A350 Melksham Bypass SOBC Appendices

Appendix A
Traffic & economic assessment report

A350 Melksham Bypass

Traffic and Economics Assessment Report

Wiltshire Council

November 2017

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1. Introduction

1.1. Overview

Wiltshire Council commissioned Atkins to identify and assess options for a Melksham Bypass to divert current through-traffic using the A350 away from the existing route through Beanacre and Melksham. Part of the impact assessment involves using the Melksham Traffic Model (MTM), developed specifically to inform this appraisal.

This Traffic and Economic Assessment Report (TEAR) details the construction of the MTM SATURN base model followed by the subsequent development of forecast models and analysis undertaken to determine the impact and economic benefits of the proposed improvements.

1.2. Background

The proposed A350 Melksham Bypass involves completion of a north-south bypass to divert current through-traffic using the A350 away from the existing route through Beanacre and Melksham. The A350 is a key north-south route between the M4 at Chippenham (Junction 17) and Dorset, passing through the west of Wiltshire. Lying on the A350 is the town of Melksham, which has been identified as a limitation of the route, due to areas of low speed limits, multiple junctions (causing delays) and frequent peak period congestion.

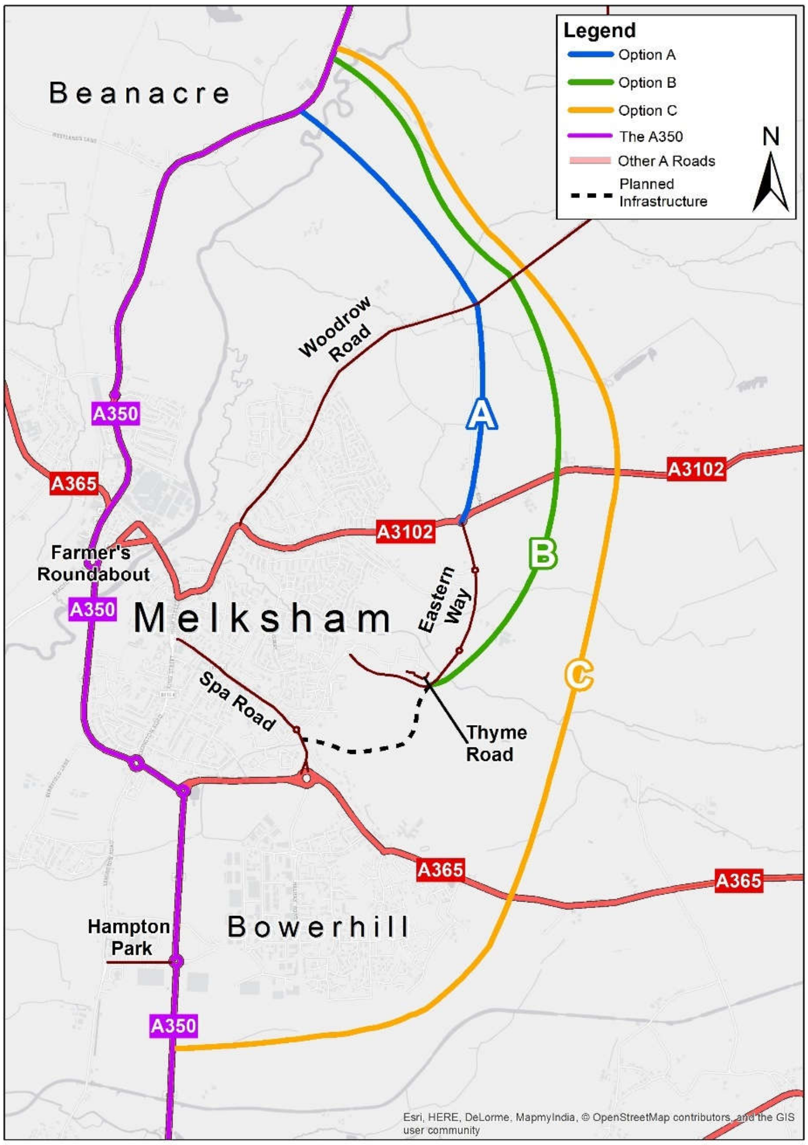
Over the last decade, the A350 corridor has experienced significant growth, and key policy documents, such as the Strategic Economic Plan (SEP) and Wiltshire Core Strategy 2006-2026, confirm that future population, housing and economic growth is also expected to be concentrated in the A350 corridor. With the current A350 route already having insufficient capacity to cope with traffic volumes, this will only worsen according to future projected volumes, with congestion and delays expected throughout the day if no action is taken.

The option assessment process resulted in three options being selected for further appraisal, due to their strategic fit in addressing the identified transport problems. These include three variations of an Outer Eastern Bypass option, shown in **Figure 1-1**.

Planning permission has been obtained for a new link road between Eastern Way and Spa Road (shown by the dotted line in **Figure 1-1**), which Options A and B will utilise. The road has been designed with a 40mph speed limit and priority junctions, including right-turning lanes, to planned developments.

Without the investment required to mitigate the existing and forecasted levels of congestion, there is concern that the viability of employment and development objectives in the A350 corridor will be hampered. This TEAR therefore compares this ‘Do-Minimum’ Scenario against the ‘Do-Something’ Scenarios involving the construction of an eastern bypass, including crossing a floodplain and bridging the River Avon.

Figure 1-1 A350 Melksham Outer Eastern Bypass Options



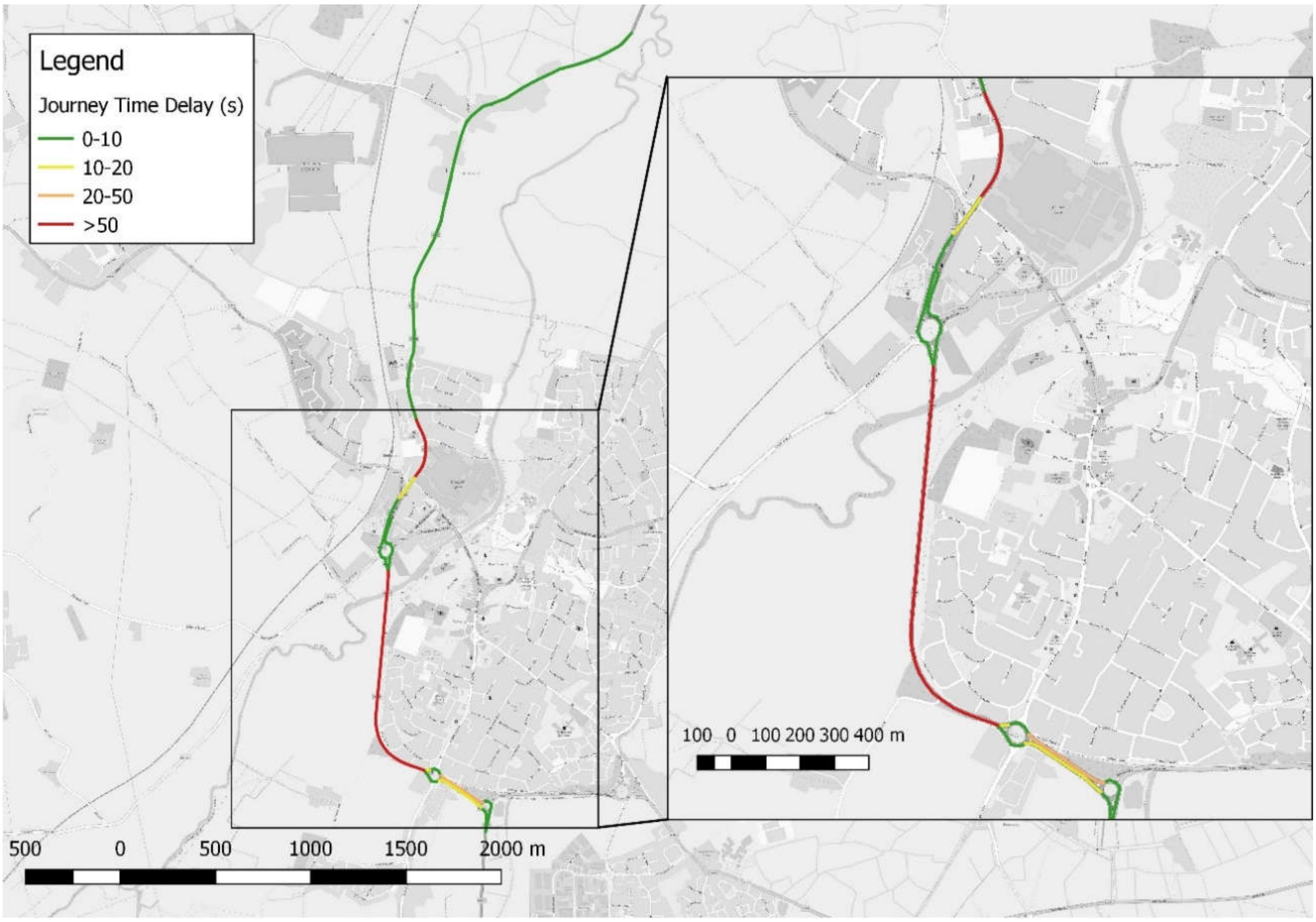
1.3. Objectives and Need for the scheme

The strategic outcomes and related transport objectives include:

- **To support sustainable population and economic growth in the A350 corridor, with a positive impact on regional and national economic productivity:** Reduce journey times and delays on the A350 through Melksham and Beanacre, allowing for future growth in demand and reduce journey times and delays on other routes through Melksham (A350 S – A3102, A365 W – A365, A350 S – A365 W), allowing for future growth in demand;
- **To support sustainable population and economic growth around Melksham/Bowerhill, supporting a revitalised town centre:** provide enhanced opportunities for walking and cycling between Melksham town centre and rail station/Bath Road, and along the existing A350 corridor within Melksham; and
- **To improve physical and mental wellbeing for users of the A350 and residents of Melksham:** Reduce personal injury accident rates and severity for the A350 and Melksham, reduce the volume of traffic, including HGVs, passing along the current A350 route and avoid negative impacts on other existing or potential residential areas.

The current (2017) delays, outputted from the Base model (the development of which is described in this report), are shown in **Figure 1-2** below for the AM peak. This shows that along the existing A350 through Melksham that vehicles experience congestion and delays, with a maximum delay of 104 seconds experienced between Farmers and Semington roundabouts, in the northbound direction. This report will demonstrate that this is anticipated to increase, with the expected levels of traffic growth due to the numerous local proposed developments.

Figure 1-2 MTM base model delays (AM Peak)



1.4. Report Structure

The rest of this report is structured as follows:

- **Chapter 2 – Base Model Specification:** an overview of the scope of the MTM base model and the data collection programme conducted to inform model development;
- **Chapter 3 – Base Network Development:** detailing the approach taken to developing the SATURN model simulation network;
- **Chapter 4 – Base Model Development:** detailing the construction of trip matrices using the A303 Stonehenge model and supplementary data sources such as AddressBase Plus data and ANPR;
- **Chapter 5 – Model Assignment and Standards:** outlining the approach to the MTM base model assignment process including parameters, and detailing the criteria required to be met;
- **Chapter 6 – Base Model Calibration;**
- **Chapter 7 – Base Model Validation:** presenting the results of the base model validation against DfT requirements for screenline, link flow and journey time criteria;
- **Chapter 8** – **Forecasting Approach and Network Development:** outlining the approach to the forecasting process used to inform the economic assessment of the scheme and noting highway schemes included within the forecast networks.
- **Chapter 9 – Forecast Matrices Development:** summarising the approach taken to forecasting future traffic growth in line with DfT guidance, based on developments included within the study uncertainty log and background traffic growth derived from NTEM and NRTF;

- **Chapter 10 – Traffic Impact Analysis:** comparing traffic patterns between the Do-Minimum and Do-Something core scenarios to understand the impacts of the scheme;
- **Chapter 11 – Estimation of Costs and Benefits:** detailing the calculation of scheme benefits (including TUBA assessments) and scheme costs; and
- **Chapter 12 – Economic Assessment Results:** presenting the schemes overall value for money and summarising the findings from this study.
- **Chapter 13 – Summary:** drawing together the key findings of the project.

2. Base Model Specification

This chapter details the specification of the Melksham Transport Model (MTM) base model in terms of temporal scope, spatial coverage and level of detail, demonstrating its suitability for assessing the traffic impacts of the A350 Melksham Bypass. It also provides an overview of the data sources used in model development.

2.1. Base Model Specification

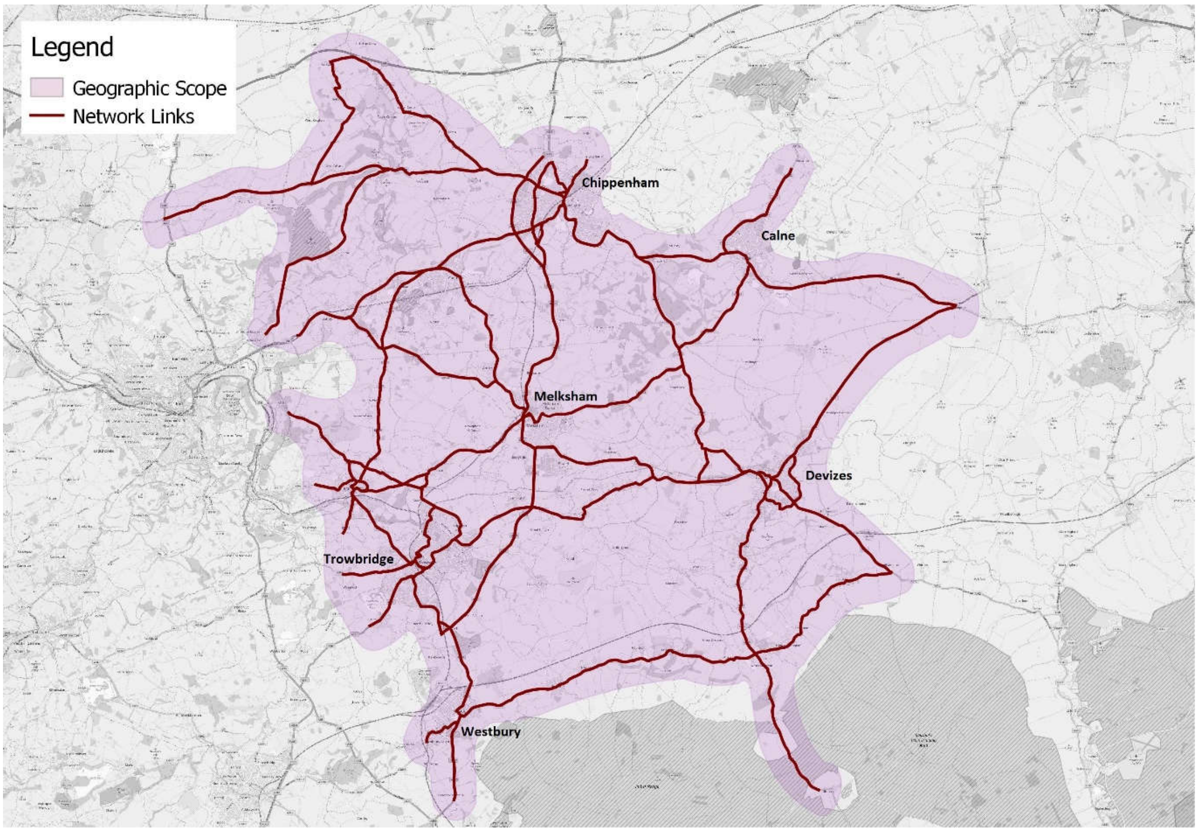
Geographic Scope

The geographic scope and local detail of the MTM was agreed at the outset of the project with Wiltshire Council to ensure that the model would be suitable for its initial purpose (the preliminary assessment of the A350 Melksham Bypass scheme).

Given the A350 Melksham Bypass's intended purpose of relieving congestion within Melksham and providing improved journey times along the A350, it was decided that the network should be centred on Melksham with the surrounding trunk network included to assess the impact on the strategic route as a whole. The network was coded in detail within Melksham itself with the surrounding area focused on strategic routes to enable the model to reflect changes to longer distance route choice and journey times.

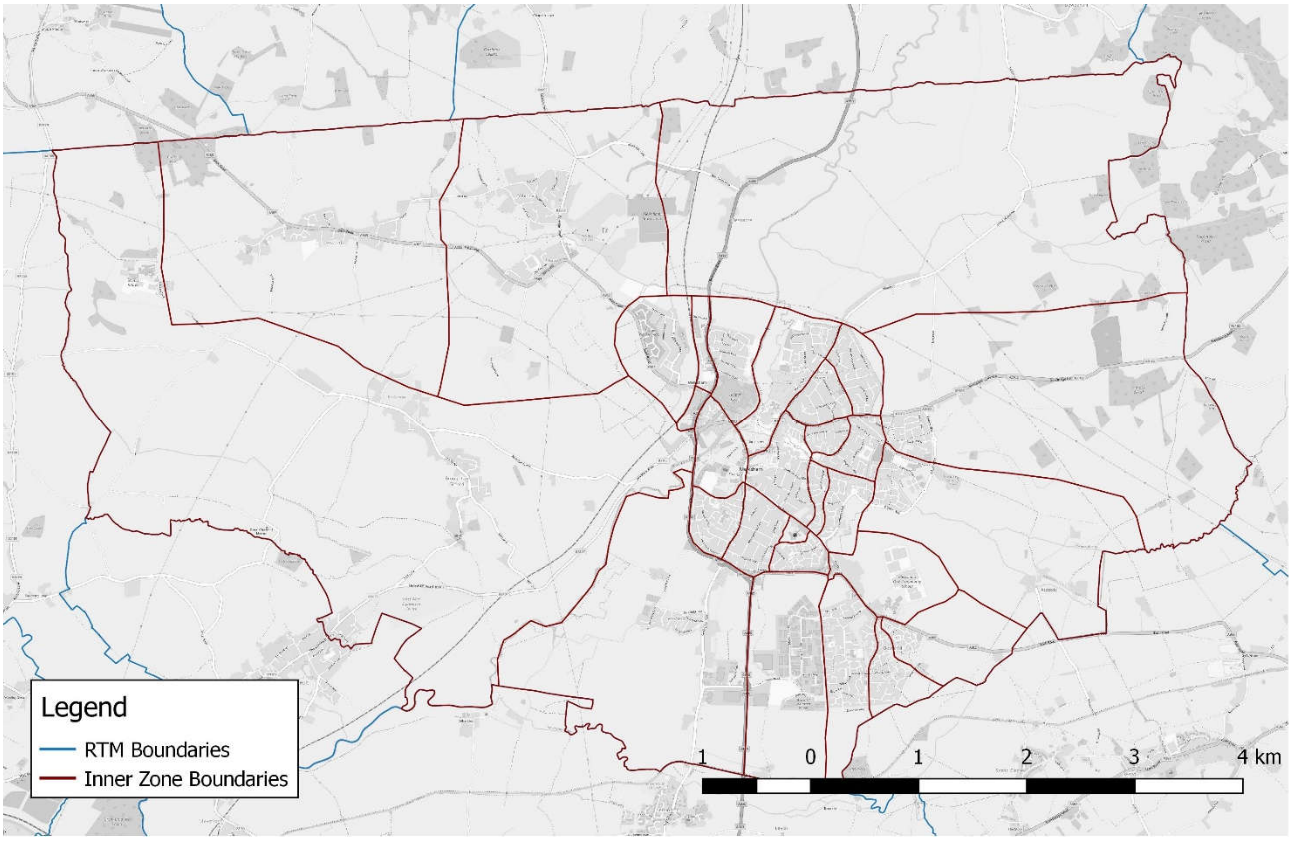
The A303 Stonehenge Model (approved by Highways England, April 2017, a derivative of the South West Regional Traffic Model (SWRTM)) was cordoned in the area of detail and the initial network and highway demand was used a starting point for the MTM. The initial core detailed network (derived from the A303 Stonehenge model) is shown in **Figure 2-1.**

Figure 2-1 A303 Stonehenge Model Cordon - Geographic Scope



The cordoned A303 Stonehenge model consisted of 35 internal zones and 29 external zones aggregated from the wider zoning system during the cordoning process. The region representing Melksham is represented as a single zone in the A303 Stonehenge model. To provide a detailed level for trip origin-destination (OD) representation within the model simulation network, this zone and the surrounding area was disaggregated into 34 zones. Residential areas were based on output area boundaries whilst key employment areas such as Bowerhill industrial estate were based on the workplace zone boundaries. The internal zoning system is shown in **Figure 2-2.**

Figure 2-2 Melksham Zoning (Zone splitting)



Model zones were also grouped according to a geographic sector system for adjusting trip distributions in order to validate the model. The external zones were grouped depending on their direction from the centre of Melksham.

Temporal Scope

The MTM has been developed to represent an average weekday in 2017 for the following time periods:

- AM Peak Hour (Average 0700-1000);
- Inter-Peak 1000-1600 (Average Hour); and
- PM Peak Hour (Average 1600-1900).

Note that the A303 Stonehenge model has a 2015 Base year but in the MTM base matrix development the matrices are re-calibrated to NTEM trip ends and data observed in 2017.

User Classes

The segmentation of travel demand in the highway assignment model is in line with the requirements as per guidance in Table 2.1 of WebTAG Unit M2. The highway assignment matrices have been segmented to five user classes as shown in **Table 2-1**.

Table 2-1 MTM User Class Definition

User Class	Vehicle Type	Purpose
1	Car	Employer's Business
2	Car	Commuting
3	Car	Other
4	Light Goods Vehicle (LGV)	-
5	Heavy Goods Vehicle (HGV)	-

Bus services operate along fixed routes. These are defined in the model as individual bus services with an associated frequency for each of the modelled time periods. Bus flows appear within the model as part of the 'fixed flow' on a given link.

Passenger Car Units

Passenger Car Units (PCUs) are a unit used to assess traffic flow rate. PCUs are introduced to allow for differences in the degree of interference to other traffic by the addition of one extra vehicle to the traffic, according to the type of the vehicle. There are established conversion factors that can be applied to convert any type of vehicle to the equivalent number of passenger car units. This allows mixed traffic streams to be assessed more accurately than if it was assumed that all vehicles have an equal impact on the highway network. The following PCU values were used:

- Light Vehicles = 1.0pcu;
- HGV = 2.5pcu;
- Bus = 2.5pcu (fixed flow)

Modelling Suite

The MTM is built in the SATURN Version 11.3.12U highway modelling suite. SATURN is a proprietary software suite able to encompass strategic modelling at a regional level down to the assessment of individual junctions at the simulation level. As a simulation modelling tool, SATURN is capable of analysing relatively minor changes in the network such as traffic management and provides detailed analysis of traffic behaviours at junctions. SATURN is an industry-respected assignment modelling tool used widely for the assessment of highways schemes and can provide robust analysis of small to large infrastructure developments. Accordingly, it is ideally suited to the assessment of the scheme as well as potential future testing of traffic impacts for development sites included within the modelled area.

2.2. Data Collection

The A303 Stonehenge model provides a good starting point for initial model network, preliminary highway demand matrices, and wider area count data. Additional data was required as:

- The network covers only links on the strategic road network;
- the highway cordon demand matrices were constructed using data taken from mobile phones, which consist only of trips longer than 5km.
- There is very limited / no count or Journey time data used in the calibration / validation of the model in the area of detail.

Therefore, in order to refine these deficiencies additional data was required.

To improve the highway network, local OS Mapping, aerial photography and ITN data was collected to improve and edit the network.

The highway demand matrices required multiple sources of data to infill the missing information. All additional data sources, together with their usage within the base model development are summarised in **Table 2-2**.

Table 2-2 Summary of Additional Data Sources Used in Model Development

Data	Description
OS Mapping and aerial photography	Utilised for network refinement (see section 3)
Automated Number Plate Recognition (ANPR) Survey	Used to inform the distribution of trips within and through Melksham (see Figure 2-3)
AddressBase Plus	AddressBase Plus data provides details on the land use within a geographical area. This data was used to estimate the proportionate split the demand to sub zones within Melksham
Automated Traffic counts (ATC)	New 2017 data used for highway validation Classified data used to estimate vehicle type. (see Figure 2-4)
TomTom GPS Journey Time Data	

Data	Description
Trafficmaster Journey time data	Validation of Key JT routes (see Figure 2-5)
NTEM 7.2 / TEMPRO	Estimate total trip ends for large areas during matrix synthesis (see Table 4-2)
TRICS database	Used to check/corroborate trip ends of proposed development zones. Used for matrix forecasting (see Table 9-3)

As part of a data collection programme, specific to the purposes of the project, a number of data sources, including on-site surveys, were conducted in Summer 2017. These were used alongside data sources that were already available.

Data collected as part of the data collection programme included:

- 12-hour Automatic Number Plate Recognition (ANPR) Survey across nine sites; and
- Twenty three 24-hour two-week Automatic Traffic Counts (ATCs).

Additional data sources include:

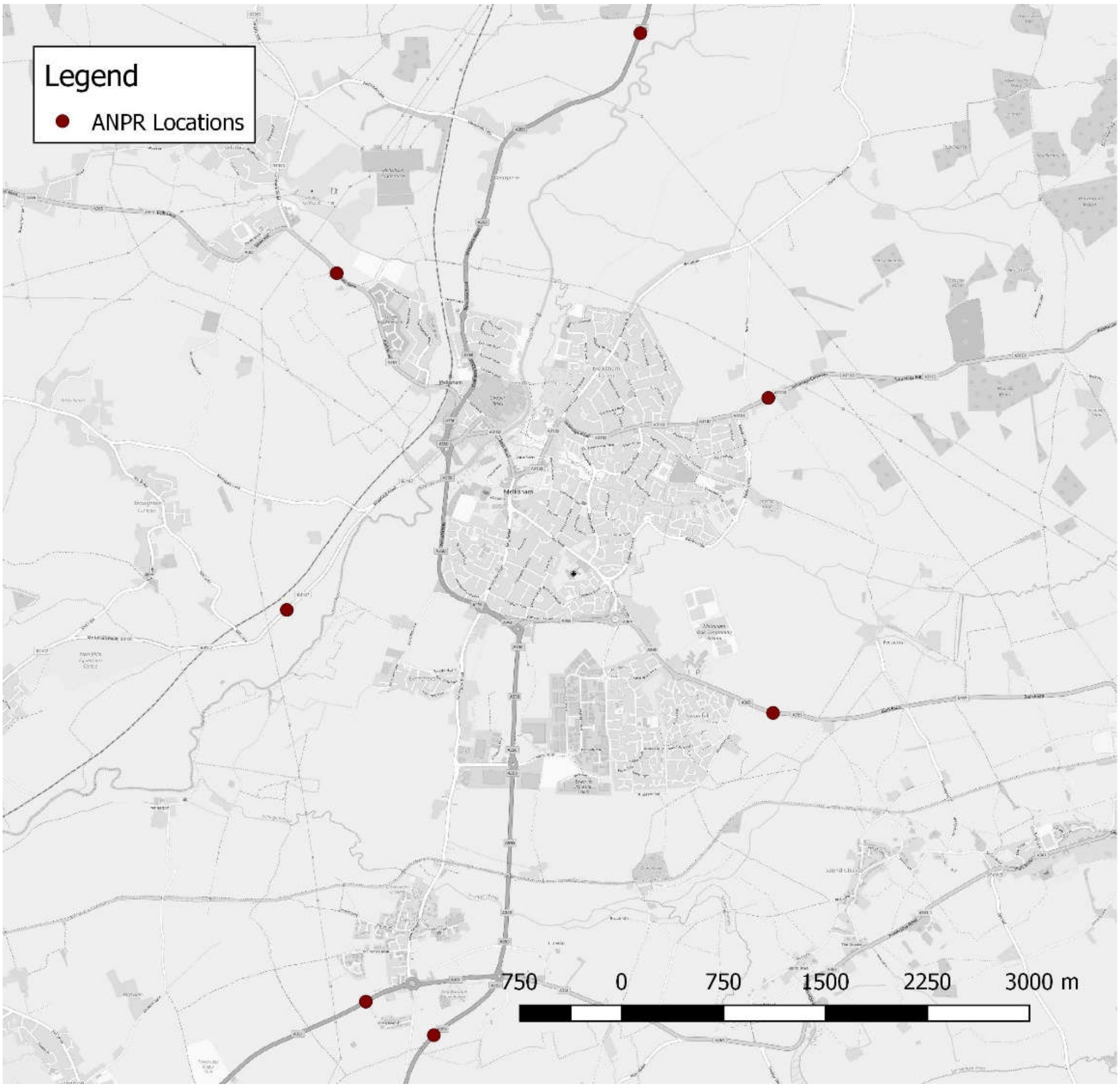
- AddressBase Plus Data for Melksham;
- GPS Journey Time data long Bath Road and the A3102; and
- GPS Journey Time data along the A350.

Further details regarding these data sources is provided below.

ANPR Survey

The ANPR survey was conducted over nine sites on July 5th 2017 between 07:00 and 19:00. The survey locations form a cordon of the key strategic links around Melksham, with seven sites cordoning Melksham (**Figure 2-3**) and two further sites on the A350 capturing the full west Wiltshire A350 corridor (north of Chippenham and south of Westbury). These locations allow the capture of both external through Melksham trips, as well as external to internal movements. Locations were chosen to determine the number of through trips along the A350, as well as those originating and ending within Melksham or the ANPR cordoned area.

Figure 2-3 ANPR Survey Locations



AddressBase Plus Data

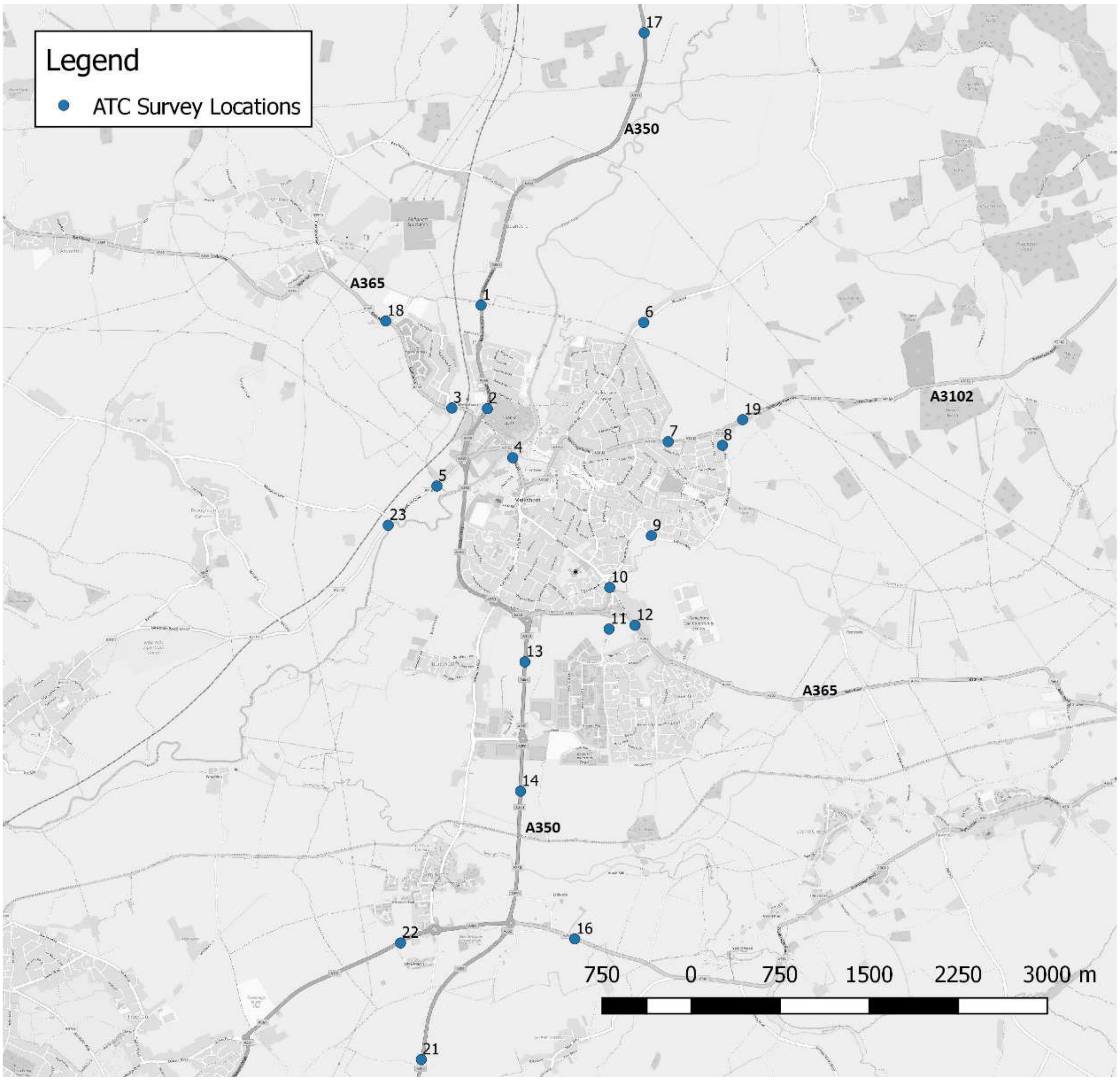
AddressBase Plus data provides the number of unique addresses within a geographical area. Data was obtained for an area consistent with the internal model zone structure and was used to inform the internal distribution of the prior matrix. Trips into and out of the single Melksham zone were distributed amongst the disaggregated zones with a weighting proportionate to the number of addresses in that zone. The majority of HGV trips were distributed amongst zones 95001 and 95025, as these zones contain Bowerhill Industrial Estate and Cooper Tire & Rubber respectively.

