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A350 Melksham Bypass

SOBC Addendum

Wiltshire Council

23rd July 2019

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This document has 37 pages including the cover.

Document history

Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
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Client signoff

Client	Wiltshire Council
Project	A350 Melksham Bypass
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1. Introduction and Scope

Context

The Major Road Network

1.1. The creation of Sub-National Transport Bodies (STBs) was enabled in 2016 following legislation passed through the Cities and Local Government Act 2016. The formation of the STBs was intended to empower neighbouring local authorities to create regional oversight on strategic transport planning. As single entities, the STBs can identify schemes and strategies which will have a positive impact on key routes of regional importance.

1.2. On 23 December 2017, the Government launched a consultation setting out proposals for the creation of a Major Road Network (MRN) with the intention that it formed a middle tier of the country's busiest and most economically important local authority 'A' roads, sitting between the Strategic Road Network (SRN) and the rest of the local road network. This was driven by the need to improve north-south connectivity within the Western Gateway area.

1.3. Following consultation, the Government announced the first wave of funding from the National Roads Fund to be spent on the MRN and/or Large and Local Majors (LLM) schemes which align with the following objectives:

- Reduce congestion
- Support economic growth and rebalancing
- Support housing delivery
- Support all road users
- Support the Strategic Road Network

1.4. To be considered for MRN funding, schemes must be identified in a Regional Evidence Base (REB) as an investment priority by STBs or other regional groupings. In February 2019, the Western Gateway STB produced their Strategy Context Document to feed into their REB, identifying the A350 strategic corridor as one of the 15 priority areas for investment.

1.5. It is stated in The Department for Transports Investment Planning Guidance for the MRN and LLM programmes that departments contribution towards LLM schemes will normally be over £50 million, with a degree of lenience.

1.6. On successful receipt of the present funding application, MRN investments by Wiltshire Council will be overseen by the Western Gateway STB. A local contribution of approximately 15%, as identified in the MRN guidance, will be provided by local contributions.

A350 Melksham Bypass

1.7. The A350 is a primary north-south route connecting the M4 with the Dorset coast and Poole port. It passes around the principal settlements of Chippenham and Trowbridge via the town of Melksham and neighbouring village of Beanacre.

1.8. The scheme will address an area of key restraint on the Major Road Network (MRN) covering the A350 corridor between Beanacre (north of Melksham) and Bowerhill (south of Melksham). The corridor currently suffers from high journey times, adverse severance impacts and high collision rates. Improving north-south connectivity is a key challenge of the Western Gateway. Poor connectivity will hinder the economic relationship between the north and south of the area due to constraints on productivity, increased business costs and reduced access to labour markets.

1.9. Whilst this area of key restraint is being addressed by the A350 Farmers Signalisation scheme, the Melksham Eastern Bypass would provide the necessary next step to addressing ever growing congestion through Melksham and help facilitate economic and development growth in the Swindon and Wiltshire Local Enterprise Partnership's (SWLEP's) A350 and Swindon – M4 Growth Zones, as well as in the wider Western Gateway area. The A350 Melksham Bypass scheme seeks to achieve this by constructing a new section of A350 highway between Beanacre and Bowerhill, allowing a bypass of the town of Melksham.

1.10. The Melksham Bypass scheme was initially considered in an Interim Options Assessment Report (IOAR) in 2016 and options were subsequently reviewed in an Options Assessment Report (OAR)

in 2017 which resulted in three potential alignments for an eastern bypass of the town. In November 2017, a Strategic Outline Business Case (SOBC) was produced and submitted to DfT where it was received favourably.

1.11. Following completion of the SOBC in 2017, a document outlining the next steps required was produced in May 2018, setting out the how the proposed A350 Melksham Bypass scheme could be progressed in a stepwise manner with limited financial commitment. The five steps were:

1. High level optioneering of the Eastern Bypass route options
2. Stakeholder engagement / public consultation
3. Route options assessment - following the public consultation, further development and assessment of bypass route options would enable the existing options to be refined, and better performing options to be identified
4. Option review and stakeholder engagement / public consultation to enable further shortlisting of options
5. Business case update to support funding bids for scheme development

Document purpose

1.12. This document has been prepared as an addendum to the SOBC submitted in 2017 so it should be read alongside the original business case document during the evaluation. Full details of the SOBC for the proposed A350 Melksham Bypass are presented in the original SOBC, while information in this addendum is focused on:

- A review of the route alignments proposed in the SOBC against recent changes in local development proposals and prospective services clashes, with updates where necessary.
- Re-costing of the revised route options (construction, risk mitigation, design and supervision).
- Re-assessment of the forecast economic benefits and Value for Money findings based on the latest design using a more up-to-date strategic transport model.

1.13. Specifically, the following elements of the original SOBC have been updated and reported in this document, with the outcomes of the feasibility design update:

- Scheme delivery cost update
- Revised risk register/risk contingency sum
- Economic benefits update from strategic transport model run
- Revised BCR
- Revised route descriptions and append route options summary report
- Updated delivery programme and timescales

Document structure

1.14. This addendum is structured around the DfT's recommended five cases model for a Transport Business Case. Each section will first summarise the original SOBC work from 2017/18 before presenting the updated work. The five cases presented are:

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

2. The Strategic Case

2017/18 SOBC Summary

2.1. The A350 is a primary north-south route connecting the M4 with the Dorset coast and Poole port. In Wiltshire, it passes around the principal settlements of Chippenham and Trowbridge via the town of Melksham and neighbouring village of Beanacre, and on to Westbury and Warminster. The proposed scheme is for a new road alignment for the A350 around the eastern side of Melksham, bypassing the village of Beanacre. Route options to the east of the town are being considered. Improving north-south connectivity is a key challenge of the Western Gateway. Growing congestion and delay on the A350 will hinder the economic relationships between the north and south of the area.

2.2. The scheme is proposed to mitigate the following issues experienced on the A350 at Melksham:

- Limitations of the road network around Melksham – the layout of the road network means the A350 serves multiple functions, journeys to and from the north and south of Melksham have to pass through the town via the A350, or face significant diversions using other routes
- Physical constraints in the 'urban' sections of the A350 in northern Melksham and Beanacre village – the A350 passes through residential areas with 30mph limits, is constrained by property frontages on both sides and there are several junctions in northern Melksham used, predominately, by local traffic to access amenities
- Insufficient capacity of the A350 through Melksham to cope with current and projected future traffic volumes – significant peak period congestion is currently experienced on the Melksham-Beanacre sections, especially around Farmers and Semington Road roundabouts, and between Bath Road and the Leekes store
- High collision rates along the A350 through Melksham - twelve serious collisions have been recorded between 2012 and 2016, with severity rates generally higher on the A350 compared to other roads in the area
- Severance impacts on communities in Beanacre and northern Melksham – high traffic volumes using the route (including significant numbers of HGVs) exposes residents to noise and air pollution, and pedestrian access to local shops in northern Melksham and the town centre is restricted, which discourages walking and cycling along the route

2.3. The Wiltshire Core Strategy identifies a housing need of 2,370 (2006-2026) in the Melksham Community area (CA), 5,090 in the Chippenham CA and 6,975 in the Trowbridge CA. This growth will place additional pressure on the issues identified above and further threaten the strategic role of the A350. Western Gateway have also identified improving north-south connectivity as a key policy area for MRN/LLM intervention.

2.4. The scheme objectives have been identified to mitigate these issues and enable the A350 to support the future development allocated in the Core Strategy and the housing and employment growth to be identified in the emerging Wiltshire Local Plan 2036 (up to 13,535 dwellings in the Chippenham Housing Market Area (HMA), including 2,045 at Melksham, and 5,245 in the Trowbridge HMA).

Scheme objectives

2.5. The objectives of the scheme are as follows:

- Reduce journey times and delays on the A350 through Melksham and Beanacre, allowing for future growth in demand
- Reduce journey times and delays on the following routes through Melksham:
  - A350 South – A3102
  - A365 West – A365 East
  - A350 South – A365 West
- Provide enhanced opportunities for walking and cycling between Melksham town centre and the rail station / Bath Road, and along the existing A350 corridor within Melksham
- Reduce personal injury accident rates and severity for the A350 and Melksham as a whole

- Reduce the volume of traffic including HGVs passing along the current A350 route in northern Melksham and Beanacre, and avoid negative impacts on other existing or potential residential areas

Route Options

2.6. Three eastern bypass options met the requirements of all five cases following the assessment and sifting process undertaken in the OAR, as highlighted below and in Table 2-1:

- **Option A:** From A350 north of Beanacre to A3102 junction with Eastern Way (then continuing via Eastern Way to Spa Roundabout) – approximately 2.7km in length
- **Option B:** From A350 north of Beanacre to A3102 east of Eastern Way, then via new road to Eastern Way south of Thyme Road) then continuing via Eastern Way to Spa Roundabout) – approximately 4.4km in length
- **Option C:** From A350 north of Beanacre to A3102 east of Eastern Way, then to A365 east of Bowerhill, then to A350 south of Hampton Park West – approximately 7.8km in length

Table 2-1 - Assumed configuration of options appraised

	Option A	Option B	Option C
Length of new carriageway	2700m	4400m	7800m
Design speed	60 mph	60 mph	60 mph
New junctions / roundabouts	1. A350 north of Beanacre 2. Woodrow Road 3. A3102 / Eastern Way	1. A350 north of Beanacre 2. Woodrow Road 3. A3102 east of Eastern Way 4. Eastern Way (south of Thyme Road)	1. A350 north of Beanacre 2. Woodrow Road 3. A3102 east of Eastern Way 4. A365 east of Bowerhill 5. A350 south of Bowerhill
Use of existing road network to form part of bypass	Eastern Way from A3102 to Spa Road; Spa Road to Western Way Roundabout	Eastern Way from south of Thyme Road to Spa Road; Spa Road to Western Way Roundabout	-

2019 Addendum Update

Business Strategy

Emerging Local Plan

2.7. Wiltshire Council, under its Local Development Scheme, commenced a review of its Local Plan in 2017 in partnership with Swindon Borough Council. When it is adopted it will provide a housing requirement for Melksham for the period 2016-2036. The Strategic Housing Market Assessment (November 2017) identified the objectively assessed need using a method outlined in best practice at the time.

2.8. The methodology adopted a staged approach to identifying the need. The stages completed were:

1. Analysis of household projections (CLG 2012 projections).
2. Adjustments for local demographic factors.
3. Affordable housing need.
4. Market signals (land and house prices, rents and affordability, rate of development, overcrowding, concealed families).
5. Converting from household growth to a requirement for dwellings, taking account of vacancies and second homes.

2.9. The method also considered employment trends, the relationship between the jobs forecast and projected number of workers, and the need for affordable housing.

2.10. Informal consultation for the emerging Local Plan has already taken place with Town and Parish Councils, Wiltshire Councillors, Duty to Cooperate bodies and infrastructure providers. Regulation 19 Pre-submission consultation on draft Local Plan will commence in Q4 2019. Submission of the Local Plan to Secretary of State to commence examination is programmed for Q3, 2020. Following this, adoption is programmed for mid-2021.

Western Gateway SSTB Strategy Context

2.11. The Western Gateway Shadow Sub-National Transport Body (SSTB) Strategy Context provides context, aims and the vision for the emerging Western Gateway transport strategy. The vision of the Western Gateway SSTB is to 'enable sustainable economic growth by identifying a long-term investment programme designed to deliver a well-connected, reliable and resilient strategic transport system', this will help to close productivity gaps and make the area more economically competitive.

2.12. The document identifies 15 strategic corridors which will form an essential part of the regional evidence base. The A350 corridor is included in the document, which is a key north-south connector starting at the M4 north of Chippenham and ending at Poole harbour.

2.13. Western Gateway have released a set of emerging objectives, which include:

- Addressing the poor connectivity of north-south links, particularly to and from the south coast ports, to help support planned development, drive business growth and improve access to international markets
- Identify and address transport-related barriers to the effective operation of labour markets which is constraining the potential for business growth
- Supporting the development of low carbon transport solutions to help reduce transport's impact on the environment
- Establishing a whole corridor approach to travel management on strategic corridors to improve reliability, safety and resilience
- Supporting the development of transport infrastructure that enables sustainable place-shaping by facilitating the delivery of new homes, business growth and employment opportunities

Route Options

2.14. Two route options are now being progressed, Option A from the original SOBC (Route 1), and Option C (Route 2) (see Figure 2-1). Option B from the original SOBC and Options Assessment Report has been discounted due to its lower value for money scoring[1].

Scheme objectives

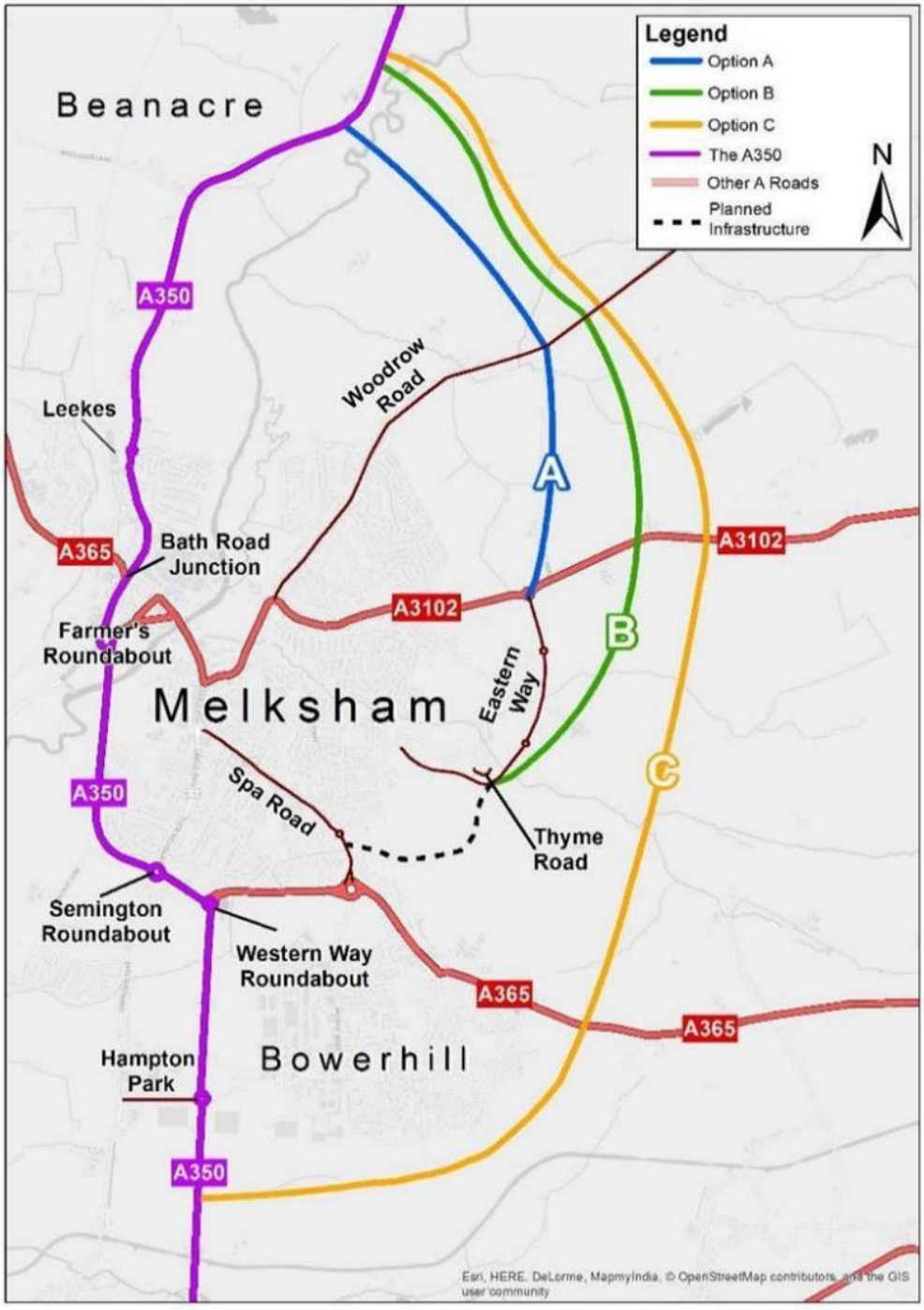
2.15. Following the release of the REB, the scheme objectives have been updated to align with the objectives given in the document. The scheme objectives are:

- Reduce journey times and delays on the A350 through Melksham and Beanacre, allowing for future growth in demand and improving local and regional north-south connectivity
- Reduce journey times and delays on the following routes through Melksham:
  - A350 South – A3102
  - A365 West – A365 East
  - A350 South – A365 West
- Provide enhanced opportunities for walking and cycling between Melksham town centre and the rail station / Bath Road, and along the existing A350 corridor within Melksham which will help reduce the impact of transport on the environment
- Reduce personal injury accident rates and severity for the A350 and Melksham as a whole, to make the corridor safer and more resilient

[1] Table 3-2 on Page 43 of the A350 Melksham Bypass SOBC, March 2018

- Reduce the volume of traffic including HGVs passing along the current A350 route in northern Melksham and Beanacre, and avoid negative impacts on other existing or potential residential areas

Figure 2-1 - Route options alignments



3. The Economic Case

2017/18 SOBC Summary

3.1. The economic case has been prepared in a manner which is considered to be proportionate to the scale of the scheme and appropriate for the SOBC stage. A Melksham Transport Model was developed specifically to forecast transport network impacts and outputs of the model were monetised using the DfT's TUBA (v1.9.9) software.

3.2. The monetised economic benefits of the A350 Melksham Bypass scheme options are likely to outweigh its costs and any negative impacts. The previous SOBC work identified the initial Net Present Value, BCRs and Value for Money (VfM) assessment, shown in Table 3-1.

Table 3-1 - A350 Melksham Bypass Options Costs

	Route 1 (Option A)	Option B	Route 2 (Option C)
NPPV	£28.7m	£26.5m	£65.8m
BCR	1.94	1.69	2.20
VfM Category	Medium	Medium	High

3.3. The findings of qualitative assessments are not considered to be significant enough to warrant any increase or decrease in the VfM categories. Potential moderate or major adverse environmental impacts have been identified for all three options with respect to landscape, biodiversity and the water environment but have scope to be reduced or mitigated through the planning and design process.

3.4. Potential beneficial impacts have also been identified with respect to reliability, wider impacts, noise, air quality, journey quality and severance, and are likely to be greatest under Option C. Options A and B are expected to result in fewer beneficial impacts than Option C since they are forecast to redistribute less traffic away from the existing A350 whilst also significantly increasing traffic volumes close to residential areas in eastern Melksham.

2019 Addendum Update

3.5. This section contains updates to the economic case for the A350 Melksham Bypass using the updated Wiltshire Strategic Highway Model (LMVR and TFR available in Appendix A and Appendix B respectively) and updated TUBA version (v1.9.12).

Options appraised

3.6. The options to be appraised are Option A and Option C from the original SOBC. Option B has been discarded due to its lower value for money scoring[2].

Approach and assumptions for appraisal

3.7. The proposed methodology has been updated from the original Appraisal Specification Report (ASR)[3] and original SOBC, the following key principles apply:

- 60-year economic appraisal period, for consistency with other transport scheme assessments across the UK and in line with WebTAG – Route 1 (Option A) will have an appraisal period from 2026-2085 and Route 2 (Option C) from 2028-2087, due to their differing opening years
- 2024 and 2036 modelled forecast years including background growth which includes a local uplift on demand generated by known housing developments included in the Wiltshire Strategic Highway Model

[2] Table 3-2 on Page 43 of the A350 Melksham Bypass SOBC, March 2018
[3] A350 Melksham Bypass Appraisal Specification Report, November 2017

- Three modelled time-periods to represent a week-day average with an AM peak hour (07:00-08:00), inter-peak (average (10:00-16:00) and PM peak hour (16:00-17:00)[4]
- Journey time savings across the network for the options compared to the Do-Minimum generated by a SATURN traffic model
- Use of the DfT program TUBA (v.1.9.12) to convert the forecast savings in journey times between the Do-Minimum and Do-Something scenarios into monetary values for the weekday AM, IP and PM, utilising values of time and vehicle operating costs from the WebTAG Data Book
- The modelled hours were expanded to represent benefits across the year on the assumption of 253 weekdays per year, and discounted to 2010 values as per WebTAG guidance

3.8. The base costs have been updated, however the methodology for calculating the outturn cost and Present Value of Costs (PVC) remains the same as that in the original SOBC.

3.9. The original methodology and impacts from the environmental, social and distributional impacts apply.

Value for Money statement

3.10. The Value for Money (VfM) statement in this section should be read in conjunction with the Transport Economic Efficiency (TEE) table, Public Accounts (PA) table and Analysis of Monetised Costs and Benefits (AMCB) table contained in Appendix C. The Appraisal Summary Table (AST) for the options are contained in Appendix D and identify the full set of scheme impacts across the economic, environmental, social and public accounts categories.

Scheme costs

3.11. The base cost estimates have been updated and are reflective of the stage of scheme development. The cost estimates include all development, construction costs and risk based on a Quantified Risk Assessment. The total scheme cost in 2017 prices (including risk but excluding inflation and lifetime costs) is estimated at £39.90m for Route 1 (Option A) and £99.69m for Route 2 (Option C). A breakdown of the main cost elements is provided in Table 3-2.

3.12. Lifetime costs are included in the estimate based on minor maintenance on a yearly basis and major maintenance every 20 years.

Table 3-2 – Revised scheme base cost estimates (2017 prices and values)

Cost element	Route 1 (Option A)	Route 2 (Option C)
Precatory costs, including planning, legal and design	£3.71m	£10.90m
Land acquisition	£0.30m	£0.73m
Construction costs, including preliminaries and service diversion	£27.47m	£74.22m
Risk cost[5]	£7.41m	£13.85m
Total (excluding lifetime costs)	**£39.90m**	**£99.69m**
Lifetime costs	£10.91m	£26.19m
Total (including lifetime costs)	**£50.81m**	**£125.88m**

[4] The peak hours have been converted from peak period, which is the standard form of the Wiltshire Strategic Highway Model. This conversion is outlined in the Forecasting Report in Appendix B.
[5] The risk budget quoted in the Economic case is different from that quoted in the Financial case to remove risks that will be double counted with optimism bias.

3.13. In accordance with WebTAG guidance, the costs presented in the Economic Case include Optimism Bias at 44%. Costs are presented in the form of Present Value of Costs (PVC), in 2010 market prices, and discounted to 2010 using the HM Treasury discount rates. The PVCs for the scheme options are presented in Table 3-3.

3.14. The costs presented here are significantly higher than those in the original SOBC[6], this is due to a more robust cost estimate, higher risk allowance, calculated from QRA, and the inclusion of lifetime costs in the PVC.

Table 3-3 – Revised PVC for the scheme options

		Route 1 (Option A)	Route 2 (Option C)
Local Government Funding	Operating costs	£5.92m	£13.72m
	Investment costs	£6.07m	£15.43m
Central Government Funding		£34.37m	£87.43m
Total		**£46.36m**	**£116.58m**

User benefits

3.15. The Wiltshire Strategic Highway Model was used to calculate the predicted benefits for both of the options in the forecast years: 2024 and 2036. These benefits have been profiled to ensure that benefits are only accrued after scheme opening (2026 for Route 1, 2028 for Route 2).

3.16. At present the journey time and vehicle flow plots have not been updated, however a similar pattern is seen in the updated transport model as to those in Appendix A of the original SOBC document[7].

3.17. The user benefits have been updated using the Wiltshire Strategic Highway Model and DfT's software TUBA (v1.9.12). The Net Present Values of travel time and operating cost benefits are given in Table 3-4. The table shows that travel time benefits are forecast and vehicle operating costs (VOC) benefits will also result from a reduction in delays and time spent in traffic queues.

Table 3-4 – Revised present value of user benefits (2010 prices and values)

Benefit stream	Route 1 (Option A)	Route 2 (Option C)
Travel time: Business	£16.79m	£65.53m
Travel time: Commuting	£18.15m	£64.33m
Travel time: Other	£14.77m	£52.10m
Travel time: Total	*£49.71m*	*£181.96m*
Vehicle Operating Costs	*£3.27m*	*£9.57m*
Total	**£52.98m**	**£191.53m**

Indirect tax revenues

3.18. Indirect tax revenues are generated through fuel duty and other changed incurred by transport users and providers. Neither of the proposed options have road tolls or public transport implications, therefore the only impact on indirect tax revenues is through changes in fuel costs. As the journey distance increases the transport users experience an indirect tax revenue disbenefit. The present values of indirect tax revenues are shown in Table 3-5.

Table 3-5 – Revised present value of indirect tax revenues (2010 prices and values)

Benefit stream	Route 1 (Option A)	Route 2 (Option C)
Indirect tax revenues	-£1.35m	-£4.24m

[6] Table 3-6 on Page 46 of the A350 Melksham Bypass SOBC, March 2018
[7] Appendix A of the A350 Melksham Bypass SOBC, March 2018

Greenhouse gases

3.19. TUBA provides a calculation for estimating changes in fuel and electricity consumption. These are automatically converted into an estimate of greenhouse gas emissions and the net present value of associated damages, following the methodology set out in WebTAG Unit A3. It is worth noting that as given in WebTAG guidance, these impacts are assessed over a 24-hour period, unlike the remaining benefits which use a 12-hour period.

3.20. The monetised impact of greenhouse gas emissions resulting from the scheme are presented in Table 3-6. The scheme is forecast to produce a small decrease in greenhouse gas emissions resulting in a net present value of over £0.5m for Route 1 and over £2m for Route 2.

Table 3-6 – Net present value of greenhouse gas emissions (2010 prices and values)

Benefit stream	Route 1 (Option A)	Route 2 (Option C)
Greenhouse gas emissions	£0.66m	£2.15m

Reliability

3.21. The reliability impacts of the scheme have been estimated using the WebTAG guidance (TAG Unit A1.3) on reliability for urban roads, using the same parameters and assumptions as the TUBA assessment. The reliability impacts are presented in Table 3-7.

Table 3-7 – Net present value of reliability impacts (2010 prices and values)

Benefit stream	Route 1 (Option A)	Route 2 (Option C)
Reliability	£2.10m	£8.09m

Wider economic impacts

3.22. Following the guidance in WebTAG Unit A2.2 'Induced Investment', in the presence of a market failure – the market structure affecting the level of competition (imperfectly competitive market), there would be additional sources of welfare on top of the usual changes in the level of output which should be captured. Following guidance in WebTAG, this was quantified through a 10% uplift of the business user conventional transport benefits and is presented in Table 3-8.

Table 3-8 – Net present value of imperfect competitive markets (2010 prices and values)

Benefit stream	Route 1 (Option A)	Route 2 (Option C)
Imperfect competitive markets	£1.91m	£7.28m

Sensitivity tests

3.23. Sensitivity tests have been updated. The sensitivity tests consider ±10% in costs and benefits and are summarised in Table 3-9 and Table 3-10. At this stage, low and high growth sensitivity tests have not been completed.

Table 3-9 – Revised BCR cost sensitivity testing

Option	Sensitivity test	PVC	PVB	BCR
Route 1 (Option A)	10% lower costs	£41.72m	£56.30m	1.35
	Calculated costs	£46.36m	£56.30m	1.21
	10% higher costs	£51.00m	£56.30m	1.10
Route 2 (Option C)	10% lower costs	£104.92m	£204.81m	1.95
	Calculated costs	£116.58m	£204.81m	1.76
	10% higher costs	£128.24m	£204.81m	1.60

Table 3-10 – Revised BCR benefit sensitivity testing

Option	Sensitivity test	PVC	PVB	BCR
Route 1 (Option A)	10% lower benefits	£46.36m	£50.67m	1.09
	Calculated benefits	£46.36m	£56.30m	1.21
	10% higher benefits	£46.36m	£61.93m	1.34
Route 2 (Option C)	10% lower benefits	£116.58m	£184.33m	1.58
	Calculated benefits	£116.58m	£204.81m	1.76
	10% higher benefits	£116.58m	£225.29m	1.93

VfM environmental and social impacts

3.24. The findings of the qualitative assessments completed for the original SOBC still hold and are summarised in the AST in Appendix D.

VfM summary

3.25. A summary of the VfM for the two scheme options is presented in Table 3-11.

Table 3-11 – Revised VfM assessment table

Assessment Type	Route 1 (Option A)	Route 2 (Option C)	Detail
Present Value of Benefits (PVB)	£56.30m	£204.81m	2010 prices, discounted to 2010 in line with DfT guidance
Present Value of Costs (PVC)	£46.36m	£116.58m	2010 prices, discounted to 2010. Includes Optimism Bias at 44%
Net Present Public Value (NPPV)	£9.94m	£88.23m	Indicates how much the benefits exceed the costs
Adjusted BCR	1.21	1.76	Not adjusted for other non-monetised impacts
Qualitative (social and environmental) assessment	Major Adverse to Moderate Beneficial	Major Adverse to Moderate Beneficial	As in SOBC document
Key risks and sensitivities	Risk budget of £7.41m in base costs	Risk budget of £13.85m in base costs	Key risks include tender prices exceeding estimates.
VfM category	Low	Medium	Monetised assessments suggest that the VfM category should be Low to Medium for the proposed scheme.

3.26. The following headline conclusions can be drawn from the initial economic appraisal results:

- Route 2 (Option C) has the higher BCR and it is anticipated with other benefit streams (such as accidents and monetised environmental impacts) this will offer High VfM
- Route 1 (Option A) is more likely to provide a Low to Medium VfM when other benefit streams are included
- The overall qualitative assessment for the options is major adverse to moderate beneficial. Many beneficial impacts have been identified, but they are potentially offset by moderate or major adverse impacts to landscape, biodiversity and the water environment. There is however scope to reduce or mitigate there impacts through the planning and design process to ensure that the benefits outweigh the adverse impacts

Summary of the economic case

3.27. The economic case has been prepared in a manner which is considered to be proportionate to the scale and preparedness of the scheme and appropriate for the SOBC stage. Transport network

impacts have been forecast using the Wiltshire Strategic Highway Model with modelled forecast years of 2024 and 2036. The outputs from the model were monetised using the DfT's TUBA software. Other economic, social and environmental impacts have been assessed qualitatively, taking account of the transport model outputs where relevant.

3.28. The scheme costs have been updated and although there have been significant increases in these, they are considered to be more robust than previous estimates. The increases in costs have resulted in lower BCRs, however monetised economic benefits for both options are likely to outweigh its costs and any quantifiable negative impacts. Further development at OBC to include other benefit streams, such as accidents, reliability and air quality and noise, and more accurate scheme costs are likely to result in further benefits and a High Value for Money for Route 2 (Option C).

3.29. The findings of the qualitative assessments are not considered to be significant enough to warrant any increase or decrease in the VfM categories. The potential moderate or major adverse impacts that have been identified have scope to be reduced or mitigated through the planning and design process. There is also scope to ensure the scheme delivers net benefits in terms of noise, air quality and severance impacts.

4. The Financial Case

2017/18 SOBC Summary

4.1. The financial case presents evidence of the scheme's affordability and how it will be funded. Scheme costs have been calculated in both 2016 prices and outturn prices (including inflation), based on high-level highway and structure costs, and including allowances for risk and uncertainty. A summary of scheme implementation costs is shown in **Table 4-1.**

Table 4-1 - A350 Melksham Bypass Options Costs

Total Scheme Cost	Option A	Option B	Option C
2016 Prices	£28.7m	£37.2m	£65.8m
Outturn Prices	£34.4m	£44.4m	£78.8m

4.2. In the original SOBC, it was assumed that the funding package proposed for financing the A350 Melksham Bypass scheme comprises of contributions from the DfTs Large Local Major Transport Schemes or Major Road Network fund (95%) and local contributions (5%). However, other sources of funding would be explored as part of any further business case work.

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Scheme Costs

4.3. Options A and C were identified as the options which have the highest VfM assessment in the original SOBC, therefore these two options were selected to be taken forward for further investigation. Table 4-2 and Table 4-3 highlight the revised costs for Option A (Route 1) and Option C (Route 2).

Table 4-2 - A350 Melksham Bypass Route 1 (Option A) revised costs

	Preparation costs	Land purchase	Construction costs	Total
Base cost	£3,709,064	£302,213	£27,469,929	£31,481,206
Risk[8]	£3,674,000	£423,000	£5,248,000	£9,345,000
Sub-total	**£7,383,064**	**£725,213**	**£32,717,929**	**£40,826,206**
Inflation	£736,479	£61,338	£8,555,987	£9,353,805
Total	**£8,119,543**	**£786,551**	**£41,273,916**	**£50,180,011**

Table 4-3 - A350 Melksham Bypass Route 2 (Option C) revised Costs

	Preparation costs	Land purchase	Construction costs	Total
Base cost	£10,900,823	£725,938	£74,217,300	£85,844,061
Risk[9]	£10,635,000	£1,015,000	£9,084,000	£20,734,000
Sub-total	**£21,535,823**	**£1,740,938**	**£83,301,300**	**£106,578,061**
Inflation	£2,164,489	£147,339	£26,920,211	£29,232,039
Total	**£23,700,312**	**£1,888,277**	**£110,221,511**	**£135,810,100**

4.4. Route 1 (Option A) has increased in outturn cost from £34.37 million to £50.18 million, and Route 2 (Option C) has increased in cost from £78.75 million to £135.81 million. The reasons for the increase in costs are due to more information being available to improve the accuracy of cost estimates.

[8] The risk budget quoted in the Economic case is different from that quoted in the Financial case to remove risks that will be double counted with optimism bias.

4.5. Risk registers have been updated for both Route 1 and Route 2, as included in Appendix E. Risks for Route 1 have been valued at £9.35 million, and for Route 2 are valued at £20.73 million.

4.6. The maximum number of structures have been costed as a worst-case scenario due to engagement with landowners not progressing to a point of knowing about land purchase agreements. Therefore, underpasses have been costed for all landowners which has led to an increase in the amount of earthworks required, and therefore the cost. A higher class of road has also been designed than was originally costed for in the first SOBC – a full distributor road including a hard strip has been costed. There has also been an increase in preliminary design cost.

4.7. One of the junctions for Route 1 joins Eastern Way existing junction which minimises the cost of a new junction. However, for Route 2, all junctions have been designed to be built offline of the existing network so as to minimise the disruption whilst the works are underway. This has also increased the cost of the works.

Cost Profile

4.8. Indicative cost profiles have been developed from the scheme cost breakdown for both of the proposed options, assuming preparation starting in 2021 and construction from 2023, see Table 4-4.

Table 4-4 – Revised indicative cost profiles (outturn prices)

Year	Route 1 (Option A)	Route 2 (Option C)
2021	£2.40m	£5.72m
2022	£4.44m	£11.50m
2023	£7.38m	£14.61m
2024	£17.68m	£26.76m
2025	£18.27m	£27.61m
2026		£24.35m
2027		£25.26m
Total	**£50.18m**	**£135.81m**

Budgets / Funding cover

4.9. At this stage, it is assumed that the funding package proposed for financing the A350 Melksham Bypass scheme would comprise contributions from the DfT's LLM fund and local contributions.

4.10. If successful in attracting DfT funding, it is expected that the majority of scheme development and construction costs will be met by from this source, with discussions about the level of contribution from local funding to be discussed as the scheme progresses.

4.11. The proposed funding package is therefore:

- DfT Large Local Major Transport Schemes / Major Road Network Fund – 85%
- Local contributions (SWLEP, Wiltshire Council and/or developer contributions) – 15%

5. The Commercial Case

2017/18 SOBC Summary

5.1. 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.

5.2. 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.

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5.3. All elements of the original SOBC Commercial Case apply.

6. The Management Case

2017/18 SOBC Summary

6.1. The management approach that has been proposed for the A350 Melksham Bypass scheme is proportionate to the overall scheme cost, its deliverability and the level of risk.

6.2. A Project Board will be established, comprising of senior Council representatives, to oversee delivery of the scheme. A Senior Responsible Owner, Project Director and Project Manager will be appointed, with the Project Manager reporting to the Project Board. A risk register has been created and will be reviewed and updated on a regular basis, with risk owners appointed as appropriate to the type of risk and the stage of the scheme when the risk is realised. Public and key stakeholders will be informed of project progress as per the communications plan and encouraged to give feedback during the design process. To ensure the scheme meets the objectives (see Strategic Case) a Benefits Realisation, Monitoring and Evaluation plan has been created. This will ensure that data collection and reporting is focussed on the objectives.

6.3. Indicative project milestones (dependent on funding) are listed in Table 6-1.

Table 6-1 - Indicative Project Milestones

Milestone (* = Critical path date)	Estimated Date
Information submission of SOBC to DfT	November 2017
Informal comments received from DfT	January 2018
Wiltshire Council decision on continuation to OBC*	April 2018
Development of OBC	May 2018 – October 2019
Public / stakeholder consultation on route options	June – July 2018
Public / stakeholder consultation on preferred route option	Quarter 1 2019
Wiltshire Council approval of preferred route option	Quarter 3 2019
OBC submission	Quarter 3 2019
DfT approval to proceed to Full Business Case (FBC)*	Quarter 4 2020
Construction	Q1 2022 – Q1 2024

6.4. Overall, the A350 Melksham Bypass is considered by Wiltshire Council to be a deliverable scheme, which will ensure that the A350 continues to function as a strategic link and enable economic growth in Wiltshire through targeted investment in transport infrastructure.

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6.5. The following sections from the original SOBC still hold:

- Evidence of similar projects
- Programme / project dependencies
- Governance, organisational structure and roles (with potential changes to the person carrying out the stated roles)
- Assurance and approvals plan
- Communications and stakeholder management
- Project reporting
- Benefits, realisation, monitoring and evaluation plan

6.6. This leaves the risk management strategy and programme which have been revised from the original SOBC.

Risk management strategy

6.7. The risk management strategy included as Appendix H in the original SOBC still applies, however risk registers have been updated for both Route 1 (Option A) and Route 2 (Option C) and are included in Appendix E.

6.8. Key risks which have been categorised as High or Extreme for both options are highlighted in Table 6-3 below, with a full risk registers included in the appendix. All risks will be managed using appropriate mitigation measures as highlighted in the Risk Register.

Programme

6.9. Revised key project milestones from SOBC submission to scheme completion are listed in Table 6-2.

Table 6-2 - Updated Indicative Project Milestones

Milestone	Date
Preliminary design complete	June 2019
Strategic Outline Business Case (SOBC) submission	July 2019
SOBC approval	December 2019
Wiltshire Council approve preferred route	January 2020
Commence planning process/Land purchase/ consultation and preliminary design for planning	January 2020
Complete preliminary design and submit planning application	December 2021
Outline Business Case (OBC) submission	December 2021
Planning decision	March 2022
OBC approval	March 2022
Advertise scheme for EOI	March 2022
Start detailed design	January 2022
Complete detailed design	June 2022
Start Contract documents/ tender	January 2023
Full Business Case (FBC) submission	September 2023
FBC approval	December 2023
Issue contract documents	June 2023
Tender evaluation	September to November 2023
Award of contract	January 2024
Start construction	March 2024
Finish construction/opening date	March 2026 (Route 1) / June 2028 (Route 2)

Table 6-3 - Key Risks

Nature of Risk	Implications	Action to be taken	Route 1 Rating	Route 2 Rating
Statutory Stakeholders Requirements - Environment Agency. Requirements incur additional costs where these costs have been missed in cost estimate. Flood zone being worsened by the introduction of highway.	Additional geotechnical design work for deepening the existing floodplain to increase capacity.	EA - Flood zone storage capacity to match existing. To be designed at Detailed Design stage. 1. Confirm levels of flooding within extents and calculate capacity using River Avon flood model. 2. Complete drainage strategy including flood risk assessment as part of planning application. 3. Detailed Design of excavation works.	High	High
Statutory Stakeholders Requirements - Natural England. Requirements incur additional costs where these costs have been missed in cost estimate. Visibility of scheme in question requiring unexpected landscaping measures.	Programme delay and cost implications.	1. EIA search at early stage. 2. Field surveys undertaken before planning submission. 3. Consult with Natural England prior to planning submission. Produce Ecology Assessment and Landscape Visual Assessment documents.	High	High
Public Relations Issue; Town Council and/or neighbouring villages object to scheme progressing. Delay to scheme progressing to construction. Impact likely to be limited to change in programmed activities and sequencing of works. Risk of physical demonstration preventing work.	Delay to scheme progressing to construction. Impact likely to be limited to change in programmed activities and sequencing of works. Risk of physical demonstration preventing work.	Consult widely/assist Wiltshire Council in consultation activities. Begin consultation alongside planning.	Extreme	Extreme
Land Ownership Constraints: Wiltshire Council do not own all the land required for construction.	High cost for CPO or negotiation to land owners. Programme implications due to legal process if necessary.	All landowners to be consulted at an early stage and risk to be re-evaluated.	Extreme	Extreme

Ecology assessments outcome: Expected requirement for EIA/HRA (Environmental Impact Assessment/Habitats Regulations Assessment).	Outcomes may require high cost mitigation or migration of species. Delay to design and following stages.	Desk based study to be undertaken with some cost already included in BoQ's. 1. Results of EIA and Site Surveys to be reviewed.	High	High
Construction Design/Scope Uncertainty.	Lack of information at this stage could result in design changes during works and redesign.	Ensure scheme requirements are fully understood and information gathered to reduce chance of scope change, keeping client informed.	High	High
Service Utility Estimate Uncertainty.	High level estimate for Service Utility diversions.	NRSWA C2, C3 and C4 process.	N/A	High
Construction Fee Estimate Uncertainty.	Uncertainty may influence the market or funders to act in an unpredictable manner. Rates used in cost estimate based on competitive tender rates from local contractors (medium sized contractors).	Consider strategy to reduce cost. WC engage with larger contractors.	High	High
Archaeology Finds: Archaeological find during watching brief/general works area.	Re-design work, Delays for investigative work, cost implications for redesign.	Desk study to be undertaken to reduce likelihood. Geophysical survey may be required. Risk reduced but not removed.	High	High
Junction capacity.	Risk of inadequate junction capacity.	Traffic modelling to confirm requirements at junctions.	High	High
Weather conditions delays.	Poor weather delays scheme.	Plan phasing of critical events with contractor early. If this is missed plan for following years summer/spring or doubling up size of contractor's team.	Low	High

Appendices

Appendix A. Wiltshire Strategic Highway Model: LMVR

SNC·LAVALIN

ATKINS
Member of the SNC-Lavalin Group

Wiltshire Strategic 2018 Base Model

Local Model Validation Report

Wiltshire Council

June 2019

Notice

This document and its contents have been prepared and are intended solely as information for Wiltshire Council and use in relation to the validation of the Wiltshire 2018 Base Model

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This document has 89 pages including the cover.

Document history

Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
Rev 1.0	Draft	PK	SC	CS	DW	30/11/2018
Rev 2.0	Realism Testing Chapter Included	PK	SC	CS	DW	29/03/2019
Rev 3.0	Peak hour model included	GG	LC	PK	PB	30/06/2019

Client signoff

Client	Wiltshire Council
Project	Wiltshire Strategic 2018 Base Model
Job number	5167358
Client signature / date	

Contents

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1. Introduction

1.1. Context

In 2017, Atkins produced the A350 Melksham Bypass Strategic Outline Business Case (SOBC) for Wiltshire Council, using the Melksham Transport Model (MTM). This model was cordoned from the A303 Stonehenge Model (which was itself derived from the South West Regional Transport Model (SWRTM, developed by Highways England). Extra refinement within the Melksham urban area was required, based on additional surveys, more detailed network coding and highway demand refinement. Whilst the MTM was sufficiently well calibrated within the Melksham area, outside of this region there was considerable model noise and uncertainty inherited from the SWRTM, which was to be expected as this model scope was defined to cover the strategic road network (SRN). The A350 Melksham Bypass SOBC study recommended that a new base model should be created with appropriate geographical scope, scale and detail.

In 2018, Wiltshire Council commissioned Atkins to scope out the additional traffic data required to enhance the existing A303 Stonehenge model (developed for Highways England) to develop a model which could be used to assess and appraise infrastructure schemes and development planning within the Wiltshire region. Atkins were then commissioned to develop the base model of Wiltshire.

This report outlines the steps taken to develop the Wiltshire 2018 base model, including the data collected, development of the model network and highway matrices and presents the output of the model calibration and validation process.

1.2. Potential uses of the model

The model is to be developed in accordance with the current Department for Transport (DfT) Transport Appraisal Guidance (TAG). See Section 2.4 for model standards. This is a general requirement when applying for major scheme business case funding from the DfT. The expected uses of the model will include, but not be limited to:

- Assessing the impacts of land developments or the impact of strategic infrastructure schemes; e.g. Chippenham Urban Expansion Housing Infrastructure Fund.
- Providing an evidential basis for informing business cases for specific transport schemes, e.g. A350 Melksham Bypass; A350 Phase 4 and 5 etc.
- Preparation of transport evidence to support transport strategy or a local plan review.
- Providing traffic forecasts to other analysis packages (local junction modelling software or micro-simulation e.g. LINSIG; Paramics, VISSIM etc)

In section 9 the recommended appropriate usage and limitations of the model are discussed.

1.3. Report structure

This report consists of the following sections:

2. Base model objective, specification and standards
3. Summary of data
4. Highway network development
5. Highway prior trip matrix development and
6. Impact of matrix estimation
7. Model validation results
8. Variable demand
9. Summary

2. Base model objective, specification and standards

2.1. Objective and need for the model

Atkins' objective for the transport model of the Wiltshire and Swindon county regions is to provide a tool which can provide: **clear, transparent & plausible** highway transport forecasts, to inform planning and highway infrastructure decisions in a **fast, flexible** and **visual** way.

To achieve this, the strategy advocated within TAG, is to produce a model which accurately represents observed generalised travel costs (supply) and highway movements (demand). In order to be **proportionate**, it is recommended that the area of focus is within the region which the model sponsor requires analysis of the changes expected to occur.

As recommended in TAG, the model is pivot-point (or incremental) which means that it uses cost changes to estimate the change in the number of trips from a base matrix. The highway traffic forecasts will pivot off the transport model base costs and reference case trip patterns to form an important role in identifying and appraising future schemes and planning decisions in the Wiltshire & Swindon area.

An overview of how this objective was achieved, the limitations of the strategic model (Section 9.2) and the model appropriateness (Section 9.3) are discussed in the report summary.

2.2. Existing traffic models

South West Regional Transport Model (SWRTM, 2015)

The SWRTM was originally developed by Highways England during 2016, with a 2015 base year. The model has good coverage of the strategic network across the South West and includes junction simulation, as well as incorporating a Variable Demand Model (VDM) capability. Traffic forecasts were developed for 2021, 2031 and 2041.

A303 Stonehenge - Amesbury to Berwick Down Model (A303 Stonehenge, 2015)

The A303 Stonehenge model was developed by the Arup Atkins Joint venture (AAJV) on behalf of Highways England for PCF stage 2 of the Amesbury to Berwick Down scheme. The LMVR was issued in April 2017 but used data collected in 2015. The model used the SWRTM as a starting point and enhanced it around the area of the A303 ABD scheme (including Salisbury, Amesbury etc.) The model used locally collected RSI and additional ATC data and provided extra detail in the area equivalent to South/East Wiltshire. The forecast years for the model include 2026 (the expected opening year of the scheme), 2041 & 2051.

Melksham Transport Model (Melksham Model, 2017)

The Melksham Transport Model, developed in 2017 by Atkins, was derived from the A303 Stonehenge Model which was cordoned with Melksham at the centre, and more detail, including zone splitting, network amendments and traffic counts, was added. The base matrix development of this model was recalibrated to NTEM trips ends and observed calibration data around Melksham in 2017.

Swindon Strategic Transport Model (Swindon Urban Model, 2014)

The Swindon strategic transport model was developed by CH2M (Jacobs) with a 2014 Base year. The transport forecast model was developed by Atkins in 2017/2018. This covers the urban area of Swindon and includes forecast years for 2021 and 2036.

2.3. Model description and specification

2.3.1. Overall specification and modelling suite

The Wiltshire 2018 base model uses the A303 Stonehenge / SWRTM as the primary starting point for further enhancement with Melksham and Swindon model detail included.

The highway component of the RTM modelling suite was developed using SATURN software. This highway model interacts with DIADEM which calculates travel demand based on changes in travel costs from the highway model (SATURN). This process iterates between demand calculations and highway assignments until equilibrium is reached with converged results

It is to be assumed that any parameters, processes or techniques used to develop the Wiltshire model suite is consistent with the Highways England RTMs, unless stated in this report.

2.3.2. Software version

The latest version of SATURN v11.4.07H was used for highway assignment.

2.3.3. Base year

The A303 Stonehenge / SWRTM was the starting point for further enhancement. Both model variants were developed using a 2015 prior matrix (derived from mobile phone data) and calibrated/validated with 2015 traffic flow counts and travel times.

Approximately 200 new traffic counts and ANPR surveys within the area of West Wiltshire were undertaken in June 2018 (see Section 3). In consultation and agreement with Highways England, the 2015 data from the wider area and the 2018 data in the localised area are sufficiently close in age to consider this model a 2018 base year without the need to apply growth factors to any of the traffic counts or the prior matrix outside the detailed model area.

2.3.4. Model time periods

The Wiltshire 2018 base model has been developed to represent an average 12-hour weekday in 2018 for the following time periods:

- AM Peak Period average hour (0700-1000)
- Inter peak average hour (1000-1600)
- PM Peak Period average hour (1600-1900)

Any reference to AM, IP or PM (peak) refers to these peak period time throughout this report, unless otherwise stated.

In additional, a peak **hour** model for the AM and PM hours has been produced, by converting the peak period models based on observed data. These time are represented as:

- AM Peak Hour (08:00-0900)
- PM Peak Hour (1700-1800)

Throughout the document PP refers to Peak Period and PH refers to Peak hour.

2.3.5. Demand segmentation

The OD trip matrices used for highway modelling are derived from the SWRTM and so comprise the same user classes, based on trip purpose and type of vehicle. Five user classes are modelled:

1. Car – business trips
2. Car – commuting trips
3. Car – other trips
4. Light goods vehicles (LGVs)
5. Heavy goods vehicles (HGVs)

The demand segmentation structure of the VDM differs from the highway only assignment. This is explained further in Section 8.

2.3.6. Generalised costs

This allows the model to take account of differences in users' value of time (VoT) and vehicle operating cost (VOC). For example, HGVs have different VOCs in comparison to cars and LGVs. The latter have been split into three trip purposes as the value of time differs between these types, i.e. vehicles on business trips are likely to have a higher value of time than, for example, a vehicle on a journey for leisure purposes.

This is explained further in Section 4.4, with base model generalised costs shown in Table 4-1.

2.3.7. Passenger Car Units

Demand in the SATURN traffic assignment is expressed in term of passenger car units (PCUs). The factors used to convert from vehicles to PCUs are listed in Table 2-1.

Table 2-1 - Passenger Car Unit Factors

Vehicle Type	PCU Factor
Car/LGV commuting	1.00
Car/LGV business	1.00
Car/LGV other	1.00
HGV	2.50

As applied in the SWRTM, the PCU factor for HGVs is a weighted average of the factors given in TAG for Rigid Goods Vehicles and Articulated Goods Vehicles. The weighting was applied using goods vehicle type splits on major roads within the study area from the Department for Transport's Annual Average Daily Flow – Data by Direction Major Roads[1].

2.4. Model standards

In general, the Wiltshire model standards are equivalent and consistent with those used for the SWRTM and A303 Stonehenge. The criteria utilised are found in the associated model validation reports. In summary, standard TAG acceptability guidelines have been utilised, with extra near criteria used which is consistent with those for all RTMs.

TAG unit M1.1 – "Principles of modelling and forecasting" states:

> *"It should be emphasised that it may not be necessary to use the most sophisticated or detailed models, nor is it likely to be appropriate to invest the highest proportion of resources to develop the best quality model at the expense of interpreting its outputs carefully and communicating its limitations".*

This report will primarily seek to present the base model outputs, carefully interpret the results and clearly communicate the sufficiency, implications (Section 9.1) and model limitations (Section 9.2).

A summary of the standards employed are discussed below.

2.4.1. Trip matrix validation

The reporting of the trip matrix validation is typically undertaken at a screenline/cordon level. TAG recommends that the differences between modelled flows and observed counts should be less than ±5% for all or nearly all screenlines.

In consistency with the RTMs, screenlines and cordons are considered *near* if the flows are within ±10%. This report will make it clear which screenlines: pass, fail or are near.

Trip matrix validation is presented and discussed in Section 7.1.

2.4.2. Individual link flow calibration

The two measures which are used for the individual link validation are GEH and flow. A link is considered successfully calibrated if one of these measures passes. For a model to be considered as suitably calibrated TAG Unit M3.1 states that 85% of individual links must pass these criteria.

The GEH measure uses the GEH statistic as defined below:

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

Where GEH is the GEH statistic, M is the modelled flow, and C is the observed flow

The flow measure is based on the relative flow difference between modelled flows and observed counts.

[1] http://www.dft.gov.uk/traffic-counts/download.php

TAG Unit M3.1 describes the Link Flow and Turning Movements Validation Criteria and Acceptability Guidelines as shown in Table 2-2.

An additional “near” criteria has been included which assumes that link flow validation is close with marginally relaxed criteria summarised below. This has been used to identify links which are considered good enough and allow focussed calibration on those areas of the model not falling within a pass or near criteria.

Table 2-2 - Link Flow and Turning Movement Validation Criteria and Acceptability Guidelines

Measure	Pass Criteria	Near Criteria
GEH	Less than or equal to 5	Less than or equal to 7
Observed flow less than or equal to 700 veh/h	Flow difference 100 veh/h or less	Flow difference 150 veh/h or less
Observed flow between 700 veh/h and 2,700 veh/h	Flow difference 15% or less	Flow difference 20% or less
Observed flow greater than 2,700 veh/h	Flow difference 400 veh/h or less	Flow difference 500 veh/h or less

Source: TAG Unit M 3.1 Table 2 provides “pass” criteria, “near” criteria is defined by either the RTM or Atkins.

The model link flow validation is presented and discussed in Section 7.2

2.4.3. Journey time validation

For journey time validation, the measure which should be used is the percentage difference between modelled and observed journey times, subject to an absolute maximum difference. TAG Unit M3.1 describes the Journey Time Validation Criterion and Acceptability Guideline as shown in Table 2-3.

Table 2-3 - Journey Time Validation Criterion and Acceptability Guideline

Criterion and Measure	Acceptability Guideline
Modelled times along routes should be within 15% (or 1 minute, if higher)	> 85% of routes

Source: TAG Unit M 3.1 Table 3

All comparisons are to be presented separately for each modelled period. There is no disaggregation presented by vehicle type. The Wiltshire model journey time validation is presented in Section 7.3.

2.4.4. Changes due to matrix estimation

Matrix estimation is a modelling technique that has become a standard feature in many traffic models. The purpose of matrix estimation is to produce a ‘most likely’ trip matrix that fits with available traffic count data. It is based on the theoretical procedure properly entitled ‘Matrix Estimation from Maximum Entropy’ and is generally referred to as ME2.

The process uses an iterative procedure to find a set of balancing factors for the origin-destination movements on each link with a traffic count to ensure that the assigned flows match the counts within certain user-defined limits. ME2 can be used to create a new trip matrix from scratch, but the best results are obtained when it is used to update an existing (prior) trip matrix. Within the SATURN suite, this process is run through the SATME2 program.

Traffic count data used for ME2 can be considered part of model calibration, but to properly validate the traffic demand distribution it is recommended that certain screenlines and cordon are not included within ME2. i.e. to allow validation of independent traffic count data.

Successive applications of ME2 should always use the same defined ‘prior’ trip matrix as an input, to prevent the process magnifying specific matrix changes on successive runs. For each modelled time period, matrix estimation needs to be applied separately for light (cars and LGVs) and heavy vehicles. TAG unit M3.1 suggests a set of benchmark criteria used to review the extent of changes due to matrix estimation relative to the prior matrix. These criteria are outlined in Table 2-4.

Table 2-4 - Matrix Estimation Change Criteria

Measure	TAG Benchmark Criteria	Additional RTM Criteria
Matrix zonal cell values	Slope within 0.98 and 1.02 Intercept near zero R^2 in excess of 0.95	N/A
Matrix zonal trip ends	Slope within 0.99 and 1.01 Intercept near zero R^2 in excess of 0.98	N/A
Trip length distributions	Means within 5% Standard deviations within 5%	N/A
Sector to sector level matrices	Differences within 5%	Trips <100 have been excluded GEH Statistic & proportion of movements which change ±10%

TAG Unit M3.1, with modifications consistent with the RTMs.

The guidance identifies that any exceedances of the criteria above do not mean that the model is unsuitable for the intended uses. The performance of the model should be reviewed against these criteria and exceedances should be examined and assessed for their importance particularly in relation to the area of influence of the scheme to be assessed. For the Wiltshire model, the changes are described in Section 6.3 and detailed in Appendix E.

2.4.5. Assignment convergence criteria

The advice on model convergence is set out in TAG Unit M3.1 (Table 4) and is reproduced below in Table 2-5. The Wiltshire model convergence statistics are presented in Section 7.4.

Table 2-5 - Summary of Convergence Criteria

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

Source: TAG Unit M 3.1 Table 4

TAG convergence criteria values were adopted, and the results presented separately for each modelled period.

2.4.6. Demand model convergence and realism testing

Realism testing is used to ensure that the model responds to changes in travel costs rationally, behaves realistically and with acceptable elasticities. This involves changing various components of travel costs to check whether the response of the VDM is consistent with general experience. Part of the calibration process involves adjusting the parameters in the VDM model until more acceptable results are obtained from such realism tests. It is recommended that these tests are started with initial logit parameters (i.e. the spread, sensitivity or scaling parameters - lamda and theta) based on median values in TAG Unit M2, Section 5.6.

The primary realism tests require that car fuel cost and car journey time elasticity tests are undertaken. Public transport generalised costs, including changes in fares are not modelled and hence public transport fare elasticites are not included.

The elasticities are calculated using model output from different runs using the base year model, from a converged run of the demand/supply loop.

For the Wiltshire model the VDM and realism testing is described and presented in Section 8.

Car Fuel Price Elasticities Targets

The car fuel cost elasticity required is the percentage change in car vehicle-kms with respect to the percentage change in fuel cost. The calculations should be carried out for a 10% or a 20% fuel cost increase. Car fuel elasticities are calculated using a matrix and network based test. The annual average fuel cost elasticity should lie within the **range -0.25 to -0.35** (overall, across all purposes).

TAG, states that target elasticities are considered more plausible if:

- the pattern of annual average elasticities shows values for employers' business trips near to -0.1, for discretionary trips near to -0.4, and for commuting and education somewhere near the average
- the pattern of all-purpose elasticities shows peak period elasticities which are lower than inter-peak elasticities which are lower than off-peak elasticities

Journey Time Elasticity Tests

The car journey time elasticity required is the change in car trips with respect to the change in journey time. I.e. as travel time increases there would be expected to be a resultant reduction in trips. TAG states that

> *"The output elasticities should be checked to ensure that model does not produce very high elasticities (no stronger than -2.0)".*

The approach adopted for testing the journey time elasticity is consistent with the method referenced in the hints and tips section of the DIADEM Manual. This states the following:

DIADEM Manual Method

Elasticities with respect to car travel times are more problematic and require a more approximate approach. The elasticities of vehicle kilometres with respect to fuel costs and journey times are related as follows:

$$E^{time}=E^{fuel} * p^{time} / p^{fuel}$$

where

p^{time} is the cost of travel as a proportion of total generalised cost, and

p^{fuel} is the cost of fuel as a proportion of total generalised cost.

If you know the total vehicle kilometres, K, and the total vehicle hours, T, then you can calculate an average value

$$p^{time} / p^{fuel}= aT / bK$$

where

a is the cost per hour from the generalised cost function and

b is the cost per kilometre.

The elasticity of vehicle kilometres with respect to journey time can then be estimated as:

$$E^{time}=E^{fuel} * aT / bK$$

This formula will be used to demostrate that output elasticites are no stronger than -2.0.

Cost Damping

As per recommended guidance, realism testing is to be conducted initially without cost damping. The algorithm used was fixed step length (0.5).

VDM Convergence

It is of crucial importance that the demand model system converges to a satisfactory degree in order to have confidence that the model results are as free from error and noise as possible. In line with guidance, target %GAP values of 0.1% for the sub area and 0.2% for the entire model are used.

3. Summary of data collection

3.1. Introduction

The Wiltshire 2018 base model was developed using data collected for the development of the following models, (detailed in Section 2.2):

- SWRTM (2015 base)
- A303 Stonehenge Amesbury to Berwick Down (2015 Base)
- Melksham Transport Model (Atkins, 2017 Base)
- Swindon Transport Model (2014 Base)

Additional data was also collected to enhance the base model. One of the conclusions of the Melksham Transport Study (Atkins, 2017) was that there was insufficient transport data in the North West Wiltshire region. The A303 Stonehenge model provided some additional data in the Southern area, but the study recommended a series of volumetric traffic count data and localised distribution data (ANPR surveys) would be required. Subsequently the required traffic count and ANPR site locations were identified and an independent specialist company was commissioned to undertake the surveys.

This section of the report describes the additional data that was collected to update the A303 Stonehenge (& SWRTM) model. This includes:

- Volumetric traffic count data
- Automatic number plate recognition surveys
- TrafficMasterTM journey time data
- AddressBaseTM plus data

3.2. Volumetric traffic count data

This data was the primary source of traffic flow calibration and validation data, to ensure that traffic demand on each of the major and minor routes across the region was matching observed information.

The locations of the all the new Volumetric Count data (including ATC, TRIS and MCC data) sites are presented in Figure 3-1. There is a total of 738 link counts within the area of detailed modelling (AoDM, discussed in Section 4.1).

Automatic Traffic Counts

Automatic traffic counts were undertaken in eight main settlements in the West Wiltshire area by Intelligent Data Company (IDC). The survey data was collected over a three-week period in 15-minute intervals and classified according to the DfT-UK (GB DTp National Core Census) classification scheme.

The 186 ATC counts were undertaken throughout June/July 2018 (outside of school holidays). The data was analysed and averaged into the peak periods identified in Section 2.3.4. Various logic and sense checks were undertaken to ensure consistency between nearby and adjacent sites, and linkages with the ANPR data.

Manual Classified Counts

Direction wise classified link counts were carried out at 11 locations during June 2018 (5^{th} -18^{th}) at 15-minute intervals for 2 weeks.

