ATKINS

M4 Junction 17 Capacity Improvement Scheme

Full Business Case

Wiltshire Council

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Wiltshire Council
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Background

A Local Growth Fund Prioritisation Pro-forma for the M4 Junction 17 was prepared by Wiltshire Council in January 2014. Following approval, the M4 Junction 17 scheme was included in the Swindon and Wiltshire Strategic Economic Plan1 (SWSEP) submitted by the Swindon and Wiltshire Local Enterprise Partnership (SWLEP) in March 2014. An Outline Business Case (OBC) was submitted in October 2017, and was recommended for approval by the SWLEP board in November 2017 upon condition of a Full Business Case (FBC) being submitted.

The scheme addresses traffic problems experienced and observed at the M4 Junction 17 roundabout. Thisscheme has been considered several times and various options have progressed to modelling over the
last two years (2014-2016). These studies looked at three options:

- Full signalisation of the roundabout
- Full signalisation of the roundabout plus widening eastbound off-slip
- Partial signalisation of the roundabout (M4 off-slips only)

The findings of these previous studies concluded that the first two proposals were both more expensive than the partial signalisation, whilst also having less success at addressing traffic problems. The two higher cost options were then discarded. What was previously considered the 'low-cost alternative' of partial signalisation, has been carried forwards as the core scenario within this Business Case.

Drivers, problems and objectives

Wiltshire Council has key policies for spatial planning and transport that guide decisions on transport infrastructure investment. The relevant policies are the Wiltshire Local Transport Plan 2011-2026 (LTP3) and the adopted Wiltshire Core Strategy which includes the Chippenham Area Strategy and the Chippenham Transport Strategy. Additionally, the M4 being operated and maintained by Highways England, it is important that the proposed scheme matches the goals and objectives of the agency, as outlined by the Highways England 2015-2020 Strategic Business and Delivery Plan.

There are major opportunities to attract new investment around the main junctions of the M4 and in the nearby towns of Swindon, Chippenham, Corsham, Malmesbury and Royal Wootton Bassett. Demand is driven in part by businesses looking to move along the M4 from London searching for more space, relatively lower costs, and the benefits of good strategic transport links.

The scheme objectives (listed below) align closely with the business strategies for the scheme promoters, the Local Economic Partnership and for Central Government – most obviously in terms of the Government's broad goals for transport.

Scheme objective	Desired Outcomes
(1) Reduce instances of queues occurring on the M4 mainline	That queues on the M4 EB and WB off-slips do not exceed the length of that particular off-slip
(2) Minimise delays at the junction, specifically on the M4 off-slip EB in AM peak and M4 off-slip WB in PM peak	Future journey times for users of the M4 off-slips are lower than under the do-minimum scenario
(3) Reduce the total amount of collisions and accidents that occur at the junction.	Future accident rates at the junction are lower than current and past accident rates
(4) Improve the capacity of the junction to deal with congestion impacts of future development	Future capacity at the junction is increased from its current capacity

Observations of the current junction conclude that many of the incoming links are already near or at capacity. With significant growth in the area planned, it is highly likely that traffic on these links will exceed

[1] SWLEP SEP

capacity at Junction 17 within the period covered by the Chippenham Core Strategy (to 2026), thus increasing delays further. Particular problems include:

- Queueing during the AM peak time on the eastbound off-slip - caused by the volume of conflicting traffic on the circulatory part of the junction
- Similarly, a queue of longer length occurs during the PM peak on the westbound off-slip which is also caused by the traffic on the junction's circulatory part

The queues not only result in journey time increases but also, in the case of the PM peak hour, the length of the queue on the westbound off slip affects the level of safety with collisions occurring due to rear shunts or lane changing incidents. The length of the queue can also have serious safety implications on the M4.

Overall, the M4 Junction 17 scheme will aim to make the junction safer and more efficient and to provide smoother traffic flows for motorists entering and exiting the M4. The scheme will also improve overall reliability by helping to reduce collisions and time delays at the junction. This could help alleviate future congestion from proposed developments, and provide confidence in the network for further development in the area given the impact on journey times and reliability.

Economic case

The potential impacts of the M4 Junction 17 scheme have been assessed in the following ways:

- Using a LinSig highway junction model to determine the impact of the scheme on the highway network
- Desktop studies to perform environmental screening and assessment
- Analysing socio-economic factors and collision statistics to determine the social and distributional impacts

The economic case has been prepared in a manner which is considered to be proportionate to the scheme investment cost of £1.460 million. Monetised benefits have been estimated using a junction model and bespoke spreadsheet modelling, consistent with WebTAG principles.

For each of the seven environmental aspects, an appraisal of the scheme has been undertaken to identify whether significant beneficial or adverse environmental effects are likely to arise. There is one nationally designated site within the footprint of the works area, (Stanton St Quintin Quarry and Motorway Cutting SSSI), crosses both carriageways of the main M4 and extends over the soft estate in the centre of the junction at to the east of the junction. This is a Geological SSSI and therefore liable to damage from any engineering works in the vicinity, including from vibration, drilling, disturbance to soil etc. Discussion has been held with Natural England and an assent for work has been granted.

Within the study period of 2011 to 2015, 47 collisions occurred in or nearby the junction, with significant clustering occurring at both the M4 westbound and eastbound off slips. In providing signals where these two collision clusters occur, it is suggested that some of these accidents will be avoided due to the clear indication to vehicles of when they can expect to be stopping or going. This reduction in the frequency of accidents that occur will have some economic benefit due to the social, damage, legal and administrative costs, and fewer instances of off slip lanes being shutdown to clear or resolve a collision.

Appraisal scheme costs

A robust approach to the estimation of scheme costs has been developed by the scheme designers and is based on benchmarked construction values from recent schemes. An £0.117 million risk allowance has been added, along with a 3% optimism bias allowance.

The total costs, once converted to 2010 market prices and values using the default rates included in TUBA, and discounted to 2010, produce a PVC of investment of £1.11 million PV.

Value for Money

The economic benefits of the M4 Junction 17 scheme are shown to far outweigh its costs and any negative impacts. The scheme has an Initial **BCR of 12.50** suggesting a ***Very High Value for Money***.

It is clear that using the partial signalisation scheme road users will experience significant benefits compared to the Do Minimum case. Most importantly, journey times will be reduced for users of the M4 eastbound off-slip in the AM peak period (in 2026 the average delay per pcu across the junction will

reduce from 331 seconds to 122 seconds) and the M4 westbound off-slip in the PM peak period (in 2026 the average delay across the junction will reduce from 301 seconds to 37 seconds).

The findings of the qualitative assessments are not considered to be significant enough to warrant any increase or decrease in the Value for Money category of the scheme. The slight adverse environmental impacts that have been identified are for landscape and ecology/biodiversity. They will be mitigated where possible, with the potential to reduce the impacts to neutral. The scheme also offers slight beneficial impacts in relation to local air quality and greenhouse gas emissions and beneficial social impacts regarding accidents.

Assessment Type	Partial signalisation	Detail
Present Value of Benefits (PVB)	£13.87 million PV	2010 prices, discounted to 2010 in line with DfT guidance.
Present Value of Costs (PVC)	£1.11 million PV	2010 prices, discounted to 2010. Includes Optimism Bias at 3%.
Net Present Value (NPV)	£12.76 million PV	The NPV indicates by how much the benefits of a scheme exceed the costs. This NPV is for the 'initial BCR'.
BCR	12.50	Not adjusted for other non-monetised impacts due to proportionate approach adopted for small scale schemes
Qualitative Assessment	Slight Adverse	Most impacts are neutral although there is potential Slight Adverse impact to biodiversity and landscape (which have the potential to be mitigated), and Slight Beneficial impact to Air Quality.
Key Risks, Sensitivities	£0.117 million PV	Key risks identified include cost increase due to necessary design changes during construction. To cater for this and other eventualities, a risk budget has been included in scheme costs. This is equivalent to approximately 13% of construction costs
VfM Category	Very High	Monetised assessments suggest that the VfM category should be Very High for the proposed scheme.

Sensitivity tests undertaken as part of the Economic Case demonstrate that:

- Scheme economic performance is greatly reduced under a scenario in which there are lower levels of background traffic growth compared to the Core Scenario. However, the BCR remains in the High Value for Money category.
- In a High growth scenario, the BCR of the scheme is doubled. However, the level of background growth assumed in that scenario is very high and compromises the operation of the junction, with impacts on the A350 and A249 leading to very high forecast do Minimum levels of delay. It is unlikely that that level of growth and the associated forecast Do Minimum conditions would occur, drivers would instead respond by retiming or rerouting their journey
- The scheme BCR is shown to reduce in scenarios where the predicted level of housing growth within Chippenham is not met, where the estimated benefits are reduced by 33%, or where scheme costs increase by 33%. However, in each case the BCR remains above 8.

Financial case

The total scheme outturn cost, on which this Business Case for funding is based, is £1.460 million including inflation and risk but excluding optimism bias. This is based on:

- £0.185 million of preparation costs
- £0.236 million for preliminaries (including site setup and traffic management)
- £0.693 for construction
- £0.200 supervision and other works
- £0.117 million for quantified risk budget
- £0.029 million for inflation

The funding package for the scheme is made up of:

- £0.500 million of funding from the Local Growth Fund
- £0.960 million of funding from Local contribution (including sunk costs)

Commercial case

The lead client on this project is Wiltshire Council. The work to deliver the scheme was offered to participants either individually, or in a package alongside the A350 Section 3 Chippenham Bypass Improvement Scheme. Following tender assessment, the preferred contractor will be appointed to deliver both schemes.

The successful tender the contractor provided a method statement in the eventuality of being awarded the combined contract, highlighting how their structure generating efficiencies and streamlining between contracts:

- Individual delivery teams have been identified
- Experienced resources are available to work within both teams
- The delivery teams will report to the same Core Management Team and Project Board

The total procurement value of the two schemes is £6.665 million, of which £0.958 million (outturn prices for construction and preliminaries elements only) for M4 Junction 17. However, costs which are currently included in the risk budget may be transferred across into the construction costs as the scheme is developed, leading to an increase in the actual value to be procured. The procurement process was run in strict accordance with the legislative framework set out within the Wiltshire Council Corporate Procurement Strategy (2012).

Wiltshire Council has selected the NEC3 Engineering and Construction Contract (ECC), Option B re-measurement priced contract with bill of quantities. Under Option B, Wiltshire Council has provided detailed designs and a bill of quantities, against which tenderers have provided a contract price that is built up using rates.

The main works contract (the M4 Junction 17 scheme element of the contract) is expected to be in place for 5 months (July 2017 to December 2017), with completion confirmed once the roundabout circulatory and adjoining roads are fully opened and when all traffic management (excluding the new signals) has been removed. Snagging will be undertaken by Wiltshire Council throughout construction, to maintain a list of defects and omissions in the works, ensuring that the scheme is completed to a high standard.

Wiltshire Council will meet with the contractor as frequently as is deemed necessary by the Project Manager. The contractor will provide regular progress and financial updates to Wiltshire Council, which will include updates to the project programme.

Management case

The M4 Junction 17 scheme is being procured in combination with the A350 Chippenham Bypass Improvements (Badger-Brook & Chequers) scheme. The successful contractor has provided a detailed programme of works which plan for how they will manage the construction phases of both schemes. It is expected that the construction of M4 Junction 17 will be complete by 1st December 2017. Assurances have been given by the contractor that unforeseen delays on one project will not affect the other, as two separate delivery teams have been identified.

The delivery of the M4 Junction 17 scheme will build upon experience from the local pinch-point scheme, completed by Wiltshire Council in March 2015, and the Bumpers Farm improvements, completed in February 2016. Wiltshire Council will establish a Project Board for delivering the M4 Junction 17 scheme. The Project Board will take overall responsibility for its delivery and will be formed by Council representatives that have a sufficient level of authority to act on behalf of the Council. Meetings of the Project Board would take place at least monthly, but would also be linked to key milestones, where they would consider progress through Highlight and Exception Reports, changes to the risk register, and changes to the Scheme Implementation Programme.

This FBC represents Stage 4 of the SWLEP agreed ‘business case development’ process. The SWLEP will use the FBC, combined with the tender results, to decide whether the scheme should progress to construction. Following FBC approval, Wiltshire Council will proceed to select a contractor for the commencement of construction.

Public consultation for the scheme is not planned due to the limited scale of the scheme, however the public and stakeholders will be kept abreast of the scheme milestones.

The objectives and success indicators for the M4 Junction 17 scheme are set out in the Strategic Case. Benefits resulting from reduced queue lengths, reduced journey times for M4 off slip users, personal injury accident reductions, and mitigation of future development impacts are emphasised.

Monitoring and evaluation of the scheme's impacts will occur 1 year and 5 years after the scheme is implemented. A budget of £10,000 has been established to fund the monitoring and evaluation of the scheme, specifically monitoring queue lengths and delays experienced at the junction as well as reviewing collision rates.

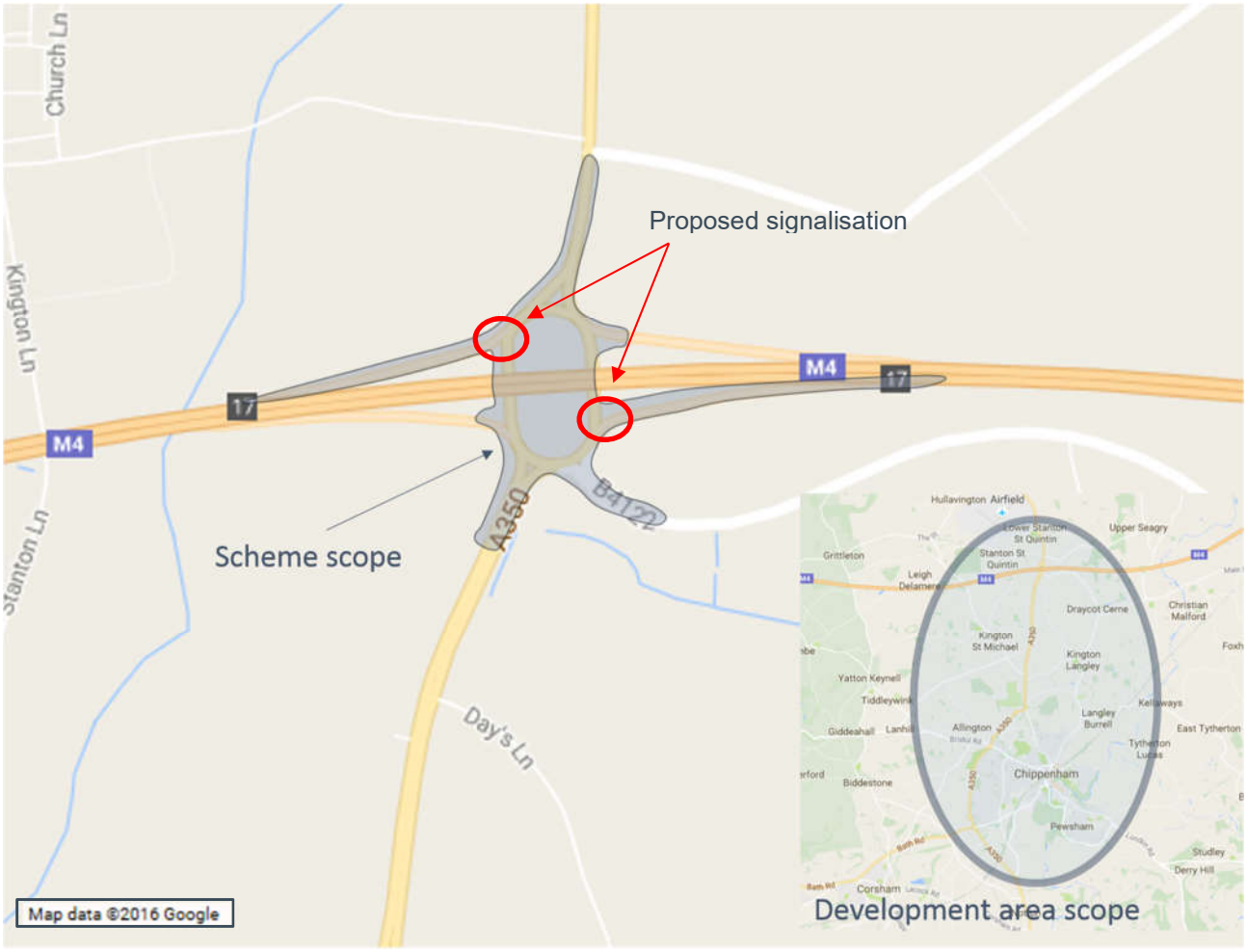
1. Introduction

M4 Junction 17 partial signalisation scheme

1.1. The M4 Junction 17 Capacity Improvement scheme (henceforth referred to as the M4 Junction 17 scheme) intends to reduce existing congestion on the M4 off-slips and prevent them from backing up onto the M4 motorway. The improvements will be focussed specifically on the west bound and east bound off slips in the AM and PM peak respectively. Without the investment required to mitigate the existing and forecast levels of congestion in Wiltshire, there is concern that the viability of the ambitious employment and residential development objectives of the area will be hampered.

