A303 Amesbury to Berwick Down

TR010025

7.5 Combined Modelling and Appraisal Report

Volume 7

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A303 Amesbury to Berwick Down
Development Consent Order 20[xx]

COMBINED MODELLING AND APPRAISAL REPORT

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Table of contents

Table of Figures

Foreword

The A303 Amesbury to Berwick Down scheme (“the Scheme”) forms part of a programme of improvements for upgrading the A303/A358 corridor, improving this vital connection between the South West and London and the South East and including the upgrade of remaining single carriageway sections on the route to dual carriageway. This investment is stated as a priority project in the National Infrastructure Plan and Government’s commitment is confirmed in the Road Investment Strategy (2015-2020). Subject to achieving an approved Development Consent Order (DCO), preliminary works are planned to start in 2020 with the main construction works following in 2021, and the Scheme is due to open to traffic in 2026.

Objectives for the Scheme have been formulated both to address identified problems and to take advantage of the opportunities that new infrastructure would provide. The objectives are defined by the Department for Transport (DfT):

a. **Transport:** To create a high quality reliable route between the South East and the South West that meets the future needs of traffic;
b. **Economic Growth:** To enable growth in jobs and housing by providing a free flowing and reliable connection between the South East and the South West.
c. **Cultural Heritage:** To help conserve and enhance the World Heritage Site and to make it easier to reach and explore; and
d. **Environment and Community:** To improve biodiversity and provide a positive legacy for nearby communities.

The objectives would be achieved by providing a high quality, two-lane dual carriageway on the A303 trunk road between Amesbury and Berwick Down in Wiltshire. The Scheme would resolve traffic problems and, at the same time, protect and the Stonehenge, Avebury and Associated Sites World Heritage Site (“WHS”). The Scheme would be approximately 8 miles (13km) long and comprise the following key components:

a. a northern bypass of Winterbourne Stoke with a viaduct over the River Till valley;
b. a new junction between the A303 and A360 to the west of and outside the WHS, replacing the existing Longbarrow roundabout;
c. a twin-bore tunnel approximately 2 miles (3.3km) in length past Stonehenge; and
d. a new junction between the A303 and A345 at the existing Countess roundabout.

The Combined Modelling and Appraisal (ComMA) Report (Application Document 7.5) documents the transport modelling and economic assessment.

Executive Summary

This Combined Modelling and Appraisal (ComMA) Report details the modelling and appraisal work undertaken for the A303 Amesbury to Berwick Down scheme. The ComMA report is an 'end of stage' document encapsulating the model development, forecasting and economic appraisal undertaken for the Scheme.

Travel demand and network performance between Amesbury and Berwick Down on the A303 and within the road network local to the Scheme have specific characteristics, which influence the transport modelling and scheme appraisal. For example:

a. There are seasonal traffic flows, associated with holiday traffic to the south west.

b. Site observations, supported by traffic data, indicate that 'rubber necking' occurs as certain drivers pass Stonehenge, reducing link capacity on the A303 past Stonehenge.

c. This is the first/last section of single carriageway on the A303 before continuous dual carriageway/motorway to the M25.

d. Congestion can occur both eastbound and westbound at the point where the A303 reduces from two lanes to one.

e. 'Rat-running' where A303 traffic uses the local road network to avoid congestion on the A303 has been observed to occur.

These factors lead to large differences in both flows and journey times, between 'neutral' and 'summer/holiday' days. This informed the decision to develop both 'neutral' and 'busy' period models, to reflect observed behaviours in the transport modelling and economic appraisal.

The 'A303 Stonehenge SWRTM (DCO)' transport model used to support the Development Consent Order (DCO) application has been developed from models used during the Project Control Framework (PCF) Stages 1 and 2 and enhanced by including new data to better represent local trip movements, busy day conditions and develop detailed operational models.

The primary use of the 'A303 Stonehenge SWRTM (DCO)' model is to assess the traffic impacts of the A303 Amesbury to Berwick Down scheme and to provide inputs into economic and environmental appraisals, as well as informing the buildability (construction, traffic management) of the Scheme and operation and design of its junctions.

The 'A303 Stonehenge SWRTM (DCO)' model is a strategic model which extends across England and Wales with an 'Area of Detailed Modelling' covering Amesbury, Bulford, Larkhill and bounded in the south by Salisbury and Wilton. The base year for the model is 2017 with morning, interpeak and evening hour models based on October data and the busy day based on August data. All the models have been calibrated and validated to a standard which meets or exceeds Department for Transport thresholds.

A microsimulation model has also been developed using 2017 data which allows for more detailed assessments of junction layouts and vehicle movements to be undertaken. The microsimulation model considers the mainline of the A303 and the route between the Countess and Longbarrow roundabouts via The Packway.

Future year models were developed from the base year by considering planned local land use and transport infrastructure changes alongside national projections of population and economic changes. The future year models were built for 2026 – the year the Scheme is assumed to be open to traffic, 2031, 2041 and 2051. A set of models without the Scheme, referred to as Do-Minimum models, were built to understand how the network operates in the absence of the Scheme. The Do-Something models then include the Scheme. Differences between the model predictions of flows, journey times and travelled distances are identified and monetised in the economic appraisal. Flows from both the Do-Minimum and Do-Something models were provided for environmental and safety assessments.

A series of sensitivity tests were undertaken to consider how sensitive the flows, journey times and travelled distances are to changes in some of the key assumptions. This scenario testing is required by the DfT to demonstrate the robustness of the core results which are being relied on as the main evidence.

The Scheme tested is a dual carriageway, in tunnel for approximately 2 miles (3.3km) passing the stones at Stonehenge, in conjunction with grade separated junctions at the current Countess and Longbarrow roundabouts, a bypass to the north of Winterbourne Stoke and some minor local works on the approaches.

All the future year models were tested against DfT standards to confirm that they were operating to a standard at or above the thresholds required. The models demonstrated that the Scheme provides a reduction in journey times in each modelled period. The largest impact was in the busy day which produced a travel time with the Scheme nearly 20 minutes less than the without scheme scenario in 2041. In addition to the reduced journey times, the Scheme encouraged traffic to route away from local roads such as The Packway. Annual average daily traffic (AADT) flows on the Scheme in 2041 are predicted to be 45,500 vehicles which is almost 20,000 more vehicles than in 2017 and 13,000 more vehicles than without the Scheme.

The economic appraisal used outputs from the future year models and monetised these, which is the process of applying a financial value to the time saved and a cost to the fuel consumed. The process subtracts the travel costs in the Do-Something from those of the Do-Minimum to generate a value for benefits. These are discounted in each of the 60 years of the appraisal period and summed for comparison against the costs of providing the Scheme including any costs or values associated with mitigating adverse impacts to create the initial benefit to cost ratio.

Changes in the number of accidents, air quality, noise and greenhouse gases have similarly been assessed, together with an assessment of impacts during construction. These are included in the economic appraisal.

In addition to the initial estimate of benefits, journey time reliability and wider economic impacts have been determined to adjust the benefit to cost ratio. These wider impacts are an assessment of how the economy reacts to the Scheme primarily through business agglomeration but also employees having access to employment and better paying jobs.

A further assessment which considered the value to the setting of Stonehenge (assessed in PCF Stage 2) has also been included in the adjusted estimate of the benefits. This contingent valuation has quantified the extent to which the setting of Stonehenge is improved when there is no traffic passing close by.

The Scheme has been assessed from the perspective of being funded either directly through the public sector or in part by private sector investment through a PF2 DBFM contract. The cost estimate for a publicly funded solution reflects the up-front expenditure required to meet the costs of preliminary works and construction of the Scheme, and ongoing operating and maintenance costs post scheme opening. For a scheme part-financed through private sector investment the cost estimate reflects preliminary costs retained by the public sector, the unitary charge which would be payable over the full term of the PF2 contract once the Scheme opens and the operating and maintenance costs retained by the public sector.

The overall economic appraisal of the Scheme shows it has beneficial impacts on all journey purposes in all modelled periods and a beneficial impact on the wider economy. For a scheme part financed through private sector investment the value of the transport economic efficiency benefits and changes in indirect taxation revenues is £262 million and the heritage, travel time reliability and wider impacts value is £1,051 million. When compared to the estimated cost to the public sector of £1,149 million this produces an initial BCR of 0.23 and an adjusted BCR of 1.14.

For a scheme directly funded through the public sector, the value of the transport economic efficiency benefits and changes in indirect taxation revenues is £257 million and the heritage, travel time reliability and wider impacts value is £1,051 million. Comparing the benefits with the estimated cost of £1,206 million this produces an initial BCR of 0.21 and an adjusted BCR of 1.08.

1 Introduction

1.1 Purpose

1.1.1 The A303 Amesbury to Berwick Down scheme is part of a wider package of proposals for the A303/A358 corridor designed to transform connectivity to and from the South West by creating a high-quality dual carriageway along the corridor. The purpose of this Combined Modelling and Appraisal (ComMA) Report is to summarise the work undertaken to model and appraise the impact of the Scheme on the strategic and local highway network, road safety and the economy. It is submitted as part of the DCO application.

1.1.2 The ComMA links to, and summarises, the following packages detailing the technical transport modelling and appraisal work undertaken as part of this project and which are Appendices to this document:

a. the Transport Data Package, Appendix A to the Combined Modelling and Appraisal Report;

b. the Transport Model Package, Appendix B to the Combined Modelling and Appraisal Report;

c. the Transport Forecasting Package, Appendix C to the Combined Modelling and Appraisal Report; and

d. the Economic Appraisal Package, Appendix D to the Combined Modelling and Appraisal Report.

1.1.3 The ComMA is designed to summarise the programme of data collection undertaken at the onset of this PCF Stage 3 appraisal; the development of the base year and forecast year transport models; and to communicate the findings of the economic appraisal of the Scheme.

1.2 Background

1.2.1 The A303/A358 corridor is a vital transport connection between the South West and the South East of England and is part of the Trans-European Network - Transport (TEN-T). While most of the road is dual carriageway, there are still over 35 miles (56km) of single carriageway. These sections act as bottlenecks for users of the route and can result in congestion, particularly in the summer months and around school holidays. This can cause delays to traffic travelling along the A303 through the Stonehenge area of over an hour at the busiest times of the year and even greater for traffic travelling between the M3 and the South West.

1.2.2 The existing A303 passes through the Stonehenge section of the Stonehenge, Avebury and Associated Sites World Heritage Site (the WHS), passing approximately 165 metres from the Stonehenge monument itself. The WHS comprises two distinct components – Avebury to the north and Stonehenge to the south. The Scheme crosses the Stonehenge component only and all subsequent references to “the WHS” refer to the Stonehenge component.

1.2.3 Objectives for the Scheme have been formulated both to address identified problems and to take advantage of the opportunities that the new infrastructure will provide. The objectives are defined in the Department for Transport's (DfT's) Client Scheme Requirements (CSRs) which respond directly to the need for change:

a. **Transport:** to create a high quality route between the South East and the South West that meets the future needs of traffic;

b. **Economic Growth:** to enable the growth in jobs and housing by providing a free flowing and reliable connection between the East and the South West peninsula;

c. **Cultural Heritage:** to help conserve and enhance the World Heritage Site and to make it easier to reach and explore; and

d. **Environment and Community:** to improve biodiversity and provide a positive legacy for nearby communities.

1.3 Scheme description

Overview of the Scheme

1.3.1 The Scheme would be approximately 8 miles (13km) long and comprise the following key components:

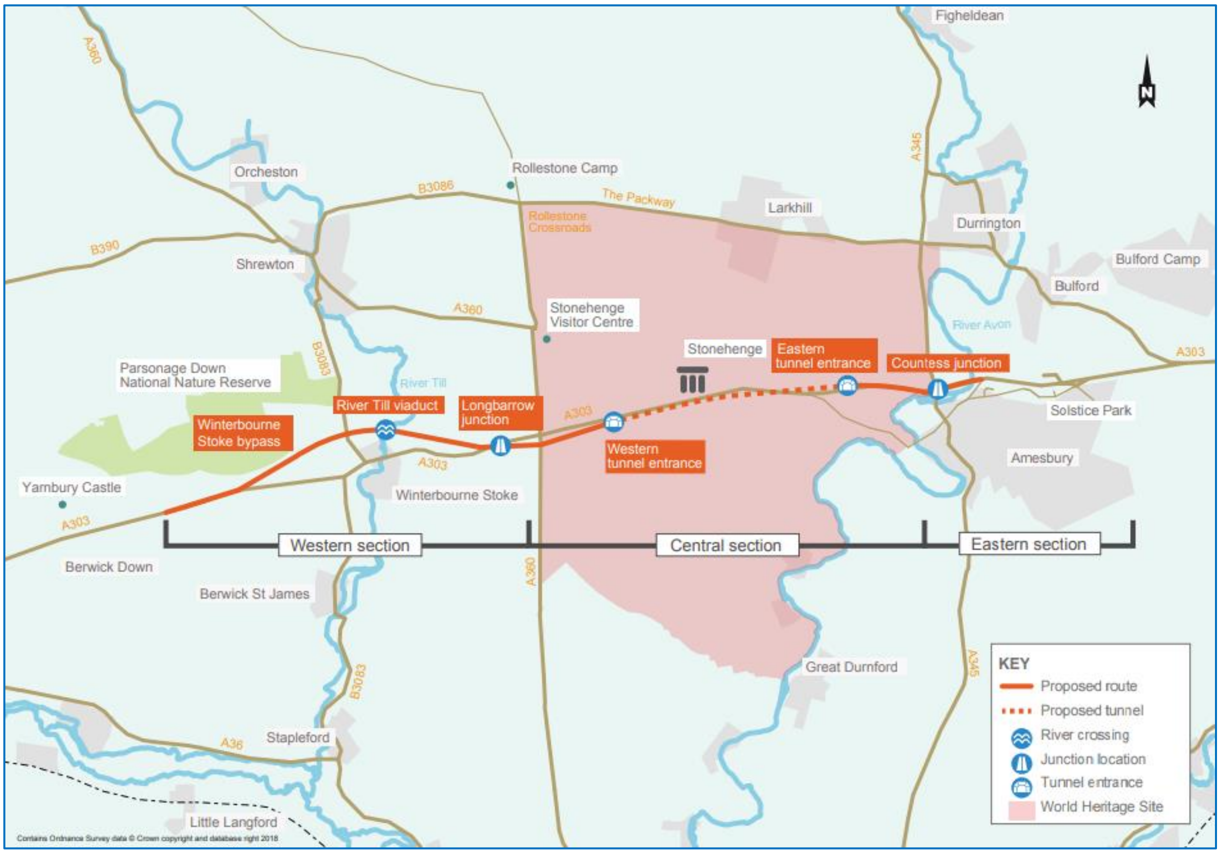
a. a northern bypass of Winterbourne Stoke with a viaduct over the River Till valley;

b. a new junction between the A303 and A360 to the west of and outside the WHS, replacing the existing Longbarrow roundabout;

c. a twin-bore tunnel approximately 2 miles (3.3km) long, past Stonehenge; and

d. a new junction between the A303 and A345 at the existing Countess roundabout.

1.3.2 The Scheme is described briefly in three route sections as shown in Figure 1-1.



Source: Figure 5.1 Scheme sections, A303 Amesbury to Berwick Down Public Consultation Booklet (February 2018)

Figure 1-1: Overview of the Scheme

a. Western section – Winterbourne Stoke bypass to Longbarrow junction

b. Central section – within the World Heritage Site

c. Eastern section – Countess junction to just beyond the Solstice Park junction

Western section

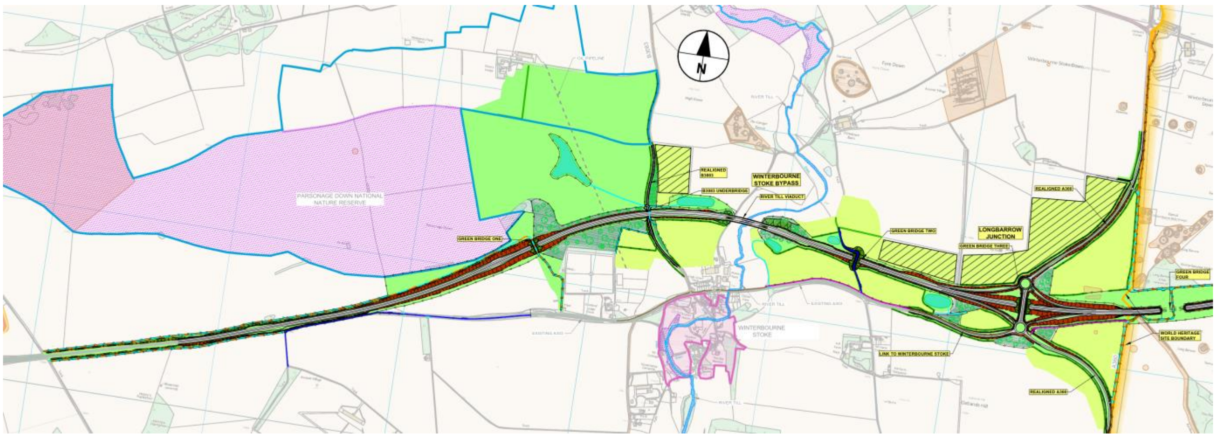


Figure 1-2: Western section

1.3.3 The Scheme would commence on the existing A303 approximately at Yarnbury Castle and would closely follow the existing A303 alignment, south of Parsonage Down NNR. It would then continue in a north easterly direction providing a bypass to the north of the village of Winterbourne Stoke.

1.3.4 A ‘green bridge’ would be constructed over the new A303 north-west of Scotland Lodge Farm near the south-east corner of Parsonage Down. This bridge would provide ecological and landscape connectivity across the Scheme and would form part of a non-motorised user (NMU) route and agricultural access route which would run from adjacent to a layby on the existing A303 to Parsonage Down and Yarnbury Castle. An area east of Parsonage Down would be used to create chalk grassland habitat using excavated chalk material arising from construction.

1.3.5 Local access from Winterbourne Stoke, northwards towards Shrewton, would be provided by the B3083. This access would be maintained by the provision of a single span bridge to carry the new A303 over the B3083. The proposed new bridge would be located approximately 50m to the west of the existing B3083. This location would necessitate the realignment of some 400m of the B3083 but would enable the B3083 to be kept open to traffic throughout the construction period other than for discrete periods to allow short duration specific activities to be undertaken (e.g. construction of tie-ins etc.). The clear span of the bridge would accommodate both the re-aligned B3083 and a segregated verge on the east side to allow cattle movements and equestrian use across the new alignment. The minimum headroom would be 5.35m.

1.3.6 The Scheme would continue in an easterly direction, crossing the River Till valley on a new twin deck viaduct. The River Till viaduct would carry the proposed A303 over the River Till SAC and SSSI and its floodplain. The viaduct would be designed to minimise impacts on the river below while balancing other environmental considerations, such as landscape and visual impacts. It would be a twin deck structure, with each deck approximately 14m wide and 210m long, and with a gap of approximately 7m between the decks. The road level on the bridge would be approximately 10m above the River Till where it crosses the river channel. The location of the piers would not be within the SAC or SSSI and would allow the existing bridleway (WST04) from Winterbourne Stoke to remain at its current location. An environmental screen, approximately 1.5m in height, would be installed on the southern parapet to help screen vehicle movements from locations to the south.

1.3.7 A second green bridge at the Winterbourne Stoke Public Right of Way (PRoW) WST06B would maintain the existing PRoW over the new A303 alignment and as with other green bridges would provide for ecological and landscape connectivity across the Scheme.

1.3.8 Continuing to the east, the Scheme would cross the line of the existing A303 approximately 700m west of the existing A360 Longbarrow roundabout. A new grade separated junction with the A360 is proposed to the west of the WHS boundary. This junction, known as the Longbarrow junction, would accommodate free-flowing traffic movements between the A360 and the A303. The junction would consist of two roundabouts connected by a short length of dual carriageway, carried over the A303 on a new green bridge with earth bunds on each side, to help mitigate visual impact and to provide ecological connectivity. The structure would be a single span bridge, with headroom of at least 5.35m. The roundabouts would be set below existing ground level.

1.3.9 Traffic lights would be required at the Longbarrow junction. The traffic lights could be used during both day and night. A link to the de-trunked A303 to the west, accessing Winterbourne Stoke, would also be provided from the new Longbarrow junction.

Central section

Figure 1-3: Central section

1.3.10 As the Scheme crosses the line of the existing A360, it would enter into the WHS where it then follows closely the line of the existing A303.