Traffic Counts

Atkins commissioned Intelligent Data[1] to conduct link counts at 23 locations for a two-week period commencing 10th June 2017. The count data was processed, with average hour counts for each time-period determined. The locations of these sites are shown below in **Figure 2-4.**

[1] http://www.intelligentdatagroup.co.uk/

Figure 2-4 Automatic Traffic Count Survey Locations



GPS Journey Time Data

Trafficmaster and TomTom GPS journey time data were obtained, on the routes in **Figure 2-5** below, for model journey time validation, in line with DfT WebTAG guidance. Trafficmaster data was obtained for a full academic year from September 2014 to August 2015 (the latest full year available at time of request) and average yearly journey times were calculated along the route, for each of the three time periods. TomTom GPS journey time data was obtained for the A350 through Beanacre and Melksham, for the period April 2015 to March 2016. The average journey time for each direction is given, as well as the absolute difference between that and the overnight journey time, assumed to be the journey time without congestion or delays.

Figure 2-5 Journey Time Validation Routes

3. Base Network Development

This chapter describes the process of developing the MTM highway networks. The approach involved first extracting a cordon around Melksham from the A303 Stonehenge Model and then adding in local roads to provide more detail in the network around the study area.

Coding Approach

A two-stage approach was adopted for the development of the MTM highway networks. The first stage involved the cordoning of the A303 Stonehenge Model, which produced a basic network of strategically important roads. The second stage involved the addition of local, lower class roads using online information, such as Google Streetview and satellite imagery.

Key roundabouts were coded as ‘exploded’ junctions in line with SATURN best practice, where the circulating and entry carriageways are explicitly defined, with the entry points represented as separate priority or signalised junctions. Circulating and entry saturation flows and gap acceptance are defined in line with values for a normal roundabout node.

Part of the detailed simulation coding involved adding in additional nodes where required, these nodes were geo-referenced back in QGIS as part of the final stage of the network development process. New link distances were then updated accordingly before final manual checks were undertaken to ensure these were accurate.

Speed Flow Curves

The principle form of capacity restraint within Melksham is at modelled junctions. This is appropriate in urban areas with relatively short links, where junction capacities have by far the greatest impact on link flows and travel times. However, speed-flow curves have been applied to the key strategic links in the model where flow capacity constraint effects become more significant. Speed flow curves used in the model are taken directly from the A303 Stonehenge model.

Junction capacities

The calculation of junction saturation capacities was based on the RTM coding manual. These calculations take into account the characteristics of the junction in question, in terms of lane width (signalised junctions), entry lane approach width/degree of flaring, junction diameter (roundabouts) and visibility lengths (priority junctions).

Table 3-1 summarises the number of simulation nodes by node type.

Table 3-1 Content of SATURN Simulation Network

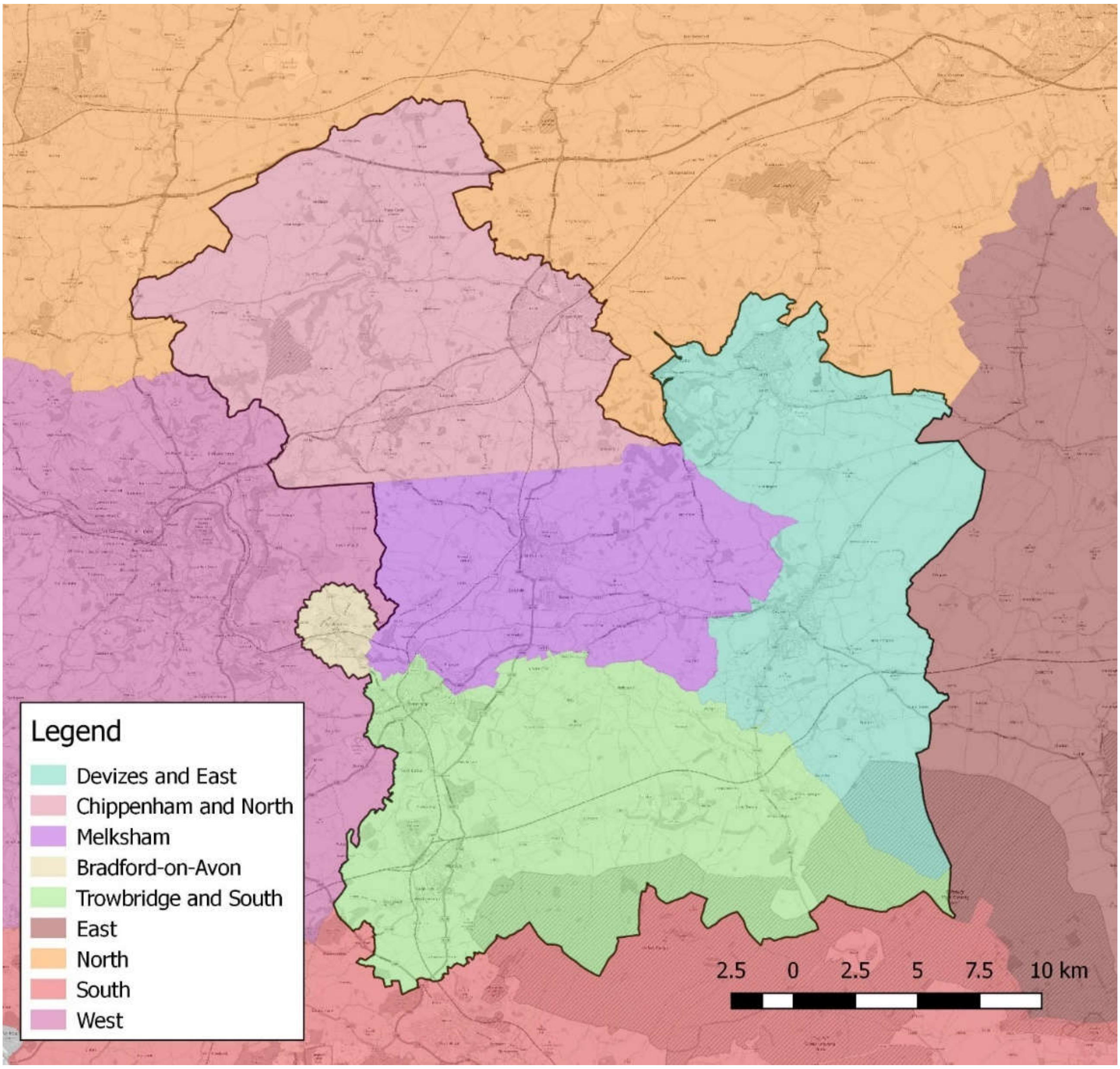
Node Type	Number of Nodes
Priority Junctions	209
Signalised Junctions/ Pedestrian Crossings	22
Roundabouts	27
External Nodes	53
Total	**346**

4. Base Matrix Development

This chapter describes the work undertaken in developing the base matrices for the Melksham Transport Model.

The highway demand has been created using a sector system, as shown in **Figure 4-1**.

Figure 4-1 MTM Sector System



4.1. Stage 1: Extracting a Cordon Matrix

The first step was to take a cordon of a larger, already-validated model to inform the distribution particularly of long-distance trips into and through Melksham that cannot be identified with local traffic counts alone. The usual practice is to take the relevant regional model for this purpose, but on this occasion, it was decided that the A303 Stonehenge model should be used in preference to the southwest regional model. This was because it had been refined around Wiltshire and was more likely to accurately reflect the distribution of trips near the study area as a result. Matrices for the cordoned off area around Melksham were extracted for all three modelled time periods.

The totals of these matrices are given in **Figure 4-1**.

Table 4-1 A303 Stonehenge Model 2015 Base Model - Cordon Matrix Trip Totals (PCUs)

User Class	AM Peak	Inter-Peak	PM Peak
UC1 Car (Employers Business)	1945	1357	1598
UC2 Car (Commute)	9812	2807	9363
UC3 Car (Other)	8203	10805	11097
LGV	2784	2228	2228
HGV	1820	1655	1095
Total	**24565**	**18852**	**25380**

4.2. Stage 2: Trip adding to match NTEM

Trips Ends

NTEM Totals

The next step was to ensure that the total demand (productions and attractions) in Melksham is appropriate. Since the A303 Stonehenge model was not validated near to Melksham itself there is no guarantee that the matrices from stage 1 immediately satisfied this requirement and indeed it was found that the matrix totals were too low at this stage. TAG Unit M1.2 recommends that data used for this purpose is consistent with the DfT NTEM (National Trip End Model) projections. Therefore, this dataset has been used to generate an estimate for locally appropriate 2015 base year matrix totals.

NTEM data is provided in 3-hour time periods for the morning and evening periods and over 6 hours for the inter-peak. Origin-Destination car driver trip ends are summarised in **Table 4-2** below.

Table 4-2 NTEM 7.2 Base 2015 Car Driver OD Data

Level	Name	Work		Employers Business		Other	
		Origin	Dest	Origin	Dest	Origin	Dest
		AM (3hrs)					
Authority	Wiltshire	11,659	10,495	72,787	69,239	46,451	44,030
	Melksham	578	492	3,626	3,084	2,264	1,925
		IP (6hrs)					
Authority	Wiltshire	18,180	17,934	30,646	30,676	158,960	157,935
	Melksham	838	866	1,456	1,480	7,608	7,623
		PM (3hrs)					
Authority	Wiltshire	9,965	10,638	50,782	53,843	73,940	74,669
	Melksham	452	533	2,288	2,725	3,453	3,670

This data provides an overall target for the level of traffic in Melksham to be incorporated within each of the model time periods – the process for how to add trips to meet these levels is described in the next section.

Trip adding

The main sources of data for choosing how to add trips to match the NTEM trip ends were from the automatic traffic counts (ATC) and ANPR surveys. The ATC sites and ANPR survey locations (Chapter 2 **Figure 2-3** and **Figure 2-4**) form a cordon of the key strategic links around Melksham, enabling the capture of both external through Melksham trips, as well as external to internal movements. Key strategic movements are therefore based on directly observed movements as much as possible.

The first step was to calculate the total number of vehicles entering and leaving Melksham per hour in each time period by looking at a selection of the ATC sites forming a cordon around the settlement. ANPR data was then analysed to determine the number of through trips: this was assumed to be any vehicle captured entering Melksham and then leaving Melksham no more than 30 minutes later. These trips – although affecting the screenline – do not affect the matrix at Melksham itself and were therefore excluded from the totals into and out of Melksham to deduce the total number of external-internal trips. The matrix was then adapted by factoring up external-Melksham trips to match this level.

Finally, the remaining difference between the matrices and the NTEM target levels was assumed to be internal trips within Melksham and these were added accordingly.

4.3. Stage 3: Melksham Zone Distribution

As part of the base network development, the A303 cordon model was refined and the zone that contained Melksham was disaggregated into 29 new zones. It was therefore necessary to split the total demand within Melksham to its constituent zones. AddressBase Plus data was used to gain an understanding of the relative size of each of the new zones, and estimated weights were applied to particular sites such as schools and the hospital. Weights were also made specific to user class, with HGVs for example mainly originating or going to the industrial park to the south of the settlement.

4.4. Stage 4: Estimating Intrazonal trips

Since the demand to and from Melksham was increased relative to A303 Stonehenge model, proportionate adjustments were made to the demand in Trowbridge, Chippenham and Bradford-on-Avon to preserve the distribution of the A303 Stonehenge model. Since the model does not have the same level of refinement around Trowbridge, Chippenham and Bradford on Avon, these trips were added as internal trips in the relevant zones. This allowed the matrix to reach the desired levels without affecting the assignment in the base or unduly blocking up individual junctions within those settlements.

5. Model Assignment and Standards

This chapter describes the assignment process used the in MTM, including assignment parameters, generalised cost coefficients and convergence criteria. The calibration and validation procedures are also described.

5.1. Assignment Process

Model assignment of trips to the highway network was undertaken using a standard approach based on a 'Wardrop User Equilibrium', which seeks to minimise travel costs for all vehicles in the network. The Wardrop User Equilibrium is based on the following proposition:

'Traffic arranges itself on congested networks such that the cost of travel on all routes used between each origin-destination pair is equal to the minimum cost of travel and unused routes have equal or greater costs.'

The Wardrop User Equilibrium as implemented in SATURN is based on the 'Frank-Wolfe Algorithm', which employs an iterative process. This process is based on successive 'all-or-nothing' iterations, which are combined to minimise an 'objective function'. The travel costs are recalculated during each iteration and then compared to the previous iteration. The process is terminated once successive iteration costs have not changed significantly. This process enables multi-routeing between any origin-destination pair.

The cost of travel in a traffic model is expressed in terms of generalised cost minutes. Generalised cost coefficients are defined within the network data file in terms of weighting factors between time and distance. Values of time (pence per minute – PPM) and distance (pence per km – PPK) for light and heavy vehicles for the base year of 2017 have been derived using the formulae contained in TAG Unit 3.1. All calibration and validation was originally completed using PPM and PPK values taken from TAG v1.8. HGV values have been doubled in line with guidance. Values for the MTM are shown in **Table 5-1.**

Table 5-1 2017 Assignment Values of PPM and PPK (WebTAG Databook v1.8 July 2017)

UC	Description	PPM (pence per minute)			PPK (pence per kilometre)		
		AM	IP	PM	AM	IP	PM
1	Car (Commute)	20.45	20.78	20.52	7.08	7.08	7.08
2	Car (Business)	30.49	31.24	30.93	16.02	16.02	16.02
3	Car (Other)	14.11	15.03	14.77	7.08	7.08	7.08
4	LGV	21.55	21.55	21.55	15.33	15.33	15.33
5	HGV	21.88	21.88	21.88	70.50	70.50	70.50

5.2. Calibration Procedure

The calibration procedure involved a number of steps to ensure that the model reproduces observed traffic flows and travel times in the model network. These included:

- Adjustments of link and junction operating parameters to represent the existing situation;
- Checks to ensure that link speeds on the network were realistic; and
- Checks to ensure that delays at junctions were realistically represented.

Flow Validation Criteria

During model development, validation checks were incorporated into processing of the model output data. This primarily consisted of the comparing the observed and modelled link flows. The calibration and validation link flow comparison used the guidelines set out in TAG Unit M3.1, shown in **Table 5-2**.

Table 5-2 TAG Unit M3.1 Acceptability Guidelines

	Criteria & Measure	Guideline	
Flow Criteria			
1	Observed flow < 700vph	Modelled flow within ± 100vph	> 85% of links
	Observed flow 700 to 2700vph	Modelled flow within ± 15%	
	Observed flow > 2700vph	Modelled flow within ± 400vph	
2	Total screen line flows to be within ± 5%	All (or nearly all) screen lines	
GEH Criteria			
3	GEH statistic for individual links <5	> 85% of links	
4	GEH statistic for screen line totals <4	All (or nearly all) screen lines	

NB: the acceptability requirement for individual links is for either the flow or GEH to be within the guideline values (i.e. both are not required).

GEH Statistic

The GEH statistic is a generally accepted value used as an indicator of 'goodness of fit', i.e. the extent to which the modelled flows match the corresponding observed flows. This is defined as:

$$GEH = \sqrt{\frac{(M - C)^2}{0.5(M + C)}}$$

Where M = modelled flow and C = observed flow.

Journey Time Validation

For journey time validation, guidance states that the measure to be used is: the percentage difference between modelled and observed journey times, subject to an absolute maximum difference. The acceptability guidelines are defined as: Modelled times along routes should be within 15% of surveyed times or 1 minute, if higher than 15% (for 85% of routes).

5.3. Convergence

Table 5-3 show the latest convergence criteria outlined in TAG Unit M3.1 (Table 4)

Table 5-3 Convergence Measures and Base Model Acceptance Values

Measure of Convergence	Base Model Acceptance Values
Delta and % Gap	Less than 0.1% or at least stable with convergence fully documented and other criteria met
Percentage of links with flow change (P) <1%	Four consecutive iterations of great than 98%
Percentage of links with cost change (P2) <1%	Four consecutive iterations of great than 98%

Convergence statistics for the post-matrix estimation assignments are included within Chapter 6.

6. Base Model Calibration

6.1. Calibration of the Initial Assignment

Calibration of the initial base year assignment focussed on reviewing, fine-tuning and rectification of network and routeing issues. Checks were undertaken to ensure that free flow speeds, signal phasing and timings, saturation flows and turn capacities were appropriate. Saturation flows for key junctions are based on values from the A303 Stonehenge model. As part of model calibration, these values were varied where modelled journey times exceeded observed values (i.e. where modelled junction delays were higher than observed), where turn capacities were lower than observed turning movements, and where modelled links/turns were operating at or in excess of capacity when the link or turn is known to operate below this level in reality.

Routing checks were carried out using select link analysis within the P1X module of SATURN to ensure that vehicles were routeing in a realistic manner. The speeds along links and junction delays were checked by comparison of the observed journey times at clear timing points against the modelled journey time for each section.

6.2. Matrix calibration

To ensure that the flows at individual ATC locations were matched as closely as possible, the main tool used was a sector system that was developed along each road going into and out of Melksham. In particular, it was found that there were insufficient through trips compared to the numbers observed in the ANPR data so these routes were factored up appropriately to match the observed screenline. In addition, certain traffic was found to be entering or leaving Melksham on the incorrect arms. Suitable network adjustments were made where errors were highlighted by this and where a change in the matrix was still necessary, ANPR data was used to inform the decision of which arm to shift the traffic to. Care was taken to preserve the total number of vehicles with Melksham as origin or destination which had been calibrated in the second stage of the base matrix development.

The final matrix totals are displayed in Table 6-1 below:

Table 6-1 Final Matrix Trip Totals (PCUs)

User Class	AM Peak	Inter-Peak	PM Peak
UC1 Car (Employers Business)	2941	2367	2385
UC2 Car (Commute)	15763	6801	14098
UC3 Car (Other)	12581	17996	15679
LGV	4934	4705	4699
HGV	3780	3728	2655
Total	**39999**	**35596**	**39516**

The Base highway demand matrices are presented in sector format in Table 6-2 to Table 6-4.

Table 6-2 MTM Base Matrix AM Peak

	Devizes	East	South	Chippenham	West	North	Melksham	Bradford On Avon	Trowbridge	Total
Devizes	1494	829	295	128	68	61	51	2	162	3090
East	1589	1071	472	616	215	553	158	12	100	4785
South	626	531	2687	210	98	208	777	88	1074	6297
Chippenham	223	437	156	2516	999	1526	336	39	98	6330
West	73	157	117	963	1234	372	251	328	1775	5271
North	67	496	169	2446	425	227	193	19	35	4077
Melksham	153	280	670	416	373	296	1174	25	223	3610
Bradford On Avon	3	11	61	32	297	15	59	704	379	1561
Trowbridge	150	120	512	124	967	73	150	474	2407	4978
Total	4376	3932	5139	7452	4677	3329	3150	1691	6254	39999

Table 6-3 MTM Base Matrix Inter Peak

	Devizes	East	South	Chippenham	West	North	Melksham	Bradford On Avon	Trowbridge	Total
Devizes	2532	533	154	53	61	34	179	4	96	3645
East	1406	634	225	247	147	302	233	9	84	3287
South	897	183	1721	96	91	200	292	45	1010	4535
Chippenham	66	322	83	3751	497	897	537	30	112	6295
West	65	126	125	676	981	248	385	237	1818	4662
North	40	343	95	2466	244	186	170	15	57	3617
Melksham	198	96	332	409	382	96	951	37	365	2865
Bradford On Avon	4	6	36	24	281	18	46	998	276	1690
Trowbridge	134	76	545	82	686	58	255	559	2605	5000
Total	5343	2318	3316	7806	3370	2041	3046	1934	6423	35596

Table 6-4 MTM Base Matrix PM Peak

	Devizes	East	South	Chippenham	West	North	Melksham	Bradford On Avon	Trowbridge	Total
Devizes	2649	1063	388	90	89	36	220	4	176	4714
East	729	884	352	287	187	379	340	11	194	3364
South	295	338	1602	174	107	244	541	34	592	3928
Chippenham	120	466	164	3736	874	1701	450	45	201	7756
West	102	174	116	814	1288	313	437	345	1125	4712
North	66	522	160	1311	352	184	206	16	93	2909
Melksham	174	210	234	389	250	130	1507	42	375	3310
Bradford On Avon	4	13	38	39	325	18	29	909	273	1647
Trowbridge	122	121	763	125	1433	63	281	526	3740	7175
Total	4262	3789	3816	6965	4905	3068	4011	1932	6769	39516

6.3. Model Convergence

A summary of the model convergence statistics are presented in Table 6-5. Full statistics are presented in **Appendix A**.

Table 6-5 Summary of MTM Base Model Covergence

Time Period	Assignment Iterations	Delta	% Flow
AM Peak	18	0.000185	98.0
	19	0.000148	98.6
	20	0.000221	98.7
	21	0.000120	98.5
	22	0.000094	99.0
Inter-peak	13	0.000264	99.5
	14	0.000296	99.6
	15	0.000223	99.6
	16	0.000214	99.5
	17	0.000172	99.4
PM Peak	13	0.000170	97.6
	14	0.000079	98.5
	15	0.000132	98.7
	16	0.000076	99.4
	17	0.000094	99.4

Table 6-5 demonstrates that two base model assignments reach acceptable convergence levels within the first 20 iterations and the AM peak reaches them within 22 iterations, with flow changes of less than 3% for 4 consecutive iterations for all peak periods. Comparison of the extended convergence statistics in **Appendix A** provides more practical interpretation of model convergence.

7. Base Model Validation

Model validation is a comparison of model output data with observed data to assess the accuracy of the calibrated model and establish its suitability as a basis from which to prepare forecasts. There are guidelines set by TAG Unit M3.1 specifying the criteria that determine whether the calibrated model is considered to be a valid representation of reality or not. A summary of these guidelines has been provided in **Table 5-2** of this report.

During model development, it was found that there are issues with the network inherited from the A303 Stonehenge model, i.e. insufficient network detail and crude template coding which results in (possibly incorrect) large delays and subsequent convergence issues and unrealistic capacity constraints in areas on the outskirts of the modelled area (i.e. in Trowbridge. Chippenham, Westbury etc.). Whilst this does not affect the validity of the model in the Melksham area, it is expected to have a possible impact on model forecasting, resulting in model noise and the potential for unrealistically constraining traffic in the regions. It is recommended that these wider area model issues are addressed in later updates and refinements to the model.

Validation of the MTM has involved the following aspects:

- Link flow and screenline validation; and
- Journey time validation.

7.1. Flow and Screenline Validation

A summary of the flow validation for all three modelled time periods is presented in **Table 7-1** for all observed sites, **Table 7-2** for screenlines and **Table 7-3** for the A350 Melksham corridor (all shown in **Figure 7-1**). Detailed link-by-link assessments for comparing observed total vehicles with modelled flows are presented in Appendix B for each time period.

Figure 7-1 MTM Cordon, Screenlines and A350 Routes

Table 7-1 to **7-3** demonstrates that:

For the AM peak base model:

- The AM peak assignment achieves a high level of link validation, with validation counts exceeding the 85% of counts threshold for both the GEH and flow criteria. All but one count achieves the GEH statistic criteria, however this has the smallest sample so may be biased; and
- The vast majority of modelled screenline flows are within ±5% of observed flows for total vehicles.

For the inter-peak base model:

- A high level of validation is achieved, with validation accounts exceeding the 85% thresholds for GEH and link flow criteria for almost all counts;
- Where sufficient counts are available, modelled screenline flows achieve a good level of validation, within the ±5% of observed flow criteria.

For the PM peak base model:

- Almost all validation accounts reach or exceed the 85% thresholds for GEH and link flow criteria; and
- Where sufficient counts are available, modelled flows achieve a high level of validation, within the ±5% of observed flow criteria.

Table 7-1 Link Flow Validation

Time Period	Total Count Sites	Observed Total Vehicles	Modelled Total Vehicles	% Difference	% GEH < 5	% Link Flow
AM	42	21,366	21,030	-1.6%	93%	93%
IP	42	18,531	17,995	-2.9%	83%	90%
PM	42	22,939	23,062	0.5%	93%	93%

Table 7-2 Melksham Cordon Observed vs Modelled Flow Comparison

Time Period	Direction	Total Count Sites	Observed Total Vehicles	Modelled Total Vehicles	% Difference
AM	IN	7	3,255	3,357	3.1%
	OUT	7	3,584	3,676	2.6%
IP	IN	7	2,962	3,003	1.4%
	OUT	7	2,875	2,860	-0.5%
PM	IN	7	4,029	3,969	-1.5%
	OUT	7	3,330	3,404	2.2%

Table 7-3 Melksham A350 Observed vs Modelled Flow Comparison

Time Period	Route	Direction	Total Count Sites	Observed Total Vehicles	Modelled Total Vehicles	% Difference
AM	North	IN	2	1,339	1,321	-1%
		OUT	2	1,617	1,797	11%
	South	IN	2	1,617	1,698	5%
		OUT	2	1,538	1,670	9%
IP	North	IN	2	1,174	1,119	-5%
		OUT	2	1,473	1,380	-6%
	South	IN	2	1,409	1,489	6%
		OUT	2	1,287	1,320	3%

Time Period	Route	Direction	Total Count Sites	Observed Total Vehicles	Modelled Total Vehicles	% Difference
PM	North	IN	2	1,328	1,502	13%
		OUT	2	1,996	1,871	-6%
	South	IN	2	1,884	1,988	6%
		OUT	2	1,522	1,706	12%

All modelled screenline flows are within ±5% of observed flows. Overall therefore, it can be concluded that each of the modelled time periods achieve high levels of fit in terms of both link and screenline criteria, meeting the TAG guidance requirements set out in Chapter 5 of this report.

7.2. Journey time validation

Journey time validation was undertaken to ensure that travel times and delays along links and at junctions across the study area are accurately represented in the model. The validation was based on a comparison of modelled and observed journey times along the two survey routes described in Chapter 2 (**Figure 2-5**).

A summary of the journey time validation for each time-period is presented in **Table 7-4**.

Table 7-4 Journey Time Validation Summary

JT route	AM Peak Travel Time (min)			Inter Peak Travel Time (min)			PM Peak Travel Time (min)		
	Obs	Model	% Diff	Obs	Model	% Diff	Obs	Model	% Diff
A350 NB	8.33	6.99	-16.1%	7.77	6.63	-14.7%	7.85	6.96	-11.3%
A350 SB	7.02	6.93	-1.4%	7.33	6.63	-9.6%	8.67	7.34	-15.3%
A3102 WB	17.25	18.22	5.6%	17.39	18.28	5.1%	16.79	18.31	9.0%
A3102 EB	17.47	18.17	4.0%	17.82	18.00	1.0%	17.63	18.39	4.3%
Proportion within ±15%	**75%**			**100%**			**75%**		

Acceptability criteria states that modelled journey times over the whole survey route should be within ±15% of observed times (or ± one minute if higher) on 85 per cent of routes.

Table 7-4 demonstrates that the IP peak and PM time periods meet the acceptability criteria (one route is over 15% different, but the modelled is within one minute of the observed so is accepted) and the AM peak come close with 3 out of 4 routes meeting criteria and only one route not accepting the criteria.

Throughout the rest of the network, a very good level of journey time validation is achieved, particularly for routes which run adjacent or parallel to the location of the proposed scheme.

7.3. Summary

The evidence presented in this chapter demonstrates that the MTM achieves a good level of validation in terms of links, screenlines and journey times for all time periods. This confirms that the model is robust and acceptable for use as a forecasting tool, including for the assessment of the Melksham Bypass scheme proposals outlined in the following chapters of this report.

8. Forecasting Approach

This chapter outlines the preparation and key assumptions which have informed the forecasting approach for testing of the A350 Melksham Bypass before outlining the highway network changes which have been incorporated.