1.2. The M4 Junction 17 (Figure 1-1 shows the scheme in context of the local area) is currently an un-signalised junction, and the proposed scheme seeks to introduce traffic signals onto two of the arms (the M4 off-slips in both directions) and the corresponding circulatory carriageway.

Figure 1-1 Scheme area



1.3. The M4 Junction 17 scheme will support the housing growth identified for Wiltshire across the next ten years. Over 4,500 new housing units are planned in Chippenham community area for the period between 2006 and 2026 (with approximately 1,500 already delivered). A further 26.5ha of employment sites will also be available to accommodate up to 2,600 new jobs.

1.4. Likewise, in the Malmesbury Community Area, 1200 new homes and 5 ha of new employment land (able to accommodate approximately 500 jobs) are planned within the same period.

1.5. Finally, Dyson is planning further expansion on its facilities in Malmesbury, which is anticipated to add 3,000 new engineering jobs, causing even more pressure at M4 Junction 17.

1.6. The M4 Junction 17 scheme is predicted to generate significant journey time savings for the off slip users, reduce the number of collisions and accidents at the junction, and improve reliability on the network. The appraisal of the M4 Junction 17 scheme's Value for Money will therefore focus on the following objectives:

Table 1-1 Key objectives of the scheme

	Key objectives of the M4 Junction 17 Capacity Improvement Scheme
1	Reduce instances of queues occurring on the M4 mainline
2	Minimise delays at the junction, specifically on the M4 off-slip EB in AM peak and M4 off-slip WB in PM peak
3	Reduce the total amount of collisions and accidents that occur at the junction.
4	Improve the capacity of the junction to deal with congestion impacts of future development

Background to the Business Case

1.7. A Local Growth Fund Prioritisation Pro-forma for the M4 Junction 17 was prepared by Wiltshire Council in January 2014. Following approval, the M4 Junction 17 scheme was included in the Swindon and Wiltshire Strategic Economic Plan2 (SWSEP) submitted by the Swindon and Wiltshire Local Enterprise Partnership (SWLEP) in March 2014. An Outline Business Case (OBC) was submitted in October 2017, and was recommended for approval by the SWLEP board in November 2017 upon condition of a Full Business Case (FBC) being submitted.

1.8. The FBC stage represents Stage 4 of the SWLEP scheme assessment and approval process, as set out in Part Five of the SWLEP Assurance Framework[3]. In July 2014, a scope of works[4] (included in Annex A and following a proportionate approach) for completion of the FBC was presented for the M4 Junction 17 scheme, and was approved by the Swindon and Wiltshire Local Transport Body (SWLTB) at the October 2014 meeting.

1.9. The proportionate approach indicated that a separate Appraisal Specification Report (ASR) would not be required due to the low cost of the scheme. However, Wiltshire have considered it good practice to produce an ASR to ensure that agreement on modelling approach could be reached with the SWLEP's independent technical reviewers (Systra consultants) and Highways England (a key stakeholder on whose network the scheme will be implemented).

The scheme

1.10. The scheme is intended to reduce traffic problems experienced and observed at the M4 Junction 17 roundabout and is being promoted by Wiltshire Council.

1.11. This scheme has been considered several times, and various options have progressed to modelling assessment. In the early stages of development, the M4 Junction 17 scheme was originally conceived to involve full signalisation of all arms on the junction, whilst other options were considered for high cost/low cost scenarios. These studies therefore looked at three options:

- Full signalisation of the roundabout

[2] SWLEP SEP
[3] 'SWLEP Assurance Framework', April 2017
[4] Appendix 2 M4 Junction 17 FBC five cases scope of works.pdf

- Full signalisation of the roundabout plus widening eastbound off-slip
- Partial signalisation of the roundabout (M4 off-slips only)

1.12. Conclusions of previous studies determined that the first two proposals were both more expensive than, and not as successful in reducing traffic problems as, the third option of partial signalisation (further detailed in the detailed design drawings in Appendix A). The two higher cost options were then discarded. What was the 'low-cost alternative' was taken forwards into the Business Case for the scheme.

1.13. The partial signalisation of the roundabout will introduce traffic signals onto two of the arms (the M4 off slips in both directions) and the corresponding circulatory carriageway.

Purpose of this document

1.14. This document and its appendices form the FBC for improvements to Junction 17 of the M4. This FBC represents Stage 4 of the SWLEP agreed 'business case development' process. The SWLEP will use the FBC to decide whether to agree to Wiltshire Council's procurement of a contractor for commencement of construction of the scheme.

Structure of the document

1.15. This FBC is structured around the DfT's recommended five cases model for a Transport Business Case:

- **Strategic Case** (Section 2), setting out a clear rationale for M4 Junction 17 improvements, the need for investment in this location, and the scheme options under consideration.
- **Economic Case** (Section 3), identifying the key economic, environmental and social impacts of the scheme and its overall value for money.
- **Financial Case** (Section 4), presenting evidence of the scheme's affordability both now (for the construction phase) and in terms of ongoing revenue liabilities. This section includes scheme outturn cost details.
- **Commercial Case** (Section 5), summarising the preferred approach to scheme procurement and justifying the commercial and legal viability of such an approach.
- **Management Case** (Section 6), setting out how Wiltshire Council will ensure that the scheme is delivered successfully – on time and to budget, with suitable governance and risk management processes in place.

2. The strategic case

Overview

2.1. This section of the business case describes the Strategic Case for the M4 Junction 17 improvements and highlights the importance of these proposed improvements to maintaining a safe and efficient junction that serves Wiltshire County and the broader region. The Strategic Case will also demonstrate 'strategic fit' which shows how this investment will further the aims and objectives of Wiltshire Council, the Swindon and Wiltshire Local Enterprise Partnership (SWLEP) and the Department for Transport.

2.2. The Strategic Case includes the following elements[4]:

- Identification of the problems the scheme will be addressing – including evidence of the extent of the problems, specific barriers / challenges, and how the scheme will overcome them (including the scale of impact)
- Details (and supporting evidence) of the impacts of not progressing the scheme
- A list of specific, measurable, achievable, realistic, time-bound (SMART) objectives for the scheme to address the problems identified
- A description of the key components of the scheme and how it fits with the aims and objectives of Wiltshire Council, Highways England, the SWLEP and the Department for Transport. The local growth agenda will be central to this part of the Strategic Case
- Clarification of what the project is expected to deliver on the ground, including what is in-scope and what is out of scope
- Identification of any high-level constraints affecting the scheme's ability to solve the problems identified
- Identification of any related assumptions or factors (interdependencies) upon which the scheme depends to be successful
- Details of the main stakeholder groups and their contribution to the project - any potential conflicts between different stakeholder groups and their demands will need to be identified
- A description of the scheme options being considered, including the reasons for any options being discounted (the approved scope of works states that a separate Options Assessment Report is not required)

Problems identified and impact of not changing

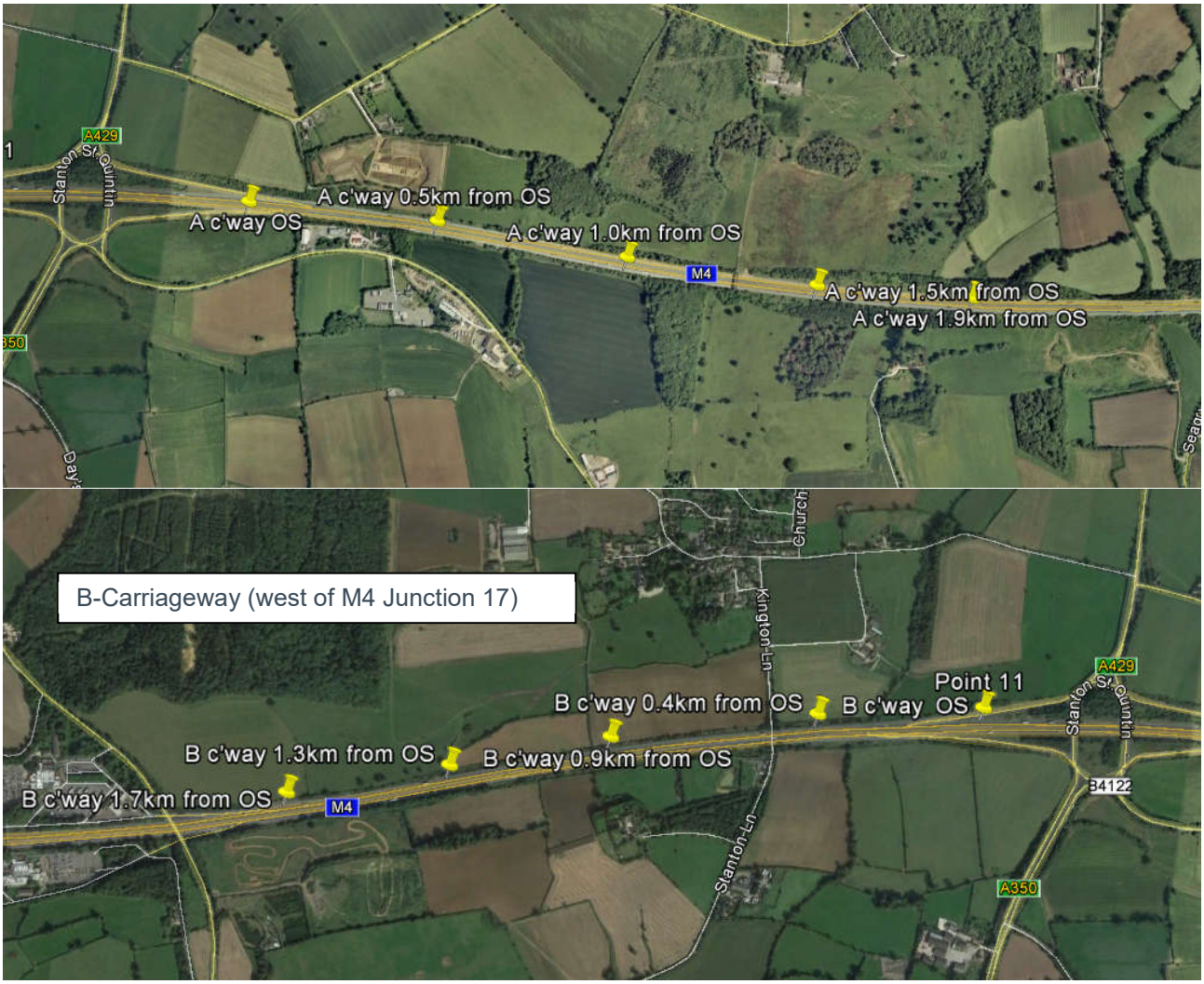
Queuing

2.3. Observations of the current junction conclude that many of the incoming links are already near or at capacity, with queues commonly filling the M4 off-slips and onto the M4 mainline. With significant growth in the area planned, it is highly likely that traffic on the M4 off-slips would regularly exceed queueing capacity at Junction 17 in peak hours, thus dramatically increasing delay. The queueing follows a tidal pattern:

- During the AM peak on the eastbound slip road - caused by the volume of traffic circulating on the roundabout reducing opportunities for waiting traffic to enter the junction
- During the PM peak on the westbound slip - also caused by the traffic on the junction's circulatory part

2.4. Analysis of the queuing issues at M4 Junction 17 has been undertaken through interrogation of MIDAS traffic data provided from Highways England Halogen Data Services. MIDAS outstations (detection loops) are permanently installed at approximately 400m to 500m intervals along the motorway network. Figure 2-1 shows the locations of the MIDAS outstations to the east and west of M4 Junction 17.

Figure 2-1 MIDAS outstations in the vicinity of M4 Junction 17



2.5. Detailed MIDAS traffic data contains lane-specific, minute averaged, speed, flow and occupancy data at the location of each MIDAS outstation. By analysing the measured occupancies of the MIDAS loops upstream of each off-slip it is possible to determine if a queue extended back to a particular location on the mainline and for how long that queue existed. A threshold occupancy of 15% suggests conditions where a queue is present.

2.6. Data for one week in November 2016 (Monday 7th to Friday 11th) was selected for analysis.

2.7. Table 2-1 presents the analysis of the A-Carriageway (westbound) outstation data for the PM peak hours during the week. The analysis indicates long queuing periods on the westbound off-slip during PM peak, with queues regularly extended onto the mainline M4 carriageway. During the week queuing on the westbound off-slip was common for between 1-2 hours on all days. From Tuesday to Thursday queues were recorded exceeding a distance of 1.9km from the off-slip for between 20 and 75 minutes.

Table 2-1 Queue duration summary for westbound carriageway in PM peak

Westbound (A) carriageway	Queue start time	Queue end time	Queue duration
Monday			
Offslip	17:10	18:10	01:00
N/S lane 0.5km from OS	17:35	18:30	00:55
N/S lane 1km from OS			
N/S lane 1.4km from OS			
N/S lane 1.9km from OS			
Tuesday			
Offslip	16:35	19:00	02:25
N/S lane 0.5km from OS	17:00	18:55	01:55
N/S lane 1km from OS	17:10	18:50	01:40
N/S lane 1.4km from OS	17:10	18:40	01:30
N/S lane 1.9km from OS	17:18	18:30	01:12
Wednesday			
Offslip	16:50	18:50	02:00
N/S lane 0.5km from OS	17:15	18:40	01:25
N/S lane 1km from OS	17:30	18:35	01:05
N/S lane 1.4km from OS	17:35	18:20	00:45
N/S lane 1.9km from OS	17:50	18:10	00:20
Thursday			
Offslip	17:00	18:50	01:50
N/S lane 0.5km from OS	17:05	18:45	01:40
N/S lane 1km from OS	17:10	18:40	01:30
N/S lane 1.4km from OS	17:20	18:35	01:15
N/S lane 1.9km from OS	17:50	18:30	00:40
Friday			
Offslip	16:40	17:50	01:10
N/S lane 0.5km from OS	17:10	17:40	00:30
N/S lane 1km from OS	17:20	17:35	00:15
N/S lane 1.4km from OS			
N/S lane 1.9km from OS			

2.8. Table 2-2 presents the analysis of the B-Carriageway (eastbound) outstation data for the AM peak hours during the week. Queuing on the off-slip is noted for up to 85 minutes during the morning peak, with queues again showing to extend onto the mainline. On two of the five days, queueing which reached 0.9km from the off-slip was recorded for over 40 minutes.