1.3.11 The proposed alignment over the first c.1.0km of this section would generally be in a cutting varying in depth between approximately 7m and 10m. Approximately 2.5m to the top of the cutting would have a 1 in 2 grassed slope. The bottom of the cutting would comprise vertical retaining walls.

1.3.12 However, shortly after entering the WHS there would be a further green bridge (also known as a 'land bridge') that would be approximately 150m in length and would start approximately 150m from the western boundary of the WHS. In addition to an NMU route, this bridge would also provide visual and landscape connectivity between barrow groups to the north and south of the Scheme. The existing A303 through the WHS would be converted to a restricted byway.

1.3.13 The western tunnel portal would be located within the WHS, north west of Normanton Gorse, approximately 1.0km east of the existing Longbarrow roundabout and immediately to the south of the existing A303. The tunnel would commence with a fully grassed approximately 200m long over cut and cover tunnel before it becomes a bored tunnel. Tunnel service buildings would be located outside the tunnel portal.

1.3.14 The Scheme would then continue in tunnel in an easterly direction following an alignment that is broadly similar to the existing A303 but at a depth of up to approximately 50m.

1.3.15 The tunnel would be a twin-bore structure, approximately 1.9 miles (approximately 3 km) in length, and each tunnel bore would have an internal diameter of approximately 11.5m.

1.3.16 The two bores would be connected underground by a series of cross passages at regular intervals to allow for the safe evacuation of road users in the event of an incident in one of the bores.

1.3.17 The tunnel would contain a number of mechanical and electrical, operational and safety systems. The items of plant required to power and control these systems would predominantly be housed at the tunnel service buildings located outside of the tunnel.

1.3.18 The tunnel would emerge at the eastern tunnel portal through a short section of cut and cover tunnel approximately 85m in length extending eastwards from the bored tunnel section. The eastern tunnel portal would be located to the east of the King Barrow Ridge and The Avenue and just to the north of the existing A303. The portal approach would be in deep cutting formed with 1 in 2 grassed slopes.

1.3.19 The Scheme would then closely follow the line of the existing A303 to Countess roundabout.

Eastern section

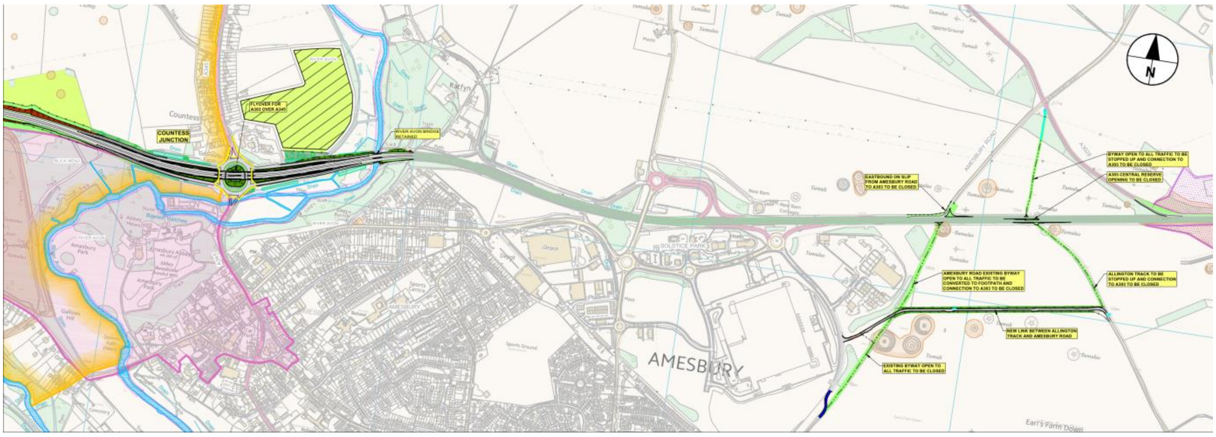


Figure 1-4: Eastern section

1.3.20 A new flyover above the existing roundabout would separate traffic going east-west along the A303 from traffic going north-south along the A345 Countess Road, with slip roads accommodating traffic movements between the two roads. The new flyover would include two single span bridges that would accommodate the existing roundabout traffic lanes. The minimum headroom of the bridges would be 5.35m.

1.3.21 Retaining walls would be required at this junction to support the A303 between the slip-roads. Noise barriers, approximately 1.8m high, would be installed along both sides of the flyover to help screen vehicles and to help attenuate vehicle noise at nearby houses.

1.3.22 There are two existing subways between the proposed eastern tunnel portal and Countess junction, which would be removed. Two new pedestrian crossings would be created around the existing Countess roundabout to provide north-south connectivity along Countess Road under the A303.

1.3.23 The Scheme would tie in with the existing A303 close to the existing River Avon Bridge, to the west of Solstice Park junction.

1.3.24 To the east of the Solstice Park junction there would be a number of changes to existing rights of way and to points of access to and from the A303.

1.4 Previous analysis and economic assessments undertaken

1.4.1 The Scheme is currently at the end of Stage 3 of the PCF process (the Development phase). Analysis has been undertaken for previous PCF Stages as follows:

a. PCF Stage 0 analysis undertaken by Mott MacDonald Grontmij;

b. PCF Stage 1 analysis undertaken by Arup Atkins Joint Venture (AAJV); and

c. PCF Stage 2 analysis undertaken by AAJV.

1.5 Report structure

1.5.1 Highways England's Transport Planning Group (TPG) revised its list of expected PCF products in 2017. The Combined Modelling and Appraisal (ComMA) report is an 'end of stage' document encapsulating the majority of reporting on the model development, forecasting and appraisal undertaken for the Scheme.

1.5.2 This ComMA details the modelling and appraisal work undertaken for the A303 Amesbury to Berwick Down scheme.

1.5.3 Following this introductory chapter, the remainder of the ComMA is structured as follows:

a. Chapter 2: Local transport situation;

b. Chapter 3: Model development;

c. Chapter 4: Forecasting;

d. Chapter 5: Economic appraisal; and

e. Chapter 6: Summary.

1.5.4 A list of abbreviations can be found at the end of this document. This consolidates key acronyms noted and previously expanded in the main text of this report.

2 Local transport situation

2.1 Overview

2.1.1 Travel demand and network performance in the vicinity of the Scheme have specific characteristics, which influence the transport modelling and scheme appraisal. For example:

a. There are seasonal traffic flows, associated with holiday traffic to the south west.

b. Site observations, supported by traffic data, indicate that 'rubber necking' occurs as certain drivers pass Stonehenge. This results in lower link capacity on the A303 past Stonehenge, when there is a higher proportion of leisure / tourist trips.

c. This is the first/last section of single carriageway on the A303 before continuous dual carriageway/motorway to the M25. Congestion can occur both eastbound and westbound at the point where the A303 reduces from two lanes to one.

d. 'Rat-running' where A303 traffic uses the local road network to avoid congestion on the A303 has been observed to occur.

2.1.2 The combination of the above factors leads to large differences in both flows and journey times, between 'neutral' and 'summer/holiday' days. This informed the decision to develop both 'neutral' and 'busy' period models, to ensure that these differences are reflected in the transport modelling and economic appraisal.

2.1.3 This section of the report seeks to summarise the above issues and present information on the baseline situation, utilising various sources of traffic data, including new data specifically collected to inform the assessment.

2.2 Description of the local transport system

Highway network

2.2.1 The A303 Amesbury to Berwick Down scheme forms part of the A303/A358 trunk route, which provides vital east-west connectivity between the South East and London and the South West and is also part of the Trans-European Network - Transport (TEN-T).

2.2.2 The A303 runs for approximately 93 miles (150 kilometres (km)) from Junction 8 of the M3 near Basingstoke towards Exeter. It carries traffic between the South East and Somerset, Devon and Cornwall as well as serving intermediate regional destinations and local small and medium sized settlements along the route.

2.2.3 Figure 1-1 shows the road network in the vicinity of the Scheme. The A3028 / A360 / B390, provides a parallel route to the A303 enabling access to local communities including Bulford, Larkhill, Shrewton and Chitterne. This corridor also provides an alternative route between the A303 and the A36 towards Warminster, and during busy periods on the A303 it serves as an alternative route for traffic which tries to avoid congestion on the A303. South of the A303, the local road network through north Amesbury also provides alternative routes for traffic to avoid congestion on the A303.

2.2.4 The A303/A360 Countess roundabout is the first at grade junction on the A303 from / towards the east. Approximately 2 km west of Countess roundabout, the A303 reduces to single carriageway and continues as single carriageway for approximately 8.5 kilometres before returning to dual carriageway west of Winterbourne Stoke.

Local and strategic public transport options

2.2.5 No current local scheduled bus services pass along the Scheme section of the A303. However, Salisbury Reds service 2 between Salisbury and Devizes does pass along a small section of the A303 at Winterbourne Stoke, as the B3083 crosses the A303.

2.2.6 The X4, X5 and activ8 operated by Salisbury Reds provide regular services connecting Salisbury/Amesbury with Larkhill, Swindon and Andover. The X5 crosses the A303 at Countess roundabout, whilst the X4 and activ8 cross the A303 at Solstice Park.

2.2.7 The Stonehenge Tour is a service operated by Salisbury Reds. It is a circular route connecting Salisbury, Stonehenge and Old Sarum. The service routes via the A360 and crosses the A303 at Longbarrow roundabout.

2.2.8 National Express service 33 operates between Salisbury and London, routing via Amesbury, stopping outside the Library on the A365. The Traveline National Data Set (TNDS) and National Coach Services Database (NCSD) indicate that there are currently limited long distance bus services operating along the length of the A303 west of Amesbury. National Express and Megabus services between the south west and London route via M4/M5, rather than the A303. South west operator Berry’s Coaches operates two of their daily south west to London services via the A303.

2.2.9 Rail services are available from the following stations in and around the study area:

a. Salisbury;
b. Andover;
c. Grateley Station; and
d. Pewsey.

2.2.10 Salisbury, Andover and Grateley stations are on the main line between Exeter and London Waterloo, serving locations similar to the A303. Salisbury additionally provides access to services between Bristol/Bath and Southampton /Portsmouth.

2.2.11 Pewsey, 15 miles north of Amesbury, is served by direct trains to London Paddington, Exeter St David’s and Penzance.

2.3 Description of key demand for travel in the Scheme area

Observed traffic flows

2.3.1 Figure 2-4Figure 2-1 summarises observed traffic flows on the A303 and local road network in the vicinity of the Scheme. The time periods correspond to those adopted in the development of the transport models, as outlined in sections 3.2.17 and 3.2.18. In summary the time periods represent:

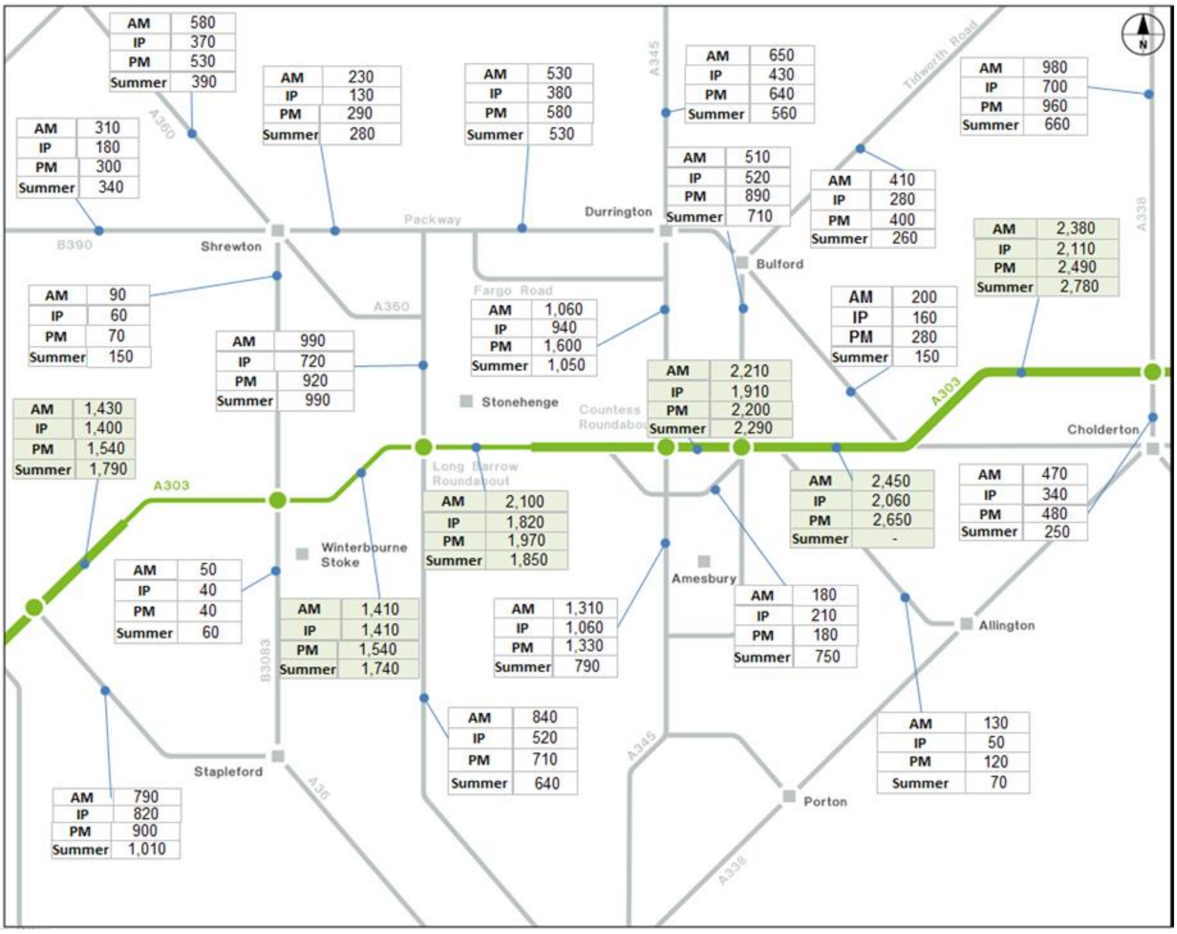
a. AM average hour (07:00 to 10:00);

b. the Inter Peak average hour (10:00 to 16:00);

c. the PM average hour (16:00 to 19:00); and

} Neutral month – Monday – Thursday, October 2017

d. The average hour 10:00 to 19:00 on busy Fridays, Saturdays and Sundays 2017 (July and August).



Observed count data rounded to nearest 10.

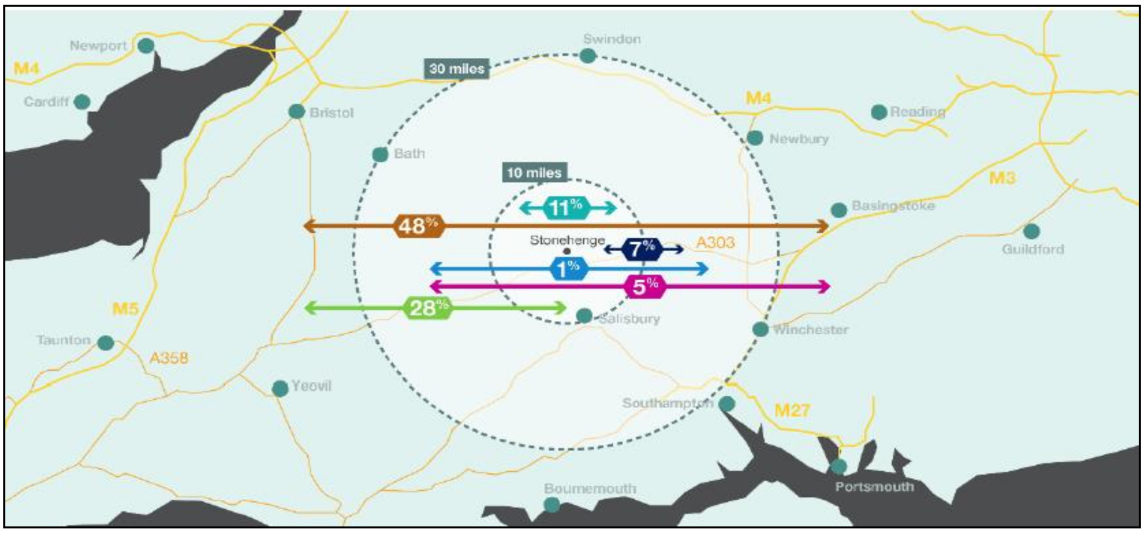
Figure 2-1: Two-way observed average hour count data - 2017

2.3.2 The observed data indicates that flows on the A303 at the eastern and western locations shown on the diagram are higher during the summer period than neutral periods. However the flow on the A303 past Stonehenge is lower in the summer period than the AM and PM neutral periods. Sections 2.4.11 – 2.4.15 discuss the impact of 'rubber-necking' which is observed to lead to a reduction in the capacity of the A303 past Stonehenge in the summer period.

2.3.3 Traffic volumes in the summer period on local roads running parallel to the A303 are similar to neutral peak periods and in some instances higher. Sections 2.4.4 to 2.4.10 discuss analysis of 'rat-running' which is observed to occur during periods of congestion on the A303.

Distribution of traffic using the A303

2.3.4 Figure 2-2 summarises the distribution of traffic using the A303 at Stonehenge. Only 11% of trips have both an origin and destination within 10 miles of Stonehenge, whilst the average length of journeys is 100 miles (160 kilometres).



Source: Roadside interview surveys undertaken in October 2015, east of Longbarrow roundabout

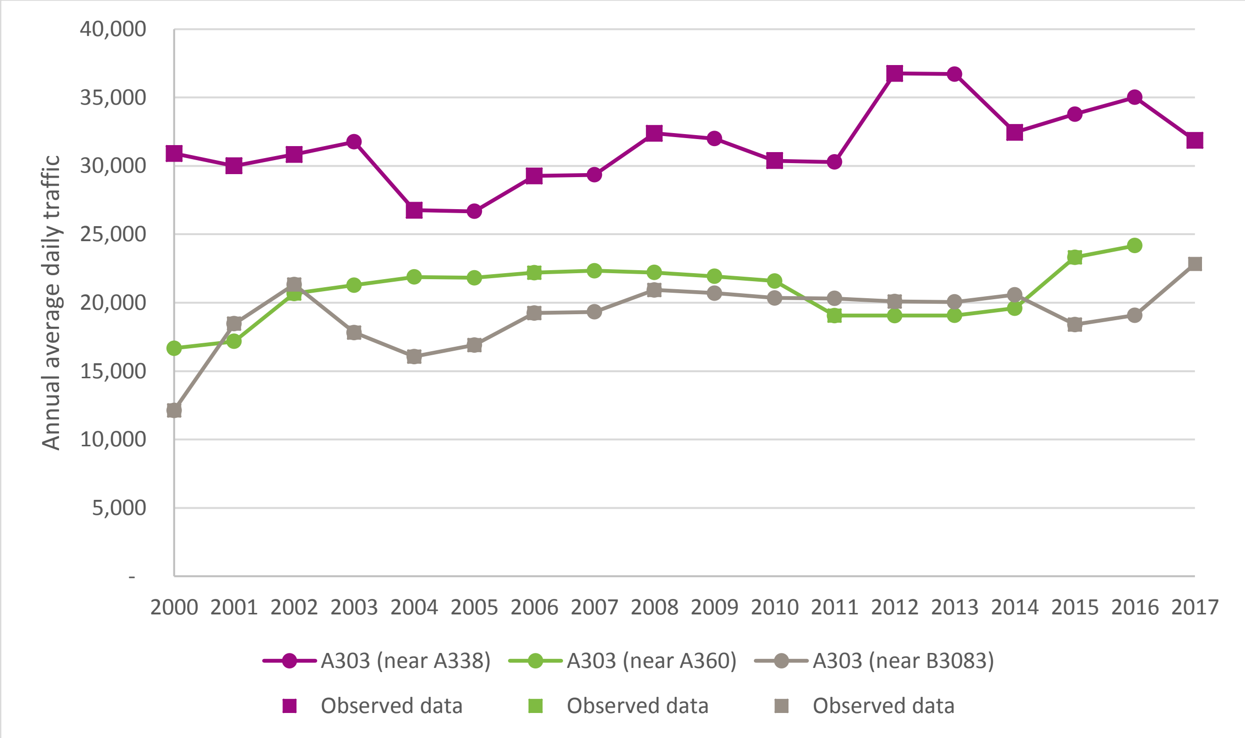
Figure 2-2: Distribution of all traffic on the A303 at Stonehenge (weekday)

Historic traffic growth

2.3.5 Figure 2-3 shows the locations of Highways England automatic traffic counters (ATC's) on the A303 in the vicinity of Stonehenge. The A303 (near A360) captures traffic which passes Stonehenge, whilst the other two sites are located east and west of the Scheme.