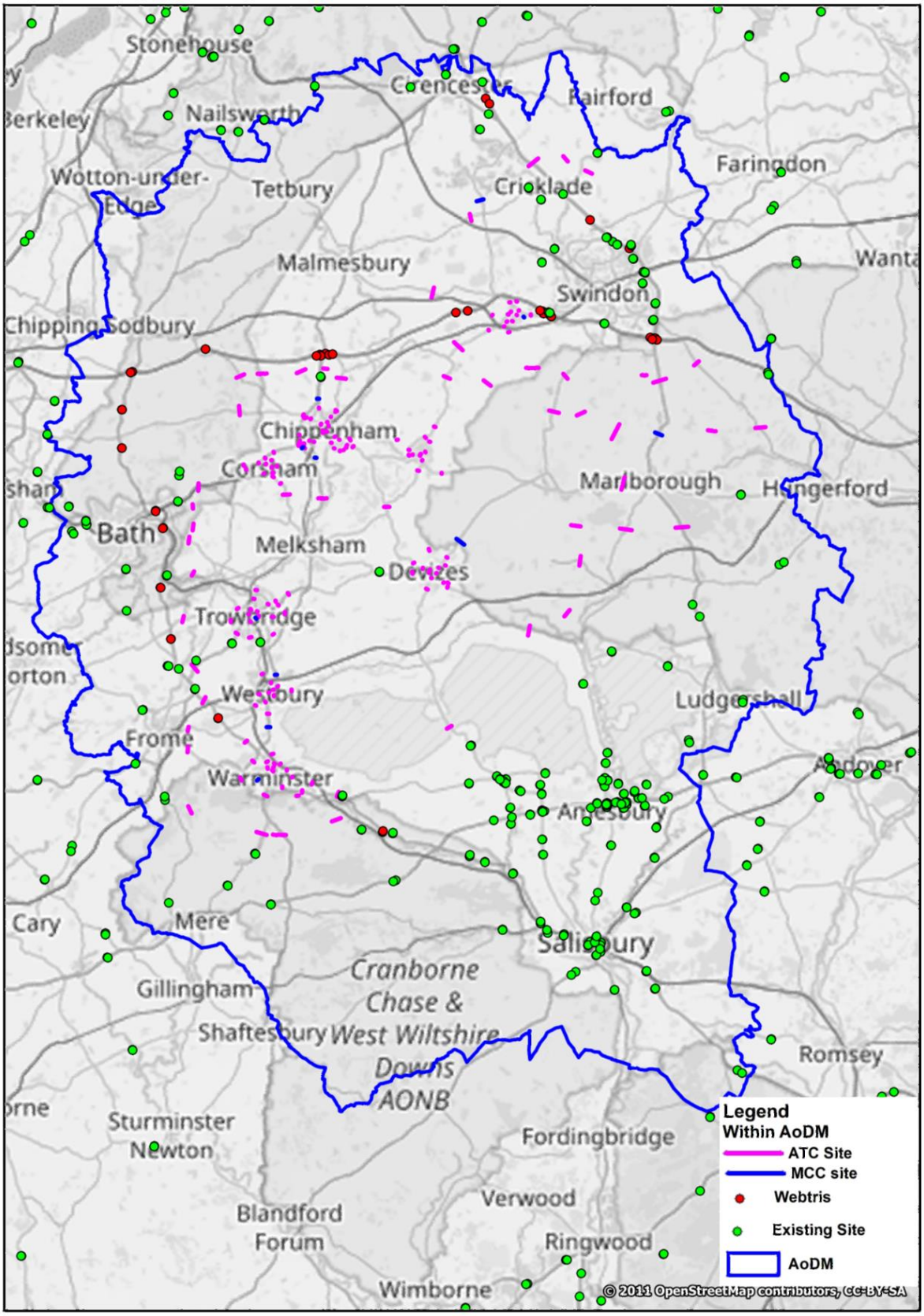
Existing Counts

The data collected was supplemented by data previously collected for the SWRTM, Melksham Transport Model and Swindon transport model. The counts from the A303 Stonehenge / SWRTM were collected or normalised to represent a 2015 Base year. The Swindon traffic counts were collected by Highways England in May 2014.

Webtris

Highways England provides a database of historic traffic count data. Relevant sites, within the AoDM, were included using May 2018 counts. Source: http://webtris.highwaysengland.co.uk/.

Figure 3-1 – Volumetric Traffic Count Data



3.3. Automatic number plate recognition surveys

As well as completing ATC and MCC, IDC also completed ANPR surveys in locations around the West Wiltshire area. Surveys were completed on a Tuesday and Wednesday at the beginning of June 2018 and recorded over a 12-hour time-period in 15-minute intervals. The counts were undertaken to form cordons around the main 9 settlements in the study area, allowing the movement of vehicles through and into each town to be understood. The locations of the all the ANPR sites are presented in Figure 3-2.

Figure 3-2 - ANPR survey Locations

The two days of ANPR data was combined with the ATC data to determine an observed cordon trip matrix for movements through each settlement. The results for each site are found in Appendix B.

This provides observed cordon flows in, out and through each of the main settlements in West Wiltshire; including:

- Chippenham
- Corsham
- Melksham
- Calne
- Devizes
- Trowbridge
- Westbury
- Warminster
- Royal Wotton Bassett

This information has been used for development of the prior trip matrix (see Section 5) and for a calibration check on the final model trip distribution. The final model base cordons are found Appendix B.

3.4. Cordon and screenline definition

For the Wiltshire & Swindon Base Model, the data collected was intended to define a range of cordons and screenlines within the Wiltshire region which would capture the highway travel demand for each of the main urban settlements within the region and the main east-west and north-south movements through the area, are presented in Figure 3-3.

Within this area there is limited route choice between or through settlements and summary reporting will focus on these key movements. The observed counts are presented in Table 3-1. The Base model assignment results are shown in Section 7.2 and Table 7-2.

Figure 3-3 - Cordons and Screenline Locations

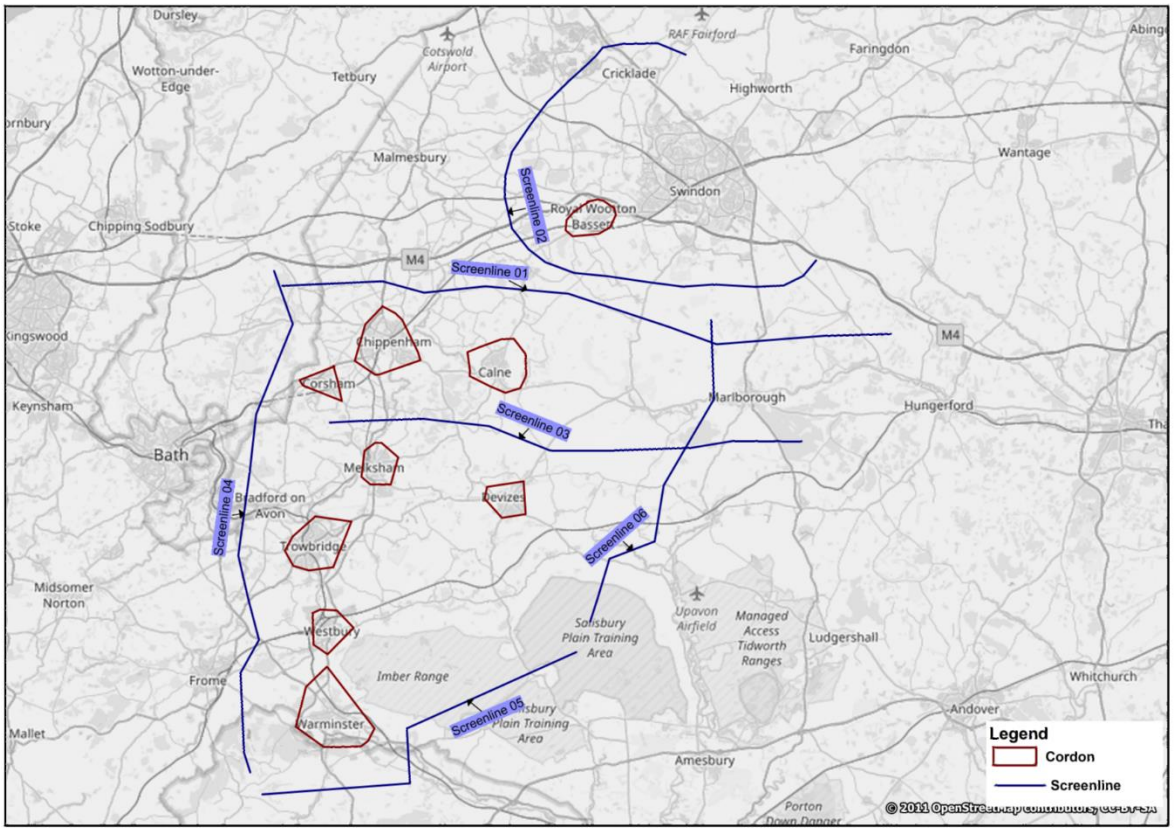


Table 3-1 - Cordon and Screenline Observed Traffic Flow Summary

Cordon / Screenline	Direction	No. links	AM	IP	PM
Calne	Inbound	5	1,571	1,439	2,172
	Outbound	5	2,141	1,360	1,680
Chippenham	Inbound	8	4,779	3,828	4,749
	Outbound	8	4,498	3,808	4,718
Corsham	Inbound	5	1,597	1,327	1,696
	Outbound	5	1,568	1,365	1,670
Devizes	Inbound	5	2,353	2,106	2,547
	Outbound	5	2,375	2,081	2,312
Melksham	Inbound	7	3,903	3,442	4,610
	Outbound	7	4,173	3,342	4,072
Trowbridge	Inbound	7	2,939	2,921	3,851
	Outbound	7	3,315	3,010	3,438
Wootton Bassett	Inbound	6	2,374	2,024	2,941
	Outbound	6	2,678	1,976	2,567
Warminster	Inbound	7	2,922	2,786	3,233
	Outbound	7	3,032	2,760	3,064
Westbury	Inbound	5	1,917	1,795	2,376
	Outbound	5	2,282	1,746	2,067
Screenline 1 North of Chippenham	NB	12	2,230	1,657	2,133
	SB	12	2,152	1,609	2,340
Screenline 2 Swindon	NB	12	2,632	1,879	2,445
	SB	12	2,380	1,845	2,757
Screenline 3 North of Melksham	NB	7	2,831	2,236	2,496
	SB	7	2,443	2,219	2,882
Screenline 4 West of Trowbridge	EB	11	3,963	3,123	4,203
	WB	11	4,001	3,173	4,024
Screenline 5 South of Westbury	EB	5	1,148	1,112	1,609
	WB	5	1,582	1,143	1,246
Screenline 6 East of Devizes	EB	5	1,121	670	714
	WB	5	749	716	1,055

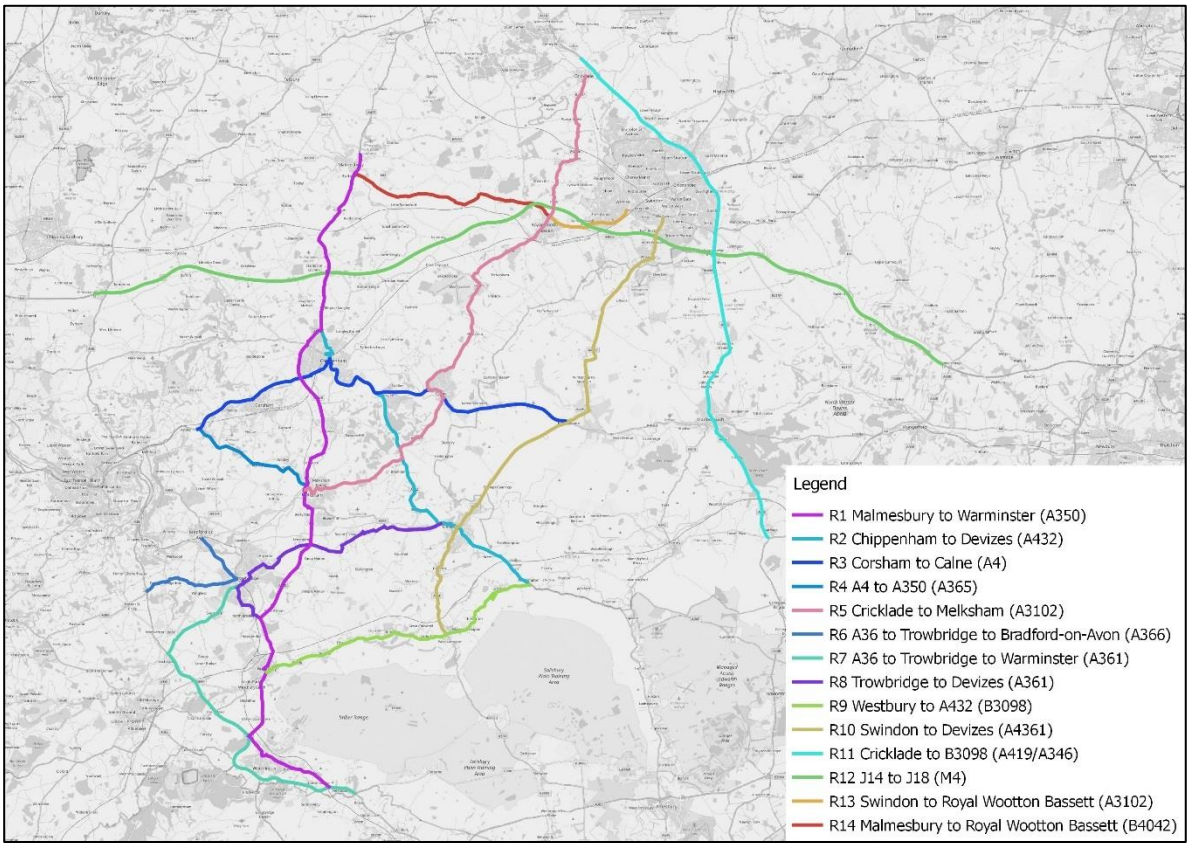
All Counts are in Total Vehicles, Peak Period

3.5. TrafficMaster™ journey time data

Trafficmaster™ Journey Time data was collected which represents network delay, for each modelled time period in September 2017 for all routes except Route 13 which is from June 2017[2]. Data from 2018 was not available at the time of model development. The routes for which data was collected are shown in Figure 3-4. Time and distance checks were made using online mapping to ensure the data had been processed as accurately as possible. The travel times, by period and trip distances, for each of the routes are shown in Table 3-2.

The journey time validation of the base model is presented in Section 7.3. Distance-Time graphs for the A350 are found in Appendix F. Any specific plots not provided in this report are available from Atkins upon request.

Figure 3-4 - Journey Time Routes



[2] June 2017 was chosen for Route 13 as there were road works on a major junction during September which were skewing the journey times on this route.

Table 3-2 - Observed Journey Times

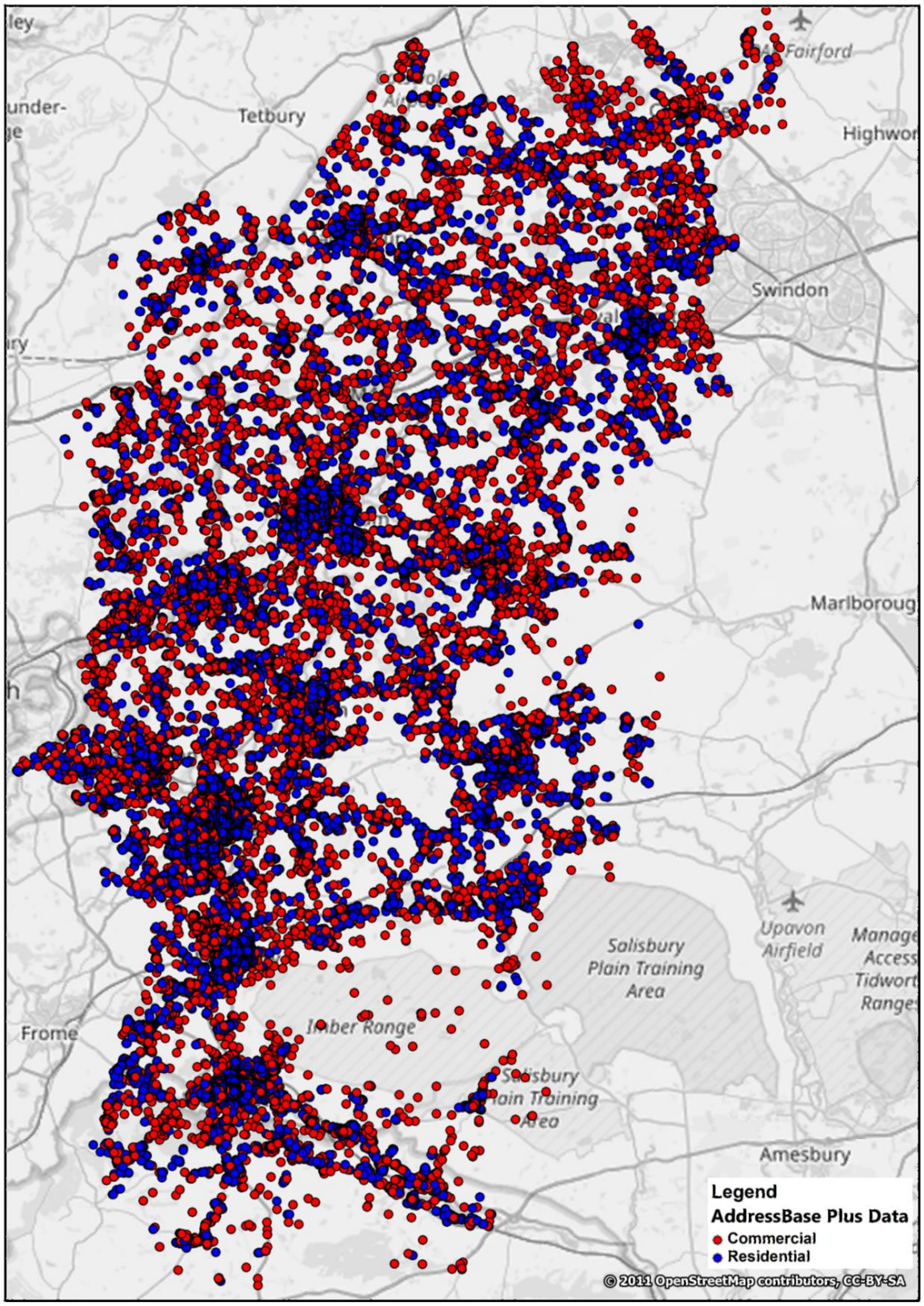
Route No.	Description	Dir	Distance (km)	AM	IP	PM
				(mins)		
1	Malmesbury to Warminster (A350)	NB	55	62	62	59
		SB	55	63	61	60
2	Chippenham to Devizes (A432)	NB	28	35	35	35
		SB	28	35	35	33
3	Corsham to Calne (A4)	EB	32	36	36	34
		WB	32	37	37	36
4	A4 to A350 (A365)	EB	10	11	11	10
		WB	10	11	11	11
5	Cricklade to Melksham (A3102)	NB	45	53	52	50
		SB	45	51	51	49
6	A36 to Bradford-on-Avon via Trowbridge (A366)	EB	11	15	15	15
		WB	11	16	15	15
7	Trowbridge to Warminster (A361 / A36)	NB	28	26	26	25
		SB	28	25	25	25
8	Trowbridge to Devizes (A361)	EB	21	27	26	25
		WB	21	24	25	24
9	Westbury to A432 (B3098)	EB	22	26	26	25
		WB	22	27	26	25
10	Swindon to Devizes (A4361)	NB	38	40	40	38
		SB	38	40	41	40
11	Cricklade to B3098 (A419 / A346)	NB	41	33	34	34
		SB	40	33	32	31
12	J14 to J18 (M4)	EB	66	35	35	34
		WB	66	34	35	34
13	Swindon to Royal Wootton Bassett (A3102)	EB	6	8	7	7
		WB	6	7	7	7
14	Malmesbury to Royal Wootton Bassett (B4042)	EB	15	14	14	14
		WB	15	14	14	13

Data is based on Trafficmaster Journey Time data from September 2017 for all routes except Route 13 (June 2017)
Distances are in km, travel time is in minutes. Distances are rounded to the nearest km and times are rounded to the nearest minute.

3.6. AddressBase™ plus data

AddressBase™ Plus gives up-to-date local authority addresses and OS MasterMap references which differentiates by commercial or residential property types as shown in Figure 3-5. This information was used to assist in zone factoring, splitting and disaggregation in the process of refinement of the initial prior trip matrix (see Section 5.1).

Figure 3-5 - AddressBase Plus Data



4. Highway network development

4.1. Area of detailed modelling

Within the SATURN software suite, highway networks can comprise either a **full simulation** network, in which the operation of individual junctions is fully simulated, or a less detailed **buffer** network, which features link distance and speed information. The strategic road network within the A303 Stonehenge / SWRTM is entirely 'simulated'. However, to reduce likely wider network convergence issues, model noise and reduce computational power and run times in regions outside the area of interest it was proposed to define an area of detailed modelling (AoDM). Within this region, the network is fully simulated and outside this area, the existing network is buffer.

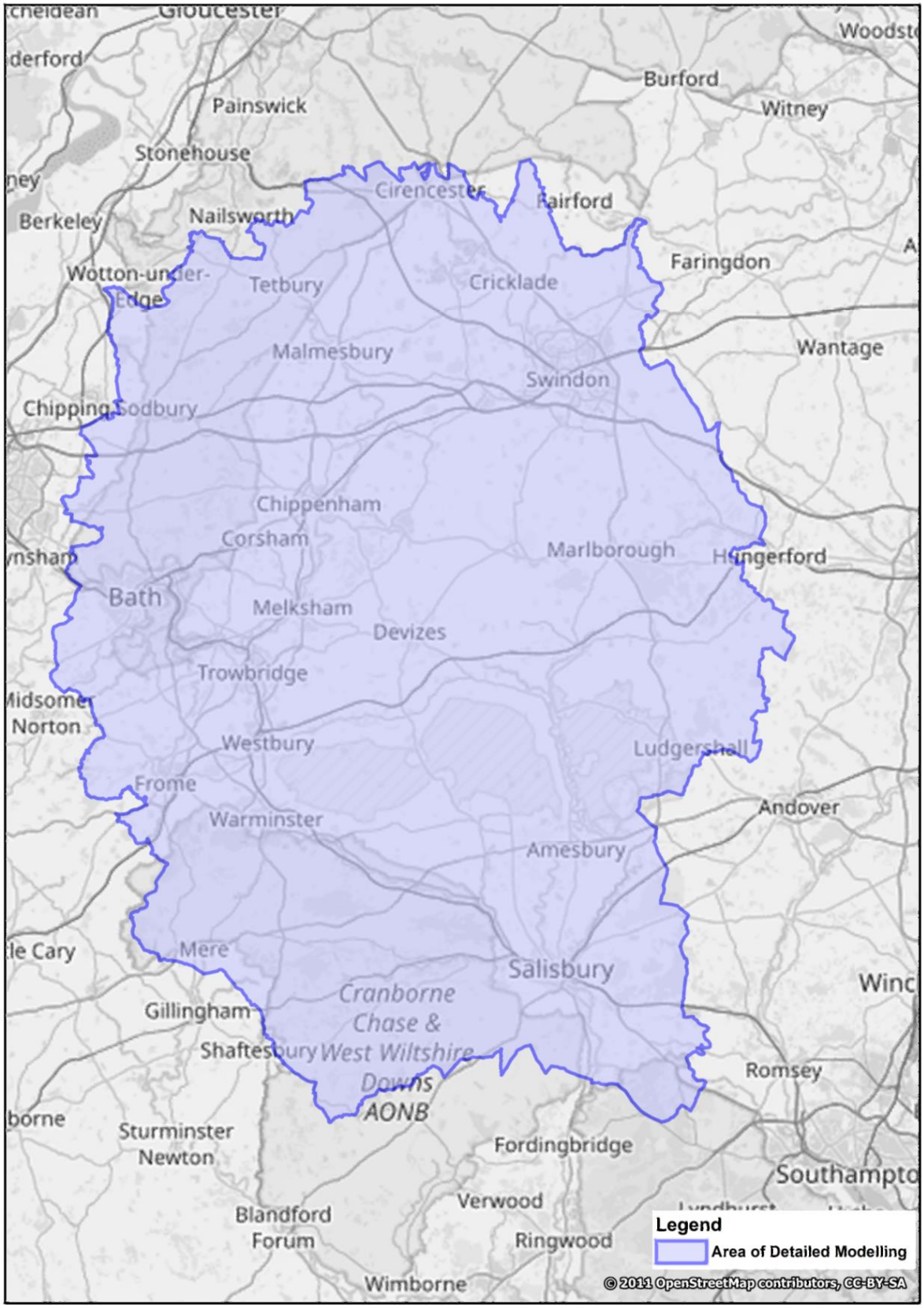
The initially proposed AoDM included only Wiltshire and Swindon, this was discussed with Wiltshire Council and Highways England. It was agreed that the AoDM would be extended to include a wider region which incorporated Bath and parts of South Gloucestershire and the Cotswolds to fully capture the network impacts of changes within Wiltshire.

The agreed AoDM is shown in Figure 4-1. The existing A303 Stonehenge / SWRTM network was converted (using SATBUF feature within SATURN) to buffer outside this area.

Whilst the focus of this report is within the AoDM, the model calibration data and processes (matrix estimation etc.) of the A303 Stonehenge / SWRTM models of the whole SW region has been retained. A summary of the model calibration and validation results is presented in Appendix C. This shows that the wider Wiltshire model retains the same level of calibration as the donor models.

A summary of the differences between the Full Simulation and Buffer variants of the Wiltshire model are presented in Appendix D. This shows that there is little difference between the two models and hence there is limited benefit in fully simulating the model outside the AoDM as this will only increase run times and likelihood of convergence and noise issues and hence reduce opportunities for sensitivity tests and plausible economic analysis within the AoDM.

Figure 4-1 - Area of Detailed Modelling (AoDM)

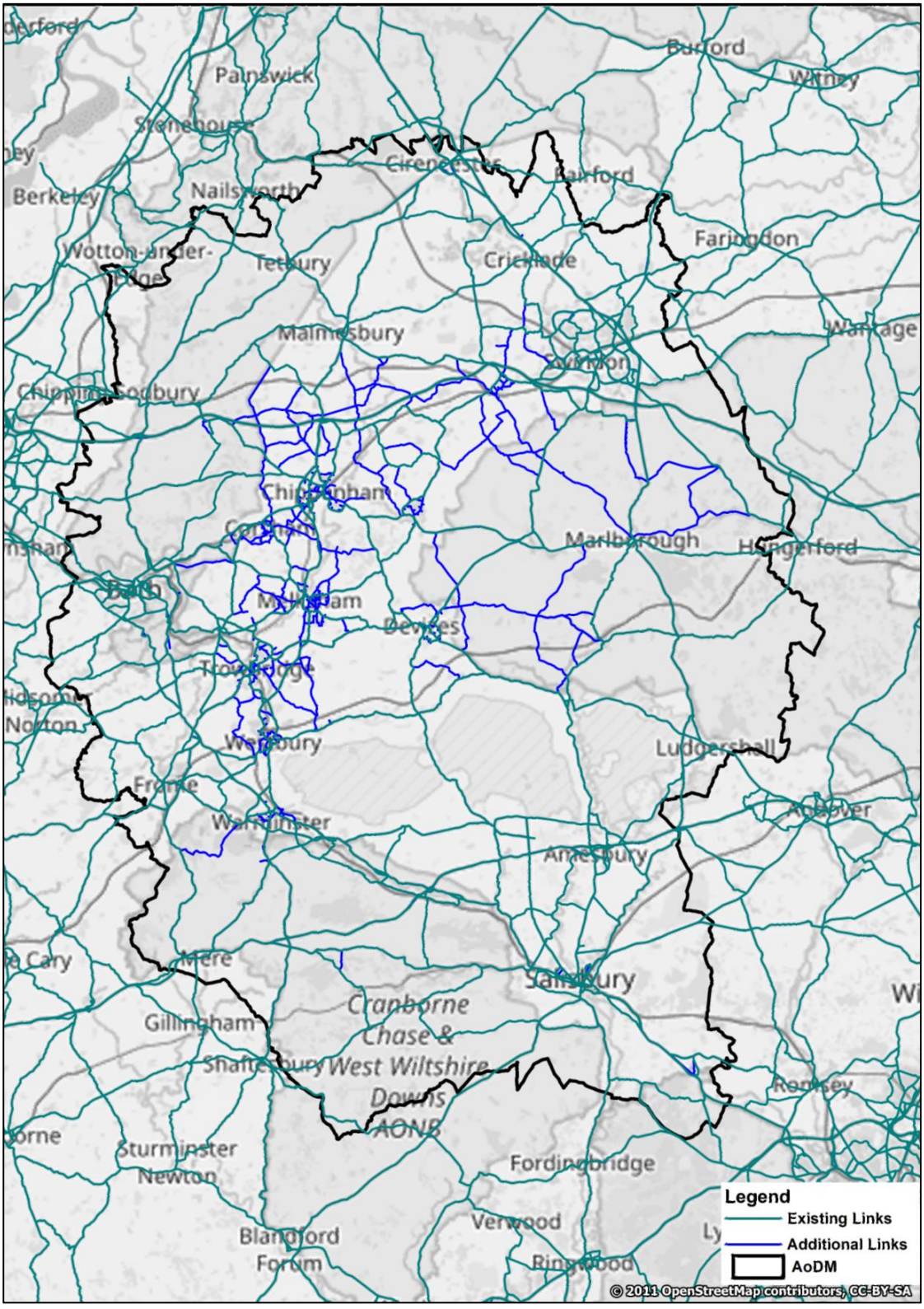


4.2. Network refinement within the AoDM

Within the AoDM, network additions and refinements were made. These include:

- Addition of local and minor roads (see Figure 4-2);
- Amendments to speed flow curves to reflect driver behaviour and speeds within towns;
- Extensive refinement of network coding to ensure realistic cost of travel throughout the AoDM. The results of the travel time validation are shown in Section 7.3.

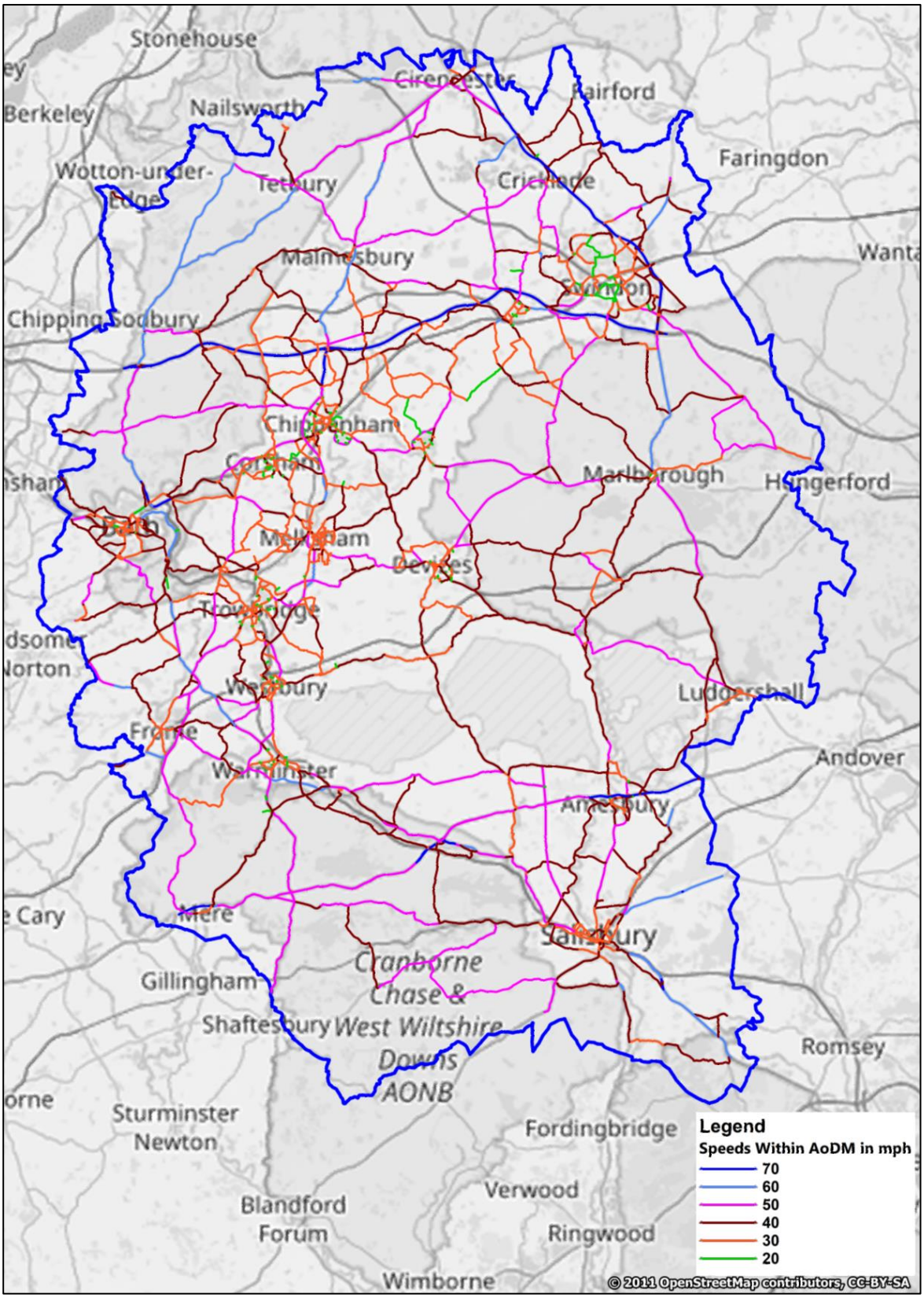
Figure 4-2 - Network Refinement



4.3. Capacity constraints

The cruise speeds used in the models are as shown in Figure 4-3. The speed flow curves (SFC) values are consistent with the SWRTM and A303 Stonehenge models. The network coding standards used are consistent with the RTM coding manual v0.8 Final.

Figure 4-3 – AoDM Network Speeds



4.4. Generalised costs (Value of Time and Vehicle Operating Costs)

The generalised cost of travel is based on a combination of factors that drivers consider when choosing routes, mainly time and distance. Generalised cost parameters are used in a SATURN model to represent drivers' value of time by pence per minute (PPM) and distance by pence per kilometre (PPK).

Values of PPK and PPM can be set universally for the entire model or individually by user class. Where a choice of route exists (as in nearly all cases) these values are used to determine which available route has a lower 'cost' to the driver. Thus, if the PPK value is high, low cost routes will be those which minimise distance; conversely, if the PPM is high then low cost routes will be those that minimise the travel time.

The TAG databook Tables A1.3.1 and A1.3.2 provide monetary values of time, which can be used to derive values of time in an assignment model in terms of PPM. Similarly, Tables A1.3.10 to A1.3.12 in the databook provide parameters to calculate fuel costs and Table A1.3.15 provides parameters to calculate nonfuel vehicle operating costs. When added together, the fuel and non-fuel elements give the total vehicle operating costs in terms of PPK for different transport users. Unit A1.37 states that, in non-work time, it is assumed that drivers do not perceive non-fuel vehicle operating costs, and so these costs have been omitted from the overall calculation of generalised costs for commuting and other trips. The PPM and PPK parameters then give the overall generalised cost for each of the different user classes, those used for the base model are presented in Table 4-1.

Table 4-1 - Assignment Values of PPM & PPK

UC	Description	PPM (pence per minute)			PPK (pence per kilometre)		
		AM	IP	PM	AM	IP	PM
1	Car (Business)	30.88	31.64	31.32	12.27	12.27	12.27
2	Car (Commute)	20.71	21.04	20.78	5.78	5.78	5.78
3	Car (Other)	14.29	15.22	14.96	5.78	5.78	5.78
4	LGV	21.83	21.83	21.83	13.53	13.53	13.53
5	HGV	44.31	44.31	44.31	44.52	44.52	44.52

TAG Databook v1.10 May 2018

5. Highway prior trip matrix development and assignment

5.1. Prior trip matrix development

5.1.1. A303 Stonehenge / SWRTM Prior Trip Matrices

The prior trip matrices for the SWRTM were primarily informed by mobile phone data (MPD) rather than being developed from more traditional sources. Further details of the SWRTM and A303 Stonehenge prior trip matrix development are found in the associated model validation reports.

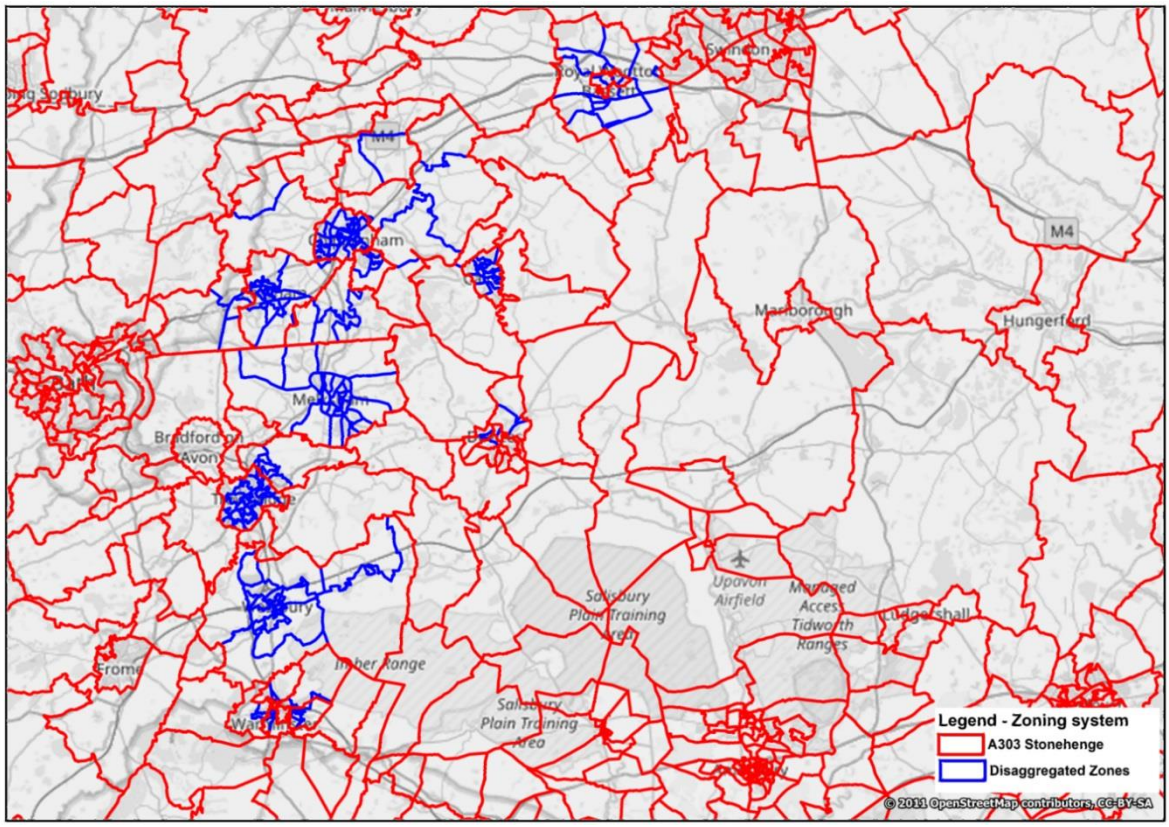
The Wiltshire prior trip matrix was based on the A303 Stonehenge prior trip matrix (which utilised the Design Fix 2 (DF2) SWRTM prior trip matrix) and zone system which was initially based on MSOAs. This was assumed to provide a reasonable distribution for longer distance trips. The RTM Technical Consistency Group (TCG) advocated using new and alternative data sets to refine and disaggregate the MPD matrices to a spatially proportionate level of disaggregation. The zones within the existing model were refined to provide more detail in key urban areas.

5.1.2. Zone disaggregation

Within the AoDM (see Figure 4-1) a finer zoning system was identified with the intention of representing the loading of trips at a suitable level of detail (as shown in Figure 5-1). This process involved splitting, where required, the A303 Stonehenge / SWRTM zones into the new zone system based on the proportion of houses and employment in each zone and hence the relative proportionate production/attraction. The proportions of housing and employment was determined by the AddressBase™ Plus data described in Section 3.6.

The total demand was consistent with the MPD prior trip matrices from the A303 Stonehenge / SWRTM matrices. The total number of zones in the A303 Stonehenge model was increased from 2,033 to 2,250. This includes 23 additional empty zones which are to be used for forecast developments.

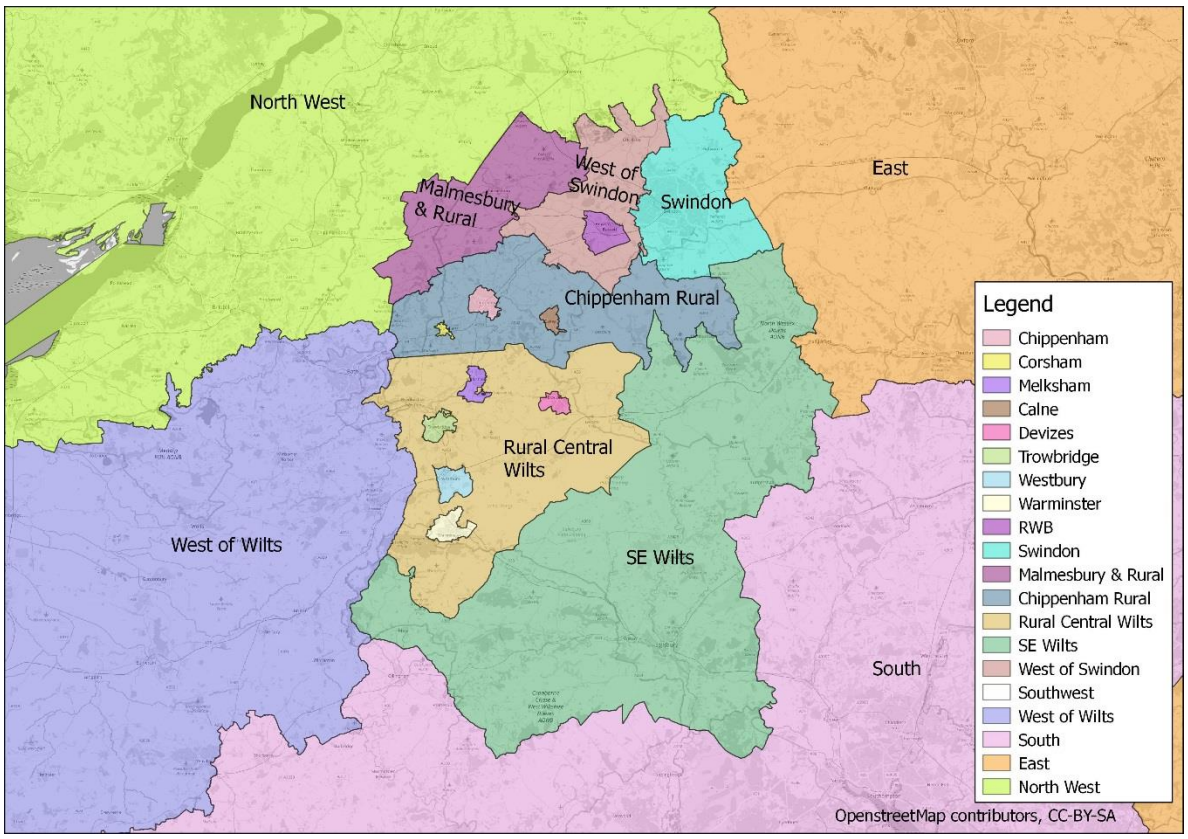
Figure 5-1 - Zone Disaggregation



5.2. Sector system

A sector system, used for model appraisal and matrix development and expected to be used for forecasting has been defined. This is presented in Figure 5-2.

Figure 5-2 - Sector System (20x20)



5.3. Prior trip matrix model assignment

Comparing an assignment of the prior trip matrices with observed traffic count data, with localised network enhancement (see Section 4.2) demonstrated that there was far too little traffic in and around the entire region and further refinement of the trip matrices was required. A high-level summary output is shown in Figure 5-2, and Table 5-1. The model standards and "near" criteria are presented in section 2.4.1 and 2.4.2)

A result of this deficiency in the demand matrix, required suitable remedial action, which is discussed in the next section.

Figure 5-2 - Initial Prior Trip Matrices Assignment Pass (Green), Near (Amber) and Fail (Red), AoDM.

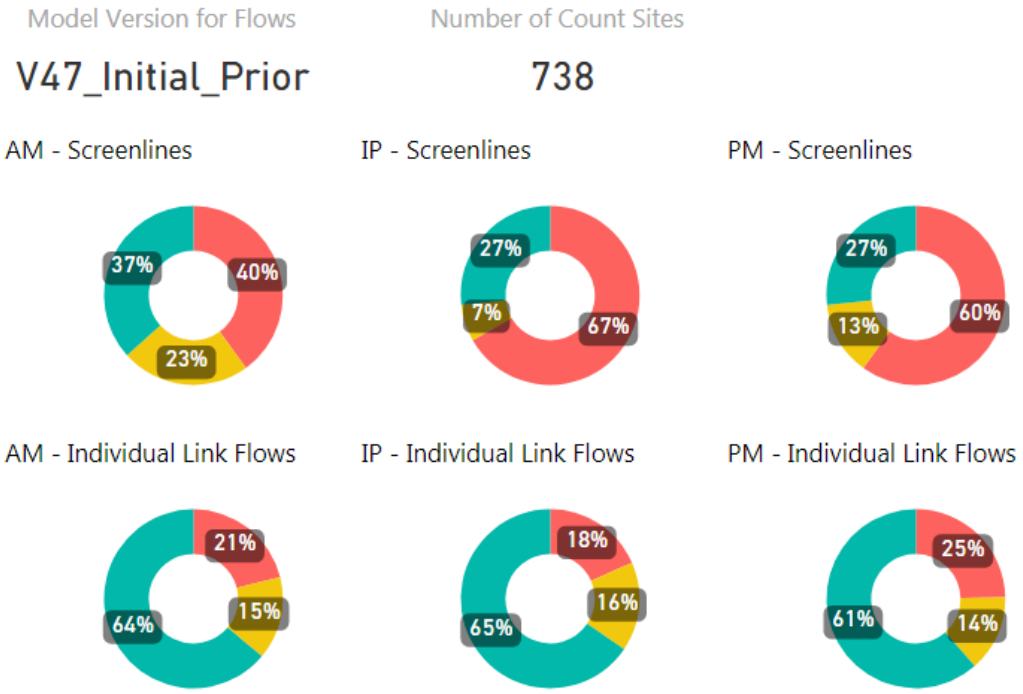


Table 5-1 - Total Peak Period Traffic flows in AoDM: Observed vs Prior Trip Matrix Model

	Observed Flows (Vehs)	Modelled Flow (Vehs)	Flow Diff	% Diff
AM peak	346,691	340,453	6,238	-1.8%
Inter Peak	298,141	259,625	38,516	-12.9%
PM Peak	369,763	340,536	29,227	-7.9%

These values are derived from the totals of all the observed traffic count data and the equivalent location in the model. The number is therefore merely indicative of the overall observed vs modelled data.

6. Impact of matrix estimation

6.1. Matrix estimation methodology

Assignment of the prior trip matrix (see previous section) showed that this was insufficient to meet TAG flow validation standards, hence use of matrix estimation was required.

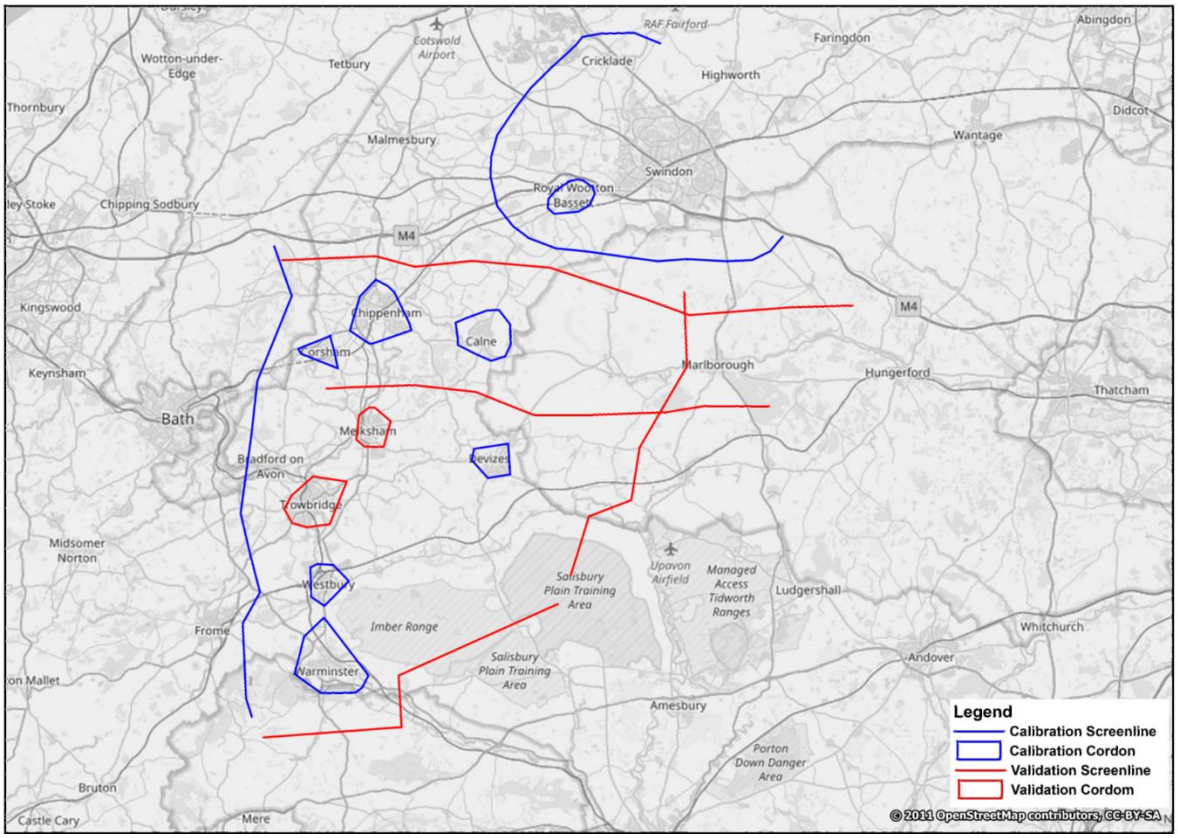
The process of matrix estimation (ME2, described in Section 2.4.4) and the parameters used for this modelling are broadly consistent with the A303 Stonehenge / SWRTM. These are summarised below:

- Cars/LGVs and HGVs are treated separately, by constraining them to observed count data. Cars have not been further subdivided, as it is not possible to distinguish between the trip purposes from the count data
- All traffic counts not specifically on a cordon or screenline have been used in this process
- All the calibration screenlines in the wider south west area from the A303 Stonehenge / SWRTM are consistent in this model
- XAMAX defines the maximum balancing factor used to limit excessive changes to the prior matrix. A value of two has been used for the car/LGV and five for HGV estimation. This reflects the relative confidence in the data used to develop the demand for each of these vehicle classes
- A convergence criteria value of 0.001 has been used

6.2. Identification of calibration screenlines

To reduce the impact of ME2, certain traffic counts on selected cordons and screenlines were used for validation, i.e. these counts were not included within ME2. Those selected for calibration in ME2 and kept separate for validation are shown in Figure 6-1 below.

Figure 6-1 - Calibration Screenlines and Cordons



6.3. Monitoring changes due to matrix estimation

This section provides a summary of the changes due to ME2 between the prior trip matrix and the final post ME2 trip demand matrices. The standards used to assess the changes presented are consistent with those required in TAG guidance and described in Section 2.4.4 and Table 2-4)

In general, the results presented demonstrate that the changes due to ME2 are considered to be within the recommended guidance and the final post ME matrix are suitable for model validation.

A more detailed output of the all the changes is presented in Appendix E.

6.3.1. Zonal cell values

The demand matrices are compared on a zonal basis to show that the change between the prior trip matrix and post ME2 matrix are within acceptance criteria. This has been done within the AoDM, the results and acceptance criteria are presented in Table 6-1. In general, it is considered that the changes are within acceptable limits.

Table 6-1 – Summary changes in Zonal Cell Values: Post ME2 vs Prior, within AoDM

AM	TAG Criteria	EB	Com	Other	LGV	HGV	All
Slope	0.98 to 1.02	0.97	0.98	0.99	0.99	0.95	0.99
Intercept	Near zero?	0.00	-0.00	0.00	0.00	0.00	Yes
R^2	> 0.98	0.93	0.97	0.99	0.98	0.85	0.98
IP							
Slope	0.98 to 1.02	0.99	0.98	0.99	1.00	0.95	0.99
Intercept	Near zero?	0.00	0.00	0.01	0.00	0.00	Yes
R^2	> 0.98	0.94	0.96	0.97	0.99	0.84	0.97
PM							
Slope	0.98 to 1.02	0.96	0.98	0.99	1.00	0.95	0.99
Intercept	Near zero?	0.00	0.00	0.01	0.00	0.00	Yes
R^2	> 0.98	0.93	0.97	0.98	0.98	0.87	0.98

6.3.2. Trip ends

This section describes the change for the trip end totals for the full matrix are presented in Table 6-2 and Table 6-3.

Table 6-2 - Summary Changes in Origin Trip Ends: Post ME2 vs Prior, within AoDM

AM	TAG Criteria	EB	Com	Other	LGV	HGV	All
Slope	0.99 to 1.01	0.93	0.94	0.96	0.98	0.90	0.95
Intercept	Near zero	0.45	2.18	3.90	1.26	2.34	Yes
R^2	> 0.98	0.97	0.98	0.98	0.96	0.87	0.98
IP							
Slope	0.99 to 1.01	0.97	0.96	0.97	0.98	0.87	0.98
Intercept	Near zero	0.58	1.93	7.46	1.78	2.56	Yes
R^2	> 0.98	0.95	0.97	0.97	0.93	0.83	0.98
PM							
Slope	0.99 to 1.01	0.95	0.96	0.97	0.99	0.87	0.97
Intercept	Near zero	0.365	2.27	4.23	1.04	1.4	Yes
R^2	> 0.98	0.96	0.98	0.98	0.94	0.85	0.98

Table 6-3 - Summary Changes in Destination Trip Ends: Post ME2 vs Prior, within AoDM

AM	TAG Criteria	EB	Com	Other	LGV	HGV	All
Slope	0.99 to 1.01	0.94	0.95	0.97	0.98	0.90	0.96
Intercept	Near zero?	0.35	1.37	2.82	1.21	2.35	Yes
R^2	> 0.98	0.96	0.98	0.99	0.96	0.87	0.98
IP							
Slope	0.99 to 1.01	0.96	0.97	0.97	1.02	0.90	0.97
Intercept	Near zero	0.63	1.73	7.60	1.31	2.46	Yes
R^2	> 0.98	0.96	0.98	0.98	0.95	0.87	0.98
PM							
Slope	0.99 to 1.01	0.94	0.96	0.97	1.03	0.79	0.97
Intercept	Near zero	0.43	1.90	4.56	0.67	1.55	Yes
R^2	> 0.98	0.97	0.98	0.99	0.96	0.87	0.98

6.3.3. Trip length distribution

It is important that the ME2 process does not fundamentally alter the trip distributions and specially the trip length distributions (TLD). A high-level comparison of the TLD, by user class, is presented in Table 6-4. A more detailed comparison is presented in Appendix E.3

This shows that there is very little change in the mean trip length, with marginal increases in trip distance, post ME2 and a small decrease for heavy vehicles.

Table 6-4 – Mean Trip Length: Post ME2 vs Prior for whole model

Time Period	Trip Purpose	Prior	Post ME2	% Difference	Standard Deviation
AM Peak	Car - Business	77.85	79.19	2%	1%
	Car - Work	45.85	46.56	2%	1%
	Car - Other	35.48	36.01	2%	2%
	LGV	54.24	54.82	1%	1%
	HGV	114.22	109.27	-4%	-1%
	Light Vehicles	46.64	47.37	2%	1.3%
	Total	51.84	52.44	1%	0.5%
Inter Peak	Car - Business	75.74	76.58	1%	1%
	Car - Work	50.86	51.10	0%	1%
	Car - Other	35.54	35.77	1%	1%
	LGV	54.86	54.89	0%	1%
	HGV	114.32	109.80	-4%	-1%
	Light Vehicles	45.38	45.67	1%	1%
	Total	52.12	52.23	0%	0.5%
PM Peak	Car - Business	75.82	78.11	3%	4%
	Car - Work	47.94	48.68	2%	1%
	Car - Other	36.34	36.96	2%	2%
	LGV	53.54	54.14	1%	1%
	HGV	114.32	110.94	-3%	0%
	Light Vehicles	45.54	46.35	2%	2.3%
	Total	48.82	49.57	2%	1.5%

Distances in kilometres, for the whole model.

Light Vehicles are Cars and LGVs.

6.3.4. Sector to sector changes

In considering the differences on a sector to sector level it is important to avoid highlighting large percentage differences which represent only a small number of trips. As such all sector to sector movements with fewer than 100 trips in the prior matrix have been excluded from this analysis. In line with RTMs, the GEH statistic has also been assessed, along with the proportion of movements with less than ±10% change. Figure 5-2 shows the spatial coverage of the sectors which have been considered in this analysis. The percentage and GEH change in sector-to-sector movements, for each time period, is provided in Appendix E.4. A summary of these changes is shown in Table 6-5.

Table 6-5 - Sector to Sector Changes: Post ME2 vs Prior

Vehicle Type	Time Period	No. Cells with >100 Trips	% Cells with <5% change	% Cells with <10% change	% Cells with GEH <5 change
Light Vehicles	AM	136	73%	76%	73%
	IP	109	58%	65%	74%
	PM	135	62%	71%	70%
Heavy Vehicles	AM	21	62%	76%	71%
	IP	21	62%	67%	76%
	PM	17	65%	71%	88%
Total	AM	140	70%	76%	72%
	IP	114	57%	66%	76%
	PM	135	61%	71%	72%

A cell is defined as a sector to sector movement or sector pair. Note that all analysis has been undertaken on cells with >100 trips in the prior sector matrix.

6.4. Post ME2 sector matrices

It has been demonstrated that the changes resulting from ME2 are acceptable under the standards utilised for the development of the RTMs and those described in Section 2.4.4. The final, post ME2 (sector) matrices, used for model validation are presented in Figure 6-2, Figure 6-3 and Figure 6-4. The sector map, defining the regions is shown in Figure 5-2.

Figure 6-2 – Sector Matrix: AM Peak Period, Post ME2

	Chippenham	Corsham	Melksham	Calne	Devizes	Trowbridge	Westbury	Warminster	RWB	Swindon	Malmesbury	Chip Rural	Rural Cen	SE Wilts	West of Swin	South West	West	South	East	North	**Total**
Chippenham	1874	45	86	75	35	125	20	6	20	100	197	578	234	50	33	8	178	23	79	309	**4073**
Corsham	51	58	13	6	8	16	2	1	2	15	15	227	43	11	4	3	66	4	14	92	**651**
Melksham	108	30	299	9	28	129	22	5	1	23	26	162	588	110	4	5	160	34	15	89	**1849**
Calne	234	12	22	441	113	28	5	2	23	133	56	264	92	41	40	7	37	9	66	96	**1720**
Devizes	58	3	10	36	432	60	9	13	26	148	4	105	464	197	32	2	37	28	60	48	**1770**
Trowbridge	141	15	106	21	59	1616	106	50	5	50	30	260	1153	154	9	10	505	79	57	114	**4537**
Westbury	30	2	28	3	14	159	290	62	1	13	5	39	443	114	3	3	132	49	12	49	**1452**
Warminster	11	1	13	2	7	65	46	464	0	6	2	32	324	207	1	3	124	58	6	20	**1392**
RWB	45	3	2	12	17	3	1	0	50	562	60	102	12	34	91	5	14	12	106	118	**1252**
Swindon	72	9	15	19	46	20	6	2	298	22	247	293	52	281	750	41	60	120	1595	1380	**28**
Malmesbury	134	8	9	10	1	6	3	1	14	118	697	141	26	13	93	19	47	23	89	588	**2039**
Chipp Rural	667	173	60	222	45	83	11	5	50	232	136	1109	205	226	75	23	347	31	161	443	**4304**
Rural Central	216	34	391	59	632	1303	360	363	13	100	33	310	2662	430	24	17	793	146	89	232	**8205**
SE Wilts	52	2	21	11	186	51	29	86	35	352	13	249	286	14	38	25	228	3050	631	172	**19**
West of Swin	60	3	3	43	8	5	2	2	108	1043	143	133	13	21	271	9	22	22	135	487	**2535**
South West	4	0	2	0	1	4	3	1	5	50	18	13	10	35	7	169	2	1	0	1	**174**
West	138	49	74	11	35	344	114	157	8	75	72	485	800	319	16	2	58	2	0	6	**72**
South	22	4	14	5	27	37	46	30	20	171	19	72	141	2929	30	1	3	278	18	2	**306**
East	52	8	10	12	19	18	11	3	94	1532	76	187	47	411	151	0	0	14	1206	27	**1250**
North	310	51	88	29	20	107	49	28	129	1966	778	690	360	254	428	1	6	2	33	3306	**3353**
Total	**4278**	**510**	**1266**	**1026**	**1734**	**4181**	**1134**	**1282**	**903**	**29**	**2629**	**5451**	**7956**	**19**	**2099**	**174**	**72**	**301**	**1261**	**3345**	**5237**

Values are Highway Trip demand in Vehs, values in red in 1000s

Figure 6-3 – Sector Matrix: Inter Peak Period, Post ME2

	Chippenham	Corsham	Melksham	Calne	Devizes	Trowbridge	Westbury	Warminster	RWB	Swindon	Malmesbury	Chip Rural	Rural Cen	SE Wilts	West of Swin	South West	West	South	East	North	**Total**
Chippenham	2257	63	92	130	27	84	19	8	27	48	163	648	169	26	39	6	117	16	42	226	**4208**
Corsham	50	56	21	7	3	15	2	1	2	6	8	192	33	3	2	2	30	4	7	25	**467**
Melksham	112	22	358	18	14	107	15	5	2	13	12	87	457	24	3	2	70	15	10	59	**1405**
Calne	107	6	16	450	59	12	2	1	17	36	17	219	51	18	33	2	17	4	17	40	**1121**
Devizes	23	4	15	80	444	49	6	5	18	39	3	65	597	162	11	1	24	17	33	15	**1609**
Trowbridge	131	11	139	18	58	1648	196	74	4	24	10	99	1334	56	5	7	280	42	36	102	**4272**
Westbury	21	1	20	2	6	194	355	61	1	8	3	14	387	43	3	4	97	36	11	36	**1304**
Warminster	9	1	8	1	5	85	92	449	0	4	1	10	329	103	1	2	121	39	5	21	**1284**
RWB	23	2	3	21	12	3	1	0	59	418	18	46	10	18	78	3	10	8	46	82	**861**
Swindon	57	9	20	54	69	24	6	2	409	20	95	198	61	228	730	44	81	73	1113	1159	**25**
Malmesbury	125	11	19	17	2	13	4	1	29	115	591	113	32	12	80	14	40	21	83	456	**1780**
Chipp Rural	600	191	102	205	57	113	16	10	45	171	128	951	219	198	61	16	257	41	121	361	**3863**
Rural Central	167	34	447	57	601	1375	367	382	10	37	21	192	2369	263	12	12	682	115	57	209	**7408**
SE Wilts	24	4	33	21	165	64	55	103	21	247	11	269	263	12	19	34	247	2115	390	192	**16**
West of Swin	31	3	4	33	11	6	2	1	88	758	74	65	14	17	200	5	17	12	85	341	**1769**
South West	5	0	1	1	1	7	3	2	7	57	29	12	9	34	8	164	2	1	0	1	**168**
West	114	33	99	24	24	293	108	139	10	66	55	292	707	254	16	2	54	2	0	5	**65**
South	12	3	17	7	14	48	32	37	11	101	23	37	81	2086	19	1	2	222	10	2	**240**
East	45	12	16	27	31	31	10	5	51	1216	76	148	65	459	106	0	0	12	1036	24	**1075**
North	193	27	57	48	28	84	43	27	85	1292	459	318	199	174	367	1	5	2	21	3066	**3098**
Total	**4107**	**493**	**1486**	**1222**	**1632**	**4254**	**1334**	**1314**	**896**	**25**	**1795**	**3975**	**7384**	**16**	**1793**	**168**	**65**	**241**	**1070**	**3102**	**4718**

Values are Highway Trip demand in Vehs, values in red in 1000s

Figure 6-4 – Sector Matrix: PM Peak Period, Post ME2

	Chippenham	Corsham	Melksham	Calne	Devizes	Trowbridge	Westbury	Warminster	RWB	Swindon	Malmesbury	Chip Rural	Rural Cen	SE Wilts	West of Swin	South West	West	South	East	North	**Total**
Chippenham	2110	72	98	244	52	165	19	6	42	64	141	692	208	39	48	5	139	14	48	248	**4452**
Corsham	51	57	22	11	5	19	2	1	3	9	9	188	34	2	3	4	39	3	7	52	**520**
Melksham	55	21	318	20	15	127	18	6	1	18	15	72	381	18	2	3	61	11	8	45	**1215**
Calne	119	10	29	417	53	23	2	0	18	27	14	226	65	11	35	1	27	2	14	43	**1135**
Devizes	29	16	19	181	487	92	15	3	49	138	2	74	655	163	18	1	39	16	31	23	**2048**
Trowbridge	76	17	198	24	86	1654	244	84	2	46	11	97	1359	68	3	6	495	48	34	71	**4623**
Westbury	13	2	30	5	9	165	322	63	1	15	6	13	398	34	2	5	130	26	8	30	**1277**
Warminster	1	1	8	1	12	64	90	438	0	5	3	5	368	97	0	1	160	32	2	17	**1306**
RWB	23	2	4	37	21	6	1	0	37	393	25	58	14	19	101	2	11	7	43	118	**923**
Swindon	146	20	29	117	134	49	7	2	535	26	183	263	90	348	1177	44	111	107	1494	1877	**32**
Malmesbury	205	13	20	47	4	26	4	1	22	150	651	122	29	8	122	16	75	8	56	783	**2362**
Chipp Rural	666	255	169	248	96	244	30	11	74	302	142	1089	317	292	100	24	401	54	172	572	**5257**
Rural Central	172	65	627	85	612	1463	463	357	17	89	39	257	2720	310	14	12	863	116	65	222	**8567**
SE Wilts	35	10	52	35	155	99	94	236	65	346	14	280	355	14	34	35	343	2849	417	225	**20**
West of Swin	36	3	6	59	26	10	2	1	112	1111	102	94	22	28	237	5	23	16	126	415	**2433**
South West	6	1	1	1	2	6	3	1	4	34	14	13	7	25	6	183	2	1	0	1	**188**
West	225	95	141	23	52	567	164	174	11	69	52	467	1094	291	15	2	61	3	0	7	**76**
South	10	6	25	17	23	45	65	47	24	169	17	35	109	3110	36	1	2	275	15	1	**298**
East	62	12	39	69	59	45	10	8	208	1857	92	180	83	653	273	0	0	17	1343	33	**1398**
North	374	62	82	129	50	160	65	41	156	1960	596	411	299	204	497	1	6	2	27	3871	**3912**
Total	**4414**	**740**	**1919**	**1771**	**1953**	**5028**	**1620**	**1480**	**1380**	**32**	**2125**	**4633**	**8607**	**20**	**2722**	**188**	**75**	**301**	**1388**	**3918**	**5961**

Values are Highway Trip demand in Vehs, values in red in 1000s

6.5. Peak Hour Matrix Conversion

In discussion with Wiltshire and Highways England it is proposed that a model which reflected peak hour demand and congestion would be most suitable for local junction analysis and appraisal.