Table 2-2 Queue duration summary for eastbound carriageway in AM peak

Eastbound (B) carriageway	Queue start time	Queue end time	Queue duration
Monday			
Offslip	07:30	08:00	00:30
N/S lane 0.4km from OS	07:35	07:45	00:10
N/S lane 0.9km from OS	07:30	07:45	00:15
N/S lane 1.3km from OS			
N/S lane 1.7km from OS			
Tuesday			
Offslip	07:20	08:45	01:25
N/S lane 0.4km from OS	07:30	08:25	00:55
N/S lane 0.9km from OS	07:30	08:10	00:40
N/S lane 1.3km from OS			
N/S lane 1.7km from OS			
Wednesday			
Offslip	07:20	08:20	01:00
N/S lane 0.4km from OS	07:20	08:00	00:40
N/S lane 0.9km from OS	07:25	07:35	00:10
N/S lane 1.3km from OS			
N/S lane 1.7km from OS			
Thursday			
Offslip	07:20	08:40	01:20
N/S lane 0.4km from OS	07:30	08:25	00:55
N/S lane 0.9km from OS	07:30	08:25	00:55
N/S lane 1.3km from OS			
N/S lane 1.7km from OS			
Friday			
Offslip	07:25	08:10	00:45
N/S lane 0.4km from OS	No data	no data	
N/S lane 0.9km from OS	07:40	08:00	00:20
N/S lane 1.3km from OS			
N/S lane 1.7km from OS			

Delay and reliability

2.9. TRIS data from Highways England[5] has been analysed for investigating the reliability of the westbound and eastbound M4 off-slips. Journey times and traffic flow data have been analysed for the peak AM (08:00-09:00) and peak PM (17:00-18:00) hours of 212 days (normal weekdays between April 2015 and June 2016), in order to examine the day-to-day travel time reliability.

2.10. This analysis has been used to determine the Planning Time Index (PTI) for the M4 off-slips. PTI is a method of determining the predictability of travel times which aims to measure the additional time (compared to free flow conditions) that drivers need to leave between junctions to ensure that

[5] http://tris.highwaysengland.co.uk/

they arrive on time. This measure is the ratio of the 95th percentile travel time to the free flow travel time (25th percentile).

2.11. Table 2-3 summarises the PTI on the M4 off-slips (but not including additional time due to queueing on the mainline). Travel times on the off-slips during peak hours are shown to be up to six times that of non-peak hours

Table 2-3 Planning Time Index derived from TRIS data

Junction Arm	Time period	25th percentile travel time (sec)	95th percentile travel time (sec)	Planning Time Index
Eastbound exit	AM Peak	22.4	144.1	6.4
	PM Peak	20.2	55.4	2.7
Westbound exit	AM Peak	23.9	40.7	1.7
	PM Peak	38.5	168.9	4.4

Safety

2.12. From 2011 to 2015 there were a total of 47 collisions associated with Junction 17. Figure 2-2 shows an overview of these collisions.

Figure 2-2 M4 Junction 17 collisons occuring between 2011 and 2015

2.13. Figure 2-3 and Figure 2-4 show the two notable collision hotspots at the junction – the conflict points of the eastbound and westbound M4 off-slips with the circulatory carriageway.

Figure 2-3 M4 east bound (EB) off-slip cluster

Figure 2-4 M4 west bound (WB) off-slip cluster

2.14. The majority of the collisions recorded at the hotspots are rear-end shunts and are the result of vehicles failing to stop. It is likely this is due to drivers believing the vehicle in front of them was going to enter the junction, when instead they braked sharply to avoid another vehicle already inside the junction. Additionally, collisions further down the off slips occur due to the lengthy queue backing up and creating a situation where the unexpected braking at the junction has a ripple effect down the entire off-slip. This miscommunication between drivers could be greatly mitigated by the presence of a traffic signal which clearly indicates when all vehicles should be preparing to go or stop.

2.15. In addition to the monetary damage and physical injuries that occur from these collisions, there are significant issues associated with lanes being shut down whilst collisions are resolved and any clean up required occurs. This in turn puts even greater strain on the network and can greatly increase queue lengths and journey time delays and reduce journey time reliability.

Impact of not changing

2.16. As growth and development takes place, more traffic volume is expected to be generated in the local network as well as at M4 Junction 17. The lack of an intervention will most likely result in increased congestion in the junction as well as on its arms.

2.17. Under the existing arrangement, overall junction delay is expected to reach 317.4 PCU-hrs in the AM peak and 142.2 PCU-hrs in the PM peak for the forecast year 2026.

2.18. These journey time delays represent a significant issue at the junction. The delays mean that more time is lost in peoples commute and overall, users experience longer, lower quality, and dangerous journeys.

2.19. In the case of the PM peak time, the length of the queue on the westbound off slip affects safety not only at Junction 17 but also on the M4. As flows increase and the occurrence of queueing on the mainline rises in future years, collisions may occur more frequently due to rear hits or lane changing incidents leading to serious safety implications for the M4.

Business strategy

2.20. Wiltshire Council, promoting authority for the scheme, has key local policies for spatial planning and transport that guide decisions on transport infrastructure investment. These local policies are the Wiltshire Local Transport Plan 2011-2026 (LTP3) and the adopted Wiltshire Core Strategy which includes the Chippenham Area Strategy and the Chippenham Transport Strategy. Any scheme that addresses the identified problems on the A350 Chippenham corridor (one of the major north-south primary routes through Wiltshire which meets the M4 at J17) must align with these policies, the relevant aspects of which are presented below.

2.21. Additionally, with the M4 being operated and maintained by Highways England, it is important that the proposed scheme matches their goals and objectives, as outlined by the Highways England 2015-2020 Strategic Business and Delivery Plan.

2.22. Likewise, the scheme is located near the Stanton St. Quintin Quarry & Motorway Cutting Site of Special Scientific Interest (SSSI) and so Natural England, as the Governments adviser for the natural environment and authority with respect to SSSI's must also be consulted.

2.23. Finally, schemes promoted by Wiltshire Council also need to support the economic growth aspirations of the Strategic Economic Plan (SEP), prepared by the SWLEP.

Strategic Economic Plan

2.24. The SEP sets out the vision and charts out the measures that will need to be taken to secure economic growth and accelerate employment and housing delivery across Swindon and Wiltshire. The SEP focuses on enabling economic growth in three core geographic areas: Swindon; A350 Corridor; and South Wiltshire. To support SEP development, work was undertaken to set out how Wiltshire's transport system should be developed through to 2026.

2.25. Following the initial report in 2014, a revised SEP was submitted to Government in January 2016 and contains a strong emphasis on growth along the A350 corridor, with supporting transport infrastructure investment. A particular focus of the SEP is on a number of transport improvements along the A350 which facilitate economic growth through addressing capacity constraints, congestion and journey time reliability on this strategic route.

2.26. The SEP identifies the necessity for Swindon and Wiltshire to utilise the connections with the M4 corridor to achieve future growth and draw in investment from Bristol and Bath to the west, Swindon, Reading and London to the east. M4 Junction 17 connects north Wiltshire with the M4 however, planned growth and development in north Wiltshire, especially at Chippenham, will increase pressure on the junction. Improvements to Junction 17 would mitigate this pressure by reducing queues on the approach slip roads which can impact the operation of the main M4 carriageway. In turn, this will support economic development in both the M4 and A350 corridors by improving journey times and reliability from the M4 onto the A350 corridor. Furthermore, improvements to the junction would help facilitate/enable access to new employment sites along the A350 corridor.

Wiltshire Local Transport Plan 2011-2026

2.27. The overarching LTP3 vision is 'to develop a transport system which helps support economic growth across Wiltshire's communities, giving choice and opportunity for people to access essential services' and to improve the quality of life and a healthy natural environment. Specific relevant strategic transport objectives from the LTP include:

- SO1 – to support and help improve the vitality, viability and resilience of Wiltshire's economy and market towns
- SO4 – to minimise traffic delays and disruption and improve journey time reliability on key routes
- SO6 – to make the best use of the existing infrastructure through effective design, management and maintenance
- SO8 – improve safety for all road users and reduce the number of casualties on Wiltshire's roads
- SO10 – to encourage the efficient and sustainable distribution of freight in Wiltshire
- SO12 – to support planned growth in Wiltshire

2.28. The proposed M4 Junction 17 capacity improvement aligns both with the economic growth aspect of the objectives and with safety being improved. Further to this, whilst 'high' transport investment priorities for Wiltshire Council centre around sustainable transport packages, 'medium' transport investment priorities for the LTP3 period include congestion management and local safety schemes - both issues would be addressed by the M4 Junction 17 scheme.

Natural England

2.29. Given the proximity of the M4 Junction 17 scheme to a Site of Special Scientific Interest (SSSI), it is important to include Natural England as a key stakeholder and statutory consultee. The Wildlife and Countryside Act of 1981 details in section 28 the legislation surrounding SSSI and the need to acquire consent from natural England if a scheme is located within or close to an SSSI.

Highways England Strategic Business Plan

2.30. The Highways England Strategic Business Plan 2015-2020 outlines the primary strategic outcomes the company hopes to achieve with their network and any schemes affecting it.

2.31. Highways England have identified 8 key performance specifications of which 6 are pertinent to the M4 Junction 17 scheme. Table 2-4 examines the links between the KPIs and how the M4 Junction 17 scheme could help to support achieving these KPIs.

Table 2-4 Highways England KPIS

Highways England KPI	M4 J17 potential outcomes
Making the network safer	Reduction in shunt collisions on slip roads
Improving user satisfaction	Reduction in delay
Supporting the smooth flow of traffic	Reduction in queue lengths
Encouraging economic growth	Increased capacity at the junction
Achieving real efficiency	Economic benefits from reduction in delay
Keeping the network in good condition	Inclusion of maintenance and upgrading in scheme cost

2.32. Overall, the M4 Junction 17 scheme will aim to make the roadway safer, more efficient, provide smoother traffic flows for motorists entering and exiting the M4, and improve overall user satisfaction by helping to reduce collisions and time delays at the junction. This in turn could help alleviate potential future congestion from proposed developments and help attract new developments to the area given the impact on journey times.

Internal drivers for change

2.33. Improvements to the M4 corridor in Wiltshire and Swindon represent an opportunity to build on the concentration of research and development and communications industries in the area to reinvigorate the corridor's reputation. There are major opportunities to attract new investment around the main junctions and in the nearby towns of Swindon, Chippenham, Corsham, Malmesbury and Royal Wootton Bassett. Demand is driven in part by businesses looking to move

along the M4 from London searching for more space, relatively lower costs and the benefits of good strategic transport links.

2.34. There are several future housing and employment developments currently proposed in the Core Strategy for the Chippenham and Malmesbury area. Over the plan period 2006 – 2026 in Chippenham Community Area 4,695 new homes will be provided as well as 26.5 ha of employment land (able to accommodate approximately 2600 jobs). A portion of this development plan has already been completed, 972 new homes were built in Chippenham between 2006 and 2011 and approximately 480 more have been built since then.

2.35. Other local employment expansion is anticipated at Dyson in Malmesbury, Cooper Tyres in Melksham and IXYS UK in Chippenham. Furthermore, in the area north of Chippenham where the A350 meets the M4, there is the potential for a number of sites for new employment facilities to be developed, although all of these developments are uncertain.

2.36. The priority is to deliver significant job growth at the strategic employment sites to help improve the self-containment within the main settlements by providing more, high quality jobs for local people. Accelerating the provision of employment growth in Chippenham is a key focus in securing the future economic prosperity of the town in the manufacturing and service sectors, including ICT and logistics.

2.37. Planned growth and development in north Wiltshire, especially at the 'principal' settlement of Chippenham, will increase pressure on the M4 Junction 17. Junction improvements would mitigate this pressure by reducing queues on the approach slip roads which are also forecast to impact on the operation of the main M4 carriageway. In turn, this will support economic development in the M4 and A350 corridors by improving journey times and reliability from the M4 onto the A350 corridor with its population of approximately 200,000. Improvements to the junction would also help enable access to a potential 28ha employment site (for a major regional distribution facility), and support the delivery of further employment land.

2.38. The scheme would also link into several local highway improvements from M4 Junction 17 along the A350 Chippenham Bypass (recently delivered or planned for delivery) which will facilitate and support the delivery of 26ha of new employment land, around 3,000 new jobs and 4,000 new homes in Chippenham.

2.39. By improving accessibility and attractiveness to employers, the M4 Junction 17 improvement could also enhance the M4's "corridor role" for encouraging strategic employment sites in Chippenham and Malmesbury (Dyson).

2.40. At a more strategic level, the A350 is considered as a key artery for the economic development of Wiltshire. The A350 is linked with the M4 through Junction 17, allowing transport flows (passenger and freight) access to the area. Junction 17 is also the linking point of A429 with A350 and M4 respectively which also provides the necessary accessibility to Malmesbury. Wiltshire Council's growth program considers the A350 as a critical element of unlocking local growth and development. Considering all the planned and envisioned improvements throughout the whole A350 as well as the role of Junction 17 as the main entry/exit point of A350, it is of critical interest that the junction should be able to serve the current as well as the area's forecasted transport flows.

2.41. In 2016 Wiltshire Council, Dorset County Council and Bath and North East Somerset Council commissioned a study into the limitations on economic development caused by the constraints on north-south corridors in the region. The final report (January 2017) has highlighted that the A350 faces problems which are likely to cause constraints to economic growth including limited highway capacity and journey time reliability. The report summarises that improvements to connectivity along the A350 corridor will:

- Enhance **economic performance** of the region (agglomeration benefits)
- Unlock new **housing** developments
- Increase land values

- Benefit **commercial traffic** and trade connectivity between the north and south coast
- Provide benefits for **commercial vehicle traffic** (including long-distance commercial traffic), and for specific sectors such as tourism
- Help **close the 'productivity gap'** regarding Wiltshire, by enhancing agglomeration economies in the area

Objectives

2.42. In order to solve the issues identified above, four SMART (Specific, Measurable, Achievable/Realistic, and Time-bound) objectives have been identified for the M4 Junction 17 scheme and are shown in Table 2-5.

2.43. Objectives 1, 2, and 3 are achieved in the immediate-to-short term of the scheme opening and deal with existing issues at the junction. Objective 4 on the other hand concerns itself with the future condition of the junction specifically that under our do-minimum scenario, anticipated population and housing growth in the area exacerbates issues at the junction and results in major capacity issues. This is to be monitored 5 years after the completion of the scheme to determine if capacity improvements under the partial signalisation scheme appropriately address actual housing and population growth in the area.