Figure 2-3 Location of automatic traffic counters on A303

2.3.6 Figure 2-4 shows annual average daily traffic (AADT) flow at these three locations. Data points that are based on observed data have been specifically labelled (squares). During years when traffic flow data is unavailable (most likely due to damaged or faulty equipment), the DfT have estimated AADT based on previous year's annual daily traffic. No data is available for the A303 (near A360) site in 2017.



Source: DfT Road Traffic Statistics, https://www.gov.uk/government/collections/road-traffic-statistics

Figure 2-4 Historic trends of AADT at three sites on the A303

2.3.7 Traffic is reported to have increased by approximately 45% on the A303 past Stonehenge (A303 (near A360)) between 2000 and 2016, 2.35% per annum, although for the years for which there were counts (2002 – 2015) the recorded growth was about 20%. The increase in traffic between the 2014 estimate and the observed 2015 count may be attributed to the permanent closure of the A344 past Stonehenge, with the A303 being the new route for traffic via Longbarrow roundabout.

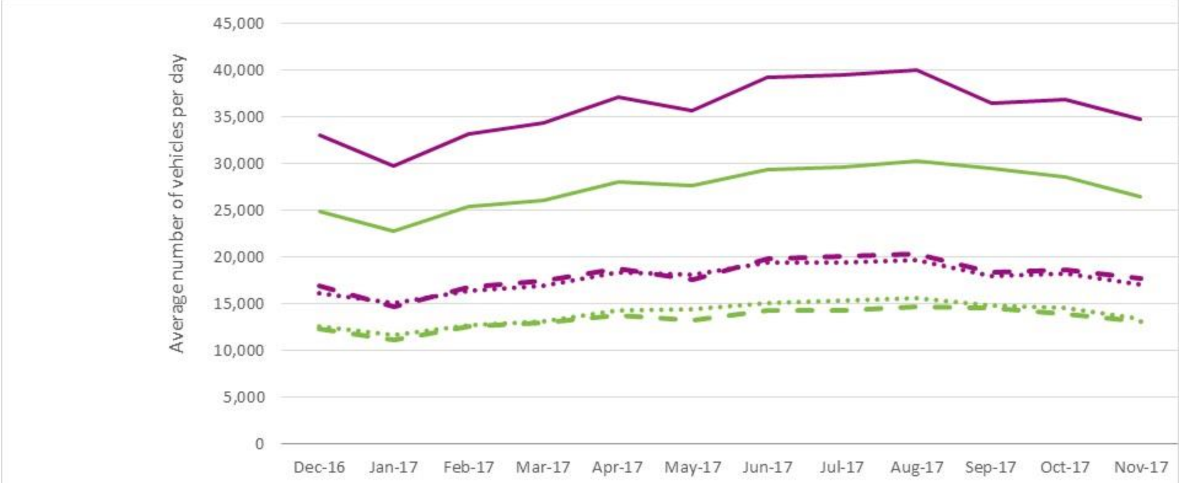
2.3.8 At the most easterly count site, (A303 (near A338)) traffic has grown by approximately 3% between 2000 and 2017, 0.2% per annum. At the most westerly site, (A303 (near B3083)) traffic has grown by approximately 90% between 2000 and 2017; however the vast majority of this growth occurred between 2000 and 2002. Between 2002 and 2017 traffic has grown by less than 10%, 0.6% per annum.

Seasonal flow profile

2.3.9 Figure 2-5 shows the monthly profile of daily traffic on the A303 from December 2016 to November 2017.

2.3.10 Past Stonehenge (A303 site near the A360 shown in green), the month with the highest daily traffic flows at this location is August with a 2-way daily traffic flow of 30,290 vehicles – this is a single carriageway section of the A303. The average daily traffic flow during neutral traffic months (late March, late April, May, June, September, October and November) is 27,975. Traffic flows at this location are on average approximately 8% higher during the summer month of August than an average neutral month.

2.3.11 At the more easterly site near the A338 (shown in magenta), the month with the highest daily traffic flows is again August with a 2-way traffic flow of 40,089 vehicles (approximately 32% higher than the site at Stonehenge – this site is dual carriageway). Daily traffic flows in August are approximately 10% higher than the average neutral month.



	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17
EB ADT (A303 near A338)	16,141	15,059	16,394	16,962	18,437	18,176	19,486	19,395	19,772	18,066	18,280	17,107
WB ADT (A303 near A338)	16,932	14,756	16,785	17,416	18,767	17,548	19,813	20,115	20,317	18,436	18,598	17,712
2-way ADT (A303 nr A338)	33,073	29,815	33,179	34,378	37,204	35,724	39,299	39,510	40,089	36,502	36,878	34,819
EB ADT (A303 near A360)	12,574	11,701	12,746	13,108	14,259	14,435	15,092	15,375	15,577	14,908	14,596	13,410
WB ADT (A303 near A360)	12,332	11,131	12,651	12,971	13,758	13,250	14,322	14,337	14,713	14,636	13,952	13,126
2-way ADT (A303 nr A360)	24,906	22,832	25,397	26,079	28,017	27,685	29,414	29,712	30,290	29,544	28,548	26,536

Figure 2-5 Monthly profile of daily traffic on A303

Daily flow profile

2.3.12 Figure 2-6 shows the daily profile of traffic on the A303 (east of the A360) for eastbound and westbound directions. Daily demand has been averaged between December 2016 and November 2017. December 2017 data were not available when the assessment was undertaken.

2.3.13 Peak demand (1,312 vehicles) occurs in the eastbound direction mid-week between 07:00 and 08:00. There is a clear distinction between Monday-Friday commuter peaks and the weekend profile, with the weekend morning peak occurring around 11:00 to 12:00. The peak in the westbound direction occurs mid-week (1,145 vehicles) between 17:00 and 18:00.

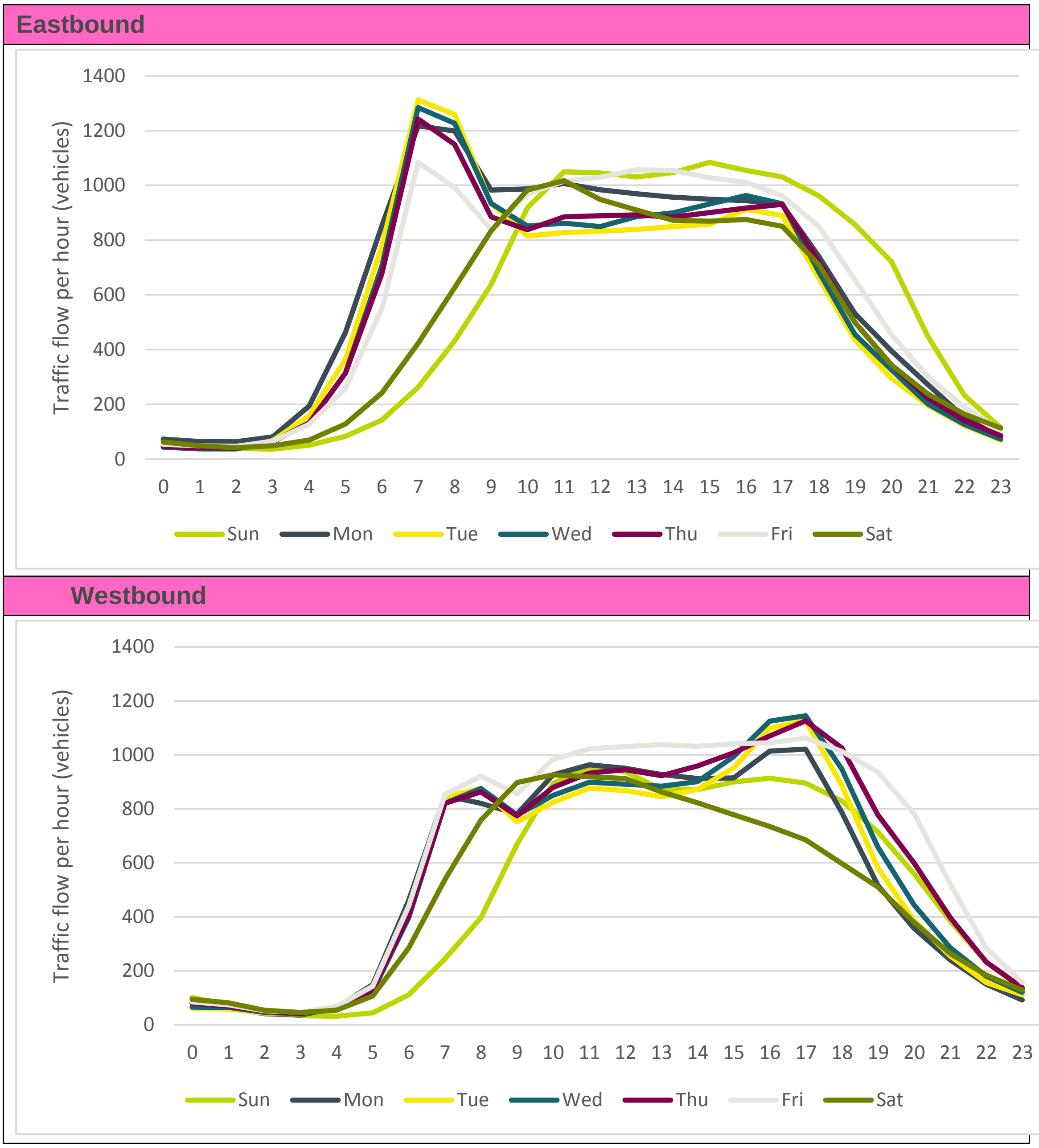


Figure 2-6 Daily profile of traffic on A303

2.4 Current transport issues

Journey times on A303

2.4.1 Automatic Number Plate Recognition (ANPR) surveys were carried out for three days during the summer period (Friday 18 August to Sunday 20 August 2017) and three days during the autumn period (Tuesday 3 October to Thursday 5 October 2017). Section 3 of the ‘Data Package’ provides further details of the ANPR survey programme, including locations where cameras were located.

2.4.2 Figure 2-7 and Figure 2-8 show travel times based on the ANPR survey on the 14 mile section of the A303 between the A338 in the east and the A36 in the west, including the Scheme section. This shows that a journey which would typically take less than 20 minutes on a normal mid-week day can take more than an hour on a summer Friday and nearly an hour on a summer Saturday.

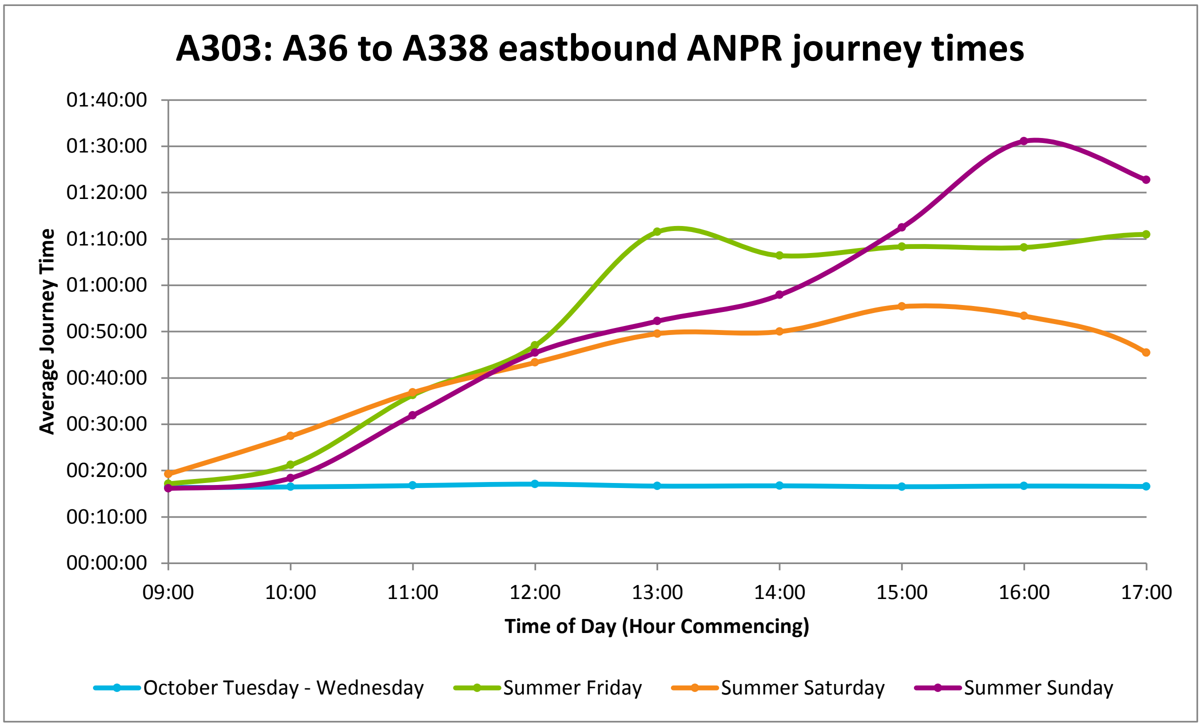


Figure 2-7: Daily profiles of eastbound journey times on A303

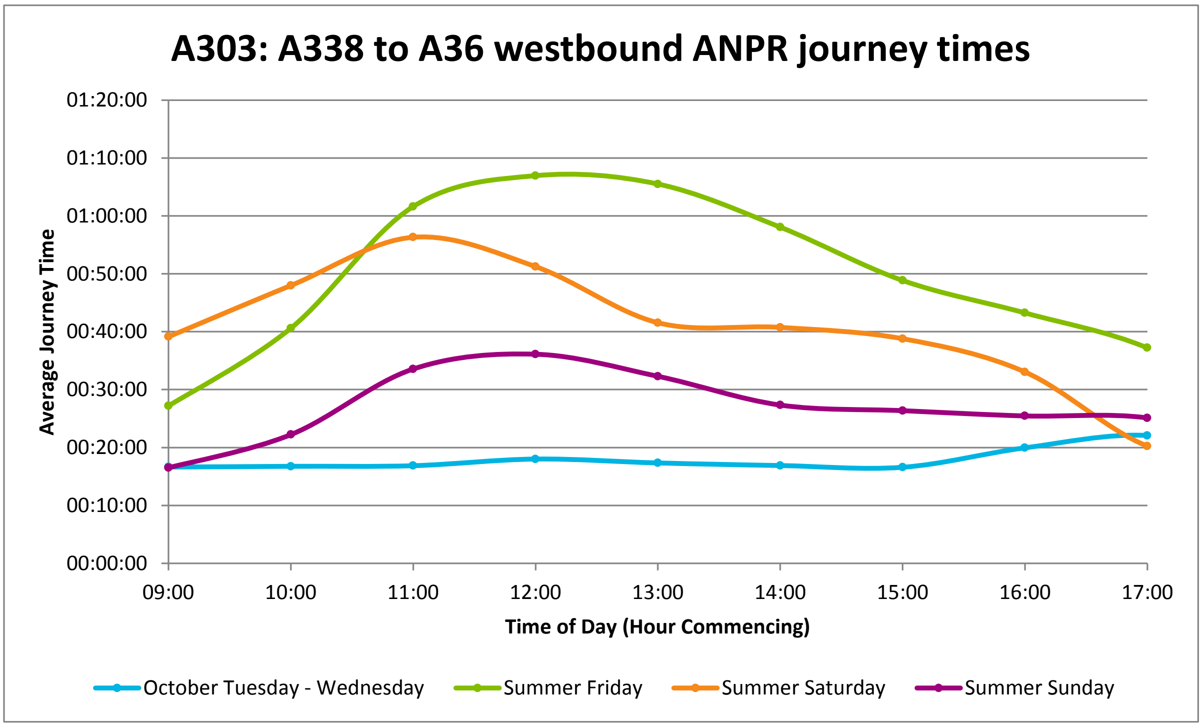


Figure 2-8: Daily profiles of westbound journey times on A303

2.4.3 Figure 2-9 shows 2016-2017 Trafficmaster average (median) journey time data for the same section of the A303 between the A338 and A36 as the ANPR analysis. The data confirms that the average journey time on most days of the year is less than 20 minutes. On 34 days the average journey time was over 30 minutes, over 50% longer than a typical day.

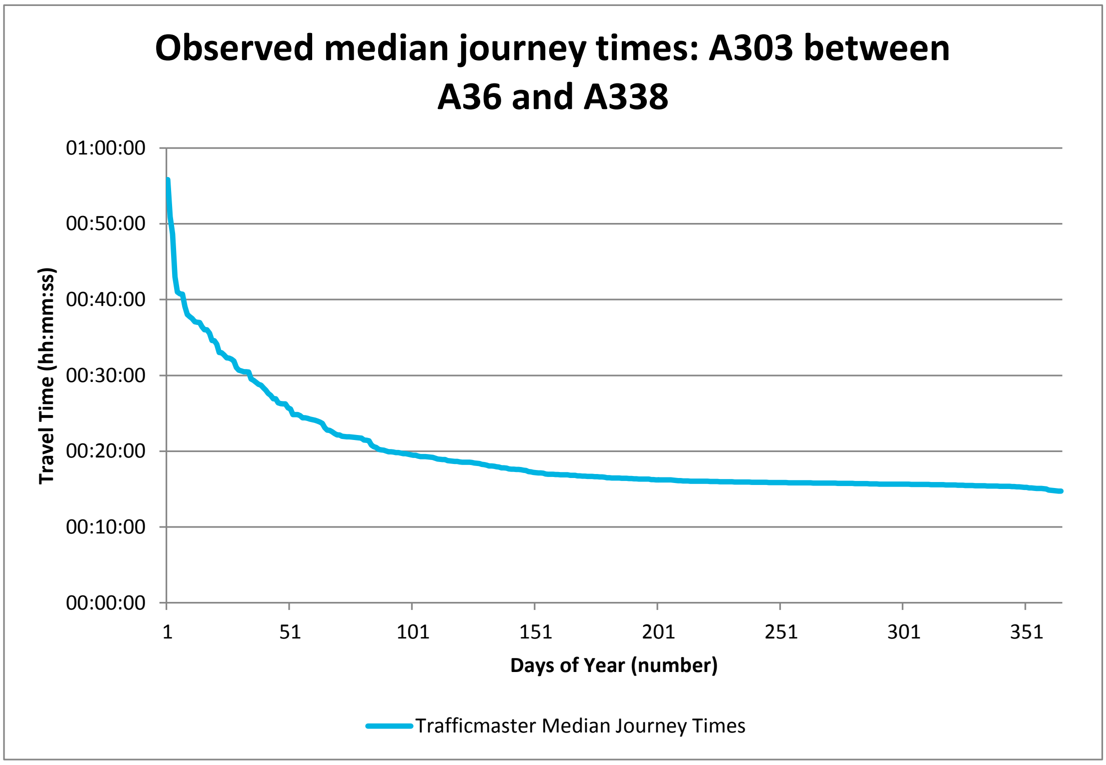


Figure 2-9: Average (median) journey times across the day during each day of the year

Observed 'rat-running' busy periods

2.4.4 Section 0 highlights that traffic volumes on the B3086 and The Packway were observed to be markedly higher during the summer surveys than on a neutral weekday. The Packway provides an alternative route to the A303 when there is congestion on the A303, with sections 2.3.10 to 2.3.12 demonstrating that during congested periods there can be substantial delays for traffic on the A303.

2.4.5 'Rat-running' activity has been investigated by analysing the ANPR data collected during August and October 2017. Figure 2-10 shows the main local routes used by traffic to avoid congestion westbound on the Scheme section of the A303, observed on the August Friday between 10:00 and 19:00. Figure 2-10 shows the percentage of the traffic on these roads which is attributable to rat running, i.e. is traffic observed on the A303 east and west of the Scheme, whilst also observed using an alternative local road instead of passing Stonehenge on the A303.

2.4.6 Approximately 21% of A303 westbound traffic was observed to divert from the A303 at either Solstice Park or Countess roundabout and use the local road network before re-joining the A303. The majority of these, approximately 13%, were observed to use the local road network through north Amesbury before re-joining the A303. A further 8% were observed to divert from the A303 and use The Packway, before re-joining the A303. Approximately 10% of the observed traffic using The Packway on the August Friday (10:00-19:00), had diverted off the A303 before re-joining the A303 past Stonehenge.