A comparison of the total observed flows during an average Peak Hour and Period, for each region is shown in Table 6-6. There is approximately a 9% increase in the peak hour vs peak period. This value is higher in urban areas (13% in the AM) and very low on strategic roads (1.5% in the AM).

Accordingly, a factor matrix, has been calculated and applied to the validated, post ME2 peak period matrices to convert them to Peak Hour. A presentation of the validation of both the peak period and peak hour models (which have the same network) is presented in the next chapter.

Table 6-6 - Peak Hour to Period factor

Wiltshire Regions	AM			PM		
	PP Obs	PH Obs	Factor	PP Obs	PH Obs	
Chippenham	26424	29869	1.130	28029	30242	1.079
Corsham	8566	10062	1.175	9141	9886	1.081
Calne	9769	10950	1.121	10452	11466	1.097
Devizes	13045	14299	1.096	13269	14721	1.109
Trowbridge	20951	24225	1.156	24148	26426	1.094
Westbury	7825	8885	1.136	8587	9497	1.106
Warminster	15191	17243	1.135	16031	17636	1.100
RWB	10181	11628	1.142	11223	12667	1.129
Wiltshire urban	111952	127161	1.136	120880	132541	1.096
Screenlines	27251	30100	1.105	27924	31552	1.130
Webtris	72565	73686	1.015	75291	79733	1.059
All sites	211768	230947	1.091	224095	243826	1.088

7. Model validation results

7.1. Overview

In TAG Unit M3.1 **calibration** is defined as adjustments to the model intended to reduce the differences between the modelled and observed data. **Validation** is the process of demonstrating the quality of the model by comparing the model output with observed data, which should be independent of data used for model development.

This chapter outlines the outcomes from validation of traffic flows, journey times within the AoDM and the model stability. The aim is to demonstrate that the model adheres to the standards presented in Section 2.4. All assignment results presented use the post ME2 highway traffic demand matrices discussed in Section 6.

7.2. Traffic flow and routeing calibration and validation

The overall results of the screenline and cordon traffic flows and the individual link flow calibration and validation for total vehicles and lights are shown in Table 7-1. The total flows (model vs observed) for each screenline and cordon are shown in Table 7-2 (note that the observed data is presented in Table 3-1). Figure 7-1 shows the link flow validation in all time periods for all vehicles and light vehicles within the AoDM. This information shows a very high level of model validation.

A full set of data, for each of the 748 count sites within the AoDM is available from Atkins upon request. The wider level of validation within the South West region (outside the AoDM) is presented in Appendix C.

Table 7-1 - Traffic Flow Calibration & Validation Summary Post ME2, Total Vehicles

Measure	Cal or Val	No. Sites	Pass	Near	Near or Fail
AM Peak Period					
Screenlines (Two Directions)	Calibration	18	78%	22%	0%
	Validation	12	83%	17%	0%
	Total	30	80%	20%	0%
Link flows	Calibration	543	92%	3%	5%
	Validation	205	79%	7%	14%
	Total	748	89%	5%	6%
IP					
Screenlines (Two Directions)	Calibration	18	83%	17%	0%
	Validation	12	83%	17%	0%
	Total	30	83%	17%	0%
Link flows	Calibration	543	94%	3%	3%
	Validation	205	82%	8%	10%
	Total	748	91%	4%	5%
PM Peak Period					
Screenlines (Two Directions)	Calibration	18	67%	33%	0%
	Validation	12	67%	27%	7%
	Total	30	67%	33%	0%
Link flows	Calibration	543	88%	6%	5%
	Validation	205	74%	11%	15%
	Total	748	88%	6%	8%
AM Peak Hour					
Screenlines (Two Directions)	Calibration	18	53%	47%	0%
	Validation	12	53%	47%	0%
	Total	30	53%	47%	0%
Link flows	Calibration	543	87%	6%	6%
	Validation	205	75%	11%	14%
	Total	748	84%	8%	9%
PM Peak Hour					
Screenlines (Two Directions)	Calibration	18	70%	30%	0%
	Validation	12	70%	30%	0%
	Total	30	70%	30%	0%
Link flows	Calibration	543	90%	5%	5%
	Validation	205	75%	8%	17%
	Total	748	86%	6%	8%

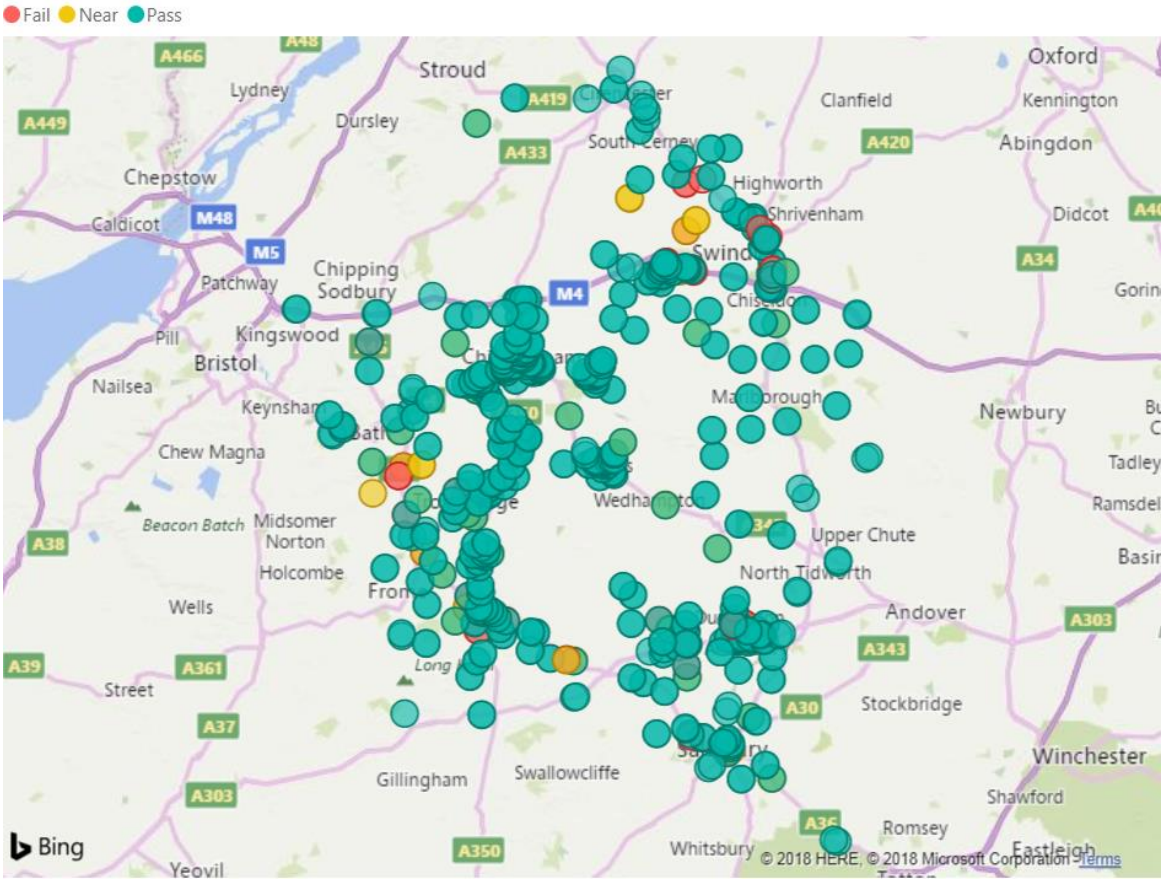
Table 7-2 – Cordon & Screenline Traffic Flow: Model vs Observed

Cordon/Screenline, Direction and Calibration/Validation				AM Peak Period			Inter Peak Peak			PM Peak Period		
				Observed	Modelled	Difference (%)	Observed	Modelled	Difference (%)	Observed	Modelled	Difference (%)
Cordon	Calne	In	C	1571	1594	1.5%	1440	1488	3.3%	2173	2308	6.2%
		Out	C	2142	2286	6.7%	1360	1379	1.4%	1681	1684	0.2%
	Chippenham	In	C	4779	5051	5.7%	3828	3975	3.8%	4748	4696	-1.1%
		Out	C	4498	4674	3.9%	3807	4134	8.6%	4718	4924	4.4%
	Corsham	In	C	1596	1565	-1.9%	1327	1356	2.2%	1696	1817	7.1%
		Out	C	1568	1523	-2.9%	1365	1306	-4.3%	1670	1714	2.6%
	Devizes	In	C	2353	2365	0.5%	2106	2132	1.2%	2546	2503	-1.7%
		Out	C	2374	2513	5.9%	2081	2088	0.3%	2310	2476	7.2%
	Melksham	In	V	3903	4135	5.9%	3442	3335	-3.1%	4610	4271	-7.4%
		Out	V	4173	4206	0.8%	3343	3273	-2.1%	4072	4133	1.5%
	Trowbridge	In	V	2940	3014	2.5%	2921	2949	1.0%	3850	3787	-1.6%
		Out	V	3315	3383	2.1%	3010	3078	2.3%	3438	3497	1.7%
	Warminster	In	C	2922	2883	-1.3%	2785	2757	-1.0%	3232	3131	-3.1%
		Out	C	3032	3020	-0.4%	2762	2719	-1.6%	3065	2944	-3.9%
	Westbury	In	C	1917	2013	5.0%	1795	1850	3.1%	2376	2265	-4.7%
		Out	C	2282	2309	1.2%	1746	1822	4.4%	2067	1950	-5.7%
	RWB	In	C	2374	2377	0.1%	2023	1971	-2.6%	2941	2855	-2.9%
		Out	C	2678	2654	-0.9%	1976	1927	-2.5%	2567	2479	-3.4%
Screenline	Sl1 North of Chippenham	NB	V	2231	2232	0.0%	1656	1637	-1.1%	2135	2168	1.5%
		SB	V	2153	2181	1.3%	1609	1624	0.9%	2338	2357	0.8%
	Sl2 Swindon	In	C	2631	2635	0.2%	1879	1739	-7.5%	2446	2610	6.7%
		Out	C	2379	2370	-0.4%	1845	1687	-8.6%	2758	2512	-8.9%
	Sl3 North of Melksham	NB	V	2831	2922	3.2%	2237	2049	-8.4%	2496	2476	-0.8%
		SB	V	2443	2295	-6.1%	2220	2048	-7.7%	2881	2801	-2.8%
	Sl4 West of Trowbridge	EB	C	3962	3827	-3.4%	3124	3153	0.9%	4202	4241	0.9%
		WB	C	4001	3945	-1.4%	3173	3127	-1.4%	4026	3922	-2.6%
	Sl5 South of Warminster	NB	V	1149	1156	0.6%	1112	1091	-1.9%	1609	1480	-8.0%
		SB	V	1583	1602	1.2%	1142	1132	-0.9%	1245	1237	-0.6%
	Sl6 East of Devizes	EB	V	1121	1140	1.7%	669	688	2.8%	714	643	-9.9%
		WB	V	749	717	-4.3%	715	685	-4.2%	1055	980	-7.1%

Observed data is presented in Table 3-1. All Traffic Flows are in Total Vehicles. C = Calibration, V = Validation

Figure 7-1 shows the locations or calibration and validation count sites in the AoDM. Using plots like this it was possible to ensure that areas of key interest (such as Chippenham) obtained a high level of calibration/validation so that future models would not encounter significant issues.

Figure 7-1 – Post ME2 Trip Matrix Link calibration/validation sites, for all vehicles in the AM



7.3. Journey time validation

The purpose of journey time validation is to show that the model is correctly replicating journey times, or entire route costs on key routes through the AoDM. The model standards utilised are shown in Section 2.4.3. The 14 routes (28 two-way) identified are presented in Figure 3-4. A summary of the total modelled journey time is shown in Table 7-3. This shows that nearly all the routes are within the model standards and the route costs within the AoDM are assumed to be an accurate reflection of delays within the network.

Distance-Time graphs for the A350 are presented in Appendix F. All other graphs are available from Atkins on request.

Table 7-3 - Journey Time Validation Summary (mins)

No.	Route	Dir	AM Peak Period			Inter Peak Peak			PM Peak Period		
			Observed	Modelled	% Difference	Observed	Modelled	% Difference	Observed	Modelled	% Difference
1	Malmesbury to Warminster (A350)	NB	62.0	62.3	0.5%	62.1	59.8	3.7%	58.9	61	3.6%
		SB	62.7	63.4	1.1%	61.1	59.7	2.3%	59.3	62.6	5.6%
2	Chippenham to Devizes (A432)	NB	35.1	33.9	3.4%	35.4	31.3	12%	34.8	32.1	7.8%
		SB	34.6	34.2	1.2%	35.2	32.0	9.1%	33.0	33.3	0.9%
3	Corsham to Calne (A4)	EB	36.0	34.2	5.0%	35.5	33.2	6.5%	34.3	35.0	2.0%
		WB	36.8	35.8	2.7%	37.0	33.6	9.2%	35.5	35.3	0.6%
4	A4 to A350 (A365)	EB	10.8	10.0	7.4%	10.8	9.9	8.3%	10.3	10.1	1.9%
		WB	11.1	10.9	1.8%	11.0	10.4	5.5%	10.7	10.5	1.9%
5	Cricklade to Melksham (A3102)	NB	53.3	47.9	10%	52.0	45.8	12%	50.0	46.6	6.8%
		SB	50.9	48.6	4.5%	51.1	46.9	8.2%	48.7	50.7	4.1%
6	A36 to Bradford-on-Avon via Trowbridge	EB	14.9	13.4	10%	14.7	13.2	10%	14.7	13.3	9.5%
		WB	15.5	14.6	5.8%	14.8	13.9	6.1%	15.2	14.5	4.6%
7	Trowbridge to Warminster (A361)	NB	25.7	24.7	3.9%	25.5	24.7	3.1%	24.6	25.1	2.0%
		SB	25.3	25.5	0.8%	25.2	24.9	1.2%	25.0	25.4	1.6%
8	Trowbridge to Devizes (A361)	EB	26.7	26.7	0.0%	25.9	26.8	3.5%	25.2	27.1	7.5%
		WB	24.1	25.5	5.8%	24.6	25.4	3.3%	24.0	26.7	11%
9	Westbury to A432 (B3098)	EB	26.1	26.0	0.4%	25.7	25.1	2.3%	24.8	25.3	2.0%
		WB	26.7	25.2	5.6%	25.6	25.0	2.3%	24.9	24.9	0.0%
10	Swindon to Devizes (A4361)	NB	39.7	44.4	12%	39.6	40.2	1.5%	37.6	43.6	16%
		SB	39.9	39.3	1.5%	40.9	39.8	2.7%	39.7	42.6	7.3%
11	Cricklade to B3098 (A419 / A346)	NB	32.8	29.9	8.8%	34	29.4	14%	33.7	30.7	8.9%
		SB	32.7	29.4	10%	31.5	28.1	11%	30.5	29	4.9%
12	J14 to J18 (M4)	EB	34.9	37.5	7.4%	34.6	36.4	5.2%	33.7	36.4	8.%
		WB	34.2	36.1	5.6%	34.9	36.6	4.9%	34	37.4	10%
13	Swindon to RWB (A3102)	EB	7.8	7.3	6.4%	6.8	6.8	0.0%	6.5	7.0	7.7%
		WB	6.8	7.0	2.9%	6.7	6.8	1.5%	6.9	7.7	12%
14	Malmesbury to RWB (B4042)	EB	13.9	14.5	4.3%	13.9	14.5	4.3%	13.8	14.4	4.3%
		WB	14.1	14.8	5.0%	14	14.2	1.4%	13.4	14.4	7.5%

Journey Time route plots are shown in Figure 3-4. All route times are in minutes

7.4. Assignment convergence stability

The level of stability and convergence achieved, as required within the model standards (see Section 2.4.5) are presented in Table 7-4. The results indicate that the model achieves a good level of convergence that complies with recommended criteria.

Table 7-4 - Assignment Convergence Statistics

AM Peak			Inter Peak			PM Peak		
Loop	% Flows	%GAP	Loop	% Flows	%GAP	Loop	% Flows	%GAP
11	97.7	0.0068	11	99	0.0023	12	98.9	0.0039
12	98.4	0.0065	12	98.3	0.0020	13	99.0	0.0030
13	99.4	0.0052	13	99	0.0025	14	99.2	0.0024
14	99.7	0.0029	14	99.5	0.0025	15	99.4	0.0021

8. Variable demand modelling

8.1. Overview of VDM

To support funding of a major infrastructure scheme from the DfT (defined as in excess of £5 million capital costs) which requires a full business case, it is a TAG (Unit M2) requirement to develop a Variable Demand Model (VDM)

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

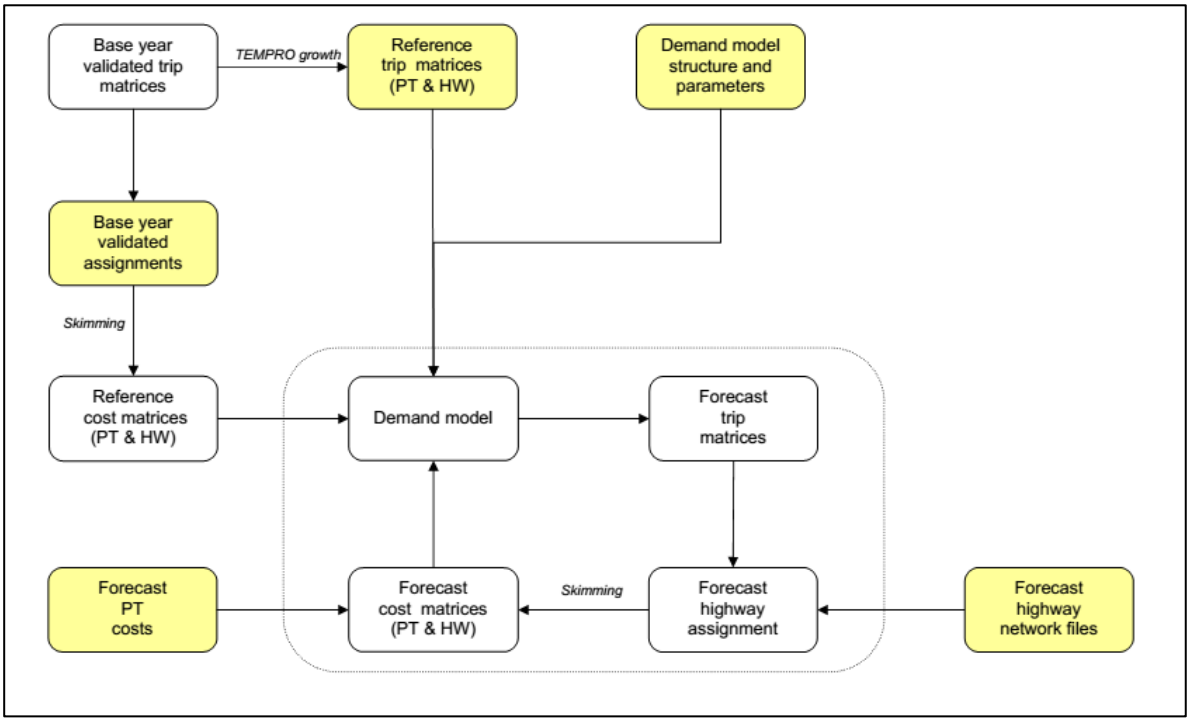
The VDM structure (24-hour incremental PA VDM, with macro time period, public transport and trip redistribution choice) and main parameters and inputs of the Wiltshire VDM are essentially consistent with the A303 Stonehenge and SWRTM VDM see associated reports for details. Any changes to the VDM are detailed later but a short summary of the main features is described below.

The output from the VDM runs are used to calculate incremental changes between the base year and the forecast year, which are then applied to the validated base year 'assignment' matrices. This approach is shown in Figure 8-1. The methodology is consistent with Appendix B of TAG Unit M2.

Incremental models rely more on observed origin-destination data, and less on the mathematical specification of the model than absolute models. Consequently, the DfT has a long-established preference for the use of incremental rather than absolute demand models, as outlined in TAG Unit M2. Therefore, an incremental VDM Model has been applied which updates the validated base year trip matrices and costs for forecast year scenarios.

The VDM modelling process uses trip demand matrices in production/attraction (PA) format, rather than origin-destination (OD) format for home-based trips as required in the traffic assignments. This is to retain the linkage between outbound and return trips. This approach allows the model to consider both legs of a home-based journey when modelling a change in travel pattern as a result of the VDM responses, which ensures the consistency of the change between the outbound and return journeys.

Figure 8-1 - Application of Incremental VDM (pivoting off the base demand)



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

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

The demand segmentation, matrix type and choice response mechanisms and structure are shown in Table 8-1.

Table 8-1 – Demand Model Responses in DIADEM

Demand Segment	Tour and purpose	Main Mode Choice	Macro Time Period Choice	Trip Distribution Constraint
1. HBW	Incremental PA	Car / Rail	24 Hr	Doubly
2. HBEB				Singly
3. HBO				
4. NHBEB	Incremental OD		Fixed - Peak Period only	
5. NHBO				
6. Fixed W	Ports / Airports / Other	Fixed		-
7. Fixed EB				-
8. Fixed O				-
9. LGV	-			-
10. HGV	-			-

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

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

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

8.2. Realism testing

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

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

It should be noted that, in accordance with TAG advice, output elasticities are based on trips within the internal simulated area. The calculations are carried out for a 10% fuel cost increase. Car fuel elasticities are calculated using a matrix test (note that network-based outputs are similar). The model standards utilised are presented in section 2.4.6.

8.2.1. Cost damping

There is strong empirical evidence that the sensitivity of demand responses to changes in generalised cost reduces with increasing trip length. DfT research has demonstrated that for all trip purposes there is a relationship between travel distance and the value of travel time savings. The evidence

indicates that travellers' sensitivity to cost declines more rapidly with distance than their sensitivity to time. The mechanism within the transport model by which this is achieved is referred to as 'cost damping' and would generally be expected to be incorporated into VDM. As consistent with the A303 Stonehenge/SWRTM, a distance-based deterrence function was used.

8.2.2. Car fuel cost output elasticities

The results of the realism testing are presented in Table 8-2. This shows the tests and changes required to ensure some plausible elasticities.

The A303 Stonehenge model (which was consistent with SWRTM) car fuel elasticity was **0.37**. It is stated in the A303 Stonehenge LMVR that this was deemed acceptable for the SWRTM model by the Highways England Technical Consistency Group. No further calibration of the A303 Stonehenge VDM model was therefore considered necessary to alter this value.

For the Wiltshire model, calibration of the VDM was undertaken to improve upon the realistic demand response of the model.

The initial (1st) Wiltshire realism test showed an increased model sensitivity (-0.73). This was due to the absence of cost damping, which was included with the A303 Stonehenge model.

The 2nd realism test introduces cost damping consistent with A303 Stonehenge model (i.e. K = 30, α = 0.5 for each purpose). This resulted in an overall elasticity value which was less sensitive than the A303 Stonehenge model (-0.3). The change is predicted to be due to the different Transport Analysis Guidance (TAG) databook values used and the refinements within the Wiltshire region.

The final test, with parameter values utilised presented in the table, shows that the level of output elasticity is within the recommended values within TAG.

Table 8-2 – Realism Tests: Logit Parameters, cost damping and car fuel cost output elasticities

No.	Test	Logit Parameters	Cost Damping	EB	Work	Other	Total
-	*A303 Stonehenge*	*λ, θ Median*	*K=30, α=0.5*	*-0.21*	*-0.19*	*-0.54*	*-0.37*
1	Wiltshire model	*λ, θ Median*	*excluded*	-0.49	-0.31	-1.12	-0.73
2		*λ, θ Median*	*K=30, α=0.5*	-0.21	-0.15	-0.43	-0.30
3		*λ, θ Median*	K = Av dist α=0.5	-0.31	-0.19	-0.46	-0.34
4(final)		*λ, θ Median*	EB-K=20, α = 0.5 W-K =1, α =0.5 O-K= 30, α =0.5	**-0.16**	**-0.25**	**-0.43**	**-0.32**

The A303 Stonehenge model used TAG databook July 2016 v1.6 values, The Wiltshire model utilised May 2018 v1.10;

All Elasticities are presented for a 24 Hour Total, based on Distance Matrix skims (Note that elasticities calculated using network statistics show similar results but with marginally reduced sensitivity);

Median Parameter values for λ, θ are derived from TAG Unit M2;

K = Av dist (km) is derived from the validated base model

Table 8-3 – Realism Tests: Car fuel cost output elasticities by time period

Time Period	EB	Work	Other	Total
AM	-0.16	-0.21	-0.43	-0.28
IP	-0.16	-0.31	-0.44	-0.37
PM	-0.14	-0.26	-0.39	-0.30
OP	-0.30	-0.34	-0.52	-0.45
24-hour	-0.16	-0.25	-0.43	-0.32

All elasticities are presented for a 24-hour total, based on distance matrix skims (Note that elasticities calculated using public transport fare elasticity tests have not been presented, as no changes to public transport parameters and demand have been made against the A303 Stonehenge/SWRTM. Therefore it is assumed that the acceptability, with regard to public transport, is sufficient and no further calibration is required.

The VDM realism tests have produced elasticities which are broadly in-line with general expectations and experience. Therefore, the VDM model is considered suitable for preparing forecasts to use in the appraisal of schemes.

9. Summary

9.1. Overview

The cordon/screenline, link flow and journey time comparisons reported (Section 6.5), the VDM set-up and realism testing (Section 8) and the consistency of the model to retain the validation across the wider region (see Appendix C) demonstrate that the development work carried out for the Wiltshire 2018 base model has significantly improved the existing model within the AoDM (see Section 4.1) without compromising the wider integrity of the validated A303 Stonehenge / SWRTM models.

The results demonstrate that the traffic model has achieved the objectives discussed in Section 2.1 and is suitable, within the requirements of TAG, to be used to support the strategic appraisal of an infrastructure project or planning decision which is required to understand the impact on local roads or the SRN within Wiltshire and the AoDM.

The model is considered a suitable basis for generating highway traffic forecasts, consistent with DfT guidance and hence strategic assessment of highway mitigation measures and land developments.

9.2. Limitations of the model

This section describes the known model limitations. The recommended appropriate usage, in response to these limitations, is described in the next section.

9.2.1. Intervention limitations

The model has been developed to assess strategic highway schemes. it has not been specifically developed to analyse and assess the following types of transport schemes and improvements:

- Pedestrian/Cycle Improvements e.g. localised carriage widening, minor improvements to traffic signal operation, standalone pedestrian crossing, cycle improvements etc.
- Certain types of infrastructure schemes e.g. linked or vehicle actuated (MOVA) traffic signal improvements, shared space or other more complex infrastructure
- Public Transport (PT) schemes e.g. Bus, Rail, LRT or metrobus schemes
    - As the model is consistent with the RTM it doesn't include a full PT element, it does include an estimation of rail demand, but this is not a fully responsive element within the modelling set.
- Parking schemes e.g. changes to parking strategy or Park & Ride sites

In light of these limitations, Atkins recommend the following appropriate usage guidance.

9.3. Appropriate usage

It is recommended that the model could be used to assess schemes or developments of an "appropriate" scale or type. This "appropriateness" is difficult to quantify precisely, and it is expected that any scheme or development should be assessed based on a **proportionate** approach and the limitations of this (and any alternate) model need to be clearly communicated, through collaboration and discussion with decision makers or stakeholders. It is recommended that any decision maker, or user, seek Atkins' advice on how to effectively utilise the Wiltshire strategic model. The following considerations are recommended to assist in the decision-making process.

9.3.1. Peak period vs Peak hour

The model, as consistent with the A303 Stonehenge / SWRTM, utilises an average peak period, as opposed to a peak hour. This would be appropriate for economic or environmental outputs or for schemes which impact on the strategic road network, but is likely to result in an underprediction of peak hour delay at a local junction level.

A peak hour model is available which can be used to assess local junctions. This has been validated and is suitable for testing of localised issues. Whether to use the peak period or peak hour model will be based on the level of detail required for local impacts and in agreement with Wiltshire Council.

9.3.2. Geographic area

The model has been developed to strategically assess the highway impact across the AoDM.

For a scheme or development assessment within the Swindon urban area, Atkins recommend usage of the Swindon model to understand the impact within this region. For a scheme or development which lies outside of the Wiltshire boundary, Atkins recommend engagement with Highways England or the appropriate Highway Authority to determine the most appropriate model or assessment tool depending on the nature and location of the assessment.

For schemes within the Wiltshire Authority boundary the Wiltshire strategic model is considered the most appropriate initial tool, unless a more detailed model is already available.

For testing of junctions which are expected to be have an impact within Wiltshire only, the peak hour model is most appropriate. For wider impact assessment and schemes which require economic or environmental appraisal the peak period model is assumed to be the default version to utilise.

9.3.3. Scheme type

For a highway scheme of appropriate scale and type, the Wiltshire model is considered suitable for initial assessment. If the intervention to be assessed is of a type which the model has known limitations (such as: Pedestrian/Cycle Improvements, PT & Parking schemes) Atkins are able to provide advice on how to estimate/quantify the likely modal shift from vehicle trips or trip redistribution as a result of these types of intervention and calculate possible highway benefit and operational impact using the Wiltshire strategic model.

9.3.4. Donor model

The Wiltshire model is able to provide a strategic forecast and assessment of a highway intervention. For an analysis and assessment of local impacts, Atkins recommend that the strategic model act as a donor for a localised application. This may include developing, using the strategic model as an input (one, or more of) the following:

- A highway cordon of the SATURN model
- Use of bespoke local junction software e.g. LINSIG, ARCADY
- Development of a micro-simulation model (Paramics, VISSIM)

Depending on the purpose, nature and scale of the scheme or development to be assessed, Atkins advise that the strategic model is used in conjunction with local cordoned refinements or other software applications in order to meet the objectives of the assessment. It would be necessary to define an appropriate area of influence (which the strategic model could provide) with potential for localised recalibration and possible adjustments to reflect peak hour demand.

Appendices

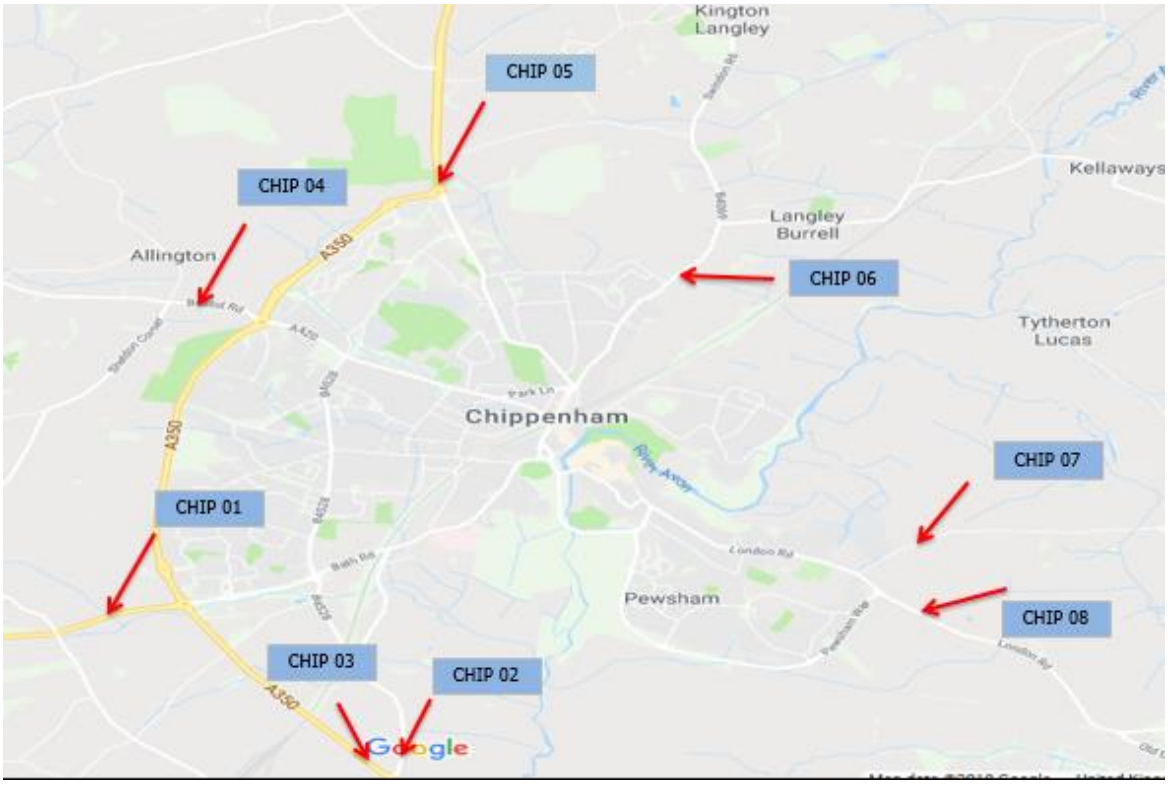
Appendix A. Abbreviations

AADT	Annual Average Daily Traffic	NTS	National Travel Survey
AAWT	Annual Average Weekday Traffic	OD	Origin-Destination
AM	Morning peak period	OGV1	Goods Vehicle – 2 or 3 axle rigid
ANPR	Automatic Number Plate Recognition	OGV2	Goods Vehicle – 4 axle rigid or 3+ axle articulated
AoDM	Area of Detailed Modelling	ONS	Office for National Statistics
ARN	Affected Road Network	OP	Off-peak period
ASR	Appraisal Specification Report	PA	Production-Attraction
ATC	Automatic Traffic Count	PCF	Project Control Framework
COBA	Cost Benefit Appraisal (software)	PCU	Passenger Car Unit
DF2	Design Fix 2 (Version No. of the Base SWRTM)	PM	Evening peak period
DfT	Department for Transport	PPK	Pence per kilometre
DM	Do Minimum	PPM	Pence per minute
DMRB	Design Manual for Roads and Bridges	RIS	Road Investment Strategy
DS	Do Something	RoF	Region of Focus (of the model)
EB	Eastbound	RSI	Roadside Interview
EB	Employer's Business	RTM	Regional Traffic Model
FMA	Fully Modelled Area	SB	Southbound
GEH	Statistic used to assess the quality of model validation	S2	Single two-lane carriageway
HBEB	Home Based Employer's Business	SATURN	Simulation and Assignment of Traffic to Urban Road Networks
HBO	Home Based Other	SOBC	Strategic Outline Business Case
HBW	Home Based Work	SRN	Strategic Road Network
HGV	Heavy Goods Vehicle	SWRTM	South West Regional Traffic Model
HOV	High Occupancy Vehicle	TAG	Traffic Appraisal Guidance
IAN	Interim Advice Note	TAME	Traffic Appraisal, Modelling and Economics
IP	Inter-peak period	TCG	Technical Consistency Group
Kph	kilometres per hour	TDCR	Traffic Data Collection Report
LGV	Light Goods Vehicle	TEMPro	Trip End Model Presentation Program
LMVR	Local Model Validation Report	TIS	Trip Information System
LSOA	Lower Layer Super Output Area	TRL	Transport Research Laboratory
MCC	Manual Classified Count	VDM	Variable Demand Model
MCTC	Manual Classified Turning Count	VOC	Vehicle Operating Cost
ME	Matrix Estimation	VoT	Value of Time
ME2	Matrix Estimation from Maximum Entropy	vph	Vehicles per hour
MPD	Mobile Phone Data	WB	Westbound
MSOA	Middle Layer Super Output Area	WebTAG	Web-based Transport Appraisal Guidance
MVR	Model Validation Report	WebTRIS	Highways England Traffic Information System
NB	Northbound		
NHBEB	Non-Home Based Employer's Business		
NHBO	Non-Home Based Other		
NTEM	National Trip End Model		

Appendix B. ANPR & ATC data cordons

The sections B.1 to B.9 are the analysis of the ANPR surveys conducted and Section B10 shows the period wise validation

B.1. Chippenham



Chippenham – ANPR Cordon

AM Peak

AVG FURNESSED	Bath Rd West	B4528 South	A350 South	Bristol Rd West	A350 North	B4069 NE	East	London Rd East	Chippenham	ATC
Bath Rd West	22	4	14	12	207	5	3	39	365	670
B4528 South	6	16	2	5	14	15	4	11	317	390
A350 South	11	1	3	34	282	1	0	1	181	513
Bristol Rd West	9	6	27	27	79	5	2	46	321	522
A350 North	151	29	213	82	52	6	1	95	728	1356
B4069 NE	9	26	1	9	7	26	1	17	234	330
East	7	4	0	2	1	1	20	25	49	109
London Rd East	50	13	2	43	94	13	28	70	463	774
Chippenham	363	277	85	300	742	212	79	470		2528
ATC	627	376	347	513	1478	284	137	773	2658	7193

Inter Peak

AVG FURNESSED	Bath Rd West	B4528 South	A350 South	Bristol Rd West	A350 North	B4069 NE	East	London Rd East	Chippenham	ATC
Bath Rd West	37	7	12	15	121	4	1	36	343	575
B4528 South	6	17	2	4	10	12	1	13	247	312
A350 South	18	2	9	32	215	2	0	2	118	399
Bristol Rd West	10	5	30	36	89	6	1	32	277	487
A350 North	120	20	201	65	58	5	1	75	538	1085
B4069 NE	7	11	1	4	5	18	1	13	166	225
East	4	1	0	2	2	1	10	12	42	75
London Rd East	38	11	4	40	76	8	11	44	381	613
Chippenham	328	248	134	276	522	165	36	387		2096
ATC	569	322	394	473	1100	222	63	613	2112	5867

PM Peak

AVG FURNESSED	Bath Rd West	B4528 South	A350 South	Bristol Rd West	A350 North	B4069 NE	East	London Rd East	Chippenham	ATC
Bath Rd West	44	3	15	6	191	8	4	43	394	706
B4528 South	6	14	2	4	13	17	2	12	305	375
A350 South	16	1	5	30	220	0	0	1	109	382
Bristol Rd West	7	6	25	23	75	6	4	48	325	520
A350 North	180	46	247	89	59	10	2	87	835	1556
B4069 NE	7	15	1	3	4	22	1	11	193	257
East	5	0	0	2	1	0	7	16	61	91
London Rd East	45	9	1	49	80	10	16	46	539	795
Chippenham	428	334	174	315	696	234	41	531		2754
ATC	738	428	470	520	1340	307	78	795	2761	7437

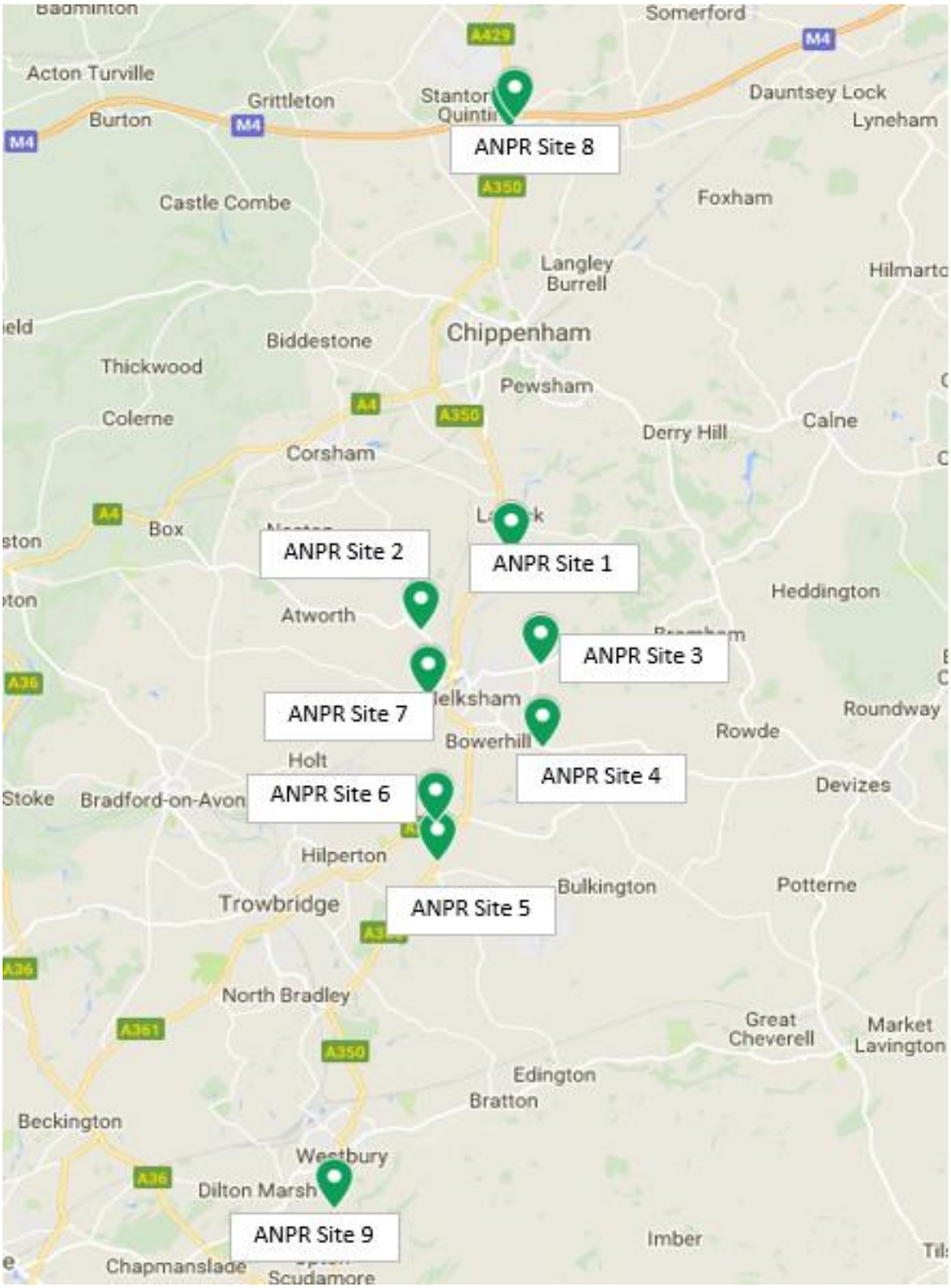
B.2. Corsham

AM Peak	A4 Bath Rd (West)	B3109 Bradford Rd	A4 Bath Rd (East)	Lacock Rd	B3353 Silver St	Corsham	ATC
A4 Bath Rd (West)	10	8	164	12	4	136	334
B3109 Bradford Rd	4	5	100	5	2	86	202
A4 Bath Rd (East)	130	112	27	10	12	394	686
Lacock Rd	12	7	4	5	4	68	99
B3353 Silver St	9	4	14	4	22	226	280
Corsham	169	73	376	90	168		877
ATC	334	210	685	127	212	910	2478

Inter Peak	A4 Bath Rd (West)	B3109 Bradford Rd	A4 Bath Rd (East)	Lacock Rd	B3353 Silver St	Corsham	ATC
A4 Bath Rd (West)	8	3	134	9	6	122	282
B3109 Bradford Rd	4	7	84	4	2	76	178
A4 Bath Rd (East)	106	99	17	8	15	352	596
Lacock Rd	8	5	2	2	2	54	73
B3353 Silver St	7	3	9	2	16	164	200
Corsham	143	70	365	58	167		803
ATC	276	187	611	83	208	767	2132

PM Peak	A4 Bath Rd (West)	B3109 Bradford Rd	A4 Bath Rd (East)	Lacock Rd	B3353 Silver St	Corsham	ATC
A4 Bath Rd (West)	10	11	172	22	7	164	385
B3109 Bradford Rd	4	6	99	7	5	83	203
A4 Bath Rd (East)	157	134	27	4	18	439	778
Lacock Rd	15	6	2	5	5	78	111
B3353 Silver St	5	4	11	3	23	178	224
Corsham	156	74	378	94	207		909
ATC	347	235	689	134	265	941	2611

B.3. Melksham


ANPR Site 8
ANPR Site 2
ANPR Site 1
ANPR Site 3
ANPR Site 7
ANPR Site 4
ANPR Site 6
ANPR Site 5
ANPR Site 9
Somerford
Acton Turville
Grittleton
Burton
Dauntsey Lock
Lyneham
Castle Combe
Foxham
Langley Burrell
Chippenham
Biddestone
Thickwood
Pewsham
Colerne
Corsham
Derry Hill
Calne
Box
Atworth
Heddington
Melksham
Roundway
Rowde
Bowerhill
Holt
Stoke
Bradford-on-Avon
Devizes
Hilperton
Bulkington
Potterne
Trowbridge
North Bradley
Great Cheverell
Market Lavington
Edington
Bratton
Beckington
Westbury
Dilton Marsh
Imber
Chapmanslade
Scudamore

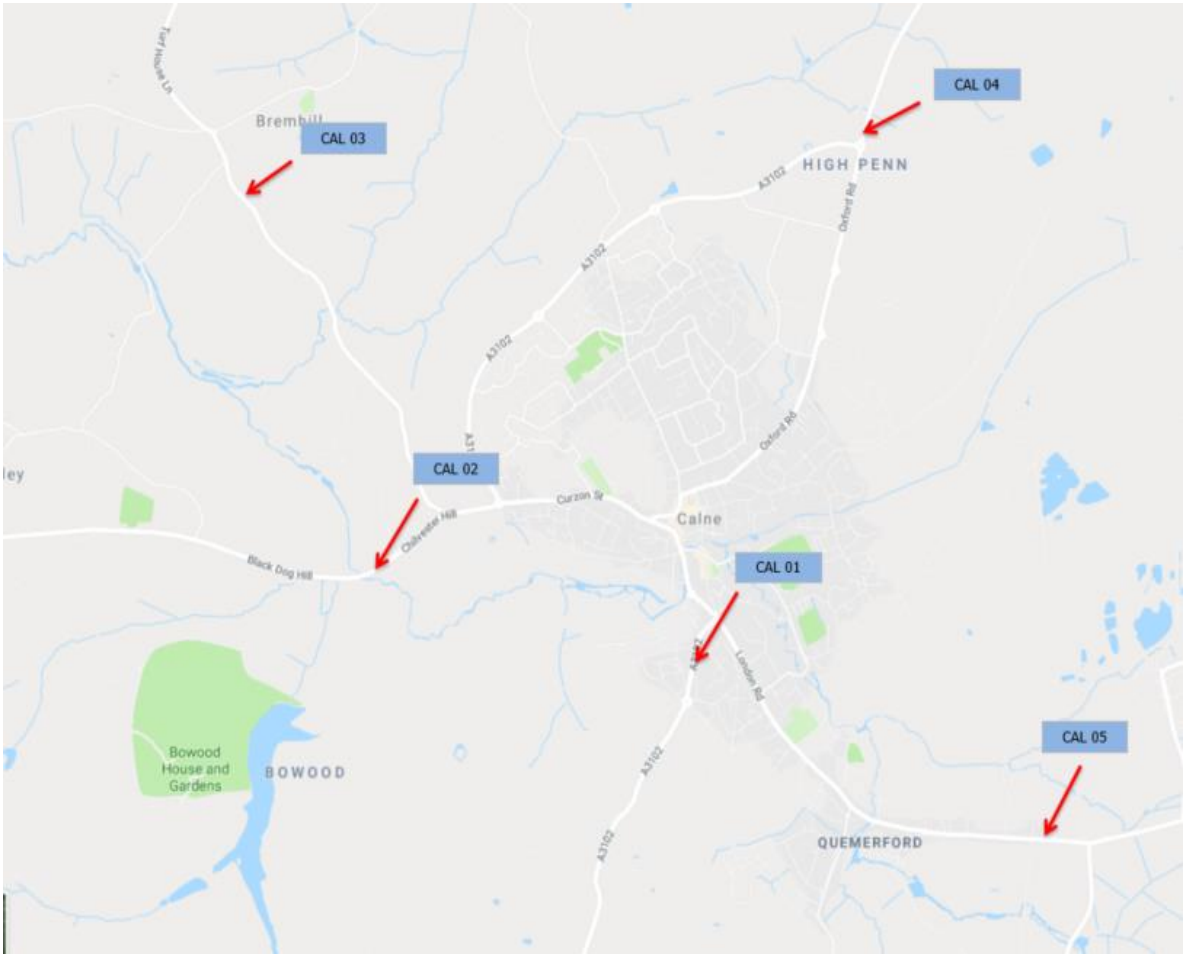
Melksham - ANPR Cordon (2017)

AM Peak	MELK 01	MELK 02	MELK 03	MELK 04	MELK 05	MELK 06	MELK 07	Inbound	ATC
MELK 01	6	4	2	17	19	54	42	655	800
MELK 02	3	18	12	68	10	17	18	311	458
MELK 03	1	11	14	3	12	41	26	212	322
MELK 04	6	77	5	12	2	3	30	234	369
MELK 05	14	38	42	4	3	7	3	506	616
MELK 06	14	24	43	5	4	18	3	551	662
MELK 07	15	12	22	22	1	1	8	156	236
Outbound	538	352	239	218	429	411	152		2338
Tot	597	535	379	350	481	552	283	2625	5802
ATC	671	543	335	595	626	592	253		

IP	MELK 01	MELK 02	MELK 03	MELK 04	MELK 05	MELK 06	MELK 07	Inbound	Tot Counts
MELK 01	5	5	4	12	19	23	14	458	539
MELK 02	6	23	9	46	16	18	12	283	413
MELK 03	2	11	12	3	19	27	17	171	260
MELK 04	11	48	5	13	2	5	19	205	308
MELK 05	11	12	13	2	5	6	2	369	420
MELK 06	21	15	26	4	5	15	2	365	453
MELK 07	16	14	11	16	3	4	10	151	224
Outbound	447	258	154	178	364	357	136		1893
Tot	519	386	234	273	432	455	212	2000	4510
ATC	641	425	276	482	525	454	219		

PM Peak	MELK 01	MELK 02	MELK 03	MELK 04	MELK 05	MELK 06	MELK 07	Inbound	Tot Counts
MELK 01	6	2	5	21	27	27	20	525	633
MELK 02	6	23	14	73	30	25	15	384	570
MELK 03	2	10	20	8	46	51	30	299	466
MELK 04	17	64	6	11	2	7	30	292	429
MELK 05	12	13	15	1	7	4	2	495	550
MELK 06	41	19	46	3	8	21	2	484	624
MELK 07	27	13	26	21	1	1	8	174	270
Outbound	666	303	230	191	510	571	188		2659
Tot	777	448	362	328	631	707	295	2652	6201

B.4. Calne


CAL 04
CAL 03
HIGH PENN
CAL 02
Calne
CAL 01
CAL 05
Bowood House and Gardens
BOWOOD
QUEMERFORD
A3102
Oxford Rd
Curzon St
Black Dog Hill
London Rd

Calne - ANPR Cordon

AM Peak	A3102 Silver St	A4 Black Dog Hill	Turf Horse Ln	A3102 Oxford Rd	A4 Quemerford	Calne	ATC
A3102 Silver St	13	8	1	36	65	140	263
A4 Black Dog Hill	7	29	5	103	108	335	587
Turf Horse Ln	2	3	3	0	8	24	40
A3102 Oxford Rd	31	78	2	25	16	204	354
A4 Quemerford	33	83	9	18	22	162	327
Calne	180	549	34	308	365		1436
ATC	266	750	53	490	583	865	3007

Inter Peak	A3102 Silver St	A4 Black Dog Hill	Turf Horse Ln	A3102 Oxford Rd	A4 Quemerford	Calne	ATC
A3102 Silver St	10	9	1	21	38	115	194
A4 Black Dog Hill	8	33	4	58	80	319	502
Turf Horse Ln	1	4	1	1	6	22	35
A3102 Oxford Rd	31	65	1	25	18	184	322
A4 Quemerford	37	91	8	16	18	217	387
Calne	105	298	16	163	194		776
ATC	192	499	31	285	353	858	2218

PM Peak	A3102 Silver St	A4 Black Dog Hill	Turf Horse Ln	A3102 Oxford Rd	A4 Quemerford	Calne	ATC
A3102 Silver St	6	5	2	28	39	187	268
A4 Black Dog Hill	6	26	5	79	81	493	689
Turf Horse Ln	2	5	3	1	10	39	60
A3102 Oxford Rd	43	118	0	37	15	366	579
A4 Quemerford	71	118	7	13	16	351	577
Calne	137	388	24	203	191		943
ATC	265	661	41	362	352	1435	3116

B.5. Devizes


DEV 01
DEV 05
DEV 04
DEV 03
DEV 02
Devizes
HARTMOOR
LITTLE COATE

Devizes - ANPR Cordon

AM Peak	A361 London Rd	A432 Nursteed Rd	A360 Potterne Rd	A361 Bath Rd	A432 Dunkirk Hill	Devizes	ATC
A361 London Rd	58	80	85	120	27	391	761
A432 Nursteed Rd	88	15	6	52	30	155	347
A360 Potterne Rd	123	10	19	21	29	239	441
A361 Bath Rd	157	57	12	17	4	291	539
A432 Dunkirk Hill	24	37	19	5	7	173	265
Devizes	542	186	151	245	146		1271
ATC	993	385	292	460	244	1249	3623

Inter Peak	A361 London Rd	A432 Nursteed Rd	A360 Potterne Rd	A361 Bath Rd	A432 Dunkirk Hill	Devizes	ATC
A361 London Rd	69	68	78	124	28	453	820
A432 Nursteed Rd	68	12	9	43	28	147	308
A360 Potterne Rd	77	7	20	19	21	170	313
A361 Bath Rd	110	40	15	23	8	247	444
A432 Dunkirk Hill	25	21	20	7	12	137	221
Devizes	426	134	166	256	146		1128
ATC	775	283	308	472	243	1153	3234

PM Peak	A361 London Rd	A432 Nursteed Rd	A360 Potterne Rd	A361 Bath Rd	A432 Dunkirk Hill	Devizes	ATC
A361 London Rd	44	72	120	155	24	591	1006
A432 Nursteed Rd	81	11	13	66	49	209	430
A360 Potterne Rd	85	6	19	16	24	194	344
A361 Bath Rd	109	46	20	20	6	303	505
A432 Dunkirk Hill	19	28	27	5	10	169	260
Devizes	380	153	206	321	173		1233
ATC	719	316	405	584	286	1467	3777

B.6. Trowbridge

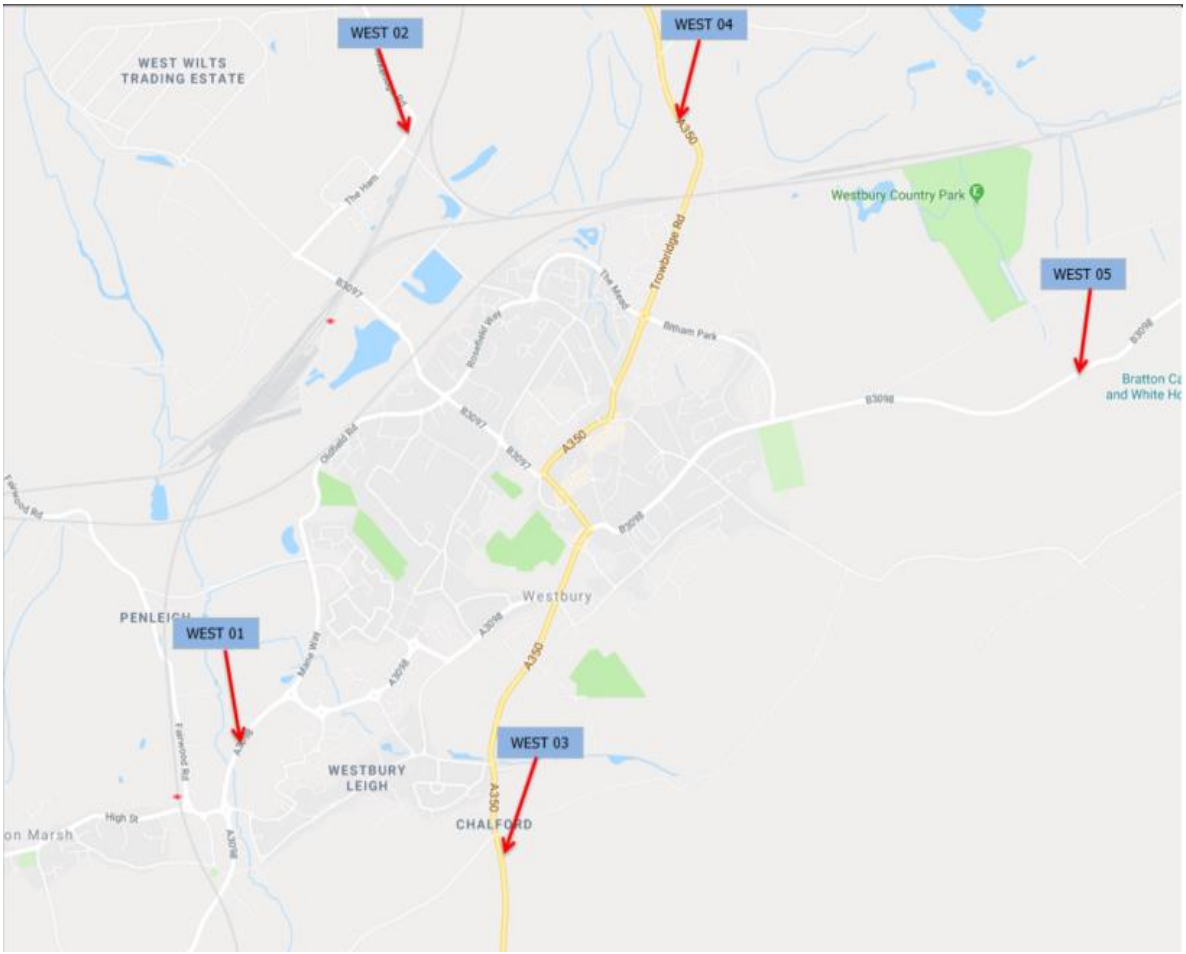
Trowbridge - ANPR Cordon

AM Peak	A366 Wingfield Rd	A363 Cockhill	A361 Frome Rd	B3106 Hammond Way	A361 nr Semington	A363 Bradley Rd	West Ashton Rd	Trowbridge	ATC
A366 Wingfield Rd	9	8	4	4	22	10	2	191	250
A363 Cockhill	5	16	7	3	16	92	4	210	352
A361 Frome Rd	5	14	32	9	16	14	2	297	390
B3106 Hammond Way	5	6	10	19	15	18	23	273	369
A361 nr Semington	22	15	13	18	26	9	5	495	603
A363 Bradley Rd	8	72	15	8	7	36	3	432	579
West Ashton Rd	6	10	5	42	9	12	25	291	399
Trowbridge	232	275	317	360	550	554	262		2549
ATC	290	416	402	463	661	745	326	2188	5491

Inter Peak	A366 Wingfield Rd	A363 Cockhill	A361 Frome Rd	B3106 Hammond Way	A361 nr Semington	A363 Bradley Rd	West Ashton Rd	Trowbridge	ATC
A366 Wingfield Rd	10	6	4	3	16	11	1	151	202
A363 Cockhill	5	25	9	6	15	61	3	232	357
A361 Frome Rd	4	9	29	7	14	20	1	253	337
B3106 Hammond Way	4	5	6	28	11	14	39	266	373
A361 nr Semington	14	14	12	13	30	11	13	416	523
A363 Bradley Rd	12	63	16	10	8	47	3	620	780
West Ashton Rd	3	3	3	27	8	10	46	254	353
Trowbridge	144	238	249	257	392	764	221		2264
ATC	195	364	328	352	494	938	327	2192	5190

PM Peak	A366 Wingfield Rd	A363 Cockhill	A361 Frome Rd	B3106 Hammond Way	A361 nr Semington	A363 Bradley Rd	West Ashton Rd	Trowbridge	ATC
A366 Wingfield Rd	7	5	6	5	23	12	8	272	339
A363 Cockhill	4	19	12	4	13	76	8	281	418
A361 Frome Rd	2	9	26	10	20	22	4	338	430
B3106 Hammond Way	4	4	10	18	14	19	46	404	518
A361 nr Semington	23	17	15	15	25	13	10	666	784
A363 Bradley Rd	9	91	17	16	11	52	7	710	914
West Ashton Rd	2	6	4	31	7	8	35	390	484
Trowbridge	178	255	329	283	492	712	313		2563
ATC	231	405	420	381	607	914	431	3061	6450

B.7. Westbury


WEST 02
WEST 04
WEST 05
WEST 01
WEST 03
WEST WILTS TRADING ESTATE
Westbury Country Park
Trowbridge Rd
A350
Westbury
PENLEIGH
WESTBURY LEIGH
CHALFORD
B3098
B3097