Table 2-5 Scheme objectives

Specific	Measurable	Agreed upon	Realistic	Time bound
Reduce instances of queues occurring on the M4 mainline	Using data from MIDAS loops to determine average speeds on the inside lanes on the M4 mainline. The presence of queues on the mainline should reduce by 75% in the first year of the scheme	Fits the LTP3 and Highways England desires to prevent safety issues on the junction and slip roads whilst also better utilising the existing infrastructure	Achieved by the proposed partial signalisation of the junction. Modelling data suggests the impact can be achieved.	To be realised immediately upon completion of construction. Monitoring and evaluation to occur 1 year following scheme implementation and 5 years after scheme implementation
Minimise delays at the junction, specifically on the M4 off-slip EB in AM peak and M4 off-slip WB in PM peak	Utilising travel time and delay data from Highways England data the standard deviation of journey times should have reduced to half of their 2016 values one year after scheme opening	Improves user experience and minimises journey time delays as desired in the LTP3 and by Highways England	Achieved by the proposed partial signalisation of the junction. Modelling data suggests the impact can be achieved.	To be realised immediately upon completion of construction. Monitoring and evaluation to occur 1 year following scheme implementation and 5 years after scheme implementation
Reduce the total amount of collisions and accidents that occur at the junction.	Absolute reduction in personal injury accidents, comparing 2018-2023 to 2011-2015	Advances the safety goals from the LTP3 and Highways England on the junction and slip roads.	In looking at the current accident data many collisions appear to be shunts which are typical of priority roundabouts. Partial signalisation of	To be realised immediately upon completion of construction. Monitoring and evaluation to occur 1 year following scheme implementation and 5 years after

			roundabout should mitigate this.	scheme implementation
Improve the capacity of the junction to facilitate future development	Absolute increase in peak hour stopline throughput at junction entries comparing pre and one-year post construction flows.	Supports the goals of the SEP, LTP3, and Highways England to promote economic growth in the area by increasing capacity and reliability of journey times at the junction	Takes into account the forecasted employment and housing in the area as well as the approved and proposed developments.	To be realised immediately upon completion of construction. Monitoring and evaluation to occur 5 years after scheme implementation as this will be dependent on future growth in the area.

Scope

2.44. The proposed scheme comprises of partial signalisation on the M4 Junction 17 roundabout servicing the A350 and B4122 to the south and the A429 to the north. Improvements elsewhere on the A350, A429, B4122 or the M4 are not included as part of this FBC.

2.45. The partial signalisation scheme will consist of introducing traffic signals onto two of the arms at the junction and the corresponding conflicting circulatory movements. Specifically, where the M4 off-slips in both the east and west bound directions meet Junction 17.

2.46. Through the specific link capacity improvement resulting from signalisation the scheme is expected to facilitate the future flows generated by planned developments as well as to increase the level of safety of the junction and M4.

2.47. The suggested improvement in the junction's capacity will affect the traffic on the surrounding local network as well as support the M4's safe and free flow operation. Therefore, the geographical area of the scheme impact is the area north of Chippenham, the area south of Malmesbury and the M4 in a radius of one mile from the junction. Junction 17's improved operation will contribute to the accessibility of Chippenham and Malmesbury, helping to facilitate the urban expansion of both settlements. In addition, the specific scheme and associated accessibility improvements can be considered as a further enabler for the expansion of several companies located in the area (especially in Malmesbury).

2.48. The geographical area of the scheme impact is the M4 Junction 17 roundabout and the immediate vicinity as shown in

2.49. Figure 2-5. Scheme impacts are expected to be of benefit particularly to the Chippenham area.

Figure 2-5 Scheme area

Constraints

2.50. A Site of Special Scientific Interest (SSSI) exists along the westbound slip road. The existence of this site restricts any digging process that may be required and needs careful consideration during the options design process.

Inter-dependencies

2.51. With significant housing and employment development planned for Chippenham and Malmesbury in the coming years, a considerable opportunity exists to deliver transport improvements which maximise the potential for economic growth in the area. The developments should act as a catalyst to addressing existing transport issues before capacity is further exceeded.

2.52. As described in paragraph 2.34, the Chippenham Area has been the focus of a significant amount of residential development planning. These development proposals will have a significant influence on the function of the M4 Junction 17 as a 33% increase in households (within the Chippenham urban area) is expected to push the junction well past its current capacity. The level of completion of these residential developments is therefore a key contributor to the final success of the proposed improvement scheme.

2.53. The M4 Junction 17 scheme is being procured in combination with the A350 Chippenham Bypass Improvements (Badger-Brook & Chequers) scheme. The successful contractor has provided a detailed programme of works which plan for how they will manage the construction phases of both schemes. It is expected that the construction of M4 Junction 17 will be complete by December 2017. Assurances have been given by the contractor that unforeseen delays on one project will not affect the other, as two separate delivery teams have been identified.

Stakeholders

2.54. Wiltshire Council are leading the development of improvement works to the M4 Junction 17 roundabout to reduce traffic problems. There are many interested parties in this project, many of whom have an active part in the delivery process.

2.55. Highways England are the landowners of all land which will be affected by the scheme and so are inherently a key stakeholder in the works. Not only are Highways England concerned with the

requirement for the works, but also important to Highways England is the quality of the works and their effectiveness, and the long-term operation and maintenance of the proposed signals. Highway England have provided Wiltshire Council with £880,000 to be ring-fenced for the scheme.

2.56. Natural England is the environmental adviser to the Government and acting authority over Sites of Special Scientific Interest (SSSIs). Due to proximity of scheme to SSSI, Natural England will be a statutory consultee and will be involved to ensure scheme will not negatively impact the site.

2.57. Operation and maintenance of the signals along the M4 is carried out by Highways England term contractor, and this will also be the case for the proposals at Junction 17. Consultation with these parties has been undertaken throughout the detailed design stage. Any design changes suggested by the contractors will also been to be approved by both Highways England and Skanska to ensure that they meet their standards and operation requirements.

2.58. The Swindon and Wiltshire Local Economic Partnership (SWLEP) have a significant role in the delivery process, notably in the funding of the scheme. A sum of £500,000 taken from the Local Growth Fund, has been allocated by SWLEP for this project.

2.59. As there are no dwellings in the immediate vicinity of the junction there has been no need to engage with home-owners. Whilst there has been no public consultation due to the small scale of the scheme, the contractor will develop a Communications and Customer Care Plan which includes contact details of identified landowners and local businesses directly to keep them informed of the scheme construction. The contractor will also include a project specific page on their company website and promote details of the scheme through social media.

2.60. The scheme was presented to the Member of Parliament for Chippenham (Michelle Donelan) on the 2nd February 2017, and to the Chippenham Area Board at the committee meeting on 13th March 2017. Neither of these parties who are representative of the local area and its population raised any concerns over the proposed scheme.

Options

2.61. Due to the very specific need for intervention at M4 Junction 17, and the relatively small size of investment required, a full and detailed Option Assessment Report was not deemed necessary within the scope of works agreed by the SWLEP.

2.62. Transport interventions such as improving public transport, walking and cycling or introducing demand management have not been considered by Wiltshire Council. Whilst such measures could, given enough investment, result in a small modal shift, any reduction in existing trips would be far outweighed by the predicted additional trips resulting from background and future planned growth.

2.63. It was considered that not only would a highway solution be the most successful in reducing the traffic issues at the junction, but that it could also likely be achieved for a modest financial investment.

2.64. The scheme selection process involved testing three potential arrangements at the M4 Junction 17.

- Full signalisation of the roundabout
- Full signalisation of the roundabout plus widening eastbound off-slip
- Partial signalisation of the roundabout (M4 off-slips only)

2.65. Initial testing identified that full signalisation of the roundabout (without additional measures of widening the eastbound off-slip) resulted in queue lengths on the A350 and A429 more than doubling in the AM peak hour as exiting opportunities for vehicles on these roads were reduced as result of the signals. This led to the option being discounted as a possible solution. Additionally, full signalisation and widening solved the issues of queue lengths at the M4 west bound and eastbound off slips, but created new issues within the junction itself, in some cases blocking back

into the junction and off slips themselves. Table 2-6 shows the summary of this testing.

Table 2-6 M4 Junction 17 Options Assessment

Delay (pcu-hrs)	Existing arrangement	Partial signalisation	Full signalisation	Full signalisation and widening
2026 AM	317	144	596	158
2026 PM	142	39	181	54
Outturn Cost Range	-	Up to £1m	Up to £1.5m	> £1.5m
Expected VfM	-	Very High	Poor	Medium

2.66. The best performing option was the partial signalisation. This option has therefore been chosen as the Core Scenario and the full signalisation plus widening eastbound off-slip options have been discarded. The partial signalisation is expected to have a very high value for money (VfM) due to the schemes relatively low cost and ability to deliver the desired results.

2.67. In line with a proportionate approach to the small scale of the scheme, a new low cost alternative has not been evaluated

3. The economic case

Overview

3.1. This section identifies the key economic, environmental and social impacts of the proposed scheme and presents the overall value for money. This effectively shows the extent to which the scheme's benefits outweigh its costs, whether monetised or not. The economic, environmental, social, public accounts and distributional impacts of the scheme have all been appraised following the principles contained within the DfT's transport appraisal guidance (WebTAG), in a manner which is proportionate to the total scheme cost. The scheme impacts are summarised in an Appraisal Summary Table (AST), providing a brief and consistent summary of expected qualitative, quantitative and monetised impacts.

3.2. This section contains the following elements:

- A description of how the scheme's value for money has been established and the options and scenarios that have been modelled
- Details of the key assumptions that have been made, regarding the assumed delivery of other nearby schemes or developments
- A Value for Money Statement, in line with the DfT's latest Value for Money Assessment guidance[6]
- Details of how different variables will affect the value for money assessment
- Commentary on the scheme's expected economic, environmental, social and public accounts impact
- A completed Appraisal Summary Table

3.3. An important aspect of the economic case is the Value for Money Statement. This is based on summing the monetised discounted impacts and comparing against discounted costs to establish an initial BCR, which implies an initial value for money band (poor, low, medium, high, or very high). This band is then adjusted to account for impacts where qualitative or quantitative, but not monetised, information is available.

Options appraised

3.4. In the early stages of scheme development, the M4 Junction 17 scheme was originally conceived to involve full signalisation of all arms on the junction. Throughout the subsequent two years of formulating this scheme, the (now) preferred option has always been treated as the minimum "low cost" option that could achieve the aims (i.e. reducing queuing back from the junction onto the motorway).

3.5. Through the detailed optioneering process, the "low cost" option of signalising just two of the arms was shown to provide significantly higher reductions in overall delay, and at a much-reduced anticipated cost. The optioneering therefore concluded that the "low cost option" was the best performing in terms of operation and cost-benefit analysis. In this Business Case the partial signalisation has therefore become the *core scenario*.

3.6. Consideration has been given to comparing the core scenario to a further low cost option however, it is suggested that there are no cheaper viable options. There are few, if any, minor highways remedial works which would have any observable impact on queues or delay, whilst a non-signalised highway widening scheme (trying to meet the same objective) would likely achieve less but cost more than the preferred scheme.

[6] *Value for Money Assessment: Advice Note for Local Transport Decision Makers,* DfT, December 2013

3.7. In keeping with the “proportionate” approach to scheme appraisal, this Business Case will not include the appraisal of any scheme other than the *core scenario*.

Approach to appraisal

3.8. The proposed methodology for assessing scheme value for money was set out in the Appraisal Specification Report (Appendix B) and expanded upon in Appendix C (Modelling and appraisal technical note).

3.9. The following key principles apply in the appraisal:

- 60-year economic appraisal period, for consistency with other transport scheme assessments across the UK
- 2018 and 2026 modelled forecast years include background traffic growth derived from NTEM v7.2 and include an uplift on demand generated by the adopted Chippenham Core Strategy development sites in North Chippenham, Hunters Moon, South West Chippenham and Rawlings Green. This is line with the forecasting approach from Chapter 9 of WebTAG Unit M4 (Using NTEM without a formal demand model)
- Average arm and junction delay and demand forecasts from the M4 Junction 17 LinSig model for the Do Minimum and with scheme scenarios have been imported into a bespoke economic appraisal spreadsheet. This converts the savings in journey times between Do Minimum and with scheme scenarios into monetary values following the principles of the DfT TUBA programme by applying vehicle purposes, values of time and occupancies from the DfT WebTAG Data book (Summer 2016). Impacts on vehicle operating costs were not estimated in this proportionate approach to appraisal.
- The Present Value of Benefits (PVB) over a 60-year appraisal period has then been estimated, using discount rates in line with TUBA and WebTAG
- Benefits have been monetised for the weekday AM and PM peak hours only in line from advice from the SWLEP independent reviewers
- The modelled hours were expanded to represent benefits across the year on the assumption of 253 weekdays per year

3.10. The outturn cost and the Present Value of Costs (PVC) for each option has been estimated using the following information:

- Estimated scheme outturn costs based on a bill of quantities for the preliminary design
- Quantified risk assessment
- Optimism bias allowance
- Anticipated real rates of inflation

3.11. The scheme only involves works entirely within the existing highway boundary; the need for extensive environmental sub-impact assessments is therefore reduced.

3.12. The main focus of scheme appraisal is therefore on the economic benefits, particularly the delay at the junction.

Appraisal assumptions

3.13. Two forecast years have been prepared to reflect likely future development scenarios for Chippenham. These are based on the adopted Chippenham Site Allocations Plan (CSAP) Development Plan Document:

- 2018 (assumed opening year), with partial build out of committed development sites at North Chippenham and Hunters Moon

- 2026, with full build out of committed development sites, and the two strategic sites at South West Chippenham and Rawlings Green (built out to the levels proposed for the end of the Chippenham Site Allocations Plan period)

3.14. Further details on the developments included in the model runs for 2018 and 2026 are listed in Table 3-1. In transport appraisal terms, none of the developments listed in Table 3-1 are considered to be 'dependent' on the M4 Junction 17 scheme. It has therefore not been necessary to consider the modelling implications of 'dependent development' as part of the appraisal.

Table 3-1 Development assumptions

Modelling Assumptions	2018	2026
Development (number of dwellings)	North Chippenham - 111[1] Hunters Moon – 111[1]	North Chippenham –639 Hunters Moon – 339 SW Chippenham – 1,400 Rawlings Green – 650
[1]This is two-thirds of the previously published expectation of 2016-2018 development at the two sites and has been calculated owing to a delay in achieving full permission.		

3.15. Five separate sensitivity tests have been undertaken:

- Background Low Growth: Reduction in base matrix (2011) by 2.5% and rising in proportion with the square root of the number of years (i.e. by 2018 reduction is 7.07% and by 2026 reduction is 10%) in line with WebTAG Unit M4
- Background High Growth: Increase in base matrix (2011) by 2.5% and rising in proportion with the square root of the number of years (i.e. by 2018 increase is 7.07% and by 2026 increase is 10%) in line with WebTAG Unit M4
- Alternative planning assumption Low Growth: Reduced levels of residential and accompanying infrastructure development across Chippenham. In this scenario, development site build-out of planned development (between 2018 and 2026) reaches only 33% of the level expected by 2026 (833 households)
- Alternative planning assumption High Growth: In this scenario, development at East Chippenham (1350 households) which has not been accepted within the Adopted Core Strategy has been included in growth between 2018 and 2026
- Cost increase: Testing the impact that a 33% increase in appraisal costs would have on scheme BCR
- Benefit decrease: Testing the impact that a 33% decrease in appraised benefits would have on scheme BCR

Value for Money (VfM)

3.16. The Value for Money Statement summarises the impact of the transport intervention under consideration. It uses the HM Treasury Green Book method of cost-benefit analysis, by weighing the benefits against the costs to indicate whether the scheme offers 'value for money'. Qualitative, quantitative and monetised information can be used in preparing the statement. This section contains the information required for a Value for Money Statement in line with the DfT's Value for Money Assessment guidance[7]. A standalone Value for Money Statement is contained in Appendix D.