2.4.7 The figure also shows the average journey time vehicles took to pass between the eastern and western ANPR survey locations. Vehicles which used the local road network had journey times which were on average 7 to 8 minutes quicker than if they had stayed on the A303, although they were still delayed relative to uncongested travel times along the A303.

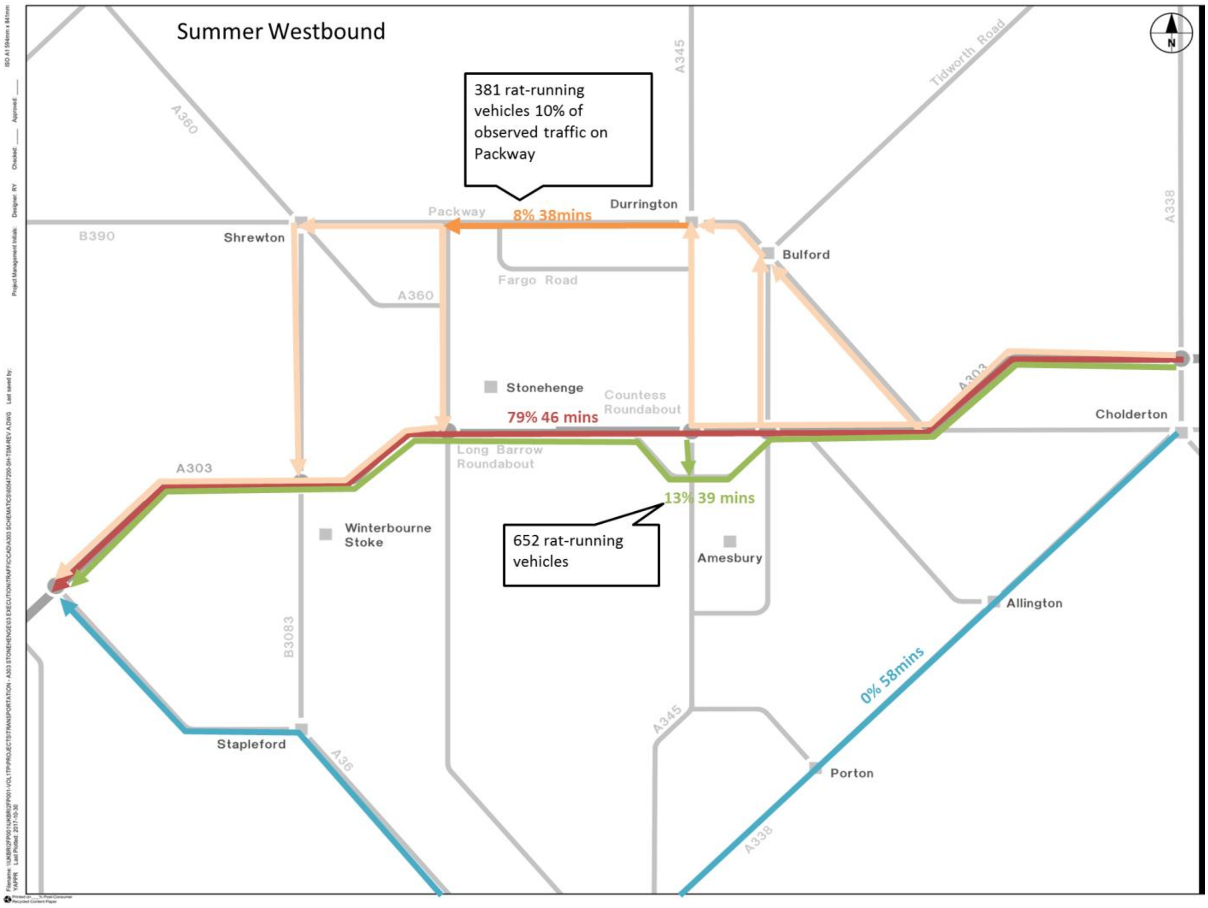


Figure 2-10: A303 rat running routes and traffic westbound (August 2017, single Friday 10:00-19:00)

2.4.8 Figure 2-11 shows the main local routes used by traffic to avoid congestion eastbound on the Scheme section of the A303. Approximately 15% of eastbound traffic was observed to divert from the A303 onto the A36 and use various local routes south of the A303 before re-joining the A303, with most (12%) re-joining the A303 at Longbarrow roundabout. Vehicles using these routes could reduce their journey time by up to 15 minutes, compared with staying on the A303.

2.4.9 Approximately 6% of observed eastbound traffic diverted north of the A303 and used The Packway before re-joining the A303. This route was on average 10 minutes longer than staying on the A303, indicating that queuing / delays occurred west of the A303/A36 junction with vehicles already incurring the delay before they diverted from the A303 on either the B3083 or A360.

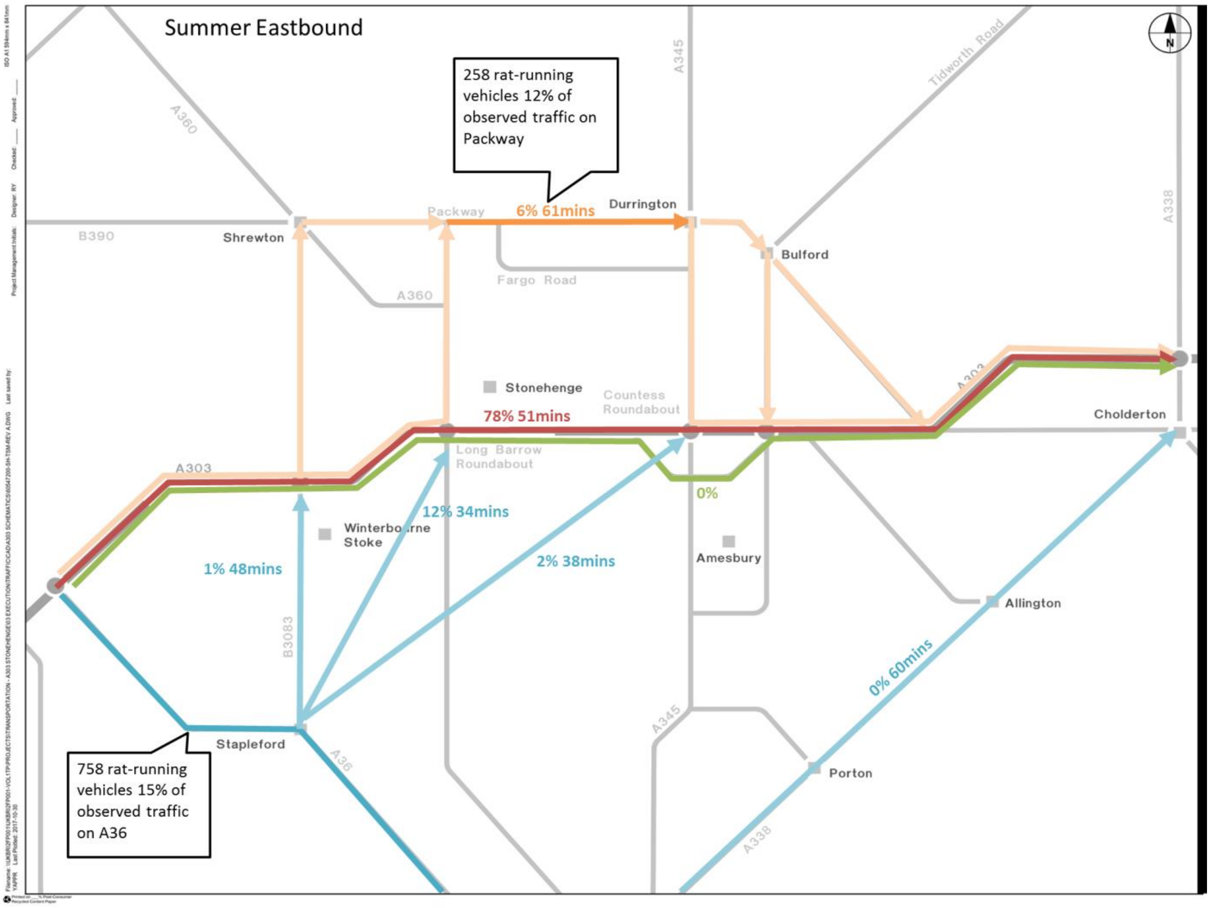


Figure 2-11: A303 rat running routes and traffic eastbound (August 2017, single Friday 10:00-19:00)

2.4.10 Analysis of the October ANPR survey showed evidence that there was no 'rat-running' occurring during this period. The ANPR journey time analysis shows that remaining on the A303 past Stonehenge is the quickest route at these times and there is no benefit to be gained by 'rat-running'.

Impact of 'rubber-necking'

2.4.11 Site observations undertaken on the A303 during the summer period suggested that drivers slowed or even stopped briefly to view Stonehenge. This driving behaviour contributes to congestion in the corridor.

2.4.12 The saturation flow of the section of carriageway passing the stones can be calculated in this instance due to the constant demand, held in eastbound and westbound queues inbound to this section and the relatively free flow conditions that exist after the stones.

2.4.13 The saturation flow was calculated using observed data, presented in Table 2-1 below, which indicates the volume of vehicles passing Stonehenge and arriving at the downstream junction; Countess roundabout in the eastbound direction, and Longbarrow roundabout in the westbound direction.

Table 2-1: Summer traffic volumes past Stonehenge – inbound to downstream junction

Junction	Traffic Direction	12:00	13:00	14:00	15:00	16:00	17:00
Countess Rbt (West Arm)	Eastbound	1,001	900	935	1,026	1,038	974
Longbarrow Rbt (East Arm)	Westbound	839	865	886	922	968	950

2.4.14 Table 2-1 indicates that eastbound flows past the stones range from 900 to 1,038 vehicles per hour, whilst westbound flows increase from 839 vehicles at 12:00 to approximately 950 by 17:00.

2.4.15 This rubber-necking behaviour was not clear from the data in the neutral month. The volumes past the stones are in Table 2-2, showing higher traffic volumes through this section of road during the neutral month without the extensive queues.

Table 2-2: Neutral traffic volumes past Stonehenge – inbound to downstream junction

Junction	Traffic Direction	AM 07:30 – 08:30	IP Average Hour 10:00 – 16:00	PM 17:00 – 18:00
Countess Rbt (West Arm)	Eastbound	1,451	870	1,022
Longbarrow Rbt (East Arm)	Westbound	1,016	908	1,106

2.5 Sources of data

The need for data

2.5.1 The models used to support the DCO application include new data from what was collected and reported on at PCF Stages 1 and 2 in document number HE551506-AA-VTR-SWI-RP-CX-000001, Traffic Data Collection Report (TDCR), July 2016. This takes the form of new data to represent better local trip movements; new traffic count data for calibration and validation of the model in the vicinity of key junctions; and new demand and count data which enabled the development of summer time period and detailed operational models.

Origin-destination (OD) data

2.5.2 Origin-destination (OD) data are a key building-block in the development of transport models. Sources of OD data that have been used in the model refinement for PCF Stage 3 include:

a. mobile phone-based OD matrix data for private vehicles from the SWRTM;
b. Trafficmaster-based (collected via Global Positioning Systems (GPS)) matrix data for Light Goods Vehicle (LGV) movements, and DfT Base Year Freight Model (BYFM)-based matrix data for Heavy Goods Vehicle (HGV) movements, from the SWRTM;

c. roadside interview (RSI) data collected in October 2015;
d. ANPR data collected in 2017 (more limited ANPR data were also collected in 2014);
e. new surveys at the Stonehenge visitor centre;
f. additional freight surveys; and
g. new data obtained from Highways England's Trip Information System (TIS).

Traffic count data

2.5.3 In addition to the manual classified turning count (MCTC) and automatic traffic count (ATC) data collected to accompany the RSIs, additional counts were collected in October 2015. Details of the ATCs, MCCs and MCTCs are included in the Stage 2 TDCR together with the ATC data collected as part of the ANPR survey described above.

2.5.4 Traffic count data were obtained from Local Authorities as part of the SWRTM development in 2016. In addition, during the development of the Stage 2 model, further count data were obtained from Local Authorities on the roads not covered by the SWRTM; these are recorded in the TDCR and LMVR for the PCF Stage 2 model. The count data from the different sources were assembled and processed for the Stage 2 model and were used for matrix development, calibration or validation of the Stage 3 model as appropriate.

2.5.5 A programme of additional traffic surveys has been undertaken as part of the PCF Stage 3 work, with the data used for the following:

a. to enable improved validation around the area to the east of Solstice Park due to the closure of junctions in this vicinity that forms part of the Scheme;
b. to enable the development of VISSIM-based corridor microsimulation operational models;
c. to refine the neutral month strategic model; and
d. to facilitate the development of the summer strategic model.

2.5.6 The data collection exercise has concentrated on providing additional data within the Area of Detailed Model (AoDM). Sections 3.3.1 to 3.3.2 discuss in further detail how the AoDM has been determined.

Journey time data

2.5.7 Journey time data used in the SWRTM drew on data from the DfT Trafficmaster dataset (September 2014 to August 2015), as outlined in the SWRTM TDCR. The same routes were used for the PCF Stage 3 model, as was the case at PCF Stage 2. Additional routes, not covered by the SWRTM, were identified during the development of the PCF Stage 2 model, again based on Trafficmaster data. These routes are recorded in the Stage 2 TDCR and LMVR. These routes have been used in PCF Stage 3 although the observed data have been updated. The base year of the model has been updated to 2017 and uses Trafficmaster data for the latest available period of July 2016 to June 2017.

Survey programme

2.5.8 Figure 2-12 and Figure 2-13 show the dates over which the various surveys were undertaken for both the summer and autumn periods respectively.

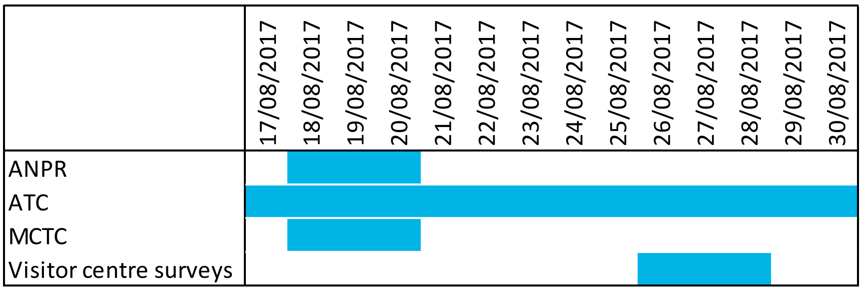


Figure 2-12: Summer programme of surveys

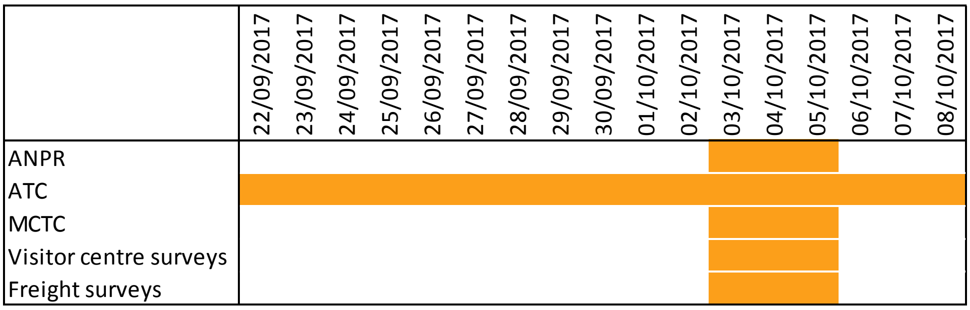


Figure 2-13: Autumn programme of surveys

2.5.9 Table 2-3 summarises the relationship between the ComMA report and other ComMA Packages and identifies where further information can be found in relation to data used in the development of the transport models.

Table 2-3: ComMA data requirements summary

ComMA Requirement	Reference to ComMA Package
Summary and review of existing data	HE551506-AA-VTR-SWI-RP-CX-000001, *Traffic Data Collection Report (TDCR), July 2016*, covers the data which was collected and reported on at PCF Stage 1/2.
Data collection	*Transport Data Package* (Appendix A to the Combined Modelling and Appraisal Report) contains details of data collected for PCF Stage 3. Specifically: Section 3 – ANPR surveys Section 4 – Automatic traffic counts and link counts Section 5 – Manual classified turning counts Section 6 – Trafficmaster data Section 7 – Highways England Trip Information System (TIS) Section 8 – Stonehenge visitor centre interviews Section 9 – Freight surveys
Final data sets	*Transport Data Package* (Appendix B to the Combined Modelling and Appraisal Report) contains details of data collected for PCF Stage 3. Specifically: Appendix A – ANPR journey time analysis Appendix B – ATC summary data Appendix C – Manual classified turning count data Appendix D – Visitor centre survey data Appendix E – References survey data files

3 Model development

3.1 Introduction

3.1.1 An existing traffic model was available following options appraisal undertaken at PCF Stage 2. This was a strategic transport model based on an interim development version of Highways England's South West Regional Traffic Model (SWRTM) with some zonal and minor network updates informed by the work undertaken at PCF Stage 1.

3.1.2 At the outset of PCF Stage 3, the transport modelling suite was reviewed to determine the suitability of the model to provide the evidence base for the DCO application. Whilst the review noted that the PCF Stage 2 model was sufficient for the purposes of comparative assessments of different proposed options at the route selection stage, it also identified a number of limitations with respect to a single scheme, preferred route assessment required to provide an evidence base for DCO. Specific issues noted included the representation of local traffic in the vicinity of the Scheme; the representation of HGV movements through the scheme area; and ensuring a better representation of the busy day periods when significant delays are encountered when travelling past Stonehenge.

3.1.3 In accordance with Highways England's PCF guidance, the modelling suite was therefore refined to provide an evidence base for PCF Stage 3 decision making and the DCO application. This included a refinement of the strategic model, henceforth referred to as the 'A303 Stonehenge SWRTM (DCO)' model, including the development of a specific busy day time period, and the development of a new microsimulation tool to provide an evidence base to determine the operational impacts of the Scheme.

3.1.4 The remainder of this chapter summarises the spatial coverage of the transport model components, their development and subsequent calibration and validation.

3.2 Overview of model

Overview of the modelling suite

3.2.1 As noted above, the refinement of the modelling suite to provide an appropriate evidence base for PCF Stage 3 and DCO application comprises two key components: a refined version of the SWRTM (known as the 'A303 Stonehenge SWRTM (DCO)' model) and a newly developed operational model.

3.2.2 The primary use of the 'A303 Stonehenge SWRTM (DCO)' model is to assess the traffic impacts of the A303 Amesbury to Berwick Down scheme and to provide inputs into economic and environmental appraisals, as well as informing the buildability (construction, traffic management) of the Scheme and operation and design of its junctions. The model may also need to be able to undertake bespoke sensitivity tests at the request of stakeholders to provide additional supporting information – either as part of the DCO examination or for separate supporting activities. It is likely that the model will also be used in the future as part of a monitoring and evaluation strategy for the Scheme.

3.2.3 For many of the construction and design focused activities for which traffic data are required, traffic data from the model has been used as an input into more specialised operational models. The separate microsimulation model has been designed for this purpose. The strategic model was refined with this in mind, with network updates undertaken to ensure compatibility for providing inputs into the microsimulation model (for example, in the case of cordoning of networks and demand).