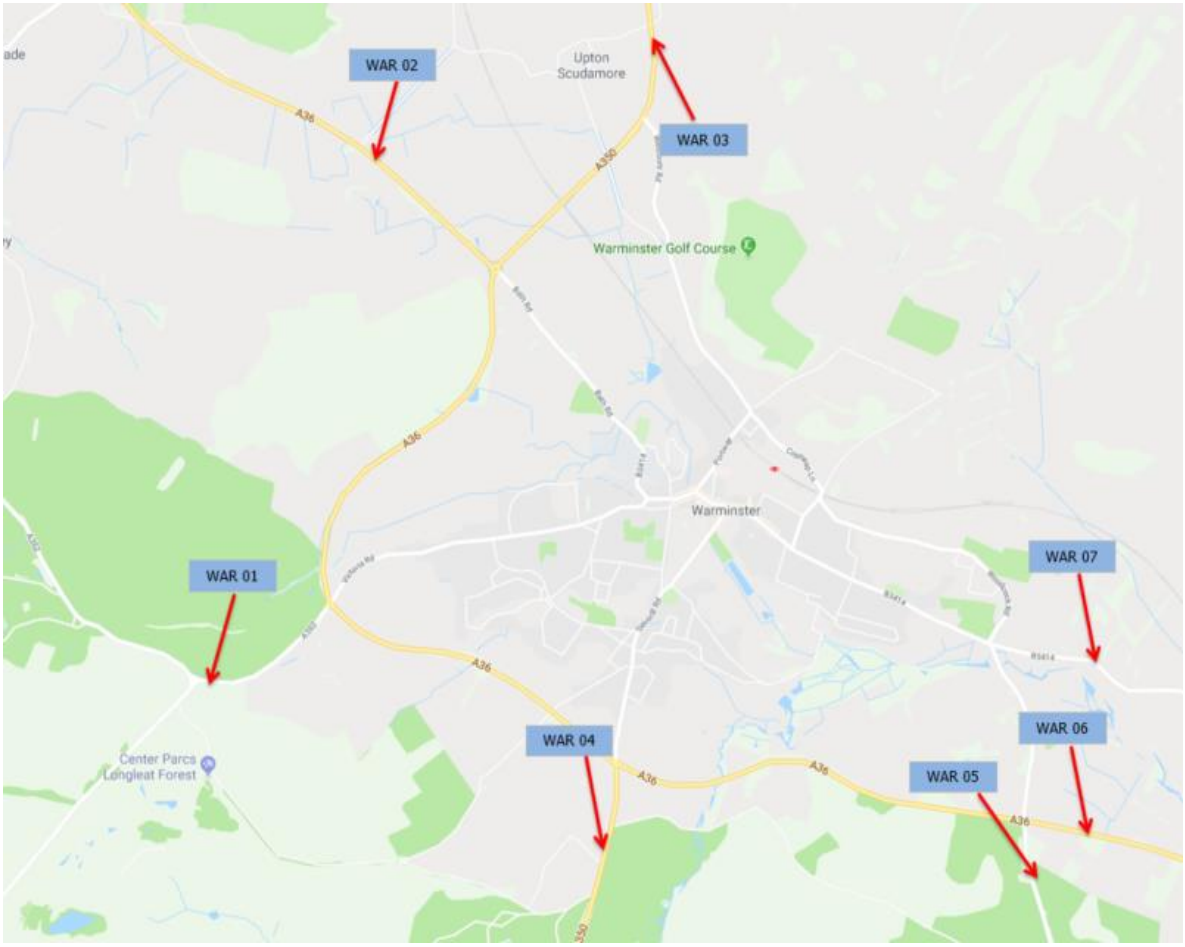
Westbury - ANPR Cordon

AM Peak	A3098 Mane Way	The Ham	A350 Warminster Rd	A350 Trowbridge Rd	B3098 Bratton Rd	Westbury	ATC
A3098 Mane Way	28	42	18	18	31	219	356
The Ham	22	13	44	2	2	134	217
A350 Warminster Rd	11	61	22	214	63	264	635
A350 Trowbridge Rd	14	2	296	18	12	178	520
B3098 Bratton Rd	26	3	56	9	10	83	187
Westbury	253	231	387	248	117		1237
ATC	354	352	824	509	236	877	3152

Inter Peak	A3098 Mane Way	The Ham	A350 Warminster Rd	A350 Trowbridge Rd	B3098 Bratton Rd	Westbury	ATC
A3098 Mane Way	30	31	10	21	13	162	267
The Ham	28	19	36	4	1	144	232
A350 Warminster Rd	12	47	21	257	24	280	641
A350 Trowbridge Rd	14	4	231	26	10	218	504
B3098 Bratton Rd	21	2	40	13	5	73	156
Westbury	163	103	251	185	101		804
ATC	269	207	590	505	155	876	2602

PM Peak	A3098 Mane Way	The Ham	A350 Warminster Rd	A350 Trowbridge Rd	B3098 Bratton Rd	Westbury	ATC
A3098 Mane Way	53	30	10	19	19	249	379
The Ham	56	27	69	5	3	234	394
A350 Warminster Rd	20	66	19	297	52	326	779
A350 Trowbridge Rd	28	4	248	22	15	284	602
B3098 Bratton Rd	37	4	54	12	9	112	228
Westbury	208	112	265	147	124		856
ATC	400	243	665	502	222	1205	3238

B.8. Warminster



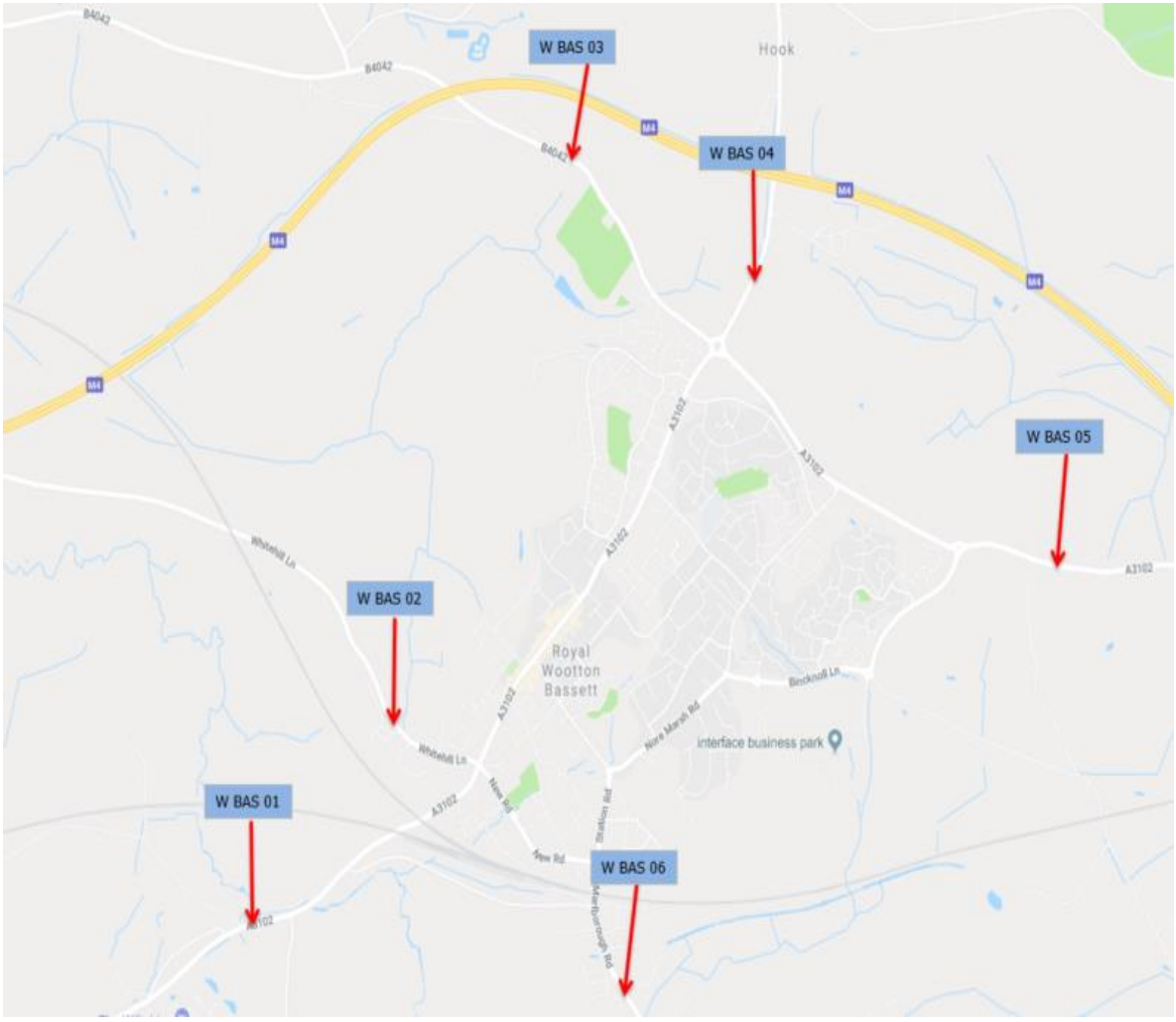
Warminster - ANPR Cordon

AM Peak	A362 nr Longleat	A36 NW Warminster	A350 N Warminster	A350 S Warminster	BishopsWAR Rd	A36 SE Warminster	B3414 Boreham Rd	Warminster	ATC
A362 nr Longleat Forest	12	16	27	40	1	189	3	138	426
A36 NW Warminster	31	16	17	91	2	183	9	202	550
A350 N Warminster	76	35	52	129	10	76	47	408	833
A350 S Warminster	40	128	101	9	0	14	2	135	430
BishopsWAR Rd	2	5	11	1	7	0	2	62	90
A36 SE Warminster	87	163	57	13	0	2	1	61	384
B3414 Boreham Rd	2	4	19	1	3	0	10	150	189
Warminster	195	248	356	167	53	149	147		1316
ATC	444	616	639	451	77	614	221	1157	4219

Inter Peak	A362 nr Longleat Forest	A36 NW Warminster	A350 N Warminster	A350 S Warminster	BishopsWAR Rd	A36 SE Warminster	B3414 Boreham Rd	Warminster	ATC
A362 nr Longleat Forest	14	24	49	44	1	121	3	176	432
A36 NW Warminster	32	14	22	133	5	154	9	186	555
A350 N Warminster	45	20	40	111	7	50	26	313	611
A350 S Warminster	52	112	113	13	2	12	2	175	482
BishopsWAR Rd	1	3	8	1	6	0	2	52	74
A36 SE Warminster	135	166	59	18	0	4	2	78	462
B3414 Boreham Rd	2	6	25	2	3	1	10	119	167
Warminster	156	159	324	181	51	88	120		1079
ATC	437	504	641	504	75	429	174	1099	3863

PM Peak	A362 nr Longleat Forest	A36 NW Warminster	A350 N Warminster	A350 S Warminster	BishopsWAR Rd	A36 SE Warminster	B3414 Boreham Rd	Warminster	ATC
A362 nr Longleat Forest	11	35	74	55	2	118	3	216	514
A36 NW Warminster	17	12	26	147	5	164	11	274	654
A350 N Warminster	33	20	35	118	8	52	22	406	694
A350 S Warminster	46	100	125	14	1	10	3	175	476
BishopsWAR Rd	1	3	7	0	7	0	2	55	76
A36 SE Warminster	185	193	78	18	0	2	1	139	615
B3414 Boreham Rd	2	7	42	1	2	0	9	172	235
Warminster	161	201	387	169	63	68	150		1199
ATC	456	571	773	522	90	414	201	1436	4463

B.9. Royal Wotton Bassett



RWB - ANPR Cordon

AM Peak	A3102 Hunts Mill Rd	Whitehill Lane	B4042 Malmesbury Rd	B4042 N of Wotton Bassett	A3102 Swindon Rd	Marlborough Rd	Wotton Bassett	ATC
A3102 Hunts Mill Rd	14	4	41	80	198	10	119	465
Whitehill Lane	2	4	1	1	4	8	21	42
B4042 Malmesbury Rd	27	0	15	63	219	30	126	481
B4042 N of Wotton Bassett	85	0	51	39	68	32	195	471
A3102 Swindon Rd	127	9	174	34	34	26	323	727
Marlborough Rd	9	4	20	16	52	14	79	193
Wotton Bassett	132	25	137	186	569	114	0	1162
ATC	395	46	440	419	1144	234	863	3541

Inter Peak	A3102 Hunts Mill Rd	Whitehill Lane	B4042 Malmesbury Rd	B4042 N of Wotton Bassett	A3102 Swindon Rd	Marlborough Rd	Wotton Bassett	ATC
A3102 Hunts Mill Rd	14	3	25	47	145	8	115	357
Whitehill Lane	3	4	1	1	7	2	16	34
B4042 Malmesbury Rd	26	1	14	32	149	16	107	346
B4042 N of Wotton Bassett	43	1	29	27	51	17	143	312
A3102 Swindon Rd	142	6	159	48	55	39	377	826
Marlborough Rd	9	2	14	18	32	10	70	157
Wotton Bassett	105	16	94	140	350	69	0	773
ATC	342	34	337	313	788	162	829	2805

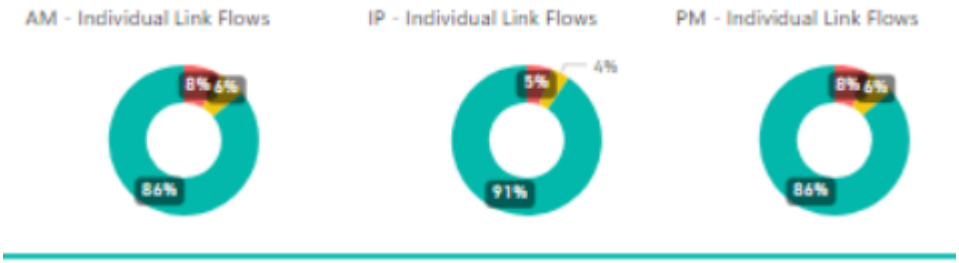
PM Peak	A3102 Hunts Mill Rd	Whitehill Lane	B4042 Malmesbury Rd	B4042 N of Wotton Bassett	A3102 Swindon Rd	Marlborough Rd	Wotton Bassett	ATC
A3102 Hunts Mill Rd	12	1	25	77	145	7	149	416
Whitehill Lane	1	4	1	2	11	6	23	49
B4042 Malmesbury Rd	62	6	18	50	184	24	183	527
B4042 N of Wotton Bassett	92	1	55	27	45	15	229	463
A3102 Swindon Rd	224	4	260	77	47	52	622	1285
Marlborough Rd	10	6	24	19	27	11	104	201
Wotton Bassett	142	20	115	206	384	69	0	936
ATC	543	42	498	458	843	183	1311	3878

Appendix C. Summary Checks in the South West Region

C.1. Individual link flow validation for all sites in south west

Note that there are a total of 1833 traffic count sites included within the SW region (including the AoDM). The link flow validation achieves a very good proportion and demonstrates that the wider model has retained the integrity of the A303 Stonehenge / SWRTM models.

Figure C-1 - Individual Link Flow Validation, South West



C.2. Screenline flow checks outside the AoDM

The table below shows the output of eight screenlines from the wider region, outside the AoDM. This shows the observed, A303 Stonehenge model and Wiltshire model across all time periods. A description of the screenlines is found in the associated model validation reports.

It shows that there is no notable variation between the A303 Stonehenge and Wiltshire modelled flows.

Table C-1 - Screenline Comparison Outside AoDM, Total Vehicle flows

Screenline	Dir	AM				IP				PM			
		Obs	Wiltshire Model Flows	A303 Model Flows	% Diff	Obs	Wiltshire Model Flows	A303 Model Flows	% Diff	Obs	Wiltshire Model Flows	A303 Model Flows	% Diff
Athelney to Newbury	NB	5341	5471	5367	2%	4737	4762	4740	0%	5863	5875	5827	1%
	SB	5742	6174	5728	8%	4478	4710	4483	5%	5644	5745	5680	1%
Boscastle to West Looe	EB	2035	1961	2044	-4%	2262	2211	2270	-3%	2195	2172	2204	-1%
	WB	2080	2049	2088	-2%	2149	2112	2159	-2%	2266	2223	2271	-2%
Holsworthy to Exmoor	NB	1064	1034	1116	-7%	984	976	1000	-2%	1196	1103	1281	-14%
	SB	1141	1192	1150	4%	1049	1038	1069	-3%	1060	984	1179	-17%
Midlands – South West	NB	11511	11343	11583	-2%	11353	10899	11459	-5%	14109	13821	14115	-2%
	SB	13233	13214	13324	-1%	10713	10343	10840	-5%	12644	12526	12910	-3%
Nether Stowey to Lyme Regis	EB	5520	5420	5522	-2%	5689	5641	5675	-1%	6210	6200	6201	0%
	WB	5980	5972	5900	1%	5260	5273	5222	1%	5970	5985	5967	0%
New Forest	NB	5414	4791	4987	-4%	4087	3903	4082	-4%	4757	4356	4731	-8%
	SB	4914	4446	4097	9%	4105	3986	4105	-3%	5747	5699	5756	-1%
Penzance	EB	1224	1243	1224	2%	1384	1406	1384	2%	1345	1373	1348	2%
	WB	1252	1265	1251	1%	1370	1390	1370	1%	1447	1476	1451	2%
South East Boundary	EB	15777	15982	15631	2%	11303	11394	11373	0%	12351	12288	12303	0%
	WB	11390	11618	11509	1%	11710	12059	11817	2%	16125	16516	16068	3%

Appendix D. Full Simulation vs Buffer Output Summary

Prior to model development, a test was done using the disaggregated Stonehenge A303 prior matrix model and an early version of the refined network to understand the relative impact of fully simulating the model vs converting the model to buffer outside of the AoDM. This was primarily undertaken to reduce model run time and improve model convergence.

A cordon of the model was considered, but a decision was made to include the full network extents to ensure that long distance trips, through the AoDM, would be retained.

Below is a comparison output from each model variant. This demonstrates that there is relatively minimal change in the global statistics but that the model run time and convergence levels suggest that for sensitivity testing and forecasting that the simulation-buffer model is the recommended model to use for future iterations.

Table D-1 – AM Buffer vs Full Simulation, Model Development, Summary Stats

Statistics	AoDM Simulation & Outside Buffer	Full Simulation
Run Times (mins)	6	23
Total Assigned Trips (pcus)	1,816,107	1,816,107
Link Cruise Time (pcu-hrs)	1,343,927	1,350,002
Transient Queued Time (pcu-hrs)	18,977	22,450
Overcapacity Queued Time (pcu-hrs)	14,998	17,020
Total Travel Time (pcu-hrs)	1,377,902	1,389,472
Travel Distance (pcu-kms)	95,748,240	95,836,336
Average Journey Speed (kph)	69.5	69
Convergence	11	23
%GAP	0.003	0.011
%flows	99.3	98

Note this information is not the validated model, shows an early test version

Table D-2 – IP Buffer vs Full Simulation, Model Development, Summary Stats

Statistics	AoDM Simulation & Outside AoDM Buffer	Full Simulation
Run Times (mins)	5	11
Total Assigned Trips (pcus)	1,390,915	1,390,916
Link Cruise Time (pcu-hrs)	992,343	962,163
Transient Queued Time (pcu-hrs)	8,649	13,469
Overcapacity Queued Time (pcu-hrs)	1,744	3,027
Total Travel Time (pcu-hrs)	1,002,736	978,659
Travel Distance (pcu-kms)	72,938,656	72,972,640
Average Journey Speed (kph)	72.7	74.6
Convergence	11	16
%GAP	0	0.004
%flows	99.1	98.5

Table D-3 – PM Buffer vs Full Simulation, Model Development, Summary Stats

Statistics	AoDM Simulation & Outside AoDM Buffer	Full Simulation
Run Times (mins)	6	20
Total Assigned Trips (pcus)	1,855,971	1,855,971
Link Cruise Time (pcu-hrs)	1,271,859	1,289,368
Transient Queued Time (pcu-hrs)	18,821	22,965
Overcapacity Queued Time (pcu-hrs)	17,439	20,151
Total Travel Time (pcu-hrs)	1,308,119	1,332,483
Travel Distance (pcu-kms)	92,261,992	92,404,184
Average Journey Speed (kph)	70.5	69.3
Convergence	11	22
%GAP	0.002	0.008
%flows	99	98.3

Appendix E. Changes due to ME2

E.1. Post ME2 vs Prior: Zonal Trip Ends

Figure E-1 - AM Origin Trip Ends All Vehicles

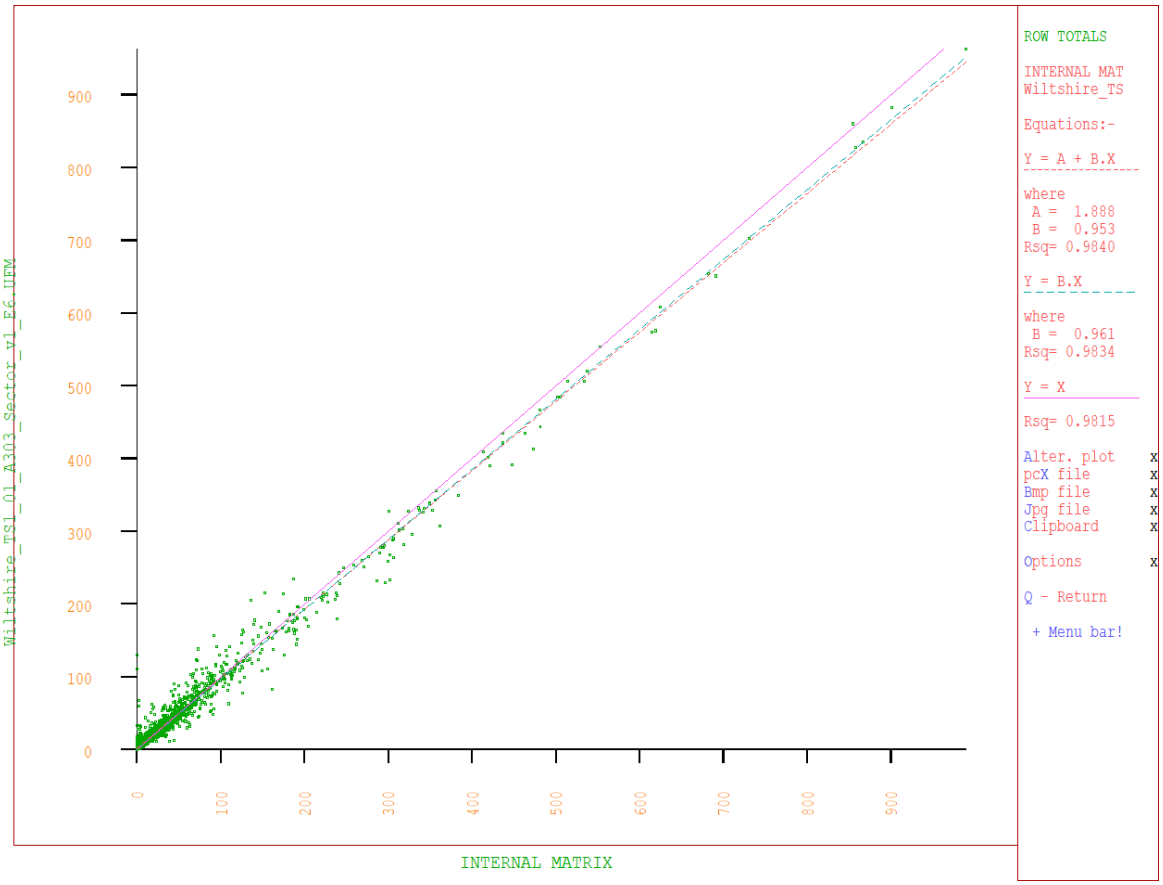


Figure E-2 - AM Destination Trip ends All Vehicles

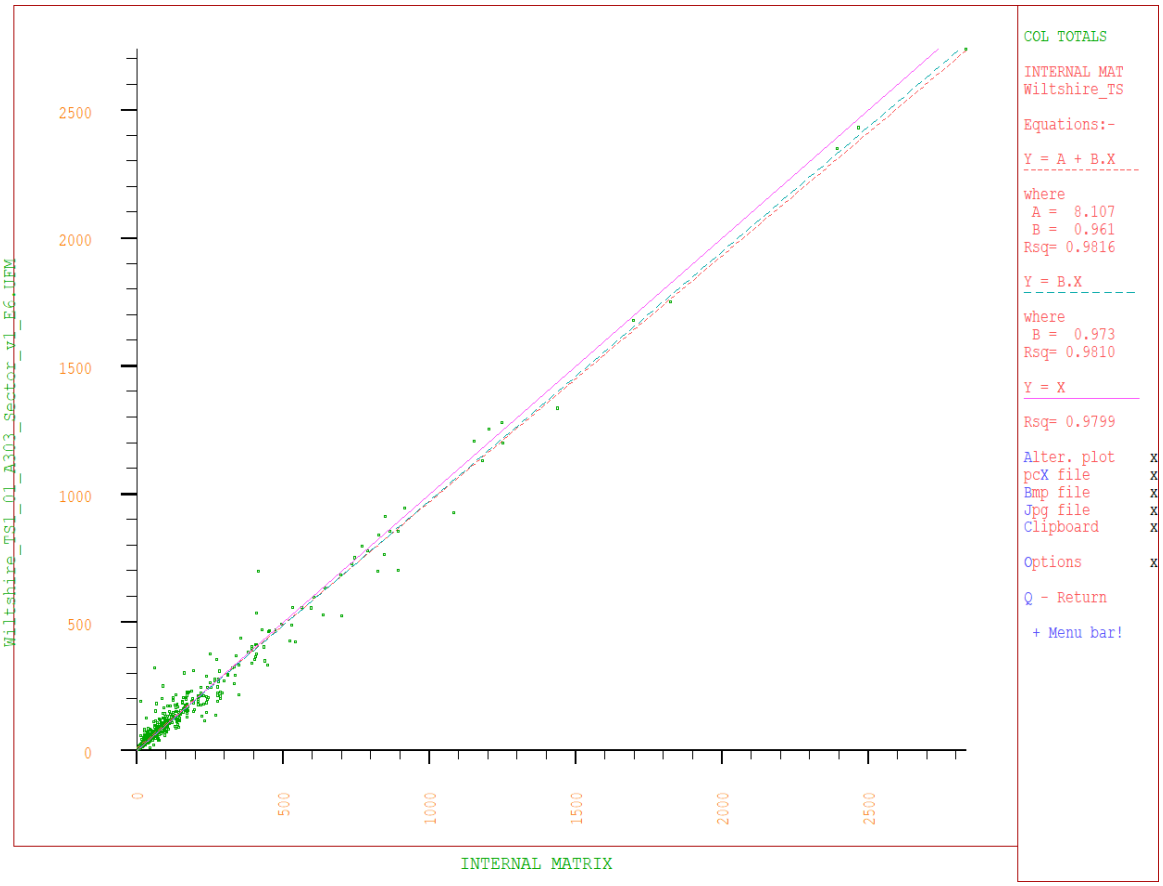


Figure E-3 - IP Origin Trip Ends All Vehicles

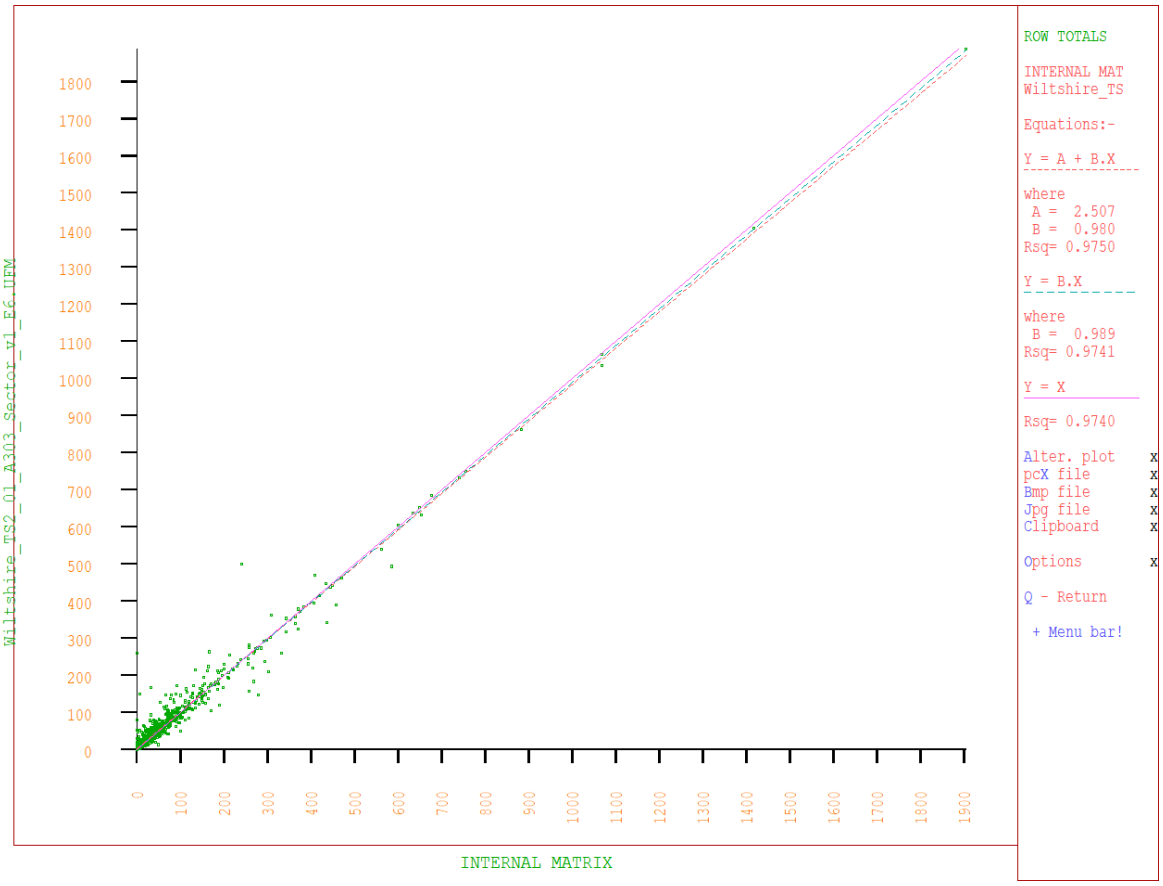


Figure E-4 - IP Destination Trip Ends All Vehicles

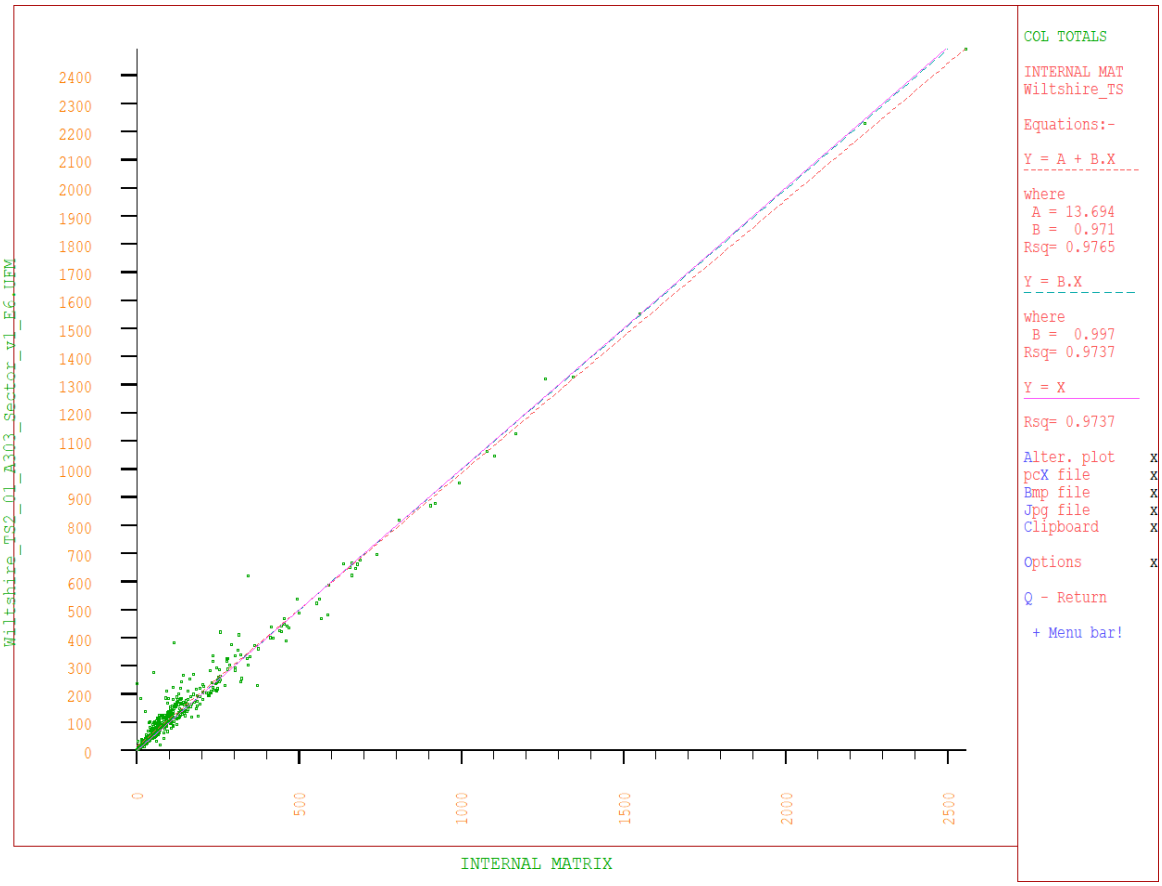


Figure E-5 - PM Origin Trip Ends All Vehicles

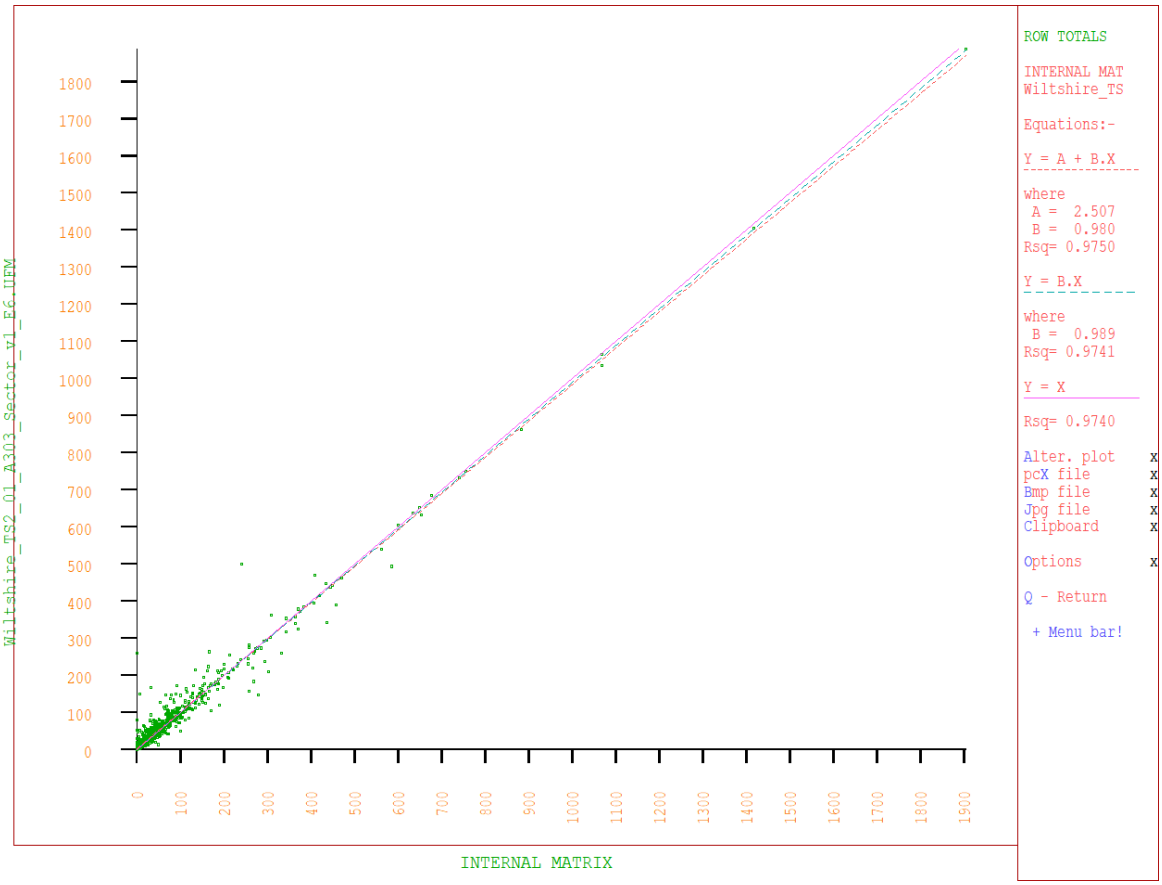
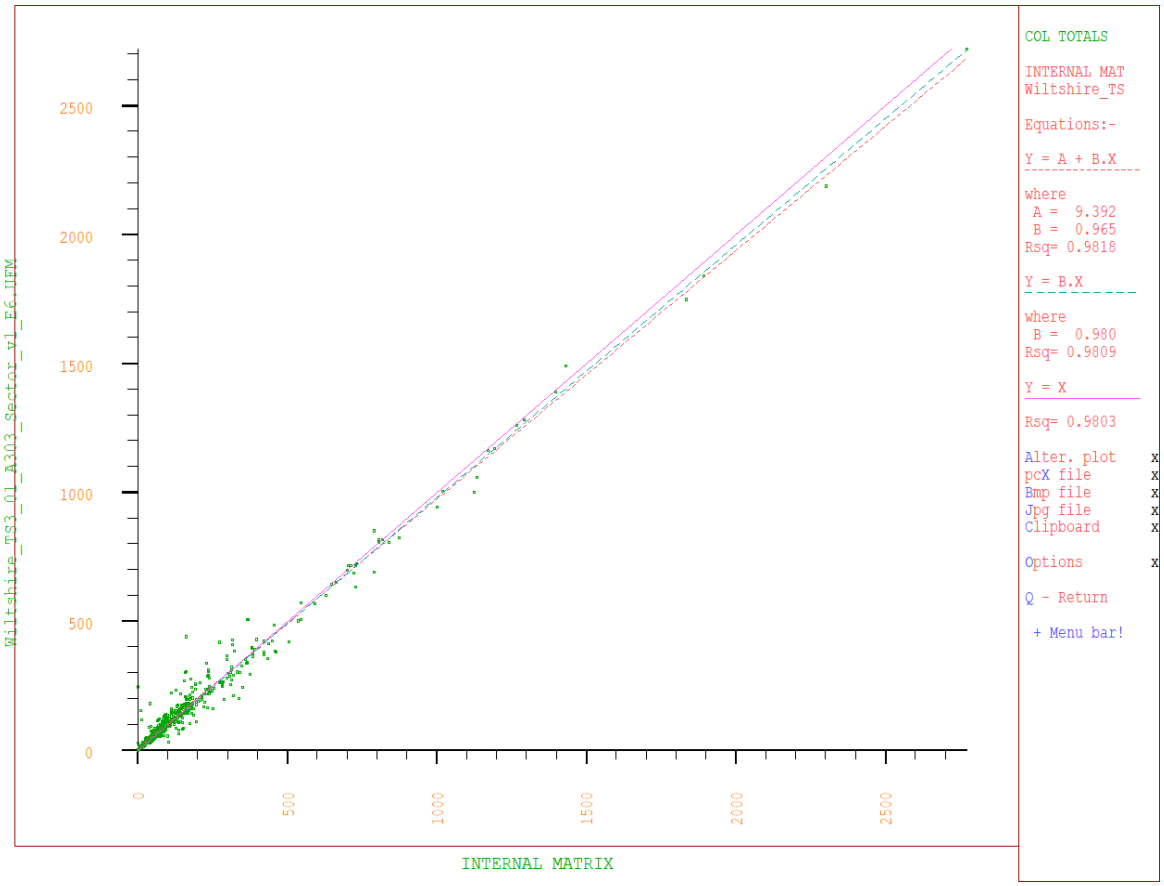


Figure E-6 - PM Destination Trip Ends All Vehicles



E.2. Post ME2 vs Prior: Zonal Cell Values

Figure E-7 - AM cell by cell All Vehicles

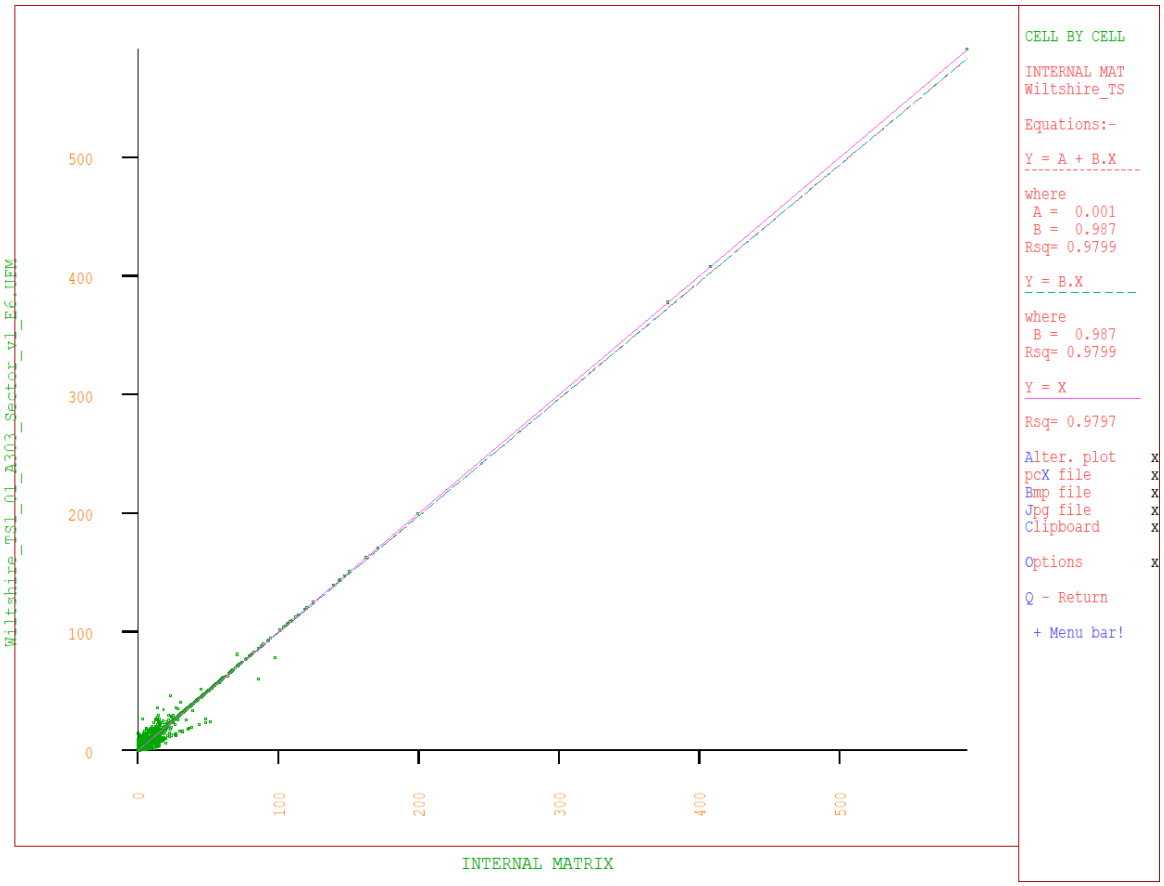


Figure E-8 - IP cell by cell All Vehicles

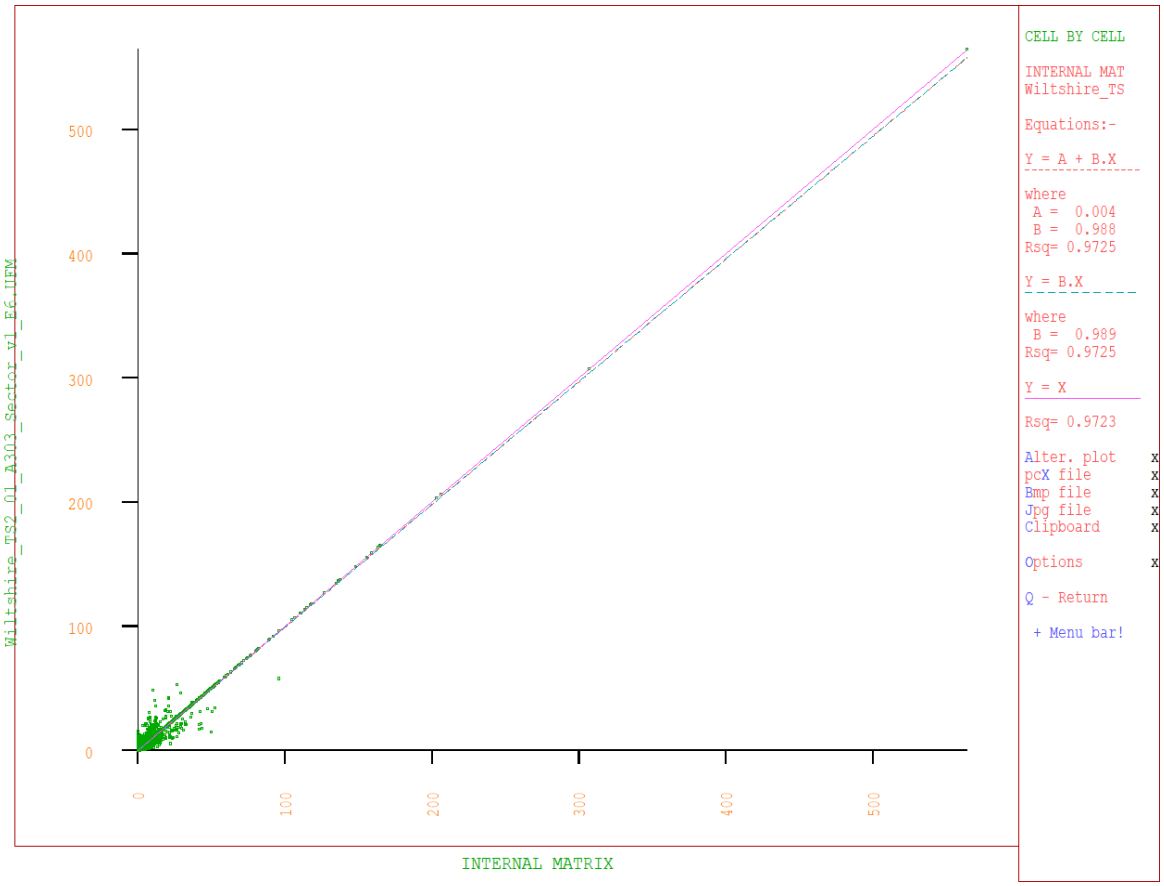
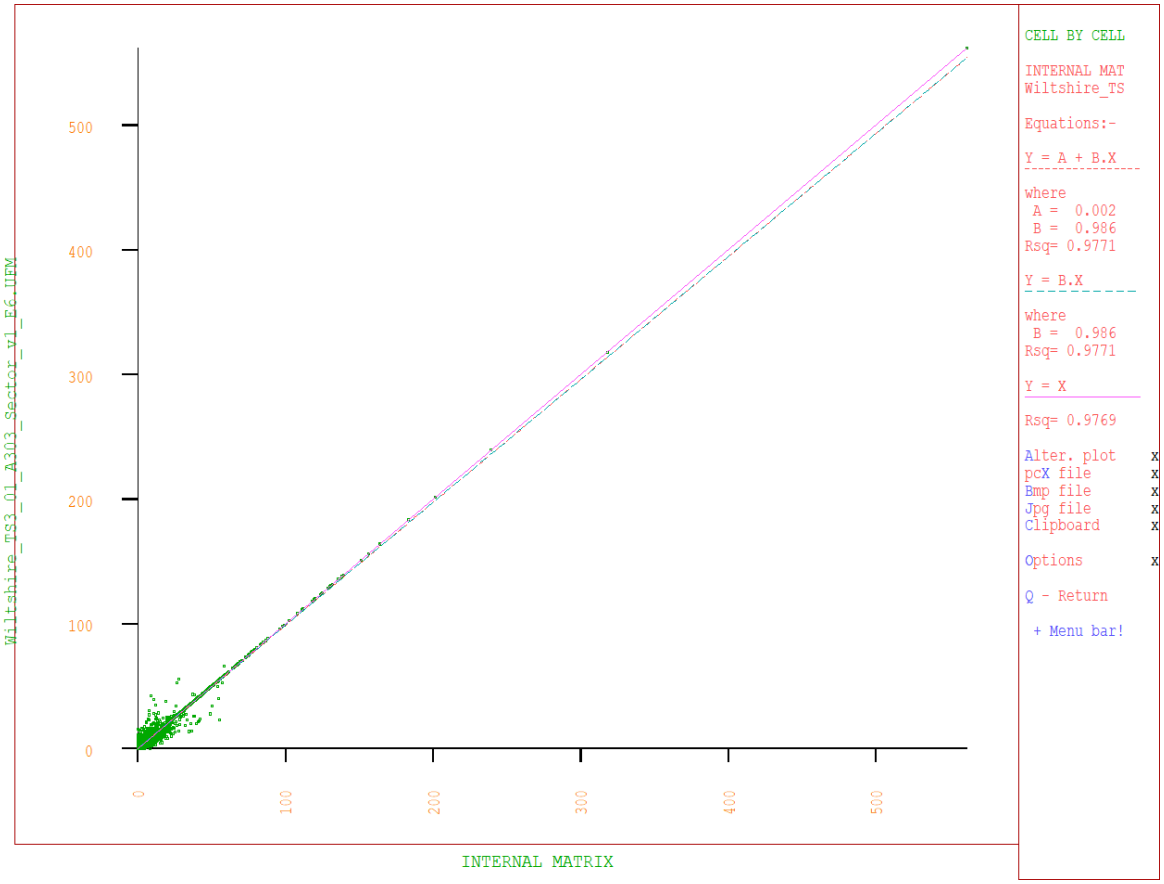


Figure E-9 - PM cell by cell All Vehicles



E.3. Post ME2 vs Prior: Trip Length Distributions

All Trip Length Distribution plots are shown for the whole model.

Figure E-10 - Trip Length Distribution AM

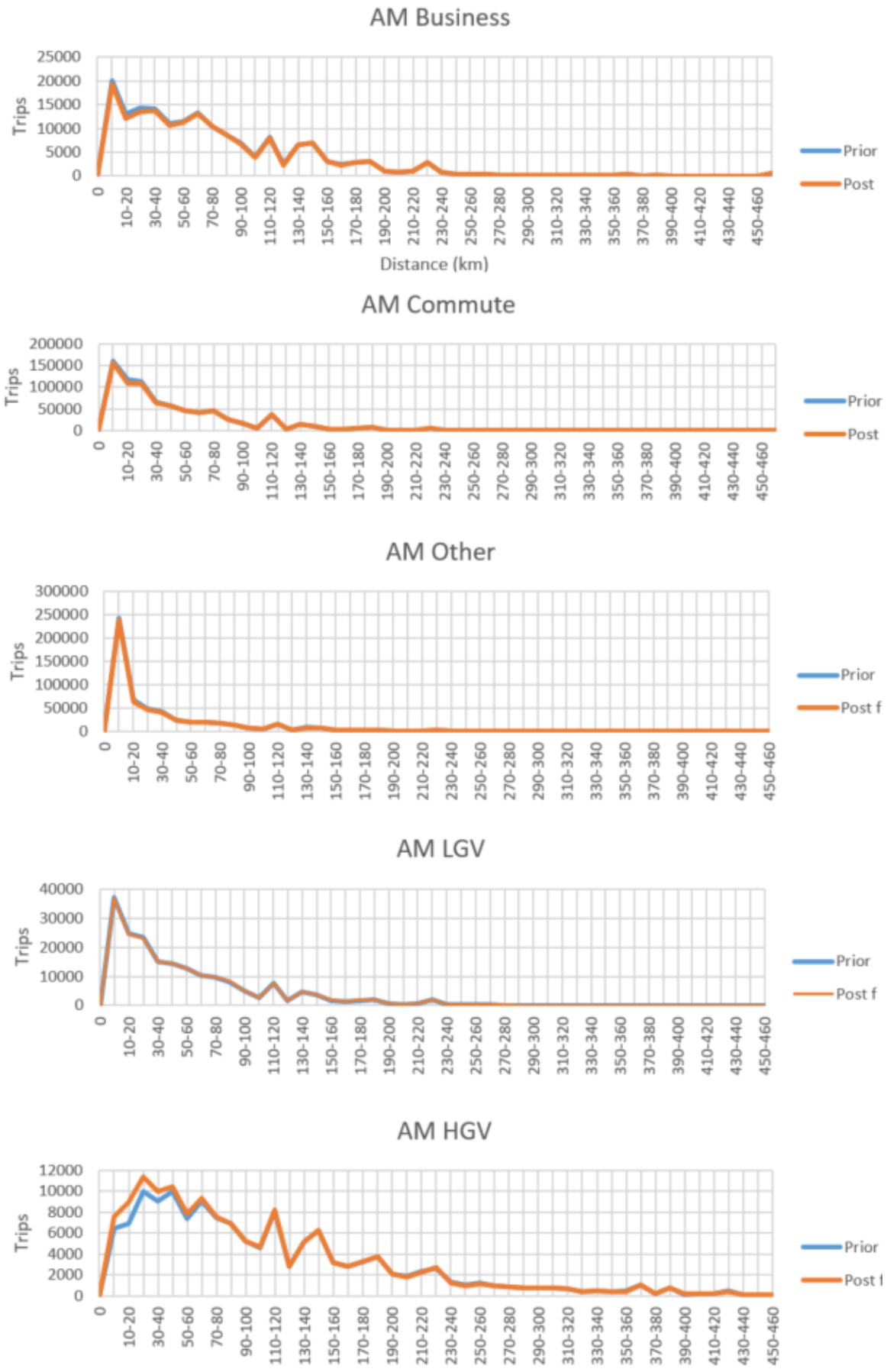


Figure E-11 - Trip Length Distribution IP

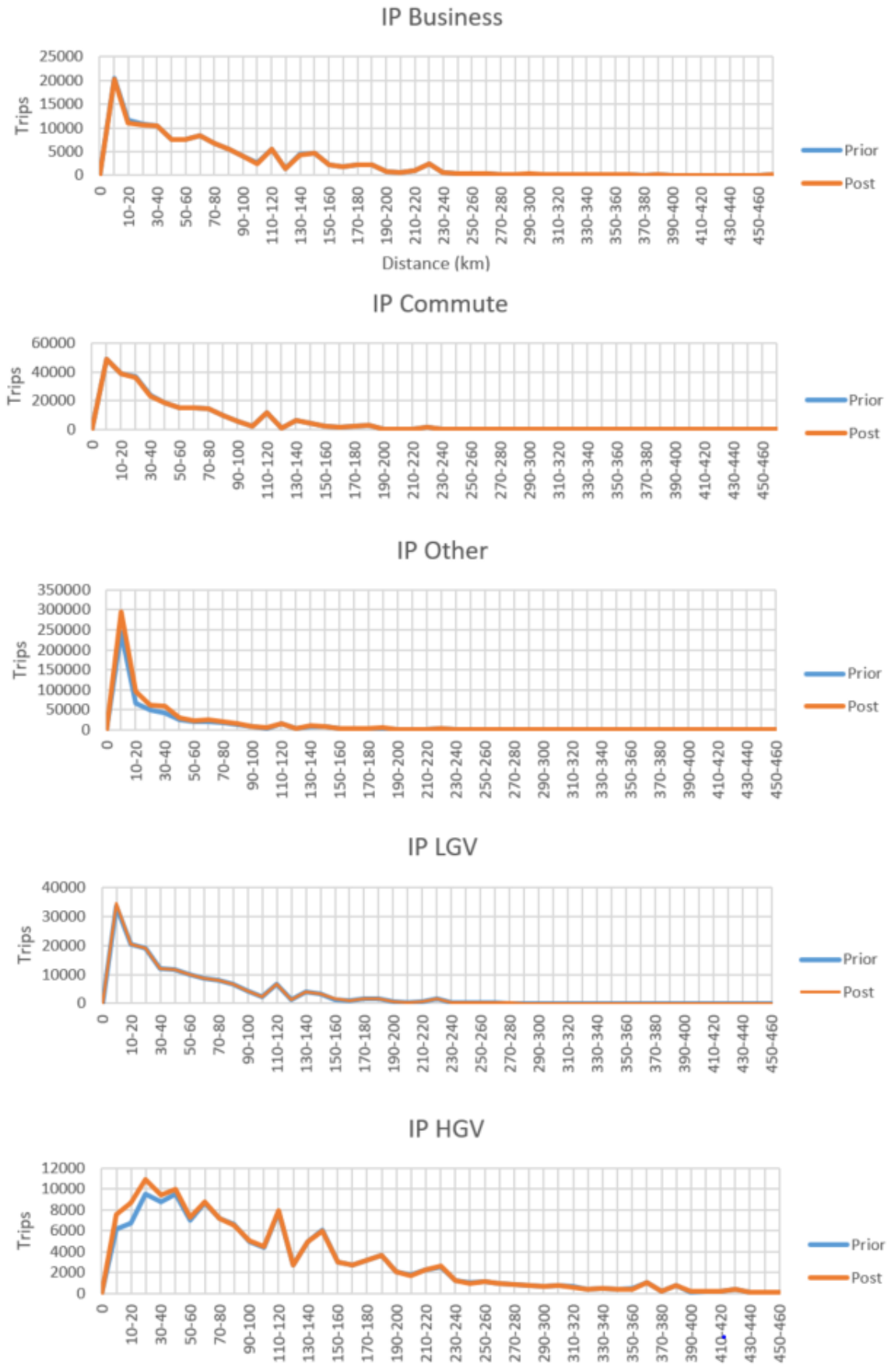
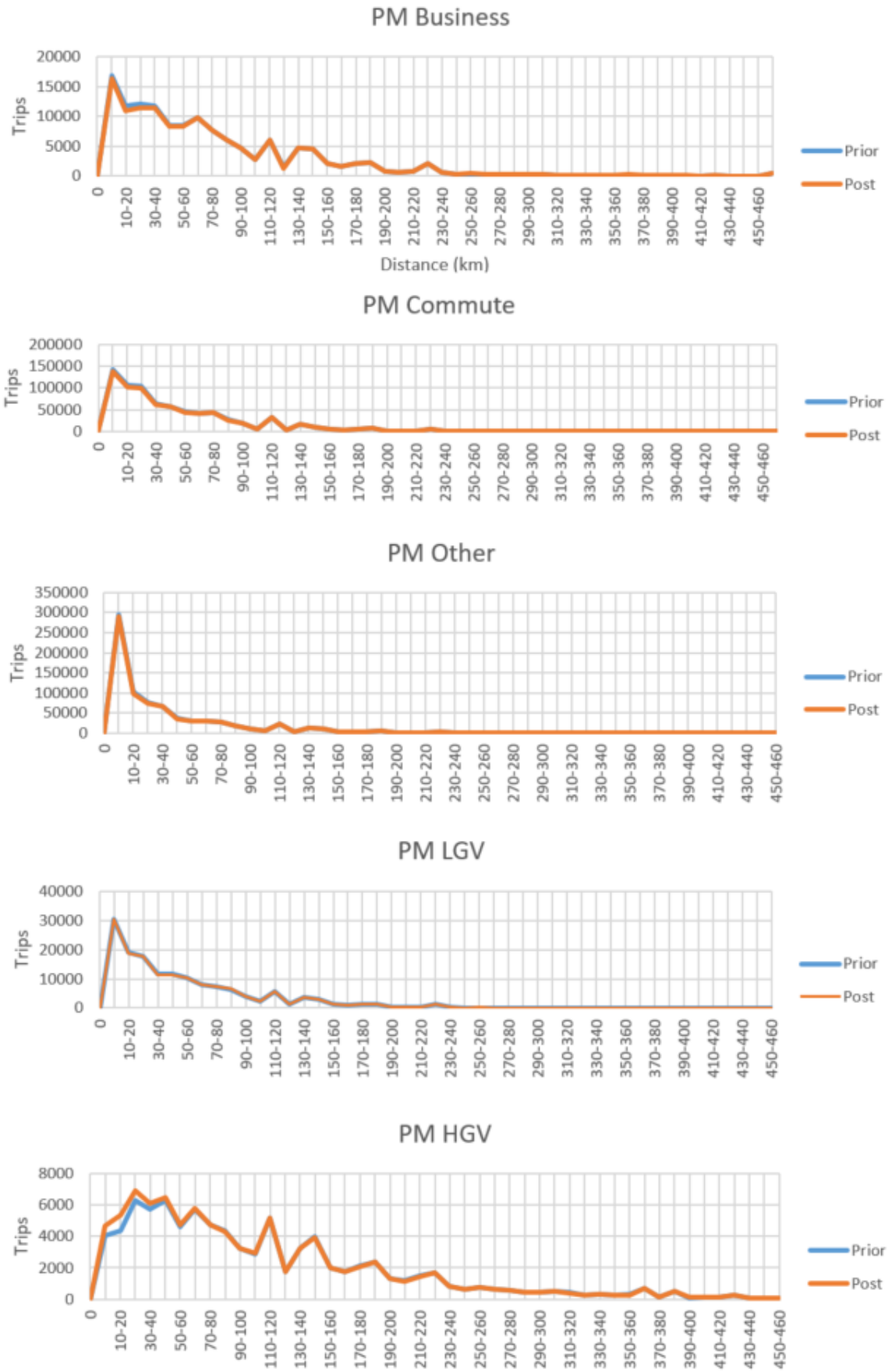


Figure E-12 - Trip Length Distribution PM



E.4. Post ME2 vs Prior: Sector to Sector Changes

Key	
	Change is less than 5%
	Change is between 5% and 10%
	Change is greater than 10%
	Prior Matrix has fewer than 100 trips

Figure E-13 – AM Sector to Sector % Change

AM Light Vehicles Sector to Sector changes in percentage

Sector	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
1	15%	74%	111%	21%	-37%	44%	130%	83%	-14%	-46%	-15%	21%	76%	13%	-7%	42%	-45%	-4%	-15%	1%	8%
2	0%	115%	23%	-6%	36%	-9%	27%	4%	3%	-30%	2%	5%	32%	106%	42%	225%	-38%	17%	11%	79%	11%
3	40%	51%	9%	-56%	90%	-14%	30%	6%	-79%	-26%	2%	3%	46%	173%	-50%	-39%	-24%	108%	-30%	3%	17%
4	38%	28%	-14%	-9%	2%	-19%	22%	-3%	-45%	-26%	6%	2%	-2%	-24%	-20%	87%	-36%	-51%	-1%	9%	-5%
5	-4%	-18%	11%	23%	-1%	-25%	38%	106%	102%	82%	-61%	16%	34%	30%	109%	-45%	-45%	-11%	103%	-3%	16%
6	45%	17%	65%	85%	0%	5%	222%	116%	-22%	10%	3%	44%	43%	99%	7%	-6%	-25%	78%	68%	-35%	16%
7	3%	-12%	-6%	-16%	-48%	20%	30%	82%	-65%	-24%	-23%	-15%	1%	69%	-41%	-36%	-40%	47%	-19%	-31%	4%
8	4%	-42%	26%	33%	-5%	-14%	183%	56%	-67%	-3%	-27%	21%	53%	28%	-40%	-32%	-27%	18%	-43%	-38%	28%
9	47%	120%	-27%	-13%	20%	-50%	-30%	-22%	29%	-10%	39%	79%	-16%	27%	14%	202%	-15%	-1%	32%	23%	7%
10	-37%	20%	10%	-56%	-38%	-32%	17%	-12%	-14%	-1%	24%	-26%	-31%	-24%	-21%	36%	-49%	-31%	-14%	-16%	-5%
11	9%	64%	56%	-21%	-66%	-13%	49%	121%	0%	-29%	-2%	-1%	26%	7%	-11%	164%	-34%	4%	-11%	4%	-2%
12	23%	21%	21%	4%	-10%	-8%	42%	42%	17%	-16%	-9%	1%	17%	-17%	36%	137%	-37%	-25%	-1%	17%	0%
13	12%	11%	11%	-23%	-3%	-7%	91%	77%	-27%	-13%	-29%	-10%	7%	5%	-3%	-26%	-30%	-5%	-16%	-37%	0%
14	17%	23%	41%	-18%	15%	1%	136%	21%	81%	-23%	-20%	-22%	-15%	-1%	50%	-27%	-5%	-5%	-34%	-29%	-4%
15	43%	128%	2%	-22%	-20%	-38%	34%	118%	1%	-14%	15%	37%	-8%	-17%	7%	104%	-5%	-12%	-4%	-1%	-4%
16	-9%	-51%	-23%	-28%	-58%	-55%	-8%	-71%	37%	-14%	17%	-21%	-52%	-36%	18%	-4%	-18%	0%	-11%	-13%	-5%
17	-25%	29%	23%	-35%	5%	-13%	118%	109%	-36%	-30%	-33%	-2%	7%	11%	-29%	0%	-1%	13%	-3%	-12%	-1%
18	-10%	4%	34%	-34%	-6%	5%	239%	3%	91%	-30%	-28%	-26%	3%	-11%	7%	-20%	-17%	-5%	-6%	4%	-5%
19	-27%	47%	-4%	-17%	16%	3%	57%	-41%	142%	-8%	-23%	-16%	-8%	-22%	45%	23%	-9%	-3%	0%	-1%	0%
20	-13%	45%	41%	-22%	-48%	-19%	58%	54%	27%	-6%	-19%	-11%	12%	-9%	-1%	14%	-19%	17%	0%	0%	0%
Total	12%	36%	20%	-8%	-3%	-3%	79%	63%	6%	-4%	-8%	-1%	16%	-2%	-5%	-4%	-5%	-5%	0%	0%	-1%