8.1. Forecasting Procedure

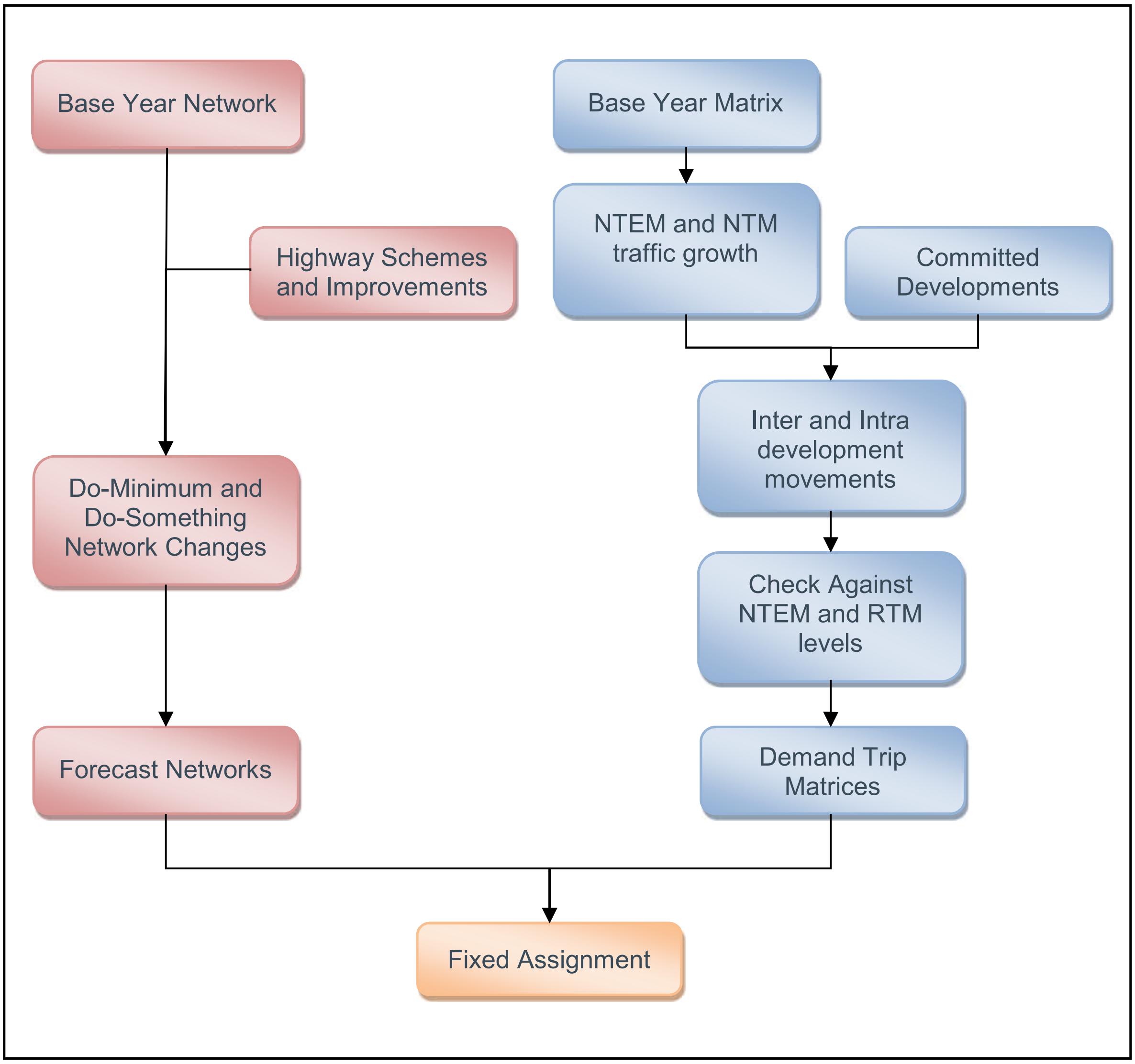
The currently planned opening year for the scheme is 2023. The economic assessment of the scheme requires a minimum of the opening year and a design year (usually 15 years after opening). A horizon year has also been included to provide an additional point to further define the benefit curve of the scheme.

Future year models have therefore been developed for:

- 2023; and
- 2041

The forecasting approach, along with the key inputs and outputs for each stage, is shown diagrammatically in **Figure 8-1**.

Figure 8-1 Forecasting Approach



At present, variable demand has not been conducted for the purposes of assessing the impact of the Melksham Bypass. Whilst for a scheme of this size, a fully WebTAG compliant Variable Demand Model will be developed, as this report is intended to support an initial Strategic Outline Business Case a fixed demand approach is considered sufficiently robust at this stage.

8.2. Uncertainty

WebTAG Unit M4 sets out the guidance for treatment of uncertainty in model forecasting. Determining uncertainty around input assumptions on demand forecasts is used to develop and assess alternative scenarios.

The key issues in assessing uncertainty are:

- The range of possible inputs;
- The likelihood of each input; and
- The interaction between different elements which affect inputs.

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

The uncertainty log includes an assessment of the uncertainty of each individual input by placing it into one of four categories, as defined in **Table 8-1** (taken from WebTAG M4 Appendix A Table A2)

Table 8-1 Classification of Future Inputs

Probability of the Input	Status
Near Certain: The outcome will happen or there is a high probability that it will happen.	Intent announced by proponent to regulatory agencies; Approved development proposals; and Projects under construction
More than likely: The outcome is likely to happen but there is some uncertainty.	Submission of planning or consent application imminent; Development application within the consent process; and Projects under construction.
Reasonably Foreseeable: The outcome may happen, but there is significant uncertainty.	Identified within a development plan; Not directly associated with the transport strategy/scheme, but may occur if the strategy/scheme is implemented; Development conditional upon the transport strategy/scheme proceeding; Or, a committed policy goal, subject to tests (e.g. of deliverability) whose outcomes are subject to significant uncertainty.
Hypothetical: There is considerable uncertainty whether the outcome will ever happen.	Conjecture based upon currently available information; Discussed on a conceptual basis; One of a number of possible inputs in an initial consultation process; Or a policy aspiration.

The development of the ‘core’ scenario in relation to highway schemes is considered in the following section. In relation to trip matrices, the ‘core’ scenario assumptions and consideration of uncertainty is considered in Chapter 9.

8.3. Forecast Networks

Planning permission has been granted for an extension to Eastern Way, between Thyme Road and Spa Road, which is included in two of the bypass options and provides access to dwellings east of Spa Road and the planned Melksham Health and Wellbeing Centre. Therefore, the 2 forecasts considered within the core scenario are:

- The 'Do-Minimum' (DM) – including approximately 950 metres of planned infrastructure between Eastern Way south of Thyme Road and Spa Road forming part of the Bypass in Option A and B.
- The 'Do-Something' (DS) – split into three options, depending on route, with a maximum of 7500m of carriage, three roundabouts being constructed and one river crossing being constructed.

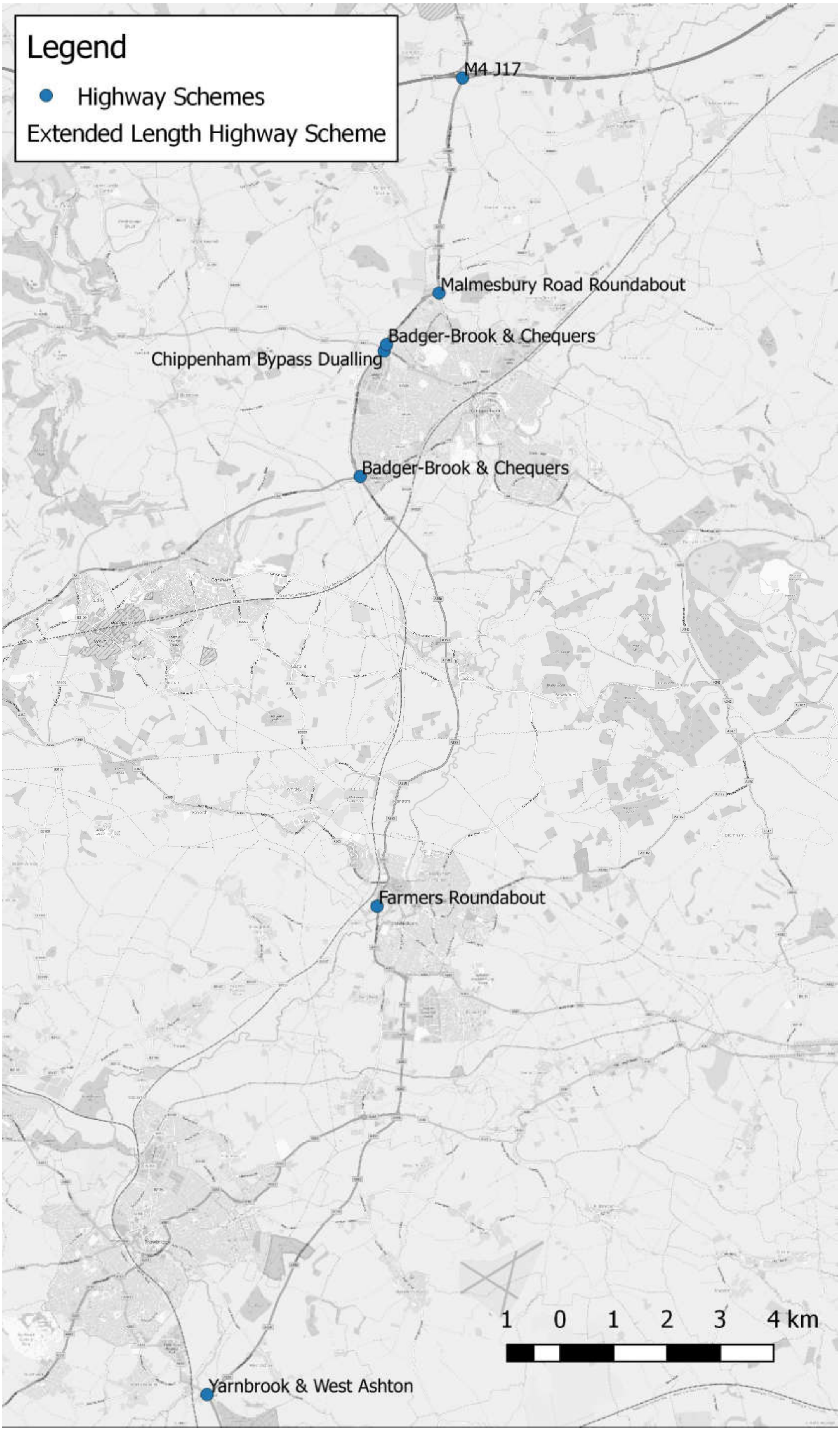
Forecast networks for the future years of 2023 and 2041 have been developed from the 2017 base model. Wiltshire Council, with consultation from key stakeholders, produced a list of future highway schemes and relative uncertainties. Details of schemes included are provided in **Table 8-2**.

Table 8-2 Future Year Highway Schemes

Ref	Scheme	Scenario	Uncertainty	Changes to Network
1	M4 J17 Improvements	DM & DS All Years	Under Construction	Signalisation of the two M4 slip road arms to the roundabout and the corresponding circulatory carriageway.
2	A350 Chippenham Bypass Improvements (Badger-Brook & Chequers)	DS All Years	Under Construction	Widening of the A350 to dual two-lane between Cepen Park South and Chequers roundabout, additional widening for approximately 250m north of Cepen Park South roundabout and 250m south of Chequers roundabout, widening of A4 approach and exit to Chequers roundabout, widening of the A350 to dual two-lane between Badge and Brook roundabout
3	A350 Malmesbury Road Roundabout Amendments	DM & DS All Years	Completed	Increased capacity and signalisation of Malmesbury Road roundabout.
4	A350 Chippenham Bypass Improvements – Dualling	DM & DS All Years	Completed	Upgrade the existing two-lane A350 Chippenham Bypass to dual two-lane standard between Bumpers Farm Roundabout and Brook Roundabout
5	A350 Farmers Roundabout Improvements	DM & DS All Years	Near Certain	Signalisation introduced at the roundabout which will be linked to traffic signals at the Asda entrance and A365 junction. Alterations to entry traffic lanes and circulatory carriage.
6	A350 Yarnbrook and West Ashton Relief Road	DM & DS All Years	Near Certain	Construction of 2.5km of new carriageway, conversion of West Ashton signals into three-arm junction, stopping up the existing A350 and construction of three new roundabouts.

Locations of each of these network improvements are shown in **Figure 8-2.**

Figure 8-2 MTM Forecast Highway Scheme Locations



9. Forecast Matrices Development

This section details the development of the forecast year matrices for all future years (2023 and 2041). The matrix development process can be outlined as follows:

- Background growth;
- Development trips;
- Long distance growth (A303 Stonehenge Model);
- Combination of matrices; and
- Comparison with A303 Stonehenge Model, NTEM & Historical Data.

To retain the distribution of trips between major centres, as well as the long-distance, through movements, a geographic sector system was derived. This sector system is comprised of five internal sectors aggregated from the model zones representing Melksham, Chippenham, Trowbridge, Bradford-On-Avon, Devizes and four external sectors, North, East, South and West. This is based on **Figure 4-1** but minor amendments to the zoning were required to account for long distance trips.

9.1. Development trips

Wiltshire Council produced an uncertainty log of all residential, education, retail and employment developments to be included within the forecast year matrices. These are detailed in **Table 9-1** and **Table 9-2**. All sites have been allocated zone numbers in line with the MTM sector system.

Table 9-1 MTM Forecast Residential and Education Development Sites

Ref	Development Name	Dwellings /Pupils	Uncertainty	Completion Date	Assumed completion by 2023	Notes
1	Off B3098, adjacent to Court Orchard/Cassways Bratton	40	MTL	2026	70%	
2	Elm Grove Farm	200	NC	2026	70%	
2		350 pupils/staff			70%	
3	Land off A363 at White Horse Business Park	150	NC	2026	70%	Apartments (25% factor applied to trip rate)
4	Elizabeth Way	205	NC	2026	70%	15% in zone 297, 85% in zone 263
4					70%	
5	Church Lane	45	NC	2026	70%	
6	Upper Studley	20	NC	2026	70%	
7	Southwick Court	180	NC	2026	70%	
8	Rowden Park	1400	NC	2026	70%	
8		200 pupils/staff			70%	
9	Rawlings Green	650	NC	2026	70%	Contains retirement/care home facility Land safe-guarded for two-form entry primary school

Ref	Development Name	Dwellings /Pupils	Uncertainty	Completion Date	Assumed completion by 2023	Notes
						Land safeguarded for local secondary school expansion
10	Hill Corner Road, North Chippenham	750 dwellings	NC	2026	70%	Land safeguarded for primary school development
11	Hunters Moon	450	NC	2026	70%	Land safeguarded for primary school development
12	Land at Kingston Farm	150	MTL	2026	70%	
13	Ashton Park Urban Extension	2600	NC	2036	43%	1600 dwellings expected by 2026, construction of two primary and a secondary school
13		1900 pupils/staff			43%	
14	Land at Station Road, Westbury	250	MTL	2026	70%	
15	Land east of Semington Road, Melksham	150	NC	2026	70%	Construction of village hall
16	Land east of Spa Road, Melksham	450	NC	2026	70%	Land for extension of medical or community facilities
17	Land south of Western Way, Melksham	235	NC	2026	70%	
17		200 pupils/staff			70%	
18	Land north of Sandridge Common, Melksham	100	NC	2026	70%	
19	East of Farrells Field, Yatton Keynell	30	NC	2026	70%	

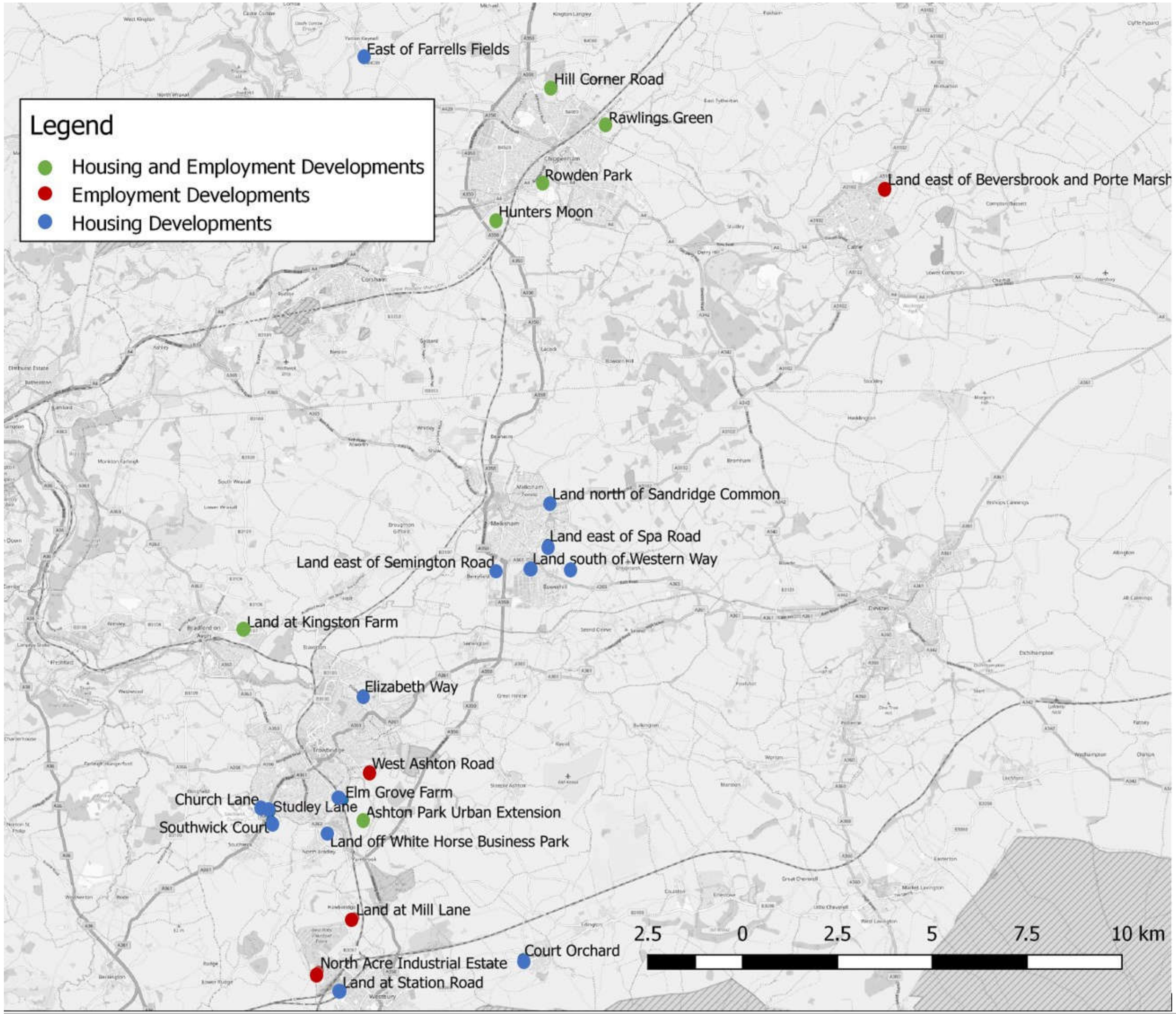
Table 9-2 MTM Forecast Employment and Retail Developments

Ref	Development Name	Land Use	Size (sqm GFA)	Uncertainty	Completion	Assumed Completion by 2023	Notes
20	Rowden Park	A1-A5	180,000 sqm	NC	2026	70%	
21	Rawlings Green	A1-A4, B1, B2	50,000 sqm	NC	2026	70%	
22	Hill Corner Road, North Chippenham	A1, B1, B2, B8	27,000 sqm	NC	2026	70%	
23	Hunters Moon	B1, B2, B8	23,000 sqm	NC	2026	70%	

Ref	Development Name	Land Use	Size (sqm GFA)	Uncertainty	Completion	Assumed Completion by 2023	Notes
24	Land at Kingston Farm	Mixed Use	30,000 sqm	MTL	2026	70%	
25	Ashton Park Urban Extension	A1-A5, B1, B2, B8, C2, C3	100,000 sqm	NC	2026	70%	
26	West Ashton Road	B1, B2, B8	100,000 sqm	NC	2026	70%	
27	Land at Mill Lane, Hawkeridge	Mixed Use	147,000 sqm	MTL	2026	70%	
28	North Acre Industrial Estate	Mixed Use	38,000 sqm	MTL	2026	70%	
29	Land east of Beversbrook farm and Porte Marsh Industrial Estate	Mixed Use	32,000 sqm	MTL	2026	70%	

Locations of each development are shown in **Figure 9-1.**

Figure 9-1 MTM Development Site Locations



The development only matrices derived have been based on:

- Land use trip rates extracted from the TRICS database;
- Transport assessment trip number; and
- Existing distributions.

Land Use Trip Rates

For employment land uses, Atkins extracted new trip rates from the TRICS (v7.4.2) database for the purposes of this study. These are outlined in a 'per unit' basis (i.e. per dwelling for residential developments and per 100sqm gross floor area for employment in **Table 9-3 (**for all vehicles).

Table 9-3 Forecast Development Land Use Trip Rates

Development Type	Unit	AM Peak		PM Peak		Inter-Peak	
		In	Out	In	Out	In	Out
Business Park	100 sqm	0.965	0.191	0.136	0.785	0.318	0.361
Industrial Estate	100 sqm	0.358	0.180	0.124	0.287	0.249	0.259
Residential	Dwellings	0.112	0.243	0.252	0.152	0.151	0.150

Trip Distribution

The trip distribution of the added development trips has been based on the sector to sector distribution of the base. A Furness Distribution model was used in order that matrix row and columns match future trip ends. This is an iterative process that ensures the model matches the trip generation for each site.

Development Only Trips

The following tables show the sector to sector development only matrix for 2023 and 2041 (AM and PM).

Table 9-4 2023 Development Only AM Peak

	Devizes	East	South	Chippenham	West	North	Melksham	Bradford On Avon	Trowbridge	Total
Devizes	-	-	-	57	-	-	5	-	15	77
East	-	-	-	15	-	-	2	-	11	27
South	-	-	-	9	-	-	19	-	42	69
Chippenham	31	14	6	296	77	113	7	3	13	558
West	-	-	-	97	-	-	4	-	186	286
North	-	-	-	254	-	-	3	-	5	263
Melksham	9	4	12	37	6	4	19	2	73	166
Bradford On Avon	-	-	-	4	-	-	2	-	38	44
Trowbridge	40	17	38	16	100	9	14	51	306	592
Total	81	35	56	784	183	126	73	56	689	2,082

Table 9-5 2023 Development Only PM Peak

	Devizes	East	South	Chippenham	West	North	Melksham	Bradford On Avon	Trowbridge	Total
Devizes	-	-	-	23	-	-	18	-	34	75
East	-	-	-	8	-	-	8	-	21	37
South	-	-	-	6	-	-	23	-	26	55
Chippenham	44	7	6	376	90	157	23	5	28	735
West	-	-	-	85	-	-	16	-	112	213
North	-	-	-	117	-	-	9	-	10	136
Melksham	2	1	4	20	2	2	35	1	44	111
Bradford On Avon	-	-	-	4	-	-	3	-	27	34
Trowbridge	16	8	27	12	125	7	31	42	427	696
Total	63	16	37	652	216	165	165	48	728	2,091

Table 9-6 2041 Development Only AM Peak

	Devizes	East	South	Chippenham	West	North	Melksham	Bradford On Avon	Trowbridge	Total
Devizes	-	-	-	160	-	-	13	-	43	216
East	-	-	-	41	-	-	5	-	30	76
South	-	-	-	24	-	-	52	-	118	194
Chippenham	87	38	16	828	214	316	19	10	36	1,564
West	-	-	-	271	-	-	10	-	520	801
North	-	-	-	711	-	-	9	-	14	735
Melksham	26	12	33	103	16	12	52	5	204	464
Bradford On Avon	-	-	-	11	-	-	5	-	106	123
Trowbridge	113	49	106	46	281	25	39	142	857	1,658
Total	225	99	156	2,197	512	353	204	157	1,928	5,831

Table 9-7 2041 Development Only PM Peak

	Devizes	East	South	Chippenham	West	North	Melksham	Bradford On Avon	Trowbridge	Total
Devizes	-	-	-	63	-	-	40	-	74	178
East	-	-	-	22	-	-	17	-	46	85
South	-	-	-	17	-	-	50	-	58	125
Chippenham	124	20	17	1,045	254	443	49	14	60	2,025
West	-	-	-	236	-	-	34	-	244	514
North	-	-	-	324	-	-	19	-	22	366
Melksham	8	2	13	60	6	5	79	3	103	278
Bradford On Avon	-	-	-	11	-	-	7	-	59	77
Trowbridge	51	26	84	38	386	22	77	130	1,026	1,840
Total	182	48	114	1,815	646	470	372	147	1,692	5,486

External Traffic Growth

External to External traffic growth has been applied to the MTM base model matrices to account for full demand growth in the model not captured by development traffic, reflecting other wider potential land use changes and the changing cost of travel in future year scenarios. The A303 Stonehenge model (a WebTAG complaint variable demand model) was used in order to inform the magnitude and distribution of this external to external growth. **Table 9-8** shows example changes between the 2015 base and the 2023 forecast matrices from the A303 Stonehenge model Different values were applied for each time period and forecast year.

Table 9-8 External to External Growth Between 2015 and 2023 from A303 Stonehenge Model

	Devizes	East	South	Chippenham	West	North	Melksham	Bradford On Avon	Trowbridge	Total
Devizes										
East		29%	23%		3%	-21%				
South		51%	5%		29%	4%				
Chippenham										
West		5%	2%		16%	24%				
North		6%	-11%		22%	76%				
Melksham										
Bradford On Avon										
Trowbridge										
Total										

9.2. MTM Forecast Matrices

The two components of matrix growth (development growth and external traffic growth) were combined to produce forecast matrices for all time periods and forecast years. These are shown in **Table 9-9** to **Table 9-12** for AM and PM peak periods only. Table 9-9

Table 9-9 2023 Forecast Demand AM Peak

	Devizes	East	South	Chippenham	West	North	Melksham	Bradford On Avon	Trowbridge	Total
Devizes	1,494	831	299	139	68	61	51	2	169	3,115
East	1,589	1,088	496	671	221	537	159	12	108	4,881
South	648	575	2,731	221	106	214	782	89	1,173	6,539
Chippenham	237	465	165	2,740	1,071	1,627	341	41	107	6,794
West	73	162	127	1,052	1,363	429	254	329	1,955	5,744
North	67	503	160	2,679	489	281	195	19	38	4,432
Melksham	157	288	694	467	388	306	1,197	25	246	3,769
Bradford On Avon	3	11	65	35	298	15	60	704	415	1,604
Trowbridge	162	132	551	134	1,063	80	152	523	2,633	5,431
Total	4,431	4,053	5,287	8,137	5,068	3,550	3,192	1,746	6,845	42,309

Table 9-10 2023 Forecast Demand PM Peak

	Devizes	East	South	Chippenham	West	North	Melksham	Bradford On Avon	Trowbridge	Total
Devizes	2,656	1,066	404	97	90	36	223	4	193	4,769
East	731	890	380	309	195	373	348	11	213	3,450
South	304	360	1,652	185	116	253	551	36	641	4,098
Chippenham	129	503	174	4,056	949	1,845	464	49	222	8,391
West	104	191	125	880	1,417	419	450	346	1,239	5,171
North	66	524	165	1,417	387	222	212	16	102	3,112
Melksham	176	211	238	402	254	131	1,524	42	387	3,364
Bradford On Avon	4	13	39	42	326	18	30	909	300	1,681
Trowbridge	130	129	822	135	1,552	68	287	567	4,132	7,822
Total	4,299	3,889	4,000	7,523	5,284	3,365	4,088	1,980	7,428	41,857

Table 9-11 2041 Forecast Demand AM Peak

	Devizes	East	South	Chippenham	West	North	Melksham	Bradford On Avon	Trowbridge	Total
Devizes	1,495	833	307	158	69	62	51	2	181	3,159
East	1,590	1,092	573	769	207	547	162	12	123	5,074
South	690	585	2,807	241	121	214	791	92	1,351	6,892
Chippenham	262	515	181	3,144	1,201	1,809	348	46	123	7,629
West	74	189	143	1,210	1,751	496	260	331	2,277	6,733
North	68	520	134	3,098	1,056	351	200	19	44	5,489
Melksham	163	302	739	557	416	324	1,238	26	289	4,054
Bradford On Avon	3	11	70	40	300	15	61	704	479	1,683
Trowbridge	186	153	622	153	1,234	93	155	612	3,040	6,247
Total	4,530	4,198	5,576	9,370	6,355	3,911	3,267	1,844	7,908	46,961

Table 9-12 2041 Forecast Demand PM Peak

	Devizes	East	South	Chippenham	West	North	Melksham	Bradford On Avon	Trowbridge	Total
Devizes	2,663	1,071	421	108	90	36	199	4	210	4,803
East	732	928	458	348	176	435	322	11	233	3,643
South	318	359	1,692	197	132	232	506	39	684	4,158
Chippenham	145	572	191	4,625	1,083	2,109	436	56	247	9,464
West	105	185	137	998	1,875	598	425	347	1,374	6,043
North	67	561	151	1,605	878	292	198	16	113	3,881
Melksham	181	219	251	472	272	138	1,450	44	425	3,450
Bradford On Avon	4	13	41	47	327	18	28	909	332	1,721
Trowbridge	144	146	915	153	1,798	79	266	652	4,659	8,812
Total	4,359	4,053	4,257	8,552	6,633	3,937	3,829	2,078	8,277	45,975

9.3. Forecast Matrix Comparison

NTEM

As required in TAG Unit M4.1 (Forecasting and Uncertainty), where specific developments have been included, the combined matrices need to be compared against the NTEM values for the model area to ensure traffic growth is in line with DfT projections so as not to overestimate the impact of the scheme.

For the modelled area trips, when known developments have been included within an uncertainty log, the standard approach as outlined in TAG Unit M4 requires growth factors to be constrained, at a suitable geographic scale, to forecast growth within the NTEM database.

However, guidance acknowledges that "in most cases, some adjustments to the NTEM dataset will be required at a local level"[2], in light of more detail local knowledge. In the case of the MTM, through discussions with Wiltshire Council it is considered necessary to consider the most appropriate forecasting approach to account for the following:

- There is considerable residential development expected between the base model year and 2026, *ahead* of the long term planning projection assumptions in NTEM;
- Development growth in Wiltshire is concentrated on the A350 corridor rather than evenly spread throughout Wiltshire;
- NTEM provides demographic projections only and therefore does not make allowance for changes in the forecast "cost" of travel (i.e. changes due to congestion or the relative value of time vs operating cost of a vehicle);

Therefore, as well as comparison with the NTEM database, further checking with other sources of information is recommended.

A303 Stonehenge Model

The A303 Stonehenge model is a WebTAG complaint, VDM which takes into account the changing cost of travel and the effects of wider network congestion and subsequent demand response across the whole of the south West. However, the A303 Stonehenge model does not include local development uncertainty in the Trowbridge, Chippenham and Melksham regions, or sufficiently detailed network to account fully for the cost of travel in the local area.

Therefore a forecast approach which uses and compares both sources of growth is recommended.

MTM Forecast

Table 9-13 compares the matrix totals for the whole MTM against the expected growth from the A303 Stonehenge model and the equivalent growth from the NTEM database.

The table demonstrates that overall growth, in **2023**, in the MTM is higher than both the A303 Stonehenge model and NTEM projections for the whole of the Wiltshire Authority. This is consistent with Wiltshire aspiration and assumptions that "front loading", up to 2026, of local developments in the region along the A350.

By 2041 the MTM forecast is lower than that projected by the A303 Stonehenge model, but slightly ahead of the NTEM demographic forecasts. This is consistent with the narrative above, as overall growth is likely to be higher than NTEM (as developments in Wiltshire are concentrated on the A350 Corridor) but the MTM forecasts do not include background/windfall developments in the region and hence potentially under predict actual growth (i.e. A303 Stonehenge model) too.