The strategic model: the 'A303 Stonehenge SWRTM (DCO)' model

Model suite structure

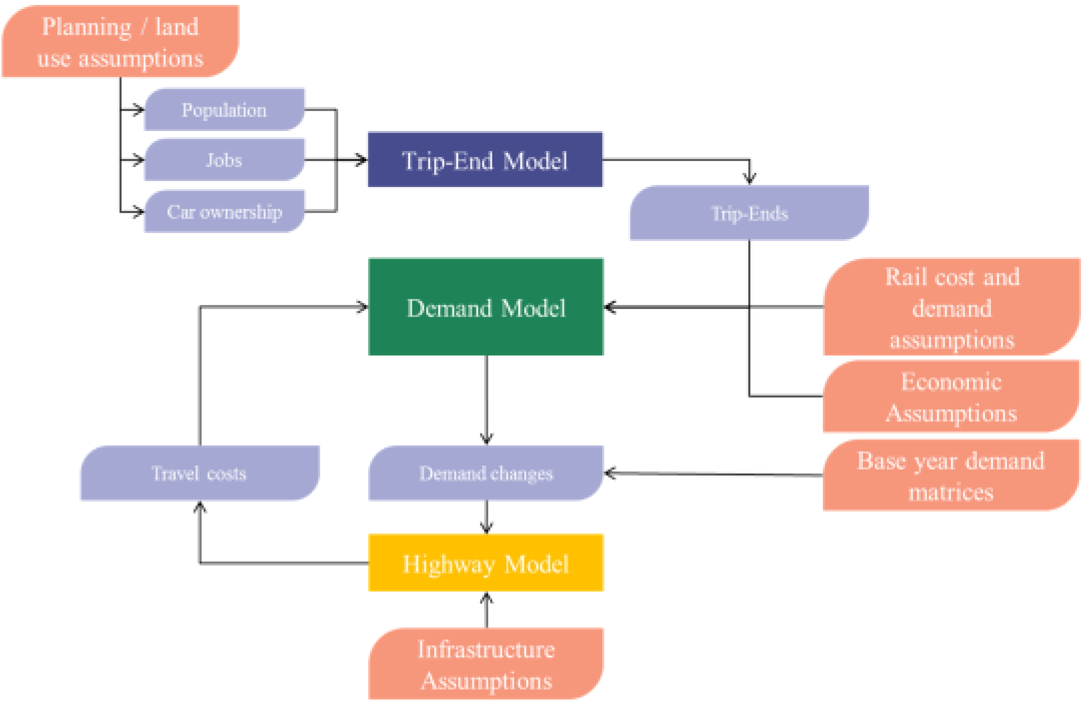
3.2.4 The 'A303 Stonehenge SWRTM (DCO)' model is a refinement of both the previous PCF Stage 2 modelling work and the current (at the time of development) SWRTM Design Freeze 3.0 (DF3) model maintained by Highways England.

3.2.5 The SWRTM is the highway assignment component of the wider Regional Traffic Model (RTM) suite. Highways England developed the RTM model suite to provide an evidence base for the future development of schemes on its SRN as part of the RIS.

3.2.6 The suite of models is aligned with the approach given in WebTAG, comprising:

a. a trip-end model, used for estimating the number of trips generated / attracted by a specific zone. Base year demand has been refined as part of the PCF Stage 3 works;
b. a variable demand model (VDM), used for estimating how travellers will respond to changes in their travel costs, including modal considerations; and
c. a highway assignment model (HAM), used for estimating travel costs and identifying the routes travellers may take through a congested road network.

3.2.7 Figure 3-1 provides an overview of the approach in flowchart form.



Source: Figure 4. South West Regional Traffic Model: Model Validation Report.

Figure 3-1: Regional Traffic Model (RTM) suite design

3.2.8 There is no formal public transport assignment model as part of the model suite. However, the model does contain public transport demand in the form of rail passenger trip matrices. For the 'A303 Stonehenge SWRTM (DCO)' model refinement, these elements have simply been disaggregated to the refined zoning system, as described below. Further data on the development of the rail matrices can be found in the South West Regional Traffic Model: Model Validation Report (document reference REP/MVR/001).

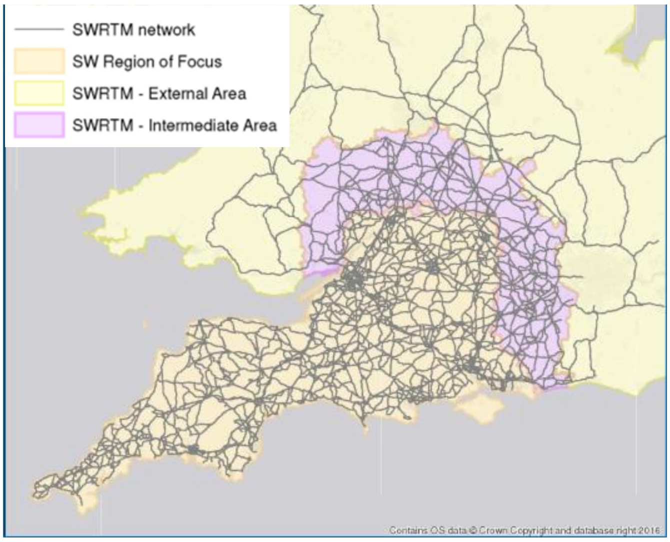
3.2.9 A variable demand model (VDM) forms part of the suite of A303 Amesbury to Berwick Down assessment tools. The demand model calculates changes in travel accessibility and applies macro time period choice, mode choice and destination choice models to reflect the changes in travel behaviour.

Spatial coverage

3.2.10 The SWRTM DF3.0 is designed to allow for the appraisal of packages of schemes across the South West region. As a result, what would ordinarily be the Area of Detailed Modelling (AoDM) for a single scheme model is much larger in the SWRTM. This has been termed as the Region of Focus (RoF). The RoF in the SWRTM represents the Fully Modelled Area and includes full demand relative to the modelled road network and is fully simulated including junction modelling on the strategic road network (SRN).

3.2.11 Within the RoF, the modelled road network includes all motorways, A roads, B roads and any unclassified roads that provide an important role in enabling strategic traffic movements within the model. Within the RoF, urban areas such as Bristol, Portsmouth, Southampton, Exeter and Plymouth are not modelled in detail and are instead coded with fixed speeds.

3.2.12 Outside of the RoF, the external area is an important element of the model in allowing full trip costs to be modelled, i.e. those that start or finish in the RoF. It provides the routeing for trips into the RoF. The external area is modelled as fixed speed network and does not include travel time responses to increased flow. The external area covers the wider UK SRN.



Source: Figure 6, South West Regional Traffic Model: Model Validation Report.

Figure 3-2: SWRTM modelled areas and network coverage

Base year, time periods and user-classes

3.2.13 The base year of the 'A303 Stonehenge SWRTM (DCO)' model is Summer (busy day) / October 2017. This represents a change from the 'standard' version of the SWRTM (and the other RTMs), which represent an average Monday-Friday weekday in March 2015.

3.2.14 The change in base year is necessary as a result of roadworks on The Packway, Larkhill being operational throughout the data collection window, as noted in the previous chapter. These roadworks were significant enough that they had the potential to influence and alter local trip movement patterns, which it would not have been possible to adequately reflect in the rebasing of traffic counts to a 2015 year through application of annualisation and seasonality adjustment factors.

3.2.15 The neutral month model represents the average Monday-Thursday weekday in October 2017. This is in accordance with the definition of a neutral month as per WebTAG Unit M1.2 §3.3.6, and is consistent with the period where the vast amount of new demand and traffic count data were collected.

3.2.16 The busy day model has been calibrated to represent an average Friday-Sunday from 15th July to 28th August 2017, consistent with the period for which new demand and traffic count data were collected. The model does, however, represent busy days outside of this period which have been shown to have similar levels of delay on the A303 past Stonehenge.

3.2.17 The neutral month time periods are consistent with the standard SWRTM DF3.0 model from which the 'A303 Stonehenge SWRTM (DCO)' model has been derived. The assignment models cover a single average hour across three time periods, being:

a. the AM average hour (07:00 to 10:00);

b. the interpeak average hour (10:00 to 16:00); and

c. the PM average hour (16:00 to 19:00).

3.2.18 The busy day model represents an average hour covering the period of 10:00 to 19:00 on busy Fridays, Saturdays and Sundays. Averaging across the three days ensures that delay in both directions on the A303 is represented, with the models representing the average of the high delay, rather than the peak of the delay.

3.2.19 The 'A303 Stonehenge SWRTM (DCO)' model represents five user-classes in the highway assignment model. These user-classes are consistent between the neutral month and busy day time period models and are as follows:

a. car business;

b. car commute;

c. car other;

d. LGVs (a mix of freight (88%) and personal (12%), in accordance with WebTAG); and

e. HGVs, comprising both Ordinary Goods Vehicles type 1 (OGV1) and Ordinary Goods Vehicles type 2 (OGV2).

3.2.20 The public transport demand included in the VDM covers three separate user-classes, all covering rail mode. These are:

a. rail commute;

b. rail other; and

c. rail business.

Key guidance documents used in development

3.2.21 Refinement of the strategic model has followed guidance set out in the DfT's WebTAG and Highways England's own RTM guidance to which the SWRTM DF3 was developed. Most notably, these include:

a. WebTAG Unit A1.3: User and Provider Impacts (March 2017);

b. WebTAG Unit M1.2: Data Sources and Surveys (January 2014);

c. WebTAG Unit M2: Variable Demand Modelling (March 2017);

d. WebTAG Unit M3.1: Highway Assignment Modelling (January 2014); and

e. WebTAG Databook (Interim May 2018).

The operational model

3.2.22 The operational model has been developed in the microsimulation software VISSIM. VISSIM is a microscopic, behaviour-based simulation model that can analyse traffic and transport operations under constraints such as lane configuration, traffic composition and traffic signals, amongst others. The model is therefore more appropriate to use to inform the detailed operational performance of the Scheme to inform the design, verification and optimisation of its design.

Spatial coverage

3.2.23 Following a review of the PCF Stage 2 strategic traffic model, two microsimulation models were developed to assess the operational performance to better represent the routeing and travel patterns in the local area. These comprise:

a. the Local Road model (covering the area north of the A303, including the B3086 and roads through Larkhill, Durrington and Bulford); and

b. the Mainline A303 model, which covers the A303 between the A338 and A36 and captures some local diversion around Solstice Park, Amesbury.

3.2.24 The spatial coverage is shown in Figure 3-3, with the networks for the Local Road model shown in orange and the Mainline A303 model in blue.

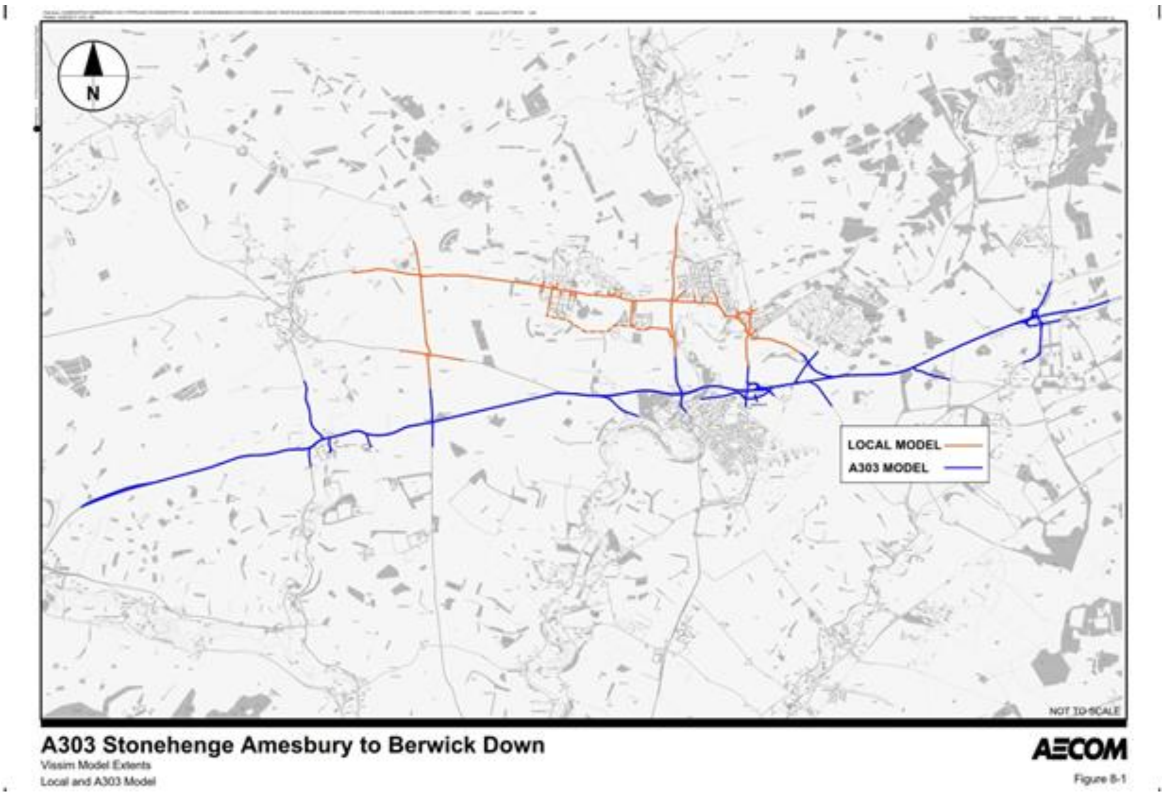


Figure 3-3: Microsimulation model extents

3.2.25 The Local Road network contains:

a. The Packway;

b. A360;

c. Fargo Road;

d. B3086;

e. A345;

f. A3028; and

g. local roads in Bulford, Larkhill and Durrington.

3.2.26 The Mainline A303 network comprises six major junctions, with additional minor arms along the network:

a. B3083 at Winterbourne Stoke;

b. A360 at Longbarrow roundabout;

c. A345 at Countess roundabout;

d. Solstice Park slip roads and roundabouts;

e. A3028 slip road; and

f. A338 slip roads.

Base year, time periods and user-classes

3.2.27 The base year of the microsimulation models is 2017, aligned with the data collection programme.

3.2.28 Unlike the strategic models, the simulation periods represented in the microsimulation models are not all average hours, but instead represent relevant peaks. Corresponding warm-up and cool-down periods have been developed to ensure appropriate levels of traffic on the network at the start of the simulated periods. Time periods are modelled as follows:

a. neutral AM peak (07:30 to 08:30), with a corresponding warm-up period of 06:00 to 07:30 and a cool-down period of 08:30 to 09:00;

b. neutral interpeak (average hour 10:00 to 16:00), with a corresponding warm-up period of one hour and a cool-down period of 30 minutes;

c. neutral PM peak (17:00 to 18:00), with a corresponding warm-up period of 15:30 to 17:00 and a cool-down period of 18:00 to 18:30; and

d. summer period (12:00 to 18:00), with warm-up and cool-down periods as follows:

i. Local Road network (11:30 to 12:00 and 18:00 to 18:30); and

ii. Mainline A303 network (11:00 to 12:00 and 18:00 to 18:30).

3.2.29 Three vehicle compositions are modelled:

a. 'Lights', comprising cars, taxis and LGVs;

b. 'Mediums', comprising rigid lorries; and

c. 'Heavies', comprising articulated lorries.

3.3 Model development

Area of Detailed Modelling

3.3.1 Initial assessments were undertaken using the PCF Stage 2 model in accord with WebTAG Unit M3.1 §2.2.1 and §2.2.5 to consider the area over which the preferred route may have significant impacts. Consideration was given to potential air quality and noise impacts as well as potential traffic volume and speed changes. Figure 3-4 illustrates the Area of Detailed Modelling (AoDM) within the Region of Focus (RoF) of the SWRTM.

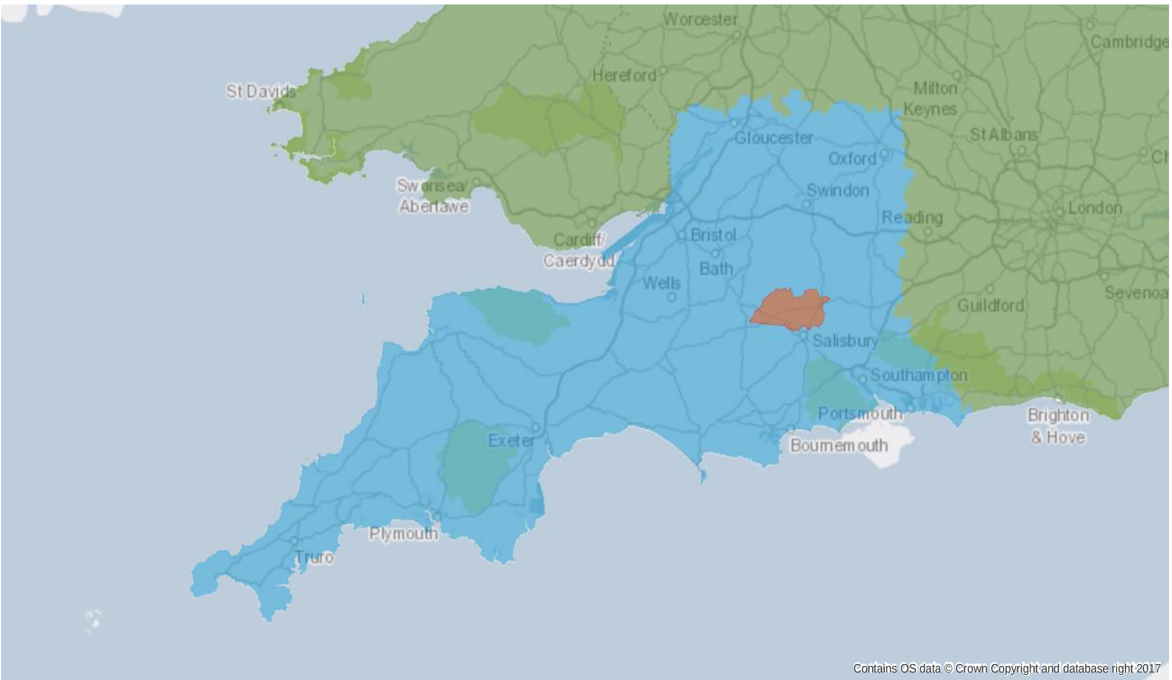


Figure 3-4: Region of Focus and Area of Detailed Modelling in the 'A303 Stonehenge SWRTM (DCO)' model

3.3.2 The AoDM extends north on the Salisbury Plain, north of Larkhill and Bulford, and south to the northern extents of Wilton and Salisbury. The eastern extent of the AoDM extends to the east of the A338, whilst the area extends towards Warminster in the west, incorporating the A36.

Local zoning

3.3.3 The zone system used in the 'A303 Stonehenge SWRTM (DCO)' model is a refinement of that in the SWRTM DF3.0. The model zoning was reviewed against the considerations set out in WebTAG Unit M3.1 §2.3.11. Zone boundaries in the AoDM were aligned to 2011 census geographic boundaries and the trip ends and size of local developments considered ensuring that the trip generation from individual zones accord with guidance. Further to this, the zoning was reviewed along the A303 through the AoDM to ensure that the zones did not span the road.

3.3.4 Figure 3-5 shows the refined zoning system with respect to the SWRTM DF3.0 for the AoDM, with detail given in Figure 3-6 for the area covering Amesbury and Larkhill.