AM HGV Sector to Sector Changes in percentage

Sector	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
1	231%	218%	238%	549%	-34%	334%	1766%	440%	246%	-56%	-22%	258%	456%	208%	355%	12%	83%	63%	37%	3%	97%
2	69%	430%	179%	184%	52%	213%	956%	248%	54%	-14%	-14%	215%	278%	522%	66%	522%	544%	517%	105%	119%	186%
3	465%	298%	34%	192%	-55%	186%	666%	122%	-1%	72%	211%	132%	168%	184%	154%	285%	469%	-14%	-42%	92%	151%
4	792%	324%	79%	207%	296%	634%	554%	89%	6%	-50%	167%	173%	124%	132%	96%	231%	284%	84%	-46%	287%	227%
5	73%	-63%	-59%	352%	10%	-24%	110%	17%	217%	166%	-56%	105%	117%	170%	177%	-66%	-20%	28%	65%	-50%	80%
6	590%	399%	570%	367%	31%	90%	225%	-2%	80%	215%	266%	241%	123%	28%	324%	80%	261%	27%	5%	70%	111%
7	2111%	1387%	905%	3210%	275%	262%	100%	-53%	1166%	431%	1078%	889%	116%	-11%	1927%	20%	298%	-53%	-22%	69%	158%
8	316%	207%	89%	524%	94%	34%	-24%	61%	139%	4%	122%	91%	-16%	75%	285%	-39%	269%	31%	-55%	-41%	31%
9	156%	210%	-29%	136%	883%	188%	169%	-22%	141%	-47%	109%	170%	34%	456%	107%	140%	38%	299%	855%	47%	167%
10	-1%	119%	-3%	-20%	-2%	-11%	-35%	-82%	-15%	-7%	76%	50%	-53%	57%	-16%	-59%	-56%	-45%	-38%	-24%	-23%
11	-55%	-31%	26%	263%	-95%	55%	592%	100%	-34%	40%	0%	-22%	132%	148%	-26%	253%	3%	169%	156%	34%	47%
12	298%	304%	34%	252%	93%	92%	513%	101%	97%	11%	2%	156%	84%	82%	205%	181%	208%	138%	26%	116%	120%
13	905%	592%	511%	1301%	125%	192%	149%	23%	436%	97%	414%	264%	93%	51%	741%	62%	245%	69%	-23%	92%	120%
14	407%	138%	57%	165%	155%	69%	46%	40%	182%	6%	129%	50%	0%	103%	92%	-37%	178%	39%	22%	8%	66%
15	187%	153%	58%	381%	341%	449%	559%	91%	136%	47%	79%	296%	120%	322%	20%	223%	54%	432%	369%	31%	132%
16	-71%	-78%	26%	-61%	-74%	-26%	-52%	-15%	545%	6%	160%	-49%	-63%	41%	257%	72%	43%	-30%	-16%	-27%	53%
17	42%	396%	56%	86%	-50%	30%	212%	98%	-11%	-54%	-45%	168%	4%	173%	-26%	52%	44%	104%	10%	-5%	29%
18	196%	-17%	-12%	180%	171%	23%	-21%	61%	359%	-16%	440%	1%	-35%	137%	254%	-70%	67%	17%	23%	-4%	15%
19	119%	284%	-24%	-51%	-30%	-45%	104%	-58%	547%	-42%	300%	85%	-44%	29%	183%	-3%	53%	10%	1%	-2%	0%
20	13%	11%	207%	60%	-40%	75%	121%	-48%	14%	-27%	-32%	86%	103%	14%	-29%	7%	27%	6%	0%	0%	0%
Total	119%	160%	171%	172%	35%	67%	179%	19%	118%	-19%	53%	116%	38%	86%	87%	51%	48%	15%	1%	0%	2%

AM Totals Sector to Sector Changes in percentage

Sector	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
1	16%	78%	113%	26%	-37%	49%	337%	144%	1%	-46%	-15%	22%	84%	16%	14%	38%	-41%	-1%	-10%	1%	9%
2	0%	116%	24%	-4%	36%	-7%	92%	26%	6%	-29%	2%	5%	35%	114%	44%	255%	-31%	39%	20%	82%	13%
3	41%	51%	9%	-56%	89%	-12%	58%	16%	-78%	-24%	3%	3%	47%	174%	-48%	97%	-16%	79%	-31%	11%	19%
4	40%	30%	-14%	-9%	2%	-16%	29%	-1%	-45%	-26%	7%	3%	-2%	-24%	-20%	90%	-30%	-50%	-1%	18%	-4%
5	-3%	-19%	11%	24%	-1%	-25%	38%	106%	103%	85%	-61%	17%	35%	35%	110%	-45%	-45%	-10%	96%	-5%	17%
6	49%	20%	76%	87%	0%	5%	222%	112%	-19%	18%	7%	45%	43%	97%	16%	5%	-23%	66%	60%	-25%	17%
7	30%	11%	17%	28%	-48%	21%	30%	81%	-18%	1%	18%	-11%	2%	69%	29%	-30%	-37%	34%	-19%	-20%	7%
8	12%	-36%	29%	39%	-5%	-13%	178%	56%	-58%	-3%	-20%	22%	52%	28%	-27%	-33%	-23%	19%	-45%	-39%	28%
9	51%	128%	-27%	-12%	24%	-37%	27%	-22%	30%	-10%	40%	81%	-14%	30%	15%	195%	-8%	5%	55%	25%	10%
10	-35%	29%	9%	-55%	-34%	-29%	5%	-29%	-14%	-2%	25%	-25%	-34%	-20%	-21%	-26%	-51%	-34%	-15%	-17%	-5%
11	7%	58%	55%	-15%	-67%	-6%	240%	112%	-1%	-27%	-2%	-1%	33%	12%	-11%	169%	-31%	8%	-2%	5%	-1%
12	25%	22%	21%	5%	-9%	-7%	70%	46%	18%	-16%	-9%	1%	18%	-17%	40%	140%	-34%	-22%	0%	22%	1%
13	20%	15%	15%	-20%	-2%	-6%	91%	77%	-16%	-8%	-20%	-9%	8%	6%	15%	-13%	-27%	6%	-17%	-24%	1%
14	30%	35%	42%	-15%	20%	2%	132%	21%	82%	-23%	-13%	-21%	-15%	-1%	51%	-28%	-2%	-5%	-33%	-26%	-4%
15	49%	132%	5%	-21%	-16%	1%	173%	114%	1%	-14%	15%	40%	0%	-13%	7%	111%	3%	-5%	4%	-1%	-3%
16	-24%	-58%	-7%	-34%	-59%	-51%	-15%	-60%	91%	-5%	23%	-23%	-53%	-34%	36%	-4%	-16%	-3%	-12%	-15%	-4%
17	-22%	40%	25%	-27%	4%	-13%	122%	109%	-32%	-35%	-33%	0%	7%	12%	-29%	1%	0%	16%	-1%	-12%	-1%
18	8%	3%	22%	-28%	-4%	9%	186%	8%	102%	-27%	-6%	-25%	-1%	-10%	12%	-26%	-16%	-5%	-5%	3%	-5%
19	-15%	77%	-9%	-19%	3%	-12%	79%	-47%	155%	-10%	-13%	-14%	-18%	-20%	47%	16%	-1%	-3%	0%	-1%	0%
20	-11%	42%	57%	-16%	-47%	-13%	66%	33%	26%	-10%	-19%	-9%	19%	-7%	-2%	13%	-18%	14%	0%	0%	0%
Total	13%	39%	24%	-7%	-3%	-2%	82%	62%	8%	-4%	-7%	0%	17%	-2%	-4%	-4%	-5%	-4%	0%	0%	-1%

Figure E-14 – IP Sector to Sector % Change

IP Light Vehicles Sector to Sector changes in percentage

Sector	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
1	51%	92%	78%	22%	-18%	99%	20%	35%	33%	-33%	58%	64%	53%	35%	48%	63%	8%	15%	-7%	53%	48%
2	53%	85%	52%	16%	18%	13%	-17%	-19%	43%	-10%	23%	19%	24%	54%	63%	112%	15%	-4%	25%	28%	29%
3	139%	108%	17%	17%	40%	31%	-16%	-31%	-28%	-5%	61%	38%	37%	107%	11%	-35%	6%	65%	-10%	44%	33%
4	28%	28%	26%	15%	65%	29%	-13%	-13%	-17%	-32%	46%	19%	19%	-7%	-6%	14%	7%	-36%	-1%	24%	15%
5	-28%	62%	40%	78%	0%	13%	-6%	39%	91%	0%	-38%	43%	34%	43%	56%	-43%	-21%	-10%	107%	-41%	20%
6	194%	35%	60%	36%	14%	17%	144%	59%	-17%	29%	46%	46%	42%	78%	18%	-17%	-15%	81%	144%	-5%	30%
7	134%	54%	24%	5%	-1%	160%	42%	121%	-29%	2%	64%	22%	58%	115%	15%	7%	16%	157%	38%	-1%	60%
8	199%	38%	47%	26%	110%	92%	218%	68%	-11%	36%	106%	63%	90%	79%	18%	-30%	44%	68%	-22%	23%	77%
9	13%	58%	-25%	-14%	39%	-21%	-47%	-62%	47%	-4%	-19%	25%	-18%	10%	1%	14%	-9%	-11%	19%	4%	2%
10	-37%	47%	48%	-13%	67%	86%	25%	-18%	-1%	-1%	5%	-16%	21%	-29%	-6%	32%	18%	-34%	14%	8%	-1%
11	10%	35%	77%	-8%	-55%	57%	30%	-13%	16%	1%	-2%	6%	38%	14%	6%	32%	-24%	3%	2%	0%	2%
12	42%	20%	32%	2%	5%	23%	-21%	-8%	13%	-40%	20%	15%	10%	-32%	17%	35%	-17%	-20%	-17%	8%	5%
13	67%	50%	32%	9%	24%	46%	44%	78%	-11%	-31%	14%	13%	10%	3%	0%	-35%	-4%	20%	-2%	-8%	20%
14	1%	63%	69%	-21%	30%	49%	108%	31%	25%	-25%	10%	-12%	-11%	1%	-1%	-32%	-5%	-3%	-30%	-28%	-2%
15	10%	113%	18%	1%	67%	35%	3%	-5%	11%	-6%	-2%	43%	22%	-9%	6%	30%	20%	-20%	21%	4%	2%
16	6%	-32%	-32%	-15%	-40%	-23%	-25%	-57%	83%	43%	117%	-4%	-47%	-26%	35%	-1%	-8%	1%	-4%	-3%	-1%
17	-31%	-17%	-11%	-16%	-24%	-19%	7%	38%	-17%	-30%	-17%	-33%	-9%	12%	-12%	-7%	0%	4%	5%	-3%	-1%
18	-19%	8%	36%	-39%	-16%	35%	105%	17%	-3%	-21%	2%	-25%	-17%	-4%	9%	3%	-13%	-3%	-5%	10%	-3%
19	-40%	30%	-10%	-10%	68%	57%	21%	-41%	11%	-2%	-9%	-19%	-13%	-25%	22%	11%	14%	-5%	0%	0%	0%
20	-6%	0%	4%	-3%	6%	-21%	20%	14%	21%	28%	-4%	-11%	-13%	-17%	21%	-4%	-10%	14%	2%	0%	0%
Total	38%	33%	28%	9%	16%	27%	54%	58%	8%	-2%	4%	8%	18%	-1%	5%	-1%	-2%	-3%	0%	0%	0%

IP HGVs Sector to Sector Changes in percentage

Sector	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
1	267%	170%	317%	760%	-10%	297%	1869%	542%	241%	-24%	-40%	271%	645%	412%	321%	-24%	-36%	91%	59%	10%	103%
2	184%	572%	388%	430%	96%	321%	2190%	546%	147%	108%	20%	383%	631%	755%	182%	-41%	119%	226%	218%	35%	168%
3	516%	257%	35%	504%	-51%	380%	891%	223%	116%	86%	142%	181%	315%	93%	279%	42%	138%	-3%	-29%	52%	121%
4	336%	198%	397%	261%	845%	1227%	1225%	332%	9%	-57%	137%	143%	510%	396%	105%	185%	169%	388%	-42%	264%	214%
5	-24%	-7%	-33%	500%	14%	80%	272%	243%	1008%	38%	-92%	129%	161%	264%	455%	-63%	-13%	51%	24%	-63%	86%
6	725%	338%	373%	2303%	87%	102%	224%	-1%	748%	133%	202%	339%	148%	20%	1052%	41%	153%	-13%	-12%	33%	81%
7	2974%	2185%	1009%	3414%	443%	231%	144%	11%	1151%	486%	1076%	1256%	225%	17%	2059%	-48%	34%	-43%	4%	-14%	142%
8	398%	137%	80%	469%	57%	-46%	-62%	79%	103%	-3%	90%	89%	-46%	-29%	251%	-41%	36%	-21%	-82%	-72%	-25%
9	309%	96%	39%	48%	295%	276%	291%	28%	184%	52%	96%	232%	85%	477%	154%	167%	-14%	703%	432%	70%	146%
10	32%	200%	87%	-19%	23%	3%	-33%	-79%	-24%	-10%	27%	99%	-16%	89%	-22%	-44%	-56%	-37%	-50%	-23%	-21%
11	-46%	-24%	66%	382%	-91%	47%	668%	150%	64%	183%	0%	14%	245%	254%	14%	829%	52%	559%	201%	83%	112%
12	341%	364%	146%	381%	112%	154%	919%	217%	176%	47%	23%	270%	240%	176%	296%	58%	66%	96%	53%	85%	125%
13	864%	605%	397%	1083%	173%	177%	225%	41%	414%	44%	275%	255%	138%	35%	607%	-27%	44%	-27%	-35%	36%	65%
14	183%	335%	127%	192%	205%	86%	84%	171%	446%	47%	210%	95%	27%	85%	204%	19%	105%	47%	-16%	64%	68%
15	363%	83%	181%	181%	178%	436%	811%	197%	176%	94%	38%	332%	264%	410%	66%	344%	9%	459%	175%	63%	140%
16	-57%	-96%	-57%	-82%	-77%	-60%	-66%	12%	1336%	40%	712%	0%	-77%	70%	894%	63%	20%	-32%	-8%	-11%	47%
17	24%	246%	82%	261%	-31%	57%	247%	442%	168%	-27%	44%	172%	58%	117%	129%	42%	50%	93%	43%	4%	38%
18	73%	62%	24%	60%	139%	106%	-34%	180%	561%	-34%	424%	20%	-10%	98%	212%	-66%	74%	19%	16%	6%	16%
19	211%	507%	24%	-23%	-2%	-24%	14%	-56%	324%	-42%	261%	175%	-17%	23%	124%	12%	70%	11%	1%	0%	1%
20	0%	9%	91%	139%	-71%	48%	89%	-31%	65%	-19%	-5%	90%	28%	20%	6%	15%	23%	-9%	-1%	0%	0%
Total	142%	180%	151%	269%	59%	88%	198%	102%	197%	-15%	79%	150%	63%	82%	150%	46%	39%	15%	1%	0%	2%

IP Totals Sector to Sector Changes in percentage

Sector	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
1	51%	93%	80%	26%	-18%	105%	158%	79%	45%	-32%	56%	66%	68%	52%	67%	47%	4%	21%	5%	46%	50%
2	55%	86%	53%	20%	19%	17%	165%	33%	55%	8%	23%	20%	31%	92%	82%	95%	19%	4%	66%	29%	33%
3	140%	108%	17%	18%	40%	36%	31%	-13%	-25%	-1%	62%	38%	39%	106%	19%	-5%	12%	38%	-13%	46%	35%
4	30%	30%	27%	15%	66%	48%	31%	4%	-17%	-32%	49%	19%	22%	-5%	-5%	24%	19%	-26%	-3%	47%	16%
5	-28%	60%	40%	79%	1%	13%	-6%	40%	101%	3%	-40%	45%	35%	53%	65%	-44%	-21%	-7%	82%	-43%	21%
6	202%	37%	65%	48%	14%	17%	144%	58%	18%	38%	54%	48%	42%	75%	106%	-9%	-12%	48%	106%	0%	31%
7	279%	211%	74%	92%	0%	161%	43%	119%	115%	76%	215%	45%	59%	112%	341%	0%	17%	105%	30%	-3%	62%
8	212%	43%	50%	51%	109%	90%	215%	68%	2%	29%	103%	64%	89%	78%	50%	-32%	44%	54%	-35%	4%	75%
9	32%	62%	-24%	-13%	41%	4%	4%	-48%	48%	-4%	-16%	29%	-13%	15%	2%	27%	-10%	11%	40%	9%	5%
10	-32%	67%	51%	-13%	60%	70%	11%	-36%	-1%	-1%	6%	-14%	13%	-23%	-6%	-17%	-4%	-35%	7%	0%	-2%
11	9%	33%	76%	-2%	-56%	56%	154%	19%	17%	7%	-2%	6%	51%	25%	6%	71%	-16%	22%	13%	3%	4%
12	45%	21%	33%	3%	7%	24%	-1%	-3%	16%	-38%	20%	15%	12%	-31%	23%	36%	-15%	-18%	-14%	12%	7%
13	81%	55%	34%	12%	25%	47%	45%	78%	3%	-23%	28%	15%	11%	4%	34%	-34%	-4%	11%	-9%	-2%	21%
14	13%	83%	71%	-20%	38%	50%	107%	32%	32%	-23%	26%	-11%	-10%	1%	4%	-31%	-3%	-3%	-29%	-23%	-1%
15	34%	108%	25%	2%	69%	90%	164%	29%	12%	-5%	-1%	50%	41%	-3%	7%	53%	18%	-8%	27%	5%	4%
16	-7%	-43%	-40%	-20%	-42%	-27%	-30%	-50%	241%	41%	148%	-4%	-51%	-23%	133%	0%	-7%	-2%	-4%	-4%	-1%
17	-29%	-13%	-9%	-11%	-24%	-18%	12%	48%	6%	-30%	-14%	-31%	-8%	13%	5%	-5%	0%	7%	10%	-3%	0%
18	-7%	12%	34%	-37%	-13%	51%	80%	33%	19%	-25%	22%	-24%	-16%	-3%	16%	-6%	-11%	-3%	-3%	9%	-3%
19	-16%	71%	-4%	-10%	51%	36%	19%	-45%	19%	-5%	1%	-14%	-13%	-24%	24%	11%	19%	-4%	0%	0%	0%
20	-5%	1%	11%	2%	-3%	-15%	28%	7%	24%	15%	-4%	-8%	-9%	-15%	21%	-2%	-8%	8%	1%	0%	0%
Total	40%	36%	30%	11%	17%	28%	57%	59%	11%	-2%	5%	9%	19%	0%	6%	-1%	-1%	-3%	0%	0%	0%

Figure E-15 – PM Sector to Sector % Change

PM Light Vehicles Sector to Sector changes in percentage

Sector	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
1	51%	92%	78%	22%	-18%	99%	20%	35%	33%	-33%	58%	64%	53%	35%	48%	63%	8%	15%	-7%	53%	48%
2	53%	85%	52%	16%	18%	13%	-17%	-19%	43%	-10%	23%	19%	24%	54%	63%	112%	15%	-4%	25%	28%	29%
3	139%	108%	17%	17%	40%	31%	-16%	-31%	-28%	-5%	61%	38%	37%	107%	11%	-35%	6%	65%	-10%	44%	33%
4	28%	28%	26%	15%	65%	29%	-13%	-13%	-17%	-32%	46%	19%	19%	-7%	-6%	14%	7%	-36%	-1%	24%	15%
5	-28%	62%	40%	78%	0%	13%	-6%	39%	91%	0%	-38%	43%	34%	43%	56%	-43%	-21%	-10%	107%	-41%	20%
6	194%	35%	60%	36%	14%	17%	144%	59%	-17%	29%	46%	46%	42%	78%	18%	-17%	-15%	81%	144%	-5%	30%
7	134%	54%	24%	5%	-1%	160%	42%	121%	-29%	2%	64%	22%	58%	115%	15%	7%	16%	157%	38%	-1%	60%
8	199%	38%	47%	26%	110%	92%	218%	68%	-11%	36%	106%	63%	90%	79%	18%	-30%	44%	68%	-22%	23%	77%
9	13%	58%	-25%	-14%	39%	-21%	-47%	-62%	47%	-4%	-19%	25%	-18%	10%	1%	14%	-9%	-11%	19%	4%	2%
10	-37%	47%	48%	-13%	67%	86%	25%	-18%	-1%	-1%	5%	-16%	21%	-29%	-6%	32%	18%	-34%	14%	8%	-1%
11	10%	35%	77%	-8%	-55%	57%	30%	-13%	16%	1%	-2%	6%	38%	14%	6%	32%	-24%	3%	2%	0%	2%
12	42%	20%	32%	2%	5%	23%	-21%	-8%	13%	-40%	20%	15%	10%	-32%	17%	35%	-17%	-20%	-17%	8%	5%
13	67%	50%	32%	9%	24%	46%	44%	78%	-11%	-31%	14%	13%	10%	3%	0%	-35%	-4%	20%	-2%	-8%	20%
14	1%	63%	69%	-21%	30%	49%	108%	31%	25%	-25%	10%	-12%	-11%	1%	-1%	-32%	-5%	-3%	-30%	-28%	-2%
15	10%	113%	18%	1%	67%	35%	3%	-5%	11%	-6%	-2%	43%	22%	-9%	6%	30%	20%	-20%	21%	4%	2%
16	6%	-32%	-32%	-15%	-40%	-23%	-25%	-57%	83%	43%	117%	-4%	-47%	-26%	35%	-1%	-8%	1%	-4%	-3%	-1%
17	-31%	-17%	-11%	-16%	-24%	-19%	7%	38%	-17%	-30%	-17%	-33%	-9%	12%	-12%	-7%	0%	4%	5%	-3%	-1%
18	-19%	8%	36%	-39%	-16%	35%	105%	17%	-3%	-21%	2%	-25%	-17%	-4%	9%	3%	-13%	-3%	-5%	10%	-3%
19	-40%	30%	-10%	-10%	68%	57%	21%	-41%	11%	-2%	-9%	-19%	-13%	-25%	22%	11%	14%	-5%	0%	0%	0%
20	-6%	0%	4%	-3%	6%	-21%	20%	14%	21%	28%	-4%	-11%	-13%	-17%	21%	-4%	-10%	14%	2%	0%	0%
Total	38%	33%	28%	9%	16%	27%	54%	58%	8%	-2%	4%	8%	18%	-1%	5%	-1%	-2%	-3%	0%	0%	0%

PM HGVs Sector to Sector Changes in percentage

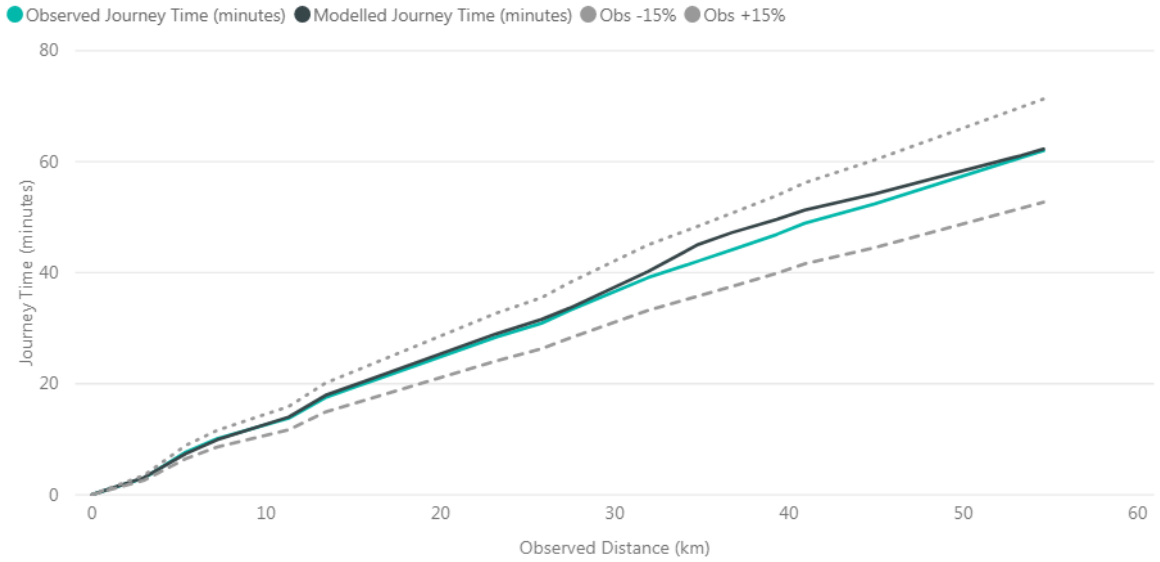
Sector	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
1	268%	67%	335%	1300%	18%	294%	825%	136%	409%	-55%	-47%	265%	375%	207%	187%	34%	-12%	94%	4%	9%	78%
2	103%	388%	496%	501%	57%	267%	947%	204%	510%	21%	-4%	259%	425%	420%	145%	-14%	145%	164%	124%	99%	144%
3	446%	158%	80%	239%	-45%	484%	789%	127%	28%	28%	202%	129%	390%	63%	52%	219%	279%	25%	-72%	-8%	136%
4	387%	47%	76%	231%	107%	288%	756%	119%	17%	-71%	-1%	50%	315%	17%	13%	214%	107%	38%	-80%	187%	122%
5	3%	-28%	-29%	462%	8%	109%	176%	84%	1003%	27%	-92%	64%	102%	126%	237%	-59%	-15%	-1%	-15%	17%	44%
6	717%	254%	239%	1473%	45%	119%	217%	-2%	493%	82%	330%	250%	160%	-1%	349%	91%	134%	-10%	-41%	-13%	56%
7	2413%	1216%	755%	3298%	426%	102%	232%	-9%	1184%	245%	1280%	824%	156%	-27%	1000%	-17%	58%	-10%	60%	-35%	110%
8	258%	9%	22%	384%	85%	-46%	-45%	29%	83%	-50%	97%	16%	-48%	-47%	57%	-57%	56%	2%	-89%	-71%	-26%
9	76%	-52%	-49%	42%	28%	27%	180%	-28%	150%	-21%	-6%	-3%	36%	80%	-2%	248%	-29%	170%	125%	-9%	21%
10	23%	17%	71%	135%	68%	4%	1%	-74%	83%	-14%	-9%	43%	-5%	33%	9%	-47%	-61%	-32%	-53%	-28%	-26%
11	-24%	-45%	111%	913%	-85%	69%	342%	13%	97%	61%	0%	-9%	137%	157%	-2%	661%	19%	263%	119%	97%	82%
12	285%	206%	225%	480%	61%	158%	568%	87%	303%	7%	-13%	171%	196%	76%	157%	95%	100%	55%	14%	108%	109%
13	990%	466%	446%	1368%	140%	205%	128%	30%	592%	36%	480%	247%	122%	-4%	406%	-37%	39%	-20%	-36%	21%	60%
14	280%	202%	290%	349%	161%	117%	275%	906%	930%	-54%	57%	51%	33%	83%	162%	32%	118%	57%	-19%	-6%	59%
15	342%	-12%	125%	582%	262%	258%	703%	105%	485%	145%	63%	210%	309%	399%	89%	306%	50%	594%	283%	21%	147%
16	-88%	-92%	-35%	-84%	-14%	4%	-30%	19%	611%	5%	27%	-79%	-53%	59%	73%	51%	13%	-42%	-12%	-17%	35%
17	42%	380%	105%	310%	3%	113%	336%	528%	92%	-43%	-59%	193%	79%	139%	-23%	24%	38%	67%	-4%	5%	29%
18	122%	29%	22%	179%	149%	48%	-3%	361%	1206%	-5%	302%	3%	-18%	61%	446%	-62%	38%	9%	5%	11%	8%
19	140%	113%	-15%	55%	3%	-53%	-2%	-5%	1684%	-12%	250%	36%	-47%	6%	456%	9%	51%	13%	0%	-2%	1%
20	-3%	-43%	95%	313%	-68%	22%	101%	58%	103%	-26%	-49%	7%	7%	27%	-28%	23%	17%	1%	-1%	0%	0%
Total	124%	83%	142%	433%	55%	75%	159%	169%	388%	-17%	30%	81%	46%	56%	99%	37%	29%	9%	0%	0%	1%

PM Totals Sector to Sector Changes in percentage

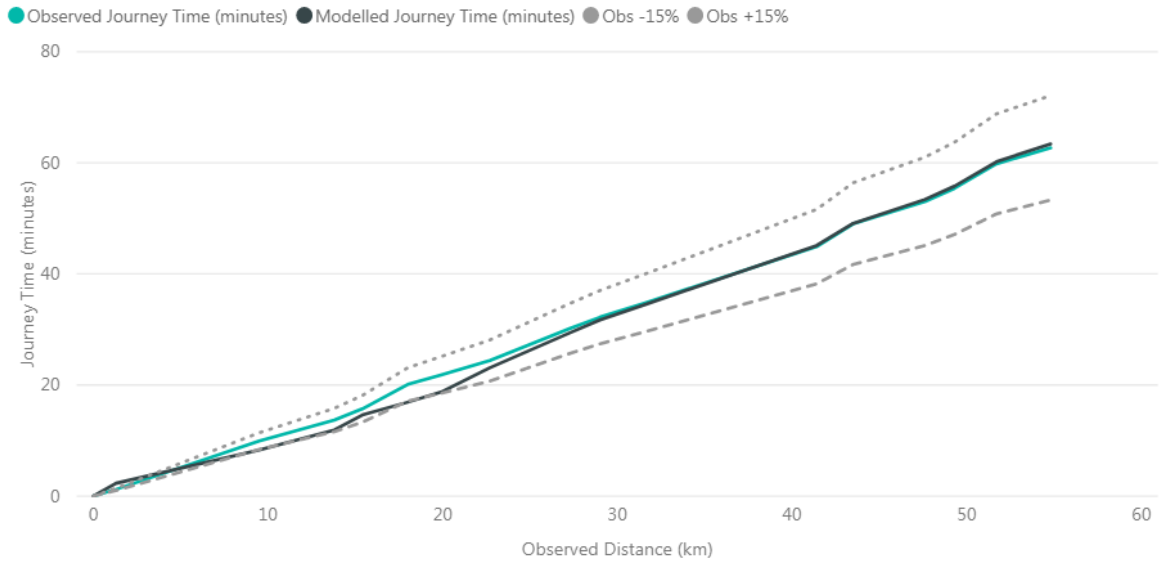
Sector	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
1	20%	28%	34%	51%	-11%	75%	-4%	-37%	36%	-44%	0%	27%	19%	14%	35%	21%	-15%	-7%	-5%	-8%	17%
2	73%	151%	61%	18%	49%	25%	0%	-41%	127%	27%	51%	40%	29%	64%	145%	501%	34%	24%	101%	80%	54%
3	17%	68%	10%	-31%	78%	47%	-25%	-45%	-63%	38%	100%	21%	12%	58%	-18%	104%	-2%	10%	1%	21%	14%
4	57%	48%	33%	-3%	30%	70%	-19%	-60%	-26%	-54%	15%	9%	-5%	-35%	-23%	51%	14%	-54%	-4%	50%	4%
5	-45%	148%	86%	80%	-4%	32%	-42%	-50%	220%	84%	-68%	43%	2%	6%	70%	-26%	4%	-23%	134%	-17%	12%
6	-7%	0%	39%	-4%	15%	2%	80%	12%	-44%	51%	47%	5%	5%	29%	-23%	30%	6%	57%	100%	-42%	8%
7	92%	213%	115%	15%	54%	187%	45%	151%	24%	144%	347%	61%	99%	170%	121%	133%	100%	156%	49%	11%	89%
8	-49%	95%	51%	-29%	81%	87%	119%	63%	-60%	40%	203%	18%	78%	61%	-38%	-43%	87%	28%	-40%	1%	70%
9	24%	18%	-18%	4%	107%	2%	-40%	-71%	40%	-9%	19%	69%	-3%	30%	7%	96%	-1%	-1%	55%	25%	7%
10	-5%	15%	12%	-26%	61%	30%	-33%	-62%	-16%	-2%	18%	-17%	-8%	-27%	-5%	19%	30%	-32%	-3%	11%	-2%
11	-4%	8%	-3%	-11%	-66%	5%	-31%	-53%	-57%	-28%	-1%	-15%	-22%	-32%	-1%	167%	-6%	-43%	-30%	-5%	-8%
12	26%	22%	20%	-6%	9%	35%	-24%	-41%	25%	-23%	2%	9%	-1%	-14%	16%	133%	-3%	-20%	5%	6%	5%
13	26%	87%	44%	-11%	32%	43%	7%	44%	15%	24%	86%	28%	9%	-8%	18%	-14%	0%	0%	30%	-12%	17%
14	-8%	107%	68%	-29%	-3%	46%	47%	75%	165%	-14%	27%	-9%	-12%	-3%	45%	-5%	13%	-14%	-25%	1%	-4%
15	40%	46%	3%	11%	96%	32%	-8%	-49%	30%	8%	3%	70%	12%	23%	12%	124%	11%	4%	51%	2%	13%
16	22%	0%	-21%	-26%	-8%	15%	-34%	-53%	130%	27%	75%	28%	-41%	-21%	93%	-3%	-7%	-8%	20%	16%	-3%
17	-42%	-21%	-40%	-64%	-17%	-15%	-17%	2%	-41%	-41%	-48%	-37%	-14%	18%	-35%	-9%	-1%	-9%	3%	-12%	-3%
18	-50%	26%	32%	-30%	-23%	19%	91%	49%	114%	-12%	0%	-26%	-20%	-6%	63%	2%	3%	-5%	-3%	19%	-5%
19	-17%	-1%	35%	-4%	61%	45%	-29%	-21%	139%	-14%	-1%	-10%	-25%	-32%	72%	35%	23%	-8%	0%	0%	0%
20	-7%	-1%	-11%	37%	-1%	7%	19%	15%	46%	16%	-2%	-9%	-7%	-14%	14%	7%	-11%	23%	0%	0%	0%
Total	9%	22%	19%	3%	13%	19%	21%	40%	15%	-2%	1%	0%	5%	-5%	7%	-3%	-1%	-5%	0%	0%	-1%

Appendix F. Distance-Time Validation

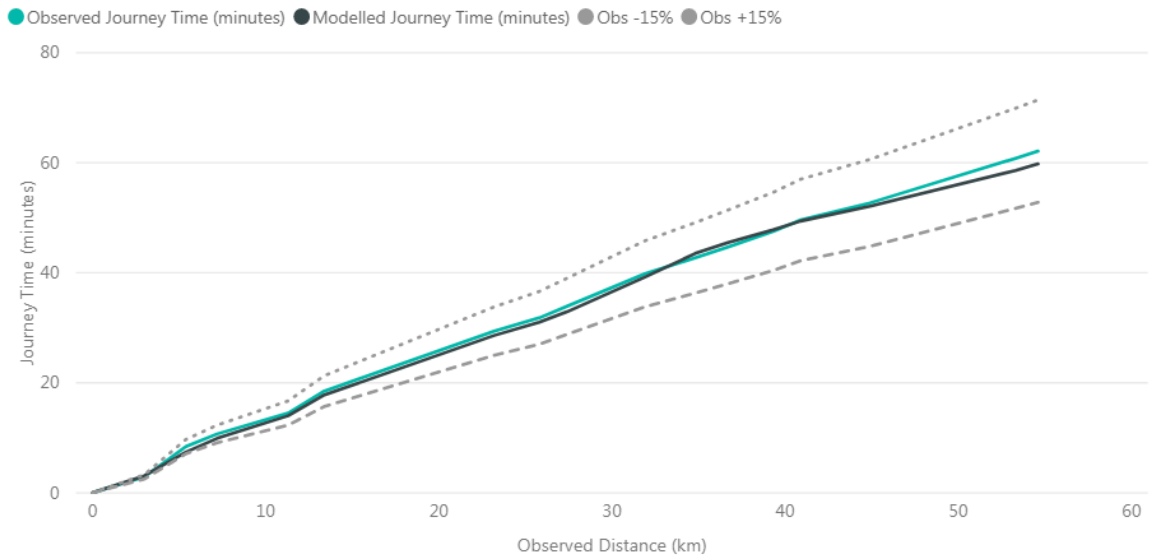
F.1. Route 1: A350 Northbound AM Peak



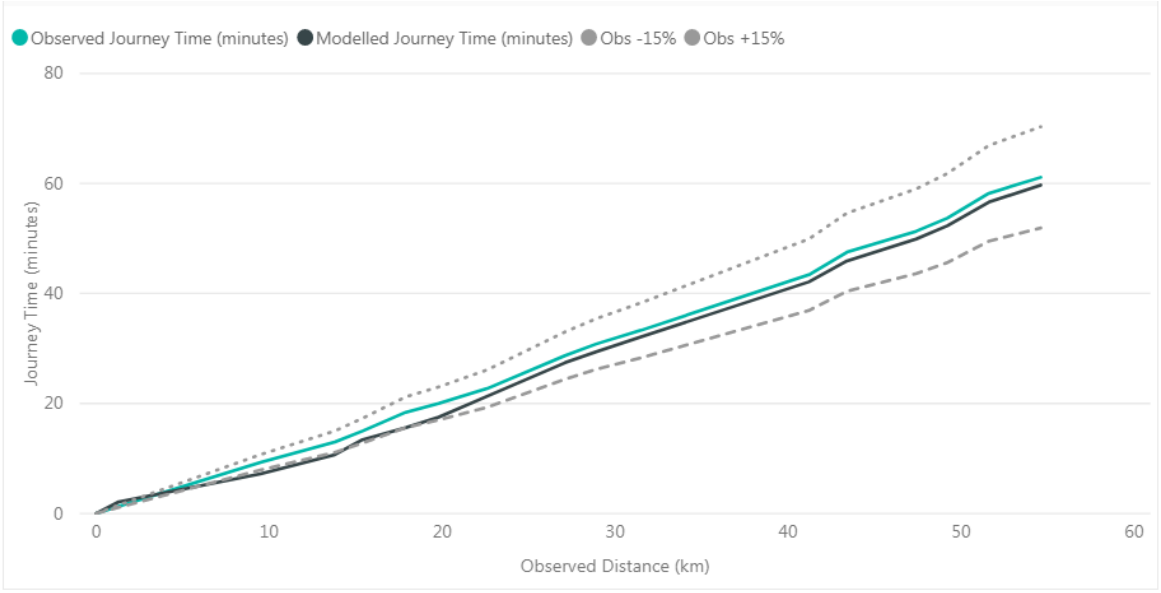
F.2. Route 1: A350 Southbound AM Peak



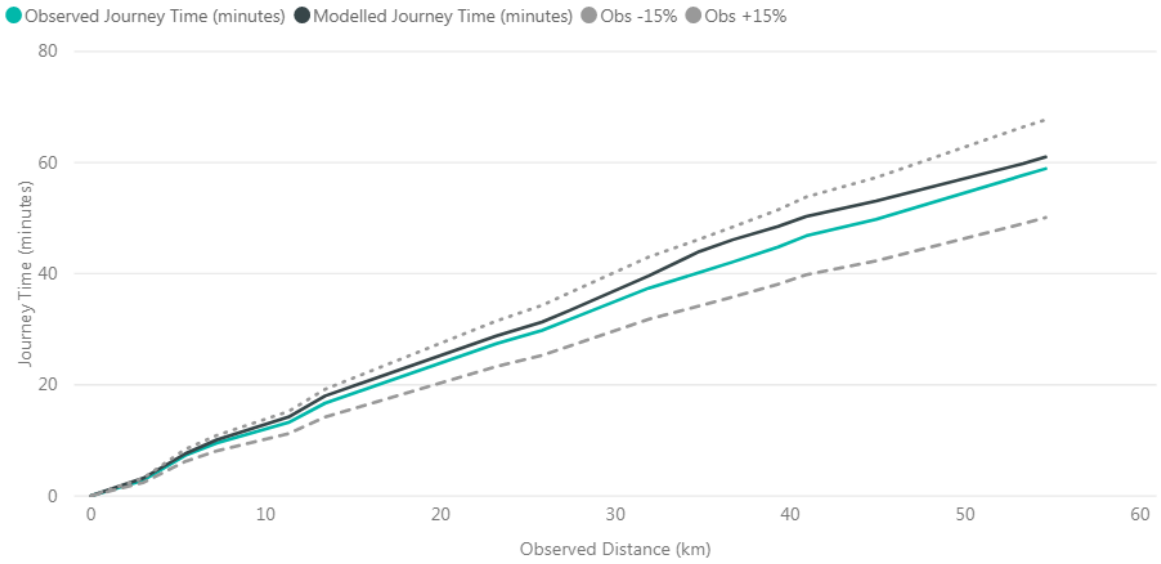
F.3. Route 1: A350 Northbound Inter Peak



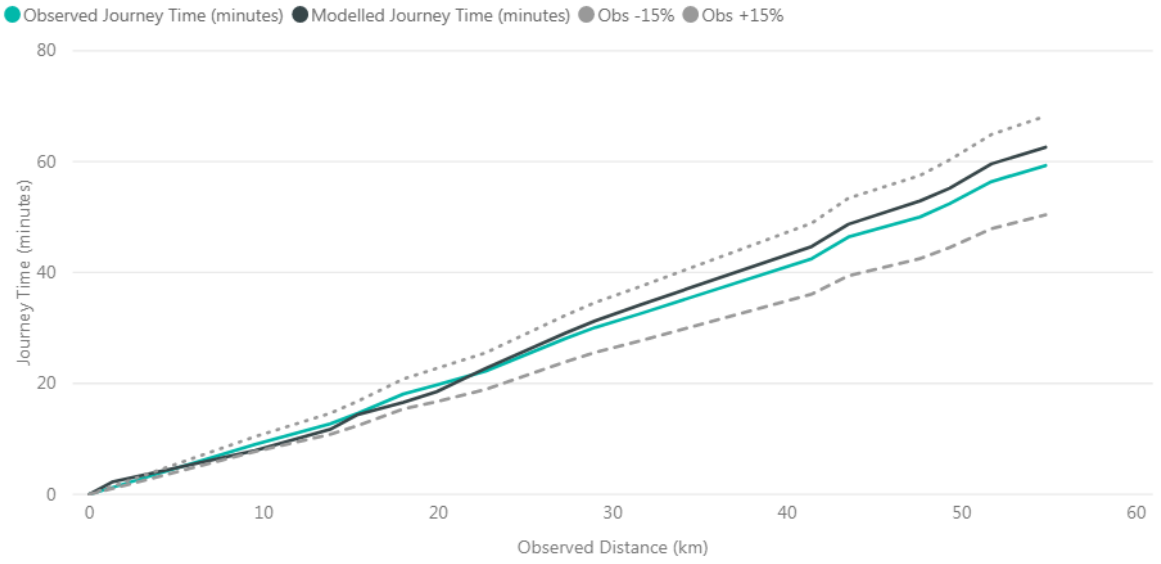
F.4. Route 1: A350 Southbound Inter Peak



F.5. Route 1: A350 Northbound PM Peak



F.6. Route 1: A350 Southbound PM Peak



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Appendix B. Wiltshire Strategic Highway Model: TFR

SNC·LAVALIN

ATKINS
Member of the SNC-Lavalin Group

Wiltshire Strategic Transport Model

Traffic Forecasting Report

Wiltshire Council

June 2019

Notice

This document and its contents have been prepared and are intended solely as information for Wiltshire Council and use in relation to Traffic Forecasting Report

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This document has 70 pages including the cover.

Document history

Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
Rev 1.0	First Issue for Review	SS/GG	PK	CS	DW	29/03/19
Rev 2.0	Includes comments from Wiltshire Council	GG	PK	PK	PB/DW	03/05/19
Rev 3.0	Includes Peak hour model	GG	PK	PK	PB	30/06/19

Client signoff

Client	Wiltshire Council
Project	Wiltshire Strategic Transport Model
Job number	5167358
Client signature / date	

Contents

Tables

Figures

1. Introduction

1.1. Overview

This report outlines the steps taken to develop Wiltshire core traffic forecasts. Details of the base model validation is found in the Wiltshire Strategic Model LMVR February 2019 Issue 2.

1.2. Potential uses of the model

The model was developed in accordance with the current Department for Transport (DfT) Transport Appraisal Guidance (TAG). This is a general requirement when applying for major scheme business case funding from the DfT. The expected uses of the model will include, but not be limited to:

- Assessing the impacts of land developments or the impact of strategic infrastructure schemes; e.g. Chippenham Urban Expansion Housing Infrastructure Fund
- Providing an evidential basis for informing business cases for specific transport schemes, e.g. A350 Melksham Bypass; A350 Phase 4 and 5 etc
- Preparation of transport evidence to support transport strategy or a local plan review
- Providing traffic forecasts to other analysis packages (local junction modelling software or micro-simulation e.g. LINSIG; Paramics, VISSIM etc)

1.3. Objectives of the model

The objective for the transport model of the Wiltshire and Swindon region is to provide a tool which can provide: clear, transparent & plausible highway transport forecasts, to inform planning and highway infrastructure decisions in a fast, flexible and visual way.

To achieve this, the strategy advocated within Transport Analysis Guidance (TAG), is to produce a model which accurately represents observed generalised travel costs (supply) and highway movements (demand). To be proportionate, it is recommended that the area of focus is within the region which the model sponsor requires analysis of the changes expected to occur.

As recommended in TAG, the model is pivot-point (or incremental) which means that it uses cost changes to estimate the change in the number of trips from a base matrix. The highway traffic forecasts will pivot off the transport model base costs and reference case trip patterns to form an important role in identifying and appraising future schemes and planning decisions in the Wiltshire & Swindon area.

1.4. Structure of the report

This report consists of the following sections:

2. Forecast approach, assumptions and uncertainty
3. Reference case trip matrices
4. Forecast year networks and assignment methodology
5. Variable demand model
6. Core traffic forecasts
7. Summary

2. Forecast approach, assumptions and uncertainty

2.1. Wiltshire 2018 base model

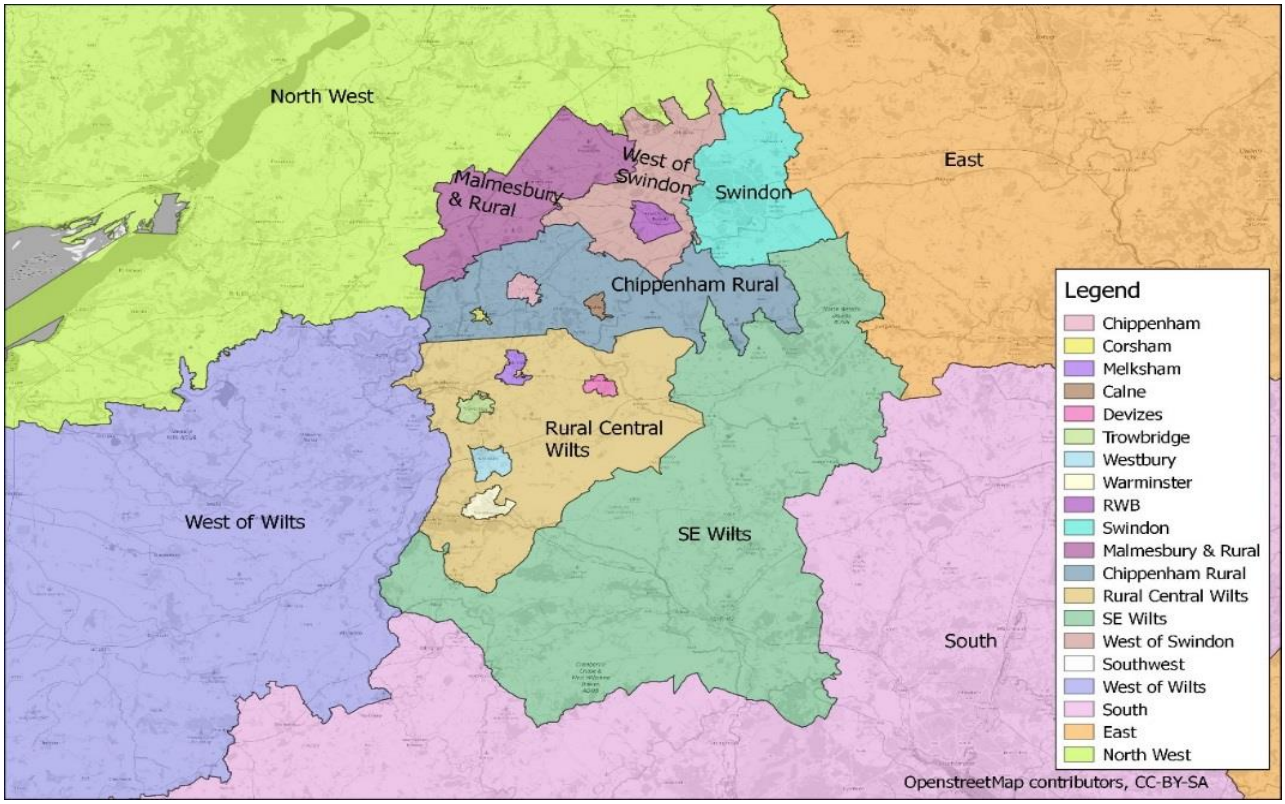
The Wiltshire strategic base model utilises the A303 Stonehenge / South West Regional Transport model developed by Highways England It includes improvements to the network and demand in the Wiltshire area

This is a peak period model which has five user classes. A sector system was defined during base model development as shown in Figure 2-1. This constitutes 20 sectors, 15 within the Wiltshire and Swindon region and the rest external.

The Wiltshire 2018 Base SATURN Model was calibrated and validated following TAG guidance, which was fully documented in the Local Model Validation Report (LMVR) issued in June 2019 (Issue 3).

The parameters and specifications have stayed consistent with the base model, unless explicitly stated in this report.

Figure 2-1 Strategic Model Sectors (20)



2.2. Forecasting approach

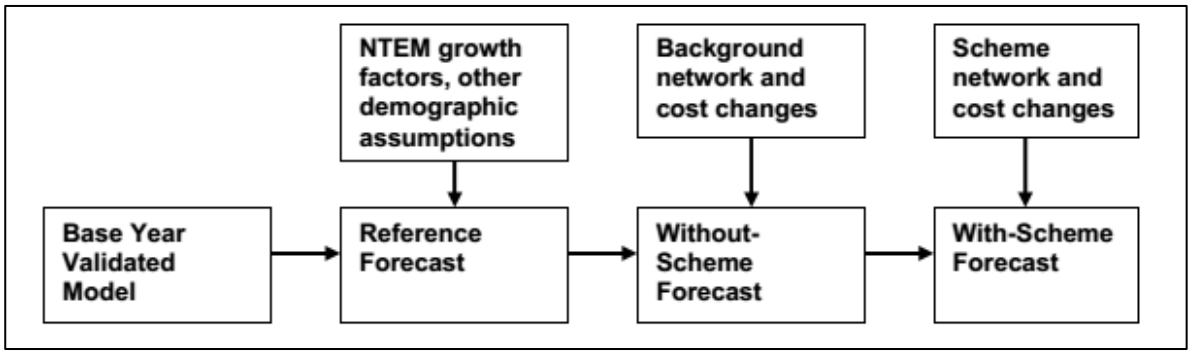
This section details the assumptions and inputs into the development of the core forecast year traffic model. The forecasting approach applied draws on the guidance from TAG unit M2 (Variable demand modelling) & M4 (Forecasting & Uncertainty).

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

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

This overall forecasting approach is summarized in the flowchart in Figure 2-2 from TAG.

Figure 2-2 Overview of traffic forecasting process



2.3. Core scenario forecast years

The core scenario is intended to provide the foundation for evidenced based decision-making using a central traffic forecast. The Wiltshire core forecast was developed using several sources, each recommended in TAG.

Traffic forecasts, as requested by Wiltshire Council, coincide with the local plan period have been developed for 2036 and 2024 assumed to be the opening year of the Chippenham Urban Extension.

2.4. Uncertainty and the uncertainty log

Most sources of forecasting uncertainty can be classified into one of five categories:

1. Model **parameter** errors – source: base model and realism tests;
2. national uncertainty in **travel demand** - Demographic projections and traveller behaviour (source: NTEM 7.2)
3. national uncertainty in **travel costs** – forecast fuel prices or government policy (source: TAG Databook)
4. local uncertainty in **travel demand** – proposed local land use developments (source: uncertainty log)
5. local uncertainty in **travel supply** (cost) – proposed transport infrastructure (source: uncertainty log)

2.4.1. National uncertainty

National uncertainty involves national projections of demographic changes, GDP growth and fuel price trends. In the core scenario, the impact of changes in demographic and traveller behaviour is based on the NTEM 7.2 dataset. The development of the forecast national travel demand is presented in section 3.

The assumptions regarding national costs of travel (value of time and fuel costs) are based on the TAG Databook v1.10 (May 2018). This is presented in section 4.

Infrastructure changes outside of Wiltshire and Swindon was derived from the A303 Stonehenge / SWRTM model networks. Demographic growth outside Wiltshire and Swindon was derived from NTEM 7.2 and is consistent with the A303 Stonehenge / SWRTM models.

2.4.2. Local uncertainty

TAG recommends that all known assumptions and uncertainties in the modelling and forecasting approach should be set out in an **uncertainty log**. The purpose of the uncertainty log is to record the central forecasting assumptions that underpin the core scenario and record the degree of uncertainty around these central assumptions. These assumptions should be the basis for developing a set of alternative scenarios.

TAG recommends that, where the analysis covers a wide geographical area, it is sufficient to focus local uncertainty to a specific region, in this case Wiltshire and Swindon. The source of the localised assumptions (Wiltshire Council and Swindon Borough Council) and comments behind the stated level of uncertainty is, as required in TAG, presented in a local uncertainty log, this is discussed in 2.4.2 and a full log is included in **Appendix B**.

It is recommended in TAG that each forecast local land use or infrastructure change is classified according to the likelihood that it will occur. The definition of each classification is summarised in Table 2-1. Where a scheme or land use change is considered "near certain" or "more than likely", it will be included in the core scenario.

Table 2-1 Uncertainty log – classification of future inputs

Probability of Input	Status	Core Scenario
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. Projects under construction.	Included in the Core Scenario
More than likely: The outcome is likely to happen but there is some uncertainty	Submission of planning or consent application imminent. Development application within the consent process	Included in the Core Scenario.
Reasonably foreseeable: The outcome may happen, but there is significant uncertainty	Conjecture based upon currently available information. Discussed on a conceptual basis. One of several possible inputs in an initial consultation process. Or a policy aspiration	Excluded from Core Scenario but may form part of the alternative scenarios
Hypothetical: There is considerable uncertainty whether the outcome will ever happen	Conjecture based upon currently available information. Discussed on a conceptual basis. One of several possible inputs in an initial consultation process. Or a policy aspiration	Excluded from Core Scenario but may form part of the alternative scenarios

Specific developments and infrastructure in the uncertainty log within the Wiltshire and Swindon regions are included. A list of the current and forecast number of households within each sector (see Figure 2-1) within Wiltshire and Swindon is shown in Table 2-2. This includes the number of households specifically included within the uncertainty log and the estimated intensification / windfall assessed to retain consistency with NTEM 7.2 projections for the whole region. The estimates are based on the existing highway demand within the base model.

A plot showing some of the main developments, from the uncertainty log, is shown in Figure 2-3 (note this excludes Swindon).

From the uncertainly log, the towns which are expected to have the most household growth up to 2036 include: Chippenham, Swindon, Trowbridge and Warminster all in excess of 20% growth (Note this does not include any proposed Local Plan 2036 growth).

The expected impact on transport demand, as a result of these household and demographic changes (the reference case) is discussed in the next chapter.

Table 2-2 Projected households in Wiltshire and Swindon

Region	Base 2018	Housing included in Uncertainty Log (UL)	2036 Core (includes UL & intensification / windfalls)	2036 vs 2018 %
Chippenham	15,452	2,957	19,057	23%
Corsham	2,700	170	2,961	10%
Melksham	8,618	1,196	10,051	17%
Calne	8,379	619	9,211	10%
Devizes	6,416	343	7,038	10%
Trowbridge	17,418	3,600	21,704	25%
Westbury	7,385	855	8,444	14%
Warminster	8,058	1,720	9,984	24%
RWB	6,059	0	6,227	3%
Malmesbury	8,772	350	9,472	8%
Chipp Rural	13,109	205	14,059	7%
Rural Central	30,241	0	31,495	4%
SE Wilts	64,389	7,819	75,161	17%
West of Swindon	10,576	0	10,941	3%
Wiltshire	**207,572**	**19,834**	**235,804**	**14%**
Swindon	96,257	19,762	118,695	23%
Wilts & Swindon	**303,829**	**39,596**	**354,499**	**17%**

The number of houses in the 2018 base year is derived from AddressBase™ plus data and is consistent with overall projections within NTEM 7.2

Figure 2-3 Core developments included within uncertainty log

Note These are indicative of the main developments within Wiltshire Authority. Sites within Swindon are included in the model, but not this map.

3. Reference case trip matrices

3.1. Introduction

This chapter outlines the process followed in developing the reference case (pre-VDM) traffic demand forecasts for the years 2024 and 2036. Travel demand changes for individual development sites within Wiltshire are included within the uncertainty log (see previous chapter & **Appendix B**) This section describes how the overall change in travel demand for the whole region was derived to match national demand forecasts and the basis for developing localised demand changes.

The reference case matrices are intended to reflect the changes in demand from the base year attributable to demographic and car ownership changes. It represents the travel demand that would be expected to arise if there were no changes in travel costs from the base year model. The demand model (described in section 5) uses the reference case matrices to extract travel costs to generate forecast year demand matrices.

3.2. NTEM 7.2 planning data

The basis for constraining the overall core future year car trip matrices utilised the NTEM 7.2 database. These forecasts act as control on the overall regional growth (after applying the growth from local known developments in the uncertainty log to the base demand) described later. Within the modelled south west region, growth has been constrained at NTEM county level. Outside this area, growth has been controlled to balance the regional projections. Data from NTEM 7.2 is presented in Table 3-1.

Table 3-1 NTEM 7.2: 24hr car driver trip growth

Trip Purpose	Format	Great Britain				
		2018	2024	% vs Base	2036	% vs Base
HBEB	PA	1,518,894	1,598,778	5.3%	1,708,169	12.5%
HBW	PA	10,043,441	10,484,175	4.4%	11,098,962	10.5%
HBO	PA	16,767,119	17,969,390	7.2%	19,876,750	18.5%
NHBEB	OD	2,049,970	2,145,771	4.7%	2,282,991	11.4%
NHBO	OD	5,111,285	5,421,911	6.1%	5,900,499	15.4%
Car (All)		35,490,709	37,620,025	6.0%	40,867,371	15.1%
Trip Purpose	Format	South West				
		2018	2024	% vs Base	2036	% vs Base
HBEB	PA	146,717	153,960	4.9%	163,459	11.4%
HBW	PA	966,857	1,005,444	4.0%	1,057,951	9.4%
HBO	PA	1,675,050	1,785,837	6.6%	1,965,360	17.3%
NHBEB	OD	195,973	204,423	4.3%	216,279	10.4%
NHBO	OD	507,040	535,874	5.7%	580,703	14.5%
Car (All)		3,491,637	3,685,538	5.6%	3,983,752	14.1%
Trip Purpose	Format	Wiltshire & Swindon				
		2018	2024	% vs Base	2036	% vs Base
HBEB	PA	20,755	21,506	3.6%	22,430	8.1%
HBW	PA	136,437	140,316	2.8%	145,236	6.4%
HBO	PA	215,874	231,873	7.4%	258,379	19.7%
NHBEB	OD	25,723	26,725	3.9%	28,360	10.3%
NHBO	OD	65,053	68,751	5.7%	74,949	15.2%
Car (All)		463,842	489,171	5.5%	529,354	14.1%

HBEB - Home Based Employer Business, HBW – Home Based Work, HBO – Home Base Others, NHBEB – Non-Home Based Employer Business, NHBO – Non- Home Base Others

3.3. Growth in car trip matrices

All matrix forecasting was prepared at the 24-hour average weekday level and in Production/Attraction format for home-based trips (Origin/Destination for non-home based). The starting point for the application of NTEM 7.2 growth was the base year 2018 P/A matrix, used for realism testing, see LMVR issue 2. The growth in NTEM PA demand is presented in **B.3**.

The car trip matrices contain trips from specific developments within the Area of Detailed Modelling (AoDM). The overall level of growth in Wiltshire county and the wider is consistent with NTEM 7.2. This is presented in Table 3-3.

3.4. Growth in freight

The DfT Road Traffic Forecasts (2018 RTF) were used to constrain the overall growth of freight (LGV & HGV) traffic in a similar way to constraints using NTEM. The resulting factors are summarised in Table 3-2

Table 3-2 Freight vehicle growth factors

Period	LGV Factor	HGV Factor
2018 to 2024	7.0%	-0.061%
2018 to 2036	23.3%	0.091%

DfT RTF18 for South West region, All roads types

3.5. Overall growth in reference case trip matrices

There is expected to be a **5.7%** growth, in the south west region, between 2018 and 2024 and **14.3%** up to 2036. Which is equivalent to a Compound Annual Growth Rate (CAGR) of 0.7% per annum.

Table 3-3 Reference case 24hr highway trip matrix totals

Trip Purpose	Format	Base 2018 Matrix	2024		2036	
			Reference Case Matrix	% growth	Reference Case Matrix	% growth
HBEB	PA	1,386,717	1,458,602	5.2%	1,561,407	12.6%
HBW	PA	9,686,022	10,110,919	4.4%	10,738,511	10.9%
HBO	PA	15,614,368	16,724,356	7.1%	18,565,949	18.9%
NHBEB	OD	2,637,037	2,763,012	4.8%	2,946,401	11.7%
NHBO	OD	9,422,153	10,002,434	6.2%	10,937,676	16.1%
Fixed (Ports)	OD	30,755	31,861	3.6%	33,712	9.6%
LGV	OD	7,962,466	8,528,190	7.1%	9,157,838	15.0%
HGV	OD	3,750,187	3,720,987	-0.8%	3,784,394	0.9%
Car (All)		38,777,052	41,091,184	6.1%	44,783,656	15.5%
Freight		11,712,653	12,249,177	4.6%	12,942,232	10.5%
Total		50,489,705	53,372,221	**5.7%**	57,725,888	**14.3%**

Highway Trips numbers are based on an Average Weekday (Mon-Fri) for a 24-hour period;
Home Based trips are based on NTEM 7.2 Production Attraction factors
Non Home Based trips are based on NTEM 7.2 Origin Destination data by time period
The reference case trip matrices include development trips in the uncertainty log.
All growth is relative to the 2018 Base Year
The central reference case change refers to the entire, i.e. Global matrix, which is predominantly in the South West but includes the whole of Great Britain. All NTEM 7.2 growth refers to average weekday Production/Attraction Trip End data.
Non Home-Based trips are grown by Time period and Origin/Destination Trip Ends, hence NTEM 7.2 data is indicative only

3.6. Development trip rates & distribution

3.6.1. Treatment of specific developments

A new model zone was created for each land use development included within the uncertainty log and standard trip rates, for OD movements by time period by land use purpose, were derived from the TRICS database for an average peak period. These rates are for sites in England and Wales and exclude London. The trip rates are shown in Table 3-4.

Table 3-4 Development trip rates per hour (derived from TRICS)

Development Type (Unit)	AM (07:00-10:00)			IP (10:00-16:00)			PM (16:00-19:00)		
	In	Out	Tot	In	Out	Tot	In	Out	Tot
A1-A5 Retail	0.51	0.41	0.92	1.45	1.32	2.76	1.83	1.39	3.22
B1 Office & BPark	0.78	0.13	0.91	0.23	0.25	0.47	0.10	0.68	0.78
B2 Industrial	0.26	0.10	0.37	0.16	0.16	0.32	0.08	0.25	0.32
B8 Warehouse	0.14	0.08	0.22	0.13	0.13	0.27	0.07	0.13	0.20
Mixed Commercial	0.42	0.18	0.61	0.49	0.46	0.95	0.52	0.61	1.13
Residential (dwelling)	0.11	0.24	0.35	0.15	0.15	0.30	0.25	0.15	0.40

Trip rates for journeys both arriving at and departing from residential dwellings were derived from TRICS data. The two sources of TRICS data used were for mixed private housing and for privately owned houses, this can be found in tables below. The final residential trip rates were calculated using a weighting of 67% towards privately owned housing and 33% towards mixed private housing.