Table 9-13 MTM Matrix Totals and Growth Comparison with A303 Stonehenge & NTEM 7.2

MTM scenario	All User Classes (including freight)					Car Only
	Totals	Development Only Growth	External Growth	Forecast MTM Growth	A303 Stonehenge Growth	NTEM 7.2 Wiltshire
Base AM	39,999	-	-			
2023AM	42,309	5%	1%	**6%**	3%	5%
2041AM	46,961	15%	3%	**17%**	21%	15%
Base IP	35,595	-	-			

[2] TAG Unit M para 7.3.4

2023IP	38,828	9%	1%	**9%**	6%	7%
2041IP	43,516	20%	2%	**22%**	28%	21%
Base PM	39,143	-	--			
2023PM	41,857	5%	1%	**6%**	3%	5%
2041PM	45,975	14%	3%	**17%**	22%	15%

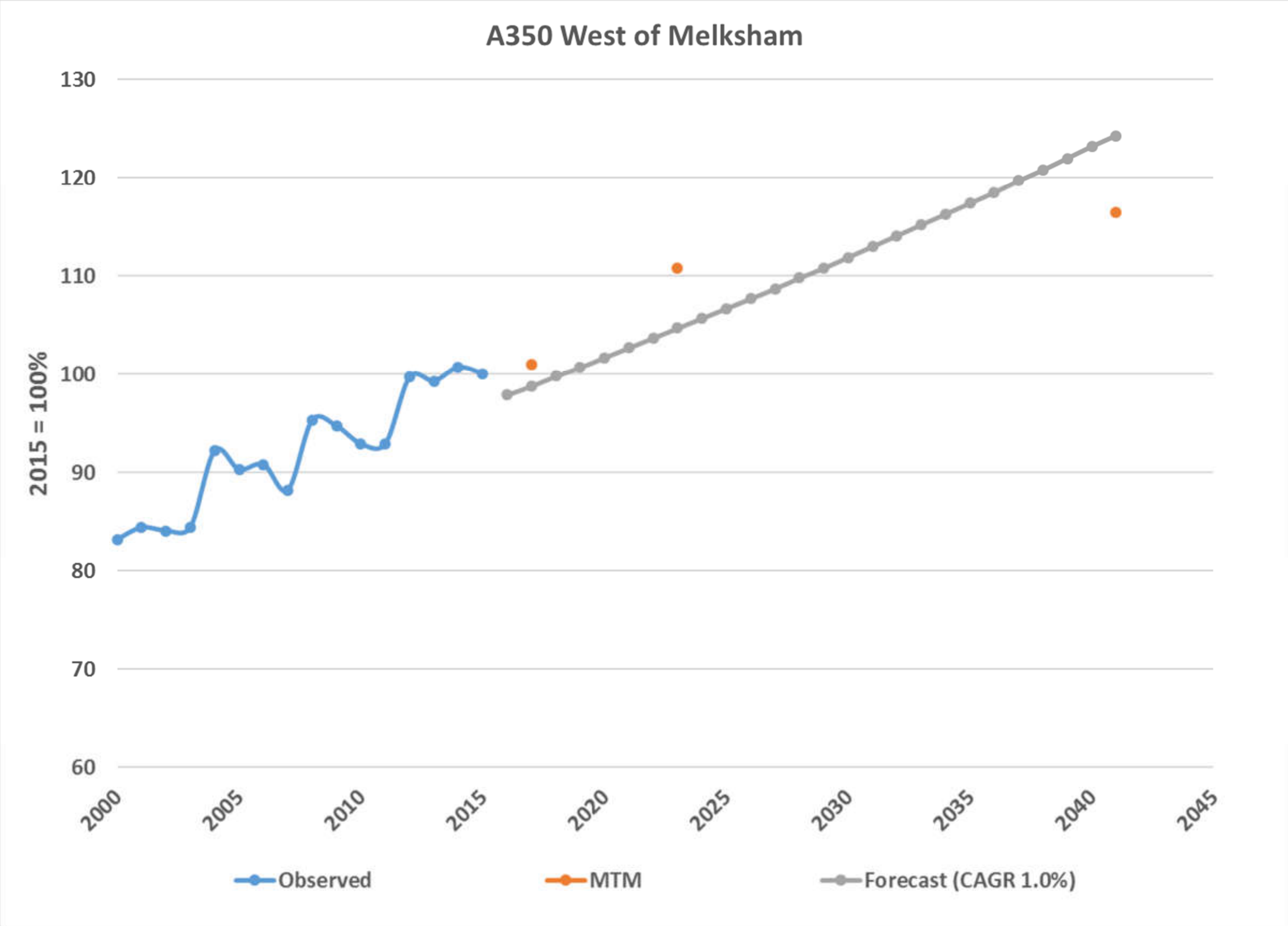
1. MTM Matrix totals are for the Fully modelled Area (Approximately West Wiltshire)
2. A303 Stonehenge uses interpolated growth relative to the A303 2015 Base Matrices and refers to cordon region
3. NTEM 7.2 growth refers to change vs 2015 for: Wiltshire Authority, Car Driver, All Trip purposes, Average Weekday, Origin/Destination Average

In addition to the comparison with the A303 Stonehenge model and NTEM, historical data, from the DfT traffic counts site[3] for a site on the A350 to the west of Melksham has been obtained and a linear trend forecast growth extrapolated based on historic growth is shown in **Figure 9-2** below shows the observed average daily traffic flow as a percentage of the levels observed in 2015. The graph shows that the assigned 2023 forecast model, is marginally higher than the linear extrapolated trend growth (consistent with narrative above) but provides a potentially conservative estimate of the longer term (up to 2041) growth along the A350.

Overall any benefits of the A350 Melksham bypass are potentially underestimated by this model as the historic long-term growth is higher than modelled.

[3] https://www.dft.gov.uk/traffic-counts/cp.php?la=Wiltshire

Figure 9-2 A350 Historical Observed Traffic Flow Growth vs Assignment Model vs Observed



1. Historical Data is derived from: https://www.dft.gov.uk/traffic-counts/cp.php?la=Wiltshire and is based on AADF
2. Forecast linear Trend Growth (CAGR 1.0%) is derived assuming that historical observed growth from 2000 up to 2016 is continued

10. Traffic Impact Analysis

Forecast trips matrices and networks developed for the future years of 2023 and 2041 were used to produce fixed demand assignments with and without the proposed scheme (i.e. matrix totals between the Do-Minimum and Do-Something scenario are consistent). The justification for use of fixed demand assignments rather than variable demand are outlined in Chapter 8 of this report. Generalised-cost parameters, defined as 'pence per minute' (PPM) and 'pence per kilometre' (PPK) were also updated each year in line with TAG guidance.

This chapter presents the traffic impacts of the A350 Melksham Bypass, comparing the Do-Minimum and Do-Something forecasts for the future year scenarios and time periods. These forecasts have been used to identify the effects of the scheme on:

- Network performance;
- Traffic flows on links;
- Journey Times; and
- Routeing.

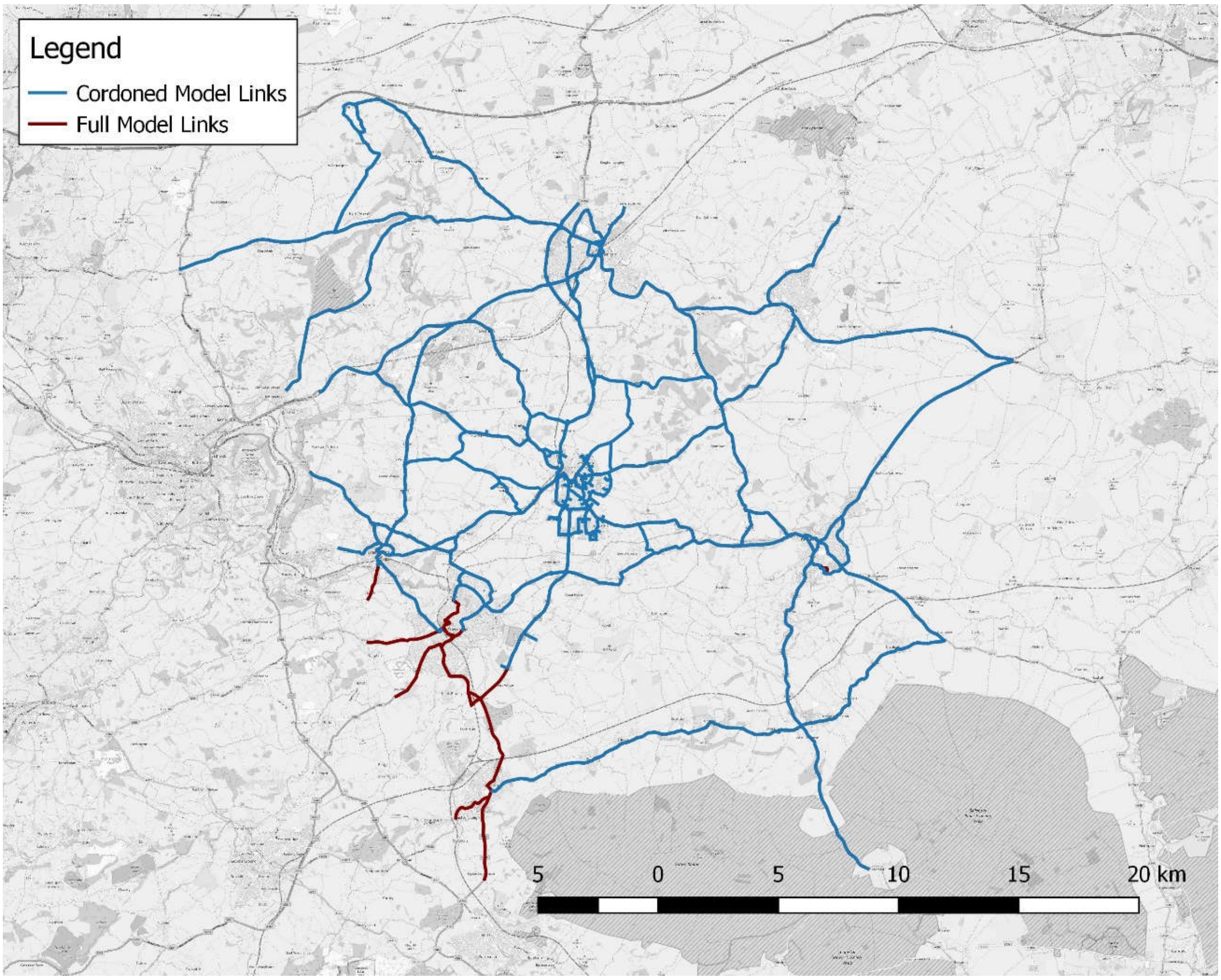
The traffic impacts discussed are for the Core scenario. This scenario is the most likely to occur based on the local authorities' view of development proposals.

10.1. Issues with the MTM

The model uses network coding form the A303 Stonehenge cordon model which includes Chippenham, Trowbridge, Devizes and other areas in West Wiltshire which have not been refined as part of this stage of work. The result of this is that there are large capacity constraints, particularly in the South west, as the network has only been coded as part of the main highway, without the additional roads and links, in the centre of these urban areas and surrounding villages (Westbury etc.). The implication is that large (possibly unrealistic) network delays are being modelled in these outlier locations. This is resulting in minor problems with model noise potential for unmatched demand. The overall impact is that the scheme benefits are likely to be conservative as delays in these outlier location is likely to be higher than actually will occur in forecast years.

Therefore, in order to more accurately assess the economic impact of the bypass, by minimising the impacts of wider area model noise and capacity constraints on the model fringe, a sub cordon of the model has been used to assess the economic scheme benefits.

Figure 10-1 MTM Sub cordon for Economic Analysis



All network and economic analysis is based on this sub cordon version of the MTM.

10.2. Network Performance

Table 10-1 and show the assignment summary statistics for all forecast year models in the AM peak, inter-peak and PM peak periods respectively. Of particular interest are the overcapacity queued time, which is generally taken as a measure of congestion, and the average speed, which summarises operating conditions for all drivers included in the trip matrices (those passing through the study area). The total travel time, made up of cruise time, transient queued time (e.g. waiting at a red light at signals) and overcapacity queued time, and total travel distance are summed over full journey lengths for all modelled trips. These together determine the average overall journey speed.

Table 10-1 Global Network Highway Statistics - AM Peak

Statistics	2023				2041			
	Do-Min	**A**	**B**	**C**	**Do-Min**	**A**	**B**	**C**
Total Assigned Trips (pcus)	31933	31933	31933	31933	35296	35296	35296	35296
Link Cruise Time (pcu-hrs)	*5965.1*	*5920.7*	*5901.6*	*5836.9*	*6785.2*	*6732.8*	*6763.6*	*6618.0*

Statistics	2023				2041			
	Do-Min	A	B	C	Do-Min	A	B	C
Transient Queued Time (pcu-hrs)	*1126.6*	*1110.2*	*1113.7*	*1118.0*	*1424.8*	*1420.8*	*1433.1*	*1438.0*
Overcapacity Queued Time (pcu-hrs)	*3944.3*	*3972.9*	*3972.1*	*3882.9*	*6052.6*	*6053.0*	*5911.0*	*5881.8*
Total Travel Time (pcu-hrs)	11036.1	11003.8	10988.1	10837.8	14262.6	14206.6	14107.7	13937.9
Travel Distance (pcu-kms)	341009	340549	341670	339504	382361	381988	385398	379940
Average Journey Speed (kph)	30.9	30.9	31.1	31.3	26.8	26.9	27.3	27.3

1) Total Travel Time = Link Cruise time + Transient Cruise time + Overcapacity Queued time (pcu-hrs)

Table 10-2 Global Network Highway Statistics - PM Peak

Statistics	2023				2041			
	Do-Min	A	B	C	Do-Min	A	B	C
Total Assigned Trips (pcus)	28550	28550	28550	28550	31682	31682	31682	31682
Link Cruise Time (pcu-hrs)	*4783.7*	*4745.2*	*4727.1*	*4688.0*	*5584.1*	*5538.9*	*5522.1*	*5477.2*
Transient Queued Time (pcu-hrs)	*896.0*	*885.7*	*885.4*	*871.3*	*1120.3*	*1108.4*	*1114.4*	*1099.7*
Overcapacity Queued Time (pcu-hrs)	*1092.5*	*1099.1*	*1123.0*	*1016.9*	*2507.7*	*2490.0*	*2496.5*	*2380.7*
Total Travel Time (pcu-hrs)	6772.3	6730.0	6735.5	6576.3	9212.1	9137.4	9133.0	8957.6
Travel Distance (pcu-kms)	283993	283780	284427	283972	326042	326068	326688	326036
Average Journey Speed (kph)	41.9	42.2	42.2	43.2	35.4	35.7	35.8	36.4

The tables show that between 2023 and 2041 the overcapacity queued time increases nearly two-fold in the AM and more than doubles in the PM for the Do-Minimum scenarios. There are also decreases in average journey speeds between the two modelled years with the largest decrease occurring in the PM.

In the AM time-period, of the three Do-Something scenarios, Option C provides the greatest decrease in overcapacity queued time in both 2023 and 2041. Option A results in an increase in both 2023 and 2041 whereas Option B provides dis-benefits in 2023 and improvements in 2041. A similar pattern is seen in the change in total travel time between scenarios. Option C provides the greatest reduction in journey time in both future years (tied with Option B in 2041) whereas option A provides no improvement in 2023 and only only a minor improvement in 2041.

In the PM time-period, small reductions in overcapacity queues are seen in 2041 in Options A and B, whilst there are increases in over-capacity queues in 2023. Option C, however provides a larger reduction in queuing both in 2023 and 2041. Options A and B see similar increases in average journey speed to each other in both years whereas a greater benefit is provided by Option C in both 2023 and 2041.

10.3. Link Flows

The flow difference plots provide further evidence for the impacts of the scheme, (green is an increase in traffic, blue is a decrease in traffic) demonstrating how the completion of the scheme draws traffic onto the bypass. They also illustrate the corresponding reductions in traffic on parallel routes most notably on the existing A350 and connecting routes.

The change in traffic flows by link for the AM and PM peaks in 2041 are presented in **Figure 10-2** and **Figure 10-3** respectively.

Figure 10-2 Change in Traffic Flow between Do-Minimum and Do-Something (c) – 2041 AM Peak

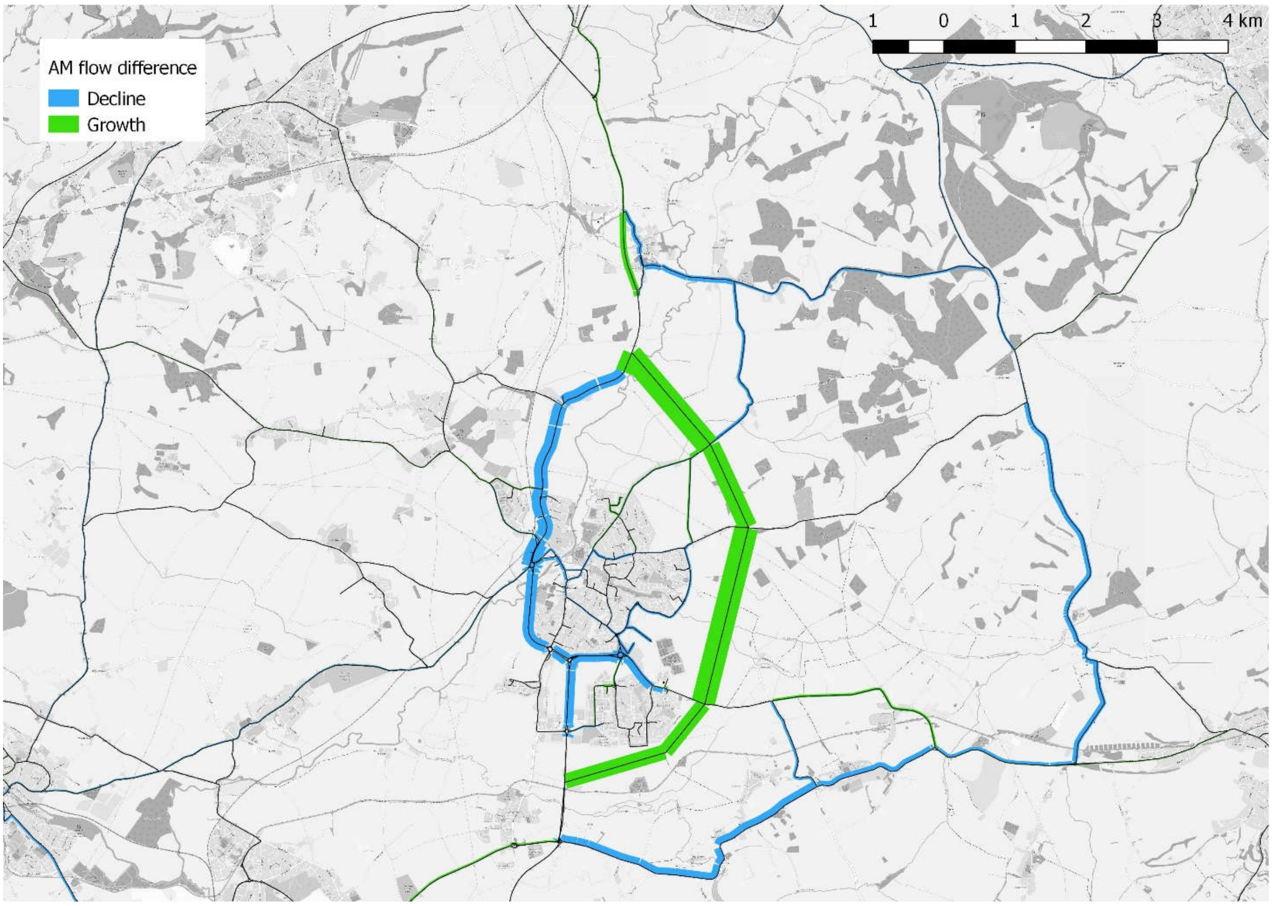


Figure 10-3 Change in Traffic Flow between Do-Minimum and Do-Something (c) – 2041 PM Peak

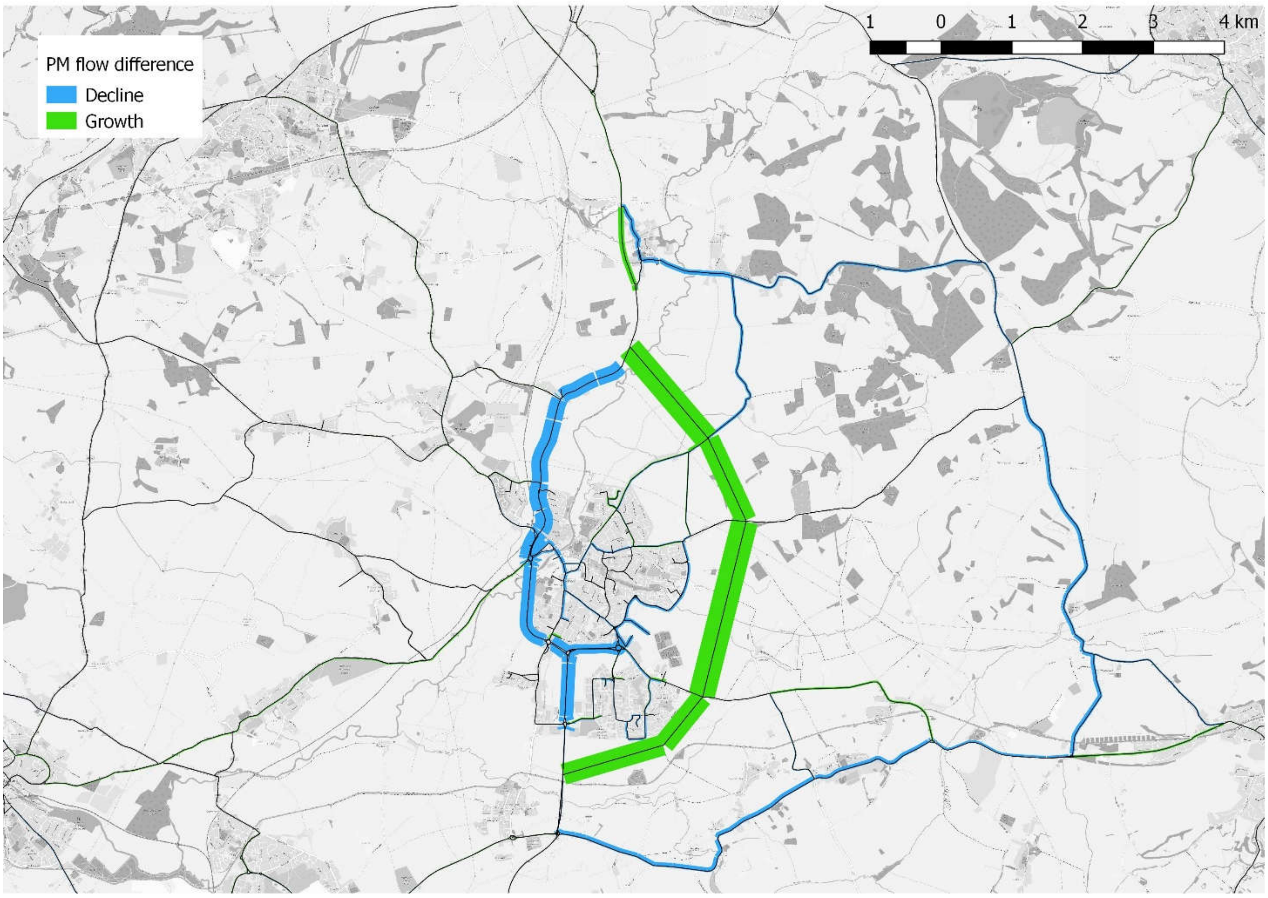


Table 10-3 and **Table 10-4** below shows the modelled two-way flows at key points within the MTM in PCUs.

Table 10-3 Two Way Flows 2041 AM

	DM	DS Option A	DS Option B	DS Option C
A350 (North of Bypass)	1974	2276	2833	2788
A350 (South of Bypass)	2383	2369	2372	2563
Existing A350 North Melksham/Beanacre	1974	1520	1480	1163
Existing A350 South Melksham/Bowerhill	2023	1958	1967	1549
Existing A350 Central Melksham	2304	1835	1765	1604
Northern Section of Bypass	-	948	1171	1494
Central Section of the Bypass	-	-	1179	1566
Southern Section of Bypass	-	-	-	959
Snowberry Lane	764	960	127	293

Table 10-4 Two Way Flows 2041 PM

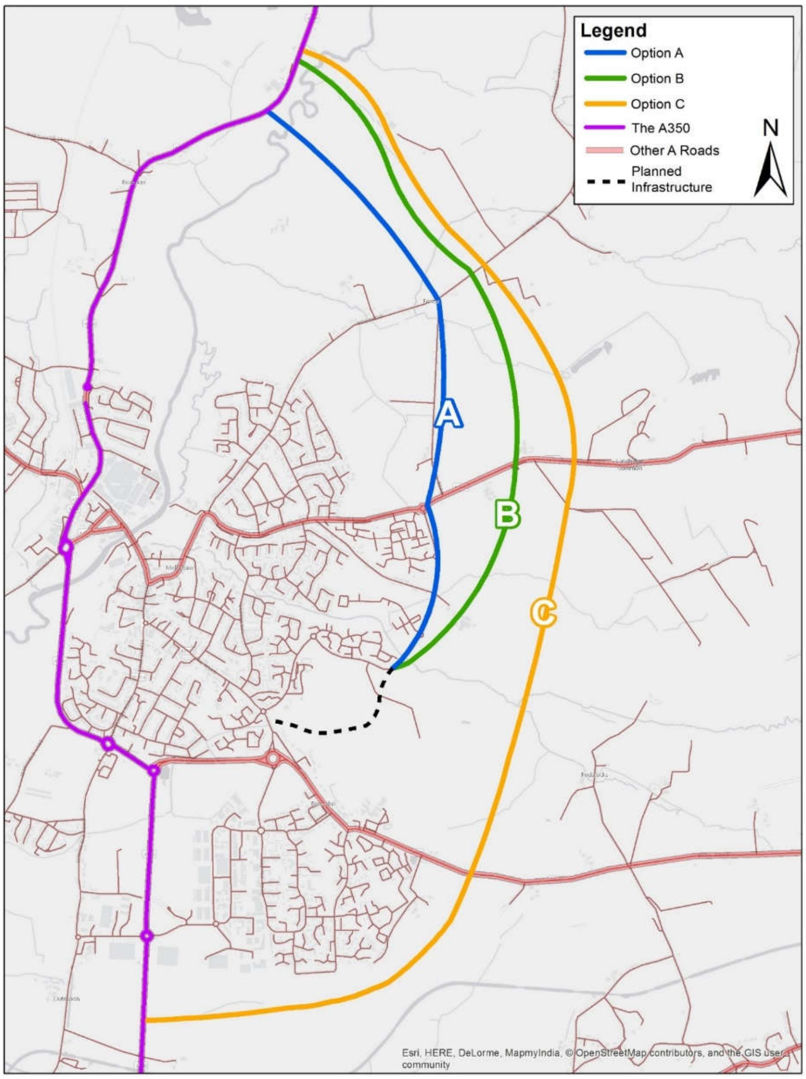
	DM	DS Option A	DS Option B	DS Option C
A350 (North of Bypass)	1991	2239	2273	2257
A350 (South of Bypass)	2348	2349	2344	2561
Existing A350 North Melksham/Beanacre	1991	1655	1504	948
Existing A350 South Melksham/Bowerhill	2224	2209	1219	1181
Existing A350 Central Melksham	2480	2164	2048	1554
Northern Section of Bypass	-	859	1043	1571
Central Section of the Bypass	-	-	1066	1721
Southern Section of Bypass	-	-	-	1380
Snowberry Lane	865	1030	174	534

The tables show that all three options reduce the flow along the A350 west of Melksham with Option C providing the most reduction – this is consistent with the flows on the bypass itself, which is highest in Option C suggesting that traffic previously using this section of the A350 is re-routing via the bypass. Options B and C result in decreases in flow along Snowberry Lane whereas Option A results in an increase. This is to be expected as Snowberry Lane forms a connecting portion of the bypass in Option A.

10.4. Journey Time Analysis

Comparison of journey times have been carried out to identify the travel time saving achieved by the A350 Bypass in 2041 during the AM and PM peak. Journey times have been considered for three routes in both directions as shown in **Figure 10-4** below.

Figure 10-4 A350 Melksham Outer Eastern Bypass Options



The changes in journey time both in terms of the existing route and (where applicable) and the alternative route provided by the scheme are shown in **Table 10-5** and **Table 10-6.**

The results show that all three bypass options provide journey time savings in both northbound and southbound directions. Journey time savings are most significant in the northbound direction during the AM peak time-period. Of the three bypass options, option C provides the largest benefits, this is to be expected as option C provides the most extensive bypass of the existing Melksham road network.

Table 10-5 Journey Time Changes 2041 AM Peak

Route	Do Min	DS (A)	Difference from DM	DS (B)	Difference from DM	DS (C)	Difference from DM
Northbound							
Existing A350	13:21	11:54	-01:27	12:20	-01:01	09:56	-03:25
Bypass	-	12:13	-01:08	12:07	-01:14	08:19	-05:02

Route	Do Min	DS (A)	Difference from DM	DS (B)	Difference from DM	DS (C)	Difference from DM
Southbound							
Existing A350	10:59	10:22	-00:37	10:29	-00:30	10:27	-00:32
Bypass	-	10:14	-00:45	10:12	-00:47	08:24	-02:35

Table 10-6 Journey Time Changes 2041 PM Peak

Route	Do Min	DS (A)	Difference from DM	DS (B)	Difference from DM	DS (C)	Difference from DM
Northbound							
Existing A350	11:48	10:46	-01:02	10:45	-01:03	09:42	-02:06
Bypass	-	10:56	-00:52	10:30	-01:18	08:25	-03:23
Southbound							
Existing A350	11:53	11:14	-00:39	11:15	-00:38	10:25	-01:28
Bypass	-	11:01	-00:52	11:03	-00:50	08:43	03:10

11. Estimation of Costs and Benefits

This chapter focuses on the costs and benefits associated with the proposed A350 Bypass in order to calculate the scheme's overall Value for Money (VfM). Costs are derived from the latest available estimates provided by Wiltshire Council. At this stage, benefits are focused on the Transport Economic Efficiency (TEE) derived from the forecast assignments using the latest versions of the TUBA software program.

11.1. Scheme Costs

Costs of transport schemes are an integral part of the scheme appraisal process, particularly where they are subsequently used to form decisions on scheme funding.

A scheme cost estimate is comprised of three main elements.

- The **base cost**, which is the basic costs of a scheme before allowing for allowing for risks, but including realistic assumptions of changes in inflation over time (i.e. cost increases above the growth in 'economy-wide' inflation);

- Adjustment for risk, which should cover all the risks that can be identified, which then need to be assessed and quantified through a Quantified Risk Assessment (QRA), although at this early stage a risk budget of 10% has been applied – the outcome of this is the **risk-adjusted cost estimate**; and

- Adjustment for optimism bias, to reflect the well-established and continuing systematic bias for estimated scheme costs and delivery times to be too low and too short respectively, and results in the **risk and optimism bias-adjusted cost-estimate**.

The rest of this section describes the methodology for estimating the scheme costs for the scheme which are subsequently included in the overall VfM assessment.

A350 Melksham Bypass Costs

Scheme costs for Option A were calculated in 2016 using a Bill of Quantities and high-level structures costs. At this early stage, this was converted into a cost-per-metre which was used to calculate costs for Option B and Option C. This is likely to be an over-estimate as a large part of the original costs for Option A were for a structure common to all routes for crossing the river. The cost breakdown is presented in **Table 11-1.**

Table 11-1 Scheme Costs (2016 Prices)

Cost Item	Option A	Option B	Option C
Construction Costs	£ 19,511,000	£ 25,215,438	£ 44,700,095
Consultancy Costs: Design, Surveys & Construction Supervision	£ 2,927,000	£ 3,782,768	£ 6,705,816
Land Purchase & Compensation	£ 320,000	£ 413,559	£ 733,126
Sub-Total	***£ 22,758,000***	***£ 29,411,765***	***£ 52,139,037***
Optimism Bias (44%)	£ 10,013,520	£ 12,941,176	£ 22,941,176
Risk allowance (10%)	£ 2,275,800	£ 2,941,176	£ 5,213,904
Total	**£ 35,047,320**	**£ 45,294,118**	**£ 80,294,118**

All costs and benefits in the economic assessment have been converted to 2010 prices and values. Accounting for the differences in GDP compared to 2010. Underlying inflation has been removed in line with the GDP deflator. Optimism bias of 44% has been applied as calculated by Wiltshire Council. Discount rates at 3.5% per annum are applied to convert to present (2010) values. Finally, a factor of 1.19 is applied to convert from factor cost to market prices.