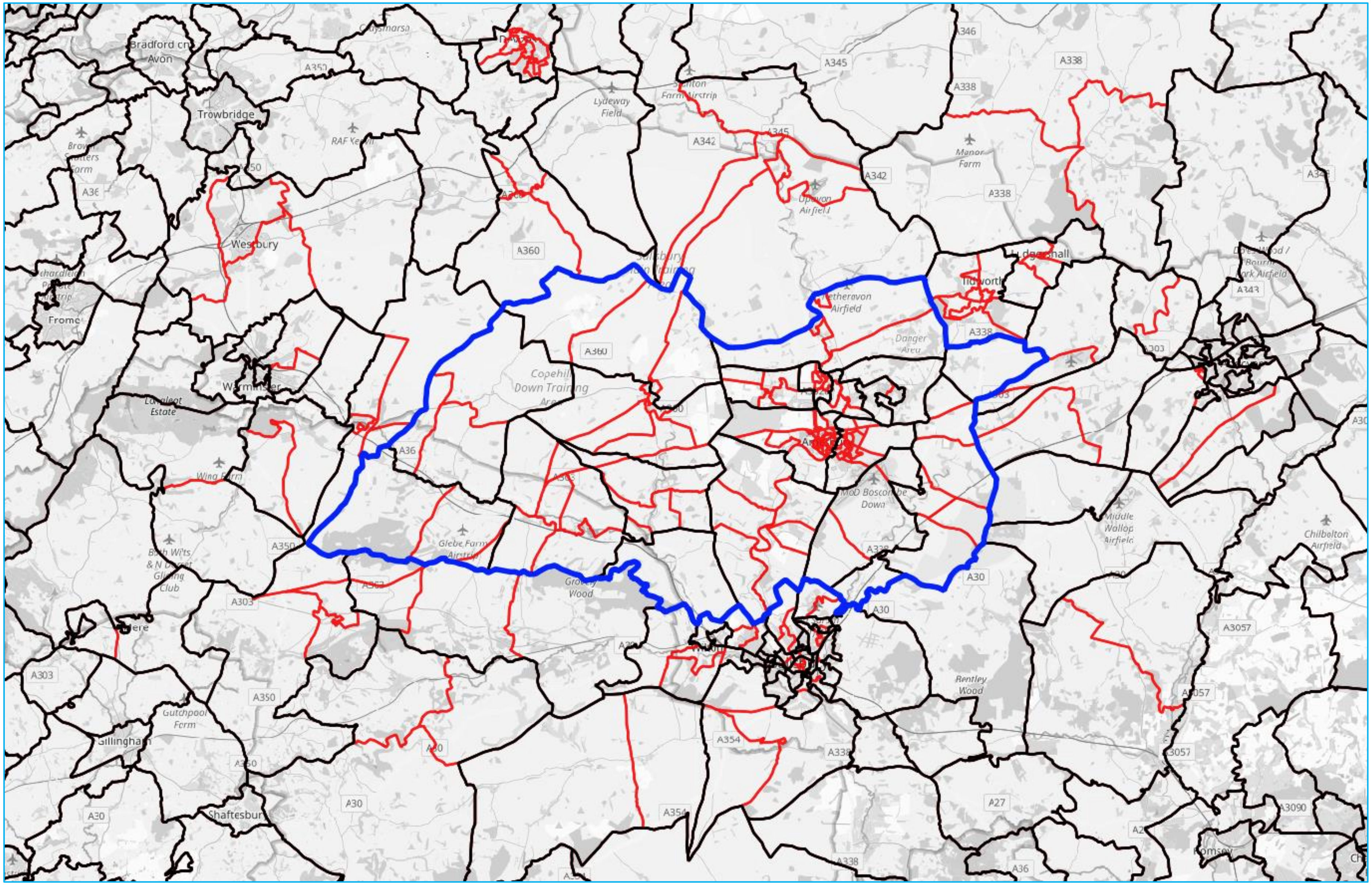


Figure 3-5: Overview of disaggregated zoning system (red) for the 'A303 Stonehenge SWRTM (DCO)' model

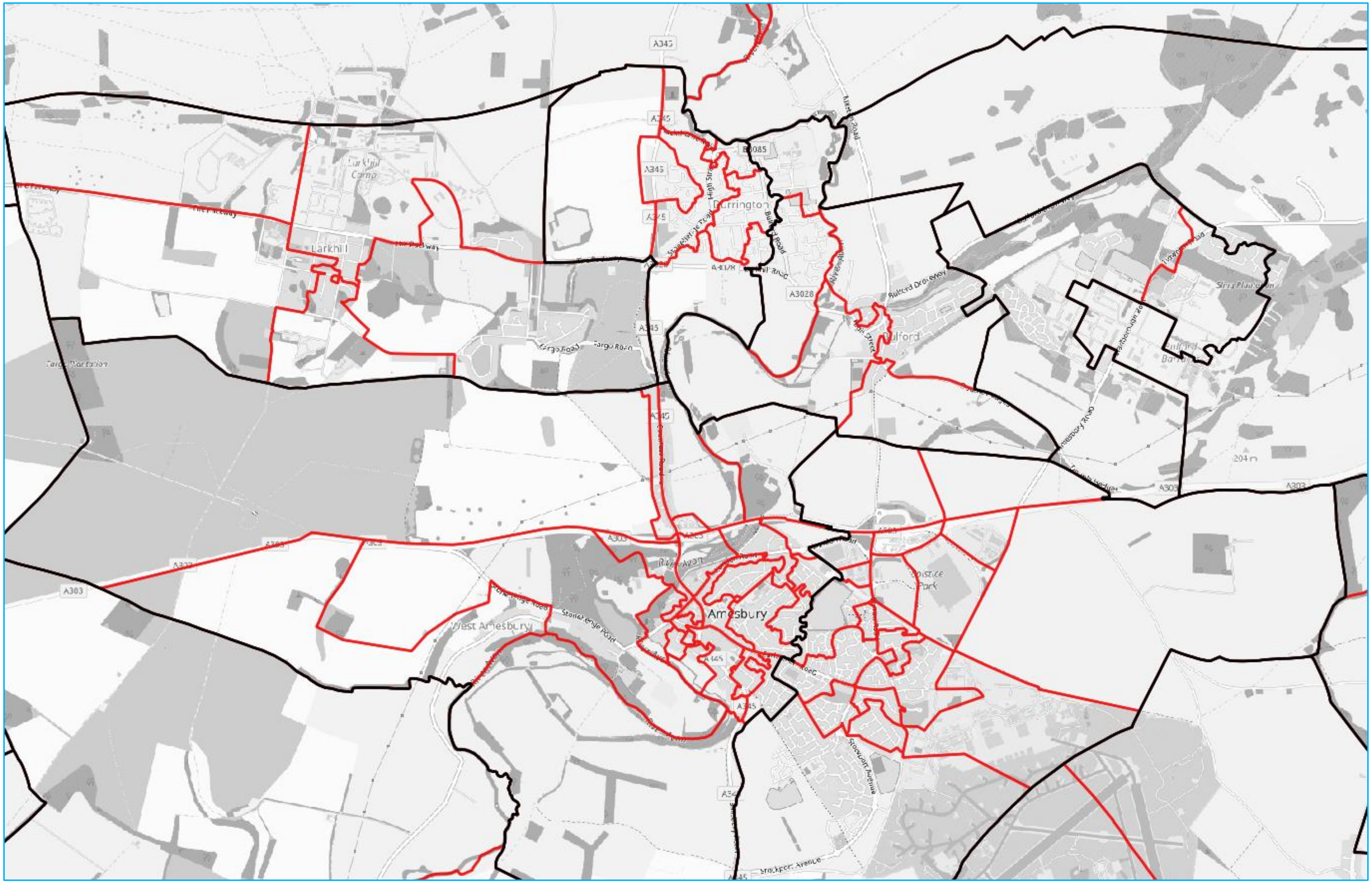


Figure 3-6: Detailed overview of zonal disaggregation around Amesbury, Larkhill and Durrington

Matrix development

3.3.5 As noted previously, one of the key aims of refinement of the model with respect to the assessment of a single scheme was to improve the representation of local trip movements. The trip matrix was therefore updated using data collected in August and October 2017 to provide better and more robust estimates of movements in and around the Scheme.

3.3.6 For the neutral day time periods, the matrices were updated from their 2015 SWRTM DF3.0 base year to the 2017 base year used in the 'A303 Stonehenge SWRTM (DCO)' model. National Trip End Model version 7.2 (NTEM v7.2) growth between 2015 and 2017 was reviewed for cars, whilst for LGVs and HGVs, both the DfT's Transport Statistics Great Britain (TSGB) and the National Transport Model Road Traffic Forecasts 2015 (RTF15) were reviewed to identify changes by vehicle type between 2015 and 2017. Whilst the evidence suggested no growth in car trips, LGV and HGV trips were factored up respectively by 5.6% and 1.5%. This uplift was applied globally across the matrices and for each time period.

3.3.7 The DfT's Continuing Survey of Roads Goods Traffic (CSRGT) data were sourced and used to refine the pattern of HGV movements for those trips that route through the AoDM. This refined the estimates of HGV in the SWRTM DF3.0 model which were based on DfT's ageing Base Year Freight Matrices (BYFM).

3.3.8 A busy day period matrix was subsequently produced from the neutral interpeak time period. Highways England's Trip Information System (TIS) data were sourced, with data obtained for March 2016 and 21 Fridays, Saturdays and Sundays in July and August 2016 to provide sector based factors to adjust car work and car other travel demand. HGV and LGV demand were adjusted reflecting observed count data.

3.3.9 Within the AoDM, a comprehensive ANPR data collection exercise was undertaken to capture the key movements through the study area, including areas of known and anticipated 'rat-running' in the busy periods These data were processed to derive sector-to-sector matrices and subsequently disaggregated spatially to model zones based on planning data (trip ends) and by purpose using the RTM estimates. This process was undertaken for both the neutral and busy day periods, using data from the October and August 2017 surveys respectively.

3.3.10 Interviews at the Stonehenge visitor centre were also undertaken, as it was not possible to otherwise refine trip movements to/from the site using planning data. These interviews provided observed vehicle type and also allowed for purpose, time of day and origin and destination of visitors to be discerned. The interview records were expanded to MCC and ATC records at the site entry / exit to provide a full matrix of movements to/from the visitor centre, for both the busy day and neutral time periods.

3.3.11 For trips outside the AoDM (i.e. those unaffected by any of the enhancements to through trips), the SWRTM DF3.0 trip matrices were retained.

Network development

3.3.12 As described in WebTAG Unit M3.1 §2.2.5 the model comprises the Fully Modelled Area (incorporating the Area of Detailed Modelling and the Rest of the Fully Modelled Area) and the External Area. The external network has been coded using buffer link coding, assuming fixed link speeds, with no detailed node coding. Within the Fully

Modelled Area the network has been modelled with a greater level of detail, including detailed junction modelling with blocking back; signal timings; lane coding and saturation flows by turn. Standard saturation flows have been used at all new and reviewed junctions, consistent with the Highways England RTM coding manual. Turn radii (tight, average, wide) have been selected by observing junction dimensions in freely available aerial and 'street view' photography.

3.3.13 Speed flow curves have been applied to the majority of simulation links. The exceptions – as per the RTM coding guidance – are the centre of large urban areas and the buffer network, which have fixed speeds derived from Trafficmaster data.

3.3.14 WebTAG Unit M3.1 §2.9.8 states that "in urban areas within the Fully Modelled Area, the use of fixed cruise speeds is advised in conjunction with junction modelling, rather than using link-based speed/flow relationships". This is due to the fact that delays within these areas are more likely to be caused by interactions at closely spaced at-grade junctions rather than the volume of traffic on links. Speed flow curves have not been coded within the external buffer to avoid potential issues with cost changes in forecasting when costs are passed between the highway assignment model and the VDM.

3.3.15 All speed flow curves used in any refinement activity have been inherited from the RTM coding manual. Some benchmarking of these has been undertaken to determine whether or not those standard rural single carriageway and dual 2 all purpose (D2AP) curves are applicable for the complex issues observed on the A303 past Stonehenge. Figure 3-7 illustrates the modelled network in the AoDM.

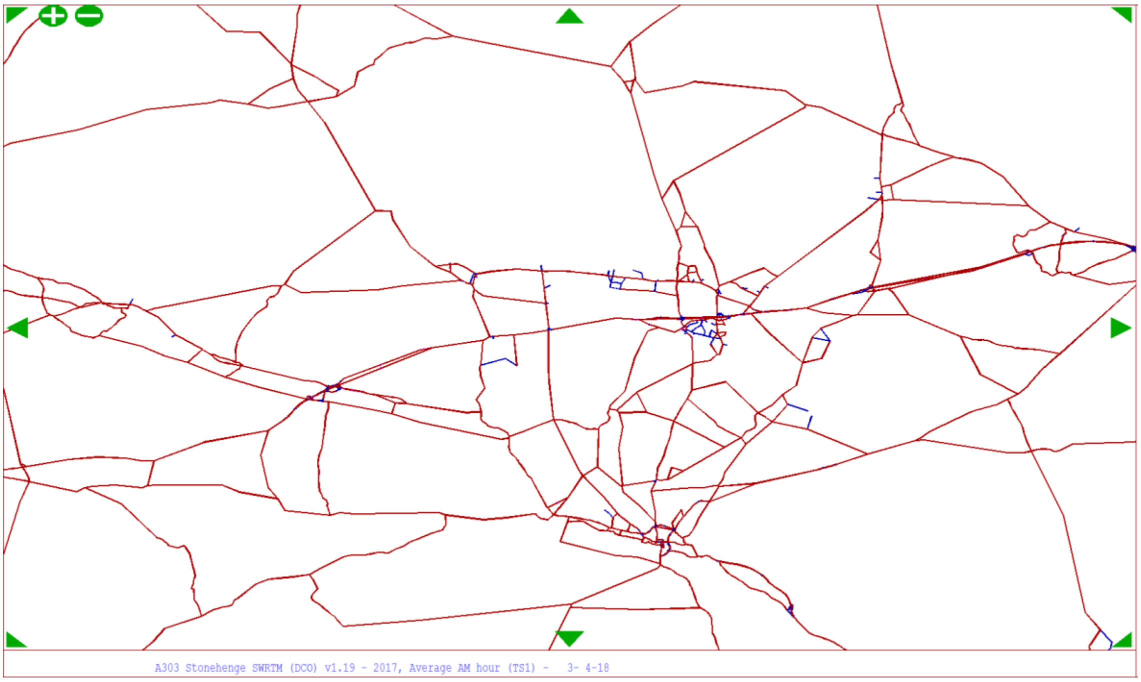


Figure 3-7 Links with speed flow curves applied, Area of Detailed Modelling

Assignment method

3.3.16 The assignment methodology used in the model is a multi-user-class equilibrium assignment. Wardrop's first principle of traffic equilibrium is that all trips will seek to minimise their cost of travel between their origin and destination. A number of different routes will normally be used between zone pairs. This results from differences in the actual location of origin and destination within the zone, differences in the relative values of time and distance between users, and changes in route costs due to congestion.

3.3.17 As the modelled time periods all cover a single average hour over a three (AM and PM) or six hour period (interpeak), there is no requirement to model a pre-peak hour through a proxy assignment. Therefore no passing of queues (a 'PASSQ' assignment) is undertaken.

3.3.18 The busy day model assignment method reflects the relatively complex routeing behaviour that could not be replicated by the 'standard RTM' assignment method retained for the neutral month periods.

a. Firstly, the ANPR analysis demonstrated that some journey times are quicker (under the severe congestion observed on busy days) for drivers that divert from the A303 than those remaining on the A303, a property inconsistent with Wardrop's first principle. Assuming that some drivers have insufficient knowledge of the alternative routes, the approach taken was to segment the 'other' car demand matrices with longer trips preloaded (giving preference to continuing along the A303).
b. Secondly, the traffic queues observed on busy days build up and decline over several hours. Accordingly the 'PASSQ' functionality was used to enable the software to represent a queue building up over a longer period than a single modelled hour.

Generalised costs

3.3.19 Route choice in the assignment model is based on the generalised cost, a combination of travel time, vehicle operating costs and any tolls or charges. Within the highway assignment model, the value of time (VoT) is expressed as the pence per minute (PPM), whilst the vehicle operating cost (VOC) is expressed as the pence per kilometre (PPK).

3.3.20 PPM and PPK values have been provided by Highways England TPG using its internal spreadsheet. This is aligned with the standard formulation given in WebTAG Unit A1.3 and the values and parameters in the WebTAG Databook (using the interim May 2018 WebTAG Databook, prior to official release, as advised by the DfT). The values applied are set out in Table 3-1.

Table 3-1: PPM and PPK values (2010 prices, 2017 values)

Vehicle Type	Purpose	PPM				PPK			
		AM	IP	PM	Busy Day	AM	IP	PM	Busy Day
Car	Business	30.61	31.36	31.05	30.86	12.34	12.34	12.34	12.34
	Commute	20.53	20.86	20.60	20.53	5.87	5.87	5.87	5.87
	Other	14.16	15.08	14.83	14.65	5.87	5.87	5.87	5.87
LGV	Average	21.63	21.63	21.63	21.55	13.51	13.51	13.51	13.51
HGV	Average	21.96	21.96	21.96	21.87	48.07	48.07	48.07	48.06

3.4 Calibration and validation

Calibration and validation approach

3.4.1 The primary focus of the 'A303 Stonehenge SWRTM (DCO)' model calibration and validation exercise focussed on the AoDM, with the aim of ensuring an appropriate representation of trips on the A303 and the local road network in the vicinity of the Scheme. The majority of the data used to calibrate and validate the model in the AoDM was from the surveys undertaken in August and October 2017.

3.4.2 A staged approach to model calibration and validation was undertaken, ensuring that any changes being made by matrix estimation processes were appropriate adjustments for limitations in the prior demand data and not to address other deficiencies in the model. The staged approach therefore ensured calibration and validation of the highway networks first, followed by an assessment of the matrix performance with any subsequent updates made via a process of estimation, and further updates as part of the assignment calibration.

Network calibration and validation

3.4.3 Network calibration was undertaken to ensure that the highway network was suitable for use prior to the assignment of matrices. This was necessary to ensure that any matrix adjustment or estimation was valid and was not the result of compensating for errors or deficiencies in the highway networks.

3.4.4 Network calibration checks are detailed fully in the Transport Model Package (Appendix B to the Combined Modelling and Appraisal Report), but included a review of SATURN errors and warnings in the AoDM; standardised network coding via use of a coding manual and subsequent checks to ensure appropriate implementation; checks of link distances against Ordnance Survey (OS) Integrated Transport Network (ITN) data, where available, or reviewing link distance warnings in SATURN; and checks of free-flow speeds against data available from OpenStreetMap and Google StreetView photography.

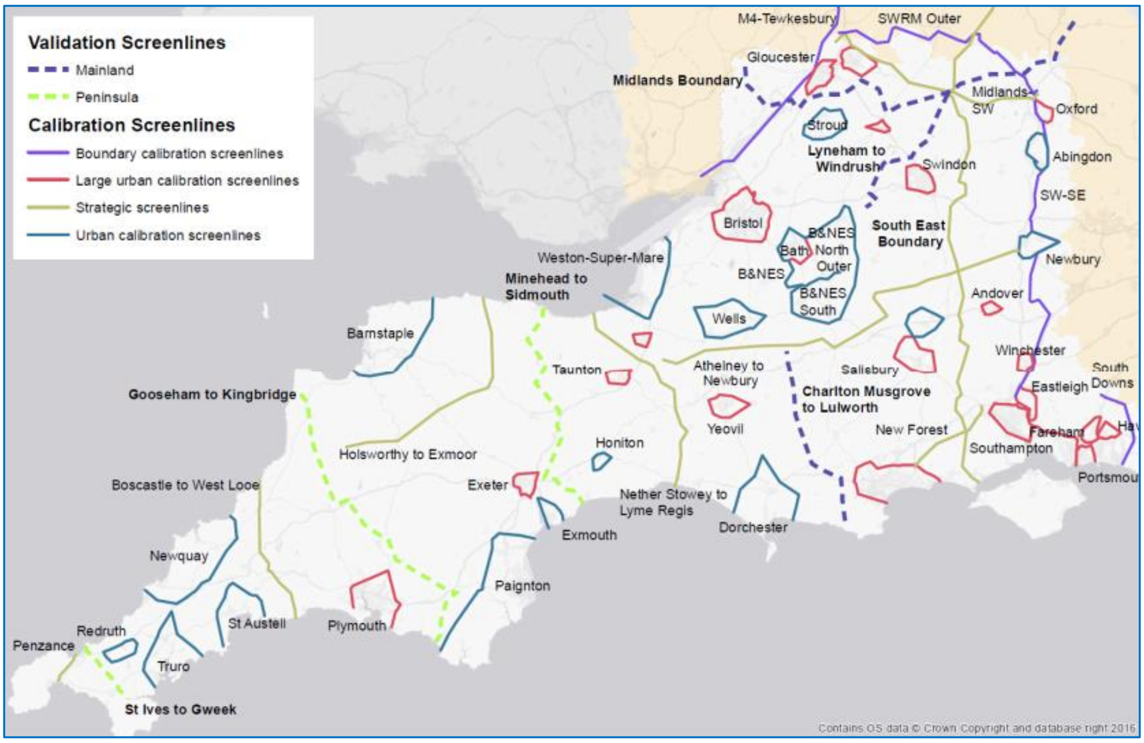
3.4.5 For network validation, a comparison of observed travel times against modelled travel times from an initial prior matrix was undertaken to help validate the network early on. This is in accordance with guidance given in WebTAG.

3.4.6 The initial comparisons identified differences of between -14% and +11% in modelled travel times. Whilst, at the time of the network validation check being undertaken, mean observed times were used for comparison instead of median times, it was felt that these were suitable to provide an area to focus further network review and calibration, by targeting the routes that were slower than the observed times (as medians would, in general, be faster than means). The differences were within the 25% difference cited in WebTAG for warranting further investigation and within the final assignment validation criteria of ±15%, so showing reasonable network validation.

Matrix validation and assignment calibration / validation

3.4.7 A key aim of the assignment calibration exercise however, was to ensure no material change from the SWRTM DF3 model in the RoFMA (the RoF for SWRTM). Therefore, the 52 calibration screenlines and cordons and six validation screenlines and ad-hoc validation counts used in the development of SWRTM DF3 were retained and used in the 'A303 Stonehenge SWRTM (DCO)' model calibration and validation process for the neutral month time periods (as there is no busy day time period for SWRTM DF3, it was not possible to undertake a check of no material change).