3.17. The Value for Money Statement in this section should be read in conjunction with the Transport Economic Efficiency table, Public Accounts Table, Analysis of Monetised Costs and Benefits table

[7] *Value for Money Assessment: Advice Note for Local Transport Decision Makers,* DfT, December 2013

and Appraisal Summary Table (AST) in Appendix E. The AST identifies the full set of scheme impacts across the economic, environmental, social and public accounts impact categories.

VfM: Transport Network User Benefits

3.18. Table 3-2 summarises the total junction delay comparison between the Do Minimum and the Core Scenario whilst Table 3-3 presents the delay per PCU in seconds.

3.19. The Do-Minimum data has been taken from ARCADY and represents the *combined Inclusive Total Queuing Delay* figure for all arms of the junction. The Do-Something data is taken from LinSig and uses the *Total Junction Delay* figure.

3.20. The results are provided in PCU-Hours and represent the aggregate of all queuing delay experienced by vehicles at the junction during the AM and PM peak hours.

3.21. It is clear that with the partial signalisation scheme road users will experience significant benefits compared to the Do Minimum case. Most importantly, journey times will be reduced for users of the M4 eastbound off-slip in the AM peak period and the M4 westbound off-slip in the PM peak period. The journey time savings achieved would offset the forecast Do Minimum increases in time, bringing journey times back towards current levels.

Table 3-2 Total junction delay comparison for the core scenario (PCU-hours)

Scenario	Do-Minimum	Do-Something	Time Saving
2018 AM (0800-0900)	86	111	-25
2018 PM (1700-1800)	17	32	-16
2026 AM (0800-0900)	388	315	73
2026 PM (1700-1800)	138	54	84

Table 3-3 Delay per PCU for the core scenario (Seconds per PCU)

Arm	Av. Delay Per PCU (s/pcu)							
	2018 AM		2018 PM		2026 AM		2026 PM	
	DM	DS	DM	DS	DM	DS	DM	DS
A429 North	127	152	10	7	306	449	28	21
M4 West bound Off-slip	21	103	31	28	41	44	362	37
B4122	19	15	11	8	32	28	14	14
A350 South	16	12	4	3	215	132	5	5
M4 East bound Off-slip	124	40	10	26	405	122	25	45

3.22. The time saving figures are then used to calculate the Present Value of Benefits (PVB). The time savings for each appraisal year have been monetized using the latest DfT's Values of Time for each travel purpose type. Journey purpose splits have been taken from the WebTAG data book (Summer 2016) as following: Business – 16.4%, Commuter – 31%, Leisure – 52.5%. Business trips were further split by mode (Car/HGV) to account for the differences in Value of Time and occupancy. Furthermore, benefits have been factored to account vehicle occupancy rates, and discounted to 2010 using WebTAG datebook values. The results of the user benefits calculation for each purpose and scenario are included in Table 3-4.

Table 3-4 Transport Economic Efficiency table (£000s, 2010 prices, Discounted to 2010)

Business trips	Commuter trips	Other trips
4,991	2,879	6,004

VfM: Risks

3.23. Key risks that would have the potential to lead to an overall increase in scheme costs have been identified and a quantified risk budget (of approximately 13% of the construction costs) has been included in both the scheme cost estimate and the economic appraisal. The risk budget has been calculated based on a combination of the estimated cost of each risk being realised and the probability of each risk becoming reality. Further detail is provided in the risk register at **Appendix F**.

VfM: Environmental and social impact

3.24. The findings of the qualitative assessments are not considered to be significant enough to warrant any increase or decrease in the value for money categories. The slight adverse environmental impacts that have been identified in the ASTs (**Appendix E**) for, landscape and biodiversity, are mitigated where possible, with the potential to reduce the impact to neutral.

Summary

Table 3-5 Value for Money Assessment Table

Assessment Type	Partial signalisation	Detail
Present Value of Benefits (PVB)	£13.87 million PV	2010 prices, discounted to 2010 in line with DfT guidance.
Present Value of Costs (PVC)	£1.11 million PV	2010 prices, discounted to 2010. Includes Optimism Bias at 3%.
Net Present Value (NPV)	£12.76 million PV	The NPV indicates by how much the benefits of a scheme exceed the costs. This NPV is for the 'initial BCR'.
BCR	12.50	Not adjusted for other non-monetised impacts due to proportionate approach adopted for small scale schemes
Qualitative Assessment	Slight Adverse	Most impacts are neutral although there is potential Slight Adverse impact to biodiversity and landscape (which have the potential to be mitigated), and Slight Beneficial impact to Air Quality.
Key Risks, Sensitivities	£0.117 million PV	Key risks identified include cost increase due to necessary design changes during construction. To cater for this and other eventualities, a risk budget has been included in scheme costs. This is equivalent to approximately 13% of construction costs.
VfM Category	Very High	Monetised assessments suggest that the VfM category should be Very High for the proposed scheme.

Value for Money sensitivity

3.25. Sensitivity tests as described in paragraph 3.15 have been undertaken, and the relevant economic values are shown in Table 3-6.

3.26. It can be noted from Table 3-6 that the economic case for the scheme weakens considerably in the case of the 'low growth' test, however the scheme remains in the Very High Value for Money category.

3.27. In the 'high growth' test, the economic analysis suggests a doubling of the transport benefits. However, the modelling suggests that in this high growth scenario, constricting queues on the M4

slip roads results in what could be considered unacceptable queuing on the other arms of the roundabout, and further mitigation may be necessary. The 'low growth' test shows how a much reduced level of additional background traffic will reduce the benefits of the scheme significantly, however the overall value for money would remain high.

3.28. In the 'alternative planning assumption' scenarios, the impact of either increasing or reducing the level of development assumed by the Chippenham Core Strategy is shown to make little difference to the benefits provided by the scheme. It is therefore clear that the driver behind how the scheme performs is the level of background growth forecast by NTEM.

3.29. If costs were to be increased by 33%, or benefits reduced by 33%, the scheme BCR would reduce to 9.40 and 8.25 respectively. In both scenarios the scheme would still show a Very High Value for Money.

Table 3-6 Sensitivity test results

Scenario	PVC	PVB	NPV	BCR
Core Scenario	**1.11**	**13.87**	**12.64**	**12.50**
Low growth	*1.11*	*4.60*	*3.49*	*4.14*
High growth	*1.11*	*33.07*	*31.96*	*29.8*
Alt planning assumption low development	*1.11*	*11.56*	*10.45*	*10.42*
Alt planning assumption high development	*1.11*	*14.57*	*13.46*	*13.13*
Increases costs	*1.48*	*13.87*	*12.40*	*9.40*
Reduced benefits	*1.11*	*9.16*	*8.05*	*8.25*
Values in £ millions, rebased to 2010 and discounted to 2010 prices				

Scheme appraisal

Economy

Reliability impact on business users

3.30. WebTAG does not provide a specific approach for assessing reliability impacts on non-urban junction specific improvement schemes. In the ASR, a monetised estimate was proposed (as a change in business user journey time impacts) however there is no evidence available which could be used to justify its robustness.

3.31. We have consulted with the Post Opening Performance Evaluation (POPE) team who assess reliability as part of the evaluation process for Highways England's trunk road schemes. Where the scope of schemes involves major changes to a mainline carriageway (e.g. widening schemes or new links), a WebTAG consistent approach (utilising MyRiad) is taken. However, for junction only schemes, Highways England's preferred approach is to utilise Planning Time Index (PTI) as a measure of reliability.

3.32. This bespoke analytical method of assessing reliability has been conducted (see Appendix C) using Highways England TRIS data to determine day to day journey time variability, and calculate a PTI (a ratio of the 95th percentile travel time to the free flow travel time (25th percentile)).

3.33. The PTI for the eastbound off-slip in the AM peak was calculated as 6.4; and for the westbound off-slip in the PM peak of 4.4, which indicates a high degree of journey time un-reliability.

3.34. To appraise the impact on reliability, the modelled reduction in travel time was subtracted from the 95th percentile travel time and a new PTI calculated. Table 3-7 shows a comparison between the existing PTI and those to be experienced with the scheme in operation. The largest change in

reliability is seen in the AM peak for the eastbound off-slip where the significant reduction in queuing leads to a much improved PTI. The westbound off-slip will also improve in the PM peak. However, it is expected that where there is no existing issue with queues (Eastbound in the PM peak, westbound in the AM peak) the scheme will create marginal reductions in reliability.

Table 3-7 Reliability assessment using Planning Time Index

Eastbound off-slip		Westbound off-slip	
AM (Existing PTI=6.4)	PM (Existing PTI=2.7)	AM (Existing PTI=1.7)	PM (Existing PTI=4.4)
0.7 (large decrease)	3 (slight increase)	2 (slight increase)	4.1 (slight decrease)

Regeneration

3.35. The scheme is not anticipated to have an impact on regeneration areas.

Wider Impacts

3.36. No appraisal of the wider impacts has been undertaken due to the small scale of scheme.

Environmental

3.37. For each of the seven environmental aspects, an appraisal of the scheme has been undertaken to identify whether significant beneficial or adverse environmental effects are likely to arise. Environmental aspects that are unlikely to be affected either beneficially or adversely have not been considered further.

Noise

3.38. The noise aspect considers the effects of the highway changes on the noise levels and, where appropriate, any consequential annoyance within the vicinity of the scheme.

3.39. Due to the scale of the scheme it is considered very unlikely that it will result in any increase in daily traffic flow and whilst the inclusion of signals 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. Therefore, the noise aspect has been scoped out of further assessment.

3.40. Traffic noise impacts on the local road network as a result of the scheme are considered **neutral**.

3.41. A construction phase of approximately two months has been set out in the preliminary design for the partial signalisation scheme. The noise impacts of this short construction with very few settlements in the immediate vicinity are expected to be minimal.

Air Quality

3.42. The inclusion of signals may result in a change in the pattern of vehicle speed on the approach to the junction however, there are no sensitive receptors within 200m of the scheme. The scheme is not anticipated to influence significantly the volume of traffic flow therefore it is not likely to impact local air quality.

3.43. A reduction in delay and queueing is anticipated due to the scheme and therefore a resulting reduction in fuel consumption, and a reduction in emissions is expected.

3.44. The scheme's impact on air quality is therefore considered **Slight Beneficial**.

Greenhouse gases

3.45. It was not considered proportionate to assess greenhouse gas impacts quantitatively.

3.46. The scale of the scheme means that it is very unlikely to result in an increase in traffic flows or journey distances. However, the reduction in delay is expected to result in a reduction in carbon emissions.

The scheme's impact on greenhouse gases is therefore considered **Slight Beneficial.**

Landscape

3.47. Landscape in WebTAG is defined as a result of the physical and cultural characteristics of the land itself. There are no designated landscape sites within 2km of the works area. The Cotswolds AONB is approximately 5km to the west.

3.48. The motorway soft estate includes 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.

3.49. The closest trees covered by Tree Protection Orders (TPOs) are approximately 550m, 840m and 1.2km to the east and 1.06km to the west of Junction 17. Therefore, no adverse impacts are anticipated on trees / tree groups covered by TPOs due to the intervening roads, buildings & other vegetation.

3.50. 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. However, vegetation and the intervening road will reduce possible impacts, but some construction operations will be visible.

3.51. The traffic signals may be more perceptible than the existing highway for a greater distance across the landscape, but will be widely screened by woodland blocks and linear woodland belts. As it is necessary for signals to be highly visible to motorists, mitigation planting is unlikely to be a feasible option.

3.52. The scheme's impact on Landscape is therefore considered **Neutral to Slight Adverse**.

Townscape

3.53. Landscape in WebTAG is defined as a result of the physical and cultural characteristics of the land itself.

3.54. An initial appraisal has identified no likely adverse impacts on the townscape or on receptors within 200m of the scheme within the urban realm.

3.55. As the scheme is not within an urban or suburban area, and is screened by existing landform and established vegetation the impacts on townscape are considered to be **Neutral**.

Heritage of historic resources

3.56. Initial appraisal has not identified any likely direct adverse impacts on the Cultural Heritage resources within the footprint of the scheme or within 750m.

3.57. There are no World Heritage Sites (WHS) within 2km; but there are three Scheduled Ancient Monuments (SAM) within 2km (although none of which are within 1km).

3.58. There are two Conservation Areas within 2km (1 within 1km at approx. 750m), and 42 Listed Buildings within 2km (but none within 500m). The Stanton St Quintin Conservation Area is approximately 750m to the northwest of the site, screened by existing landform and vegetation. No impacts are anticipated to the setting of the Conservation Area.

3.59. 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.

3.60. As there will be no impacts on known nationally designated heritage assets, the impacts of the scheme on heritage resources are considered to be **Neutral**.

Biodiversity / Ecology

3.61. There is one nationally designated site within the footprint of the works area (Stanton St Quintin Quarry and Motorway Cutting SSSI), which crosses both carriageways of the main M4, extending over the soft estate in the centre of the junction and to the east of the junction. This is a Geological SSSI and is therefore liable to damage from any engineering works in the vicinity, including from vibration, drilling, disturbance to soil etc.

3.62. The 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.

3.63. Consultation has taken place with Natural England and an assent for the works has been granted to the land owner (Highways England) based on the understanding that:

- There will be no excavating into the geological strata of the cutting
- Machinery will be mini excavators, small dump truck, powered hand tools, cherry-pickers and delivery lorries
- Any amendments to drainage, pipes or ducting will be made within the existing trenches and boxes and making re-use of original backfill

3.64. There are also four County Wildlife Sites, within 6km – at 3.4km to the southwest, 3.5km to the south, 6km to the southwest and 6km to the south of the works area. Direct or indirect impacts on these sites are not anticipated due to distance and intervening roads, buildings and fields.

3.65. There are minor watercourses and ditches / drains present in the fields around the works area, the closest being approximately 80m to the south. There is low potential for these to be impacted on during the construction phase.

3.66. The scheme's impacts on Biodiversity and Ecology are considered potentially to be **Slight Adverse** during construction and operation.

Water environment

3.67. The water environment aspect considers the effects of the M4 Junction 17 scheme on surface and ground water quality, and flood risk.

3.68. There are no major watercourses within 2km of Junction 17, and although the River Avon is approximately 3km to the east, its flood zone (Flood Zone 3) is no closer than 2.4km away.

3.69. There are several minor un-named watercourses at approximately 1000m to the south and 350m to the west although the junction is not located within the flood zones.

3.70. There is to be no increase in the impermeable area due to the scheme, no alteration to the existing surface water drainage and no loss of floodplain or flood storage area.

3.71. The scheme's impact on the water environment is therefore considered **Neutral**.

Social

Reliability impact on commuting and other users

3.72. As outlined in section 3.30, the scheme should improve the reliability of journeys through Junction 17 on the arms where the largest deviation of travel times are currently noted (eastbound off-slip in the AM peak, westbound off-slip in the PM peak.

Physical activity

3.73. No appraisal of the scheme's impact on physical activity has been undertaken. The scheme does not propose any changes to walking or cycling routes and therefore is not anticipated to improve or hinder physical activity.

3.74. The scheme's impact on physical activity is therefore considered **Neutral**.

Journey quality

3.75. Whilst traveller stress may be reduced as an impact of a reduction in delays, these impacts are likely to be diluted due to the assumed length of the journeys which would pass through this trunk road network junction.

