	Yes	Planned - Chippenham Transport Strategy
Chippenham	Malmesbury Road roundabout improvements	Chippenham Design Sketches v2	Elongation and further signalisation	Unknown	MTL	Yes	Planned - Chippenham Transport Strategy - requires land from Birds Marsh in current format.
Chippenham	A4 link road - Ave la Fleche to Bath Road	-	Cuts into Rowden Park country park land	Unknown	RF	No	At pre-feasibility stage.
Chippenham	Bridge Centre Gyratory	-	Several options	Unknown	MTL	Yes	Planned - tied up with redevelopment of Bridge centre
Chippenham	Birds Marsh spine road (s/b termed North Chippenham Link Road)	Drawing	First link of northern distributor from Malmesbury Rd rdbt to Mauds Heath Causeway.	2026	NC	Yes	Committed - delivered as part of Birds Marsh (s/b North Chippenham) development (N/12/00560/OUT)
Chippenham	Parsonage Way realignment	Drawing Title - Landscape Proposals 683-02A	Double roundabout on Mauds Heath, linked to Birds Marsh.	Unknown	NC	Yes	Committed - delivered as part of Wavin application
Chippenham	Signalisation of Marshfield Road/Park Lane mini roundabout.	-	Altering the combined mini roundabout and priority junction found at the intersection of Marshfield Road and Park Lane to two signalised junctions.	Unknown	Unknown	Yes	None
Strategic	M4 J15 Improvements	HE	Upgrading capacity and changing layout of gyratory at J15 (Swindon East). £4.5m 3rd party scheme required to accommodate nearby Urban Expansion of Swindon at Commonhead. Additional lane on gyratory, additional lane on A419 southbound	2020	MTL	Yes	None

Area	Transportation intervention/name	Source / Link	Description of the intervention	Estimated opening year	Uncertainty Category	Included in Core Scenario?	Comments
			approach, and dedicated turning lane onto eastbound M4 slip.				
Strategic	Link to Junction 16 of the M4	SLP	New road linking Wichelstowe to M4 J16 including new crossing of the M4.	2022	MTL	Yes	Design being prepared. LGF funding secured subject to FBC being approved by DfT.
Strategic	M4 J16 Improvement	LGF scheme	Junction improvement at J16 involving slip road widening, circulatory carriageway widening and new layout improving access between Wroughton and Wootton Bassett.	2018	NC	Yes	Under construction.
Strategic	M4 Junction 17 - amendments. Three lanes on circulatory carriageway.	Drawing - Chippenham Gateway - M4 Junction 17 -	Includes a flare on A350, 3 lane on southern circulatory, 3 lane flare on B4122, signalisation of A350 and B4122 arms	Unknown	NC	Yes	Committed - To be delivered as part of the Chippenham Gateway development.
Strategic	Further M4 17 Amendments	Hullavington Airfield Project)	Three lanes on northern circulatory carriageway and a signalised A249 arm	Unknown	unknown	No	Planning in progress.

Tracey Poole
Atkins Limited
The Hub
500 Park Avenue
Aztec West
Bristol
BS32 4RZ