3.4.8 Figure 3-8 provides an overview of the retained calibration and validation screenlines, cordons and ad-hoc counts from SWRTM DF3.0 in the ‘A303 Stonehenge SWRTM (DCO)’ model refinement process.



Source: Figure 9, South West Regional Traffic Model: Model Validation Report

Figure 3-8: SWRTM DF3.0 retained calibration and validation screenlines

3.4.9 For the purpose of local area calibration, traffic counts were arranged into five separate screenlines covering the key movements in the AoDM. These screenlines and their definition are consistent in the neutral month and busy day time period models. These form:

a. the ‘North of A303’ screenline (capturing traffic approaching / leaving the A303 to its north side);
b. the ‘South of A303’ screenline (capturing traffic approaching / leaving the A303 to its south side);
c. the ‘East of AoDM’ screenline (capturing traffic on the A303 and parallel routes at the east of the AoDM);
d. the ‘West of AoDM’ screenline (capturing traffic on the A303 and parallel routes at the west of the AoDM); and
e. the ‘West of Amesbury to West of Durrington’ screenline (a short screenline running parallel to the A345 Countess Road, capturing east-west traffic at the mid-point of the AoDM).

3.4.10 Figure 3-9 shows the locations of the screenlines spatially.

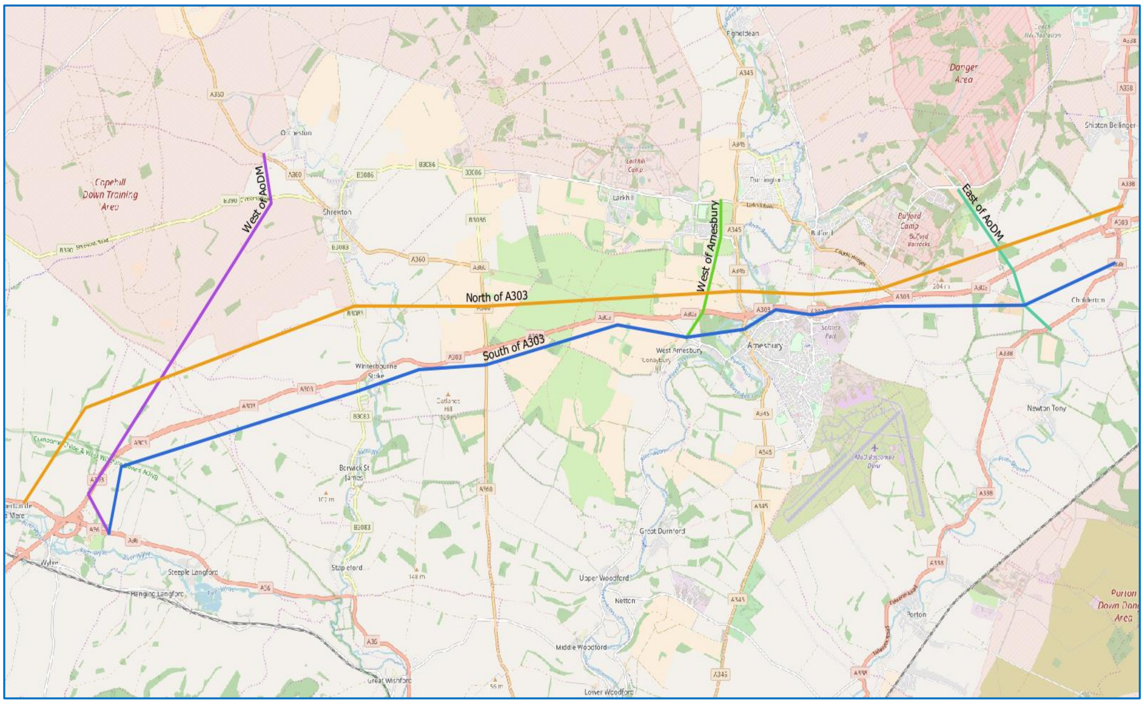


Figure 3-9: AoDM calibration screenlines formed of new data

3.4.11 It should be noted that the 'West of Amesbury to West of Durrington' screenline was only used in the neutral month model calibration. In the busy day time period, the definition of this screenline was altered so this was located to the east of the A345, instead crossing the A3028 between Durrington and Bulford, the A303 between Countess roundabout and Solstice Park and London Road south of the A303.

3.4.12 In addition to the above screenlines, a further 18 new ATCs (9 sites, two directions) were included in the AoDM validation process for the neutral month time periods as 'ad-hoc' sites – i.e. they are unaligned to screenlines. The main purpose of these was to ensure appropriate representation of traffic volumes on key links. The locations of these individual sites are shown spatially in Figure 3-10.

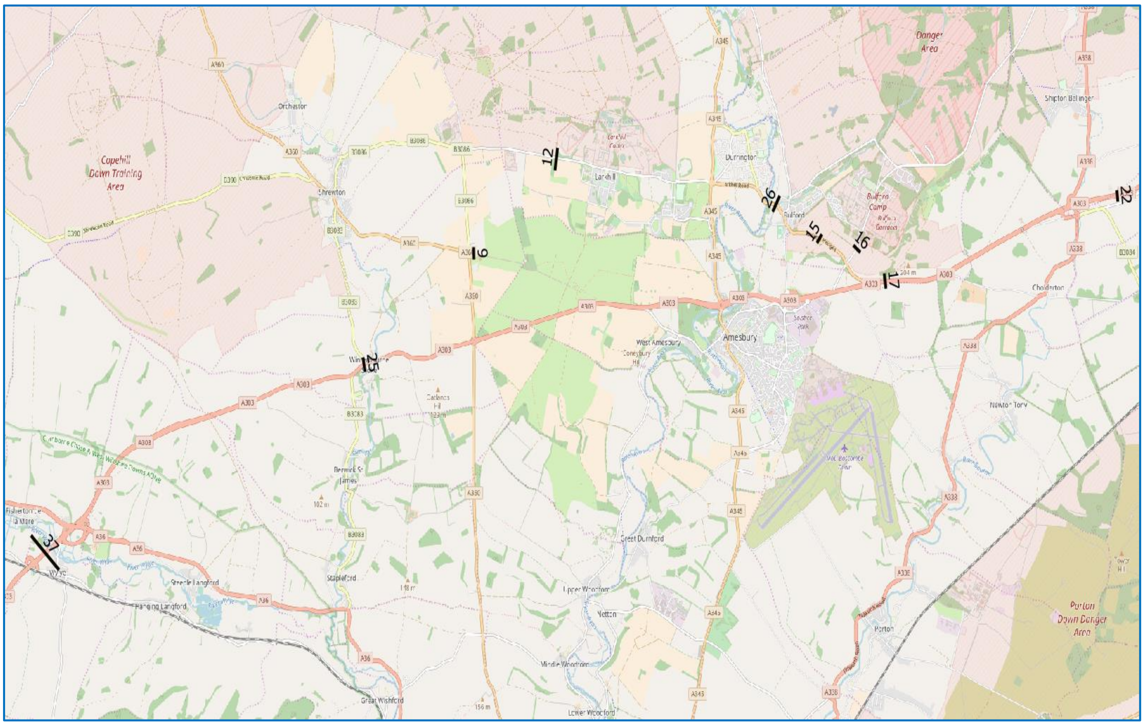


Figure 3-10: Locations of ATC sites used as ad-hoc validation

3.4.13 For the purpose of local area validation, a combination of turning count and link count validation was undertaken. The data used were wholly independent from those used for model calibration or matrix build.

3.4.14 In total, 35 turning count locations were selected for the purposes of wholly independent validation. These comprised 14 junctions on the A303 and 21 junctions on the local road network. These data were collected across both the neutral month time periods and the busy day model time period. These sites have therefore been used as independent turning count validation for all three neutral month model time periods and for the busy day model time period. The locations of the sites selected for independent turning count validation are shown in Figure 3-11.

3.4.15 Further to the turning count validation, independent link validation was undertaken in the neutral month time period models, making use of ATCs from Wiltshire County Council's ongoing survey and monitoring programme.

3.4.16 Following a review of the sites available, data were requested from 15 separate locations for use in the validation of the traffic model. The primary purpose of these sites was to identify locations in the RoFMA, around the edge of the AoDM, where new local count data were not collected but where an understanding of model performance would be necessary to inform air quality and noise appraisal of the Scheme. These data were held completely independent from any matrix build, adjustment or estimation processes and retained for independent validation purposes. These data are therefore used for ad-hoc independent validation purposes. These locations are shown in Figure 3-12.

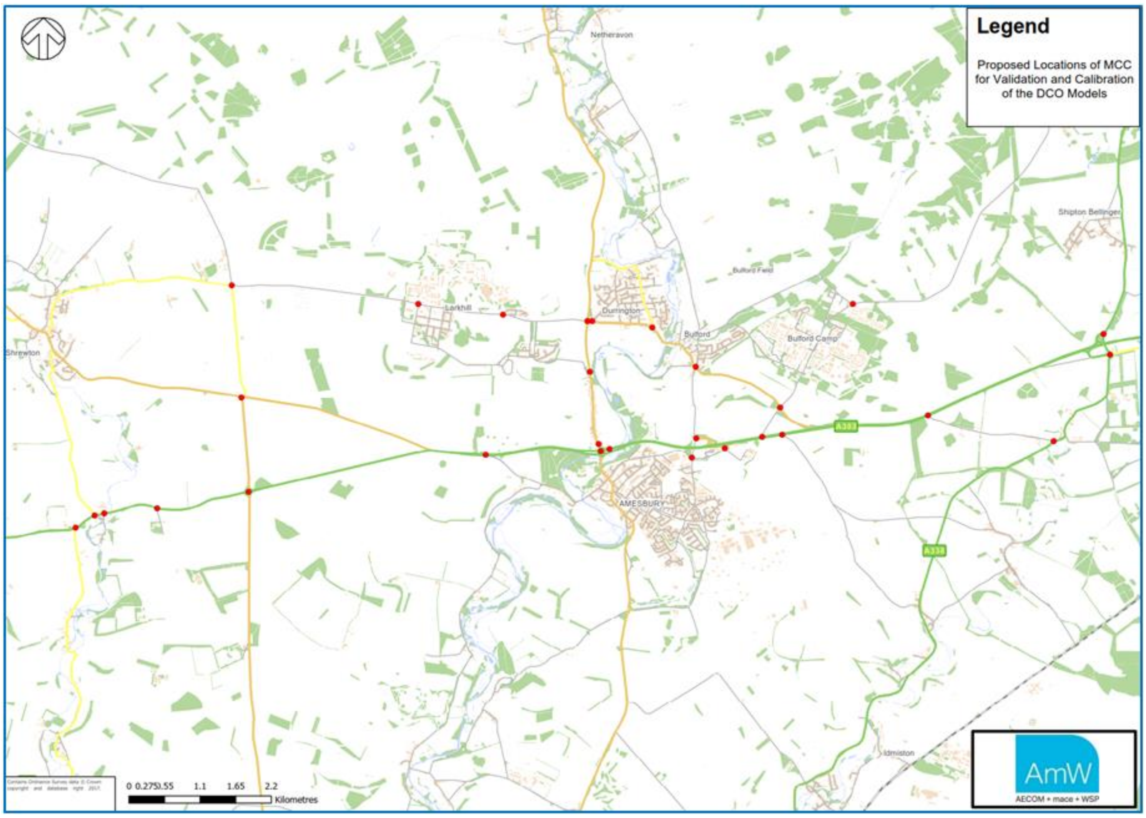


Figure 3-11: Spatial locations of independent turning count validation

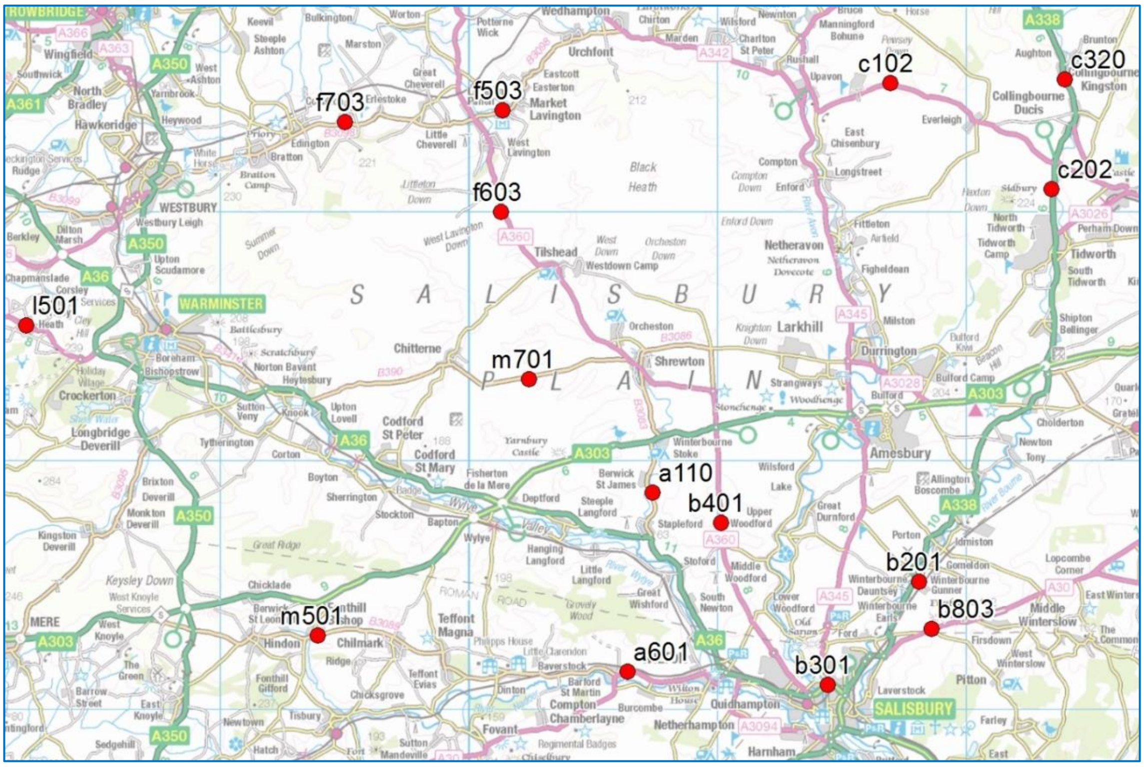


Figure 3-12: Spatial location of ATCs obtained from Wiltshire County Council

3.4.17 The model was also validated to observed travel times throughout the AoDM and across the wider Fully Modelled Area. As with the approach to traffic count data, the existing 104 journey time routes used for validation of the SWRTM DF3.0 (comprising 44 routes on the SRN and 60 routes on the remainder of the road network) were retained to ensure no material change to the wider model. The exception to this was where new data for 2017 were able to be sourced from DfT.

3.4.18 Updated Trafficmaster data were requested and received from DfT for the purpose of validating the modelled travel times through the AoDM and on the parallel / alternative SRN routes (M4 / M5, and M3 / M27 / A31 / A35 (the 'Coast Route')) to the A303. The new Trafficmaster data were collected for validation as a result of the change in model base year to 2017, which meant that the SWRTM observed data from 2014 and 2015 were outdated. The most recent data available from DfT at the time of request covered the period of July 2016 to June 2017. The locations of the routes where updated data have been used are shown in Figure 3-13.

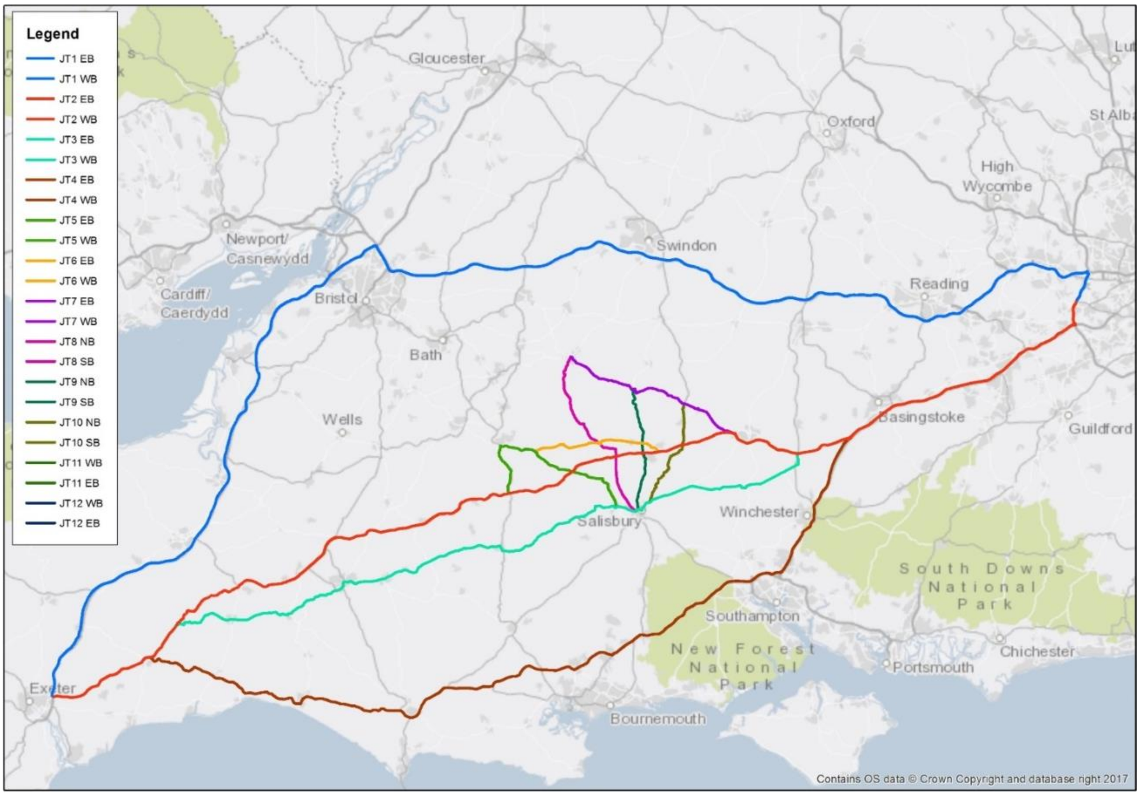


Figure 3-13: Updated journey time data for modelled travel time validation

3.4.19 The data were processed to calculate the median travel times for each of these routes, ensuring consistency with the observed data used for the validation of the standard SWRTM DF3.0 model and also with the definition of average hour time periods, as opposed to peak hours. Routes exceeding 40 minutes in total travel time were split into segments, in accordance with the guidance provided in WebTAG Unit M3.1 §4.4. Owing to the strategic nature of the model, routes are generally in excess of the 15km length noted in the same section of the guidance.

3.4.20 A shortcoming of the new Trafficmaster data provided by DfT is that it did not contain information for the B3083, between the A36 and Shrewton. This is a key north-south route in the AoDM, which crosses the A303 in Winterbourne Stoke and on which traffic is likely to be affected by the provision of a bypass of Winterbourne Stoke as part of the Scheme. Data were not included in Trafficmaster due to the low sample of trips with GPS receivers using this route.

3.4.21 To account for this, a series of moving car observer (MCO) surveys were undertaken to provide data for this route. These involved driving a car along the length of the route between the A36 and Shrewton and recording travel times at key points along the route. The MCO surveys were undertaken on 23 January 2018 and covered the AM, IP and PM periods. No MCO was undertaken for the busy day time period. Four journey time runs were undertaken for each time period. The average of these runs has been compared to commercially available travel time data (Google Maps), which provides similar journey times to the MCOs in all time periods.

Matrix estimation

3.4.22 Matrix estimation was used to refine trip estimates in the 'A303 Stonehenge SWRTM (DCO)' model. SWRTM DF3.0, along with the other RTMs, set a precedent for the use of matrix estimation for the refinement of the mobile phone origin-destination derived trip matrices by this method.

3.4.23 As the starting point of the refined trip matrices for the 'A303 Stonehenge SWRTM (DCO)' model is the same prior matrices as developed for SWRTM DF3.0, with only primarily local area updates with more detailed data, matrix estimation is a requirement for this model. However, matrix estimation was only undertaken following network calibration and validation, and after assessing the performance of the prior trip matrices at a screenline level for the five AoDM screenlines, to ensure that – in accordance with WebTAG Unit M3.1 §8.3 – estimation did not result in significant changes on the underlying observed data.