3.76. The scheme's impact on journey quality is therefore considered **Neutral**.

Accidents

3.77. Within the study period of 2011 to 2015, 47 collisions occurred in or nearby the junction, with significant clustering occurring on both the M4 westbound and eastbound off slips. As mentioned in the strategic case, a large proportion of these accidents are shunts due to a misunderstanding between vehicles entering the junction and those behind them, whereby unexpected braking results in a collision.

3.78. In providing signals where these two collision clusters occur, it is suggested that some of these accidents will be avoided due to the clear indication to vehicles of when they can expect to be stopping or going. This reduction in the frequency of accidents that occur will have some economic benefit due to the reduced social, damage, legal and administrative costs, and fewer instances of off slip lanes being shutdown to clear or resolve a collision.

3.79. The scheme's impact on accidents is therefore considered **Slight Beneficial**.

Security

3.80. The scheme proposes no changes which would improve or degrade security on the highway network.

3.81. The scheme's impact on security is therefore considered **Neutral**.

Access to services

3.82. 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.

3.83. The scheme's impact on accessibility is therefore considered **Neutral**.

Affordability

3.84. 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.

3.85. The scheme's impact on affordability is therefore considered **Neutral.**

Severance

3.86. The scheme is wholly within the existing highway boundary and all existing rights of way are maintained.

3.87. The scheme's impact on severance is therefore considered **Neutral**.

Option values and non-use values

3.88. The scheme does not lead to a change in the availability of transport services or transport options.

3.89. The scheme's impact on option values and non-use values is therefore considered **Neutral.**

Distributional Impacts

3.90. Distributional impact assessment is now a mandatory requirement of the appraisal process. Scheme promoters need to 'consider the variance of transport intervention impacts across different

social groups'. Specifically, there are eight social and environmental indicators for which the distributional impact must be considered: commuting and other road user economic benefits; noise; air quality; accidents; severance; security; accessibility; and personal affordability.

3.91. Given that the distributional impacts are expected to be marginal in extent, and broadly dispersed among social groups, only Step 1 of the WebTAG distributional impact process (screening) has been completed. A completed distributional impact screening proforma is included in Appendix G. No significant distributional impacts are anticipated.

Public Accounts

Cost to broad transport budget

3.92. The 'cost to broad transport budget' covers the scheme costs that will be borne by the public sector, whether by local or central government. It is the same as the Present Value of Costs (PVC), which includes an allowance for optimism bias and is estimated in 2010 market prices, also discounted to 2010 using the HM Treasury discount rates, in accordance with DfT guidance[8].

3.93. It should be noted that the PVC does not represent the actual investment cost and should therefore not be used in any request for funding. The PVC is for economic appraisal purposes only. Information on scheme costs is presented in the Financial Case (Section 4).

3.94. The *Core Scenario* costs are inclusive of:

- Preparatory costs (including detailed design and survey work)
- Preliminaries (including site setup and traffic management)
- Construction (including utility diversions)
- Site supervision
- Maintenance (costs borne by Central Government as Highways England take responsibility for operation and maintenance)

3.95. In addition, an allowance has been made for risk (discussed below), and an uplift of 3% for optimism bias. Table 3-8 breaks down the appraisal cost for the scheme

Table 3-8 Scheme appraisal cost breakdown

Cost category	Appraisal costs (£millions)
Investment cost in price year base (2016) - including real cost inflation - excluding risk, optimism bias and operation	£1.430
Risk adjusted cost	£1.325
Optimism bias adjusted cost	£1.362
Risk/ OB adjusted cost deflated and discounted to 2010 and adjusted to market prices	£1.362
Risk/ OB adjusted cost deflated and discounted to 2010 market prices including maintenance/operation	**£1.110**

3.96. The PVC (2010 prices, discounted to 2010) is calculated at **£1.10 million PV**.

[8] TAG Unit A1.2, Scheme Costs.

Indirect tax revenues

3.97. Whilst a reduction in delay may result in a reduction in fuel costs, this is expected to be marginal and the will be no changes to travel distance as a result of the scheme.

Summary of economic case

3.98. The economic case has been prepared in a manner which is considered to be proportionate to the scheme investment cost, using a junction model, bespoke economic assessment spreadsheet modelling approach and DfT guidance to estimate the monetised benefits.

3.99. The monetised economic benefits of the M4 Junction 17 scheme are shown to far outweigh its costs and any negative impacts. The scheme has an Initial **BCR of 12.50** suggesting a ***Very High Value for Money***.

3.100. Furthermore, the scheme presents no worse than Slight Adverse for any environmental impacts, for which mitigation is possible, and offers beneficial social impacts with regard to accidents.

3.101. Sensitivity tests undertaken as part of the Economic Case demonstrate that:

- Scheme economic performance is greatly reduced under a scenario in which there are lower levels of background traffic growth compared to the Core Scenario but still falls within the High Value for Money category
- In a High Background Growth scenario, the BCR of the scheme is doubled. However, the level of background growth assumed in that scenario is very high and compromises the operation of the junction, with impacts on the A350 and A249 leading to very high forecast do Minimum levels of delay. In reality it is unlikely that that level of growth and the associated forecast Do Minimum conditions would occur, drivers would instead respond by retiming or rerouting their journey.
- The scheme BCR is shown to reduce in the scenarios where the predicted level of housing growth within Chippenham is not met, where the estimated benefits are reduced by 33%, or where scheme costs increase by 33%. However, in each case the BCR remains above 8.

4. The financial case

Introduction

4.1. The financial case provides evidence on the affordability of the proposal, how it is to be funded and any technical accounting issues. It includes the financial profile for the scheme and the impact of the proposed investment on budgets and accounts.

4.2. The financial case contains the following key elements:

- The expected implementation cost of the scheme, including the base cost and risk allowance in out-turn prices
- A cost profile showing year on year costs, and breakdown by cost type and parties on whom they fall
- A summary of key financial risks (including any risk allowance quantification)
- Consideration of the long-term financial sustainability of the scheme, including robust plans to ensure the affordability of any ongoing costs for operation, maintenance and major capital renewals

Scheme costs

4.3. Scheme costs have been calculated in both 2016 prices and outturn prices (including inflation), based on tender return prices (summarised in Appendix H). A summary of scheme implementation costs for the scheme is shown in Table 4-1.

Table 4-1 Scheme implementation costs

Cost Category	Implementation cost (£millions)
Preparatory (including detailed design and survey work)	£0.185
Preliminaries (including site setup and traffic management)	£0.236
Construction (including utility diversions)	£0.693
Site Supervision	£0.200
Land	-
Quantified Risk Budget	£0.117
Total – 2016 prices	£1.431
Inflation	£0.029
Total – Outturn prices	£1.460

Implementation costs – base year prices

4.4. The estimated base year (2016 prices) for the M4 Junction 17 scheme are **£1.431** million.

4.5. Preparatory costs include allowances for the following (these are not included within the cost of the devolved Local Growth Fund bid and are to be paid for directly through local funding contribution):

- Detailed design and safety auditing
- Full Business Case completion
- Non-statutory consultation with stakeholders
- Procurement costs
- Set aside cost for monitoring and evaluation

4.6. Construction costs include the following:

- Traffic management and site mobilisation
- Site clearance and earthworks
- Fencing
- Road restraint systems
- Drainage
- Pavements
- Traffic signs and road markings
- Road lighting and electrical works
- Landscaping
- Structures
- Provisional sums for utility diversions

4.7. An allowance has been made to cover site supervision costs, in order that the requirements of the Construction Design and Management (CDM) Regulations can be fulfilled. There are no land purchase or land opportunity costs associated with the scheme

Risk budget

4.8. The purpose of the risk budget is to cover any increased costs that may result from the full set of identified scheme risks, whether direct cost increases or indirectly as a result of scheme delays.

4.9. A risk register for the scheme is provided in Appendix F, with 48 preconstruction and construction phase risks (of which 10 have been closed following the tender assessment) identified. For each risk, the associated 'residual probability' is multiplied by the 'most likely' cost impact to calculate a 'mean expected value'.

4.10. The sum of the 'mean expected values' for the scheme is £0.117 million.

4.11. Further information on the key risks and how these risks will be managed throughout scheme development and implementation is provided in the Management Case (Section 6).

Inflation assumptions

4.12. Investment, operating and maintenance costs have all been forecast at current prices and inflated up to the point of expenditure.

4.13. For the purposes of appraisal only real inflation (i.e. the rate of inflation of costs above the rate of background inflation) has been considered, for the financial case the full rate of inflation has been included in cost forecasts to present outturn costs.

4.14. Latest forecasts suggest that construction related costs will rise in average by 5% p.a. in absolute terms in line with current TPI forecast. Preparatory and supervision costs will rise in average by 2.0% p.a. in line with RPI forecasts.

Quantified cost estimates

4.15. Table 4-2 sets out the quantified cost estimate, (outturn cost) which includes risk and inflation and shows the years in which the costs are incurred.

Table 4-2 Quantified Cost Estimate (millions, outturn)

Cost element	Year cost are incurred (millions)				Total
	2015/16	2016/17	2017/18	2018/19	
Preparatory (including detailed design and survey work)	£0.050	£0.118	£0.005	£0.010	£0.184
Prelims and construction (including utility diversions)	-	-	£0.958	-	£0.958
Site supervision	-	-	£0.201	-	£0.201
Quantified Risk Budget	-	-	£0.117	-	£0.117
Total	**£0.050**	**£0.118**	**£1.281**	**£0.010**	**£1.460**

Ongoing revenue liability

4.16. Operation and maintenance liabilities of the scheme will fall to Highways England as the highway authority for the junction. Highways England have agreed to be liable for these costs and have waived any requirement for commuted sums from Wiltshire Council.

4.17. These costs have not been included in the cost estimate as they will be become part of the maintenance and operations costs for the principal road network authority. Although they have been included in the appraisal cost in Chapter 3.

Budgets/ Funding cover

Funding package

4.18. The funding package proposed for financing the M4 Junction 17 scheme is made up of £0.500 million which will be contributed by the SWLEP from the Local Growth Fund and £0.960 million of Local Contribution. A signed agreement between Wiltshire Council and Highways England has resulted in the payment of £0.880 million to Wiltshire Council which is ring-fenced solely for spend on the M4 Junction 17 scheme and is available to be drawn down upon from March 2017.

Phasing of the total funding package

4.19. Table 4-3 shows the total cost estimate and the funding sources by year broken down by funding organisation.

Table 4-3 Funding package (£m, outturn)

Organisation funding source	Year cost are incurred (millions)				Total
	2015/16	2016/17	2017/18	2018/19	
Local Growth Fund	-	-	£0.50	-	£0.500
Local contribution	£0.050	£0.118	£0.78	£0.01	£0.960
Total	**£0.050**	**£0.118**	**£1.281**	**£0.010**	**£1.460**

Accounting implications

4.20. The M4 Junction 17 scheme is expected to have the following implications on the public accounts:

- Devolved funding (Local Growth Fund) is requested to fund £0.5 million of the scheme implementation costs with all expenditure occurring over the 2017/18 financial year. This

funding will not be used to cover preparatory costs, nor those of post-construction monitoring or maintenance

- A total local contribution of £0.960 million is required for the implementation of the scheme:
- £0.005 to be spent in 2017/18 on preparatory costs
- £0.776 to be spent in 2017/18 primarily on construction
- £0.010 to be spent in 2018/19 on monitoring and evaluation

5. The Commercial Case

Outline approach

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

5.2. The commercial case contains the following key elements:

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

Output based specification

Scheme to be procured

5.3. The M4 Junction 17 scheme will involve the part signalisation of the junction. The procurement value of the scheme is £0.958 million (outturn prices for construction and preliminaries elements only). However, costs which are currently included in the risk budget may be transferred across into the construction costs as the scheme is developed, leading to an increase in the actual value to be procured.

5.4. The outputs which the preferred procurement strategy must deliver are summarised as:

- installation of signal infrastructure and equipment at the junction points of the eastbound and westbound M4 off-slips with the circulatory carriageway
- installation of MOVA controller detection on the M4 off-slips and circulatory carriageway
- an option to resurface the entire eastbound and westbound M4 off-slips, funded by Highways England
- improvements to highway drainage system carrier drain
- Road lighting columns and brackets along with installation of CCTV masts and cantilever masts
- Electrical works including the installation of residual current trip devices
- Repairs to the existing kerbs and steel vehicle restraint barriers

5.5. Preparatory and site supervision aspects will be led by Wiltshire Council, whether directly, or indirectly through an existing term contract. Preparatory and site supervision costs are therefore excluded from the value to be procured.

Key procurement considerations

5.6. The following outcomes were relevant to the procurement process:

- To achieve cost certainty, or certainty that the scheme can be delivered within the available funding constraints
- To minimise further preparation costs with respect to scheme design by ensuring best value, and appropriate quality

- To obtain contractor experience and input to the construction programme to ensure the implementation programme is robust and achievable
- To obtain contractor input to risk management and appraisals, including mitigation measures, to capitalise at an early stage on opportunities to reduce construction risk and improve out-turn certainty thereby reducing risks to a level that is 'As Low As Reasonably Practicable'

Procurement strategy

5.7. The procurement process will be run in strict accordance with the legislative framework set out within the Wiltshire Council Corporate Procurement Strategy (2012). In addition, the process will be governed by the Council's own constitutional Contract Procedure Rules (2012) and is subject to the Council's Procurement Gateway Process.

5.8. Under the Procurement Gateway Process, the strategy is subject to review by the Council's Procurement Manager, senior Legal officer and senior officers from across the Council who are highly experienced in strategic procurement and contract management. Express approval must be gained from the Procurement Gateway Board to enable the procurement to move to the award procedure stage following review of the award recommendation.

Procurement option assessment

5.9. A high level assessment of procurement options for the main construction contract was undertaken as part of the OBC. The following options were assessed against criteria for time (speed or certainty of completion date), cost (price level and cost certainty), and quality (functionality and performance):

- Option 1 – Traditional Contract
- Option 2 – Design and Build
- Option 3 – Early Contractor Involvement (ECI)
- Option 4 - Private Finance Initiative (PFI) Funding, Design Build Operate and Maintain (DBOM)

5.10. Table 5-1 summarises the options, presenting the pros and cons of each procurement route. The following considerations need to be accounted for in relation to the procurement of the scheme:

- The primary consideration is the supplier's ability to effectively carry out the works and early engagement of the supplier in order to ensure the inclusion of skills and knowledge at the earliest stage
- There is a time constraint on the project – due to the constraints on the Local Growth Fund there is a requirement for all funding to be spent on the project within specific financial years
- Consideration for traffic management arrangements during construction – an important element of scheme community relations and short-term environmental impacts
- Supplier environmental credentials
- Evaluation of social and environmental considerations in procurement process, for example use of sustainable materials, disposal of waste materials, use of local sub-contractors and human resources, etc.
- Economic considerations in terms of value for money of suppliers

Table 5-1 Procurement options

Procurement Type	Description	Risk Transfer	Pros	Cons
Traditional	Client completes a full detailed design followed by tendering for a contractor, who is passed the design to construct. The form of contract is usually the NEC or similar	Risk resulting from design is carried by the client.	• Allows for competitive tender and better opportunity for scrutiny of supplier value for money on scheme • Comparable in programme terms with D&B • High client control over specification and quality	• Majority of risk is carried by the client • Generally poorer record in terms of cost certainty
Design & Build	Client submits for tender the design developed during the statutory processes and passes it to the contractor to tender the detailed design and construction.	Risk from detailed design is carried by the contractor. The client develops a detailed knowledge of risk, enabling a more informed negotiation of risk transfer at tender stage.	• Allows for competitive tender • Comparable in programme terms with traditional • Target cost contract allows for high degree of cost certainty and potential cost savings • Design solutions are likely to be directed towards specific Contractor methods aiding buildability and potential for value engineering	• Requires well-developed works information to ensure client control over specification and quality
Early Contractor Involvement	Contractor appointed prior to preliminary design stage.	All design risk carried by the contractor. Risk register developed in partnership with supplier. Opportunity to share risk to most appropriate party.	• Allows for early supplier engagement on a partnering basis Contractor is better placed to manage risk, having been involved from an early stage in the design process • Allows for the incorporation of the supplier skills and knowledge within the early stages of design • ECI benefits projects with complex engineering challenges	• Although rates would be market tested, the target cost for the main construction works negotiated rather than competitively tendered. • Requires some certainty of scheme funding prior to the commencement of preliminary design and statutory processes.
PFI DBOM	A Concession contract is awarded and service fee paid for delivery of operational and maintenance services	All risk is carried by the PFI Operator	• Total cost of the scheme is effectively spread over the whole project lifecycle • Long term interest in maintenance helps ensure quality driven approach to design and construction.	• Increased time of procurement process will lead to significantly later start date of construction and therefore potential for increased cost to completion.