11.2. Estimation of TEE Benefits

TUBA (v1.9.9) has been used to estimate the Transport Economic Efficiency (TEE) benefits. TUBA is an industry-recognised software package recommended by DfT for the appraisal of highway and public transport schemes such as the A350 Bypass. It includes estimation of benefits relating to travel times, vehicle operating costs, user charges, indirect tax and private sector revenues, all of which contribute to the Present Value of Benefits (PVB) for the scheme proposals. The derivation of TEE benefits is outlined below.

Travel Time Savings

Travel time savings are calculated using the rule of half applied to generalised time skims from the SATURN highway model. Since parking costs are not included in the MTM, generalised time equates solely to in-vehicle time.

Travel times in the traffic model are represented in seconds. These are converted to vehicle hours and annualised for each modelled time period, so that annual AM, inter-peak and PM travel time savings can be calculated. Savings are calculated for each modelled year, with benefits for non-modelled years being calculated via linear interpolation between modelled years, and flat-line extrapolation beyond the final modelled year (in this case 2041). However, the impact if discounting on estimated benefits means that the benefits 'curve' declines toward the end of the scheme lifetime (taken to be 60-years).

Default economic assumptions have been applied, as contained in the TUBA software and based on guidance contained in the DfT's TAG databook (July 2017).

Derivation of Annualisation Factors

The MTM is based on 'average peak hour' highway assignments so annualisation factors have been adopted to convert hourly benefits to annual benefits, as shown in **Table 11-2**.

Table 11-2 A350 Melksham Bypass Annualisation Factors

Modelled Hour	Annualisation Factor
AM Peak Average Hour (07:00-10:00)	759
Inter-peak (Average Hour 10:00-16:00)	1518
PM Peak Average Hour (1600-1900)	759

The model has been produced for average peak hours (an average taken over 07:00-10:00 for the AM peak and over 16:00-19:00 for the PM peak) and average inter-peak hours (an average taken over 10:00-16:00), so the annualisation factor simply accounts for the conversion from one modelled hour to two sets of 3 peak hours and 6 inter-peak hours in a day. This has been annualised by factoring 253 'peak days' in a year. The annualization factors are assumed to be same across all user classes.

Vehicle Operating Cost Savings

Vehicle operating costs are calculated for both fuel and non-fuel elements of the journey, based on formulae set out in the DfT's TAG Databook (July 2017). All assumptions relating to fuel costs, duty and vehicle efficiency are those contained in the default TUBA economics file. The same annualisation factors defined above are applied to derive VOC benefits.

11.3. Implications for Tax Revenues

Indirect tax revenues are generated through fuel duty and any other changes incurred by transport users (e.g. tolls) and providers (e.g. public transport revenues). In the case of the A350 Bypass, with no road tolls and no public transport implications, the only impact on indirect tax revenues is through changes in fuel-related vehicle operating costs.

11.4. Estimation of Construction and Maintenance Costs

Transport users incur additional costs when the highway network is undergoing construction and/or maintenance works. However, in the case of the A350 Bypass, it is anticipated that the scheme will result in little or no disruption to the existing highway network as it is all offline, except for the tie ins at the existing junctions. Consequently, construction impacts are considered minimal.

Maintenance costs (in terms of highway and structural repair) are not included within scheme cost figures provided by Wiltshire Council.

12. Economic Assessment Results

This chapter presents the results of the economic assessment for the core scenario of the A350 Melksham Bypass as described in the previous chapter (based on the masked version of the model). This includes TEE benefits and indirect tax derived from TUBA, including greenhouse gases. Monetised impacts on the environment and of accidents have not been calculated and so are not included in the economic assessment.

All benefits and costs have been assessed over a 60-year project lifetime then discounted back to a common base year (2010). Discount rates of 3.5% and 3.0% have been applied to benefits and costs for years 1-30 and 31-60 respectively.

The price base is also 2010. All prices in the appraisal have been adjusted for inflation to be shown in 2010 prices. This rebasing of prices is undertaken within TUBA by comparing the GDP in the current year with that in 2010.

All benefits and costs are therefore shown in present values for a 2010 base year, at 2010 prices. TUBA results of sensitivity tests are also presented for comparison with the core scenario.

12.1. Masking

To ensure the benefits of the scheme were logical and representative of the likely impact, masking of erroneous trip patterns was utilised. This involved 'masking' origin-destination sector pairs that were deemed to not directly benefit or be affected by the scheme, i.e. Trips travelling from Devizes to East, or Bradford Upon Avon to Trowbridge. **Table 12-1** shows the complete masking, where '0' indicates that the origin-destination pair has been masked.

Table 12-1 Sector Masking

	Devizes	East	South	Chippenham	West	North	Melksham	Bradford-on-Avon	Trowbridge
Devizes	0	0	1	1	1	1	1	1	1
East	0	0	1	0	1	1	1	1	1
South	1	1	0	1	1	1	1	1	0
Chippenham	1	0	1	0	0	0	1	1	1
West	1	1	1	0	0	0	1	1	0
North	1	1	1	0	0	0	1	1	1
Melksham	1	1	1	1	1	1	1	1	1
Bradford-on-Avon	1	1	1	1	1	1	1	0	0
Trowbridge	1	1	0	1	0	1	1	0	0

12.2. TEE Benefits

The scheme produces substantial benefits amounting to £57.8 million over the 60-year project lifetime for option A, £64.8 million over the 60-year project lifetime for option B and £149.6 million over the 60-year project lifetime for option C. These benefits are generated by travel time savings with some contribution from vehicle operating costs, as detailed in **Table 12-2**.

Table 12-2 Masked Benefits Split

Option	Unmasked		Masked	
	Travel Time Benefits	Vehicle Operating Costs Benefits	Travel Time Benefits	Vehicle Operating Costs Benefits
A	£41.9m	£6.2m	£54.6m	£6.8m
B	£75.8m	£1.5m	£63.7m	£2.0m
C	£196.1m	£14.6m	£143.7m	£10.6m

The complete bypass route provides direct time savings and lower vehicle operating costs for north-south movements of traffic as well as further savings for traffic not using the scheme itself, by reducing congestion in Melksham.

The effects of masking actually resulted in a large reduction in potential scheme benefits, and therefore this approach can be considered particularly conservative. The scheme may actually result in some benefits between the masked sector pairs. This approach is to ensure that the results can be considered particualrly robust. This is discussed more in the next section.

Therefore, results presented subsequently will be for the masked model.

The majority of the benefits (65% for Option A, 59% for Option B and 64% for Option C) accrue to consumer users (commuters and 'other' trips) which is sensible as, whilst business users generally have a higher value of time, consumer users form a significantly higher proportion of total road users.

Table 12-3 Benefits Split (Consumers/Business)

Option	Consumers	Business
A	£37.3m	£20.4m
B	£38.2m	£26.6m
C	£95.1m	£54.3m

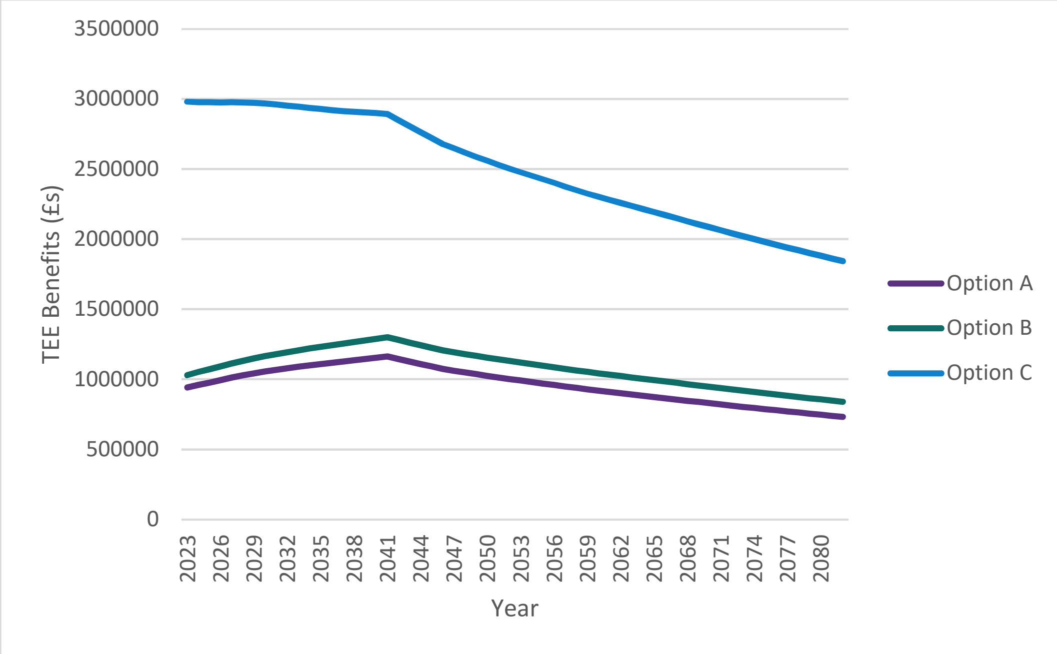
It should be noted that the benefits do not include those generated during the weekend and overnight time periods. Benefits to public transport have also not been included. Public transport would benefit from the reduced congestion in Melksham town centre. The PVB derived, therefore, may be considered conservative.

60-Year Profile

Figure 12-1 shows the profile of TEE Benefits across the 60-year project lifetime (not including the developer contribution towards scheme cost). The PVB rises through the early years of the project lifetime for options A and B, with benefits increasing up to 2041. This increase is plausible as the network will become more congested in future years, offering greater potential for congestion relief (and monetised benefits) for the proposed scheme. Option C PVB decreases slightly year-on-year, however these benefits are still almost triple those of options B and C.

The annual PVB declines between 2041 and 2082 because TUBA assumes a flat benefits profile beyond the final modelled year, but the impact of discounting (beyond any increase in value of time) means the annual benefit falls. (Note that this still means there are benefits, merely of a lower value).

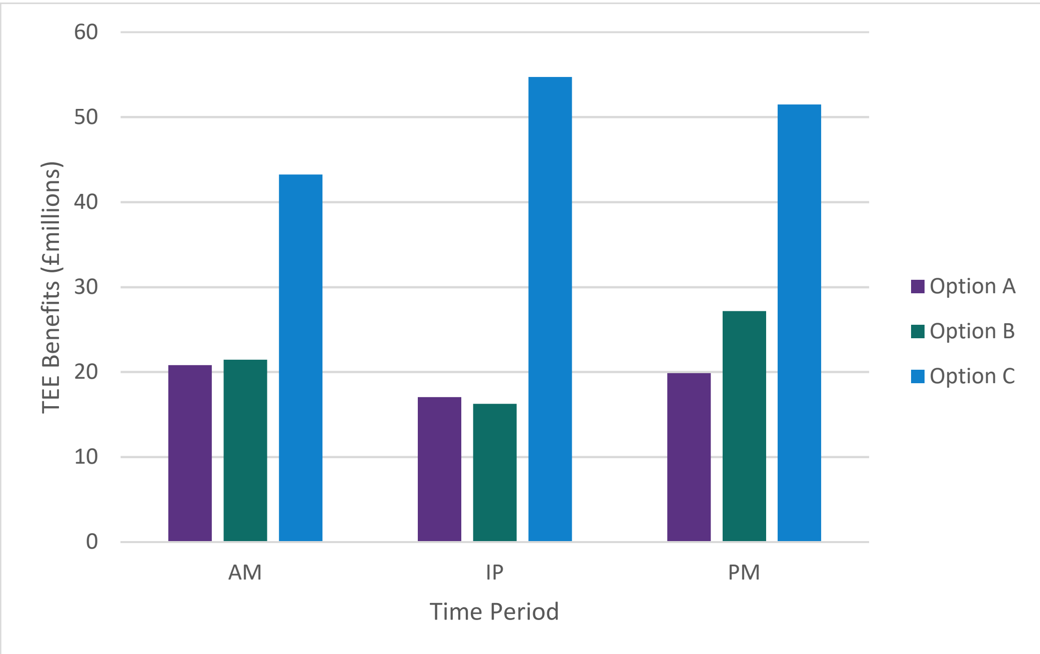
Figure 12-1 60-year TEE Benefits Profile



Temporal Distribution of TEE Benefits

Figure 12-2 presents the PVB by time-period, demonstrating when the scheme is likely to have the greatest impact in terms of reducing congestion. It can be observed that all time periods demonstrate substantial benefits, however the greatest benefits are obtained during the Interpeak.

Figure 12-2 TEE Benefits by Modelled Time Period



Spatial Distribution of TEE Benefits

Sector analysis has been undertaken to gain a better understanding of the journeys that are generating the greatest benefits. The MTM sector system consists of 9 sectors as presented in Chapter 4, **Figure 4-1**.

Sector analysis provides an important check on the ability of the model to produce plausible forecasts of future year travel demand. It also shows the extent to which model 'noise' is potentially having an impact on the results produced by TUBA. This is usually identified by spurious-looking benefits or dis-benefits for movements across the study area that we would not expect to be affected by the scheme. The breakdown of total TEE benefits by sector (in £m), with the top 10 sector-sector benefits highlighted is shown below.

Analysis by sector demonstrates that as would be expected the greatest sector movements are linked to Melksham in Option A and Option B. Option C retains the benefits to Melksham while also providing increased benefits to Trowbridge, particularly those heading north towards Chippenham.

The following tables present the Public Accounts table for the central case scenario. The scheme investment costs amount to £29.7m for Option A, £38.3m for Option B and £67.9m for Option C. At present, maintenance costs are not specifically considered but an allowance has been made for this in the costs provided by Wiltshire Council.

Table 12-4 TEE Benefits (£Ms) by Sector (Option A)

	Devizes	East	South	Chippenham	West	North	Melksham	Bradford On Avon	Trowbridge	Total
Devizes	0	0	0	1	1	0	0	0	0	*1*
East	0	0	0	0	0	0	0	0	0	*0*
South	-2	-1	0	2	0	4	3	1	0	*7*
Chippenham	2	0	1	0	0	0	6	0	1	*9*
West	0	0	0	0	0	0	2	0	0	*2*
North	1	1	1	0	0	0	4	0	0	*7*
Melksham	0	0	0	12	4	6	3	0	1	*26*
Bradford On Avon	0	0	0	0	0	0	0	0	0	*0*
Trowbridge	-1	-1	0	3	0	3	1	0	0	*5*
Total	*0*	*0*	*1*	*18*	*5*	*12*	*19*	*1*	*1*	***58***

Table 12-5 TEE Benefits (£Ms) by Sector (Option B)

	Devizes	East	South	Chippenham	West	North	Melksham	Bradford On Avon	Trowbridge	Total
Devizes	0	0	0	1	1	0	1	0	0	*3*
East	0	0	1	0	1	1	2	0	0	*5*
South	0	1	0	2	1	3	1	1	0	*9*
Chippenham	2	0	1	0	0	0	7	0	1	*11*
West	0	1	0	0	0	0	2	0	0	*2*
North	1	2	1	0	0	0	4	0	-1	*7*
Melksham	0	1	0	11	4	5	3	0	1	*25*
Bradford On Avon	0	0	0	0	0	0	0	0	0	*0*
Trowbridge	-1	-1	0	2	0	3	-1	0	0	*3*
Total	*2*	*3*	*3*	*16*	*7*	*12*	*19*	*1*	*1*	***65***

Table 12-6 TEE Benefits (£Ms) by Sector (Option C)

	Devizes	East	South	Chippenham	West	North	Melksham	Bradford On Avon	Trowbridge	Total
Devizes	0	0	0	3	1	1	2	0	1	8
East	0	0	3	0	2	0	3	0	4	*13*
South	-1	3	0	8	1	11	10	1	0	*34*
Chippenham	5	0	5	0	0	0	5	0	4	*19*
West	0	1	0	0	0	0	2	0	0	*3*
North	2	5	4	0	0	0	3	0	2	*17*
Melksham	0	1	1	12	5	5	7	0	2	*33*
Bradford On Avon	0	0	0	0	0	0	0	0	0	*0*
Trowbridge	-2	0	0	9	0	10	5	0	0	*23*
Total	*5*	*10*	*13*	*32*	*9*	*27*	*37*	*2*	*14*	***150***

12.3. Analysis of Monetised Costs and Benefits

At this stage, benefits related to accidents and environmental impacts have not been calculated and so the present value of TEE benefits is the same as the overall PVB. The PVBs, PVCs, BCRs and NPVs for each option are shown in **Table 12-7**.

Table 12-7 BCRs and NPVs

Option	PVC (£000)	PVB (£000)	BCR	NPV (£000)
A	£29,659	£57,751	1.95	£28,092
B	£38,331	£64,845	1.69	£26,514
C	£67,949	£149,606	2.20	£81,657

Options A and B therefore represent medium value for money, based on DfT guidance (BCR between 1.5 and 2) and Option C represents high value for money (BCR between 2 and 4).

As the costs calculated were very high level, sensitivity tests have been calculated on the BCRs for each option, considering ±10% in costs, as seen in **Table 12-8** and ±10% in benefits in **Table 12-9**. The BCR for Option A ranges from 1.75 to 2.16, for Option B it ranges from 1.52 to 1.88 and for Option C it ranges from 1.98 to 2.45. The small range of change in the BCR to Option B shows that it is resilient to change. Option A ranges from medium to high value for money when the costs decrease by 10% or benefits increase by 10%.

Table 12-8 BCR Sensitivity Testing - Costs

Option	Sensitivity tests	PVC (£000)	PVB (£000)	BCR
A	10% lower costs	£ 26,690	£ 57,751	2.16
	Calculated costs	£ 29,656	£ 57,751	1.95
	10% higher costs	£ 32,622	£ 57,751	1.77
B	10% lower costs	£ 34,494	£ 64,845	1.88

Option	Sensitivity tests	PVC (£000)	PVB (£000)	BCR
	Calculated costs	£ 38,327	£ 64,845	1.69
	10% higher costs	£ 42,160	£ 64,845	1.54
C	10% lower costs	£ 61,149	£ 149,606	2.45
	Calculated costs	£ 67,943	£ 149,606	2.20
	10% higher costs	£ 74,737	£ 149,606	2.00

Table 12-9 BCR Sensitivity Testing - Benefits

Option	Sensitivity tests	PVC (£000)	PVB (£000)	BCR
A	10% lower benefits	£ 29,656	£ 51,976	1.75
	Calculated benefits	£ 29,656	£ 57,751	1.95
	10% higher benefits	£ 29,656	£ 63,526	2.14
B	10% lower benefits	£ 38,327	£ 58,361	1.52
	Calculated benefits	£ 38,327	£ 64,845	1.69
	10% higher benefits	£ 38,327	£ 71,330	1.86
C	10% lower benefits	£ 67,943	£ 134,645	1.98
	Calculated benefits	£ 67,943	£ 149,606	2.20
	10% higher benefits	£ 67,943	£ 164,567	2.42

12.4. Indirect Tax Revenues

For this scheme, the only impact on indirect tax revenues will be through changes in fuel-related vehicle operating costs. The scheme leads to reduced vehicle operating costs, as it provides a more efficient route for traffic the travelling from the north to the south of Melksham. This results in reduced indirect tax revenues amounting to £3.7 million across the 60-year project lifetime for Option A, £0.8 million for Option B and £4.8 million for Option C.

13. Summary

This report has detailed the methodology used to develop the Melksham Transport Model (MTM) for a 2017 base year and the subsequent forecasting and economic testing conducted for the completion of the A350 Melksham Bypass.

13.1. Base Model Summary

Separate models have been developed to represent the AM peak hour (average 0700-1000), inter-peak average hour (1000-1600) and PM peak hour (average 1600-1900) traffic conditions, utilising a number of new and existing data sources. Initial prior matrices were developed from the A303 Stonehenge Model with internal trips added using AddressBase Plus data. The output matrices were analysed for changes in trip totals and all changes were concluded as acceptable. The model convergence achieves the required WebTAG criteria.

The indicators of model performance set out within the report demonstrate the models robustly represent 2017 base year conditions (in terms of link, screenline and journey time validation) and are therefore suitable for use in informing the economic assessment of the scheme.

The base model shows significant delays within Melksham, particularly in the town centre. In the AM peak period a delay of 104 seconds is experienced between Farmers and Semington roundabouts, as well as a large delay between Leekes roundabout and Farmers roundabout, which is also present in the IP and PM peak periods.

13.2. Model Forecasting

Forecast models were developed for the future years of 2023 (proposed scheme opening year) and 2041. Future year networks and matrices have been developed for both a ‘Do-Minimum’ (with the planned Eastern Way expansion) and ‘Do-Something’ scenario using WebTAG guidance on ‘uncertainty’ testing. The impact of the proposed scheme was assessed using a range of indicators including:

- Network assignment statistics;
- Key link flow changes; and
- Journey times.

Analysis demonstrates that the proposed scheme draws traffic onto the A350 bypass, relieving congestion in the town centre, which is unsuited to carrying future traffic levels. This leads to significant improvements in journey times in terms of those who can use the scheme directly but also on other routes where traffic levels are reduced. To a degree, the scheme also helps to reduce journey times on other routes through Melksham, such as the A365, due to reduced traffic at key junctions along the existing A350.

13.3. Economic Assessment

Benefits have been estimated from a number of sources, all of which contribute to the total Present Value of Benefits (PVB) of the A350 Bypass Scheme.

TEE benefits have been calculated using TUBA, the preferred software package for assessment of highway schemes. TUBA calculates monetised benefits based on changes in travel times, vehicle operating costs, user charges and private sector revenues, presented in 2010 prices and values.

Economic testing for the core scenario demonstrates that the scheme will generate between £57.7 million for option A, £64.8 million for option B and £149.6 million for option C of Transport system economic efficiency benefits over a 60-year project lifetime. The majority of these benefits are in the form of travel time savings, with £54.6 million, £63.7 million and £143.7 million gained for options A, B and C respectively. These benefits generally increase over time, as the growth in traffic levels and associated congestion imposes greater travel costs on road users, meaning the scheme has a more significant impact in terms of congestion relief.

The PVC for the scheme has been calculated at £29.7 million, £38.3 million and £67.9 million, comparing this figure against the scheme PVB generates a NPV of £28.1 million, £26.5 million and £81.7 million and BCR of 1.95, 1.69, 2.20 (all for options A, B and C respectively). The scheme therefore represents medium value for money for options A and B, and high value for money for option C based on WebTAG guidance for scheme appraisal. Option C generates the highest value for money, however Option B is more resilient to change, shown by the sensitivity testing. Option A generates a higher NPV than option B and has the potential to reach a high value for money under certain conditions.

Appendices

A. Convergence Statistics

AM Peak Convergence Statistics

Convergence Statistics

Loop	Ass.	Sim.	A/S Step	%Flows	%Delays	%V.I.	%Gap
13	0.0589/16	0.003/7	1.000/1	95.9	98.2	0.0051	0.042
14	0.0496/17	0.002/7	1.000/1	97.3	99.0	0.0039	0.034
15	0.0270/18	0.001/7	1.000/1	98.0	98.8	0.0025	0.076
16	0.0220/19	0.004/7	1.000/1	92.9	98.3	0.0016	0.031
17	0.0184/20	0.003/7	1.000/1	95.9	98.6	0.0019	0.017
18	0.0185/21	0.002/7	1.000/1	98.0	98.9	0.0019	0.018
19	0.0148/22	0.001/7	1.000/1	98.6	99.6	0.0015	0.018
20	0.0221/23	0.001/7	1.000/1	98.7	99.5	0.0014	0.016
21	0.0120/24	0.001/7	1.000/1	98.5	99.4	0.0011	0.010
22	0.0094/25	0.001/7	1.000/1	99.0	99.5	0.0009	0.014

Where:

Ass. – Delta Function (%) / Number of Iterations
Sim. – Final Average ABS Change In Out CFP (PCU/HR) / Number of Iterations
A/S Step – Step Length used on Ass/Sim Loop/Simulation Iterations
%FLOWS – Link flows differing by <5%
%DELAYS – Turn delays differing by <5%
%V.I. – Variational Inequality – Should be >0
%GAP – Wardrop Equilibrium Gap Function Post-Simulation

Extended Convergence Statistics

Loop	Ass-Hrs	Change	Sim-Hr	Sim-Km	GEHAv	AAD	RAAD	XMSD	SAD	RSAD
13	14283.8	0.024	10150.0	307300.5	0.032	0.62	0.17	0.4	0.9	2.3
14	14284.4	0.004	10150.4	307273.5	0.019	0.32	0.09	0.2	0.8	2.0
15	14296.7	0.086	10161.8	307237.3	0.014	0.23	0.06	0.1	0.8	2.2
16	14280.6	-0.113	10148.2	307332.2	0.048	1.12	0.30	1.0	0.9	2.3
17	14282.8	0.015	10149.8	307232.8	0.027	0.60	0.16	0.5	0.8	2.1
18	14281.2	-0.011	10148.6	307180.4	0.019	0.39	0.11	0.3	0.7	1.9
19	14283.9	0.019	10149.8	307136.4	0.011	0.19	0.05	0.1	0.7	1.9
20	14284.2	0.002	10149.5	307123.7	0.008	0.12	0.03	0.1	0.7	1.9
21	14285.9	0.012	10150.6	307115.1	0.009	0.15	0.04	0.1	0.7	1.9
22	14286.2	0.002	10150.8	307100.1	0.007	0.13	0.03	0.1	0.8	2.0

Where:

Ass-Hrs – Total PCU-HR/HR from the buffer and simulation networks
Change – % change in ASS-HRS
Sim-Hr – Total PCU-HR/HR from the simulation
Sim-Km – Total PCU-KM/HR from the simulation
GEHAv – Mean GEH Statistic, Link Demand Flows
AAD – Average Absolute Difference in Link Flow PCU/HR
RAAD – % Relative Average Absolute Difference in Link Flows
XMSD – % Relative Standard Deviation in Link Flows
SAD – Mean Absolute Difference in ASS/SIM Delays (seconds)
RSAD – % Relative Mean Absolute Difference in ASS/SIM Delays

Inter Peak Convergence Statistics

Convergence Statistics

Loop	Ass.	Sim.	A/S Step	%Flows	%Delays	%V.I.	%Gap
8	0.0787/15	0.003/7	1.000/1	93.2	97.8	0.015	0.095
9	0.0527/15	0.002/7	1.000/1	95.3	98.2	0.0097	0.081
10	0.0470/15	0.002/7	1.000/1	97.0	98.7	0.0071	0.066
11	0.0353/15	0.002/7	1.000/1	97.5	98.6	0.0056	0.068
12	0.0328/15	0.002/7	1.000/1	97.7	99.2	0.0045	0.059
13	0.0264/15	0.001/7	1.000/1	97.9	99.5	0.0034	0.048
14	0.0296/15	0.001/7	1.000/1	98.9	99.6	0.0025	0.036
15	0.0223/15	0.001/7	1.000/1	99.1	99.6	0.0020	0.031
16	0.0214/15	0.001/7	1.000/1	99.1	99.5	0.0016	0.028
17	0.0172/15	0.001/7	1.000/1	99.0	99.4	0.0013	0.027

Extended Convergence Statistics

Loop	Ass-Hrs	Change	Sim-Hr	Sim-Km	GEHAv	AAD	RAAD	XMSD	SAD	RSAD
8	8201.9	0.314	6537.4	234927.6	0.045	0.70	0.24	0.79	0.54	2.39
9	8215.4	0.164	6540.7	234888.5	0.030	0.44	0.15	0.44	0.40	1.76
10	8223.7	0.101	6542.7	234875.8	0.022	0.32	0.11	0.31	0.36	1.58
11	8228.4	0.058	6544.3	234858.7	0.018	0.24	0.08	0.24	0.33	1.45
12	8231.0	0.031	6545.1	234857.5	0.014	0.20	0.07	0.20	0.31	1.36
13	8231.7	0.008	6545.0	234864.0	0.012	0.17	0.06	0.17	0.29	1.27
14	8232.9	0.015	6545.3	234863.6	0.008	0.12	0.04	0.12	0.28	1.20
15	8233.7	0.010	6545.6	234862.5	0.007	0.10	0.04	0.09	0.26	1.15
16	8232.8	-0.011	6544.9	234865.7	0.006	0.08	0.03	0.10	0.27	1.16
17	8232.7	-0.001	6544.9	234868.9	0.006	0.09	0.03	0.10	0.27	1.17

PM Peak Convergence Statistics

Convergence Statistics

Loop	Ass.	Sim.	A/S Step	%Flows	%Delays	%V.I.	%Gap
8	0.0183/10	0.004/7	1.000/ 1	96.8	98.6	0.0031	0.065
9	0.0511/9	0.003/7	1.000/ 1	95.5	99.0	0.0029	0.025
10	0.0350/20	0.003/7	1.000/ 1	96.7	98.8	0.0045	0.026
11	0.0297/20	0.003/7	1.000/ 1	97.6	99.0	0.0023	0.023
12	0.0101/20	0.002/7	1.000/ 1	97.4	98.8	0.0022	0.020
13	0.0170/20	0.002/7	1.000/ 1	97.6	99.1	0.0016	0.014
14	0.0079/20	0.002/7	1.000/ 1	98.5	98.9	0.0011	0.014
15	0.0132/20	0.002/7	1.000/ 1	98.7	99.2	0.0009	0.008
16	0.0076/20	0.001/7	1.000/ 1	99.4	99.6	0.006	0.011
17	0.0094/20	0.001/7	1.000/ 1	99.4	99.7	0.006	0.006

Extended Convergence Statistics

Loop	Ass-Hrs	Change	Sim-Hr	Sim-Km	GEHAv	AAD	RAAD	XMSD	SAD	RSAD
8	8426.9.8	0.012	7241.0	276912.9	0.024	0.383	0.113	0.363	0.188	0.996
9	8424.5	-0.029	7239.3	276935.9	0.023	0.372	0.110	0.298	0.110	0.584
10	8423.2	-0.015	7238.9	276900.3	0.024	0.348	0.102	0.243	0.111	0.592
11	8422.3	-0.011	7237.7	276920.4	0.015	0.223	0.066	0.162	0.086	0.457
12	8422.8	0.006	7237.9	276924.4	0.017	0.265	0.078	0.189	0.093	0.492
13	8421.6	-0.014	7237.2	276904.2	0.015	0.227	0.067	0.163	0.062	0.331
14	8418.5	-0.038	7234.7	276914.0	0.011	0.173	0.051	0.126	0.068	0.363
15	8420.7	0.027	7235.6	276874.3	0.011	0.182	0.054	0.124	0.043	0.229
16	2421.1	0.004	7235.6	276869.5	0.006	0.105	0.031	0.075	0.027	0.141
17	8420.3	-0.009	7234.9	276868.8	0.006	0.085	0.025	0.063	0.025	0.131