Table 3-5 Housing Trip Rates

Time Segment	Private housing mixed			Privately owned houses			Housing (weighted)		
	In	Out	Tot	In	Out	Tot	In	Out	Tot
07:00-08:00	0.062	0.207	0.269	0.08	0.26	0.34	0.074	0.243	0.317
08:00-09:00	0.094	0.258	0.352	0.13	0.36	0.49	**0.118**	**0.326**	**0.444**
09:00-10:00	0.1	0.115	0.215	0.14	0.16	0.30	0.127	0.145	0.272
10:00-11:00	0.103	0.145	0.248	0.13	0.15	0.28	0.121	0.148	0.269
11:00-12:00	0.105	0.103	0.208	0.14	0.15	0.29	0.128	0.134	0.263
12:00-13:00	0.134	0.124	0.258	0.15	0.15	0.30	0.145	0.141	0.286
13:00-14:00	0.13	0.113	0.243	0.16	0.15	0.31	0.150	0.138	0.288
14:00-15:00	0.105	0.143	0.248	0.16	0.18	0.33	0.142	0.168	0.303
15:00-16:00	0.168	0.118	0.286	0.25	0.17	0.42	0.223	0.153	0.376
16:00-17:00	0.17	0.124	0.294	0.26	0.16	0.42	0.230	0.148	0.378
17:00-18:00	0.233	0.128	0.361	0.31	0.15	0.46	**0.285**	**0.143**	**0.427**
18:00-19:00	0.202	0.127	0.329	0.26	0.16	0.42	0.241	0.149	0.390

3.6.2. Development site trip distribution

A scripting process was utilised which distributed development trips using the base trip distribution of each model sector (see Figure 2-1) by user class and time period. This process included inter-development trip movements (i.e. trips between new developments) based on the relative size/attractiveness of each development. Intra development trips was estimated based on the relative size and amount of housing and employment within each site.

4. Forecast year networks and assignment methodology

4.1. Network

The Forecast year network includes all infrastructure schemes and improvements in the uncertainty log (**Appendix B.2**). The model coding of the proposed schemes is based on the RTM coding manual, consistent with the base model (see LMVR issue 2).

Scheme infrastructure designs have been provided by Wiltshire Council or Swindon Borough Council. Some of the main designs are included in **Appendix B.3**. The forecast network scheme changes outside the AoDM are consistent with A303 Stonehenge / SWRTM model.

4.2. Generalised cost parameters

The generalised cost of travel represents travellers' value of time by purpose (by pence per minute: PPM) and the relative distance (by pence per kilometre: PPK). These values have been defined for the entire model trip purpose. The highway model (SATURN) assigns trips to the lowest "cost" path.

The forecast generalised travel costs are based on values in the v1.10 (May 2018) TAG databook and are shown in Table 4-1 (Value of time, PPM) and Table 4-2 (vehicle operating costs, PPK.

The values come from the TAG Databook Tables A1.3.1 to A1.3.2 (monetary values of time), Tables A1.3.10 to A1.3.12 (fuel costs) and Table A1.3.15 (non-fuel vehicle operating costs).

When added together, the fuel and non-fuel elements give the total vehicle operating costs in terms of PPK for different transport users. TAG Unit A1.3 states that, in non-work time travellers do not perceive non-fuel vehicle operating costs, so these have been omitted from the overall calculation of generalised costs for commuting and other trips. Operating costs are expected to decrease overtime for car trips (due to greater fuel efficiency) but increase marginally for freight travel.

Table 4-1 Value of time (in pence per minute) by time period & user: 2018, 2024 & 2036

User	Base 2018			2024			2036		
	AM	IP	PM	AM	IP	PM	AM	IP	PM
Car Business	30.88	31.64	31.32	32.62	33.43	33.10	40.37	41.37	40.95
Car Commute	20.71	21.04	20.78	21.88	22.23	21.99	27.07	27.51	27.17
Car Other	14.29	15.22	14.96	15.09	16.08	15.81	18.68	19.90	19.56
LGV	21.83	21.83	21.83	23.06	23.06	23.06	28.53.	28.53	28.53
HGV	44.31	44.31	44.31	46.82	46.82	46.82	57.94	57.94	57.94

HGV PPM values are adjusted as per guidance in TAG

Table 4-2 Vehicle operating costs (pence per kilometre) by user: 2018, 2024 & 2036

User	Base 2018	2024	2036
Car Business	12.27	11.85	10.93
Car Commute	5.78	5.58	5.37
Car Other	5.78	5.58	5.37
LGV	13.53	13.62	13.39
HGV	44.52	47.65	52.09

Values are the same for all time periods

4.3. Highway assignment model convergence

Convergence of the highway assignment model is important to provide consistent, stable and robust model results and is particularly important for economic appraisal.

Guidance on the degree of model convergence is given in TAG and is presented in the LMVR. The main measure of the convergence of a traffic assignment is the Delta statistic, or %GAP. This is the difference between the costs along the chosen routes and those along the minimum cost routes, expressed as a percentage of the minimum costs. TAG recommends a guideline target for the %GAP value of 0.1% or less. In addition, TAG recommends that the proportion of links for which the changes in traffic volumes is less than 1% should be at least 98% for four consecutive iterations. The convergence results for the highway assignment traffic forecasts are presented in Table 4-3. This shows that the criteria have been met.

Table 4-3 Core highway assignment traffic forecast model - convergence statistics

Scenario	Period	Convergence Statistics				%Flows - Last 4 iterations			
		Loops	% Flows	% Delays	% GAP	N-4	N-3	N-2	N-1
Core Scenario (2024)	AM	15	99.1	99.3	0.003	98.2	98.5	99	99.1
	IP	14	99.2	99.6	0.001	98.1	98.8	99	99.2
	PM	16	99.1	99.2	0.003	98.3	98.9	98.9	99.1
Core Scenario (2036)	AM	16	99.1	99.0	0.002	98.3	98.5	98.9	99.1
	IP	14	98.4	99.3	0.004	98	98.8	98.5	98.4
	PM	17	98.8	98.4	0.005	98.1	98.9	99.2	98.8

The convergence results presented are from the post VDM highway model. A description of the impact of VDM is presented in the next chapter.

5. Variable demand model

5.1. Overview of the VDM approach

The Wiltshire Transport model VDM approach is consistent with the A303 Stonehenge/SWRTM, i.e. it is an incremental VDM model. A description of the VDM modelling process is presented in issue 2 of the LMVR, chapter 8. This presents the structure of the model process and the realism tests undertaken which demonstrates its suitability for use in traffic forecasting.

5.2. Convergence of the VDM

5.2.1. Guidance on convergence

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

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

The regional models utilised a criterion of a %Gap of less than 0.1% for the fully modelled area and 0.2% for the sub-area, the AoDM. The same have been used for Wiltshire Transport Model.

5.2.1. VDM convergence results

The results achieved from the convergence of the VDM for the Core Scenario are shown in Table 5-1. The results show that it achieves the recommended convergence requirement.

Table 5-1 VDM Convergence Statistics Gap%

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

5.3. Impact of VDM: change in travel demand

The output matrix resultant from VDM varies between the Base and the Core scenario in respect to the changes in the total number of trips, vehicle-kilometres travelled and total vehicle-hours. The relative change between the Base; Reference case (i.e. before the impact of VDM) and a core (Post-VDM) scenario for each modelled forecast year is presented.

The change travel demand is presented in:

- Highway & PT 24hr PA demand: Table 5-2 (Global highway), Table 5-3 (Global PT)
- Highway OD demand: Table 5-4 (Global) and Table 5-5 (Wiltshire)

There is a relatively minimal change in the core demand (post VDM) when compared with the reference case. There is a small reduction in 24hr highway demand (Table 5-2) and a resultant increase in PT (Table 5-3). There is also a macro time period shift from the peak periods (Table 5-4) and an increase in off peak travel. These responses are due to increased peak period highway congestion but are relatively small overall.

In the Wiltshire region there are increase in highway demand Table 5-5 which is consistent with NTEM 7.2 growth. The core highway OD demand matrices for all time periods are presented in **Appendix D** in sector format, consistent with Figure 2-1.

Table 5-2 Global 24 hr Highway PA Trip Demand

Year	Scenario	HBEB	HBW	HBO	NHBEB	NHBO	24Hr Tot
2018	Base	1,387	9,686	15,614	2,637	9,422	38,746
2024	Reference case	1,459	10,111	16,724	2,763	10,002	41,059
	Core (Post VDM)	1,457	10,068	16,719	2,761	10,007	41,012
2036	Reference case	1,561	10,739	18,566	2,946	10,938	44,750
	Core (Post VDM)	1,561	10,676	18,562	2,947	10,934	44,680

Base and reference case are 24hr inputs, Post VDM is an output form DIADEM. values are in 1000s

Table 5-3 Global 24Hr Public Transport PA Trip Demand

Year	Scenario	HBEB	HBW	HBO	NHBEB	NHBO	24Hr Tot
2018	Base	90,567	780,730	265,598	35,688	106,834	1,279,416
2024	Reference case	92,372	792,927	253,376	36,862	111,710	1,287,246
	Core (Post VDM)	94,562	839,723	261,921	38,807	107,408	1,342,420
2036	Reference case	94,863	818,919	284,968	38,278	121,456	1,358,483
	Core (Post VDM)	94,863	851,012	293,032	37,515	125,166	1,401,588

Base and reference case are 24hr inputs, Post VDM is an output form DIADEM

Table 5-4 Global Car only OD Trip Demand

Year	Scenario	AM	IP	PM	OP	24Hr
2018	Base	4,481,036	3,993,929	5,371,965	998,482	65,504,364
2024	Reference case	4,753,241	4,253,002	5,675,901	1,063,347	69,565,600
	Core (Post VDM)	4,742,432	4,246,503	5,660,686	1,021,045	68,940,908
2036	Reference case	5,156,425	4,652,731	6,135,909	1,152,785	75,626,811
	Core (Post VDM)	5,147,634	4,649,757	6,119,822	1,164,642	75,676,615

Table 5-5 Wiltshire All Vehicles OD Trip Demand

Year	Scenario	AM	IP	PM	OP	Total
2018	Base	69,937	63,354	75,407	15,713	1,004,712
2024	Core	74,005	68,270	79,029	17,067	1,073,528
	% vs Base	5.8%	7.8%	4.8%	8.6%	6.8%
2036	Core	81,111	75,177	85,619	18,996	1,179,202
	% vs Base	16.0%	18.7%	13.5%	20.9%	17.4%

5.4. Impact of VDM: change in mean trip length

The forecast change in mean distance (vehicle-kilometres) between scenarios is shown in Table 5-6 for 2018 base, 2024 & 2036.

The VDM has resulted in an increase in mean travel distance for car trips between the base year and forecast years This response is linked to the reducing cost of car travel in real terms as result of increased fuel efficiency and income levels projected by the Department for Transport TAG databook.

There are reductions in distance travelled by freight vehicles. These vehicles are not subject to VDM, and the distance is based on reassignment only. Freight is responding to projected increases in the cost of fuel by reducing the mean distance travelled (see Table 4-1 & Table 4-2)

Table 5-6 Changes in mean trip length (kms)

Time Period	Trip Purpose	Base 2018	2024	2036	2024 vs Base %	2036 vs Base %
AM Peak	Car - Business	79.2	79.5	81.2	0.4%	2.5%
	Car - Work	46.6	46.8	47.4	0.5%	1.7%
	Car - Other	36.0	36.3	36.4	0.8%	1.0%
	LGV	54.8	54.7	54.6	-0.2%	-0.4%
	HGV	109.2	109.0	108.9	-0.2%	-0.3%
	Cars	46.4	46.6	47.1	0.4%	1.4%
	Total	52.4	52.3	52.4	-0.2%	-0.1%
Inter Peak	Car - Business	76.6	76.9	79.4	0.5%	3.7%
	Car - Work	51.1	51.4	52.2	0.5%	2.2%
	Car - Other	35.8	36.0	36.6	0.7%	2.3%
	LGV	54.9	54.7	54.6	-0.4%	-0.6%
	HGV	109.8	109.5	109.4	-0.2%	-0.4%
	Cars	44.3	44.4	45.1	0.3%	1.9%
	Total	52.2	51.9	52.0	-0.6%	-0.5%
PM Peak	Car - Business	78.1	78.6	80.9	0.6%	3.6%
	Car - Work	48.7	48.9	49.8	0.5%	2.2%
	Car - Other	37.0	37.4	37.9	1.1%	2.5%
	LGV	54.1	54.0	53.9	-0.3%	-0.5%
	HGV	110.9	110.7	110.5	-0.2%	-0.3%
	Cars	45.6	45.9	46.7	0.6%	2.3%
	Total	49.6	49.7	50.1	0.2%	1.1%

Distances in kilometres, for the whole model.

6. Core traffic forecasts

6.1. Overview

The core scenario traffic forecasts, based on the post VDM modelling discussed in the previous chapter, account for the following demand and assignment responses:

- changes in demographic and car ownership levels
- transport infrastructure interventions between the base year and the forecast year;
- changes in the value of time resulting from changes in income and changes in fuel efficiency
- modal and time period response resulting from changes in levels of congestion arising from the changes above

The change in the core traffic forecast relative to the base for three key indicators are presented:

- Global mean travel time and delay – the expected average travel time and delay and change vs the base for each vehicle
- Traffic flow – the expected change in highway demand between the core and base
- Travel times – the forecast changes in the travel times on validated routes between the core and base

6.2. Conversion to Peak Hour Approach

The peak period to peak hour conversion factor matrix has been applied to the peak period traffic forecasts.

6.3. Mean travel time and delay

Global travel trends in time and delay are presented in Table 6-1. This shows that there are moderate increases in average travel time and delay, because of the expected growth in traffic and congestion.

Table 6-1 Mean travel time and delay changes

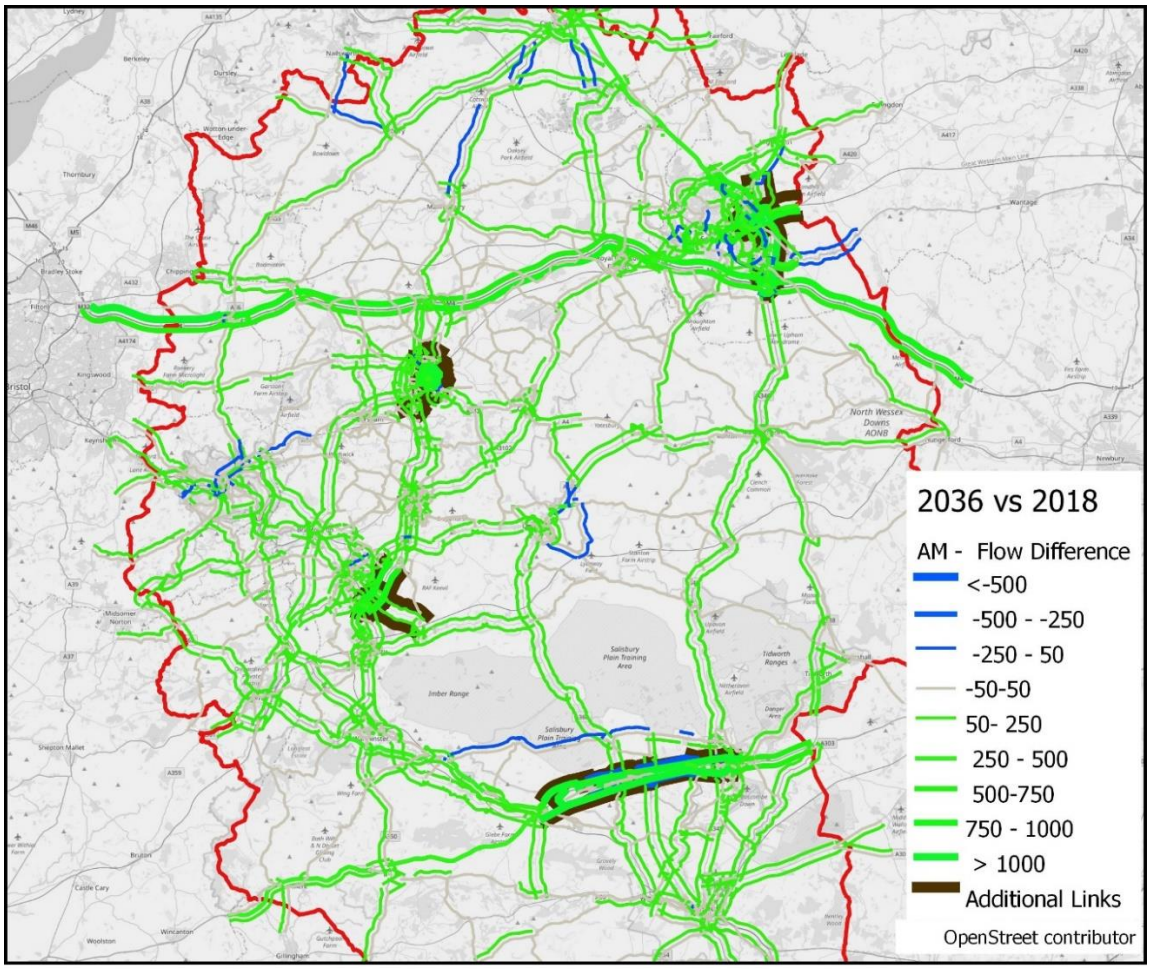
Scenario	Peak	Global				AoDM (Wiltshire and Swindon)			
		Av time (mins per pcu)	Change vs Base %	Av delay (mins per pcu)	Change vs Base %	Av time (mins per pcu)	Change vs Base %	Av delay (mins per pcu)	Change vs Base %
Base	AM	45.0	-	0.82	-	16.9	-	2.33	-
	IP	43.2	-	0.46	-	15.6	-	1.60	-
	PM	41.8	-	0.89	-	16.3	-	2.32	-
2024 Core	AM	47.3	5%	0.94	14%	17.0	1%	2.29	-2%
	IP	44.9	4%	0.50	10%	16.0	2%	1.70	6%
	PM	44.0	5%	0.97	9%	16.6	2%	2.42	4%
2036 Core	AM	47.2	5%	1.04	27%	18.0	7%	2.90	25%
	IP	45.1	4%	0.70	54%	16.8	8%	2.17	36%
	PM	44.6	7%	1.25	41%	18.0	10%	3.21	39%

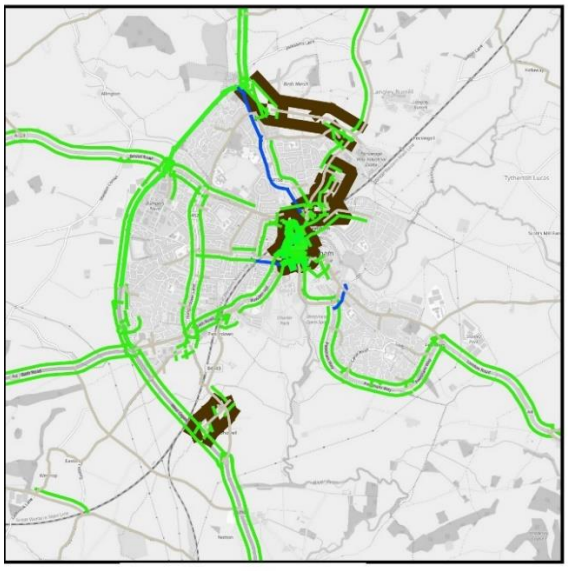
The AoDM output is based on a cordon of the full model, it therefore doesn't necessarily reflect full end to end travel time. This is why travel times are less than the full model. The change is therefore relative rather than absolute.

6.4. Traffic flow difference

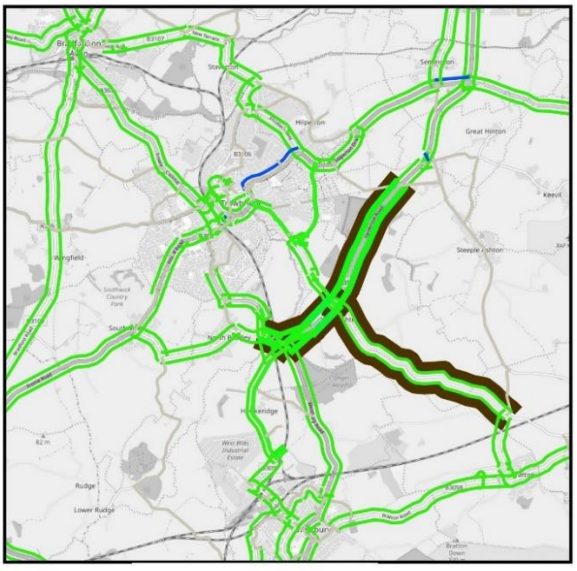
A traffic flow difference plot between the 2036 AM peak core and the base model is presented in Figure 6-1. There are, in general, increases on the strategic road network, within relatively minimal changes on the minor / rural roads in the region. The traffic flow differences for the remaining forecast years and time periods show a similar pattern and are presented in **Appendix E**. Where there are reductions in trips this is mainly due to network changes which result in the reassignment of trips. This is considered a plausible trend change in the overall trip patterns.

Figure 6-1Traffic flow difference (2036 AM Core vs Base Year AM)





Chippenham



Trowbridge

6.5. Travel time change

The forecast change in travel time on the validated routes within the core area are presented in Table 6-2. The routes (see Figure 6-2) expected to show a 10% increase in journey time are highlighted in red.

The main increases are journeys on

- R2 northbound: Devizes to Chippenham
- R3 between Corsham and Calne, via Chippenham
- R7 southbound: Trowbridge to Warminster

These changes are primarily due to the large amount of development and the increases in demand north-south on the A350 are resulting in increased congestion on this route.

Figure 6-2 Journey time routes

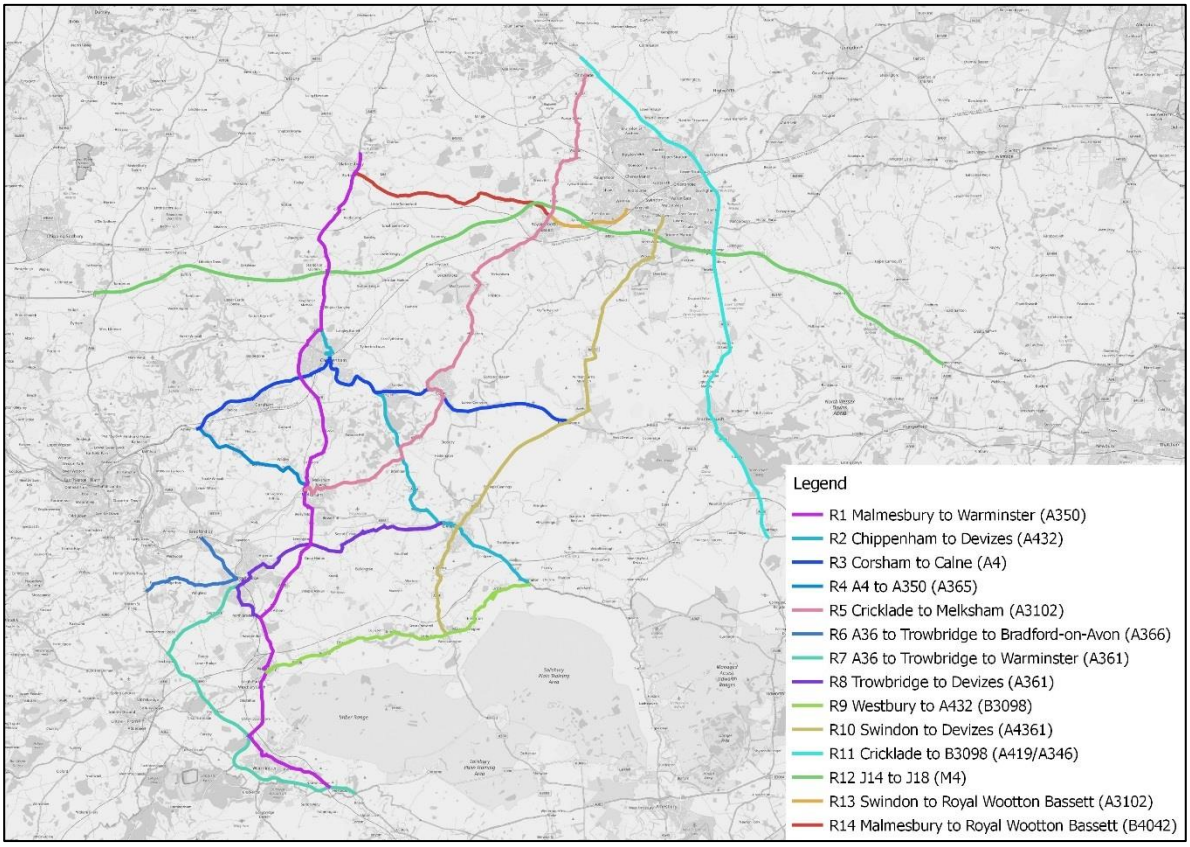


Table 6-2 Journey time changes compared to the base on strategic routes

No.	Route	Dir	AM Peak Period			Inter Peak Period			PM Peak Period		
			Base (min)	Core (2024) %	Core (2036) %	Base (min)	Core (2024) %	Core (2036) %	Base (min)	Core (2024) %	Core (2036) %
1	Malmesbury to Warminster (A350)	NB	62.3	3%	6%	59.8	4%	7%	61.0	3%	8%
		SB	63.4	2%	6%	59.7	4%	7%	62.6	2%	6%
2	Chippenham to Devizes (A432)	NB	33.9	9%	12%	31.3	11%	12%	32.1	10%	12%
		SB	34.2	1%	3%	32.0	6%	7%	33.3	6%	9%
3	Corsham to Calne (A4)	EB	34.2	12%	14%	33.2	13%	14%	35.0	12%	14%
		WB	35.8	16%	18%	33.6	18%	20%	35.3	16%	18%
4	A4 to A350 (A365)	EB	10.0	2%	2%	9.9	1%	1%	10.1	1%	2%
		WB	10.9	6%	6%	10.4	6%	6%	10.5	7%	7%
5	Cricklade to Melksham (A3102)	NB	47.9	7%	8%	45.8	8%	9%	46.6	8%	9%
		SB	48.6	6%	10%	46.9	7%	7%	50.7	6%	9%
6	A36 to Bradford-on-Avon via Trowbridge	EB	13.4	1%	2%	13.2	1%	2%	13.3	3%	3%
		WB	14.6	0%	1%	13.9	1%	2%	14.5	-1%	1%
7	Trowbridge to Warminster (A361)	NB	24.7	5%	9%	24.7	5%	7%	25.1	4%	9%
		SB	25.5	7%	11%	24.9	9%	14%	25.4	10%	15%
8	Trowbridge to Devizes (A361)	EB	26.7	1%	3%	26.8	1%	3%	27.1	0%	2%
		WB	25.5	4%	7%	25.4	5%	8%	26.7	3%	6%
9	Westbury to A432 (B3098)	EB	26.0	2%	2%	25.1	2%	3%	25.3	2%	4%
		WB	25.2	4%	6%	25.0	4%	5%	24.9	4%	6%
10	Swindon to Devizes (A4361)	NB	44.4	-1%	-1%	40.2	2%	2%	43.6	-3%	-2%
		SB	39.3	1%	2%	39.8	0%	1%	42.6	-1%	-2%
11	Cricklade to B3098 (A419 / A346)	NB	29.9	2%	4%	29.4	2%	4%	30.7	3%	10%
		SB	29.4	4%	7%	28.1	2%	4%	29.0	3%	6%
12	J14 to J18 (M4)	EB	37.5	2%	5%	36.4	1%	2%	36.4	1%	2%
		WB	36.1	0%	1%	36.6	1%	2%	37.4	1%	2%
13	Swindon to RWB (A3102)	EB	7.3	-8%	-5%	6.8	-6%	-3%	7.0	-6%	-1%
		WB	7.0	7%	11%	6.8	4%	10%	7.7	4%	8%
14	Malmesbruy to RWB (B4042)	EB	14.5	0%	1%	14.5	0%	1%	14.4	0%	1%
		WB	14.8	3%	4%	14.2	4%	4%	14.4	4%	6%

7. Summary

7.1. Overview

This report has described the process followed in preparing traffic forecasts for the Wiltshire transport model. Local growth within Wiltshire and Swindon has been derived from an uncertainty log, presented in Appendix B. Growth within each region has been constrained to NTEM 7.2 for car trips and the National transport model for freight traffic.

Two traffic forecast years have been developed. Across the south west region there is expected to be a **5.7%** growth between 2018 and 2024 and **14.3%** up to 2036. Which is equivalent to a CAGR of 0.7%.

7.2. Variable demand model

The core traffic forecast allows for number of behavioural responses in addition to the (fixed) highway assignment response and changes in parameters using the TAG databook. In addition to re-routeing, the VDM can also take into account modal shift to (fixed) rail, macro re-timing and trip redistribution (changes in trip destination). The VDM model form is consistent with the A303 Stonehenge/SWRTM adopted by Highways England. It was subjected to realism tests (see LMVR Issue 3) to ensure it is suitable for traffic forecasting.

7.3. Model outputs

Key indicators used to measure the core traffic forecast against the validated base include:

- Statistics on the convergence of the highway model
- Mean distance travelled, travel time and delay for each vehicle in each year and time period
- Changes in highway traffic flow in each year and time period
- Changes in travel time, delay and volume over capacity on key links in the model area

7.4. Appropriate usage

It is recommended that the model could be used to assess schemes or developments of an “appropriate” scale or type. This “appropriateness” is difficult to quantify precisely, and it is expected that any scheme or development should be assessed based on a **proportionate** approach and the limitations of this (and any alternate) model need to be clearly communicated, through collaboration and discussion with decision makers or stakeholders. It is recommended that any decision maker, or user, seek Atkins’ advice on how to effectively utilise the Wiltshire strategic model. The following considerations are recommended to assist in the decision-making process.

7.4.1. Peak period vs Peak hour

The model, as consistent with the A303 Stonehenge / SWRTM, utilises an average peak period, as opposed to a peak hour. This would be appropriate for economic or environmental outputs or for schemes which impact on the strategic road network, but is likely to result in an underprediction of peak hour delay at a local junction level.

A peak hour model is available which can be used to assess local junctions. This has been validated and is suitable for testing of localised issues. Whether to use the peak period or peak hour model will be based on the level of detail required for local impacts and in agreement with Wiltshire Council.

7.4.2. Geographic area

The model has been developed to strategically assess the highway impact across the AoDM.

For a scheme or development assessment within the Swindon urban area, Atkins recommend usage of the Swindon model to understand the impact within this region. For a scheme or development which lies outside of the Wiltshire boundary, Atkins recommend engagement with Highways England or the appropriate Highway Authority to determine the most appropriate model or assessment tool depending on the nature and location of the assessment.

For schemes within the Wiltshire Authority boundary the Wiltshire strategic model is considered the most appropriate initial tool, unless a more detailed model is already available.

7.4.3. Scheme type

For a highway scheme of appropriate scale and type, the Wiltshire model is considered suitable for initial assessment. If the intervention to be assessed is of a type which the model has known limitations (such as: Pedestrian/Cycle Improvements, PT & Parking schemes) Atkins are able to provide advice on how to estimate/quantify the likely modal shift from vehicle trips or trip redistribution as a result of these types of intervention and calculate possible highway benefit and operational impact using the Wiltshire strategic model.

7.4.4. Donor model

The Wiltshire model is able to provide a strategic forecast and assessment of a highway intervention. For an analysis and assessment of local impacts, Atkins recommend that the strategic model act as a donor for a localised application. This may include developing, using the strategic model as an input (one, or more of) the following:

- A highway cordon of the SATURN model
- Use of bespoke local junction software e.g. LINSIG, ARCADY
- Development of a micro-simulation model (Paramics, VISSIM)

Depending on the purpose, nature and scale of the scheme or development to be assessed, Atkins advise that the strategic model is used in conjunction with local cordoned refinements or other software applications in order to meet the objectives of the assessment. It would be necessary to define an appropriate area of influence (which the strategic model could provide) with potential for localised recalibration and possible adjustments to reflect peak hour demand.

7.5. Potential further enhancements

There are few areas where the traffic modelling can be further enhanced in future.

- Locations within the AoDM region where calibration/validation data is limited or sparse could be added and further calibration undertaken.
- Any changes to the uncertainty log, as new/refined planning applications are provided by Wiltshire Council and associated changes to the travel demand or network infrastructure.
- Atkins will retain a log of any changes required during model application and scheme testing. It may be necessary to provide updates to the model in light of these amendments. The results presented in this report are based on v53 of the base model and v3 of the traffic forecasts.

Appendices

Appendix A. Abbreviations

AADT	Annual Average Daily Traffic	NC	Near Certain
AAJV	Arup Atkins Joint Venture	NHBEB	Non-Home Based Employers' Business
AAWT	Annual Average Weekday Traffic	NHBO	Non-Home Based Other
AM	Morning peak period	Non-CA	Non-Car Available
AoDM	Area of Detailed Modelling	NTEM	National Trip End Model
AONB	Area of Outstanding Natural Beauty	NTM	National Transport Model
ASR	Appraisal Specification Report	NTS	National Travel Survey
ATC	Automatic Traffic Count	OD	Origin-Destination
CA	Car Available	OGV	Other Goods Vehicle
DF	Design Fix	ONS	Office for National Statistics
DfT	Department for Transport	OP	Off-peak period
DIADEM	Dynamic Integrated Assignment and Demand Modelling	P/A	Production/Attraction
DM	Do Minimum	PCF	Project Control Framework
DMRB	Design Manual for Roads and Bridges	PCU	Passenger Car Unit
DS	Do Something	PM	Evening peak period
EB	Eastbound	PPK	Pence per kilometre
GBFM	Great Britain Freight Model	PPM	Pence per minute
GDP	Gross Domestic Product	PT	Public Transport
FMA	Fully Modelled Area	RIS	Road Investment Strategy
GIS	Geographic Information System	RSI	Roadside Interview Survey
GFA	Gross Floor Area	RTM	Regional Traffic Model
HATRIS	Highways Agency Traffic Information System	SATURN	Simulation and Assignment of Traffic to Urban Road Net
HBEB	Home Based Employers' Business	SB	Southbound
HBO	Home Based Other	SEWTM	South East Wales Transport Model
HBW	Home Based Work	SOBC	Strategic Outline Business Case
HDV	Heavy Duty Vehicle	SR	Spending Review
HEIDI	Highways England Interactive DIADEM Interface	SRN	Strategic Road Network
HGF	Housing and Growth Fund	SWARMMS	South West Area Multi-Modal Study
HGV	Heavy Goods Vehicle	SWRTM	South West Regional Traffic Model
HPC	Hinkley Point C	TA	Transport Assessment
HW	Highway	TAG	Transport Appraisal Guidance
IAN	Interim Advice Note	TAME	Traffic Appraisal, Modelling and Economics
IP	Inter-peak period	TEMPro	Trip End Model Presentation Program
LGV	Light Goods Vehicle	TFR	Traffic Forecasting Report
LMVR	Local Model Validation Report	TUBA	Transport User Benefits Analysis
MPD	Mobile Phone Data	VADMA	Variable Demand Assessment
MPOD	Mobile Phone Origin-Destination Data	VDM	Variable Demand Modelling
MCC	Manual Classified Count	VISUM	Transport Modelling Software
MCTC	Manual Classified Turning Count	VOC	Vehicle Operating Cost
MOIRA	Model of Inter-Regional Activity	VoT	Value of Time
MOVA	Microprocessor Optimised Vehicle Actuation	vpd	vehicles per day
MTL	More Than Likely	WB	Westbound
NB	Northbound	WebTAG	Web based Transport Appraisal Guidance

Appendix B. Uncertainty Log

B.1. Land developments

Note that HSAP refers to proposed allocation in emerging housing site allocation plan

Model Sector	Development site name	Planning Permission	No. of dwellings (2018 onwards)	Non-resi land use	Employment (ha)	Uncertainty Category	Completion Date	Comments	Inc ?
Rural Central	Land at Kingston Farm	W/13/00643/FUL	150	Mixed Use	3	NC	2020	Under construction	Y
Calne	Land east of Beversbrook Farm	-	0	Mixed Use	3.2	RF	Unknown	-	N
Chippenham	East of Farrells Field	-	30	-	-	NC	2026	HSAP	Y
Chippenham	Birds Marsh	N/12/00560/OUT	750	A1, B1, B2, B8	2.7	NC	2027	Under construction	Y
Chippenham	Rawlings Green	15/12351/OUT	650	A1-A4, B1, B2, B8	5	More than likely	2027	-	N
Chippenham	Rowden Park	14/12118/OUT	1000	A1-A5, C3, C3	18	MTL	2030	-	Y
Chippenham	Hunters Moon	16/12493/FUL	450	B1, B2, B8	2.3	MTL	2027	-	Y
Melksham	Land North of Sandridge Common	17/01096/REM	100	-	-	MTL	2022	-	Y
Melksham	Land East of Spa Road	14/10461/OUT	450	-	-	MTL	2025	-	Y
Melksham	Land East of Semmington Road	17/10416/VAR	150	-	-	MTL	2023	-	Y
Melksham	Land South of Western Way	16/01123/OUT	235	-	-	MTL	2025	-	Y
Rural Central	Land at Mill Lane	14/03118/OUT	0	Mixed Use	14.7	NC	Unknown	-	Y
Rural Central	North Acre Industrial Estate	-	0	Mixed Use	3.8	RF	Unknown	Saved allocation for employment uses	N
Trowbridge	Elizabeth Way	-	355	-	-	MTL	2028	HSAP	Y
Trowbridge	West Ashton Road	W/11/01663/REM	0	B1, B2, B8	10	RF	Unknown	Saved allocation for employment uses.	N
Trowbridge	Elm Grove Farm	-	250	-	-	MTL	2025	HSAP	Y
Trowbridge	Ashton Park Urban Extension	15/04736/OUT	2600	A1-A5, B1, B2, B8, C2,C3, D1	10	MTL	2031	Resolution to permit	Y

Trowbridge	Land off A363 at White Horse Business Park	-	150	-	-	MTL	2024	HSAP	Y
Trowbridge	Southwick Court	-	180	-	-	MTL	2025	HSAP	Y
Trowbridge	Church Lane	-	45	-	-	MTL	2022	HSAP	Y
Trowbridge	Upper Studley	-	20	-	-	MTL	2024	HSAP	Y
Westbury	Land at Station Road	17/12194/REM	300	-	-	MTL	2028	-	Y
Westbury	Off B3098, adjacent to Court Orchard/Cassways Braton	-	35	-		MTL	2022	HSAP	Y
SE Wilts	Drummond Park Depot	E/11/0001/OUT	475	-	-	MTL	2026	Homes England site	Y
SE Wilts	North of Tidworth Road	K/042723/O	0	Commercial	12	RF	Unknown	Units completed in 2013 and 2014. No further permissions.	N
SE Wilts	Ludgershall	15/02770/FUL	246	-	-	NC	2024	Service Families Accommodation	Y
SE Wilts	Ludgershall Garden Centre Granby Gardens	E/2013/0234/OUT	181	-	-	MTL	2021	-	Y
SE Wilts	Riverbourne Fields, Tidworth	-	311	-	-	NC	2020	Under construction	Y
SE Wilts	Riverbourne Fields	14/05389/VAR	289	-	-	NC	2016	Complete	Y
SE Wilts	Larkhill	-	444	-	-	NC	2024	Service Families Accommodation	Y
SE Wilts	Bulford	-	227	-	-	NC	2024	Service Families Accommodation	Y
SE Wilts	Land immediately to the south and west of Archers Gate	15/02530/OUT	400	-	-	NC	2027	outline permission for Phase 3	Y
SE Wilts	Kings Gate	-	1300	-	-	NC	2027	under construction	Y
SE Wilts	Fugglestone	S/2012/0814	1250	Commercial	0.08	NC	2027	Under construction	Y
SE Wilts	Hampton Park	S/2009/1943	500	-	-	NC	2018	Complete	Y
SE Wilts	Longhedge	-	673	Commercial	0.08	NC	2021	Under construction	Y
SE Wilts	UKLF	-	450	Commercial	0.03	NC	2021	Under construction.	Y
SE Wilts	Netherhampton Road	-	700	-	-	MTL	2027	HSAP	Y
SE Wilts	Churchfields & Engine Sheds	-	1100	-	-	RF	2036	-	N
SE Wilts	Central Car Park	-	200	Commercial	0.04	RF	2024	-	N

SE Wilts	Erskine	13/04870/OUT	292	-	-	NC	2021	This permission is the outline permission for UKLF record. Duplicate	Y
Swindon	Central Swindon	-	3000	A1, A2 & B1a	14.37	NC	2021	-	Y
Swindon	Wichelstowe	S/13/1524	3178	B1, A1,A2,A3	7.34	NC	2021	-	Y
Swindon	Commonhead	S/10/0842	890	B1 and/or B2, A1	13.28	NC	2021	-	Y
Swindon	NEV	-	8270	B1a, B1b/c or B2, B8, A1	41.2	NC	2021	-	Y
Swindon	Tadpole Farm	S/11/1588	1695	B1 and/or B2, A1	5.1	NC	2021	-	Y
Swindon	Kingsdown	-	1650	A1	0.1	NC	2021	-	Y
Swindon	Highworth (Blackworth Industrial Estate)	-	200	B8	5	NC	2021	-	Y
Swindon	Wroughton	S/03/1887	179	-	-	NC	2021	-	Y
Devizes	Underhill Nursery, Market Lavington	-	50	-	-	Hypothetical	Unknown	Deleted from HSAP	N
Warminster	East of the Dene	-	100	-	-	MTL	2023	HSAP	Y
Warminster	Bore Hill Farm	-	70	-	-	MTL	2023	HSAP	Y
Malmesbury	Ridgeway Farm, Crudewell	-	50	-	-	Hypothetical	Unknown	Deleted from Housing Site Allocations Plan	N
SE Wilts	Land at Rowbarrow	-	100	-	-	MTL	2023	HSAP	Y
Chippenham	Langley Park	16/04269/FUL	0	A1	0.0174	NC	Unknown	Aldi store - under construction	Y
Chippenham	Langley Park - Additional	16/03515/OUT	400	A1, A3, C1, C3	1.3656	MTL	2026	This is an outline application for the wider site	Y
Chippenham	Land South-East of Junction 17 of M4	17/03417/OUT	0	B8	9.290304	MTL	Unknown	-	Y
Chippenham	Hullavington Airfield	18/08271/OUT	0	B1	4.415	MTL	Unknown	-	N
Chippenham	Land at Hungerdown Lane	17/09445/FUL	35	A1	Unkown	NC	Unknown	-	Y
Chippenham	Land at Showell Farm	N/13/00308/OUT	0	B1 (a), (b) & (c), B2, B8	5	MTL	Unknown	Employment allocation in Chippenham Site Allocations Plan	Y
Chippenham	Forest Farm	15/11153/OUT	200	B1	Unkown	Hypothetical	Unknown	Permission refused and appeal dismissed	N
Chippenham	Land at Patterdown Road	16/09277/OUT	72	-	-	MTL	2022	-	Y

Chippenham	Riverside	15/12363/OUT	1500	A1-A4, B1-B2, C2-C3, D1-D2	5	Hypothetical	Unknown	Site deleted from draft Chippenham Site Allocations Plan	N
Devizes	Lay Wood	15/12095/REM	220		-	NC	2021	Under construction	Y
Devizes	Land at Quakers Road	15/01388/OUT	123		-	MTL	2022	-	Y
Chipp Rural	Land west of Salisbury Road	15/02026/OUT	175	C1	-	NC	2023	Under construction	Y
SE Wilts	Land at Empress Way	E/2013/0234/OUT	270		-	MTL	2025	Part permitted. HSAP	Y
Melksham	Former George Ward School	14/11295/REM	261			NC	2020	Under construction	Y
Corsham	Land at Bradford Road	16/09292/REM	170			MTL	2020	-	Y
Corsham	Land north of Bath Road	13/05188/OUT	130			RF	2025	-	N
Westbury	Land at The Mead	14/10977/REM	220			NC	2020	Under construction	Y
Westbury	Land north of Bitham Park	14/09262/OUT	300			MTL	2024	-	Y
Calne	Land at Prince Charles Drive	14/11179/OUT	130			MTL	2021	-	Y
Calne	Land off Abberd Lane	15/05254/REM	124			NC	2019	Under construction	Y
Calne	Land to east of Oxford Road	16/07209/VAR	200			MTL	2022	-	Y
Calne	Land north of Low Lane	17/00679/OUT	165	A1		MTL	2023	Calne Community Neighbourhood Plan allocation. Permitted.	Y
Malmesbury	Land to south of Filands	15/05015/REM	180			NC	2020	Under construction	Y
Malmesbury	Backbridge Farm	-	170			MTL	2023	Malmesbury Neighbourhood Plan allocation.	Y
Warminster	West of Warminster urban extension	Various	1550	A1-A5, B1, B2, B8	6	NC	2033	Under construction. Approved masterplan includes schedule for 1550 dwellings	Y
Swindon	Ridgeway Farm		700	D1		NC	2021	Under construction.	Y

B.2. Infrastructure

Note that 2024 and 2036 networks are identical for the core scenario with the exception of the A303 Stonehenge tunnel scheme which is not included in the 2024 model.

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

Chippenham	A350 - B4258 Link Road	Chippenham Design Sketches v2	New junction on A350 and link road through to B4528	Unknown	NC	Yes	Committed - Delivered as part of Showel Farm development (N/13/00308/OUT)
Chippenham	Roundabout on B4528	-	Delivered as part of Rowden Park - to link to Showel Farm access road	2026	NC	Yes	Committed - Part of Rowden Park Development
Chippenham	Station Hill/New Road Junction	Chippenham Design Sketches v2	Conversion of mini-roundabout to signalised T-junction.	Unknown	MTL	Yes	Planned - Chippenham Transport Strategy
Chippenham	Rowden Hill roundabout improvements	Chippenham Design Sketches v2	Flare on approach from south	Unknown	MTL	Yes	Planned - Chippenham Transport Strategy
Chippenham	Pewsham Way/Ave La Fleche roundabout improvements.	Chippenham Design Sketches v2	2 lane exit on Ave la Fleche	Unknown	MTL	Yes	Planned - Chippenham Transport Strategy
Chippenham	Malmesbury Road roundabout improvements	Chippenham Design Sketches v2	Elongation and further signalisation	Unknown	MTL	Yes	Planned - Chippenham Transport Strategy - requires land from Birds Marsh in current format.
Chippenham	A4 link road - Ave la Fleche to Bath Road	-	Cuts into Rowden Park country park land	Unknown	RF	No	At pre-feasibility stage.
Chippenham	Bridge Centre Gyratory	-	Several options	Unknown	MTL	Yes	Planned - tied up with redevelopment of Bridge centre
Chippenham	Birds Marsh spine road (s/b termed North Chippenham Link Road)	Drawing	First link of northern distributor from Malmesbury Rd rdbt to Mauds Heath Causeway.	2026	NC	Yes	Committed - delivered as part of Birds Marsh (s/b North Chippenham) development (N/12/00560/OUT)
Chippenham	Parsonage Way realignment	Drawing Title - Landscape Proposals 683-02A	Double roundabout on Mauds Heath, linked to Birds Marsh.	Unknown	NC	Yes	Committed - delivered as part of Wavin application
Chippenham	Signalisation of Marshfield Road/Park Lane mini roundabout.	-	Altering the combined mini roundabout and priority junction found at the intersection of Marshfield Road and Park Lane to two signalised junctions.	Unknown	Unknown	Yes	None
Trowbridge	A350 Yarnbrook and West Ashton Relief Road	Design	Construction of 2.5km of new carriageway, conversion of West Ashton signals into three-arm	2021	NC	Yes	None

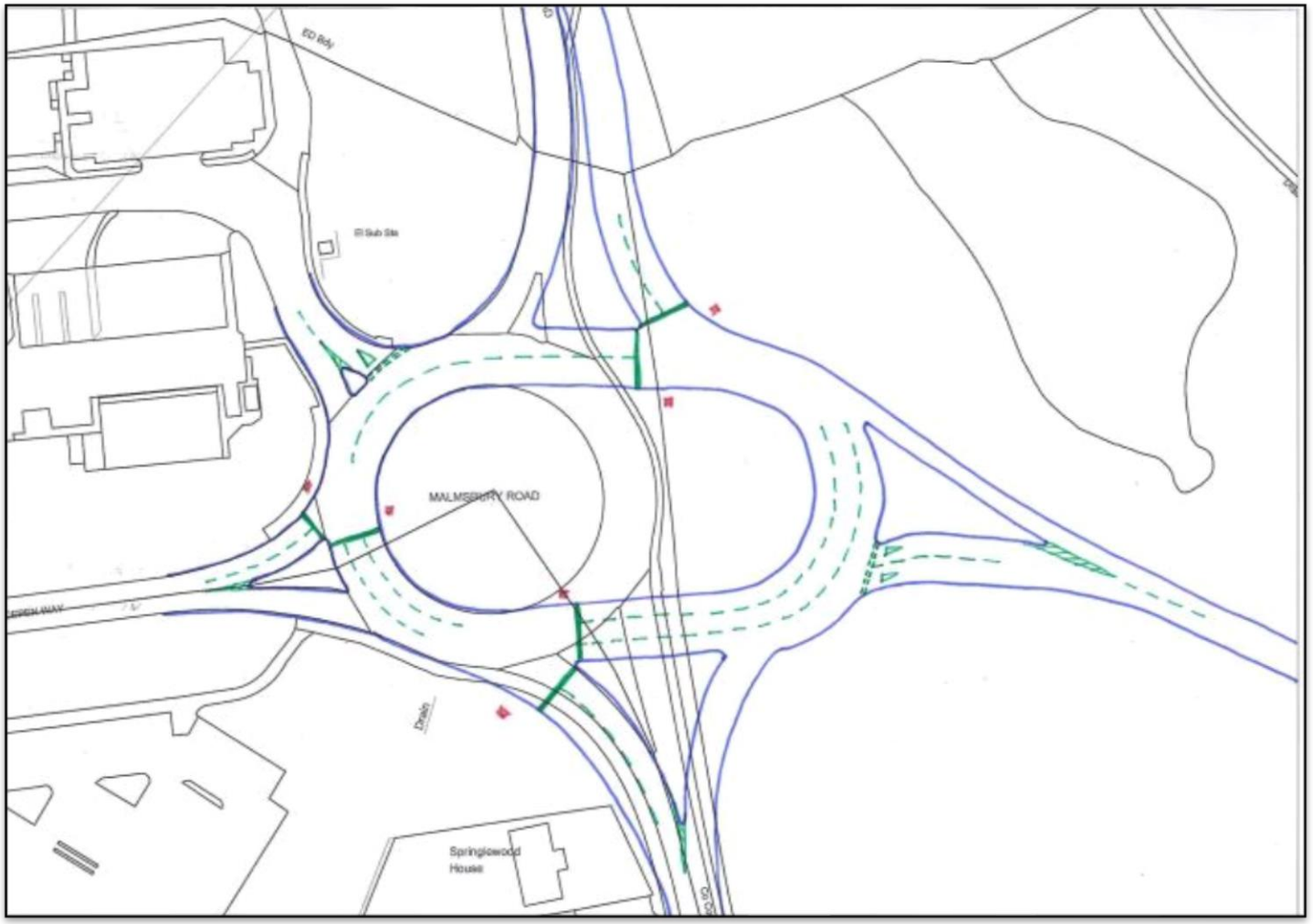
			junction, stopping up the existing A350 and construction of three new roundabouts.				
Trowbridge	Staverton Bypass	Atkins Feasibility	-	Unknown	Hypothetical	N	Undertaking sub-SOBC work.
Trowbridge	Longfield Gyratory Capacity Improvements	Trowbridge Transport Strategy	-	Unknown	Hypothetical	N	
Trowbridge	Trinity Rbout Capacity Improvements	Trowbridge Transport Strategy	-	Unknown	Hypothetical	N	
Trowbridge	Wicker Hill / Broad Street	Atkins Detailed Design	One way reversal scheme	Unknown	Hypothetical	N	
Devizes	A361 London Road / Windsor Drive	Atkins Detailed Design	Capacity improvements	2018	NC	Y	Being constructed
Salisbury	H01 Harnham Gyratory - remodelling	Transport Strategy		2026	MTL	Y	
Salisbury	H02 Exeter Street roundabout enhancements	Transport Strategy	-	2026	MTL	Y	
Salisbury	H03 St Pauls Roundabout enhancements	Transport Strategy	MOVA upgrade	2026	RF	N	
Salisbury	H04 Route hierarchy	Transport Strategy	Development of a hierarchy of routes that restricts traffic movements in the city	2026	RF	N	
Salisbury	HO5 UTMC improvements	Transport Strategy	Use and improve UTMC in accordance with the route user hierarchy in Core Policy 61	2026	MTL	Y	
Salisbury	H06 College Roundabout capcaity enhancement	Transport Strategy	-	2026	RF	N	
Salisbury	H07 A36 Bourne Way capacity enhancements (Petersfinger P&R junction)	Transport Strategy	-	2026	RF	N	
Salisbury	H08 St Marks Roundabout capacity enhancements	Transport Strategy	-	2026	MTL	Y	
Salisbury	H09 Park Wall Junction (A36/A3094) improvements	Transport Strategy	-	2026	MTL	Y	
Salisbury	H10 Clean Air Zone	Transport Strategy	-	2026	Hypothetical	N	
Salisbury	H11 Freight management scheme (hierarchy / routes)	Transport Strategy	-	2026	Hypothetical	N	

Salisbury	H12 Castle Roundabout capacity enhancements	Transport Strategy	-	2026	MTL	Y	
Salisbury	H14 Maltings/Central car park redevelopment	Transport Strategy	Long stay car parking replaced by multi-storey short stay car park	2026	MTL	Y	
Salisbury	SC01 - 05 Smarter Choices measures	Transport Strategy	Workplace, residential and school travel planning, car clubs and support for electric vehicles	2026	RF	N	
Salisbury	PC01 Pedestrian improvements	Transport Strategy	Improve pedestrian facilities and pedestrian priority in the city centre (bus routes to be maintained - pedestrianisation could be considered as part of this).	2026	RF	N	Pedestrian improvements in progress but pedestrianisation scheme subject to review / consultation
Salisbury	PC02 - PC15 Pedestrian and cycle route improvements	Transport Strategy	Various walking and cycling route improvements.	2026	RF	N	
Salisbury	PT03 - Bus priority measures on Park & Ride routes (Salisbury Road / Wilton Road, Castle Road, London Road, Southampton Road, Downton Road / Exeter Street)	Transport Strategy		2026	MTL	Y	London Road bus lane (700m). Bus priority measures through UTC on other routes, the centre and potentially Exeter Street bus lane.
Salisbury	PT04 - Bus link between the hospital and Britford Park & Ride	Transport Strategy		2026	RF	N	
Salisbury	PT05 - High frequency buses serving all new development sites - at least 4 buses per hour (PR3, Red 10, PR11, PR7, Red 5)	Transport Strategy		2026	MTL	N	
Salisbury	PT09 - Salisbury Rail Station Interchange Improvements - details subject to ongoing work being conducted in partnership between Wiltshire Council, Network Rail and public transport operators	Transport Strategy		2026	RF	N	
Salisbury	A36 Southampton Road upgrades		Depends on options - increased capacity; bus lanes; service lane for retail facilities along A36	Unknown	Hypothetical	N	
Wilton	Wilton Rail Station	Atkins study		Unknown	Hypothetical	N	

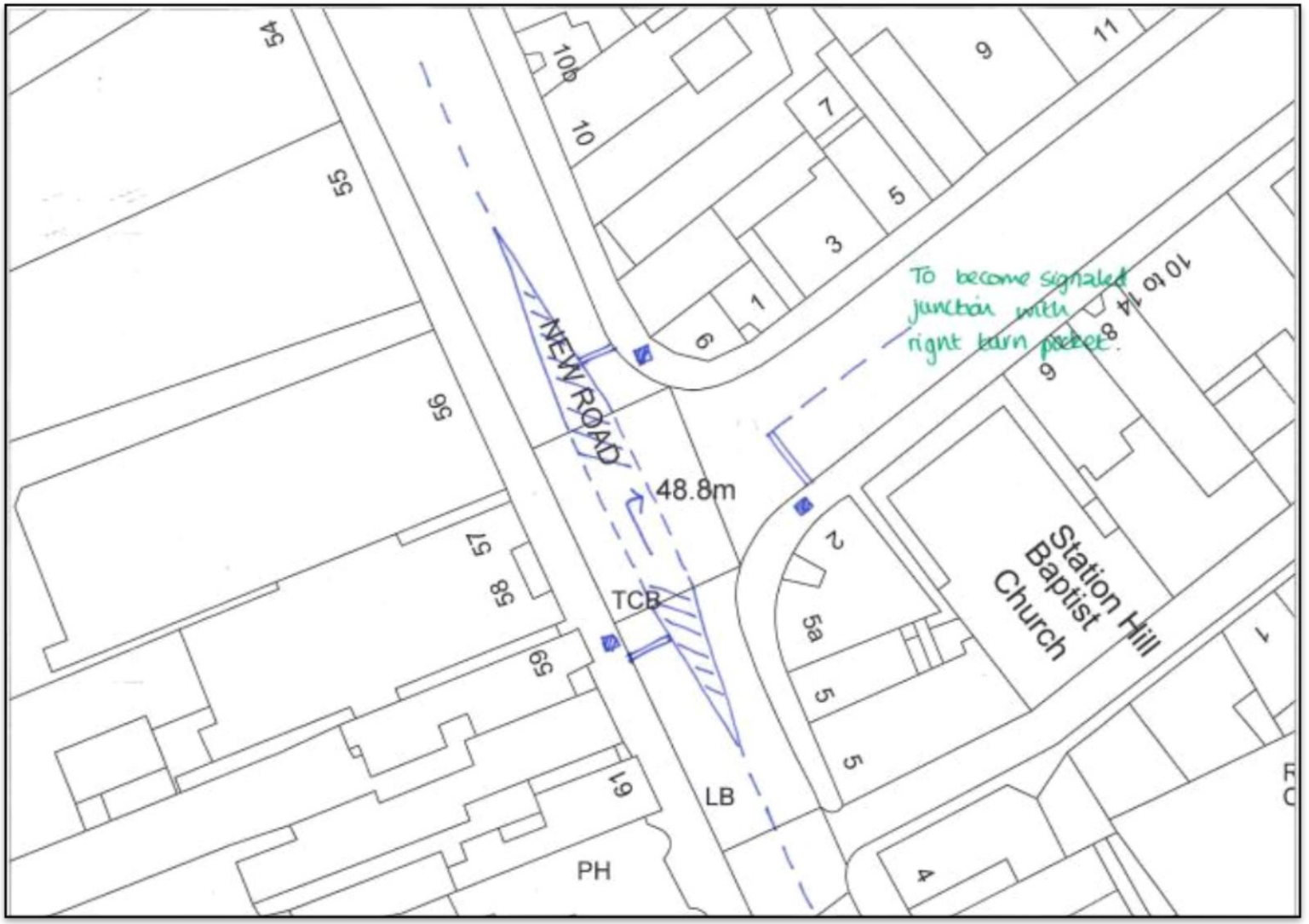
Porton	Porton Rail Station			Unknown	Hypothetical	N	
Amesbury	Boscombe Down access	Atkins study	-	Unknown	RF	N	Undertaking sub-SOBC work.
Strategic	M4 J15 Improvements	HE	Upgrading capacity and changing layout of gyratory at J15 (Swindon East). £4.5m 3rd party scheme required to accommodate nearby Urban Expansion of Swindon at Commonhead. Additional lane on gyratory, additional lane on A419 southbound approach, and dedicated turning lane onto eastbound M4 slip.	2020	MTL	Yes	None
Strategic	Link to Junction 16 of the M4	SLP	New road linking Wichelstowe to M4 J16 including new crossing of the M4.	2022	MTL	Yes	Design being prepared. LGF funding secured subject to FBC being approved by DfT.
Strategic	M4 J16 Improvement	LGF scheme	Junction improvement at J16 involving slip road widening, circulatory carriageway widening and new layout improving access between Wroughton and Wootton Bassett.	2018	NC	Yes	Under construction.
Strategic	M4 J17 - amendments. Three lanes on circulatory carriageway.	Drawing - Chippenham Gateway - M4 J17 -	Includes a flare on A350, 3 lane on southern circulatory, 3 lane flare on B4122, signalisation of A350 and B4122 arms	Unknown	NC	Yes	Committed - To be delivered as part of the Chip Gateway development.
Strategic	Further M4 17 Amendments	Hullavington Airfield Project)	Three lanes on northern circulatory carriageway and a signalised A249 arm	Unknown	unknown	No	Planning in progress.
Strategic	Severn River Crossing Toll	-	Toll charge to be ended by beginning of 2019.	2019	NC	No	Tolls removed
Strategic	A303 Stonehenge Tunnel	Highways England Website	To move the A303 into a tunnel that would run below Stonehenge	2026	MTL	Yes	Site construction forecast to start 2021.