Adopted procurement route

Sourcing options

5.11. Unlike a traditional two-stage tender route, Wiltshire Council submitted a Full Works information pack along with the Pre-Qualification Questionnaire with the aim of reducing the length of the competitive assessment process. The process was started in November 2016 and a total of 11 organisations responded during the four-week PQQ period. Of these 5 supplied full tenders. The invitation to tender was offered to participants in a package alongside the A350 Section 3 Chippenham Bypass Improvement Scheme. Whilst contractors had the opportunity to bid for both items, they were free to provide a tender price solely for the M4 Junction 17 scheme.

5.12. The full tender process has been used to provide quality assurance and to confirm a price. The price/quality ratio was set at 70/30. The dominance of price at the full tender stage reflects the need for value for money and also reflects the advanced status of scheme designs.

5.13. The recommendation for awarding of the contract was made by Wiltshire Council on the 24th March 2017. It has been confirmed that the M4 Junction 17 scope is recommended to be awarded in combination with that of the A350 Chippenham Bypass Improvements scheme. The decision to have one tender for both schemes achieves cost savings in the procurement process, and potentially achieves cost savings if contractors are willing to provide a single reduced price on the basis of economies of scale.

Contract type

5.14. An industry standard published form of contract will be used to procure the construction works through a traditional contract approach. The main advantages of the 'traditional' contract approach will be:

- Familiarity among contractors and consultants, with roles and responsibilities well understood
- Wiltshire Council will retain responsibility for and control of the design team
- Direct independent reporting by the design team to Wiltshire Council to ensure that quality control is maintained
- Price certainty (given that the work has been fully designed in advance)

5.15. Wiltshire Council has selected the NEC3 Engineering and Construction Contract (ECC), Option B re-measurement priced contract with bill of quantities. Under Option B, Wiltshire Council has provided detailed designs and a bill of quantities, against which tenderers have provided a contract price that is built up using rates.

5.16. Option B is considered to offer the following advantages for the scheme:

- Priced bill of quantities will provide a basis for variations to be priced at tendered rates, making variations easy to understand
- The lowest price tender is usually the best value for money
- Easier to resolve disputes as the industry ‘standard methods of measurement’ set out the items that need to be covered when costing against bill of quantities
- There is no need for a contractor to build in a risk premium, which can artificially inflate the contract price

Human Resource issues

5.17. In order to ensure construction of the scheme meets the programmed timeline, the ability for the contractor to resource the project effectively has been scrutinised at procurement stage via the procurement specifications set out in the tender documentation.

5.18. Within their methodologies the contractor provided a method statement in the eventuality of being awarded the combined contract, highlighting how their structure generating efficiencies and streamlining between contracts:

- Individual delivery teams have been identified
- Experienced resources are available to work within both teams
- The delivery teams will report to the same Core Management Team and Project Board

Payment/ Charging mechanisms and framework

5.19. The chosen payment option for the contract is:

- Priced contract with bill of quantities – a re-measurement contract where the contractor inserts rates and prices against items in the bill of quantities

5.20. The contractor will be paid monthly in arrears by Wiltshire Council and quantity re-measurement will take place throughout the construction period. Due to the relatively straightforward nature of the scheme, payment incentives and deductions based on performance targets will not be included in the contract. This minimises the risk of insurance premiums being priced into the tender responses.

Risk allocation and transfer

5.21. Risk allocation is determined primarily by the form of contract selected (NEC3 ECC Option B). Under NEC3 ECC Option B, the contractor will have priced the contract based on the bill of quantities supplied by Wiltshire Council.

5.22. Risk is therefore allocated as follows:

- The risk of changes to unit prices, for example as a result of changes in demand for particular products or materials, or due to changes in the wider economy, is transferred to the contractor
- The risk of different quantities being required, for example as a result of an underestimate or due to unexpected ground conditions, is allocated to Wiltshire Council

5.23. Wiltshire Council is prepared to accept the risk associated with quantities, as the scheme has been taken to a full detailed design stage. A risk budget is also included in the scheme costs to deal with any changes in quantities associated with known risks.

Key project risks

5.24. Table 5-2 identifies the key project risks throughout the planning and implementation of the scheme. The full risk register can be found in Appendix F.

Table 5-2 Key project risks

Risk	Mitigation
Cost risks & mitigation	
Changes to design (after construction has commenced).	Detailed design for the contract tender documents include as much detail as possible on the site conditions and methods of construction.
Statutory Undertaker diversions cost underestimated	Continual liaison with SU's. Consider employment of specialist consultant to value engineer planned diversions at preliminary design stage.
Design changes suggested by the contractor not approved by Highways England	Submit designs for review early to minimise delays if approval is not granted

Risk	Mitigation
Investigation of slip roads condition requires extensive carriageway restructure	Establish existing asset condition through surveys and due diligence. Early discussions with Highways England over contribution towards additional costs of asset repair/replacement.
Delay in diversion of known utilities, and changes to utilities in advance of construction.	Adequate planning, liaison and undertaking of works in advance of main programme. Agreement of any utilities work before start of construction.

Contract length and management

5.25. The main works contract (procured in combination with the A350) is expected to be in place for a total of 13 months (July 2017 to August 2018). The M4 Junction 17 element is expected to be start in July 2017 and to be completed in December 2017, with completion confirmed once the roundabout circulatory and adjoining roads are fully opened and when all traffic management (excluding the new signals) has been removed. Snagging will be undertaken by Wiltshire Council throughout construction, to maintain a list of defects and omissions in the works, ensuring that the scheme is completed to a high standard.

5.26. Wiltshire Council will meet with the contractor as frequently as is deemed necessary by the Project Manager. The contractor will provide regular progress and financial updates to Wiltshire Council, which will include updates to the project programme.

5.27. Further details on the management structure are provided in Section 6 (Management Case).

Summary

5.28. The adopted procurement approach for the M4 Junction 17 and A350 Chippenham Bypass Improvement schemes, comprising up to £0.878 million of construction and preliminaries works, is summarised in Table 5-3.

Table 5-3 Adopted procurement approach

Facts	Procurement Approach	Form of Contract	Tender Process	Notes
Scope of work is known and the scheme will be at detailed design stage Planning approval is not required. Land is available (all within highway boundary) Procurement value unlikely to exceed OJEU threshold.	Traditional Contract, via OJEU Restricted Procedure Combined PQQ and Full Tender Package process	NEC3 ECC Option B - Priced contract with bill of quantities Additional working hours clauses to be included.	Oct-Nov 2016: PIN with pre-qualification stage (quality / capability assessment) Nov 2016 – Jan 2017: Full tender stage price/quality ratio 70/30 Contract Award Notice at end of 16/17 financial year	Wiltshire Council completed the detailed designs and bill of quantities, on which tenderers based their prices.

6. The Management Case

Outline approach

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

6.2. The management case contains the following key elements:

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

Evidence of similar projects

6.3. The delivery of the M4 Junction 17 scheme will build upon the experiences from the local pinch-point scheme, completed by Wiltshire Council in March 2015, and the Bumpers Farm improvements, completed in February 2016. Opportunities are being taken, wherever possible, to improve delivery processes, through acting upon lessons learnt.

6.4. The Bumpers Farm Improvements scheme delivered increased highway capacity along the A350 Chippenham Bypass near the Bumpers Farm roundabout, and consisted of:

- Widening the A350 to dual 2-lane between Brook and Bumpers Farm
- Additional widening of the A350 for approximately 250 metres north of Brook to allow for a suitable merge length back to single lane running and to allow for two southbound lanes for 100 metres approaching Brook
- Widening to dual two-lane on a short stretch of the A350 immediately south of Bumpers Farm
- Minor widening of the Bumpers Farm Industrial Estate entry arm to Bumpers Farm Roundabout

6.5. The works were procured through a traditional two-stage competitive tender process and were awarded on the basis of a NEC3 ECC Option B contract.

6.6. The scheme was programmed for a 38-week construction period however, despite minor design changes the works were finished 7 weeks ahead of schedule. The realised quarterly spend profile matched that anticipated in the Business Case for the scheme and the scheme budget was £3.267million was on target.

Programme / Project dependencies

6.7. The M4 Junction 17 scheme is being procured in combination with the A350 Chippenham Bypass Improvements (Badger-Brook & Chequers) scheme. The successful contractor has provided a detailed programme of works which plan for how they will manage the construction phases of both schemes. It is expected that the construction (physical works) of M4 Junction 17 will start on 14th August 2017 and be complete by 1st December 2017. Assurances have been given in the methodologies provided by the contractor that unforeseen delays on one project will not affect the other. Two wholly separate delivery teams have been identified to work on the A350 and M4 Junction 17 elements.

Governance, organisational structure and roles

6.8. Wiltshire Council will establish a Project Board for delivering the M4 Junction 17 scheme. The Project Board will take overall responsibility for its delivery and will be formed by Council representatives at sufficiently senior level to have authority to act on behalf of the Council. Meetings of the Project Board will take place at least monthly, but will also be linked to key milestones, where they will consider progress through Highlight and Exception Reports, changes to the risk register, and changes to the Scheme Implementation Programme.

6.9. The Project Board will be led by the Associate Director, Highways and Transport as Senior Responsible Owner (SRO). The SRO will be responsible for nominating the Project Board chairperson and for providing guidance and direction to the Project Manager. The SRO will ensure that the project team is progressing the scheme in line with the Scheme Implementation Programme and that outputs and milestones agreed by the Project Board are achieved.

6.10. Following FBC approval, the Project Manager will be appointed by the SRO and will be responsible for delivering the scheme in line with the agreed controls and procedures set out in the Project Plan. The Project Manager will report to, and be accountable to, the SRO and the Project Board. The primary focus of the Project Manager will be to ensure that the scheme is delivered on time, within budget and to specification. The Project Manager will also be responsible for preparing Highlight and Exception Reports.

Programme / Project plan

6.11. Key project milestones from OBC submission to scheme completion are listed in Table 6-1.

6.12. Tendering and detailed design refinements was complete in March 2017. The final scheme approval, to allow for devolved funding to be released, is proposed for May 2017, with construction preliminaries starting in July 2017. The physical works programmed for mid-August 2017 and is expected to last for approximately 4 months, until 1st December 2017.

6.13. The contractor's programme is provided within Appendix I and will be subject to review throughout scheme development.

Table 6-1 Project milestones

Milestone (* = critical path date)	**Estimated Date**
Signal specification sent to Highways England/ Skanska	28/9/2016
Outline Business Case (OBC) complete	14/10/2016
Complete detailed design (for procurement)*	10/10/2016
Issue invitations to submit Participation Requests	24/10/2016
OBC approval	28/11/2016
Prior Information Notice (PIN) published*	6/12/2016
Tender recommendation*	24/03/2017
Full Business Case (FBC) submission*	27/03/2017
FBC approval*	25/05/2017
Main construction start*	14/08/2017
Construction complete*	01/12/2017
Opening date	02/12/2017

Assurance and approval plan

6.14. The M4 Junction 17 scheme is currently being progressed in line with the SWLEP Assurance Framework.

6.15. This FBC represents Stage 4 of the SWLEP agreed 'business case development' process. The SWLEP will use the FBC, to decide whether the scheme should be approved to progress through to construction. Following FBC approval, Wiltshire Council will identify a contractor for construction of the scheme to commence.

6.16. Full Business Case approval (Stage 4 approval) is anticipated for May 2017. In accordance with the Assurance Framework, it is at this stage that a formal agreement is made between the owner of the devolved funding (SWLEP) and Wiltshire Council setting out the terms and conditions under which the devolved funding is to be spent. Funding will then be approved to Wiltshire Council in line with those terms and conditions.

Communications and stakeholder management

6.17. Public consultation for the scheme is not planned due to the small scale of the scheme, however the public and stakeholders will be kept abreast of the scheme milestones.

6.18. Serial press releases are not proposed for the scheme although notification of construction and opening in the local press may take place.

6.19. The scheme was presented to the Member of Parliament for Chippenham (Michelle Donelan) on the 2nd February 2017, and to the Chippenham Area Board at committee meeting on the 13th March 2017. Neither of these parties who are representative of the local area and its population raised any concerns over the proposed scheme.

6.20. The contractor will develop a Communications and Customer Care Plan which includes contact details of identified landowners and local businesses directly to keep them informed of the scheme construction. The contractor will also include a project specific page on their company website and promote details of the scheme through social media.

6.21. Following SWLEP approval of the Full Business Case, announcements and information will be published on the SWLEP and Wiltshire Council websites; and Wiltshire Council will liaise with Highways England to provide scheme information on their website.

6.22. Table 6-2 below summarises how and when stakeholders will be informed of the scheme.

Table 6-2 Stakeholder management

Who	How	Inform/involve/consult	When
Cabinet	Briefings	Inform, involve and consult	As necessary, and at key decision points
All Councillors	Internal Member documents	Raise awareness and consult	At key points in the project
Councillors local to scheme	E-mail updates	Consult and gain buy-in	As necessary, and at key decision points
Local MPs and MEPs	One to one briefings	Consult and gain buy in	As necessary
Town / Parish Councils and Area Boards	Attendance at meetings	Consult and gain buy in	As necessary
Public	Press releases and website	Inform, raise awareness	As project progresses
Media and Social Media	Press releases. Twitter account	Inform	As project progresses
Emergency services	Regular meetings	Consult and gain buy in	As project progresses
Highways England	Regular project meetings	Consult and seek approval	At key points in the project
Bus and coach operators	Regular meetings	Consult and gain buy in	As project progresses
Statutory bodies – Environment Agency, Natural England and English Heritage	Letters and meetings on key aspects of scheme design	Inform, consult and seek approval	As necessary to achieve licenses

Programme / Project reporting

6.23. Responsibility for accurate, timely and appropriate communications within the project team rests with the Wiltshire Council Project Manager to ensure that the Project Board is kept up-to-date with programme developments.

6.24. The Project Manager identified is responsible for ensuring the Project Board is provided with sufficient information and that the Project Board clearly understands that information in order to provide necessary guidance on programme decisions. The Project Manager is responsible for leading the Delivery Team and for reporting to the SRO to ensure that all parties are up-to-date with relevant information.