B. Link Validation (Total Vehicles)

AM Peak Link Validation

Road Name	A Node	B Node	Dir	Observed	Modelled	% Diff	GEH
A365 Bath Road	62261	45122	EB	574	557	-3.0%	0.7
A3102 Sandridge Common	45007	45018	EB	206	174	-15.4%	2.3
Unnamed Road	45005	45004	EB	281	246	-12.5%	2.2
Site 16	62429	65657	EB	386	353	-8.6%	1.7
Site 22	45094	61453	EB	610	607	-0.5%	0.1
A350 Beanacre Road	62262	45181	NB	906	759	-16.2%	5.1
A3102 Bath Road	45168	62256	NB	633	466	-26.5%	7.1
Bradford Road	45088	45107	NB	271	251	-7.3%	1.2
Unnamed Road	45006	45007	NB	308	354	15.0%	2.5
Spa Road	45019	45002	NB	760	700	-7.9%	2.2
Unnamed Road	45065	45027	NB	406	397	-2.4%	0.5
Site 13	62431	45037	NB	970	956	-1.4%	0.4
Site 17	45184	45115	NB	671	831	23.8%	5.8
Site 21	65955	62429	NB	671	732	9.0%	2.3
A350 Beanacre Road	45181	62262	SB	719	775	7.8%	2.0
A3102 Bath Road	62256	45168	SB	375	384	2.5%	0.5
Bradford Road	45107	45088	SB	339	296	-12.6%	2.4
Unnamed Road	45007	45006	SB	280	206	-26.5%	4.8
Unnamed Road	45027	45065	SB	314	263	-16.4%	3.0
Site 13	45037	62431	SB	824	754	-8.5%	2.5
Site 17	45115	45184	SB	664	608	-8.5%	2.2
Site 21	62429	65955	SB	626	704	12.5%	3.0
A365 Bath Road	45122	62261	WB	544	499	-8.2%	2.0
A3102 Sandridge Common	45018	45007	WB	224	157	-30.1%	4.9
Unnamed Road	45004	45005	WB	361	385	6.8%	1.3
Site 16	65657	62429	WB	366	342	-6.6%	1.3
Site 22	61453	45094	WB	591	583	-1.4%	0.4
A350 Beanacre Road	55001	45111	IB	675	709	5.0%	1.3
Woodrow Road	45013	45172	IB	30	39	28.2%	1.5
A365 Bath Road	45063	62268	IB	529	453	-14.4%	3.4
Site 14	62429	45057	IB	946	969	2.4%	0.7
Bath Road	62263	45110	IB	469	579	23.3%	4.8
A3102 Sandridge Common	45080	62283	IB	404	417	3.3%	0.6
Site 23	45088	45090	IB	271	296	9.1%	1.5
A350 Beanacre Road	45111	55001	OB	803	821	2.3%	0.6

Inter-Peak Link Validation

Road Name	A Node	B Node	Dir	Observed	Modelled	% Diff	GEH
A365 Bath Road	62261	45122	EB	468	498	6.3%	1.3
A3102 Sandridge Common	45007	45018	EB	198	134	-32.4%	5.0

Road Name	A Node	B Node	Dir	Observed	Modelled	% Diff	GEH
Unnamed Road	45005	45004	EB	252	236	-6.1%	1.0
Site 16	62429	65657	EB	296	329	11.4%	1.9
Site 22	45094	61453	EB	524	602	15.0%	3.3
A350 Beanacre Road	62262	45181	NB	809	612	-24.4%	7.4
A3102 Bath Road	45168	62256	NB	490	377	-23.1%	5.4
Bradford Road	45088	45107	NB	280	323	15.6%	2.5
Unnamed Road	45006	45007	NB	215	171	-20.7%	3.2
Spa Road	45019	45002	NB	576	466	-19.2%	4.8
Unnamed Road	45065	45027	NB	364	277	-23.9%	4.8
Site 13	62431	45037	NB	756	768	1.6%	0.4
Site 17	45184	45115	NB	641	594	-7.2%	1.9
Site 21	65955	62429	NB	576	703	22.0%	5.0
A350 Beanacre Road	45181	62262	SB	732	579	-21.0%	6.0
A3102 Bath Road	62256	45168	SB	491	451	-8.2%	1.8
Bradford Road	45107	45088	SB	297	334	12.7%	2.1
Unnamed Road	45007	45006	SB	222	214	-3.6%	0.5
Spa Road	45002	45019	SB	648	535	-17.4%	4.6
Unnamed Road	45027	45065	SB	388	306	-21.1%	4.4
Site 13	45037	62431	SB	721	749	3.9%	1.0
Site 17	45115	45184	SB	522	545	4.4%	1.0
Site 21	62429	65955	SB	525	474	-9.6%	2.3
A365 Bath Road	45122	62261	WB	511	536	4.9%	1.1
A3102 Sandridge Common	45018	45007	WB	196	110	-43.9%	7.0
Unnamed Road	45004	45005	WB	249	198	-20.5%	3.4
Site 16	65657	62429	WB	303	233	-23.0%	4.3
Site 22	61453	45094	WB	447	455	1.9%	0.4
A350 Beanacre Road	55001	45111	IB	652	577	-11.6%	3.0
Woodrow Road	45013	45172	IB	44	53	20.2%	1.3
A365 Bath Road	45063	62268	IB	451	357	-20.7%	4.6
Site 14	62429	45057	IB	832	779	-6.4%	1.9
Bath Road	62263	45110	IB	456	556	21.9%	4.4
A3102 Sandridge Common	45080	62283	IB	281	169	-39.9%	7.5
Site 23	45088	45090	IB	250	334	33.5%	4.9

PM Peak Link Validation

Road Name	A Node	B Node	Dir	Observed	Modelled	% Diff	GEH
A365 Bath Road	62261	45122	EB	533	591	10.9%	2.4
A3102 Sandridge Common	45007	45018	EB	303	270	-11.0%	2.0
Unnamed Road	45005	45004	EB	425	400	-5.9%	1.2
Site 16	62429	65657	EB	373	361	-3.3%	0.6
Site 22	45094	61453	EB	769	645	-16.2%	4.7
A350 Beanacre Road	62262	45181	NB	868	755	-13.1%	4.0
A3102 Bath Road	45168	62256	NB	445	484	8.6%	1.8

Road Name	A Node	B Node	Dir	Observed	Modelled	% Diff	GEH
Bradford Road	45088	45107	NB	280	372	32.9%	5.1
Unnamed Road	45006	45007	NB	315	304	-3.5%	0.6
Spa Road	45019	45002	NB	681	677	-0.5%	0.1
Unnamed Road	45065	45027	NB	326	318	-2.5%	0.5
Site 13	62431	45037	NB	958	1,038	8.4%	2.5
Site 17	45184	45115	NB	845	676	-20.0%	6.1
Site 21	65955	62429	NB	733	989	35.0%	8.7
A350 Beanacre Road	45181	62262	SB	888	679	-23.6%	7.5
A3102 Bath Road	62256	45168	SB	577	531	-8.0%	2.0
Bradford Road	45107	45088	SB	345	409	18.4%	3.3
Unnamed Road	45007	45006	SB	365	366	0.4%	0.1
Spa Road	45002	45019	SB	893	655	-26.6%	8.6
Unnamed Road	45027	45065	SB	423	379	-10.5%	2.2
Site 13	45037	62431	SB	896	904	0.8%	0.2
Site 17	45115	45184	SB	492	621	26.1%	5.4
Site 21	62429	65955	SB	615	673	9.3%	2.3
A365 Bath Road	45122	62261	WB	641	706	10.2%	2.5
A3102 Sandridge Common	45018	45007	WB	249	243	-2.2%	0.3
Unnamed Road	45004	45005	WB	366	364	-0.6%	0.1
Site 16	65657	62429	WB	412	367	-10.7%	2.2
Site 22	61453	45094	WB	563	653	16.0%	3.6
A350 Beanacre Road	55001	45111	IB	835	670	-19.7%	6.0
Woodrow Road	45013	45172	IB	81	39	-52.6%	5.5
A365 Bath Road	45063	62268	IB	610	499	-18.2%	4.7
Site 14	62429	45057	IB	1,151	1,176	2.2%	0.7
Bath Road	62263	45110	IB	584	685	17.3%	4.0
A3102 Sandridge Common	45080	62283	IB	380	430	13.2%	2.5
Site 23	45088	45090	IB	305	409	34.1%	5.5

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Appendix B

WebTAG appraisal tables

1. TEE Tables

Option A

Non-business: Commuting	**ALL MODES**	**ROAD**	**BUS and COACH**	**RAIL**	**OTHER**
User benefits	**TOTAL**	**Private Cars and LGVs**	**Passengers**	**Passengers**	
Travel time	17033	17033			
Vehicle operating costs	346	346			
User charges	0	0			
During Construction & Maintenance	0	0			
NET NON-BUSINESS BENEFITS: COMMUTING	17379	17379			

Non-business: Other	**ALL MODES**	**ROAD**	**BUS and COACH**	**RAIL**	**OTHER**
User benefits	**TOTAL**	**Private Cars and LGVs**	**Passengers**	**Passengers**	
Travel time	12010	12010			
Vehicle operating costs	2228	2228			
User charges	0	0			
During Construction & Maintenance	0	0			
NET NON-BUSINESS BENEFITS: OTHER	14238	14238			

Business								
User benefits			**Goods Vehicles**	**Business Cars & LGVs**	**Passengers**	**Freight**	**Passengers**	
Travel time	12830		9210	3620				
Vehicle operating costs	3648		2916	732				
User charges	0		0	0				
During Construction & Maintenance	0		0	0				
Subtotal	16478	*(2)*	12125	4353				
Private sector provider impacts						**Freight**	**Passengers**	
Revenue	0							
Operating costs	0							
Investment costs	0							
Grant/subsidy	0							
Subtotal	0	*(3)*						
Other business impacts	0							
Developer contributions	0	*(4)*						
NET BUSINESS IMPACT	16478	*(5) = (2) + (3) + (4)*						
TOTAL Present Value of Transport Economic Efficiency Benefits (TEE)	48095	*(6) = (1a) + (1b) + (5)*						

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

Option B

Non-business: Commuting	**ALL MODES**	**ROAD**	**BUS and COACH**	**RAIL**	**OTHER**
User benefits	**TOTAL**	**Private Cars and LGVs**	**Passengers**	**Passengers**	
Travel time	25035	25035			
Vehicle operating costs	-1122	-1122			
User charges	0	0			
During Construction & Maintenance	0	0			
NET NON-BUSINESS BENEFITS: COMMUTING	23913	23913			

Non-business: Other	**ALL MODES**	**ROAD**	**BUS and COACH**	**RAIL**	**OTHER**
User benefits	**TOTAL**	**Private Cars and LGVs**	**Passengers**	**Passengers**	
Travel time	23225	23225			
Vehicle operating costs	-291	-291			
User charges	0	0			
During Construction & Maintenance	0	0			
NET NON-BUSINESS BENEFITS: OTHER	22934	22934			

Business								
User benefits			**Goods Vehicles**	**Business Cars & LGVs**	**Passengers**	**Freight**	**Passengers**	
Travel time	27548		20632	6915				
Vehicle operating costs	2890		2479	411				
User charges	0		0	0				
During Construction & Maintenance	0		0	0				
Subtotal	30438	*(2)*	23111	7326				
Private sector provider impacts						**Freight**	**Passengers**	
Revenue	0							
Operating costs	0							
Investment costs	0							
Grant/subsidy	0							
Subtotal	0	*(3)*						
Other business impacts	0							
Developer contributions	0	*(4)*						
NET BUSINESS IMPACT	30438	*(5) = (2) + (3) + (4)*						

TOTAL		
Present Value of Transport Economic Efficiency Benefits (TEE)	77285	*(6) = (1a) + (1b) + (5)*

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

Option C

Non-business: Commuting	**ALL MODES**	**ROAD**	**BUS and COACH**	**RAIL**	**OTHER**
User benefits	**TOTAL**	**Private Cars and LGVs**	**Passengers**	**Passengers**	
Travel time	62967	62967			
Vehicle operating costs	3585	3585			
User charges	0	0			
During Construction & Maintenance	0	0			
NET NON-BUSINESS BENEFITS: COMMUTING	66552				

Non-business: Other	**ALL MODES**	**ROAD**	**BUS and COACH**	**RAIL**	**OTHER**
User benefits	**TOTAL**	**Private Cars and LGVs**	**Passengers**	**Passengers**	
Travel time	68230	68230			
Vehicle operating costs	3208	3208			
User charges	0	0			
During Construction & Maintenance	0	0			
NET NON-BUSINESS BENEFITS: OTHER	71438	71438			

Business

User benefits			**Goods Vehicles**	**Business Cars & LGVs**	**Passengers**	**Freight**	**Passengers**	
Travel time	64866		45633	19233				
Vehicle operating costs	7775		5723	2052				
User charges	0		0	0				
During Construction & Maintenance	0		0	0				
Subtotal	72641		51356	21285				
Private sector provider impacts						**Freight**	**Passengers**	
Revenue	0							
Operating costs	0							
Investment costs	0							
Grant/subsidy	0							
Subtotal	0	*(3)*						
Other business impacts	0							
Developer contributions	0	*(4)*						
NET BUSINESS IMPACT	72641	*(5) = (2) + (3) + (4)*						

TOTAL		
Present Value of Transport Economic Efficiency Benefits (TEE)	210631	*(6) = (1a) + (1b) + (5)*

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

2. Public Accounts Tables

Option A

Local Government Funding	ALL MODES TOTAL		ROAD INFRASTRUCTURE	RAIL	OTHER
Revenue	-		-		
Operating Costs	-		-		
Investment Costs	8,898		8,898		
Developer and Other Contributions	-		-		
Grant/Subsidy Payments	-		-		
NET IMPACT	8,898	*(7)*	8,898		
Central Government Funding: Transport					
Revenue	-		-		
Operating costs	-		-		
Investment Costs	20,761		20,761		
Developer and Other Contributions	-		-		
Grant/Subsidy Payments	-		-		
NET IMPACT	20,761	*(8)*			
Central Government Funding: Non-Transport					
Indirect Tax Revenues	2,957	*(9)*			
TOTALS					
Broad Transport Budget	29,659	*(10) = (7) + (8)*			
Wider Public Finances	2,957	*(11) = (9)*			

Notes: Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers. All entries are discounted present values in 2010 prices and values.

Option B

Local Government Funding	ALL MODES TOTAL		ROAD INFRASTRUCTURE	RAIL	OTHER
Revenue	-		-		
Operating Costs	-		-		
Investment Costs	11,499		11,499		
Developer and Other Contributions	-		-		
Grant/Subsidy Payments	-		-		
NET IMPACT	11,499	*(7)*	11,499		
Central Government Funding: Transport					
Revenue	-		-		
Operating costs	-		-		
Investment Costs	26,831		26,831		
Developer and Other Contributions	-		-		
Grant/Subsidy Payments	-		-		
NET IMPACT	26,831	*(8)*			
Central Government Funding: Non-Transport					
Indirect Tax Revenues	830	*(9)*			
TOTALS					
Broad Transport Budget	38,331	*(10) = (7) + (8)*			
Wider Public Finances	830	*(11) = (9)*			

Notes: Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers. All entries are discounted present values in 2010 prices and values.

Option C

Local Government Funding	ALL MODES TOTAL		ROAD INFRASTRUCTURE	RAIL	OTHER
Revenue	-		-		
Operating Costs	-		-		
Investment Costs	20,385		20,385		
Developer and Other Contributions	-		-		
Grant/Subsidy Payments	-		-		
NET IMPACT	20,385	*(7)*	20,385		
Central Government Funding: Transport					
Revenue	-		-		
Operating costs	-		-		
Investment Costs	47,565		47,565		
Developer and Other Contributions	-		-		
Grant/Subsidy Payments	-		-		
NET IMPACT	47,565	*(8)*			
Central Government Funding: Non-Transport					
Indirect Tax Revenues	6,751	*(9)*			
TOTALS					
Broad Transport Budget	67,949	*(10) = (7) + (8)*			
Wider Public Finances	6,751	*(11) = (9)*			

Notes: Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers. All entries are discounted present values in 2010 prices and values.

3. Analysis of Monetised Cost and Benefits

Option A

Noise	-	*(12)*
Local Air Quality	-	*(13)*
Greenhouse Gases	1537	*(14)*
Journey Quality	-	*(15)*
Physical Activity	-	*(16)*
Accidents	-	*(17)*
Economic Efficiency: Consumer Users (Commuting)	17379	*(1a)*
Economic Efficiency: Consumer Users (Other)	14238	*(1b)*
Economic Efficiency: Business Users and Providers	16478	*(5)*
Wider Public Finances (Indirect Taxation Revenues)	-2957	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	46675	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*
Broad Transport Budget	29659	*(10)*
Present Value of Costs (see notes) (PVC)	29659	*(PVC) = (10)*
OVERALL IMPACTS		
Net Present Value (NPV)	17016	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)	1.57	BCR=PVB/PVC

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

Option B

Noise	-	*(12)*
Local Air Quality	-	*(13)*
Greenhouse Gases	439	*(14)*
Journey Quality	-	*(15)*
Physical Activity	-	*(16)*
Accidents	-	*(17)*
Economic Efficiency: Consumer Users (Commuting)	23913	*(1a)*
Economic Efficiency: Consumer Users (Other)	22934	*(1b)*
Economic Efficiency: Business Users and Providers	30438	*(5)*
Wider Public Finances (Indirect Taxation Revenues)	-830	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	76894	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*
Broad Transport Budget	38331	*(10)*
Present Value of Costs (see notes) (PVC)	38331	*(PVC) = (10)*
OVERALL IMPACTS		
Net Present Value (NPV)	38563	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)	2.01	BCR=PVB/PVC

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

Option C

Noise	-	*(12)*
Local Air Quality	-	*(13)*
Greenhouse Gases	3368	*(14)*
Journey Quality	-	*(15)*
Physical Activity	-	*(16)*
Accidents	-	*(17)*
Economic Efficiency: Consumer Users (Commuting)	66552	*(1a)*
Economic Efficiency: Consumer Users (Other)	71438	*(1b)*
Economic Efficiency: Business Users and Providers	72641	*(5)*
Wider Public Finances (Indirect Taxation Revenues)	-6751	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	207248	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*
Broad Transport Budget	67949	*(10)*
Present Value of Costs (see notes) (PVC)	67949	*(PVC) = (10)*
OVERALL IMPACTS		
Net Present Value (NPV)	139299	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)	3.05	BCR=PVB/PVC

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

Appendix C

Appraisal Summary Tables

Appraisal Summary Table

Date produced:	2	11	17

Contact:	
Name	Robert Murphy
Organisation	Wiltshire Council
Role	Promoter/Official

Name of scheme:	A350 Melksham Bypass
Description of scheme:	Eastern Route Corridor, Option A

Impacts		Summary of key impacts	Assessment: Quantitative	Assessment: Qualitative	Assessment: Monetary £(NPV)	Assessment: Distributional 7-pt scale/ vulnerable grp
Economy	Business users & transport providers	The scheme will result in benefits from journey time and operating cost savings for business users, including road freight.	Value of journey time changes(£): 18.6m Net journey time changes (£): 0 to 2min: ; 2 to 5min: ; > 5min:	-	20.4m	Not assessed
Economy	Reliability impact on Business users	The scheme is expected to produce reliability benefits approximately in proportion to journey time benefits.	-	Slight Beneficial	-	
Economy	Regeneration	Although the scheme is expected to support economic growth across the A350 corridor, the option is not connected to specific regeneration sites. By reducing traffic volumes passing through Melksham it will however indirectly support the Council's aims to regenerate the town centre.	-	Neutral	-	
Economy	Wider Impacts	Given Melksham's location at the centre of the A350 corridor, the scheme has potential to produce Wider Impacts such as static agglomeration benefits, approximately in proportion to journey time benefits.	-	Slight Beneficial	-	
Environmental	Noise	Options A and B would result in increases in traffic volumes and construction activity along Eastern Way within 200m of housing areas resulting in potential adverse impacts to a large number of households, but only a relatively small reduction in traffic volumes along the existing A350.	-	Slight to Moderate Adverse	-	Slight beneficial for low income households in vicinity of current A350 route.
Environmental	Air Quality	As with noise, the scheme expects to decrease air quality in the vicinity of the new route, however will increase air quality along the current A350 route. Reductions in congestion and delays will result in less fuel consumption and emissions, therefore the impact is expected to be slight to moderate adverse.	-	Slight to Moderate Adverse	-	Slight beneficial for low income households in vicinity of current A350 route.
Environmental	Greenhouse gases	The scheme is likely to result in changes in journey distances due to traffic re-routing onto the bypass, and increases in average vehicle speed compared to the Do Minimum, producing a small increase in greenhouse gas emissions. Construction of the bypass would also result in additional adverse embedded carbon emissions.	Change in non-traded carbon over 60y (CO2e): Change in traded carbon over 60y (CO2e): -	-	-1.5m	
Environmental	Landscape	No national or international designations present within 2km: Neutral Impact National & regional landscape features include; National Cycle Routes, Public Rights of Way, Ancient Woodland present within 2km: Slight Adverse Impact Recreational parkland & Registered Parks & Gardens, K&A Canal within 2km, & may have adverse impacts on their settings & visual amenity: Slight Adverse Impact The route would cut through large open agricultural land with mature hedgerows & trees resulting in adverse impact on landscape character, setting, landscape pattern & visual amenity: Moderate Adverse Impact	-	Neutral to Moderate adverse	-	
Environmental	Townscape	Route corridor follows predominantly rural setting, with little impact on the fabric & cohesiveness of the townscape. Not visually intrusive in urban area but will impact on certain views into & across the area. Cannot be completely integrated & not quite fitting scale & layout of the town.	-	Slight Adverse	-	
Environmental	Historic Environment	Potential for direct impact on Local / Regional historic designations,including Listed Buildings: Slight Adverse Impacts Indirect impact on the setting of known historic features include; Scheduled Monument Listed Buildings, Registered Parks and Gardens, Conservation Areas: Slight Adverse Impacts.	-	Slight Adverse	-	
Environmental	Biodiversity	The Eastern Corridor has potential for impacts on the Bath and Bradford Avon Bats SAC (approximately 7.2 km, north east) through loss of commuting or foraging habitat for bats within the local area linked to this SAC. Spye Park SSSI, Seend Cleeve Quarry SSSI, and the Seend Ironstone Quarry and Road Cutting SSSI are present within 1-2km from the Eastern Corridor. No impacts to these sites are anticipated. The Eastern Corridor may result in direct loss and /or disturbance of the priority habitat deciduous woodland, as well as a range of agricultural habitats and associated species. A crossing of the River Avon may result in loss of bankside habitat and impacts to aquatic	-	Moderate Adverse	-	
Environmental	Water Environment	The scheme would lead to an increase in surface water run-off as a result of the impermeable area. A surface water drainage strategy may be required. The scheme crossing water courses, two new bridge crossings are therefore required. Also, new drain/ditch crossings are also required. The scheme may potentially require compensatory flood storage as a result of loss/impact on floodplain. The eastern corridor lies in the Environment Agency Flood Zone 2 and 3 in three different areas.	-	Major Adverse	-	
Social	Commuting and Other users	Benefits from journey time and operating cost savings for commuting and other users as a result of the scheme.	Value of journey time changes(£): 36.0m Net journey time changes (£): 0 to 2min; 2 to 5min; > 5min	-	37.3m	Not assessed

	Reliability impact on Commuting and Other users	The new journey time provides a faster journey time with expanded capacity and increased journey time reliability, therefore the impact is expected to be slight beneficial.		Slight Beneficial		
	Physical activity	The scheme does not propose to directly alter any walking or cycling routes, however a reduction in traffic on the current A350 route makes it more attractive for pedestrians and cyclists. Increased traffic volumes could discourage some walking and cycling journeys along Eastern Way.	-	Neutral	-	
	Journey quality	Traveller stress may be reduced due to faster and more reliable journey times	-	Slight Beneficial	-	
	Accidents	The scheme has potential to reduce personal injury accidents through reduction of traffic at known collision clusters on the existing A350 route through Melksham, and provision of a new route which is less congested and with reduced risk of collisions with cyclists and pedestrians.	-	Slight Beneficial	-	Slight Beneficial for vulnerable groups in exisitng A350 route vicinity.
	Security	The scheme proposes no changes which would improve or degrade security on the highway network.	-	Neutral	-	Not assessed
	Access to services	No changes to public transport provision or accessibility to services are anticipated as a result	-	Neutral	-	Not assessed
	Affordability	The scheme will result in vehicle operating cost savings for users and will therefore improve affordability.	-	Slight Beneficial	-	Beneficial for low income households in existing A350 route vicinity.
	Severance	Options A and B both result in a modest reduction in traffic volumes and associated severance along the existing A350 in Beanacre and Melksham. However, they also risk increasing severance along Eastern Way and Spa Road.	-	Neutral	-	Slight adverse for DSA claimants in the route vicinity, however beneficial affects for DSA claimants in vicinity of exisitng A350 route.
	Option and non-use values	The scheme does not lead to a change in the availability of transport services or transport options.	-	Neutral	-	
Public Accounts	Cost to Broad Transport Budget	Total scheme costs	-	-	29.7m	
	Indirect Tax Revenues	A reduction in delay may result in a reduction of fuel costs, however this is expected to be marginal, therefore the impact is expected to be neutral.	-	-	3.7m	

Appraisal Summary Table

Date produced:	2 11 17

Name of scheme:	A350 Melksham Bypass
Description of scheme:	Eastern Route Corridor, Option B

Contact:	
Name	Robert Murphy
Organisation	Wiltshire Council
Role	Promoter/Official

Impacts		Summary of key impacts	Assessment: Quantitative	Assessment: Qualitative	Assessment: Monetary £(NPV)	Assessment: Distributional 7-pt scale/ vulnerable grp
Economy	Business users & transport providers	The scheme will result in benefits from journey time and operating cost savings for business users, including road freight.	Value of journey time changes(£): 24.2m Net journey time changes (£): 0 to 2min: ; 2 to 5min: ; > 5min:	-	26.6m	Not assessed
	Reliability impact on Business users	The scheme is expected to produce reliability benefits approximately in proportion to journey time benefits.	-	Slight Beneficial	-	
	Regeneration	Although the scheme is expected to support economic growth across the A350 corridor, the option is not connected to specific regeneration sites. By reducing traffic volumes passing through Melksham it will however indirectly support the Council's aims to regenerate the town centre.	-	Neutral	-	
	Wider Impacts	Given Melksham's location at the centre of the A350 corridor, the scheme has potential to produce Wider Impacts such as static agglomeration benefits, approximately in proportion to journey time benefits.	-	Slight Beneficial	-	
Environmental	Noise	Options A and B would result in increases in traffic volumes and construction activity along Eastern Way within 200m of housing areas resulting in potential adverse impacts to a large number of households, but only a relatively small reduction in traffic volumes along the existing A350.	-	Slight to Moderate Adverse	-	Slight beneficial for low income households in vicinity of current A350 route.
	Air Quality	Options A and B would result in increases in traffic volumes and construction activity along Eastern Way within 200m of housing areas resulting in potential adverse impacts to a large number of households, but only a relatively small reduction in traffic volumes along the existing A350.	-	Slight to Moderate Adverse	-	Slight beneficial for low income households in vicinity of current A350 route.
	Greenhouse gases	The scheme is likely to result in changes in journey distances due to traffic re-routing onto the bypass, and increases in average vehicle speed compared to the Do Minimum, producing a small increase in greenhouse gas emissions. Construction of the bypass would also result in additional adverse embedded carbon emissions.	Change in non-traded carbon over 60y (CO2e): Change in traded carbon over 60y (CO2e): -	-	-0.4m	
	Landscape	No national or international designations present within 2km: Neutral Impact National & regional landscape features include; National Cycle Routes, Public Rights of Way, Ancient Woodland present within 2km: Slight Adverse Impact Recreational parkland & Registered Parks & Gardens, K&A Canal within 2km, & may have adverse impacts on their settings & visual amenity: Slight Adverse Impact The route would cut through large open agricultural land with mature hedgerows & trees resulting in adverse impact on landscape character, setting, landscape pattern & visual amenity: Moderate Adverse Impact	-	Neutral to Moderate Adverse	-	
	Townscape	Route corridor follows predominantly rural setting, with little impact on the fabric & cohesiveness of the townscape. Not visually intrusive in urban area but will impact on certain views into & across the area. Cannot be completely integrated & not quite fitting scale & layout of the town.	-	Slight Adverse	-	
	Historic Environment	Potential for direct impact on Local / Regional historic designations,including Listed Buildings: Slight Adverse Impacts Indirect impact on the setting of known historic features include; Scheduled Monument Listed Buildings, Registered Parks and Gardens, Conservation Areas: Slight Adverse Impacts.	-	Slight Adverse	-	
	Biodiversity	The Eastern Corridor has potential for impacts on the Bath and Bradford Avon Bats SAC (approximately 7.2 km, north east) through loss of commuting or foraging habitat for bats within the local area linked to this SAC. Spye Park SSSI, Seend Cleeve Quarry SSSI, and the Seend Ironstone Quarry and Road Cutting SSSI are present within 1-2km from the Eastern Corridor. No impacts to these sites are anticipated. The Eastern Corridor may result in direct loss and /or disturbance of the priority habitat deciduous woodland, as well as a range of agricultural habitats and associated species. A crossing of the River Avon may result in loss of bankside habitat and impacts to aquatic species	-	Moderate Adverse	-	
	Water Environment	The scheme would lead to an increase in surface water run-off as a result of the impermeable area. A surface water drainage strategy may be required. The scheme crossing water courses, two new bridge crossings are therefore required. Also, new drain/ditch crossings are also required. The scheme may potentially require compensatory flood storage as a result of loss/impact on floodplain. The eastern corridor lies in the Environment Agency Flood Zone 2 and 3 in three different areas.	-	Major Adverse	-	
Social	Commuting and Other users	Benefits from journey time and operating cost savings for commuting and other users as a result of the scheme.	Value of journey time changes(£): 39.6m Net journey time changes (£)	-	38.2m	Not assessed

S			0 to 2min / 2 to 5min / > 5min	-	38.2m	
	Reliability impact on Commuting and Other users	The new journey time provides a faster journey time with expanded capacity and increased journey time reliability, therefore the impact is expected to be slight beneficial.		Slight Beneficial	-	
	Physical activity	The scheme does not propose to directly alter any walking or cycling routes, however a reduction in traffic on the current A350 route makes it more attractive for pedestrians and cyclists. Increased traffic volumes could discourage some walking and cycling journeys along Eastern Way.	-	Neutral	-	
	Journey quality	Traveller stress may be reduced due to faster and more reliable journey times		Slight Beneficial	-	
	Accidents	The scheme has potential to reduce personal injury accidents through reduction of traffic at known collision clusters on the existing A350 route through Melksham, and provision of a new route which is less congested and with reduced risk of collisions with cyclists and pedestrians.	-	Slight Beneficial	-	Slight Beneficial for vulnerable groups in exisitng A350 route vicinity.
	Security	The scheme proposes no changes which would improve or degrade security on the highway	-	Neutral	-	Not assessed
	Access to services	No changes to public transport provision or accessibility to services are anticipated as a result	-	Neutral	-	Not assessed
	Affordability	The scheme will result in vehicle operating cost savings for users and will therefore improve affordability.	-	Slight Beneficial	-	Beneficial for low income households in existing A350 route vicinity.
	Severance	Options A and B both result in a modest reduction in traffic volumes and associated severance along the existing A350 in Beanacre and Melksham. However, they also risk increasing severance along Eastern Way and Spa Road.		Neutral	-	Slight adverse for DSA claimants in the route vicinity, however beneficial affects for DSA claimants in vicinity of exisitng A350 route.
	Option and non-use values	The scheme does not lead to a change in the availability of transport services or transport options.	-	Neutral	-	
Public Accounts	Cost to Broad Transport Budget	Total scheme costs	-	-	38.3m	
	Indirect Tax Revenues	A reduction in delay may result in a reduction of fuel costs, however this is expected to be marginal, therefore the impact is expected to be neutral.	-	-	0.8m	