B.3. Selected scheme designs

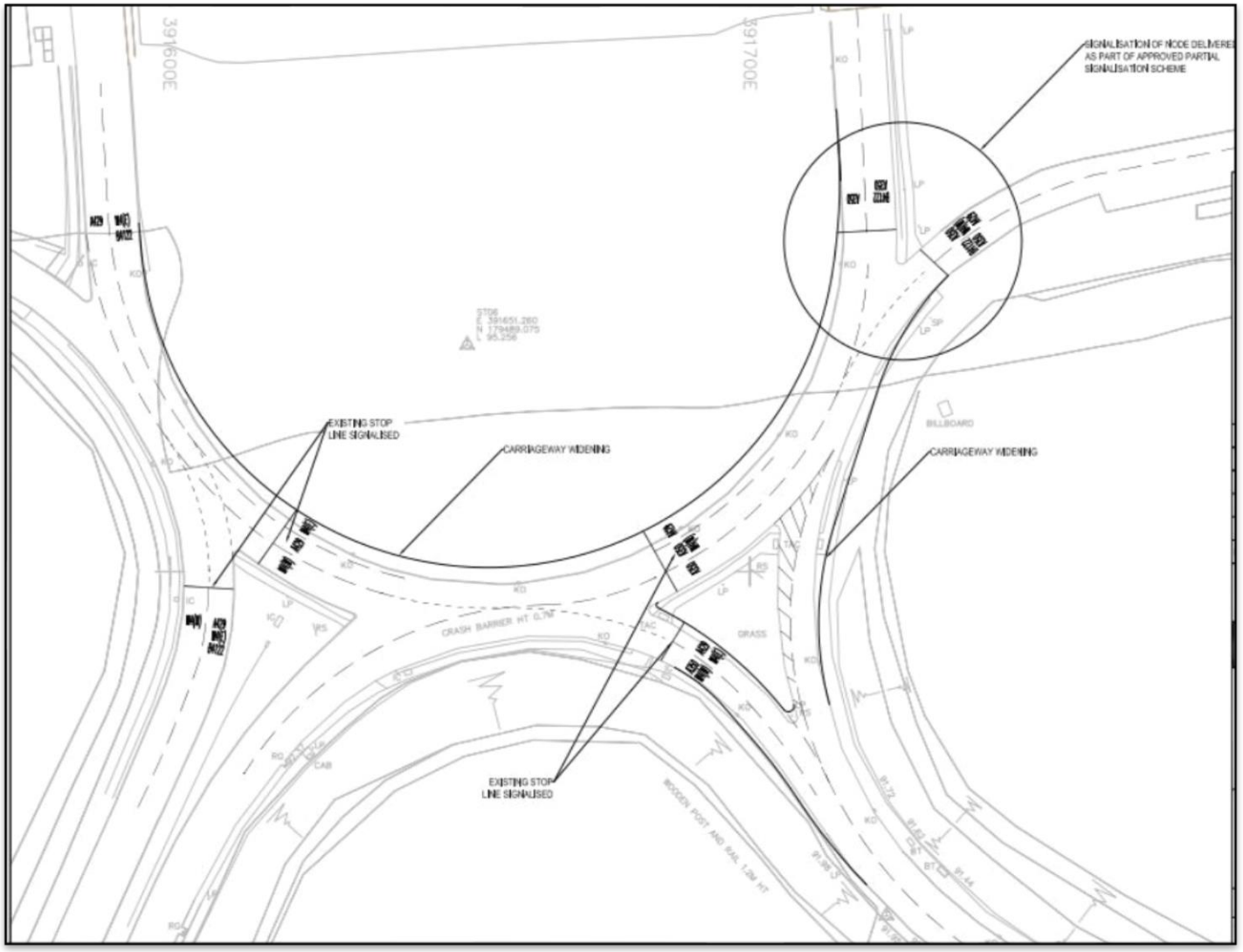
B.3.1. Malmesbury Road roundabout improvements



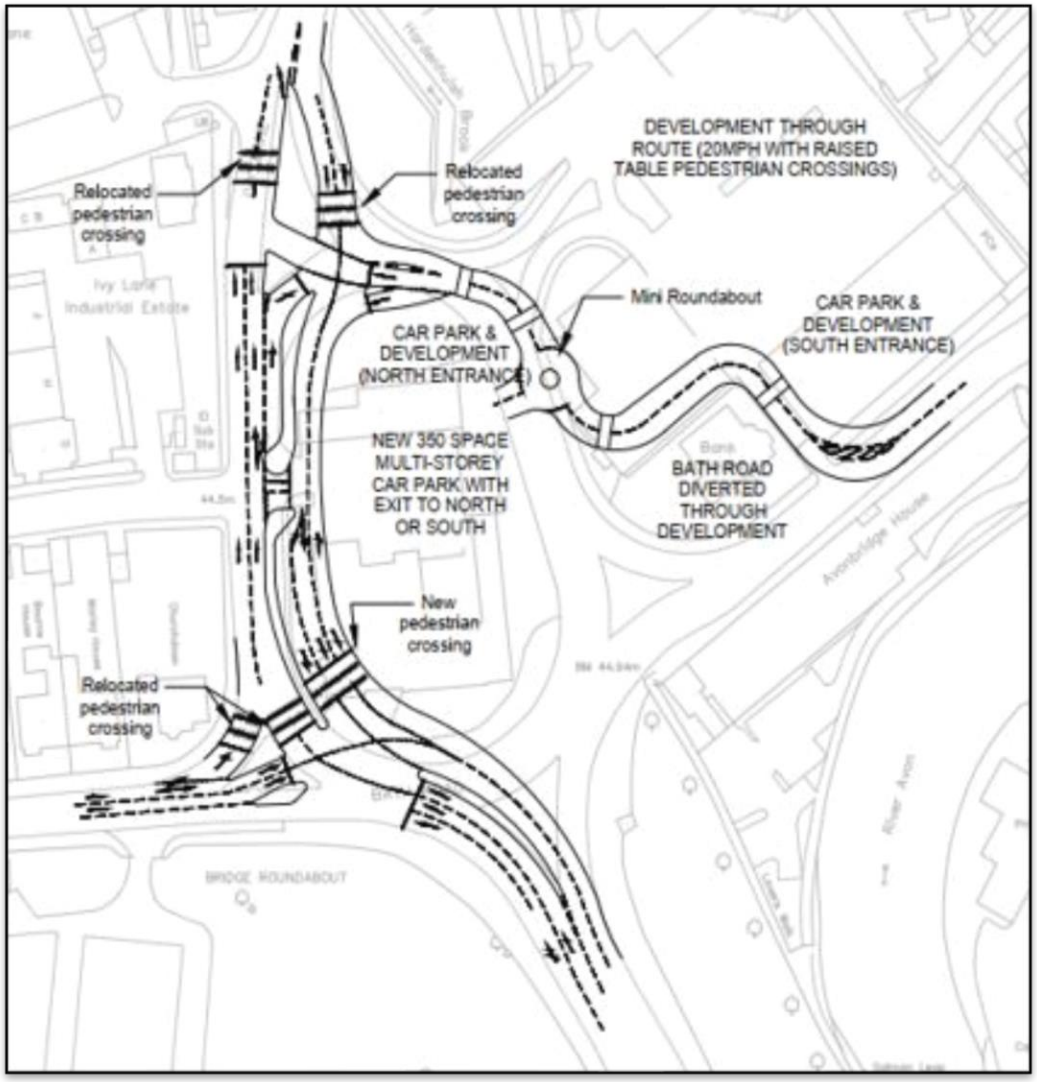
B.3.2. Station Hill/New Road Junction



B.3.3. M4 J17 - amendments. Three lanes on circulatory carriageway

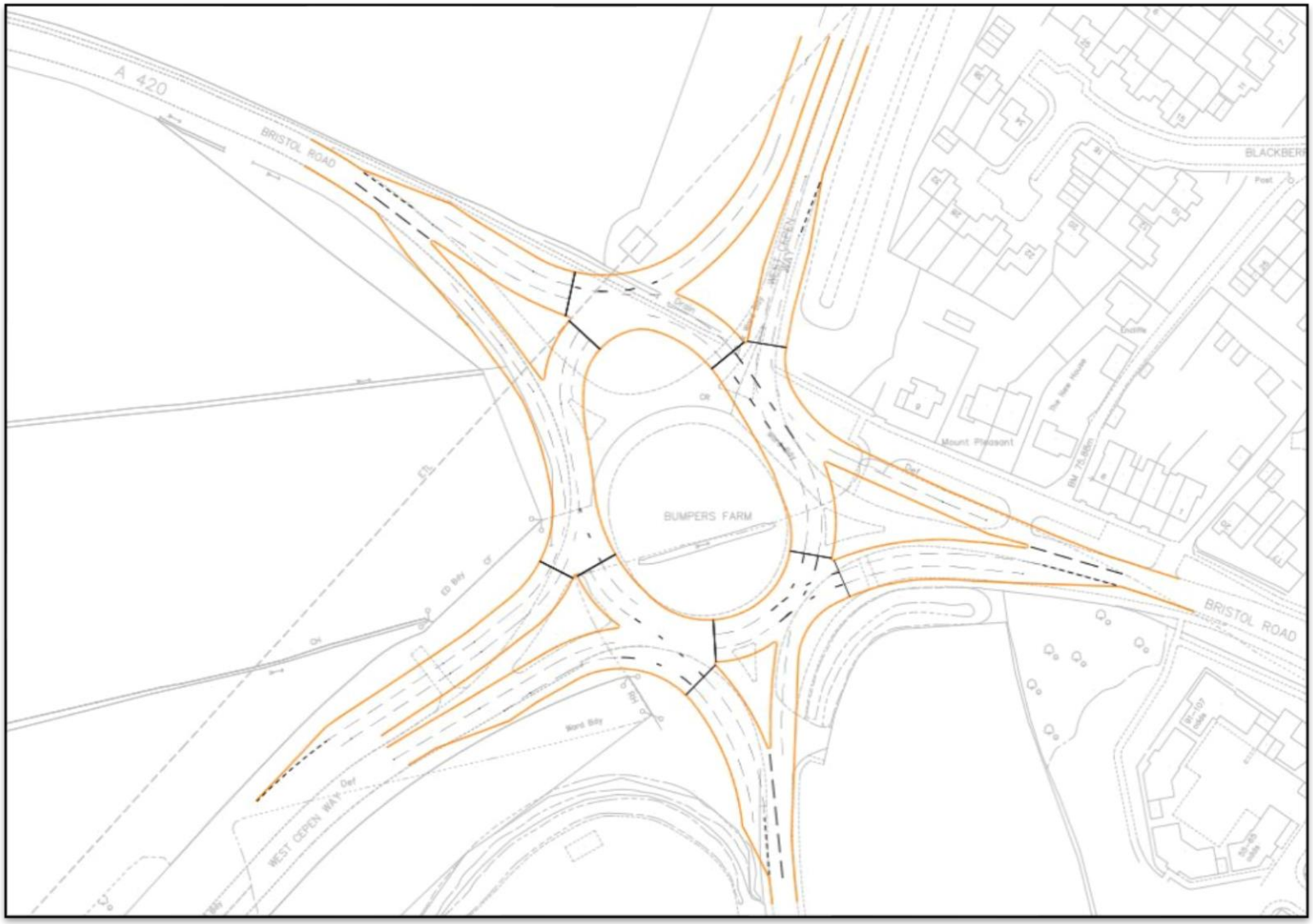


B.3.4. Bridge Centre Gyratory

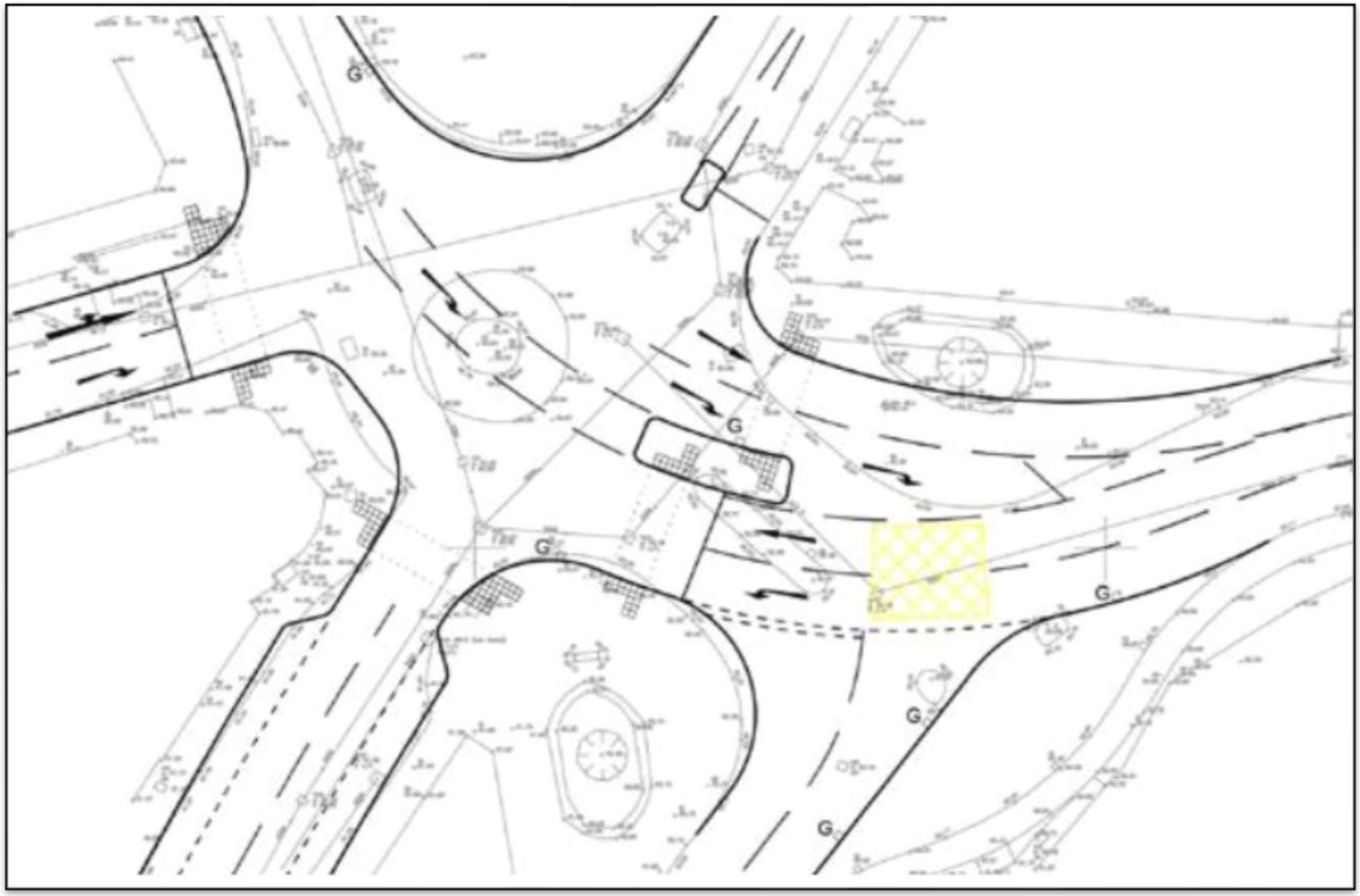


B.3.5. Birds Marsh spine road (s/b termed North Chippenham Link Road)

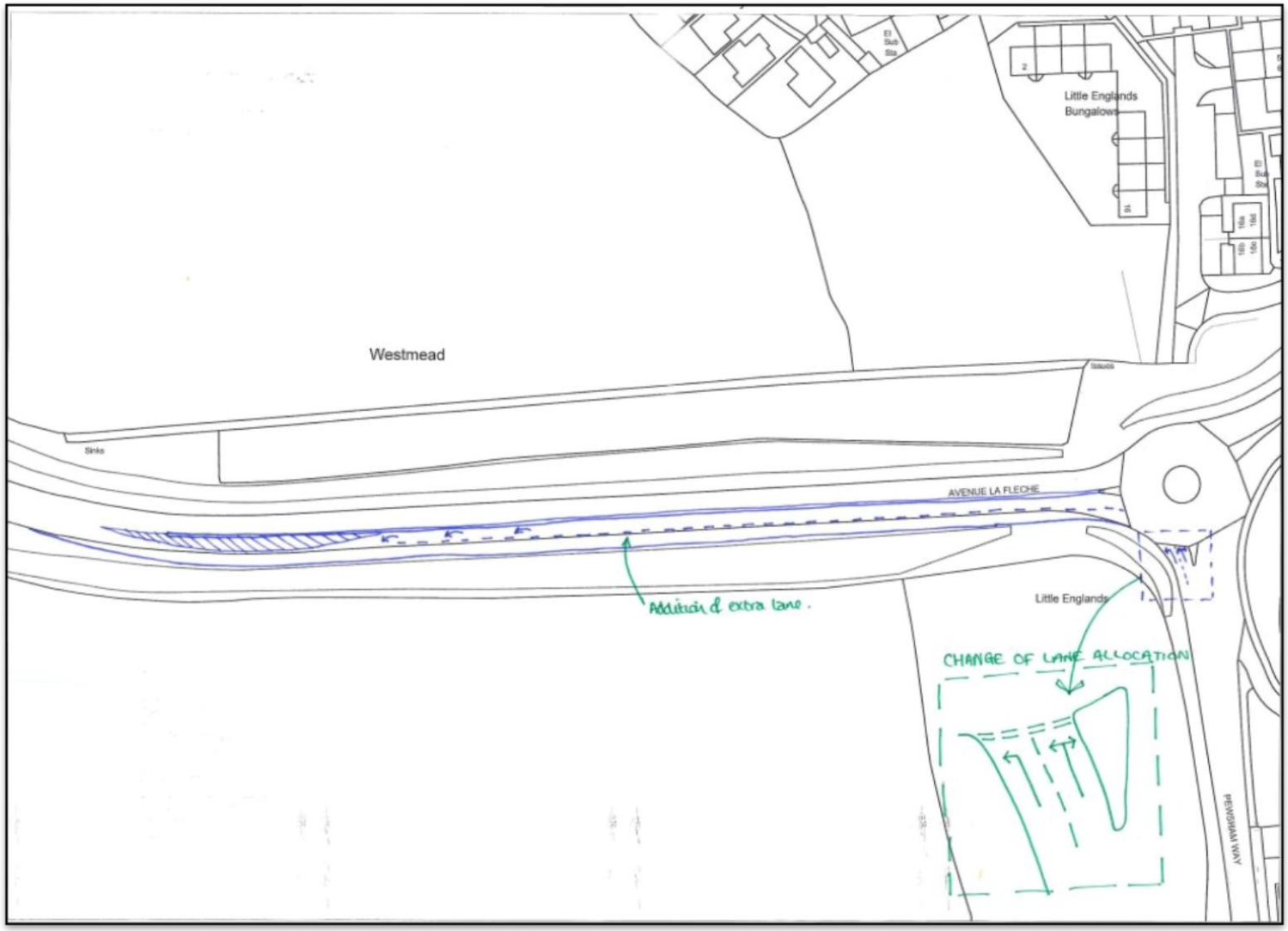
B.3.6. Bumpers Farm Roundabout Improvements



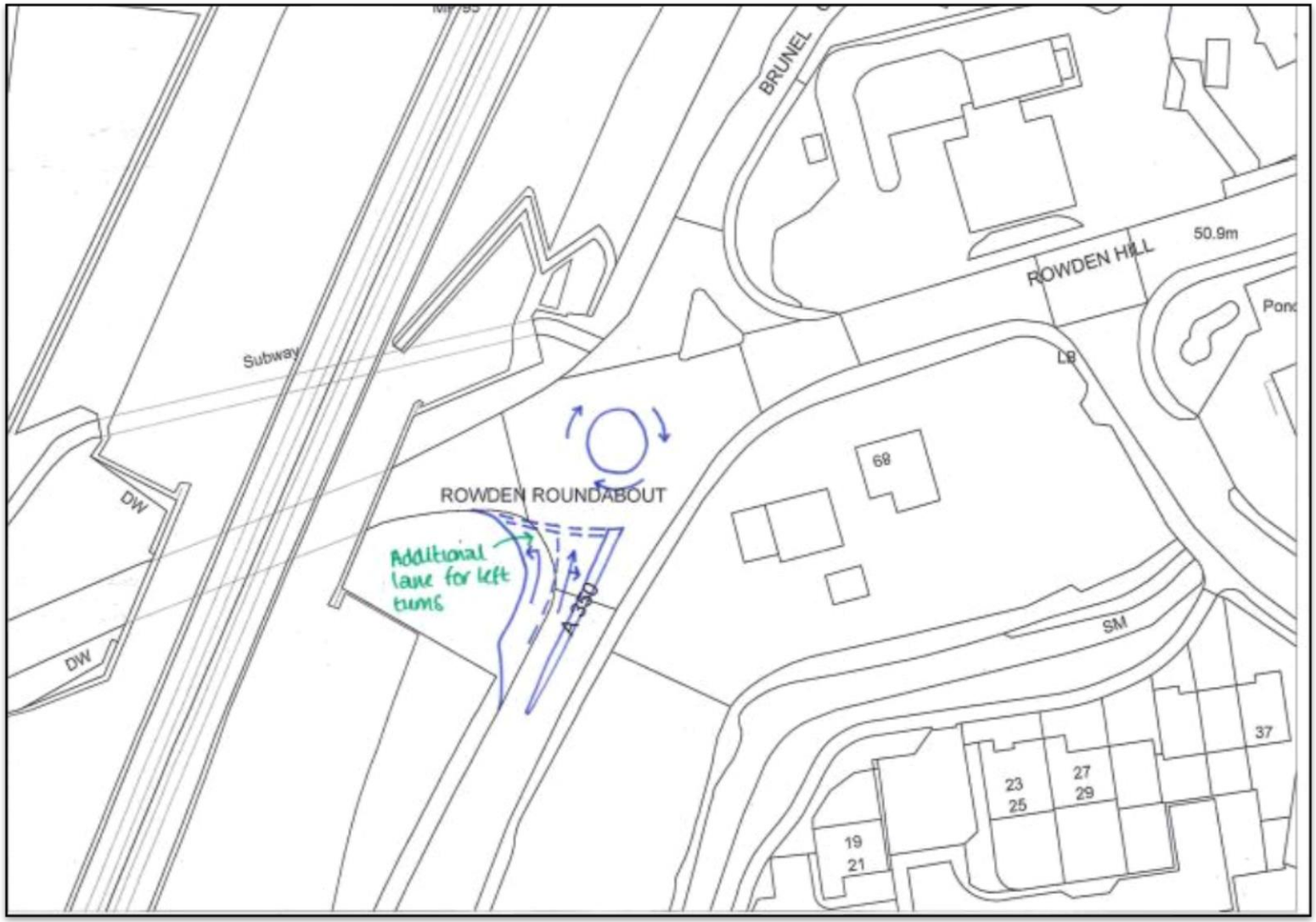
B.3.7. Little George Roundabout Improvements



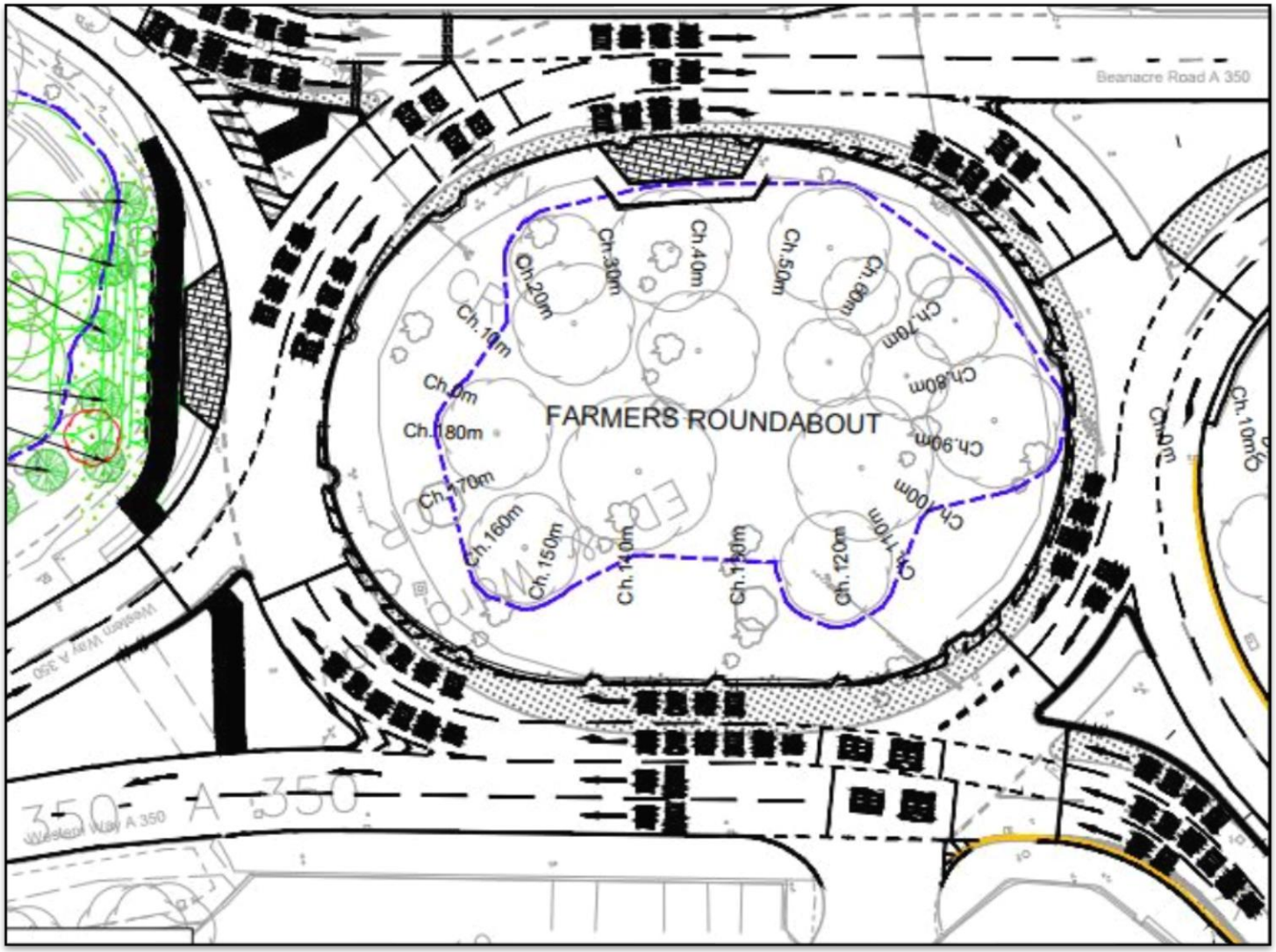
B.3.8. Pewsham Way/Ave La Fleche roundabout improvements



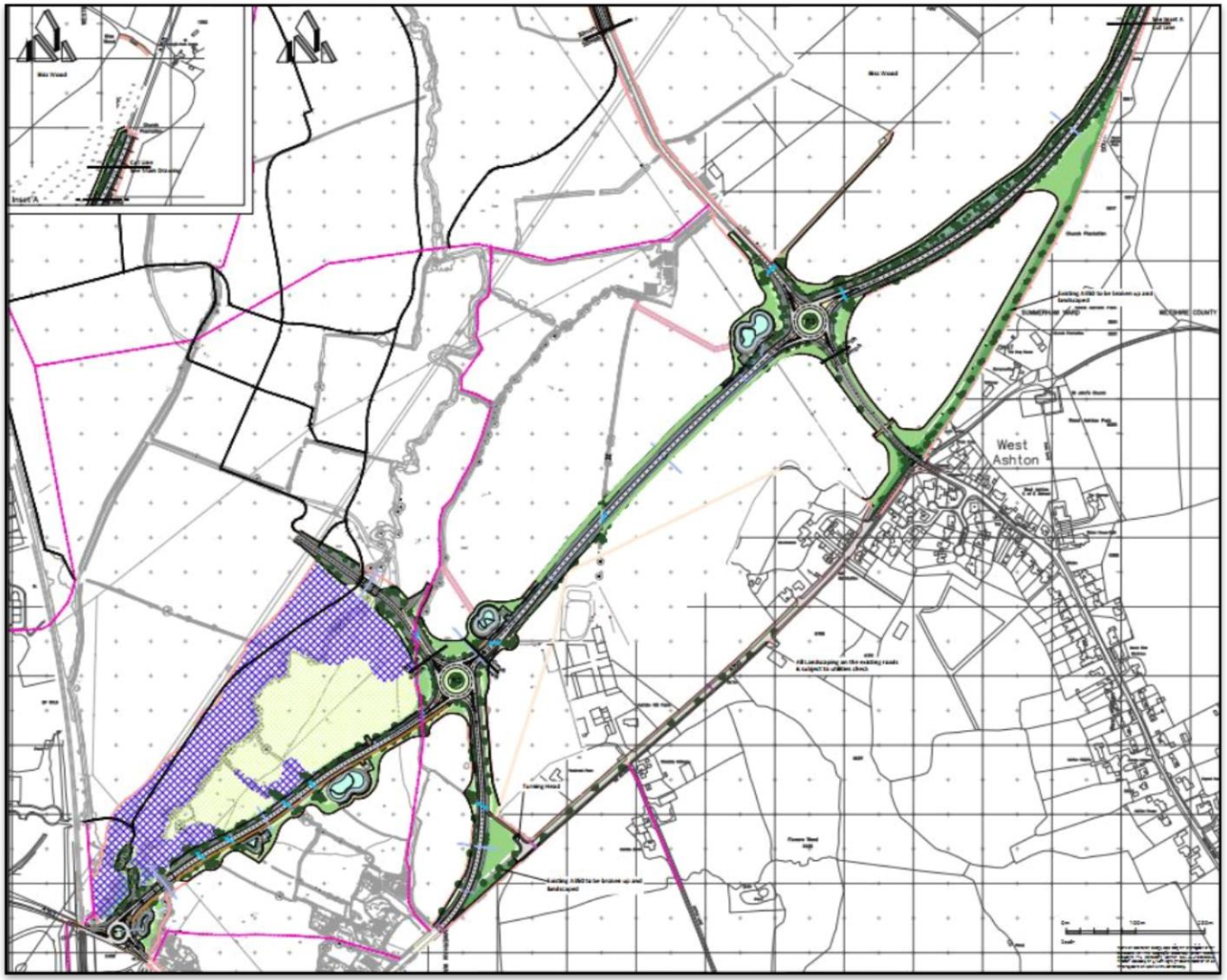
B.3.9. Rowden Hill roundabout improvments



B.3.10. A350 Farmers Roundabout Improvements



B.3.11. Yarnbrook to West Ashton relief road



Appendix C. NTEM 7.2 Growth

C.1. 2024 NTEM 7.2 growth factor (Av Weekday 24hr PA Car driver)

Area Description	HB Work		HB Employers Business		NHB Work		NHB Employers Business		HB Other		NHB Other	
Name	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction
EAST	1.0340	1.0406	1.0436	1.0500	1.0631	1.0638	1.0471	1.0461	1.0887	1.0921	1.0724	1.0733
EM	1.0369	1.0369	1.0452	1.0452	1.0485	1.0485	1.0400	1.0400	1.0671	1.0671	1.0555	1.0555
LON	1.0634	1.0471	1.0685	1.0558	1.0692	1.0665	1.0518	1.0523	1.0987	1.0917	1.0752	1.0733
NE	1.0514	1.0514	1.0613	1.0613	1.0533	1.0533	1.0514	1.0514	1.0641	1.0641	1.0573	1.0573
NW	1.0456	1.0456	1.0522	1.0522	1.0495	1.0495	1.0454	1.0454	1.0617	1.0617	1.0540	1.0540
SCOTLAND	1.0475	1.0475	1.0574	1.0574	1.0502	1.0502	1.0482	1.0482	1.0637	1.0637	1.0558	1.0558
SE	1.0415	1.0455	1.0503	1.0543	1.0596	1.0597	1.0496	1.0492	1.0799	1.0797	1.0660	1.0669
Bristol	1.0544	1.0364	1.0664	1.0449	1.0507	1.0521	1.0397	1.0407	1.0754	1.0739	1.0592	1.0589
Cornwall	1.0417	1.0394	1.0525	1.0505	1.0470	1.0460	1.0426	1.0421	1.0628	1.0616	1.0537	1.0544
Devon	1.0435	1.0446	1.0538	1.0548	1.0525	1.0531	1.0475	1.0477	1.0690	1.0696	1.0606	1.0602
Dorset	1.0336	1.0329	1.0431	1.0422	1.0421	1.0420	1.0361	1.0359	1.0575	1.0588	1.0493	1.0494
Gloucestershire	1.0437	1.0437	1.0528	1.0528	1.0493	1.0495	1.0459	1.0460	1.0614	1.0624	1.0546	1.0549
Somerset	1.0389	1.0417	1.0478	1.0507	1.0540	1.0536	1.0456	1.0452	1.0712	1.0729	1.0616	1.0611
Wiltshire	1.0284	1.0349	1.0362	1.0436	1.0496	1.0492	1.0390	1.0390	1.0749	1.0705	1.0568	1.0574
WALES	1.0360	1.0360	1.0458	1.0458	1.0427	1.0427	1.0388	1.0388	1.0594	1.0594	1.0503	1.0503
WM	1.0386	1.0386	1.0468	1.0468	1.0493	1.0493	1.0414	1.0414	1.0668	1.0668	1.0556	1.0556
YH	1.0532	1.0532	1.0611	1.0611	1.0554	1.0554	1.0536	1.0536	1.0660	1.0660	1.0595	1.0595

C.2. 2024 NTEM 7.2 growth factor (Av Weekday 24hr PA Rail)

Area Description	HB Work		HB Employers Business		NHB Work		NHB Employers Business		HB Other		NHB Other	
Name	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction
EAST	0.9971	1.0243	1.0138	1.0293	1.0568	1.0427	1.0315	1.0285	1.0228	1.0394	1.0458	1.0412
EM	1.0072	1.0072	0.9973	0.9973	1.0255	1.0255	1.0077	1.0077	0.9949	0.9949	1.0111	1.0111
LON	1.0334	1.0283	1.0466	1.0383	1.0334	1.0398	1.0297	1.0304	1.0340	1.0316	1.0325	1.0347
NE	0.9907	0.9907	0.9755	0.9755	1.0032	1.0032	0.9945	0.9945	0.9614	0.9614	0.9851	0.9851
NW	0.9931	0.9931	0.9820	0.9820	1.0077	1.0077	0.9979	0.9979	0.9729	0.9729	0.9926	0.9926
SCOTLAND	0.9942	0.9942	0.9836	0.9836	1.0106	1.0106	1.0000	1.0000	0.9718	0.9718	0.9951	0.9951
SE	1.0047	1.0153	1.0138	1.0242	1.0381	1.0335	1.0245	1.0220	1.0112	1.0141	1.0271	1.0219
Bristol	1.0203	1.0114	1.0031	1.0071	1.0279	1.0357	1.0076	1.0156	1.0008	1.0095	1.0150	1.0192
Cornwall	1.0049	1.0004	1.0044	0.9991	1.0269	1.0239	1.0115	1.0093	0.9806	0.9861	1.0103	1.0091
Devon	1.0067	1.0090	1.0037	1.0062	1.0300	1.0314	1.0140	1.0149	0.9946	0.9925	1.0152	1.0157
Dorset	1.0086	1.0080	1.0017	1.0021	1.0205	1.0206	1.0087	1.0087	0.9863	0.9878	1.0072	1.0075
Gloucestershire	1.0140	1.0123	1.0136	1.0106	1.0281	1.0272	1.0183	1.0183	0.9968	0.9905	1.0149	1.0134
Somerset	1.0114	1.0133	1.0127	1.0103	1.0372	1.0356	1.0195	1.0153	1.0070	1.0062	1.0254	1.0246
Wiltshire	1.0011	1.0095	1.0023	1.0041	1.0343	1.0276	1.0142	1.0115	1.0107	1.0068	1.0207	1.0182
WALES	0.9955	0.9955	0.9903	0.9903	1.0120	1.0120	1.0025	1.0025	0.9722	0.9722	0.9975	0.9975
WM	0.9953	0.9953	0.9943	0.9943	1.0198	1.0198	1.0051	1.0051	0.9921	0.9921	1.0061	1.0061
YH	1.0017	1.0017	0.9944	0.9944	1.0164	1.0164	1.0095	1.0095	0.9834	0.9834	1.0017	1.0017

C.3. 2036 NTEM 7.2 growth factor (Av Weekday 24hr PA Car driver)

Area Description	HB Work		HB Employers Business		NHB Work		NHB Employers Business		HB Other		NHB Other	
Name	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction
EAST	1.0768	1.0970	1.0982	1.1194	1.1665	1.1695	1.1160	1.1158	1.2376	1.2488	1.1912	1.1939
EM	1.0976	1.0976	1.1168	1.1168	1.1288	1.1288	1.1059	1.1059	1.1759	1.1759	1.1460	1.1460
LON	1.1511	1.1017	1.1625	1.1218	1.1742	1.1678	1.1186	1.1185	1.2675	1.2438	1.1922	1.1861
NE	1.1258	1.1258	1.1488	1.1488	1.1274	1.1274	1.1258	1.1258	1.1519	1.1520	1.1374	1.1374
NW	1.1107	1.1107	1.1268	1.1268	1.1203	1.1203	1.1113	1.1113	1.1487	1.1487	1.1305	1.1305
SCOTLAND	1.1219	1.1219	1.1470	1.1470	1.1274	1.1274	1.1239	1.1239	1.1609	1.1609	1.1422	1.1422
SE	1.0896	1.1017	1.1085	1.1213	1.1503	1.1502	1.1147	1.1144	1.2111	1.2118	1.1686	1.1710
Bristol	1.1608	1.0955	1.1867	1.1125	1.1394	1.1408	1.1049	1.1064	1.2139	1.2014	1.1603	1.1592
Cornwall	1.1115	1.0977	1.1342	1.1223	1.1192	1.1178	1.1060	1.1053	1.1640	1.1548	1.1345	1.1353
Devon	1.0964	1.1030	1.1194	1.1254	1.1291	1.1298	1.1114	1.1118	1.1685	1.1730	1.1480	1.1476
Dorset	1.0883	1.0833	1.1079	1.1030	1.1113	1.1108	1.0921	1.0917	1.1496	1.1527	1.1278	1.1278
Gloucestershire	1.0868	1.0877	1.1061	1.1064	1.1194	1.1201	1.0965	1.0965	1.1672	1.1689	1.1367	1.1374
Somerset	1.0903	1.0985	1.1089	1.1169	1.1393	1.1383	1.1097	1.1090	1.1867	1.1935	1.1595	1.1584
Wiltshire	1.0645	1.0921	1.0807	1.1097	1.1332	1.1335	1.1025	1.1028	1.1991	1.1893	1.1521	1.1533
WALES	1.0980	1.0980	1.1163	1.1163	1.1085	1.1085	1.1020	1.1020	1.1422	1.1422	1.1239	1.1239
WM	1.1002	1.1002	1.1176	1.1176	1.1282	1.1282	1.1070	1.1070	1.1705	1.1705	1.1426	1.1426
YH	1.1190	1.1190	1.1379	1.1379	1.1352	1.1352	1.1227	1.1227	1.1702	1.1702	1.1476	1.1476

C.4. 2036 NTEM 7.2 growth factor (Av Weekday 24hr PA Rail)

Area Description	HB Work		HB Employers Business		NHB Work		NHB Employers Business		HB Other		NHB Other	
Name	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction
EAST	0.9905	1.0555	1.0303	1.0685	1.1554	1.1294	1.0792	1.0745	1.0986	1.1368	1.1250	1.1139
EM	1.0234	1.0234	1.0104	1.0104	1.0752	1.0752	1.0327	1.0327	1.0247	1.0247	1.0391	1.0391
LON	1.0831	1.0701	1.1130	1.0931	1.1105	1.1227	1.0768	1.0776	1.1407	1.1347	1.0969	1.1021
NE	0.9846	0.9846	0.9573	0.9573	1.0129	1.0129	0.9987	0.9987	0.9303	0.9303	0.9713	0.9713
NW	0.9925	0.9925	0.9744	0.9744	1.0275	1.0275	1.0082	1.0082	0.9641	0.9641	0.9921	0.9921
SCOTLAND	0.9899	0.9899	0.9683	0.9683	1.0297	1.0297	1.0065	1.0065	0.9435	0.9435	0.9897	0.9897
SE	1.0088	1.0365	1.0318	1.0553	1.1121	1.1054	1.0607	1.0557	1.0769	1.0865	1.0824	1.0690
Bristol	1.0695	1.0378	1.0398	1.0322	1.0911	1.1061	1.0345	1.0494	1.0696	1.0761	1.0561	1.0652
Cornwall	1.0308	1.0077	1.0351	1.0132	1.0757	1.0698	1.0385	1.0330	1.0003	1.0046	1.0399	1.0363
Devon	1.0099	1.0198	1.0121	1.0224	1.0803	1.0831	1.0387	1.0411	1.0212	1.0198	1.0452	1.0470
Dorset	1.0351	1.0298	1.0239	1.0209	1.0676	1.0676	1.0342	1.0339	1.0246	1.0240	1.0362	1.0357
Gloucestershire	1.0217	1.0173	1.0295	1.0212	1.0825	1.0801	1.0389	1.0365	1.0462	1.0316	1.0479	1.0447
Somerset	1.0279	1.0370	1.0352	1.0358	1.1066	1.1038	1.0542	1.0489	1.0555	1.0645	1.0742	1.0730
Wiltshire	1.0058	1.0340	1.0115	1.0261	1.1011	1.0864	1.0487	1.0409	1.0635	1.0613	1.0683	1.0620
WALES	1.0032	1.0032	0.9886	0.9886	1.0312	1.0312	1.0175	1.0175	0.9586	0.9586	0.9973	0.9973
WM	1.0020	1.0020	1.0021	1.0021	1.0620	1.0620	1.0263	1.0263	1.0128	1.0128	1.0289	1.0289
YH	0.9994	0.9994	0.9898	0.9898	1.0501	1.0501	1.0229	1.0229	0.9906	0.9906	1.0132	1.0132

Appendix D. Core highway demand matrices

D.1. 2024 AM Peak

	Chippenham	Corsham	Melksham	Calne	Devizes	Trowbridge	Westbury	Warminster	RWB	Swindon	Malmesbury	Chip Rural	Rural Cen	SE Wilts	West of Swin	South West	West	South	East	North	**Total**
Chippenham	2331	53	163	92	38	143	42	11	28	111	208	677	215	58	49	12	214	29	106	372	**4949**
Corsham	58	61	23	6	8	18	3	1	2	16	15	248	38	12	4	4	76	5	17	101	**718**
Melksham	152	37	753	15	35	175	37	9	2	32	33	218	472	134	7	13	233	50	25	165	**2598**
Calne	269	12	43	479	112	31	6	3	24	139	57	279	79	43	42	9	43	10	67	115	**1862**
Devizes	62	3	14	37	454	61	9	14	27	161	4	109	494	222	33	2	36	30	75	47	**1894**
Trowbridge	159	16	172	23	60	1836	125	61	5	59	31	276	1280	167	10	14	556	106	65	159	**5180**
Westbury	45	3	48	5	14	183	324	76	3	21	8	44	500	123	7	5	157	56	16	69	**1706**
Warminster	13	1	20	3	8	75	54	549	1	6	2	32	385	236	2	4	148	73	8	26	**1646**
RWB	52	4	3	13	18	5	1	0	55	549	59	106	13	35	89	6	19	14	130	128	**1298**
Swindon	91	12	27	22	59	25	8	3	297	24	273	322	58	328	750	68	82	150	1752	1801	30
Malmesbury	145	9	17	13	1	8	7	2	15	133	706	149	25	15	95	23	55	24	110	598	**2150**
Chipp Rural	748	180	105	232	46	87	14	6	53	243	138	1198	176	232	80	28	361	33	174	492	**4627**
Rural Central	225	31	488	60	634	1364	379	411	16	112	32	284	2556	441	29	24	805	190	99	269	**8447**
SE Wilts	69	3	32	12	217	57	34	101	38	360	16	271	322	14	39	28	249	3133	689	191	20
West of Swin	71	3	5	45	9	9	4	3	104	1017	141	140	15	22	264	11	29	24	150	477	**2543**
South West	5	0	5	1	1	6	4	2	8	94	22	16	12	42	10	180	2	1	0	1	185
West	174	57	136	14	36	395	138	197	10	96	78	538	869	355	19	3	62	2	0	7	77
South	35	4	26	6	30	56	58	44	25	222	28	81	170	3290	36	1	3	288	29	2	328
East	82	13	22	14	27	26	19	5	108	1795	97	223	64	494	163	0	0	25	1308	51	1388
North	396	57	206	39	23	144	68	37	144	2516	828	797	375	299	457	2	7	3	66	3576	3658
Total	**5182**	**561**	**2307**	**1131**	**1830**	**4705**	**1332**	**1536**	**964**	31	**2775**	**6008**	**8117**	21	**2184**	186	77	323	1408	3642	5727

Values are Highway Trip demand in Vehs, values in red in 1000s

D.2. 2024 vs Base AM Peak

	Chippenham	Corsham	Melksham	Calne	Devizes	Trowbridge	Westbury	Warminster	RWB	Swindon	Malmesbury	Chip Rural	Rural Cen	SE Wilts	West of Swin	South West	West	South	East	North	**Total**
Chippenham	431	5	11	12	2	10	6	2	3	7	7	82	23	4	4	2	9	3	10	23	656
Corsham	5	2	1	0	0	1	0	0	0	0	0	19	3	0	0	0	-1	0	0	-1	29
Melksham	14	2	65	2	4	17	4	1	0	1	0	17	60	7	0	1	9	3	1	8	216
Calne	29	0	2	38	-1	2	0	0	0	6	0	14	5	1	1	1	0	0	1	4	104
Devizes	3	0	1	1	18	2	0	1	0	3	0	2	24	6	0	0	-2	0	0	-3	57
Trowbridge	11	1	14	1	1	216	15	9	0	1	-1	13	151	10	0	1	23	7	1	9	487
Westbury	5	0	5	1	0	19	33	14	0	1	0	2	58	8	0	1	11	4	1	4	168
Warminster	1	0	2	0	1	9	8	85	0	0	0	0	62	27	0	1	14	7	1	2	219
RWB	3	0	0	0	-1	0	0	0	3	-14	-3	1	1	-1	-2	0	0	0	-3	-3	-18
Swindon	11	1	1	2	2	1	1	0	-3	1	18	18	6	9	-2	6	5	5	32	62	1
Malmesbury	10	0	0	1	0	0	1	0	0	7	7	6	2	1	1	2	1	0	2	-16	22
Chipp Rural	60	5	2	8	-1	2	0	1	1	2	-1	80	8	2	1	2	-15	0	0	-5	151
Rural Central	12	0	14	3	-4	67	16	46	0	3	-1	4	124	7	0	1	-11	0	0	-3	278
SE Wilts	6	0	2	1	12	4	3	15	2	-6	0	19	34	1	0	2	7	58	8	-1	1
West of Swin	4	0	0	1	0	0	0	0	-6	-32	-5	0	1	-1	-9	1	0	-1	-5	-26	-77
South West	1	0	0	0	0	1	0	0	0	7	2	2	2	4	1	7	0	0	0	0	8
West	18	1	10	1	1	42	14	33	0	7	2	32	97	28	1	0	2	0	0	0	3
South	4	0	2	1	3	5	6	7	2	18	1	8	21	293	2	0	0	15	1	0	16
East	11	1	1	1	2	2	1	1	5	152	5	23	6	41	9	0	0	1	81	2	84
North	49	3	13	3	1	15	6	6	5	175	36	66	36	17	18	0	0	0	3	184	188
Total	689	21	147	77	38	414	115	222	14	1	67	408	723	1	26	8	3	16	85	187	304

Values are Highway Trip demand in Vehs, values in red in 1000s

D.3. 2024 Inter Peak

	Chippenham	Corsham	Melksham	Calne	Devizes	Trowbridge	Westbury	Warminster	RWB	Swindon	Malmesbury	Chip Rural	Rural Cen	SE Wilts	West of Swin	South West	West	South	East	North	**Total**
Chippenham	2716	72	143	152	29	99	41	15	35	64	178	737	177	37	53	9	132	21	65	292	**5067**
Corsham	58	59	28	8	3	16	5	1	2	9	9	206	32	5	3	2	33	5	11	32	**528**
Melksham	169	31	741	27	18	162	31	10	3	21	18	125	468	37	5	6	109	31	18	132	**2162**
Calne	126	7	25	480	61	17	4	1	18	41	19	235	53	20	35	2	22	5	18	59	**1246**
Devizes	25	5	20	80	458	52	6	5	20	47	3	68	633	201	12	1	24	19	43	16	**1738**
Trowbridge	149	13	191	22	60	1871	220	87	6	32	12	106	1490	67	9	11	312	60	42	141	**4901**
Westbury	40	3	38	4	6	221	393	74	2	16	6	19	433	50	6	5	108	43	14	47	**1528**
Warminster	13	1	12	1	6	99	110	539	1	6	2	11	395	126	1	3	142	51	6	27	**1549**
RWB	33	2	4	22	13	5	2	1	64	423	19	50	11	20	77	3	13	11	58	93	**923**
Swindon	78	13	34	60	87	32	8	2	413	22	112	225	76	283	735	80	104	110	1245	1598	27
Malmesbury	136	11	27	20	2	15	8	2	30	143	595	119	33	15	82	21	52	28	101	490	**1930**
Chipp Rural	690	205	145	218	59	121	22	12	49	192	135	1000	207	216	68	19	272	45	133	418	**4230**
Rural Central	167	32	453	60	643	1542	410	457	13	48	22	185	2404	309	17	16	712	137	65	236	**7926**
SE Wilts	33	5	46	23	200	73	62	123	24	274	15	289	298	13	22	37	263	2258	420	228	17
West of Swin	47	3	7	35	12	10	5	2	87	765	76	73	18	19	198	7	22	15	92	349	**1841**
South West	8	1	3	2	2	9	4	4	13	117	41	17	11	43	14	174	2	1	0	2	180
West	143	39	150	31	25	351	135	191	16	96	67	324	801	294	23	2	57	2	0	6	70
South	20	4	32	8	17	79	41	59	16	150	34	44	109	2455	24	1	2	235	19	2	262
East	80	19	29	31	41	42	15	8	61	1486	94	183	86	552	116	0	1	21	1138	44	1206
North	263	33	108	63	31	118	60	37	101	1827	513	394	235	223	399	1	5	2	42	3336	3391
Total	**4990**	**557**	**2237**	**1347**	**1773**	**4935**	**1581**	**1630**	**974**	28	**1968**	**4410**	**7969**	18	**1899**	180	70	264	1202	3394	5190

Values are Highway Trip demand in Vehs, values in red in 1000s

D.4. 2024 vs Base Inter Peak

	Chippenham	Corsham	Melksham	Calne	Devizes	Trowbridge	Westbury	Warminster	RWB	Swindon	Malmesbury	Chip Rural	Rural Cen	SE Wilts	West of Swin	South West	West	South	East	North	**Total**
Chippenham	431	7	10	16	2	8	6	2	3	8	13	72	19	5	4	1	6	2	5	26	644
Corsham	5	2	1	0	0	1	0	0	0	1	0	12	2	0	0	0	0	0	0	1	27
Melksham	14	3	62	3	2	17	3	1	0	2	1	8	52	4	0	0	4	2	1	8	187
Calne	16	0	3	30	1	2	0	0	1	4	1	14	6	2	2	0	1	0	1	5	90
Devizes	2	0	2	0	10	2	0	1	0	3	0	1	30	12	0	0	-1	1	0	0	62
Trowbridge	10	1	18	2	2	219	21	11	0	3	1	5	168	7	1	1	14	5	0	12	501
Westbury	5	0	4	1	0	23	37	12	0	2	1	1	41	6	0	0	6	3	0	3	146
Warminster	2	0	2	0	1	14	18	89	0	1	0	1	66	22	0	0	18	7	1	4	246
RWB	3	0	0	1	0	0	0	0	4	2	0	0	1	0	-2	0	0	0	-1	-3	5
Swindon	9	1	2	5	5	3	0	0	3	1	11	13	8	10	2	7	7	6	41	85	2
Malmesbury	9	0	0	1	0	0	1	0	0	13	2	3	2	1	0	1	1	1	0	-2	31
Chipp Rural	69	11	8	10	0	5	1	1	1	11	4	38	13	13	1	2	0	1	1	12	202
Rural Central	19	3	49	6	34	179	38	73	1	5	1	13	204	36	1	1	30	9	2	15	719
SE Wilts	4	0	5	1	11	6	5	18	1	7	1	16	30	1	0	2	6	106	5	2	1
West of Swin	4	0	0	1	0	1	0	0	-2	1	0	1	1	0	-4	0	0	0	-2	-13	-10
South West	2	0	0	0	0	1	1	1	1	12	4	4	2	5	1	8	0	0	0	0	8
West	18	2	14	3	1	48	17	34	1	11	5	18	100	35	1	0	2	0	0	0	3
South	3	0	4	1	2	9	5	10	1	16	3	5	14	313	2	0	0	15	1	0	16
East	11	1	3	4	3	5	2	1	3	177	6	18	9	60	7	0	0	1	76	2	80
North	42	3	11	8	2	16	7	6	6	186	40	42	30	19	20	0	0	0	2	178	181
Total	676	35	198	93	74	562	162	261	23	2	93	285	798	1	36	8	3	16	79	181	293

Values are Highway Trip demand in Vehs, values in red in 1000s

D.5. 2024 PM Peak

	Chippenham	Corsham	Melksham	Calne	Devizes	Trowbridge	Westbury	Warminster	RWB	Swindon	Malmesbury	Chip Rural	Rural Cen	SE Wilts	West of Swin	South West	West	South	East	North	**Total**
Chippenham	2612	79	142	282	55	180	26	8	51	75	151	754	205	45	55	7	148	17	58	286	**5235**
Corsham	57	58	30	11	4	21	3	1	4	10	9	189	31	3	3	4	39	3	9	53	**542**
Melksham	103	38	760	34	22	203	32	9	2	33	26	124	479	29	4	7	110	24	15	96	**2151**
Calne	138	10	40	452	51	25	3	1	18	29	14	229	62	12	35	1	28	2	14	51	**1216**
Devizes	30	15	24	175	498	93	15	3	46	138	2	71	652	181	17	1	37	16	35	23	**2071**
Trowbridge	88	18	269	27	89	1967	270	96	3	50	12	99	1424	75	4	8	505	59	36	85	**5186**
Westbury	24	3	43	6	9	183	360	74	2	19	8	14	419	39	3	6	136	32	11	36	**1427**
Warminster	3	1	12	2	13	77	109	542	0	6	4	6	432	116	0	1	187	42	3	22	**1577**
RWB	27	2	5	38	20	6	1	0	39	386	25	56	14	20	94	3	12	8	46	112	**914**
Swindon	164	20	39	122	146	52	8	2	503	27	194	264	99	359	1134	66	123	125	1519	2085	34
Malmesbury	212	13	27	50	3	26	5	1	23	165	644	118	25	9	117	20	76	10	65	745	**2355**
Chipp Rural	754	267	228	260	95	254	33	12	76	315	143	1124	285	309	99	27	400	54	175	582	**5490**
Rural Central	170	54	557	81	637	1590	508	425	20	92	34	217	2654	347	16	14	869	131	68	217	**8700**
SE Wilts	43	10	64	37	170	106	101	274	64	343	14	278	370	14	33	37	344	2820	433	227	20
West of Swin	46	3	9	61	25	11	4	1	107	1096	101	94	23	29	222	6	26	17	128	392	**2403**
South West	8	1	2	2	2	9	4	2	6	63	17	15	10	31	8	192	3	1	0	2	197
West	261	103	206	27	54	661	201	230	14	87	55	498	1207	333	17	3	64	3	0	7	81
South	18	7	37	19	26	63	78	71	30	209	23	39	128	3547	41	1	2	280	25	2	315
East	90	14	55	79	71	54	15	14	242	2202	109	204	98	777	299	1	1	28	1446	60	1540
North	446	64	128	151	53	190	80	57	168	2422	637	436	316	242	516	1	7	2	51	4107	4175
Total	**5294**	**782**	**2678**	**1915**	**2043**	**5771**	**1857**	**1822**	**1420**	34	**2221**	**4828**	**8933**	21	**2717**	197	79	318	1525	4184	6401

Values are Highway Trip demand in Vehs, values in red in 1000s

D.6. 2024 vs Base PM Peak

	Chippenham	Corsham	Melksham	Calne	Devizes	Trowbridge	Westbury	Warminster	RWB	Swindon	Malmesbury	Chip Rural	Rural Cen	SE Wilts	West of Swin	South West	West	South	East	North	**Total**
Chippenham	485	6	12	31	2	11	2	1	4	8	8	51	16	4	3	1	0	1	3	11	659
Corsham	5	1	1	0	0	1	0	0	0	0	0	0	1	0	0	0	-3	0	0	-5	1
Melksham	8	2	59	2	2	18	2	1	0	1	0	2	31	2	0	0	0	1	0	0	131
Calne	17	0	3	34	-2	1	0	0	1	2	0	3	3	1	0	0	-1	0	-1	1	65
Devizes	1	-1	2	-6	8	2	0	0	-4	-2	0	-4	-6	8	-2	0	-3	-1	-2	-2	-11
Trowbridge	7	1	25	2	2	309	24	12	0	1	0	1	97	6	0	0	-1	2	0	2	490
Westbury	3	0	3	0	0	17	37	11	0	1	0	0	22	5	0	0	3	1	0	1	106
Warminster	1	0	2	0	1	12	19	104	0	1	0	0	65	19	0	0	24	6	0	3	258
RWB	2	0	0	0	-1	0	0	0	2	-9	0	-2	0	0	-8	0	-1	0	-2	-10	-28
Swindon	11	0	1	3	0	0	0	0	-34	1	8	-5	5	-9	-45	4	2	1	-42	-6	1
Malmesbury	5	-1	-1	0	0	-1	0	0	0	9	-8	-6	-1	0	-5	1	-5	0	-1	-63	-75
Chipp Rural	76	11	12	9	-1	8	0	0	0	8	0	29	8	15	-3	2	-14	-2	-4	-23	131
Rural Central	21	3	63	6	24	166	47	68	1	9	1	6	203	39	1	1	27	5	2	5	699
SE Wilts	4	0	3	1	3	5	5	32	-3	-7	0	-4	14	0	-2	1	-6	-43	-11	-11	0
West of Swin	3	0	0	1	-2	0	0	0	-7	-19	-2	-3	0	-1	-16	0	-1	-1	-8	-31	-85
South West	1	0	0	0	0	1	1	0	0	6	2	2	1	4	1	6	0	0	0	0	6
West	26	4	21	1	2	85	28	42	0	8	2	18	133	37	0	0	3	0	0	0	3
South	4	1	5	2	2	7	11	12	2	19	1	3	13	424	2	0	0	12	1	0	13
East	14	1	7	9	6	7	2	2	13	236	7	17	11	86	17	0	0	1	86	3	91
North	54	1	12	14	2	21	7	9	3	235	35	11	24	18	13	0	0	0	2	203	206
Total	747	29	233	111	48	671	188	295	-23	1	55	117	639	1	-43	6	3	13	89	206	323

Values are Highway Trip demand in Vehs, values in red in 1000s

D.7. 2036 AM Peak

	Chippenham	Corsham	Melksham	Calne	Devizes	Trowbridge	Westbury	Warminster	RWB	Swindon	Malmesbury	Chip Rural	Rural Cen	SE Wilts	West of Swin	South West	West	South	East	North	**Total**
Chippenham	2579	57	184	103	43	176	46	14	30	117	212	721	247	69	52	14	245	34	124	412	**5480**
Corsham	62	63	24	7	9	21	3	1	3	15	15	252	41	13	4	5	80	6	19	106	**751**
Melksham	167	38	796	16	39	203	39	12	3	34	33	225	514	151	7	14	253	57	29	178	**2808**
Calne	294	13	47	485	117	38	6	3	23	137	56	284	87	48	42	10	47	11	77	123	**1949**
Devizes	67	3	15	39	459	72	10	19	28	167	4	110	522	241	34	2	40	34	83	54	**2002**
Trowbridge	188	18	196	27	70	2190	145	82	6	69	34	313	1466	207	12	17	646	135	83	183	**6087**
Westbury	48	3	51	5	15	209	334	97	3	22	8	46	526	139	7	5	168	70	19	72	**1848**
Warminster	17	1	25	4	10	98	68	719	1	8	3	40	479	327	2	5	187	110	12	33	**2148**
RWB	63	4	4	16	22	6	1	1	63	551	64	122	16	40	97	7	22	17	147	150	**1412**
Swindon	122	15	36	30	78	36	10	5	357	27	334	407	77	407	895	87	107	197	2251	2278	35
Malmesbury	157	9	19	14	1	10	7	3	16	134	691	153	27	17	95	26	61	28	122	650	**2242**
Chipp Rural	797	183	114	239	50	104	15	8	55	243	138	1218	193	254	82	32	387	38	197	529	**4877**
Rural Central	242	31	510	63	649	1550	396	516	16	118	32	290	2672	497	29	26	856	219	114	285	**9111**
SE Wilts	80	3	37	14	239	72	38	133	41	359	17	291	374	15	42	33	288	3503	796	217	22
West of Swin	81	4	6	50	10	11	4	4	108	1024	150	155	18	26	277	14	33	28	173	552	**2726**
South West	7	0	5	1	1	8	4	2	8	107	26	19	14	53	11	199	3	1	0	2	205
West	198	61	154	16	42	476	154	258	12	107	82	569	957	425	21	3	68	3	0	7	85
South	39	5	29	7	36	68	71	59	28	244	30	93	207	3685	39	1	4	315	33	3	359
East	94	15	25	16	31	32	21	7	120	1835	105	252	76	570	180	0	0	28	1431	56	1519
North	468	66	234	44	27	176	75	49	162	2704	892	897	431	348	495	2	8	3	70	3889	3979
Total	**5771**	**591**	**2510**	**1195**	**1950**	**5555**	**1448**	**1992**	**1081**	35	**2928**	**6455**	**8944**	23	**2426**	206	86	354	1539	3963	6247

Values are Highway Trip demand in Vehs, values in red in 1000s

D.8. 2036 vs Base AM Peak

	Chippenham	Corsham	Melksham	Calne	Devizes	Trowbridge	Westbury	Warminster	RWB	Swindon	Malmesbury	Chip Rural	Rural Cen	SE Wilts	West of Swin	South West	West	South	East	North	**Total**
Chippenham	679	9	33	23	7	43	9	5	5	13	12	126	55	15	8	4	41	9	28	64	1187
Corsham	9	4	3	1	1	4	0	1	0	0	-1	23	5	1	0	1	3	1	2	4	62
Melksham	29	3	108	3	9	45	6	4	0	3	0	23	103	25	1	2	28	10	5	20	426
Calne	54	0	6	44	4	8	1	1	0	4	-1	19	13	6	1	3	4	2	10	12	192
Devizes	8	0	3	3	23	12	1	6	1	9	0	2	52	25	2	0	2	4	9	4	165
Trowbridge	40	3	39	6	11	570	35	31	1	11	3	51	338	50	2	4	113	35	19	33	1394
Westbury	8	0	8	1	1	45	43	35	0	3	1	4	84	24	1	1	22	17	4	7	310
Warminster	5	0	7	1	3	31	22	254	0	2	1	8	156	118	1	2	53	44	4	9	720
RWB	14	0	1	3	4	1	0	0	12	-12	2	17	4	5	5	2	3	3	14	19	96
Swindon	41	4	10	10	21	13	3	2	58	5	79	102	25	87	143	24	31	52	531	539	6
Malmesbury	22	0	2	2	0	2	1	1	1	8	-8	10	4	3	2	5	7	4	14	35	115
Chipp Rural	110	8	12	14	3	19	1	3	3	2	-1	100	25	24	2	7	11	5	23	32	402
Rural Central	30	0	37	6	11	253	33	151	1	9	-1	10	240	62	1	3	40	29	15	12	942
SE Wilts	17	0	6	3	34	19	8	46	4	-6	2	38	85	1	3	7	46	428	115	25	2
West of Swin	13	0	1	6	1	2	0	1	-2	-25	4	15	3	3	5	3	4	3	18	49	106
South West	3	0	1	0	0	2	1	1	1	19	6	6	4	15	2	26	1	0	0	0	27
West	42	5	28	3	7	123	31	94	1	17	6	63	184	98	3	1	9	0	0	1	12
South	9	1	5	1	8	17	19	22	4	40	3	20	58	688	6	0	1	41	4	0	47
East	23	2	5	4	6	9	3	3	17	191	14	52	18	117	26	0	0	4	203	7	215
North	122	11	40	9	5	47	13	18	23	363	100	166	92	66	56	0	1	0	7	498	509
Total	1278	51	350	141	158	1264	231	678	131	5	220	855	1550	3	269	28	12	47	216	508	825

Values are Highway Trip demand in Vehs, values in red in 1000s

D.9. 2036 Inter Peak

	Chippenham	Corsham	Melksham	Calne	Devizes	Trowbridge	Westbury	Warminster	RWB	Swindon	Malmesbury	Chip Rural	Rural Cen	SE Wilts	West of Swin	South West	West	South	East	North	**Total**
Chippenham	3000	78	161	168	33	122	44	19	41	80	191	790	197	43	59	11	161	26	76	350	**5647**
Corsham	63	61	30	8	4	19	5	2	3	11	9	212	35	5	3	2	38	5	12	36	**562**
Melksham	192	34	789	30	21	191	32	13	4	26	20	135	502	43	6	7	125	35	22	149	**2375**
Calne	139	7	27	487	64	20	4	2	20	47	20	242	58	23	37	3	25	6	22	66	**1318**
Devizes	28	5	23	84	459	61	7	7	24	57	3	73	663	217	14	2	28	23	50	19	**1844**
Trowbridge	185	15	223	27	72	2255	255	119	7	43	14	128	1728	84	11	13	395	77	56	174	**5883**
Westbury	44	3	41	5	7	257	409	95	3	19	7	21	458	58	6	5	126	53	17	53	**1686**
Warminster	17	1	15	1	8	138	143	727	1	8	3	14	506	171	2	4	198	72	9	36	**2074**
RWB	37	2	5	25	15	6	2	1	74	476	21	56	13	23	84	4	15	13	67	112	**1050**
Swindon	94	15	41	69	104	42	9	3	469	25	127	261	92	317	823	95	130	133	1465	1941	31
Malmesbury	145	11	29	21	2	18	8	3	34	166	587	122	35	17	88	24	58	31	115	550	**2066**
Chipp Rural	739	210	156	224	63	144	24	15	55	219	139	1025	224	234	74	24	306	54	158	479	**4564**
Rural Central	186	34	482	65	671	1786	432	574	15	59	24	201	2537	351	19	19	815	169	81	272	**8793**
SE Wilts	38	6	53	26	219	93	70	165	28	308	17	314	341	13	25	46	319	2660	509	270	19
West of Swin	52	4	8	37	13	11	5	2	97	857	80	80	20	22	216	9	26	18	110	409	**2076**
South West	9	1	3	2	2	11	4	5	13	137	44	18	13	50	15	193	3	1	1	2	200
West	159	40	164	34	28	409	144	242	17	116	72	337	852	335	25	2	64	3	1	7	79
South	23	5	35	9	19	97	48	80	18	179	37	50	127	2666	27	1	3	259	21	3	290
East	89	20	33	36	46	52	18	11	70	1671	103	204	100	628	133	1	1	23	1267	48	1343
North	295	36	118	68	36	138	64	46	116	2127	541	421	256	248	437	2	6	2	46	3641	3702
Total	**5532**	**587**	**2435**	**1425**	**1885**	**5871**	**1728**	**2131**	**1107**	32	**2058**	**4704**	**8757**	19	**2105**	199	79	292	1338	3706	5704