6.25. The SRO is responsible for keeping the Lead Members aware of the development of the scheme towards meeting the project objectives.

6.26. Project team meetings are held on a monthly basis, with the outcomes escalated to the Project Board.

Implementation of work streams

6.27. The package of work comprises of eight key elements, all of which will assist towards the overall implementation of the scheme and its objectives. The key work streams required for implementing the project are as follows:

- Approval of business case - submitted in March 2017 with full approval by May 2017
- Detailed design (completed)
- Procurement exercise (currently under assessment)
- Early site works (through appointed contractor for scheme)

- Utility works (led by in-house team, carried out by appointed contractor)
- Construction of main scheme (through appointed contractor for scheme)
- Site supervision (led in-house)
- Monitoring and evaluation (led in-house)

Key issues for implementation

6.28. Table 5-2 identifies the key project risks throughout the planning and implementation of the scheme and are summarised below:

- The tender prices received from the contractors exceed the available budget to construct the scheme.
- Statutory Undertaker diversions cost underestimated
- Design changes suggested by contractor not approved by Highways England and/or Skanska
- Faults with existing infrastructure
- Delay in diversion of known utilities, and changes to utilities in advance of construction.

6.29. Monitoring during implementation will be undertaken by the PM/SRO and will ensure that mitigation measures identified in the risk register will be undertaken and adhered to.

Risk management strategy

6.30. Risk management is a structured approach to identifying, assessing, and responding to risks that occur during a project. The details of risks have been covered in detail in Chapters 4 and 5 of this report and an updated risk register is contained in Appendix F.

6.31. The Wiltshire Council Project Manager will hold overall responsibility for maintaining the risk register, including requesting that the design team, Wiltshire Council officers and contractor notify them of potential new risks.

6.32. For each individual risk, a client or contractor owner is identified who will hold the responsibility for instigating mitigation and monitoring the risk. Risk owners will alert the Project Manager to changes in the likelihood or status of risks.

6.33. The Project Manager will report on risk status to the SRO on a regular basis. Any new high risk items will be escalated to the SRO immediately.

6.34. A summary of the key risks is listed below (these are covered in detail - both in terms of the risk and the mitigation – in Table 5-2 and paragraphs 5.21 to 5.24):

- Changes to design (after construction has commenced
- Statutory Undertaker diversions cost underestimated
- Design changes suggested by the contractor not approved by Highways England
- Investigation of slip roads condition requires extensive carriageway restructure

6.35. The most significant risks (by financial value if realised) and the mitigation measures that are being adopted are as follows:

- Changes to design (after construction has commenced). - the detailed design for the contract tender documents provides as much detail as possible on the site conditions and methods of construction. Liaison with contractor and design team over how proposed changes can be value engineered.

- Investigation of slip roads condition requires extensive carriageway restructure - Undertake carriageway condition investigation with HE
- Increases in statutory undertaker's apparatus diversion costs - Delay in diversion of known utilities, and changes to utilities in advance of construction, which can lead to delays to scheme and additional costs. To reduce the likelihood of a delay, adequate planning, liaison and undertaking of works will be undertaken in advance of main programme, and agreement regarding any utilities work will be met before start of construction.

6.36. The Risk Register (Appendix F) sets out the mitigation measures for all risks and their current 'owners'. As scheme delivery progresses, risks will be reviewed regularly and will pass to new owners as appropriate.

Benefits realisation plan

6.37. Tracking of the scheme benefits will be a key element in understanding the success of a specific intervention. The realisation of benefits will be reviewed through the Monitoring and Evaluation plan (discussed in the following section).

Scheme objectives, outcomes and impacts

The objectives and success indicators for the M4 Junction 17 scheme are set out in the Strategic Case (Section 2.42) and further detailed in the Logic Map seen in Figure 6-1. In particular, benefits resulting from reduced queue lengths, reduced journey times for M4 off slip users, personal injury accident reductions, and mitigation of future development impacts are emphasised.

6.38. A SMART objectives table has been produced in Section 2.42 which highlights specific, measurable, agreed upon, realistic, and time bound objectives. In having objectives that fit all of these criteria, the benefits realisation plan has a foundation as well as performance indicators with which to measure the overall success of the scheme.

6.39. The Wiltshire Project Manager will be the owner, responsible for tracking the benefits being realised and for reporting any exceptions to the Project Board. This will allow early identification of any particular areas where benefits are not being realised as expected. The Project Board will then appoint someone with sufficient expertise to oversee remedial actions to try to bring benefits back in line with expectations.

Benefit monitoring

6.40. The monitoring of the benefits realised against each objective is reviewed within the Monitoring and Evaluation plan. This sets out the necessary data and information requirements to track the performance of objectives.

Responsibilities and Resources

6.41. The overall Benefits Realisation Plan is owned by the Senior Responsible Owner (SRO), with responsibility for overseeing particular benefits delegated as necessary. The owners for each benefit will be defined following scheme approval, with ownership remaining with the SRO at present.

6.42. The owners will be responsible for tracking the benefits being realised and for reporting any exceptions to the SRO. This will allow early identification of any particular areas where benefits are not being realised as expected. The SRO will then appoint someone with sufficient expertise to oversee remedial actions to try to bring benefits back in line with expectations.

Monitoring and evaluation

6.43. The purpose of the Monitoring and Evaluation Plan is to identify how the scheme benefits (direct and wider) and actual scheme delivery, including (construction and budget management), are to be evaluated.

6.44. Monitoring and evaluation of the scheme will occur 1 year and 5 years after it is implemented by Wiltshire. A budget of £10k has been established for the monitoring and evaluation of the scheme

to take place specifically, monitoring queue lengths and delays experienced at the junction as well as recording collision rates.

6.45. A key element of the Monitoring and Evaluation plan is to map the intervention logic. This involves systematically linking key components of an intervention in order to produce a causal pathway (see) across the:

- Inputs (i.e. what is being invested in terms of resources and activities)
- Outputs (e.g. signals built, products developed)
- Outcomes (i.e. short and medium-term results, such as changes in traffic flow levels and safety improvements)
- Impacts (i.e. long-term results such as better quality of life, improved health and environmental benefits)

6.46. sets out the intervention logic map for the scheme and shows linkages between key components of the intervention and the scheme objectives. The map shows the process by which the scheme outputs will deliver the primary objectives for intervention (shown as dark purple boxes), and describes an outline evaluation approach for monitoring the extent to which these are achieved as part of a pre and post-opening monitoring report.

6.47. The map also shows wider and longer term impacts, which depend on the delivery of the primary objective.

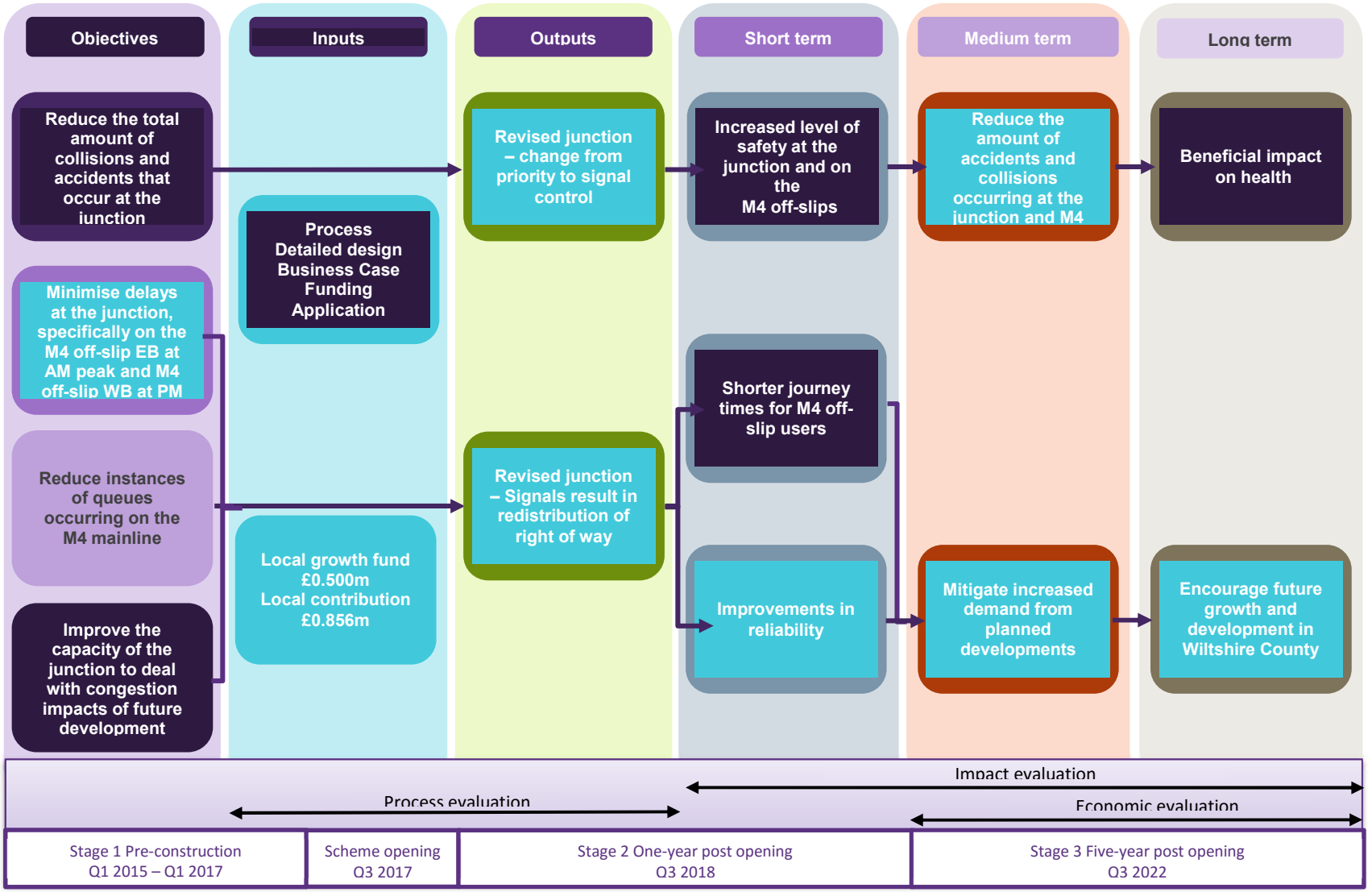
Three-stage approach for Monitoring and Evaluation

6.48. As shown in the intervention logic map, different scheme-specific objectives are realised over different timescales. Some objectives will be realised immediately or shortly after the scheme opens; such short and medium term scheme effects are referred to as outcomes. Other objectives such as supporting economic growth and development are less direct and tangible effects of the scheme and are expected to take effect over a longer period; these longer term effects are called impacts. Impacts can be more difficult to attribute directly to the scheme

6.49. For this reason, the Scheme Monitoring and Evaluation Plan will be undertaken in three distinct stages:

- Stage 1 - Pre-Construction Study
- Stage 2 - One Year Post Opening Process Evaluation, Q4 2018
- Stage 3 - Five Year Post Opening Impact Evaluation Study, Q4 2022

Figure 6-1 Intervention logic map for M4 Junction 17 Partial Signalisation Scheme



Evaluation objectives

6.50. The evaluation objectives are as follows: (1) the efficiency of the scheme management and delivery process leads to (2) whether outcomes have been achieved, which in turn provides (3) the ability to demonstrate accountability for the initial investments. Evaluation objectives have been set to show a clear flow reflecting the process, impact and economic elements of the evaluation.

Process evaluation

6.51. The resources and finances used in delivering the scheme should be understood in order to gain an understanding of existing planning techniques and to provide lessons learned for use in future best practice.

6.52. The Process Evaluation will be undertaken as the construction nears completion through to the Stage 2 One Year Post Opening Process Evaluation.

6.53. The aim of the process evaluation is to identify factors influencing the extent to which objectives have been achieved, identify and investigate unintended outcomes, and identify lessons learned.

6.54. The process evaluation will extend beyond a desk-based study and will involve interviews with key project officers and a process review workshop with key parties (e.g. Wiltshire, Highways England) and stakeholders. This will include assessment of:

- Programme management, success factors and key obstacles to delivering the scheme. Provide details of project plan assessment, delivery at key milestones, etc. This will help identify good practice in this area, which can be shared in the future
- A review of evidence collated through Wiltshire's project management and governance procedures
- Consultation with key stakeholders to garner a range of views of the operation and success of the scheme
- The evolution of the risk register and the effectiveness of the risk management strategy e.g. safety during construction, delays to transport users, impacts on local business during construction
- If and how the context and rationale behind the scheme has changed
- Identify any changes to the delivered scheme from the planned scheme and the reasons behind any changes. This can be used to identify good practice
- Assess how well scheme objectives are being realised at this stage
- All costs involved in the management, construction and delivery of the scheme compared to the forecast costs including an assessment of risk and optimism bias in pricing

Impact evaluation

6.55. The planning and processes used in defining an intervention from the outset, and their continual evolution throughout design, construction and implementation play a key factor in predicting outcomes. Understanding of how the predicted outcomes match those which are delivered by the scheme is essential in providing lessons learned for future proposals

6.56. The evaluation of impacts will be undertaken using a standard knowledge-based theory of change approach, and designed so that the unique contribution of the M4 Junction 17 partial signalisation scheme can be established, and so that the approaches and methods are commensurate with the scheme's scale. This approach has been adopted as it will allow:

- The evaluation of specific interventions
- The ability to derive causal based effects of the interventions
- An opportunity for continual forecasting of impacts

6.57. Stage 1 (Pre-construction) involves the collation of baseline information which can be used in the evaluation of impacts in the later stages.

6.58. Collating electronic copies of all reports, documents, data and models relating to the scheme appraisal that will be required to establish baseline conditions and forecast impacts in terms of accidents, traffic volumes and journey times.

6.59. In Stages 2 and 3 the impact evaluation will be updated through the following steps:

- Request and process personal injury accident data for period beginning five years prior to the start of construction and finishing five years after opening. Compare accident and casualty numbers allowing for a robust assessment of safety impacts
- Comparison of traffic flows on slip roads (using MIDAS data collected from Highways England webtris site)
- Comparison of MIDAS lane occupancy data to assess the change in queuing on slip-roads and M4 mainline
- Compare Stage 1 baseline data to post opening data to determine scheme impacts
- An evaluation of the scheme in terms of the outturn impacts on economic development and growth (Stage 3 only)
- Obtain and analyse local socio-economic and economic metrics such as employment data and housing volumes to establish any correlation between the delivery of the scheme and improvements in local economic conditions (Stage 3 only).

Economic evaluation

6.60. The outcomes of the scheme will enable Wiltshire to establish a revised assessment of the benefits of the scheme. Whether anticipated or not, do the benefits justify the investment made at the outset? How can the VfM forecasts be considered in the planning of future schemes?

6.61. After completion of the Stage 3 monitoring and impact evaluation, an economic evaluation will be undertaken to assess the accountability of the investment into the scheme through answering the following questions.

- How do the realised benefits, and therefore, VfM correspond with those assumptions derived from the scheme appraisal?
- Have any unexpected benefits occurred or have other predicted benefits not materialised?
- Are on-going benefits expected to change?

6.62. The actual outturn costs and movement data will be used to generate a new BCR to understand the Value for Money provided. This will be compared back to that generated within the original Business Case.

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