Appraisal Summary Table

Date produced:	2	11	17

Name of scheme:	A350 Melksham Bypass	**Contact:**	
Description of scheme:	Eastern Route Corridor, Option C	**Name**	Robert Murphy
		Organisation	Wiltshire Council
		Role	Promoter/Official

Impacts		Summary of key impacts	Assessment: Quantitative	Assessment: Qualitative	Assessment: Monetary £(NPV)	Assessment: Distributional 7-pt scale/ vulnerable grp
Economy	Business users & transport providers	The scheme will result in benefits from journey time and operating cost savings for business users, including road freight.	Value of journey time changes(£): 50.6m Net journey time changes (£): 0 to 2min: ; 2 to 5min: ; > 5min:	-	54.3m	Not assessed
	Reliability impact on Business users	The scheme is expected to produce reliability benefits approximately in proportion to journey time benefits.	-	Moderate Beneficial		
	Regeneration	Although the scheme is expected to support economic growth across the A350 corridor, the option is not connected to specific regeneration sites. By reducing traffic volumes passing through Melksham it will however indirectly support the Council's aims to regenerate the town centre.	-	Neutral	-	
	Wider Impacts	Given Melksham's location at the centre of the A350 corridor, the scheme has potential to produce Wider Impacts such as static agglomeration benefits, approximately in proportion to journey time benefits.	-	Moderate Beneficial	-	
Environmental	Noise	Option C would result in increases in traffic volumes and construction activity on a route which is mostly 200m or more from major housing areas, so the potential for adverse impacts is substantially reduced. Conversely, it is expected to result in a significant reduction in traffic volumes and associated noise impacts along the existing A350 through Melksham.	-	Slight to Moderate Beneficial	-	Slight beneficial for low income households in vicinity of current A350 route. Slight adverse for older people in the new route vicinity.
	Air Quality	Option C would result in increases in traffic volumes on a route which is further away from major housing areas, so the potential for adverse impacts is substantially reduced. Conversely, it is expected to result in a significant reduction in traffic volumes and NO2 levels along the existing A350 through Melksham and Beanacre, with beneficial impacts also in rural villages including Lacock, Rowde and Seend.	-	Slight to Moderate Beneficial	-	Slight beneficial for low income households in vicinity of current A350 route. Slight adverse for older people in the new route vicinity.
	Greenhouse gases	The scheme is likely to result in changes in journey distances due to traffic re-routing onto the bypass, and increases in average vehicle speed compared to the Do Minimum, producing a small increase in greenhouse gas emissions. Construction of the bypass would also result in additional adverse embedded carbon emissions.	Change in non-traded carbon over 60y (CO2e): Change in traded carbon over 60y (CO2e):	-	-3.4m	
	Landscape	No national or international designations present within 2km: Neutral Impact National & regional landscape features include; National Cycle Routes, Public Rights of Way, Ancient Woodland present within 2km: Slight Adverse Impact Recreational parkland & Registered Parks & Gardens, K&A Canal within 2km, & may have adverse impacts on their settings & visual amenity: Slight Adverse Impact The route would cut through large open agricultural land with mature hedgerows & trees resulting in adverse impact on landscape character, setting, landscape pattern & visual amenity: Moderate Adverse Impact	-	Neutral to Moderate adverse	-	
	Townscape	Route corridor follows predominantly rural setting, with little impact on the fabric & cohesiveness of the townscape. Not visually intrusive in urban area but will impact on certain views into & across the area. Cannot be completely integrated & not quite fitting scale & layout of the town.	-	Slight Adverse	-	
	Historic Environment	Potential for direct impact on Local / Regional historic designations,including Listed Buildings: Slight Adverse Impacts Indirect impact on the setting of known historic features include; Scheduled Monument Listed Buildings, Registered Parks and Gardens, Conservation Areas: Slight Adverse Impacts.	-	Slight Adverse	-	
	Biodiversity	The Eastern Corridor has potential for impacts on the Bath and Bradford Avon Bats SAC (approximately 7.2 km, north east) through loss of commuting or foraging habitat for bats within the local area linked to this SAC. Spye Park SSSI, Seend Cleeve Quarry SSSI, and the Seend Ironstone Quarry and Road Cutting SSSI are present within 1-2km from the Eastern Corridor. No impacts to these sites are anticipated. The Eastern Corridor may result in direct loss and /or disturbance of the priority habitat deciduous woodland, as well as a range of agricultural habitats and associated species. A crossing of the River Avon may result in loss of bankside habitat and impacts to aquatic species.	-	Moderate Adverse	-	
	Water Environment	The scheme would lead to an increase in surface water run-off as a result of the impermeable area. A surface water drainage strategy may be required. The scheme crossing water courses, two new bridge crossings are therefore required. Also, new drain/ditch crossings are also required. The scheme may potentially require compensatory flood storage as a result of loss/impact on floodplain. The eastern corridor lies in the Environment Agency Flood Zone 2 and 3 in three different areas.	-	Major Adverse	-	

Social	Commuting and Other users	Benefits from journey time and operating cost savings for commuting and other users as a result of the scheme.	Value of journey time changes(£) 93.1m Net journey time changes (£) 0 to 2min | 2 to 5min | > 5min	-	95.1m	Not assessed
	Reliability impact on Commuting and Other users	The new journey time provides a significantly faster journey time with expanded capacity and increased journey time reliability, therefore the impact is expected to be moderate beneficial.	-	Moderate Beneficial		
	Physical activity	The scheme does not propose to directly alter any walking or cycling routes, however a reduction in traffic on the current A350 route makes it more attractive for pedestrians and cyclists.	-	Slight Beneficial	-	
	Journey quality	Traveller stress may be reduced due to faster and more reliable journey times	-	Moderate Beneficial		
	Accidents	The scheme has potential to reduce personal injury accidents through reduction of traffic at known collision clusters on the existing A350 route through Melksham, and provision of a new route which is less congested and with reduced risk of collisions with cyclists and pedestrians.	-	Slight Beneficial	-	Slight Beneficial for vulnerable groups in exisitng A350 route vicinity.
	Security	The scheme proposes no changes which would improve or degrade security on the highway	-	Neutral	-	Not assessed
	Access to services	No changes to public transport provision or accessibility to services are anticipated as a result of the scheme.	-	Neutral	-	Not assessed
	Affordability	The scheme will result in vehicle operating cost savings for users and will therefore improve affordability.	-	Slight Beneficial	-	Beneficial for low income households in existing A350 route vicinity.
	Severance	Option C results in a significant reduction in traffic along the existing A350, and therefore a larger severance benefit to the communities in northern Melksham and Beanacre (and possibly other villages such as Lacock, Rowde and Seend), without increasing traffic volumes in other residential areas.	-	Moderate Beneficial	-	Slight adverse for DSA claimants in the route vicinity, however beneficial affects for DSA claimants in vicinity of exisitng A350 route.
	Option and non-use values	The scheme does not lead to a change in the availability of transport services or transport options.	-	Neutral	-	
Public Accounts	Cost to Broad Transport Budget	Total scheme costs	-	-	67.9m	
	Indirect Tax Revenues	A reduction in delay may result in a reduction of fuel costs, however this is expected to be marginal, therefore the impact is expected to be neutral.	-	-	4.8m	

Appendix D
Procurement strategy

1. Introduction and background

1.1. This appendix outlines the procurement strategy for the A350 Melksham Bypass project. The purpose of this appendix is to review the potential procurement strategies for the A350 Melksham Bypass project. The strategy describes how the project will be contracted and structured to ensure a high-quality standard of construction and operation of the scheme.

Procurement strategy approach and purpose

1.2. The objective of the procurement strategy is to provide a framework for Wiltshire Council to obtain both value and social capital from its purchased goods and services. This strategy focuses on the delivery of the following corporate and social goals:

- Identifying and delivering efficiencies, but not at the expense of quality
- Developing and embracing the principles of sustainable procurement.

1.3. To examine this, this appendix explores the following elements:

- Procurement objectives for the scheme;
- Procurement options; and
- The preferred procurement option

2. Procurement objectives

2.1. The capital (infrastructure) works procurement strategy must identify and acknowledge appropriate risk allocation and work with the design strategy and set the appropriate engagement of consultants and contractors for the detailed design and implementation. The capital works strategy is realised through the resulting project organization, project management, contracting strategy and the consistency and co-ordination of the contract terms between the client and external organisations.

2.2. One of the most fundamental decisions when addressing the procurement strategy for infrastructure works is how to source the design elements of the work.

2.3. The design requirements of the infrastructure work vary between the options. There may be elements in some of the options that are challenging and may present a risk of delay either because of design complexity or because of necessary interface with third parties. Examples of risk accruing from relative technical complexity are the new bridge over the floodplain of the River Avon (required for all scheme options) and potentially the re-design of junctions and highway along Eastern Way (in Options A and B). Examples of risk accruing from design interfaces with third parties are the land assembly and design approvals from the respective statutory bodies for planning and highways amendment consents.

2.4. Infrastructure design is a process with distinct but related stages. Operational design, sometimes referred to as 'Preliminary', 'Outline' or 'Reference'[1], defines the performance criteria of the scheme and what the actual outputs will be, whereas detailed design defines the construction of the project and how it is delivered on the ground.

2.5. Given that the key external constraints and risks on the project (land assembly and statutory utilities diversions) are largely defined during the initial phases of the design of the selected option, the procurement strategy can be effective in partially managing these risks before the delivery mechanism is set.

[1] The term 'Reference' being applied often when an outline design is incorporated into a construction contract as part of the specification, being the design which a Design and Build contractor will need to develop with detailed design work before constructing.

2.6. In terms of the construction phase of the project, the key risks identified in the options include the planning and logistics involved with the construction of a new bridge over the floodplain.

Objectives

2.7. Prior to assessing options and developing a strategy for procurement of a project, it is necessary to understand clearly the focus of the procurement.

2.8. To determine the priorities of a procurement process it is common practice to examine the objectives i.e. the purpose of the procurement. The purpose can often be split into 'primary' and 'secondary' objectives: primary objectives being those which procurement options considered must deliver and; secondary objectives being those where it would be beneficial if a chosen solution delivered the preferred outcome.

2.9. In setting or determining procurement objectives, it is necessary to consider the project being procured. The objectives must be specific to the individual project. In addition, it is common to use some generic objectives to ensure that the general regulatory requirements will be met by any particular approach to procurement.

2.10. At this stage, the suggested objectives are as outline below, looking separately at primary and secondary issues.

2.11. Primary:

- Will deliver the scheme within the available funding
- The promoting authorities will be able to commit to the project in full
- Will ensure Best Value is delivered
- Will ensure that appropriate quality is delivered
- Will offer an affordable whole life cost solution
- Reduces risks to a level that is As Low As Reasonably Practicable (ALARP)

2.12. Secondary:

- Offers the opportunity to engage Contractors in the early planning stage development of the scheme
- Provides Contractor input to the design, risk assessment and delivery programme
- Offers the opportunity to engage a Contractor in the planning public inquiry in respect of construction techniques, disruption and subsequent mitigation measures during the works
- Offers the promoters affordable opportunities for change throughout the project life-cycle.

2.13. Most of the above objectives should be self-explanatory. However, the ability of any particular procurement route to offer the promoters with the chance of affordable change throughout the project life cycle is a challenge for any procurement process. Where a high degree of risk transfer to the contractor takes place, there is an almost equal degree of increase in the cost of promoter changes during the project. There are few procurement options that offer a high degree of risk transfer and the chance of affordable changes to the project during its life-cycle.

2.14. It is important that any consideration of procurement routes or options acknowledges that the procurement process itself is all about risk management and transfer. Perhaps more accurately it is about appropriate risk transfer at an affordable price.

2.15. Frequently, expectations with respect to risk transfer are unrealistic at the planning stage and subsequently result in overly optimistic forecasts of construction costs. Risk management and transfer come with a cost. It is equally important to understand that the cost associated with a particular risk is not simply a function of the risk itself but the potential impact of that risk on other activities. During the construction phase the cost of a risk is highly proportional to the impact on the construction programme as this is normally considered critical from a contractor's perspective. If there can be flexibility in the delivery date, then the cost of many risks can be reduced dramatically.

3. Procurement options

3.1. The contract strategy will determine the level of integration of design, construction and maintenance for a project. This should support the objectives for outputs expressed in respect of time, cost, and quality which, subject to fine tuning, are understood to be generally stated as follows:

- **Cost** - a high degree of certainty that the scheme can be delivered within the available funding constraints;
- **Quality** - the provision of a high-quality asset with minimal maintenance issues and interruptions to planned operation levels; and
- **Time** - bringing the new assets into operation quickly after funding is approved.

3.2. These objectives conflict to a certain degree and consequently the sourcing option will reflect an optimised balance between them. Mechanisms will be put in place in the chosen contract strategy to further incentivise the supply chain towards the objectives. The choice of strategy must ensure that control is concentrated where it is most needed and on the factors most important to the partnership, with risk being allocated in a way that it is held by the party best able to manage it, consistent with the stated objectives.

3.3. The main types of procurement strategy for capital works are:

- **Traditional:** design by client-engaged consultants before tender and separate placement of a contract for the construction works;
- **D&B:** detailed design and construction are both undertaken by the same organisation;
- **D&C**: a hybrid of 'traditional' and D&B where part of the design is prepared before the contractor is appointed;
- **Construction management:** design by the client's consultants and construction of the works overlap. A fee-earning construction manager defines and manages the work packages. All contracts are between a client and the trade contractors. The final cost of the project may only be accurately forecast when all packages have been let;
- **Management contracting:** design by the client's consultant and construction overlap. A management contractor is appointed early to let elements of work progressively by trade or package contracts ('works packages'). The contracts are between the management contractor and the works contractors. As with construction management, the final cost can only be forecast with reasonable certainty when the last package has been let; and
- **PFI/PPP:** This procurement route is typically where a public-sector client buys services with defined outputs from the private sector on a long-term basis, typically for 25 years. This will typically involve constructing and maintaining the delivered asset, and consequently the supplier is incentivised in this model to have the highest regard to whole-life costing as it has the risk of future operation and maintenance costs for a substantial period of time.

3.4. Table 3-1 summarises and compares the options, presenting the pros and cons of each basic procurement route. Later in this section we explain how the divisions between each separate route can be fine-tuned to obtain the optimum characteristics for the project contracting strategy.

Table 3-1 Comparison of capital works procurement options

Procurement type	Description	Risk transfer	Advantages	Disadvantages
Traditional approaches	*Client completes a full detailed design followed by tendering for a contractor, who is passed the design to construct.*	*The contractor assumes responsibility and financial risks for the building works whilst the client takes the responsibility and risk for design team performance. Therefore, if the contractor's works are delayed by the failure of the design team to meet their obligations, the contractor may claim against the client for additional costs and/or time to complete the project.*	• *design-led, facilitating a higher level of client control over the design;* • *reasonable price certainty at contract award based upon market forces;* • *the strategy is satisfactory in terms of public accountability;* • *potential to separate scheme delivery into a series of contracts rather than single entity* • *the procedure is well known; and* • *changes are easy to arrange and value.*	• *overall programme may be longer than for other strategies as there is no parallel working;* • *limited 'buildability' input by contractor; and* • *the strategy often results in adversarial relationships developing.*
D&B	*Client goes to tender on the basis of performance criteria for the asset together with other design and logistical constraints possibly together with very limited design information. The successful contractor then becomes responsible for completing the design and construction in accordance with the stated requirements*	*Design risk is carried by the contractor. The client develops a detailed knowledge of risk, enabling a more informed negotiation of risk transfer at the tender stage.*	• *the client has only to deal with one firm;* • *more construction efficiency benefits ('buildability') are prioritised in the design;* • *price certainty is obtained before construction starts provided the client's requirements are adequately specified and changes are not introduced; and* • *reduced total project time through early completion is possible because of overlapping activities. Detailed Design is completed by the contractor to suit its own construction programme, the advanced site works being*	• *There are very few true D&B construction organisations and what is usually being procured is a collaboration between a contractor and design organisation;* • *the client is required to commit itself before the detailed designs are completed;* • *there is no design overview unless separate consultants are appointed by the client for this purpose;* • *difficulties can be experienced by clients in preparing an adequate brief;*

Procurement type	Description	Risk transfer	Advantages	Disadvantages
			undertaken while the design for later activities is still in progress	• *bids are difficult to compare since each design, programme and cost will vary;* • *client changes to project scope can significantly add to the scheme costs; and* • *Practical difficulties are possible if, despite contractual checks a contractor is intent on implementing a programme of cost savings*
D&C	*The client submits for tender an outline design together with performance criteria for the asset together with other design and logistical constraints. The successful contractor then becomes responsible for the outline design that it has inherited and completes the detailed design and construction in accordance with that outline design modified as necessary to comply with all the contract requirements. It is typical under this model for the client's designer to be transferred to the contractor to maintain knowledge and continuity.*	*Generally as D&B above but the contractor's design is constrained within certain parameters derived and defined by the outline design already undertaken by the client.*	• *as D&B above but because of the pre-contract outline design work together with continuous checking of the developing detailed design the client has more control over the main characteristics of the asset as finally constructed.*	• *as D&B above but the difficulties of and unpredictability of outcomes arising from representing the brief purely in words is mitigated by the client's 'pre-contract' partial design.* • *loss of contractor buildability input into the outline design stage however this can be mitigated by inviting alternative proposals with tenders; and* • *additional programme time spent before tender although limited net delay to achievement of the construction completion*
Management contracts	*Management contracts cover both the 'management contracting' and 'construction management. Procurement approaches; although technically different they are very similar. 'Construction management' is characterised by the provision of a construction management consultancy service and 'management contracting' is*	*Under both regimes the work is let in separate work packages (generally by trade) which may include design responsibility). Under the construction management regime all work package contracts are placed directly by the client whereas under 'management contracting'*	• *the strategy offers time saving potential for overall project time due to the overlapping of procedures;* • *buildability advice potential is inherent;* • *breakdown of traditional adversarial barriers although a certain amount of contractor /*	• *price certainty is not achieved until the last trade packages have been let; and* • *an informed, proactive client is required in order to operate such a strategy*

Procurement type	Description	Risk transfer	Advantages	Disadvantages
	effectively traditional contracting but with the contractor working for a fee based on the total value of the works packages procured and managed by it.	*the contractor places these contracts.*	*client barriers remain under the 'management contracting' regime;* • *parallel working is an inherent feature;* • *clarity of roles, risks, and relationships for all participants; and* • *changes in design can be accommodated later than with some other strategies, without paying a premium, provided the relevant trade packages have not been let and earlier awarded packages are not too adversely affected.*	
PFI/PPP	*This procurement route is typically where a public sector Client buys services with defined outputs from the private sector on a long-term basis, typically for 25 years. This will involve maintaining or constructing and maintaining the asset, and the supplier is incentivised to consider whole-life costing as it will benefit directly from reduced spending on maintenance.*	*All risk is carried by the PFI Operator*	• *total cost of the scheme including maintenance and operation is effectively spread over the whole lifecycle of the project; and* • *long term interest in maintenance helps ensure quality driven approach to the design and construction of the scheme.*	• *increased procurement process duration will lead to significantly later start date of construction and therefore potential for increased cost to completion;* • *generally more expensive overall than self-funded procurement models;* • *very long 'lock-in' time with the contractor may be problematic if relationships are not satisfactory; and* • *strong differences of political opinion exist on the use of PFI models of procurement. This may generate political difficulty in obtaining sanction for use.*

3.5. Certain identified design and construction risks exist, and all scheme options will require complex engineering design associated with the River Avon bridge and floodplain crossing to the north of Melksham. This will include compliance with requirements of the Water Framework Directive and undertaking Flood Risk Assessments, with consideration given to compensatory flood storage. The contractor will need to meet these legal requirements and work with the Environment Agency to agree appropriate solutions. The possibility of letting contracts for the construction of the bypass section which includes the floodplain and river crossing elements separately from the other sections will be considered as an option.

3.6. One of the key design risks is the establishment of the precise route of the chosen option, and the source of the risk deriving from the time taken to undertake the necessary land assembly. The land transactions, if concluded by negotiation/agreement, will potentially involve a large number of separate contracts with third party landowners. Consequently, it will take a significant amount of time before the route can be finalised and the consequent time and cost risk can be removed. This argues for the D&C procurement process, where a relatively detailed outline design is developed at an earlier stage than under the D&B model (before the contractor is engaged) enabling the client to commence acquisition of land as early as possible. The extent of land and consequently the number of land transactions required varies between the five options, in Table 3-1,and this issue should therefore be taken into consideration in the choice of the preferred option.

3.7. The problem of a large number of land transactions deriving from the chosen route may be mitigated significantly by the exercise of compulsory purchase powers (if such are authorised) through the general vesting declaration process, which would not require a large number of separate contracts with third party landowners.

3.8. In addition, another major risk is with the utilities that may need to be diverted to incorporate the new bypass and maintain service provision in the area to residents and businesses. This work comes with significant time and cost implications as the engagement process prescribed under the New Roads and Street Works Act 1991 (NRSWA) is capable of being extremely prolonged and costly. Early engagement with drainage and utilities companies is therefore considered vital to identify the necessary diversions and the cost and programme requirements of these works. Additionally, mostly being installed underground, the adaptation work is likely to be needed at a relatively early stage in the construction process. The preparatory engagement with the utilities companies should reap dividends in time savings, final arrangements, detailed planning and implementation are more effectively managed by the contractor who should be required to contract with each utility company for the works.

3.9. The only caveat to this recommendation is that the discount given by utilities companies to public authority clients under the provisions of the NRSWA may not accrue to the works contractor. Although experience has suggested that, if the contractor provides evidence that the works are being undertaken on behalf of a public authority, then most utility companies will offer the same discount. This will be one of the issues to be checked during the early stages of client / utility company engagement; if the discount will not be offered to a contractor, then this aspect of the procurement strategy ought to be re-considered.

3.10. With some minor exceptions, the work involved seems suited to transferring a significant amount of design to the construction supply chain; the quality aspects of most of the infrastructure being heavily prescribed by nationally codified highways standards rather than client preference. However, it needs to be acknowledged that the operational performance standards required for the infrastructure need to be set out and the contractor's designs to achieve that performance reviewed for compliance as highways standards may not address these aspects satisfactorily.

3.11. The risks accruing from the negotiation of land purchases to allow the new infrastructure to be established within a given boundary is unsuitable to be transferred to a contractor and would almost inevitably lead to delay and cost escalation. However, other transportation schemes which have obtained compulsory purchase powers for contractors under a Transport Works Act (TWA) Order have adopted this approach.

3.12. The high time and cost risk accruing from the drainage and utilities works will attract significant risk premiums unless mitigated in some way. As discussed above this risk can be mitigated by early engagement with the companies to identify and plan the necessary adaptions required by the chosen route option. This process is suitable for a contractor and is an argument in favour of Early Contractor Involvement (ECI).

Conclusions

3.13. Decisions regarding the preferred procurement strategy will be made at Outline Business Case stage, once the requirements of the proposed scheme have been defined with greater certainty. The following key points will be considered:

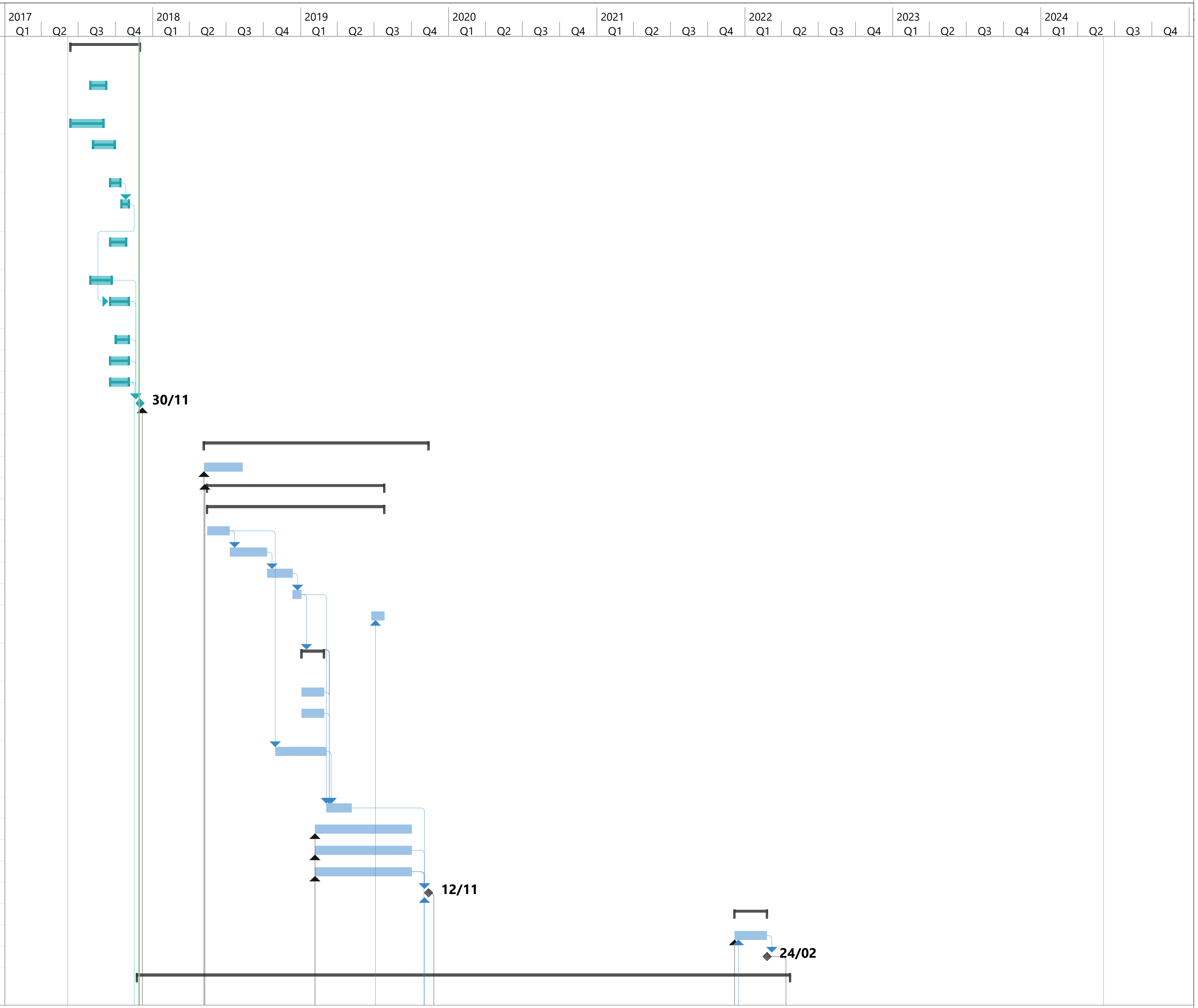
- Overall scope of works required (i.e. earthworks, highway construction, structures, landscaping)
- Physical scale and location of works
- Need for complex engineering design and environmental mitigation associated with River Avon bridge and floodplain crossing
- Land assembly process
- Utilities diversion requirements.

3.14. Consideration will be given to traditional procurement versus alternative approaches such as D&B, and the relative merits of letting a single contract or a series of contracts, which could be split by route section or work type.