Values are Highway Trip demand in Vehs, values in red in 1000s

D.10. 2036 vs Base Inter Peak

	Chippenham	Corsham	Melksham	Calne	Devizes	Trowbridge	Westbury	Warminster	RWB	Swindon	Malmesbury	Chip Rural	Rural Cen	SE Wilts	West of Swin	South West	West	South	East	North	**Total**
Chippenham	715	12	27	31	5	31	9	7	9	23	26	125	40	10	10	3	34	6	16	83	1224
Corsham	10	4	3	1	0	4	1	1	0	2	0	17	5	1	0	1	4	1	1	5	61
Melksham	38	6	110	6	4	45	5	4	1	7	2	19	86	9	1	1	20	6	4	25	400
Calne	28	1	6	36	5	5	1	1	3	11	2	22	10	5	4	1	4	1	5	11	161
Devizes	5	0	4	4	11	12	1	2	4	12	0	5	59	29	2	0	4	4	7	3	168
Trowbridge	46	3	50	7	13	603	56	43	2	14	3	27	406	25	2	3	97	21	15	45	1483
Westbury	9	0	7	1	1	59	53	33	0	5	1	3	67	13	1	1	24	13	3	10	304
Warminster	6	0	5	0	3	52	51	277	0	4	1	4	178	67	1	1	74	29	4	14	771
RWB	7	0	1	3	2	1	0	0	14	55	2	6	3	3	5	1	2	2	8	16	132
Swindon	25	3	9	14	21	14	2	1	58	5	27	49	24	44	91	22	33	30	261	428	6
Malmesbury	18	0	2	2	0	3	1	1	3	36	-6	6	4	3	7	4	7	4	14	58	168
Chipp Rural	118	16	18	16	4	28	2	4	7	37	8	63	30	31	7	6	33	10	25	72	536
Rural Central	38	5	78	11	62	424	60	190	3	16	3	30	337	79	3	4	133	41	18	51	1586
SE Wilts	9	1	12	5	31	26	13	60	4	41	2	41	73	1	4	11	62	508	95	44	2
West of Swin	9	0	1	4	2	3	0	1	7	93	5	8	3	3	15	2	4	2	16	48	225
South West	3	0	1	1	0	3	1	2	1	31	8	5	3	12	2	26	1	0	0	0	28
West	34	3	28	6	4	106	26	85	2	30	10	31	152	75	3	1	9	0	0	1	12
South	5	1	6	2	4	27	12	31	3	45	6	11	32	524	5	0	0	38	3	0	44
East	20	2	6	8	8	15	4	4	12	361	15	39	23	136	24	0	0	4	205	7	217
North	74	5	20	14	6	36	11	15	21	486	67	68	51	44	58	0	1	0	6	483	492
Total	1219	65	396	171	187	1497	308	762	155	6	183	579	1586	2	243	28	12	44	215	493	807

Values are Highway Trip demand in Vehs, values in red in 1000s

D.11. 2036 PM Peak

	Chippenham	Corsham	Melksham	Calne	Devizes	Trowbridge	Westbury	Warminster	RWB	Swindon	Malmesbury	Chip Rural	Rural Cen	SE Wilts	West of Swin	South West	West	South	East	North	**Total**
Chippenham	2901	82	157	308	60	217	28	10	60	98	161	793	224	54	62	8	182	21	73	360	**5859**
Corsham	61	58	30	11	5	23	3	1	4	12	9	186	31	3	3	5	44	4	10	64	**568**
Melksham	119	40	792	37	24	230	33	12	2	43	29	130	497	34	5	7	127	27	19	116	**2322**
Calne	153	11	43	446	53	30	3	1	20	37	15	229	64	13	37	2	34	3	18	60	**1271**
Devizes	34	16	26	177	489	107	15	4	54	180	2	74	660	197	19	1	44	20	43	29	**2190**
Trowbridge	117	21	311	33	104	2479	308	130	4	75	15	119	1628	95	5	10	656	77	50	110	**6345**
Westbury	28	3	46	7	10	211	367	94	2	24	8	15	432	43	3	7	162	38	13	41	**1554**
Warminster	6	1	17	2	18	110	144	767	0	9	5	9	569	159	0	2	274	62	4	31	**2187**
RWB	30	2	6	37	21	7	1	0	45	439	26	58	15	22	96	3	14	10	53	137	**1022**
Swindon	178	20	42	123	158	63	9	3	508	30	197	278	108	369	1157	76	145	145	1670	2410	37
Malmesbury	215	12	26	49	3	29	5	1	25	194	611	114	25	10	121	23	83	11	74	841	**2473**
Chipp Rural	797	265	233	259	97	287	33	15	83	369	144	1111	291	326	105	33	449	66	211	689	**5864**
Rural Central	201	56	596	86	655	1822	522	536	24	121	37	231	2744	394	18	17	994	169	87	261	**9570**
SE Wilts	51	11	72	41	184	131	111	385	70	402	15	296	416	15	36	47	427	3380	532	281	22
West of Swin	52	3	9	61	26	13	4	1	111	1246	102	98	24	31	231	7	30	20	150	461	**2681**
South West	9	1	2	2	2	10	5	2	6	75	19	17	10	35	9	210	3	1	1	2	217
West	277	98	204	28	54	702	195	274	16	107	56	475	1162	356	19	3	71	3	0	8	89
South	22	8	39	20	26	75	88	94	33	251	24	43	143	3578	43	1	3	303	27	2	341
East	98	15	59	82	76	66	16	19	259	2474	117	217	108	826	322	1	1	31	1580	66	1683
North	450	60	128	153	57	205	75	70	182	2791	635	428	314	255	551	2	7	3	55	4446	4519
Total	**5797**	**783**	**2838**	**1962**	**2122**	**6816**	**1965**	**2419**	**1510**	39	**2228**	**4919**	**9467**	22	**2843**	217	88	344	1667	4530	6952

Values are Highway Trip demand in Vehs, values in red in 1000s

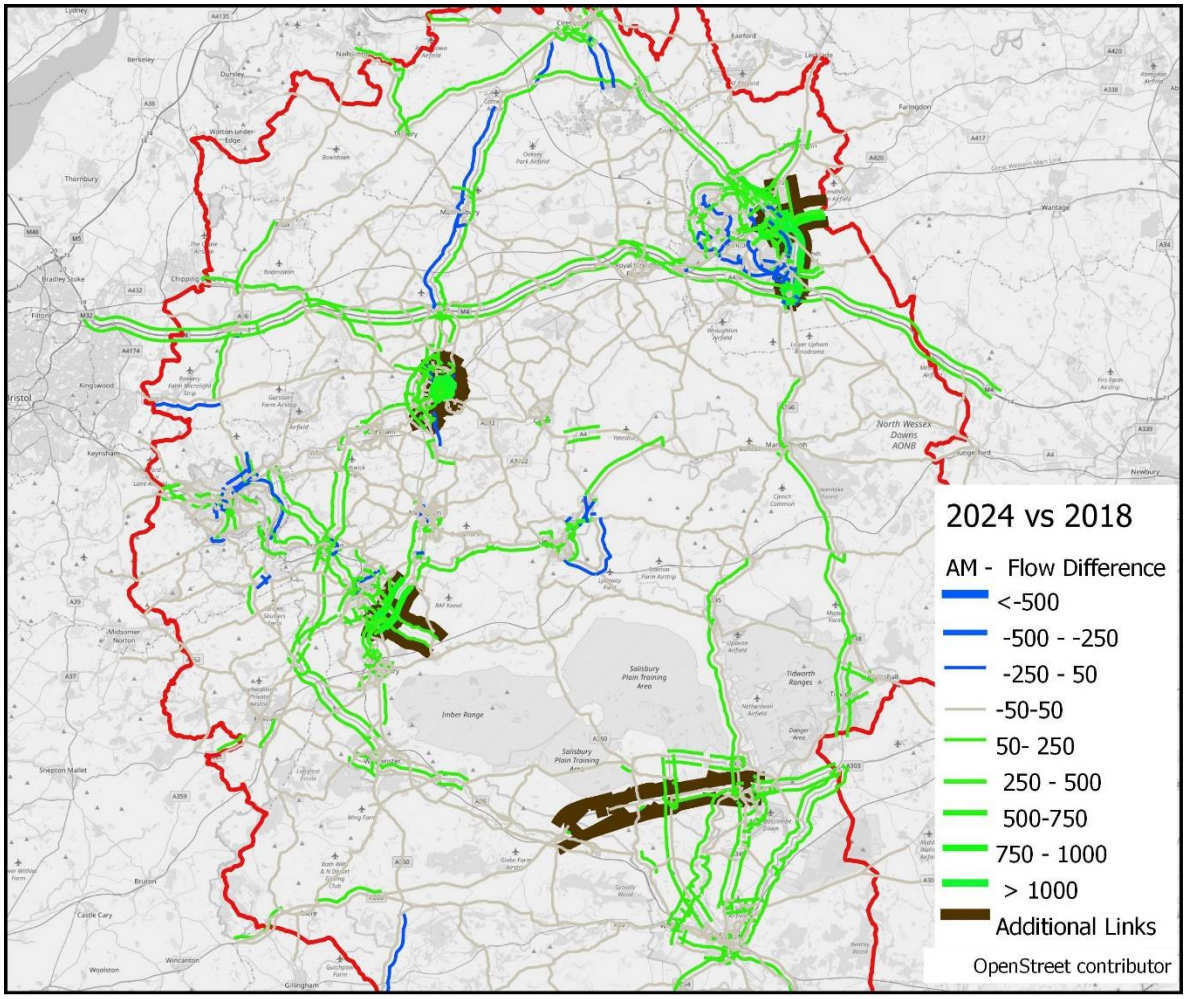
D.12. 2036 vs Base PM Peak

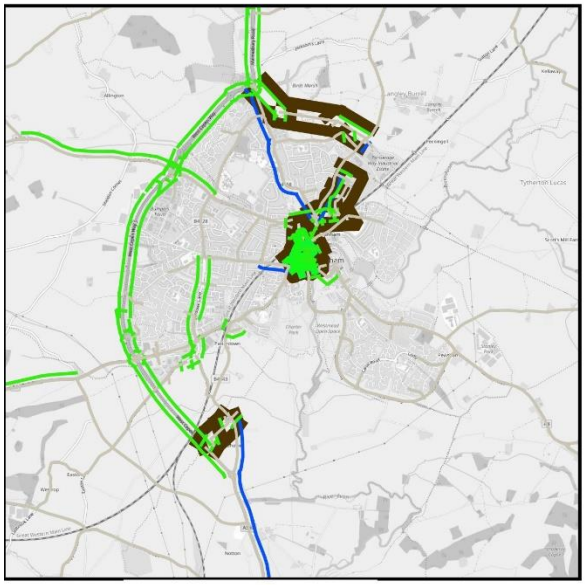
	Chippenham	Corsham	Melksham	Calne	Devizes	Trowbridge	Westbury	Warminster	RWB	Swindon	Malmesbury	Chip Rural	Rural Cen	SE Wilts	West of Swin	South West	West	South	East	North	**Total**
Chippenham	773	10	27	56	8	47	5	3	12	31	18	90	35	13	10	2	35	5	19	85	1283
Corsham	9	0	2	0	0	3	0	0	0	3	0	-3	1	0	0	1	2	1	1	5	27
Melksham	23	3	92	4	4	45	3	3	0	11	2	8	49	6	1	1	18	4	4	19	302
Calne	32	1	6	29	0	6	0	0	3	10	1	3	6	2	2	0	5	1	3	10	120
Devizes	5	0	5	-4	-1	15	0	1	4	39	0	-1	2	23	1	0	5	4	6	3	108
Trowbridge	37	4	67	7	18	821	61	45	1	26	3	20	300	26	1	2	150	20	14	27	1649
Westbury	7	0	6	1	1	44	43	31	0	7	1	1	35	9	0	2	29	7	3	7	233
Warminster	4	0	6	1	6	45	54	328	0	4	2	3	201	62	0	1	111	26	2	12	868
RWB	5	0	1	0	0	1	0	0	8	45	1	0	1	2	-6	1	2	1	5	15	80
Swindon	25	-1	4	5	11	11	1	1	-28	4	12	9	14	0	-22	15	25	21	110	319	4
Malmesbury	7	-1	-1	-1	-1	2	0	0	2	38	-41	-9	-1	1	-2	3	3	1	8	34	43
Chipp Rural	119	9	18	9	0	41	1	4	6	62	1	16	13	32	3	8	36	11	33	85	506
Rural Central	52	5	101	11	41	397	61	179	5	38	4	20	293	86	3	4	153	43	21	49	1568
SE Wilts	12	1	11	5	17	30	15	144	3	53	1	13	60	1	1	11	78	517	88	43	2
West of Swin	9	0	1	1	0	2	0	0	-3	130	-1	1	2	1	-7	1	3	2	14	38	194
South West	3	0	0	0	0	2	1	1	1	18	4	4	2	8	2	25	1	0	0	1	26
West	42	-2	20	2	2	127	23	86	2	28	3	-5	88	60	2	1	9	1	0	1	12
South	8	1	7	3	3	19	20	35	4	61	3	7	28	454	5	0	0	34	4	0	39
East	22	1	11	11	11	18	3	8	29	507	15	29	21	135	39	0	0	4	221	8	234
North	58	-3	12	16	6	36	2	23	17	604	34	3	22	31	48	0	1	0	6	541	550
Total	1249	30	392	158	127	1716	296	892	67	6	62	208	1173	2	83	26	12	40	231	553	875

Values are Highway Trip demand in Vehs, values in red in 1000s

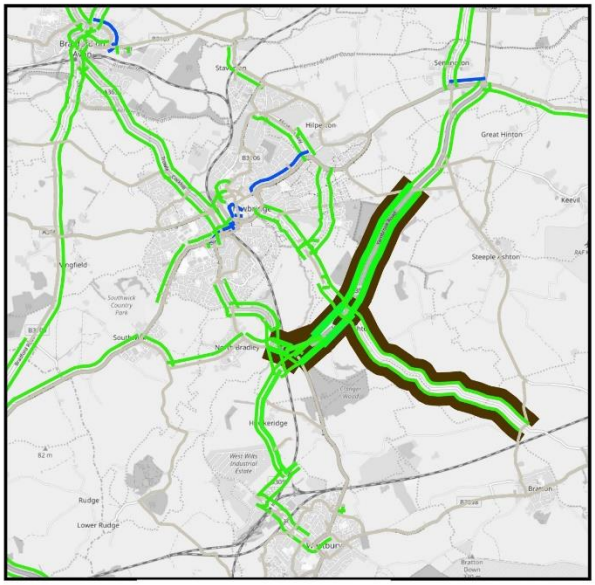
Appendix E. Traffic flow changes

E.1. Traffic flow change 2024 vs Base AM peak



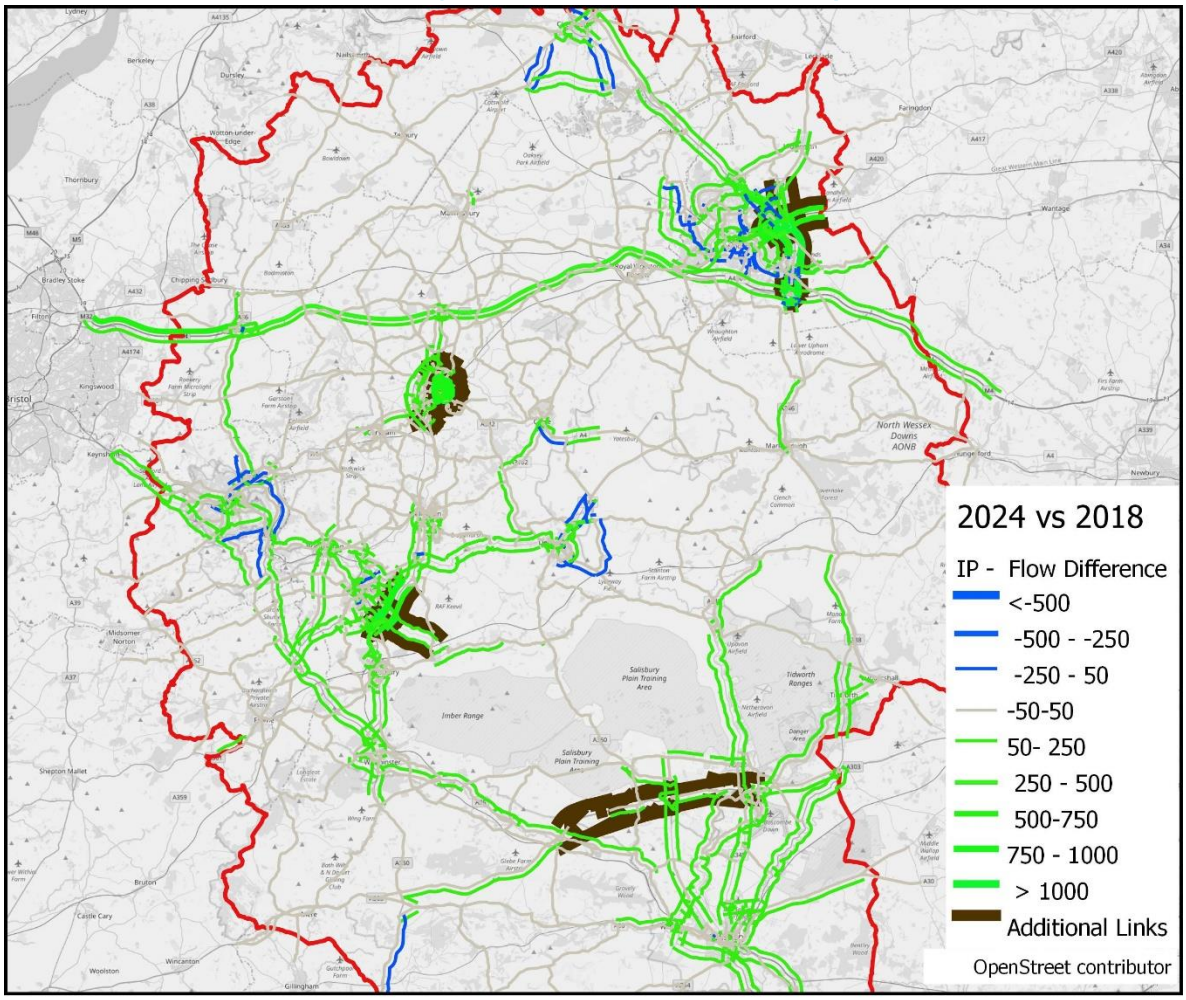


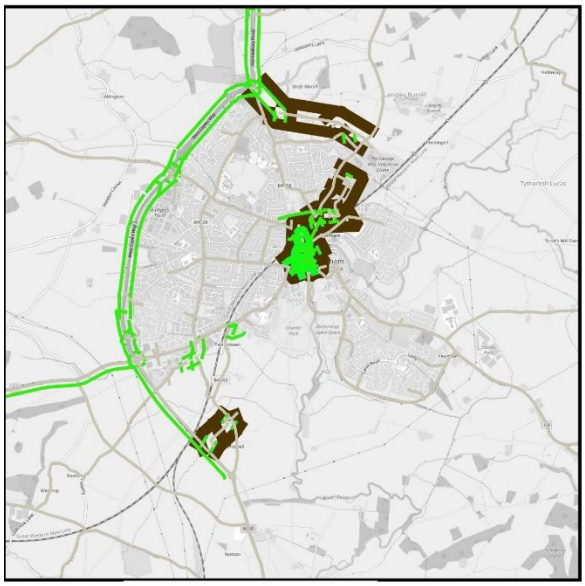
Chippenham



Trowbridge

E.2. Traffic flow change 2024 vs Base Inter peak





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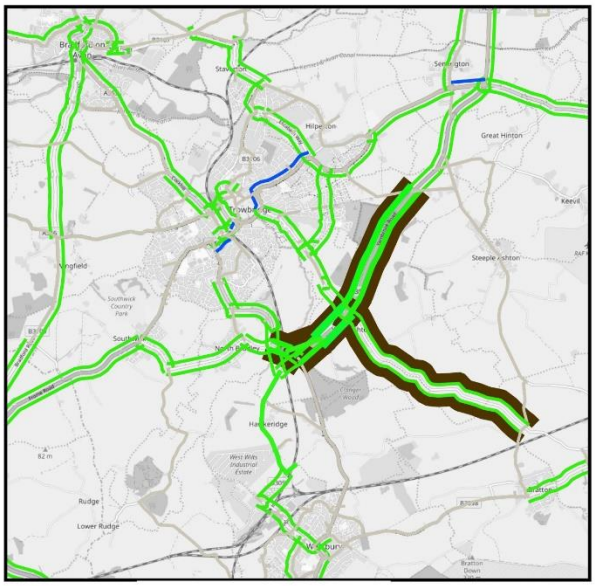
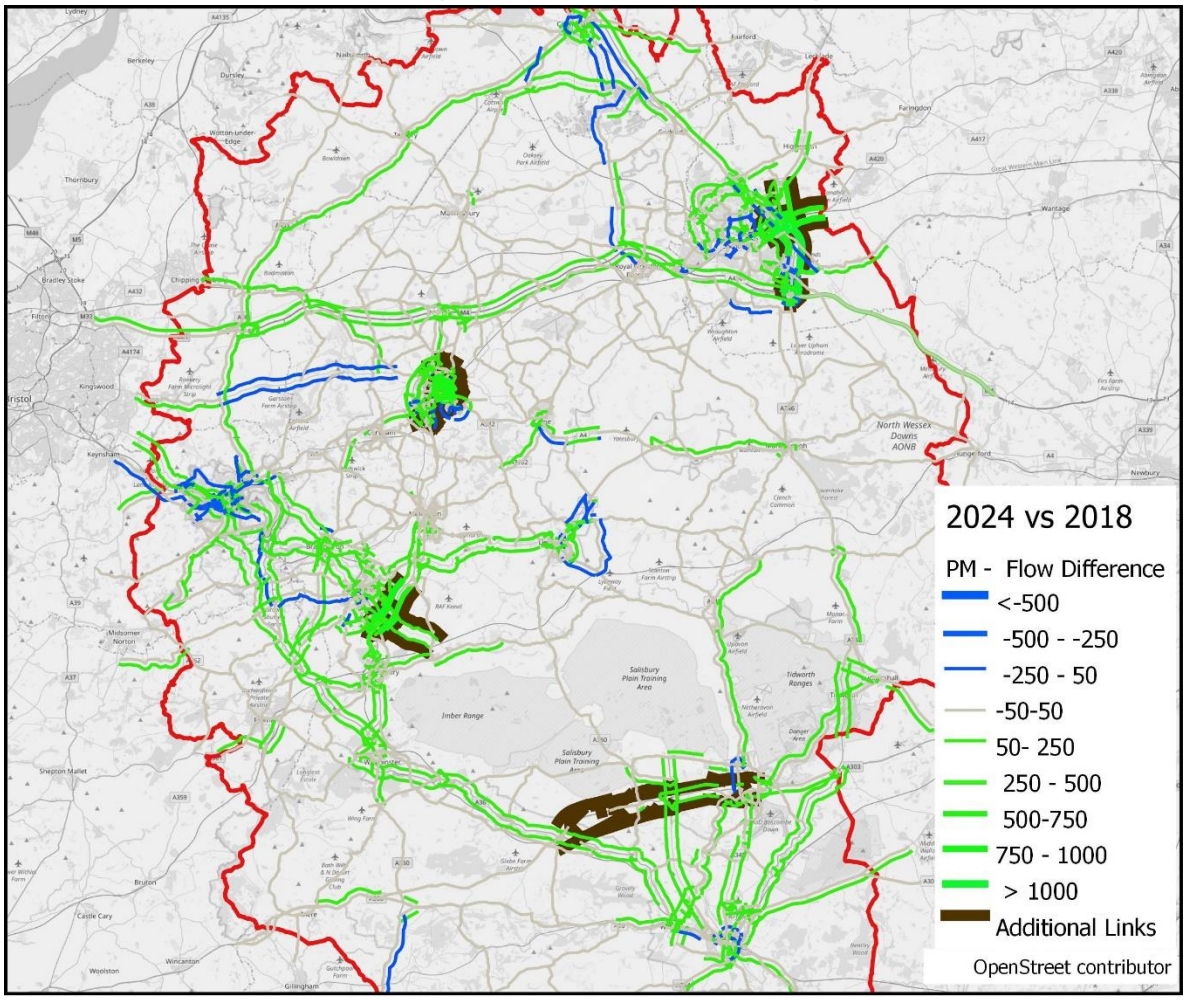
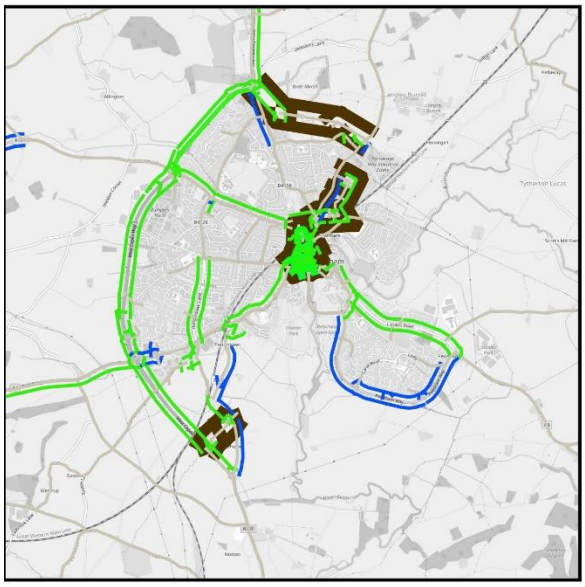


Trowbridge

E.3. Traffic flow change 2024 vs Base PM peak





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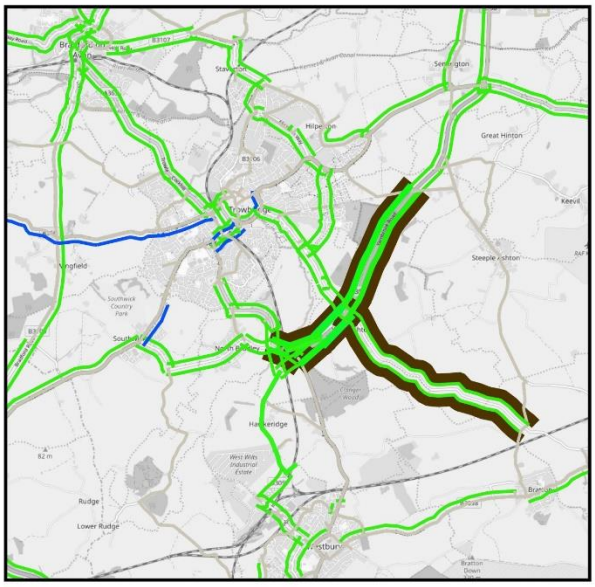
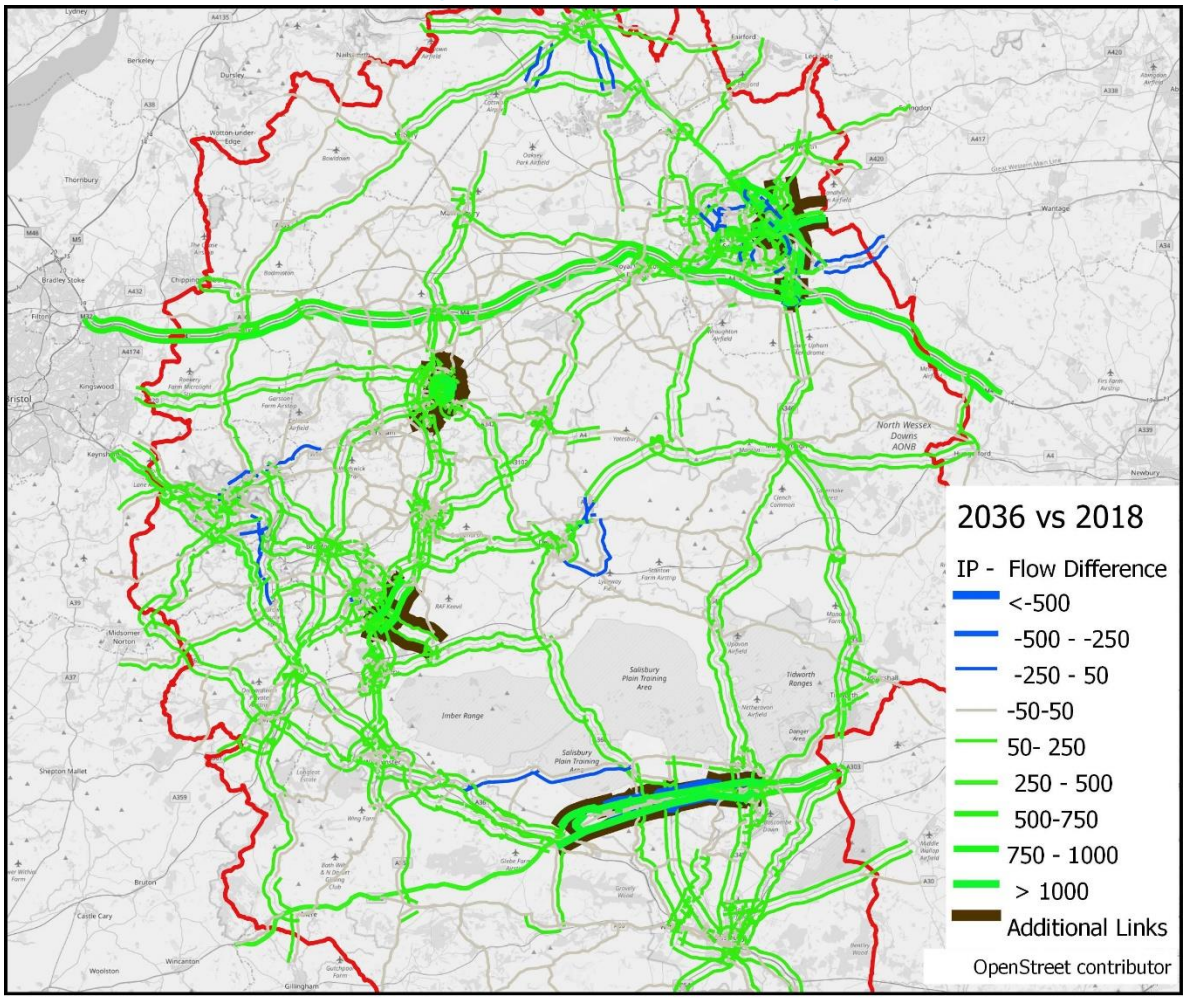
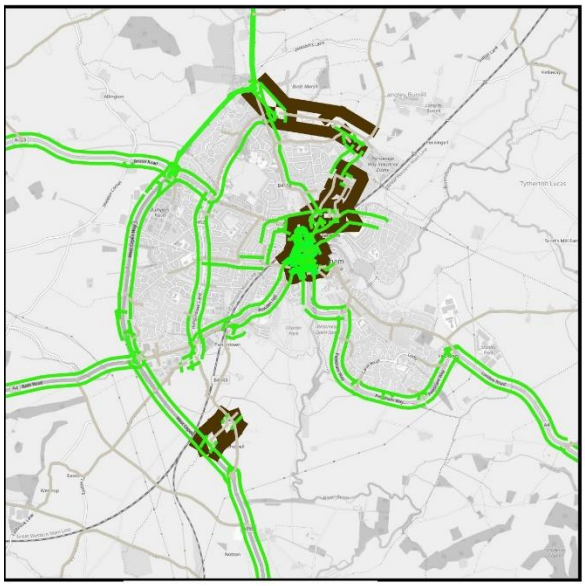


Trowbridge

E.4. Traffic flow change 2036 vs Base Inter peak





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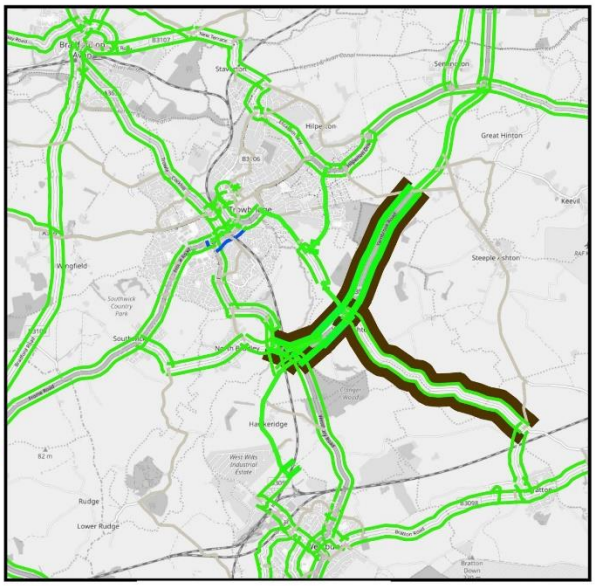

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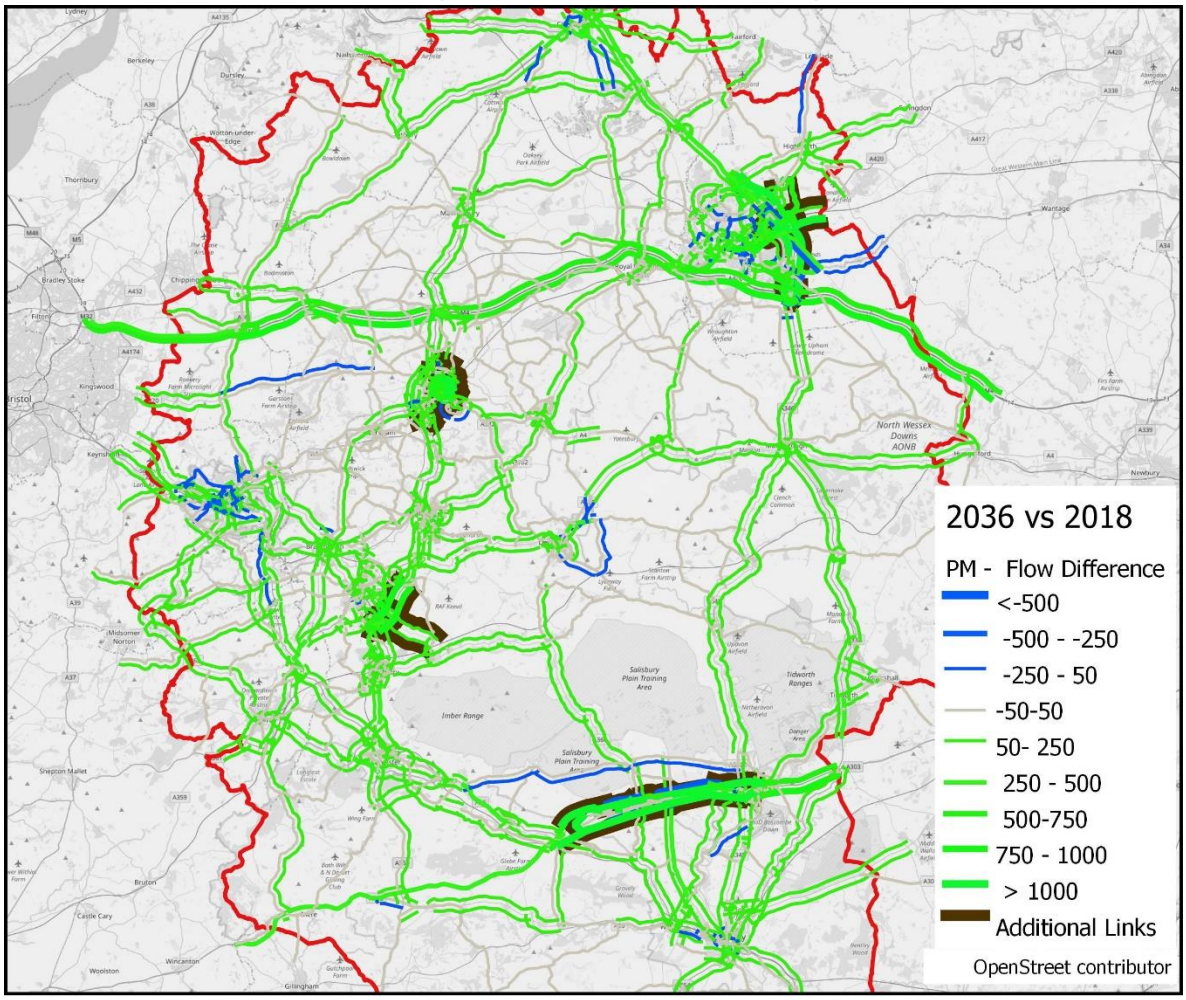
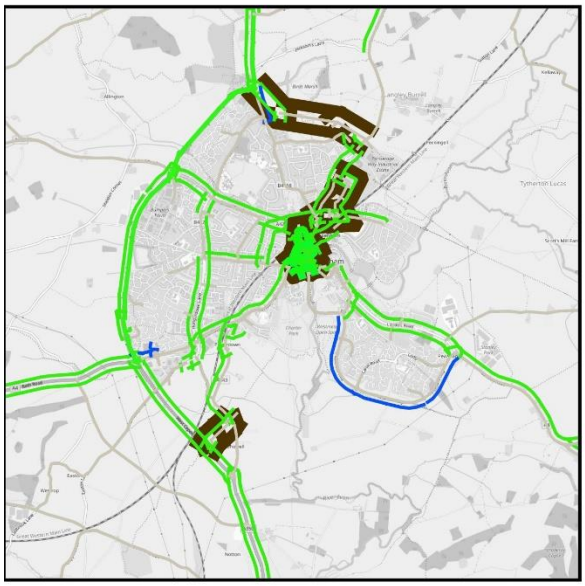
E.5. Traffic flow change 2036 vs Base PM peak





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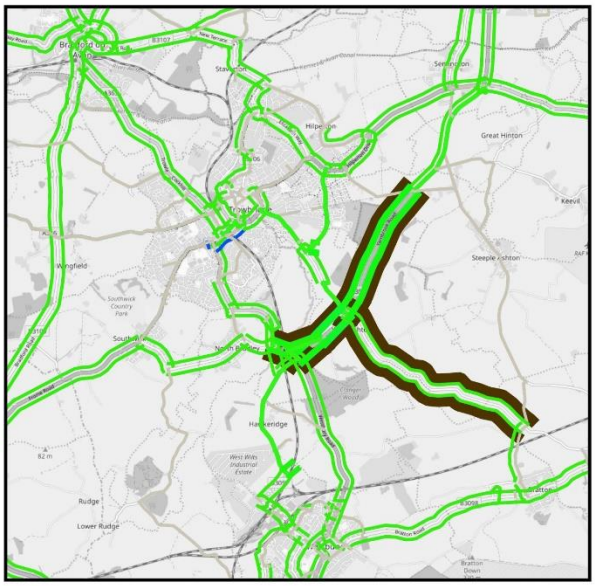

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Appendix C. Economic Assessment Tables

C.1. Transport Economic Efficiency (TEE)

C.1.1. Route 1 (Option A)

Non-business: Commuting	**ALL MODES**		**ROAD**
User benefits	**TOTAL**		**Private Cars and LGVs**
Travel time	18,149		18,149
Vehicle operating costs	478		478
User charges			
During Construction & Maintenance			
NET NON-BUSINESS BENEFITS: COMMUTING	18,627	*(1a)*	18,627

Non-business: Other	**ALL MODES**		**ROAD**
User benefits	**TOTAL**		**Private Cars and LGVs**
Travel time	14,773		14,773
Vehicle operating costs	518		518
User charges			
During Construction & Maintenance			
NET NON-BUSINESS BENEFITS: OTHER	15,291	*(1b)*	15,291

Business			**ROAD**	
User benefits			**Private Cars and LGVs**	**Goods Vehicles**
Travel time	16,789		13,638	3,151
Vehicle operating costs	2,278		790	1,487
User charges				
During Construction & Maintenance				
Subtotal	19,066		14,429	4,638
Private sector provider impacts				
Revenue				
Operating costs				
Investment costs				
Grant/subsidy				
Subtotal		*(3)*		
Other business impacts				
Developer contributions		*(4)*		
NET BUSINESS IMPACT	19,066	*(5) = (2) + (3) + (4)*		

TOTAL		
Present Value of Transport Economic Efficiency Benefits (TEE)	52,984	*(6) = (1a) + (1b) + (5)*

C.1.2. Route 2 (Option C)

Non-business: Commuting	**ALL MODES**		**ROAD**
User benefits	**TOTAL**		**Private Cars and LGVs**
Travel time	64,326		64,326
Vehicle operating costs	1,393		1,393
User charges			
During Construction & Maintenance			
NET NON-BUSINESS BENEFITS: COMMUTING	65,719	*(1a)*	65,719

Non-business: Other	**ALL MODES**		**ROAD**
User benefits	**TOTAL**		**Private Cars and LGVs**
Travel time	52,102		52,102
Vehicle operating costs	870	870	
User charges			
During Construction & Maintenance			
NET NON-BUSINESS BENEFITS: OTHER	52,972	*(1b)*	52,972

Business			**ROAD**	
User benefits			**Private Cars and LGVs**	**Goods Vehicles**
Travel time	65,530		47,638	17,892
Vehicle operating costs	7,309		1,038	6,271
User charges				
During Construction & Maintenance				
Subtotal	72,839		48,676	24,163
Private sector provider impacts				
Revenue				
Operating costs				
Investment costs				
Grant/subsidy				
Subtotal		*(3)*		
Other business impacts				
Developer contributions		*(4)*		
NET BUSINESS IMPACT	72,839	*(5) = (2) + (3) + (4)*		

TOTAL		
Present Value of Transport Economic Efficiency Benefits (TEE)	191,530	*(6) = (1a) + (1b) + (5)*

C.2. Public Accounts (PA)

C.2.1. Route 1 (Option A)

	ALL MODES TOTAL	
Local Government Funding		
Revenue		
Operating Costs	7,507	
Investment Costs	6,065	
Developer and Other Contributions		
Grant/Subsidy Payments		
NET IMPACT	13,572	*(7)*
Central Government Funding: Transport		
Revenue		
Operating costs		
Investment Costs	34,366	
Developer and Other Contributions		
Grant/Subsidy Payments		
NET IMPACT	34,366	*(8)*
Central Government Funding: Non-Transport		
Indirect Tax Revenues	1,345	*(9)*
TOTALS		
Broad Transport Budget	47,938	*(10) = (7) + (8)*
Wider Public Finances	1,345	*(11) = (9)*

C.2.2. Route 2 (Option C)

	ALL MODES TOTAL	
Local Government Funding		
Revenue		
Operating Costs	17,757	
Investment Costs	15,428	
Developer and Other Contributions		
Grant/Subsidy Payments		
NET IMPACT	33,185	*(7)*
Central Government Funding: Transport		
Revenue		
Operating costs		
Investment Costs	87,427	
Developer and Other Contributions		
Grant/Subsidy Payments		
NET IMPACT	87,427	*(8)*
Central Government Funding: Non-Transport		
Indirect Tax Revenues	4,243	*(9)*
TOTALS		
Broad Transport Budget	120,612	*(10) = (7) + (8)*
Wider Public Finances	4,243	*(11) = (9)*

C.3. Analysis of Monetised Costs and Benefits (AMCB)

C.3.1. Route 1 (Option A)

Noise	Not assessed	*(12)*
Local Air Quality	Not assessed	*(13)*
Greenhouse Gases	Not assessed	*(14)*
Journey Quality	Not assessed	*(15)*
Physical Activity	Not assessed	*(16)*
Accidents	Not assessed	*(17)*
Economic Efficiency: Consumer Users (Commuting)	18,627	*(1a)*
Economic Efficiency: Consumer Users (Other)	15,291	*(1b)*
Economic Efficiency: Business Users and Providers	19,066	*(5)*
Wider Public Finances (Indirect Taxation Revenues)	-1,345	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	51,639	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*
Broad Transport Budget	47,938	*(10)*
Present Value of Costs (see notes) (PVC)	47,938	*(PVC) = (10)*
OVERALL IMPACTS		
Net Present Value (NPV)	3,701	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)	1.08	BCR=PVB/PVC

C.3.2. Route 2 (Option C)

Noise	Not assessed	*(12)*
Local Air Quality	Not assessed	*(13)*
Greenhouse Gases	Not assessed	*(14)*
Journey Quality	Not assessed	*(15)*
Physical Activity	Not assessed	*(16)*
Accidents	Not assessed	*(17)*
Economic Efficiency: Consumer Users (Commuting)	65,719	*(1a)*
Economic Efficiency: Consumer Users (Other)	52,972	*(1b)*
Economic Efficiency: Business Users and Providers	72,839	*(5)*
Wider Public Finances (Indirect Taxation Revenues)	-4,243	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	187,287	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*
Broad Transport Budget	120,612	*(10)*
Present Value of Costs (see notes) (PVC)	120,612	*(PVC) = (10)*
OVERALL IMPACTS		
Net Present Value (NPV)	66,675	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)	1.55	BCR=PVB/PVC

Appendix D. Appraisal Summary Table

D.1. Route 1 (Option A)

Appraisal Summary Table

Date produced:	22	7	19

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	Qualitative	Monetary £(NPV)	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(£): 16.8m Net journey time changes (£): 0 to 2min / 2 to 5min / > 5min	-	19.1m	Not assessed
	Reliability impact on Business users	The scheme is expected to produce reliability benefits approximately in proportion to journey time benefits.	-	Slight Beneficial	0.7m	
	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 to Slight Beneficial	-	
	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	1.9m	
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 (c. 20%) 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 (c.20%) in traffic volumes along the existing A350. There are no AQMAs in the area.	-	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): -	Slight Adverse	0.7m	
	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(£)** 32.9 **Net journey time changes (£)** 0 to 2min / 2 to 5min / > 5min	-	33.9m	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	1.4m	
	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.	-	Slight 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, including whole life costs and 44% optimism bias	-	-	46.4m	
	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.	-	-	1.4m	

D.2. Route 2 (Option C)

Appraisal Summary Table

Date produced:	22	7	19

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

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

	Impacts	Summary of key impacts	Assessment: Quantitative	Qualitative	Monetary £(NPV)	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(£): 65.5m Net journey time changes (£): 0 to 2min / 2 to 5min / > 5min	-	72.8m	Not assessed
Economy	Reliability impact on Business users	The scheme is expected to produce reliability benefits approximately in proportion to journey time benefits.	-	Moderate Beneficial	3.0m	
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 to Slight Beneficial	-	
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.	-	Moderate Beneficial	7.28m	
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 larger reduction in traffic volumes (c. 40%) 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.
Environmental	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 larger reduction in traffic volumes (c.40%) and NO2 levels along the existing A350 through Melksham and Beanacre, with beneficial impacts also in rural villages including Lacock, Rowde and Seend. There are no AQMAs in the area.	-	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.
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)	Slight Adverse	2.2m	
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 species.	-	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(£) 116.4m Net journey time changes (£) 0 to 2min / 2 to 5min / > 5min	-	118.7m	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	5.1m	
	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	-	-	116.6m	
	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.	-	-	4.2m	

Appendix E. Risk Register

E.1. Route 1 (Option A)

HEADLINE RISKS

Rebomilisation:	1500

Risk Ref.	Nature of Risk	Implications	Mitigation	Action to be Taken	Owner	Likelihood	Consequence	Rating	Residual Probability	Cost Estimate £ 000's			
										Min	Most Likely	Max	MEV
1.1	**Statutory Stakeholders Requirements - Environment Agency.** Requirements incur additional costs where these costs have been missed in cost estimate. Flood zone being worsened by the introduction of highway.	Additional geotechnical design work for deepening the existing floodplain to increase capacity.		EA - Flood zone storage capacity to match existing. To be designed at Detailed Design stage. 1. Confirm levels of flooding within extents and calculate capacity using River Avon flood model. 2. Complete drainage strategy including flood risk assessment as part of planning application. 3. Detailed Design of excavation works.	Client	Possible	Major	High	40.00%	£ -	£ 2,125	£ 3,000	£ 850
1.2	**Statutory Stakeholders Requirements - English Heritage.** Requirements incur additional costs where these costs have been missed in cost estimate.	Programme delay and cost implications		English Heritage (Archaeology) - Consultation with County Archaeologist at early stages. 1. EIA search programmed at early stage. 2. Potential Geophysical survey (dependant on EIA). 3. Possible planned dig if known locations. 4. If found during construction, consult with County Archaeologists and await outcome.	Client	Possible	Moderate	Medium	50.00%	£ -	£ 125	£ 250	£ 63
1.3	**Statutory Stakeholders Requirements - Natural England.** Requirements incur additional costs where these costs have been missed in cost estimate. Visibility of scheme in question requiring unexpected landscaping measures.	Programme delay and cost implications		1. EIA search at early stage. 2. Field surveys undertaken before planning submission. 3. Consult with Natural England prior to planning submission. Produce Ecology Assessment and Landscape Visual Assessment documents.	Client	Possible	Major	High	50.00%	£ 140	£ 290	£ 600	£ 145
1.4	**Public Relations Issue; Town Council and/or neighbouring villages object to scheme progressing.** Delay to scheme progressing to construction. Impact likely to be limited to change in programmed activities and sequencing of works. Risk of physical demonstration preventing work.	Delay to scheme progressing to construction. Impact likely to be limited to change in programmed activities and sequencing of works. Risk of physical demonstration preventing work.		Consult widely/assist Wiltshire Council in consultation activities. Begin consultation alongside planning.	Client	Likely	Major	Extreme	70.00%	£ 80	£ 960	£ 1,920	£ 672
1.5	**Land Ownership Constraints:** Wiltshire Council do not own all the land required for construction	High cost for CPO or negotiation to land owners. Programme implications due to legal process if necessary.	WC land to be used where possible to reduce cost.	All landowners to be consulted at an early stage and risk to be re-evaluated.	Client	Likely	Major	Extreme	70.00%	£ -	£ 604	£ 1,300	£ 423
1.7	**Ecology assessments outcome:** Expected requirement for EIA/HRA (Environmental Impact Assessment/Habitats Regulations Assessment).	Outcomes may require high cost mitigation or migration of species. Delay to design and following stages.		Desk based study to be undertaken with some cost already included in BoQ's. 1. Results of EIA and Site Surveys to be reviewed.	Client	Possible	Major	High	50.00%	£ -	£ 160	£ 620	£ 80

1.8	**Construction Desing/Scope Uncertainty**	Lack of information at this stage could result in design changes during works and redesign	No mitigation has been included against future changes I scope as these have not been predicted	Ensure scheme requirements are fully understood and information gathered to reduce chance of scope change, keeping client informed	Client	Likely	Moderate	High	50.00%	£ -	£ 130	£ 310	£ 65
1.9	**Construction Fee Estimate Uncertainty**	Uncertainty may influence the market or funders to act in an unpredictable manner. Rates used in cost estimate based on competitive tender rates from local contractors. (medium sized contractors)		Consider strategy to reduce cost. WC engage with larger contractors	Client	Possible	Catastrophic	High	40.00%	£ -	£ 4,500	£ 7,200	£ 1,800
2.1	**Unforeseen Ground Conditions:** Clay geology sub-standard: Additional costs and potential re-design required based on imported fill/stabilisation works in embankments.	Design work becomes more onerous extends programme. Risk of localised design issues remain.		1. Ground investigation surveys to commence early to evaluate level of design required. 2. Order of construction phasing to be considered to reduce delay to scheme. 3. Site survey to consider requirements.	Client	Possible	Moderate	Medium	40.00%	£ 325	£ 970	£ 4,420	£ 388
2.2	**Weather conditions delays.**	Poor weather delays scheme.	Beginning of structures scheme requiring more excavation of poor ground and/or delay to the programme.	Plan phasing of critical events with contractor early. If this is missed plan for following years summer/spring or doubling up size of contractors team.	Client	Unlikely	Minor	Low	10.00%	£ -	£ 320	£ 1,500	£ 32
2.3	**Changes to design (after construction has commenced).**	Design changes due to unforeseen ground conditions/conflicting design civils items.	Scheme Delays and compensation events on site for changes to the planned works.	1. Technical Reviewer workshop. 2. ECI with selection of contractors following PQQ. 3. PCI with chosen Principal Contractor. 4. Design Coordinator to be appointed by Consultant and approved by Wiltshire Council. 5. Design to progress through approved design stage gate process with relevant experienced and where possible local technical leads.	Client	Unlikely	Minor	Low	15.00%	£ -	£ 320	£ 960	£ 48
2.4	**Delay in diversion of known utilities, and changes to utilities in advance of construction.**	Insufficient programming results in late delivery of Utility diversions.	Quotations for work change resulting in higher cost and/or greater than 4 weeks delay to arrange services diversion.	1. Complete statutory searches timely in the correct design stage. 2. Design out clashes where possible. 3 If required, arrange mitigation before other site works commence.	Client	Possible	Moderate	Medium	20.00%	£ -	£ 320	£ 640	£ 64
2.5	**Service Strike:** Unknown services struck during construction works incurring delays to programme.	Underground/Overhead Services damaged by construction plant. Possible risk to human health/life.	Large compensation fees and site delays to the scheme.	1. NRSWA process. 2. GPR. 3. Trial Holes. 4. PCI. 5. CPP and RAMS to be supplied by Contractor. 6. Appropriate PI and contractual terms to be included to assign appropriate owner of risk	Client	Unlikely	Major	Medium	10.00%	£ 50	£ 230	£ 2,500	£ 23

2.6	**Contractor disposal cost (rate) for offsite disposal of UA1 unacceptable material proves higher than OBC figure.**	Additional costs to contract, no delay	Undertake trial pitting, CBR and suitably robust SI survey with lab testing as part of detailed design	Apply SI results in identifying classification grading of "unsuitable" material in Spec and BOQ. Provide schedule of earthworks quantities by type and works location. Allow extra-over costs in Risk register.	Client	Possible	Moderate	Medium	30.00%	£ -	£ 438	£ 2,300	£ 131
2.7	**Nat Grid EHV Cable Overhead Clearance to proposed Carriageway**	Insufficient overhead clearance to permit adoption of balanced carriageway design. Final design may prove more costly than allowed for in OBC Cost estimate	Design out risk, through topographic survey and close consultation with National Grid.	Include E/O cost estimate assuming worst case: lowering relevant section of carriageway by notional 300mm;	Client	Possible	Moderate	Medium	30.00%	£ 355	£ 760	£ 1,126	£ 228
2.8	**River Avon Bridge Delay**	Knock on effect to access at the North Site incurrs delay to project		1. Close communication with developers to ascertain their programme expectation match WC intensions. 2. Alternative access (local farmers) and alternative phasing to be considered.	Client	Possible	Moderate	Medium	15.00%	£ -	£ 320	£ 1,920	£ 48
2.9	**Site Works Locate Unknown Service**	Delay on site		1. NRSWA process. 2. GPR. 3. Trial Holes. 4. PCI. 5. CPP and RAMS to be supplied by Contractor. 6. Appropriate PI and contractual terms to be included to assign appropriate owner of risk	Client	Possible	Moderate	Medium	30.00%	£ 16	£ 320	£ 640	£ 96
2.10	**Contaminated Material:** e.g. Asbestos, Fuels, Rural waste Contaminated soils found during construction.	Abortive design work, cost implications for disposal and programme delays.		Desk based study to be undertaken. Additional cost in dealing with contamination, removal and disposal - will vary with quantity and type of material. All are outside Atkins' area of PI. SI scope to accommodate testing for contamination.	Client	Unlikely	Major	Medium	15.00%	£ 500	£ 2,000	£ 10,000	£ 300

E.2. Route 2 (Option C)

HEADLINE RISKS

Rebomilisation:	*1500*

Risk Ref.	Nature of Risk	Implications	Mitigation	Action to be Taken	Owner	Likelihood	Consequence	Rating	Residual Probability	Cost Estimate £ 000's			
										Min	Most Likely	Max	MEV
1.1	**Statutory Stakeholders Requirements - Environment Agency.** Requirements incur additional costs where these costs have been missed in cost estimate. Flood zone being worsened by the introduction of highway.	Additional geotechnical design work for deepening the existing floodplain to increase capacity.		EA - Flood zone storage capacity to match existing. To be designed at Detailed Design stage. 1. Confirm levels of flooding within extents and calculate capacity using River Avon flood model. 2. Complete drainage strategy including flood risk assessment as part of planning application. 3. Detailed Design of excavation works.	Client	Possible	Major	High	40.00%	£ -	£ 2,125	£ 4,250	£ 850
1.2	**Statutory Stakeholders Requirements - English Heritage.** Requirements incur additional costs where these costs have been missed in cost estimate.	Programme delay and cost implications		English Heritage (Archaeology) - Consultation with County Archaeologist at early stages. 1. EIA search programmed at early stage. 2. Potential Geophysical survey (dependant on EIA). 3. Possible planned dig if known locations. 4. If found during construction, consult with County Archaeologists and await outcome.	Client	Possible	Moderate	Medium	50.00%	£ -	£ 125	£ 250	£ 63
1.3	**Statutory Stakeholders Requirements - Natural England.** Requirements incur additional costs where these costs have been missed in cost estimate. Visibility of scheme in question requiring unexpected landscaping measures.	Programme delay and cost implications		1. EIA search at early stage. 2. Field surveys undertaken before planning submission. 3. Consult with Natural England prior to planning submission. Produce Ecology Assessment and Landscape Visual Assessment documents.	Client	Possible	Major	High	50.00%	£ 140	£ 850	£ 930	£ 425
1.4	**Public Relations Issue; Town Council and/or neighbouring villages object to scheme progressing.** Delay to scheme progressing to construction. Impact likely to be limited to change in programmed activities and sequencing of works. Risk of physical demonstration preventing work.	Delay to scheme progressing to construction. Impact likely to be limited to change in programmed activities and sequencing of works. Risk of physical demonstration preventing work.		Consult widely/assist Wiltshire Council in consultation activities. Begin consultation alongside planning.	Client	Likely	Major	Extreme	70.00%	£ 135	£ 120	£ 240	£ 84
1.5	**Land Ownership Constraints:** Wiltshire Coucnil do not own all the land required for construction	High cost for CPO or negotiation to land owners. Programme implications due to legal process if necessary.	WC land to be used where possible to reduce cost.	All landowners to be consulted at an early stage and risk to be re-evaluated.	Client	Likely	Major	Extreme	70.00%	£ -	£ 1,450	£ 3,600	£ 1,015
1.7	**Ecology assessments outcome:** Expected requirement for EIA/HRA (Environmental Impact Assessment/Habitats Regulations Assessment).	Outcomes may require high cost mitigation or migration of species. Delay to design and following stages.		Desk based study to be undertaken with some cost already included in BoQ's. 1. Results of EIA and Site Surveys to be reviewed.	Client	Possible	Major	High	50.00%	£ -	£ 270	£ 990	£ 135
1.8	**Construction Design/Scope Uncertainty**	Lack of information at this stage could result in design changes during works and redesign	No mitigation has been included against future changes I scope as these have not been predicted	Ensure scheme requirements are fully understood and information gathered to reduce chance of scope change, keeping client informed	Client	Likely	Moderate	High	70.00%	£ -	£ 1,005	£ 2,060	£ 704

1.8	**Service Utility Estimate Uncertainty**	High level estimate for Service Utility diversions		NRSWA C2, C3 and C4 process	Client	Possible	Major	High	70.00%	£ -	£ 2,500	£ 3,500	£ 1,750
1.9	**Construction Fee Estimate Uncertainty**	Uncertainty may influence the market or funders to act in an unpredictable manner. Rates used in cost estimate based on competitive tender rates from local contractors. (medium sized contractors). Uncertainty in measures (2d design)		Consider strategy to reduce cost. WC engage with larger contractors. 3D design using topo data.	Client	Possible	Catastrophic	High	50.00%	£ -	£ 13,250	£ 21,200	£ 6,625
2	**Unforeseen Ground Conditions:** Clay geology sub-standard: Additional costs and potential re-design required based on imported fill/stabilisation works in embankments.	Design work becomes more onerous extends programme. Risk of localised design issues remain.		1. Ground investigation surveys to commence early to evaluate level of design required. 2. Order of construction phasing to be considered to reduce delay to scheme. 3. Site survey to consider requirements.	Client	Possible	Moderate	Medium	40.00%	£ 490	£ 1,465	£ 5,740	£ 586
2.1	**Weather conditions delays.**	Poor weather delays scheme.	Beginning of structures scheme requiring more excavation of poor ground and/or delay to the programme.	Plan phasing of critical events with contractor early. If this is missed plan for following years summer/spring or doubling up size of contractors team.	Client	Possible	Major	High	50.00%	£ -	£ 540	£ 1,500	£ 270
2.2	**Changes to design (after construction has commenced).**	Design changes due to unforeseen ground conditions/conflicting design civils items.	Scheme Delays and compensation events on site for changes to the planned works.	1. Technical Reviewer workshop. 2. ECI with selection of contractors following PQQ. 3. PCI with chosen Principal Contractor. 4. Design Coordinator to be appointed by Consultant and approved by Wiltshire Council. 5. Design to progress through approved design stage gate process with relevant experienced and where possible local technical leads.	Client	Possible	Moderate	Medium	50.00%	£ -	£ 540	£ 1,620	£ 270
2.3	**Delay in diversion of known utilities, and changes to utilities in advance of construction.**	Insufficient programming results in late delivery of Utility diversions.	Quotations for work change resulting in higher cost and/or greater than 4 weeks delay to arrange services diversion.	1. Complete statutory searches timely in the correct design stage. 2. Design out clashes where possible. 3 If required, arrange mitigation before other site works commence.	Client	Possible	Moderate	Medium	50.00%	£ -	£ 540	£ 1,080	£ 270
2.4	**Service Strike:** Unknown services struck during construction works incurring delays to programme.	Underground/Overhead Services damaged by construction plant. Possible risk to human health/life.	Large compensation fees and site delays to the scheme.	1. NRSWA process. 2. GPR. 3. Trial Holes. 4. PCI. 5. CPP and RAMS to be supplied by Contractor. 6. Appropriate PI and contractual terms to be included to assign appropriate owner of risk	Client	Possible	Moderate	Medium	50.00%	£ 50	£ 285	£ 2,500	£ 143

2.5	**Contractor disposal cost (rate) for offsite disposal of UA1 unacceptable material proves higher than OBC figure.**	Additional costs to contract, no delay	Undertake trial pitting, CBR and suitably robust SI survey with lab testing as part of detailed design	Apply SI results in identifying classification grading of "unsuitable" material in Spec and BOQ. Provide schedule of earthworks quantities by type and works location. Allow extra-over costs in Risk register.	Client	Possible	Moderate	Medium	30.00%	£ -	£ 875	£ 4,600	£ 263
2.6	**Nat Grid EHV Cable Overhead Clearance to proposed Carriageway**	Insufficient overhead clearance to permit adoption of balanced carriageway design. Final design may prove more costly than allowed for in OBC Cost estimate	Design out risk, through topographic survey and close consultation with National Grid.	Include E/O cost estimate assuming worst case: lowering relevant section of carriageway by notional 300mm;	Client	Unlikely	Moderate	Medium	30.00%	£ 575	£ 1,200	£ 1,786	£ 360
2.7	**River Avon Bridge Delay**	Knock on effect to access at the North Site incurrs delay to project		1. Close communication with developers to ascertain their programme expectation match WC intensions. 2. Alternative access (local farmers) and alternative phasing to be considered.	Client	Possible	Moderate	Medium	15.00%	£ -	£ 540	£ 3,240	£ 81
2.8	**Site Works Locate Unknown Service**	Delay on site		1. NRSWA process. 2. GPR. 3. Trial Holes. 4. PCI. 5. CPP and RAMS to be supplied by Contractor. 6. Appropriate PI and contractual terms to be included to assign appropriate owner of risk	Client	Possible	Moderate	Medium	30.00%	£ 27	£ 540	£ 1,080	£ 162
2.9	**Contaminated Material:** e.g. Asbestos, Fuels, Rural waste Contaminated soils found during construction.	Abortive design work, cost implications for disposal and programme delays.		Desk based study to be undertaken. Additional cost in dealing with contamination, removal and disposal - will vary with quantity and type of material. All are outside Atkins' area of PI. SI scope to accommodate testing for contamination.	Client	Unlikely	Major	Medium	15.00%	£ 1,000	£ 4,000	£ 20,000	£ 600

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