Appendix E
Programme

A350 Melksham Bypass Indicative Programme

ID	Task Name	Duration	Start	Finish
1	**1 Strategic Outline Business Case**	**124 days?**	**Mon 12/06/17**	**Thu 30/11/17**
2	Options Assessment Report (OAR)	30 days	Mon 31/07/17	Fri 08/09/17
3	Data collection & analysis	60 days	Mon 12/06/17	Fri 01/09/17
4	Baseline traffic model calibration	40 days	Mon 07/08/17	Fri 29/09/17
5	Forecasting	20 days	Mon 18/09/17	Fri 13/10/17
6	Preliminary option modelling	15 days	Mon 16/10/17	Fri 03/11/17
7	Appraisal specification report (ASR)	30 days	Mon 18/09/17	Fri 27/10/17
8	Strategic case	40 days	Mon 31/07/17	Fri 22/09/17
9	Economic case	35 days	Mon 18/09/17	Fri 03/11/17
10	Financial case	25 days	Mon 02/10/17	Fri 03/11/17
11	Commercial case	35 days	Mon 18/09/17	Fri 03/11/17
12	Management case	35 days	Mon 18/09/17	Fri 03/11/17
13	Submission of SOBC to DfT	18 days	Tue 07/11/17	Thu 30/11/17
14				
15	**Outline Business Case**	**397 days?**	**Mon 07/05/18**	**Tue 12/11/19**
16	Strategic case	70 days	Mon 07/05/18	Fri 10/08/18
17	**Economic case**	**314 days**	**Tue 15/05/18**	**Fri 26/07/19**
18	**Strategic modelling**	**314 days**	**Tue 15/05/18**	Fri 26/07/19
19	Data collection	40 days	Tue 15/05/18	Mon 09/07/18
20	LMVR	66 days	Tue 10/07/18	Tue 09/10/18
21	Forecasting	45 days	Wed 10/10/18	Tue 11/12/18
22	Option tests	16 days	Wed 12/12/18	Wed 02/01/19
23	Post consultation ammendments	25 days	Mon 24/06/19	Fri 26/07/19
24	**Monetised environment assessment**	**40 days**	**Thu 03/01/19**	**Wed 27/02/19**
25	Noise assessment	40 days	Thu 03/01/19	Wed 27/02/19
26	AQ and Greenhouse Gas assessment	40 days	Thu 03/01/19	Wed 27/02/19
27	Non monetised environmental assessment	90 days	Tue 30/10/18	Mon 04/03/19
28	Economic appraisal	45 days	Tue 05/03/19	Mon 06/05/19
29	Financial case	171 days	Tue 05/02/19	Tue 01/10/19
30	Commercial case	171 days	Tue 05/02/19	Tue 01/10/19
31	Management case	171 days	Tue 05/02/19	Tue 01/10/19
32	Submission of OBC to DfT	1 day?	Tue 12/11/19	Tue 12/11/19
33	**Full Business Case**	**59 days**	**Mon 06/12/21**	**Thu 24/02/22**
34	Completion of FBC	58 days	Mon 06/12/21	Wed 23/02/22
35	Submission to DfT	1 day	Thu 24/02/22	Thu 24/02/22
36	**Approvals and statutory Process**	**1152 days?**	**Thu 23/11/17**	**Fri 22/04/22**

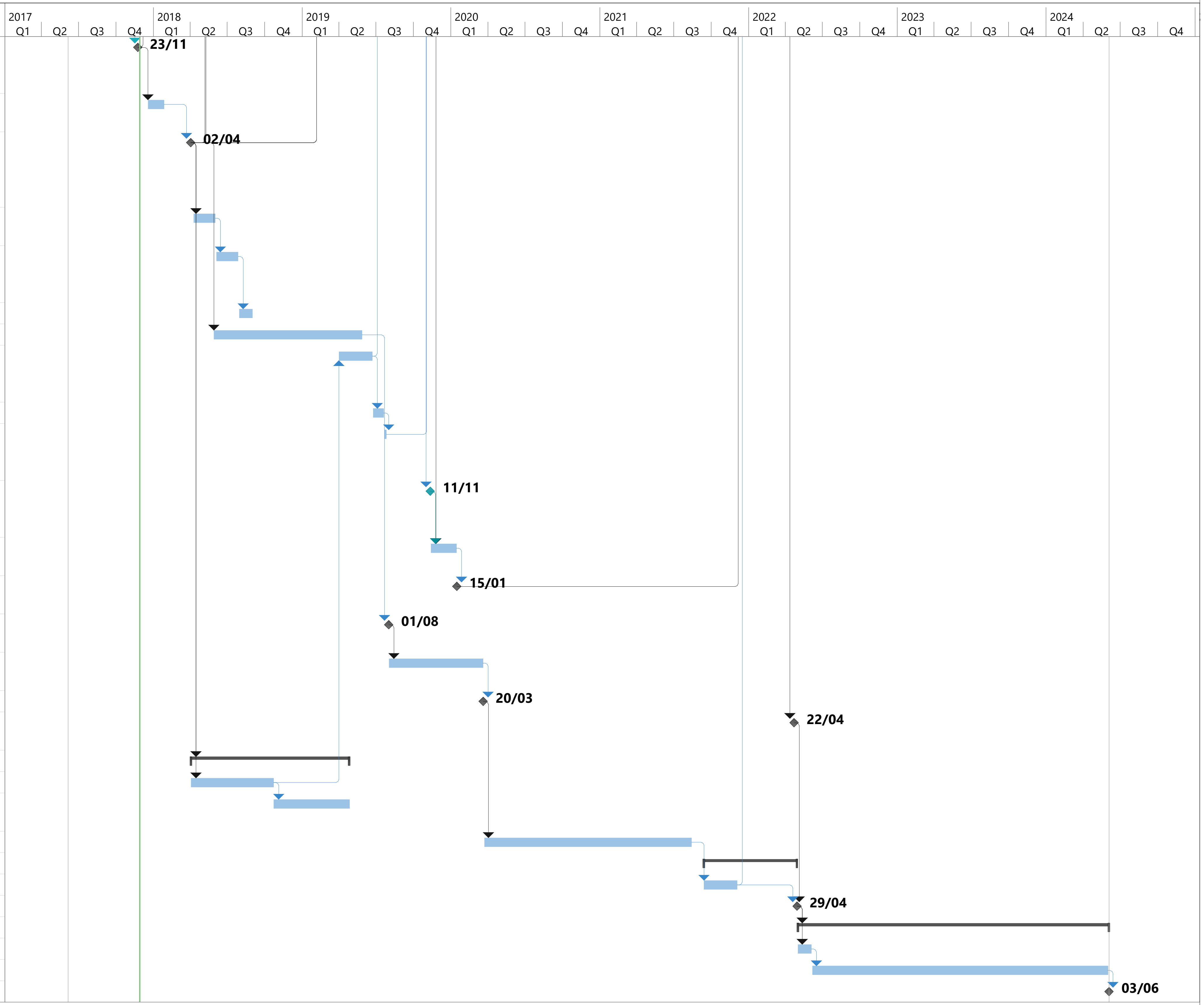


Project: 2017 11 28 - Scheme p
Date: Tue 28/11/17

Task	Project Summary	Manual Task	Start-only	Deadline
Split	Inactive Task	Duration-only	Finish-only	Progress
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress
Summary	Inactive Summary	Manual Summary	External Milestone	

A350 Melksham Bypass Indicative Programme

ID	Task Name	Duration	Start	Finish
37	Wiltshire Council cabinet authorisation for SOBC submission to DfT	1 day?	Thu 23/11/17	Thu 23/11/17
38	DfT consideration of SOBC submission	30 days	Mon 18/12/17	Fri 26/01/18
39	Wiltshire Council cabinet authorisation for continuation to OBC/ Preliminary design	1 day?	Mon 02/04/18	Mon 02/04/18
40	Preparation for public consultation	40 days	Mon 09/04/18	Fri 01/06/18
41	1st Public/Stakeholder consultation on shortlisted options	40 days	Mon 04/06/18	Fri 27/07/18
42	Consultation outputs	25 days	Mon 30/07/18	Fri 31/08/18
43	Environmental surveys	260 days	Tue 29/05/18	Mon 27/05/19
44	2nd Public/Stakeholder consultation on preferred option	60 days	Mon 01/04/19	Fri 21/06/19
45	Consultation outputs	20 days	Mon 24/06/19	Fri 19/07/19
46	Wiltshire Council cabinet authorisation seclection of preferred route	5 days	Mon 22/07/19	Fri 26/07/19
47	Wiltshire Council cabinet authorisation for OBC submission to DfT	1 day?	Mon 11/11/19	Mon 11/11/19
48	DfT consideration of OBC submission	45 days	Wed 13/11/19	Tue 14/01/20
49	DfT approval to proceed to Full Business Case (FBC)	1 day?	Wed 15/01/20	Wed 15/01/20
50	Submission of planning application and CPO	1 day	Thu 01/08/19	Thu 01/08/19
51	Planning / CPO consideration &enquiry	165 days	Fri 02/08/19	Thu 19/03/20
52	Planning / CPO approval	1 day	Fri 20/03/20	Fri 20/03/20
53	Agreement to release funds from DfT	1 day?	Fri 22/04/22	Fri 22/04/22
54	**Preliminary design**	**279 days**	**Tue 03/04/18**	Fri 26/04/19
55	Route option assessment	145 days	Tue 03/04/18	Mon 22/10/18
56	Additional preferred route design	134 days	Tue 23/10/18	Fri 26/04/19
57	Detailed design	365 days	Mon 23/03/20	Fri 13/08/21
58	**Procurement**	**165 days**	**Mon 13/09/21**	**Fri 29/04/22**
59	Tender process	60 days	Mon 13/09/21	Fri 03/12/21
60	Contract award	5 days	Mon 25/04/22	Fri 29/04/22
61	**Construction**	**546 days**	**Mon 02/05/22**	**Mon 03/06/24**
62	Construction preparation	25 days	Mon 02/05/22	Fri 03/06/22
63	Scheme construction	520 days	Mon 06/06/22	Fri 31/05/24
64	Scheme opening	1 day	Mon 03/06/24	Mon 03/06/24



Project: 2017 11 28 - Scheme p
Date: Tue 28/11/17

Task	Project Summary	Manual Task	Start-only	Deadline
Split	Inactive Task	Duration-only	Finish-only	Progress
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress
Summary	Inactive Summary	Manual Summary	External Milestone	

Appendix F
Communication & stakeholder management strategy

1. Introduction

1.1. This appendix outlines the strategy for communication and stakeholder management for the A350 Melksham Bypass project. The plan describes how the project will ensure that all internal and external stakeholders are informed of relevant project information.

1.2. Effective communication is key to the success of a project, therefore the objective of the communication plan is to ensure that accurate and timely messages regarding the project are given to a range of identified stakeholder groups.

2. Communication Objectives

2.1. Public and stakeholder engagement is a key method for solving problems and making decisions that directly impact upon living, working, using services and doing business in the area. Engaging with the stakeholders may include informing, consulting, involving, collaborating and empowering them to understand issues, allowing them to make informed choices.

2.2. To ensure that concise and informative messages are sent and received it is necessary to follow a set of communication objectives and ensure that key messages are portrayed. The key messages may change over the course of the project as issues; however, the immediate messages are given below.

2.3. The communication objectives are:

- To inform stakeholders of the scheme progress and to enable feedback on the detailed design, aiding scheme approval
- To communicate the scheme benefits to all stakeholders at every opportunity, hence increasing awareness of the scheme
- To manage stakeholder expectations
- To address perceptions of the scheme which are inconsistent with the objectives and forecast outcomes
- To provide consistent, clear information to those affected by the scheme, including the nature of scheme-related impacts and how and when it will affect people

2.4. The key messages are:

- The A350 through Melksham and Beanacre has insufficient capacity to cope with current and future traffic volumes and has areas that are unsuitable for the traffic volumes that are experienced
- The A350 Melksham Bypass will reduce journey times and delays on the A350 through Melksham and Beanacre, as well as on other routes through Melksham
- Wiltshire Council wishes to promote economic growth and has identified Melksham as having a strategic employment role within the A350 Growth Zone. The A350 bypass will encourage regeneration of Melksham town centre, employment growth in Melksham and surrounding areas and residential growth to complement economic growth.
- The scheme will also reduce the volume of traffic, including HGVs, on the current A350 route, hence reducing personal injury accident rates and severity, reducing severance impacts in Melksham and Beanacre and providing enhanced opportunities for walking and cycling within Melksham.
- The scheme will be funded by the Local Growth Fund, from the SWLEP, and Wiltshire Council funding.
- During the construction period, there will be inevitable delays to road users, but this will be minimised as much as possible and affected parties will be informed as per the Communication plan

The environmental impact will be minimised during the scheme design and construction by ensuring that the natural balance of the scheme is understood.

3. Stakeholders

3.1. Key stakeholders will be identified and involved in the delivery of the project in a number of ways. The engagement of the public and stakeholders is vital to the success and acceptance of a project. There are five main groups to consult with:

- Residents and landowners adjacent to the route of the proposed bypass
- Non-residential stakeholders adjacent to the proposed bypass route
- Those not living adjacent to the proposed route, but using the route
- Influencers on those journey makers, e.g. business organisations, unions, media, local authorities
- Advocates and Detractors, e.g. media, political stakeholders

Project stakeholders

3.2. Project stakeholders are shown in Tables 3-1 and 3-2 below.

Table 3-1 Internal Stakeholders

Internal Stakeholders	
Cabinet Member for Highways, Transport and Waste, Wiltshire Council	Cllr Bridget Wayman
Client project manager	Rob Murphy
Client risk manager	Tbc
Senior Responsible officer	Parvis Khansari
Section 151 Officer	Michael Hudson
Project Director	Peter Binley

Table 3-2 External Stakeholders

Identified external stakeholders		
Wiltshire Council	Road Haulage Association	Wiltshire Police
Melksham Area Board	Environment Agency	South-west Ambulance Service
Melksham Without Parish Council	Natural England	Local residents
Melksham Neighbourhood Plan	Historic England	Local businesses
Melksham Town Council	English Heritage	Road users
Local Town/Parish Councils	Forestry Commission	Non-motorised users
South West Local Enterprise Partnership Transport Infrastructure Sub-Group	Utility/ Services Companies	Fire and Rescue Service

Stakeholder tactics

3.3. The stakeholder tactics describe how groups of stakeholders will be communicated with and will comprise of three main parts:

(a) Inform
(b) Involve
(c) Consultation

Table 3-3 Stakeholder tactics

Stakeholder	Method(s)	Inform/Involve/Consult
Local Authority	Letter, web-based scheme page, social media, face-to-face, forum, newsletter, email	Inform, involve and consult
Community	Letter, web-based scheme page, media release, social media, newsletter, email	Inform and raise awareness
Business	Letter, web-based scheme page, social media, newsletter	Consult and gain buy-in
Statutory bodies	Letter, web-based scheme page, social media, face-to-face, forum, newsletter	Inform, consult and gain buy-in
Internal (Wilts Council staff)	Web-based scheme page, face-to-face, newsletter	Inform
Equality groups	Letter, web-based scheme page, social media, forum, newsletter	Inform and consult
Government	Letter, web-based scheme page, face-to-face, forum, newsletter, email	Consult and gain buy-in
Media	Web-based scheme page, media release, social media, public event, newsletter, email	Inform
Key stakeholder	Letter, web-based scheme page, social media, face-to-face, forum, newsletter, email	Consult and gain buy-in
General public	Web-based scheme page, media release, social media, newsletter	Inform and raise awareness
Campaign groups e.g. environmental	Letter, web-based scheme page, social media, forum, public event, newsletter	Inform and consult
Transport body	Letter, Web-based scheme page, forum, newsletter	Consult and gain buy-in

4. Timeline

4.1. Milestones of the project that require communication are set out in Table 4-1.

Table 4-1 Project milestone communications

Phase	Expected Date	Description
Preliminary design	February – October 2018	Public / stakeholder consultation on route options and then on preferred route option
OBC approval	January 2019	Approval of scheme and proceed to FBC stage
Planning Application	May 2019	Submission of planning application and CPO
Planning Approval	February 2020	Approval of planning application and CPO
Detailed design	January – September 2020	Public / stakeholder consultation on route
FBC approval	March 2021	Guarantee of funding for scheme
Pre-construction	April 2021	Preparation for the commencement of construction works
Construction	May 2021	Construction work on site
Construction ends	April 2023	Scheme complete, end of construction activity
Opening	May 2023	Official ‘opening’

5. Risks

5.1. A selection of communications and public acceptability risks are identified in Table 5-1 below, as well as mitigation that can be undertaken.

Table 5-1 Risks and mitigation

Risk	Mitigation
Objections to some elements of the scheme by local residents, landowners and environmental groups	Early engagement with stakeholders and communications to highlight the benefits of the scheme
Impact on existing traffic during construction	Provide advance warning of construction and publicise alternative diversionary routes
Delays to construction due to changes in design at a late stage	Communicate all scheme issues to manage expectations and ensure the process is open, so stakeholders understand how and when they can influence the scheme
Delays causing the scheme to overrun and result in an overspend	Mitigate delays and provide full details of reasons for delays, revised programmes and any revised costs
Lack of enthusiasm for the scheme	Highlight the scheme benefits and ensure accurate evaluation is undertaken

6. Evaluation

6.1. On completion of the project, an evaluation report will be produced detailing the performance of the communications plan. This will include:

- Information on the media coverage of the A350 Melksham Bypass scheme, with evidence of how the key messages identified in Section 2 were used
- Number of hits on appropriate Wiltshire Council web pages
- Attendance and outcome from meetings/events
- Evidence of support for the scheme including member, resident and business support

Appendix G
Risk management strategy

1. Introduction

Risk Management Plan

1.1. This appendix outlines the risk management plan for the A350 Melksham Bypass scheme. The plan describes how risk management will be structured and performed on the project to ensure risks are being managed and controlled at acceptable levels.

1.2. The objective of a risk management process is to minimize the impact of unplanned incidents on the project by identifying and addressing potential risks before significant, negative consequences occur. The plan will outline how a risk will be dealt with including how it will be assessed, who is responsible and how often risk planning will be undertaken.

2. Risk management process

2.1. The process examined in this section are those which are considered relevant to the immediate task involved - the delivery of risk products for the Strategic Outline Business Case (SOBC). It is acknowledged that, as the scheme progresses, the methods of assessment may change (most notably with the move to quantitative risk assessment in the Outline Business Case (OBC) and Full Business Case (FBC), and these changes will be examined when the Risk Management Plan (RMP) is updated at the beginning of each new stage.

Identification

2.2. A preliminary risk register has been started during the SOBC stage with general risks identified through discussions between consultant Project Manager and the design, environment and modelling teams. That preliminary version will be transferred into a full OBC stage risk register product, and augmented by the identification of risks through:

- Brainstorming – A small workshop event involving the consultant and Wiltshire Council project managers and leads for the various disciplines involved in the project. This stage will flesh out the preliminary risk register from the SOBC.
- Working groups – The consultant Project Manager will request that the discipline leads hold working groups amongst their individual teams to produce a long-list of risks. Each discipline will then be responsible for feeding responses back to the Risk Co-ordinator.
- Regular risk call – The Risk Co-ordinator will lead a monthly teleconference with the discipline leads to summarise change in the risk register from the previous month, and to request any information on new risks.
- Risk workshop – The above three methods of risk identification will provide a basis for the risk register in the early parts of the OBC stage. However, once option design and modelling has been more fully investigated a full Risk Workshop will be required to identify new risks (including those from stakeholders) and to review known risks.

2.3. For each risk, a clear understanding of cause, event and impact is required before an assessment can be made regarding the rating levels of probability and impact can be assigned. It is the responsibility of the consultant Project Manager to identify these aspects for each risk through consultation with the source of the risk identification and the relevant risk owner.

Categorisation of risks

2.4. Similar types of risk may also have interactions which will be investigated further during the risk assessment. This will be particularly true of programme (time impact) risks where the effects on time cannot simply be added together. An understanding of the overall schedule of activities and the critical path through these activities will be ascertained to determine the real aggregate effect of time risks.

2.5. The following principles have been adopted when considering when to group/categorise risks:

- Similar causes or types of risk
- A potential domino effect
- Same or similar response strategy
- The same owner or manager
- Activities often run in parallel
- The occurrence of a risk causes a time delay in one activity which impacts on another

Assessment

2.6. Within the assessment applied to the risk register, each identified risk is to be assigned a prescribed level of probability and impact. When combined within the 5x5 matrix, an overall risk rating is calculated. Table 2-1 shows the 5x5 matrix.

Table 2-1 5x5 Probability and impact matrix

PROBABILITY						
>80%	Very High (5)	5	10	15	20	25
51 to 80%	High (4)	4	8	12	16	20
21 to 50%	Medium (3)	3	6	9	12	15
6 to 20%	Low (2)	2	4	6	8	10
<5%	Very Low (1)	1	2	3	4	5
	IMPACT	Very Low (1)	Low (2)	Medium (3)	High (4)	Very High (5)
	Cost	<0.5%	0.5 to 1%	1 to 3%	3 to 5%	>5%
	Schedule	<1%	1 to 5%	5 to 10%	10 to 20%	>20%

CRITICAL RISK
HIGH RISK
MEDIUM RISK
LOW RISK

2.7. The specific levels of probability and impact for each identified risk will be proposed, discussed and agreed through many of the same channels as identified for risk identification - notably the working groups and risk workshop.

2.8. Table 2-2 shows in broad terms how the project team is empowered to deal with various degrees of risk from the 5x5 matrix.

Table 2-2 Risk exposure and response

Risk exposure	Management response
Low	Tolerate but keep the risk under review Ensure adequate allowance is included in cost estimates/risk allowances and programme plans
Medium	Manage/mitigate the risk as part of day-to-day project team activities and re-assess as the risk register is updated Ensure adequate allowance is included in the cost estimates/risk allowances and programme plans
High	Focused senior project management attention is required to address the risk and seek to mitigate it Ensure adequate allowance is included in the cost estimates/risk allowances and programme plans
Critical	Risk with a high likelihood and having significant detrimental impact on the achievement of project objectives which cannot effectively be controlled by the project team. May require elevation to the Senior Responsible Officer

Probability assessment

2.9. To begin with, the likelihood of a risk occurring must be decided. The probability is rated on a sliding scale from 'very low' to 'very high'. Risks which have no likelihood of occurring are not included.

2.10. Table 2-3 provides the scale on which risks will be assessed for probability.

Table 2-3 Probability Levels

Level	Likelihood	Description	Percentage
1	Very Low	Virtually impossible	0 to 5%
2	Low	Low but not impossible	6 to 20%
3	Medium	Fairly likely to occur	21 to 50%
4	High	More likely to occur than not	51 to 80%
5	Very High	Probably will occur	>80%

Impact assessment

2.11. In addition to assigning a probability, each risk will be assessed for its impact on cost and time (programme and resources).

2.12. At the SOBC stage, the assessment of impacts is primarily through qualitative methods, and therefore minimum, likely and maximum cost impacts are not included. The risk assessment can then be used as the basis for risk quantification e.g. the impact ranges relating to the risk scores can be used for the cost quantification figures for minimum and maximum. The most likely figure can then be evaluated. This approach enables the project team to focus on any of those significant risks e.g. critical or high and refine the accuracy of the quantification for those items.

2.13. Table 2-4 and Table 2-5 define the preliminary rating levels associated with the scheme's risk impacts.

Table 2-4 Cost impact rating levels

Rating Level	Degree of Impact	Description	Percentage	Actual Values[1] (£millions)
1	Very Low	Minimal impact on project cost	<0.5%	<£400k
2	Low	Minor impact on project cost	0.5 to 1%	£400k - £800k
3	Medium	Moderate impact on project cost	1 to 3%	£800k - £2.4m
4	High	Large impact on project cost	3 to 5%	£2.4m - £4m
5	Very High	Major impact on project cost	>5%	>£4m
[1]Actual values based on a scheme of cost £80m				

Table 2-5 Programme impact rating levels

Rating Level	Degree of impact	Description	Percentage	Actual values[1] (months)
1	Very Low	Minimal impact on project programme	<1%	<2 weeks
2	Low	Minor impact on project programme	1 to 3%	2 weeks – 1.5 months
3	Medium	Moderate impact on project programme	3 to 7%	1.5 - 3 months
4	High	Large impact on project programme	7 to 15%	3 - 7 months
5	Very High	Major impact on project programme	>15%	>7 months
[1]Actual values based on 4 year programme				

Response

2.14. Once risks have been identified and assessed, decisions will need to be made on how best to respond to them.

2.15. The concept of applying the five basic options for responding to risk (known as the 5 “T’s”) will be adopted on this project and are as follows:

- **Treat** - mitigation action to reduce the likelihood of a risk or the effect of the risk
- **Transfer** - where the ownership of the risk is transferred to another party.
- **Tolerate** - if the likelihood of a risk occurring is very low and / or the consequences are small, it may be appropriate to ignore the risk
- **Terminate** - the project or activity - if the risks associated with a project or activity are beyond the risk appetite of Wiltshire Council or where the project is no longer viable due to the potential risk costs
- **Take the opportunity** - it may be possible to exploit new opportunities

2.16. Proposed mitigation of the identified risks will be undertaken by the risk owner.

2.17. Quantitative analysis of risk will be carried out as part of the OBC estimating process using the risk ratings for cost identified within the risk register.

Reporting and escalation

2.18. Reporting and escalation of risks is an essential element of the management process. A Risk Coordinator will be responsible for reporting an update to the Project Manager on a monthly basis. The monthly update will include a list of the Top Ten risks.

2.19. Wherever a new high or critical rated risk is identified, the Project Manager will be informed immediately and discussions held as to appointing a risk owner and developing a mitigation plan.

Review

2.20. Risks will be reviewed by the Risk Coordinator on a monthly basis through discussion with risk owners. The full review cycle is described in Section 4 below.

3. Risk management organisation

3.1. The process examined in this section are those which are considered relevant to the immediate task involved - the delivery of risk products for the SOBC. It is acknowledged that as the scheme progresses, the methods of assessment may change, most notably with the move to a quantitative risk assessment in the OBC and FBC, and these changes will be examined when the RMP is updated at the beginning of each new stage.

Roles and responsibilities

3.2. The risk management organisation for this scheme consists of four key parties: the Project Board, the Project Manager, the Risk Manager and the Risk Owner.

3.3. **The Project Board** has overall responsibility for ensuring sufficient resources are available to manage risks across the scheme. Risks shall be allocated and managed in a cost-effective manner by the most appropriate party and at an appropriate level. The Project Board shall be primarily concerned with managing strategic level risks relating to interfaces between the scheme and the wider project environment.

3.4. **The Project Manager** has overall responsibility for ensuring that the risk management process is implemented and managed in accordance with the strategies contained within this appendix.

3.5. **The Risk Manager** shall ensure that risks are actively managed in a consistent and appropriate manner across all work streams in accordance with this Plan. All risks shall be reported by the Risk Manager to the Project Board through the Project Manager. In addition, all risks which relate to the overall direction, organisation and control of the scheme, e.g. loss of key project staff, shall be reported to the Project Board. In the preparatory stages of the scheme the duties of the Risk Manager will be undertaken by the Assistant Project Manager

3.6. The Risk Manager shall:

- ensure that an appropriate procedural framework is adopted
- report to the Project Manager in the review and management of project performance

- agree the required level of risk management support to be provided for risk identification, analysis, review and reporting
- facilitate risk workshops/meetings as appropriate and be supported by a risk co-ordinator, if required
- be the custodian of the risk register and the contained data

3.7. **The Risk Owner** shall be responsible for the day to day management of the risk(s) that they own. The selection and appointment (by the Project Manager) of a risk owner will be on a "best person for the task" approach and, once appointed, the risk owner will monitor and update the risk register informing the risk manager of changes.

Table 3-1 Roles and Responsibilities

Role	Responsible	Accountable	Consult	Inform
Project Board	✓		✓	
Project Manager		✓		✓
Risk Manager		✓	✓	✓
Risk Owner	✓			

4. Review cycle

Risk workshops

4.1. A Risk Workshop with discipline leads will be held in February 2018.

Risk reviews

4.2. The Risk Co-ordinator will lead a monthly telecom with the discipline leads to summarise change in the risk register from the previous month, and to request any information on new risks. The Wiltshire Council Project Manager or delegate will attend this monthly meeting.

One to ones

4.3. Regular one to one meetings will be held between the risk co-ordinator and the discipline leads. The discipline leads will be responsible for co-coordinating all risks for which they (or someone in their team) are the owner.

Progress meetings

4.4. The monthly risk telecom will be held at a convenient date in the month to allow any outputs to be reported in the project monthly reporting cycle.

Appendix H
Benefits realisation, monitoring and evaluation

1. Introduction

Benefits realisation, monitoring and evaluation plan

1.1. 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

1.2. The objectives and success indicators for the A350 Melksham Bypass scheme are set out in the Strategic Case (Section 2) and further detailed in the Logic Map seen in Figure 1-1. Benefits resulting from reduced journey times, personal injury accident reductions, and mitigation of future development impacts are emphasised.

1.3. A SMART objectives table has been produced in the Strategic Case (Main Document, Table 2-6) which highlights specific, measurable, agreed upon, realistic, and time bound objectives. In having objectives that fit these criteria, the benefits realisation plan has a foundation as well as performance indicators with which to measure the overall success of the scheme.

1.4. The Wiltshire Council 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

1.5. 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.

Monitoring and evaluation

1.6. Monitoring and evaluation of the scheme will occur 1 year and 5 years after it is implemented by Wiltshire Council. A budget of £10k will be established for the monitoring and evaluation of the scheme to take place specifically, monitoring traffic volumes, delays, and collisions experienced on the new bypass as well as the existing A350.

1.7. A key element of the Monitoring and Evaluation plan is to map the intervention logic. This involves systematically linking key components of an intervention to produce a causal pathway (see Figure 1-1) across the:

- Inputs (i.e. what is being invested in terms of resources and activities)
- Outputs (e.g. bypass 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)

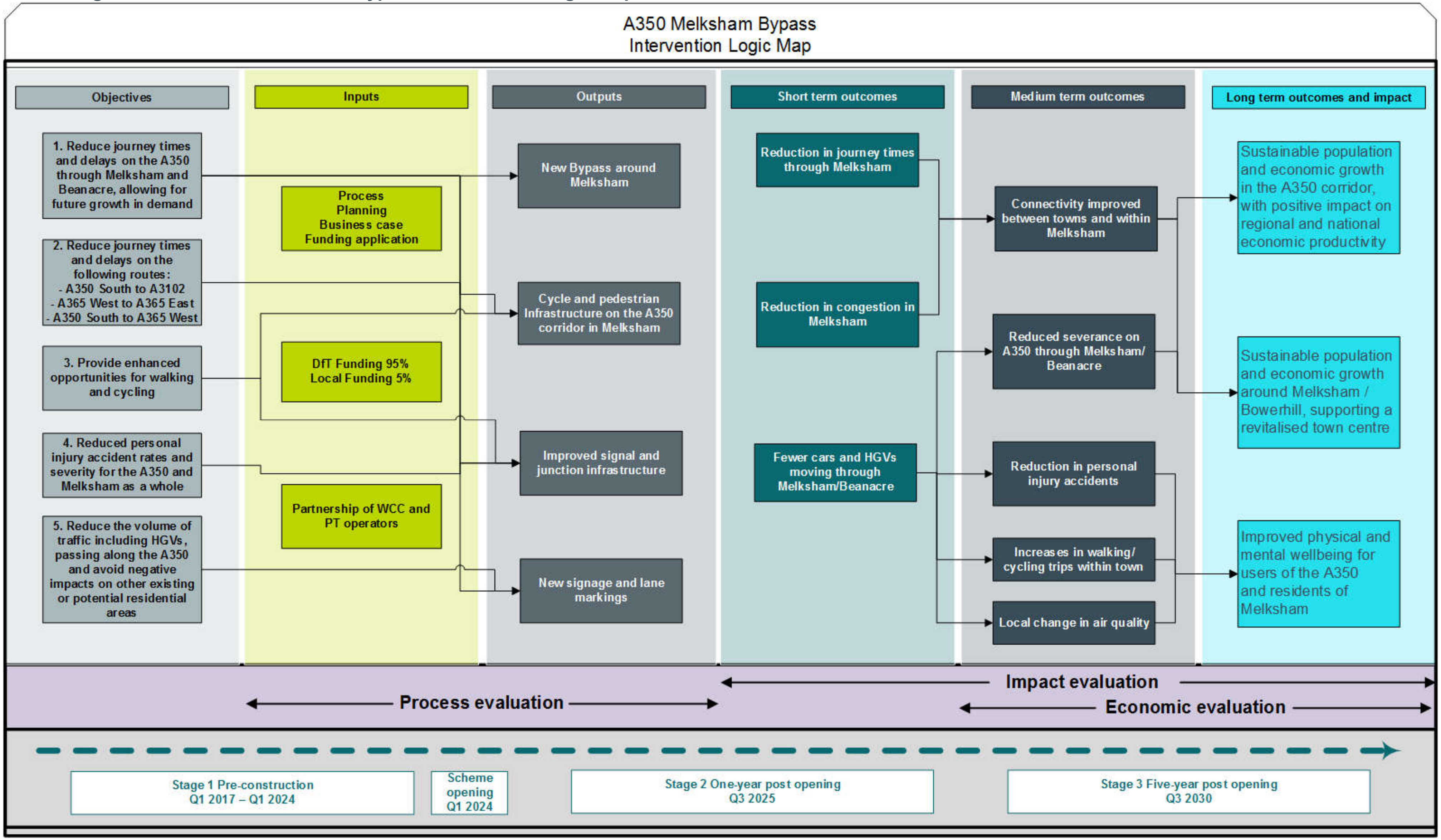
1.8. Figure 1-1 sets out the intervention logic map for the scheme and shows linkages between key components of the intervention and the scheme objectives. The map shows the process by which the scheme outputs will deliver the primary objectives for intervention (shown as light gray colour boxes), and describes an outline evaluation approach for monitoring the extent to which these are achieved as part of a pre-opening and post-opening monitoring report. The map also shows wider and longer-term impacts, which depend on the delivery of the primary objectives

Evaluation objectives

1.9. The objectives of the benefits realisation, monitoring and evaluation plan are devised to help achieve efficiency of the scheme management and delivery process. In examining whether the outcomes have been achieved or not, the benefits realisation, monitoring and evaluation plan demonstrates accountability for the initial investments.

1.10. Evaluation objectives have been set to show a clear flow reflecting the process, impact and economic elements of the evaluation.

Figure 1-1 A350 Melksham Bypass Intervention Logic Map



2. Evaluation

Process evaluation: Efficiency of scheme delivery

2.1. 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.

Impact evaluation: Delivery of projected outcomes

2.2. The planning and processes used in defining an intervention from the outset, and their continual evolution (throughout the 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

Economic evaluation: Accountability for investment

2.3. The outcomes of the scheme will enable Wiltshire Council 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?

Three-stage approach for Monitoring and Evaluation

2.4. It is important to establish how different scheme-specific objectives are realised over different timescales.

2.5. 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

2.6. 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, Q3 2024
- Stage 3 - Five Year Post Opening Impact Evaluation Study, Q3 2028

Process evaluation

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

2.8. 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.

2.9. The process evaluation will extend beyond a desk-based study and will involve interviews with key project officers together with a process review workshop with key parties (e.g. Wiltshire Council) and stakeholders. This will include an 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 Council'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 are compared with the forecast costs including an assessment of risk and optimism bias in pricing

Impact evaluation

2.10. 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 A350 Melksham Bypass 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

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

2.12. 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.

2.13. 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 the A350 and the new bypass (using traffic count data collected by Wiltshire Council and with the DfT)
- 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

2.14. After the 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?

2.15. 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.