3.4.24 Assignment of the prior matrices was compared to the WebTAG criterion of 5% variance in total modelled flows compared to total observed flows across a screenline in the AoDM, as well as a relaxed criterion of 10% employed during the development of the RTMs. This comparison was used to determine the quality of the prior matrices and network and to judge the need for estimation. Across all vehicles and for cars in isolation, performance of the three neutral time periods ranged from 30% to 60% of local screenlines meeting the WebTAG criterion, increasing to between 50% and 90% against a 10% measure. Performance for the busy day time period was poorer, reflecting the greater uncertainties in the data and methodology used for the derivation of the matrices.

3.4.25 Performance against the RTM criterion of ±10%, whilst being above 50% (and at 80% and 90% in the interpeak) for total vehicle and total car flows across the screenlines in the neutral month time periods, fell short of the WebTAG acceptability guidelines of 'all or nearly all screenlines'. Thus, the overall fit of the model against observed data in the AoDM, despite refinements made to the prior matrix and appropriate network coding checks and network validation, suggested that matrix estimation was required in the AoDM to make moderate scale adjustments to the demand in order to attain reasonable performance against the WebTAG criteria and acceptability guidelines.

3.4.26 Matrix estimation was undertaken for all four modelled time periods. Estimation was undertaken for cars, LGVs and HGVs separately. As previously noted, all calibration screenline counts and ad-hoc calibration counts defined in SWRTM DF3.0 were used for this process for the neutral month time periods, along with the addition of the five local AoDM calibration screenlines and ad-hoc counts as previously described. In the busy day model, fewer counts were used outside of the AoDM, with reliance on WebTRIS data to cover the SRN only. Counts on screenlines were grouped into combined constraints (or mini-screenlines) in the estimation to prevent undue distortion of trips.

3.4.27 A blending process was employed in all four time periods to further prevent the undue distortion of the base observed data. A blending process was originally derived as part of the development of the RTMs and the same process was used in the development of the neutral month time periods.

3.4.28 Two parallel versions of matrix estimation were undertaken for the neutral month, as follows:

a. unconstrained: whereby only trips to or from ports and airport zones in the model were frozen for all user classes; and

b. constrained: whereby all car trips longer than 20km were also frozen, reflecting the greater confidence in the longer-distance movements derived from mobile phone data.

3.4.29 Work was undertaken in the development of the SWRTM to determine an appropriate ratio from which to 'blend' the results of the unconstrained and constrained estimation runs. This work has not been repeated as part of the 'A303 Stonehenge SWRTM (DCO)' model development and the 60% constrained / 40% unconstrained process that was selected as providing the best balance between optimising model validation and minimising matrix distortion was retained.

3.4.30 Similarly, the busy day model matrix estimation was carried out blending two different versions of the process, as follows:

a. Simple: carried out without preload or PASSQ; and

b. Matrix estimation with preload and PASSQ: whereby the preload and PASSQ were added to the model in order to get better representation of the delay and congestion that has been observed in the AoDM.

3.4.31 The blending process was carried out with 50% of each matrix.

3.4.32 Following matrix estimation, the changes between the prior and post estimation trip matrices were analysed against the significance measures set out in WebTAG Unit M3.1 §8. The analysis showed that across the whole model, trip-end, cell value and trip length changes met the significance measures in all time periods. For just the zones comprising the AoDM, the cell values meet the criteria in all neutral month time periods. The achieved values in the AoDM for trip length and trip-end changes fall just outside of the significance measures in the neutral month time periods, with the largest variances noted in the busy day model.

Screenline performance

3.4.33 The comparison of total modelled flows with total observed flows across screenlines provides an assessment of the trip patterns within the demand matrices. For the 'A303 Stonehenge SWRTM (DCO)' model, the performance has been judged in two-ways: firstly, comparing total screenline performance in the neutral month against that of the unadjusted SWRTM DF3.0 to determine if the refinements to the local area have had any material change on the rest of the model; and secondly, to judge the representation of trip movements within the AoDM. Full detail of the screenline performance is given in the Transport Model Package (Appendix B to the Combined Modelling and Appraisal Report).

3.4.34 Comparing the 'A303 Stonehenge SWRTM (DCO)' model with the SWRTM DF3.0 model, the out-turn matrix validation (percentage of screenlines meeting the WebTAG and RTM criterion for total observed versus modelled flows) is very similar between the two models. There is a slight performance increase (an additional 1% to 2% of screenlines meeting the acceptability criteria) across all calibration and validation screenlines in the 'A303 Stonehenge SWRTM (DCO)' model. Performance is similar across all types of screenline (e.g. urban area cordons, regional boundary screenlines) and at a total level for calibration and validation screenlines. This demonstrates that the local AoDM demand and network refinement, and introduction of additional traffic counts for calibration, has not materially changed the overall performance of the model in the region of focus outside the AoDM.

3.4.35 For the five screenlines in the AoDM, the performance of both the neutral and busy day models may be judged. It should be noted that all five of the AoDM screenlines are used for model calibration. Table 3-2 to Table 3-5 show the model performance.

3.4.36 For the five AoDM screenlines, the AM and PM average hour models show that 90% of screenlines have total vehicle and car flows within 5% of the observed values whilst, for the interpeak, this drops slightly lower, with 80% of total vehicle flows meeting the criteria and 70% of car flows meeting the criteria.

3.4.37 In the AM average hour, the only screenline failing to meet the 5% criterion is the West of AoDM screenline in the eastbound direction, with total vehicle flows exceeding the observed by 5.8%, just outside of the criterion. This same screenline is the cause of the car failure, where modelled car flows exceed the observed by 7.7%. It should be noted that, in both these cases, the absolute difference is 99 and 101 vehicles / cars respectively. The screenline itself comprises just four links which, combined with a low absolute difference and relatively low total flow, shows the slight exceedances are very close to meeting a demanding target.

3.4.38 In the PM average hour, the only screenline failing to meet the 5% criterion is the 'West of Amesbury to West of Durrington' screenline in the eastbound direction, with total vehicle flows 6% lower than observed and car flows 6.3% lower than observed, so just outside of the criterion. This screenline comprises only three links, two of which are low flow routes: The Packway (closed to all but construction traffic in the base year) and Fargo Road. The screenline is heavily dominated by the flow on the A303 to the east of Countess roundabout. The actual shortfall of just 76 vehicles and 66 cars across the screenline is very small and, were the screenline to be judged on the basis of individual link flows, well within the tolerance of the 15% difference that would be applied to the individual A303 link.

3.4.39 In the IP average hour, the two screenlines failing to meet the criterion are the West of AoDM screenline (as per the AM) and the East of AoDM screenline for both total vehicles and cars. In both cases, the screenlines are comprised of four links and the absolute flows are within 110 vehicles (and in three of the four cases, fewer than 100 vehicles/cars) difference from the observed. The relatively low flows result in proportionately larger percentage differences. A third screenline fails to meet the criterion for cars, with the North of A303 screenline southbound having 6.4% too many cars on it – fewer than 100 cars difference from the observed.

3.4.40 Across each of the neutral month time period models, the LGV and HGV screenline totals are generally in excess of 70% compliance across all screenlines, with just PM HGVs falling to 60%. Given the low observed flows, this is a good result, as many of those screenlines where modelled flows do not meet the 5% difference from observed values have very low absolute differences – many of the HGVs that have failed to meet the 5% criterion, have absolute differences of 10 vehicles or fewer.

3.4.41 Overall, the performance of the matrices for the neutral month time periods against the observed data for the local AoDM screenlines is acceptable. Those cases where the criterion has been exceeded are slight, with no percentage differences for total vehicles or cars being more than 9% (and, in most cases, lower than 7%). These are the equivalent of absolute differences of fewer than 100 vehicles in most cases. The local flows crossing these screenlines are therefore considered to be representative of observed values.

3.4.42 In the busy day average hour, all of the screenlines meet the criteria for the total vehicle flow. The car flows fail on the north screenline in the southbound direction with flows being 5.32% higher than observed. With regard to the LGV and HGV flows none of the screenlines pass. The lower modelled flows suggest that the simulation allows more rerouting due to the congestion on the A303, making these vehicles choose another route.

Link flow calibration

3.4.43 The modelled link flow comparisons for sites used in calibration are given in Table 3-6. This compares the results for calibration links between SWRTM DF3.0 and the ‘A303 Stonehenge SWRTM (DCO)’ model neutral month time periods, to allow for an assessment of whether the refinements in the AoDM have materially altered the rest of the model. Model performance is compared against the GEH criterion (i.e. those sites with a GEH of less than 5.0), RTM flow criterion and those meeting either of the two measures.

Table 3-2: Post estimation matrix validation (AoDM screenlines), average AM hour

			Average AM Hour											
Screenline	Direction	No. Sites	Total			Car			LGV			HGV		
			Obs	Mod	%Diff	Obs	Mod	%Diff	Obs	Mod	%Diff	Obs	Mod	%Diff
East of Scheme	EB	4	2,051	2,008	-2.1%	1,539	1,587	3.1%	283	292	3.1%	229	130	-43.2%
East of Scheme	WB	4	1,483	1,463	-1.4%	1,136	1,105	-2.7%	207	233	12.9%	140	124	-11.4%
North of A303	NB	7	2,237	2,218	-0.8%	1,739	1,725	-0.8%	343	343	0.0%	155	151	-2.9%
North of A303	SB	8	2,773	2,864	3.2%	2,157	2,248	4.2%	426	426	-0.2%	190	190	-0.1%
South of A303	NB	11	2,336	2,409	3.1%	1,849	1,920	3.9%	331	330	-0.4%	157	159	1.4%
South of A303	SB	10	2,574	2,622	1.9%	2,081	2,117	1.7%	349	349	-0.1%	144	156	8.4%
West of Amesbury to West of Durringtor	EB	3	1,526	1,506	-1.3%	1,206	1,188	-1.5%	217	211	-3.0%	103	108	4.3%
West of Amesbury to West of Durringtor	WB	4	1,257	1,226	-2.5%	950	916	-3.6%	195	194	-0.7%	111	116	4.5%
West of AoDM	EB	4	1,709	1,808	5.8%	1,310	1,411	7.7%	256	252	-1.5%	143	145	1.2%
West of AoDM	WB	4	1,295	1,274	-1.6%	921	917	-0.4%	226	213	-5.5%	148	143	-3.2%
TOTAL					90%			90%			80%			70%

Table 3-3: Post estimation matrix validation (AoDM screenlines), average IP hour

			Average Interpeak Hour											
Screenline	Direction	No. Sites	Total			Car			LGV			HGV		
			Obs	Mod	%Diff	Obs	Mod	%Diff	Obs	Mod	%Diff	Obs	Mod	%Diff
East of Scheme	EB	4	1,388	1,399	0.8%	1,021	1,038	1.7%	190	220	15.5%	177	141	-20.4%
East of Scheme	WB	4	1,497	1,388	-7.3%	1,152	1,052	-8.7%	216	206	-4.8%	130	131	1.3%
North of A303	NB	7	1,981	1,967	-0.7%	1,503	1,498	-0.3%	298	299	0.4%	180	170	-5.4%
North of A303	SB	8	1,913	2,006	4.8%	1,451	1,543	6.4%	287	287	0.1%	176	175	-0.3%
South of A303	NB	11	1,933	1,974	2.1%	1,505	1,539	2.3%	271	271	0.3%	158	164	3.9%
South of A303	SB	10	1,871	1,937	3.5%	1,464	1,527	4.3%	260	260	-0.1%	148	150	1.8%
West of Amesbury to West of Durringtor	EB	3	1,119	1,119	0.0%	835	835	0.0%	162	164	1.2%	122	120	-1.3%
West of Amesbury to West of Durringtor	WB	4	1,134	1,164	2.6%	859	878	2.2%	164	167	2.2%	112	119	6.4%
West of AoDM	EB	4	1,267	1,341	5.9%	945	1,021	8.1%	176	177	0.7%	146	143	-2.3%
West of AoDM	WB	4	1,355	1,391	2.6%	991	1,039	4.9%	204	195	-4.6%	160	157	-2.3%
TOTAL					80%			70%			90%			70%

Table 3-4: Post estimation matrix validation (AoDM screenlines), average PM hour

Screenline	Direction	No. Sites	Average PM Hour Total Obs	Total Mod	Total %Diff	Car Obs	Car Mod	Car %Diff	LGV Obs	LGV Mod	LGV %Diff	HGV Obs	HGV Mod	HGV %Diff
East of Scheme	EB	4	1,565	1,600	2.3%	1,297	1,344	3.6%	177	176	-1.0%	91	81	-10.4%
East of Scheme	WB	4	2,053	1,971	-4.0%	1,739	1,677	-3.5%	236	216	-8.4%	78	78	-0.2%
North of A303	NB	7	3,104	2,993	-3.6%	2,640	2,537	-3.9%	350	351	0.3%	114	105	-8.5%
North of A303	SB	8	2,641	2,683	1.6%	2,231	2,277	2.0%	300	299	-0.1%	110	106	-3.0%
South of A303	NB	11	2,822	2,874	1.8%	2,442	2,495	2.2%	289	287	-0.7%	92	92	0.5%
South of A303	SB	10	2,548	2,631	3.3%	2,183	2,266	3.8%	279	278	-0.4%	86	87	1.6%
West of Amesbury to West of Durringtor	EB	3	1,261	1,185	-6.0%	1,051	985	-6.3%	145	134	-7.5%	65	66	1.7%
West of Amesbury to West of Durringtor	WB	4	1,448	1,473	1.7%	1,224	1,232	0.7%	165	172	4.2%	59	69	16.6%
West of AoDM	EB	4	1,285	1,314	2.2%	1,051	1,086	3.3%	153	148	-3.5%	81	81	-0.9%
West of AoDM	WB	4	1,771	1,752	-1.1%	1,436	1,458	1.5%	234	203	-13.2%	101	91	-10.0%
TOTAL					90%			90%			70%			60%

Table 3-5: Post estimation matrix validation (AoDM screenlines), average busy day hour

Screenline	Direction	No. Sites	Average Summer Hour Total Obs	Total Mod	Total %Diff	Car Obs	Car Mod	Car %Diff	LGV Obs	LGV Mod	LGV %Diff	HGV Obs	HGV Mod	HGV %Diff
East of Scheme	EB	4	1,773	1,764	-0.52%	1,617	1,673	3.49%	114	58	-49.18%	42	33	-22.10%
East of Scheme	WB	4	1,706	1,651	-3.21%	1,562	1,571	0.57%	100	50	-50.26%	43	30	-30.58%
North of A303	NB	7	2,288	2,268	-0.88%	2,136	2,180	2.06%	120	53	-56.08%	31	35	11.31%
North of A303	SB	8	2,270	2,339	3.02%	2,112	2,225	5.32%	123	69	-43.31%	35	45	26.47%
South of A303	NB	11	2,136	2,085	-2.37%	1,987	1,986	-0.03%	110	69	-37.20%	39	30	-22.58%
South of A303	SB	10	2,511	2,478	-1.31%	2,296	2,304	0.35%	140	106	-24.27%	74	68	-9.25%
East of A345	EB	3	1,885	1,801	-4.45%	1,742	1,733	-0.52%	107	36	-66.79%	36	33	-9.02%
East of A345	WB	3	1837	1799	-2.07%	1700	1714	0.83%	103	44	-57.54%	34	41	20.67%
West of B3083	EB	4	1760	1762	0.11%	1607	1660	3.28%	111	73	-33.77%	42	28	-31.90%
West of B3083	WB	4	1764	1791	1.51%	1609	1679	4.38%	113	80	-28.86%	42	31	-26.40%
TOTAL					100%			90%			0%			0%

Table 3-6: Comparison of link flow calibration: SWRTM vs 'A303 Stonehenge SWRTM (DCO)' model

Link classification	Time Period	GEH <5.0		Flow criterion		GEH or Flow criterion	
		SWRTM	A303	SWRTM	A303	SWRTM	A303
Calibration	AM	59.0%	61.4%	90.0%	90.6%	90.6%	91.1%
	IP	64.5%	65.7%	95.4%	94.8%	95.5%	94.9%
	PM	59.5%	62.1%	91.4%	91.3%	91.5%	91.5%

3.4.44 The 'A303 Stonehenge SWRTM (DCO)' model shows slight increases in the total number of calibration links meeting the GEH criterion with between a 1% and 2.5% increase in links meeting the criterion in all time periods. The very similar results between the two models demonstrate that the 'A303 Stonehenge SWRTM (DCO)' model local area refinements have not materially changed the performance of the rest of the model across the Fully Modelled Area.

3.4.45 The link flow calibration has subsequently been examined to demonstrate the performance of the model in the AoDM, in the vicinity of the Scheme. Calibration counts exist on calibration screenlines for all modelled time periods, with separate ad-hoc counts from the October survey period and ad-hoc counts from WebTRIS additionally used in the calibration of the three neutral month time periods. Table 3-7 and Table 3-8 show the validation for the neutral month time periods and the busy day time period respectively.

3.4.46 The performance of link calibration counts within the AoDM for the neutral month is in excess of the WebTAG acceptability guidance in all time periods, with total vehicles meeting the flow criteria of 91% (AM), 94% (IP) and 88% (PM), and with car performance against the same criteria of 89% (AM), 99% (IP) and 89% (PM).

3.4.47 Across the screenline counts, the individual link performance of counts forming those screenlines is in excess of 86% in all cases for total vehicles and cars, with the majority in excess of 90%.

3.4.48 Against the ad-hoc counts, performance against the October 2017 surveys is better than against WebTRIS (albeit only eight ad-hoc counts from WebTRIS data are used, meaning that seven sites must meet the criteria to achieve the 85% acceptability guidance).

3.4.49 Individual link count performance is best in the interpeak and worst in the PM, although noting each time period exceeds the 85% acceptability guidance on screenlines and at an overall level.

3.4.50 For the busy day period, individual link performance is 95% for the total flow and 93% taking into account only the car flows. Both cases are above the 85% acceptability guidance.

3.4.51 The results demonstrate that calibration is good within the AoDM, meeting and exceeding the acceptability guidelines previously specified.

Table 3-7: Summary of link calibration performance in AoDM, by link type (neutral month time periods)

			Average AM Hour						Average Interpeak Hour						Average PM Hour					
Location	Direction	No. Sites	Total			Car			Total			Car			Total			Car		
			GEH	Flow	Either	GEH	Flow	Either	GEH	Flow	Either	GEH	Flow	Either	GEH	Flow	Either	GEH	Flow	Either
East of Scheme	EB	4	2	3	3	1	2	2	4	4	4	3	4	4	3	4	4	3	3	4
East of Scheme	WB	4	4	4	4	3	4	4	3	4	4	3	4	4	2	3	3	2	4	4
North of A303	NB	7	7	7	7	7	7	7	7	7	7	7	7	7	6	6	6	6	6	6
North of A303	SB	8	8	8	8	8	8	8	6	7	7	6	8	8	6	6	6	6	6	6
South of A303	NB	11	9	11	11	10	10	10	11	11	11	10	11	11	10	11	11	10	11	11
South of A303	SB	10	8	9	9	8	9	9	9	9	9	9	10	10	9	9	9	9	9	9
West of Amesbury to West of Durringtor	EB	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3
West of Amesbury to West of Durringtor	WB	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
West of AoDM	EB	4	1	1	1	1	1	1	3	3	3	2	4	4	3	3	3	2	3	3
West of AoDM	WB	4	3	4	4	3	3	3	4	4	4	3	4	4	4	4	4	3	4	4
Screenline Link Summary					**92%**			**86%**			**95%**			**100%**			**90%**			**92%**
Ad-hoc calibration links (TRACSIS)	Various	21	19	18	19	19	20	20	17	19	19	17	20	20	16	16	17	14	16	16
Ad-hoc calibration links (TRACSIS)					**90%**			**95%**			**90%**			**95%**			**81%**			**76%**
Ad-hoc calibration links (WebTRIS)	Various	8	6	6	6	6	6	6	6	6	6	6	5	6	5	5	5	5	5	5
Ad-hoc calibration links (WebTRIS)					**75%**			**75%**			**75%**			**75%**			**63%**			**63%**
TOTAL	Various	80	67	72	73	67	71	71	70	75	75	67	79	79	66	69	70	62	69	70
TOTAL (AoDM)					**91%**			**89%**			**94%**			**99%**			**88%**			**88%**

Table 3-8: Summary of link calibration performance in AoDM, by link type (busy day period)

			Average Summer Hour			Average Summer Hour		
Location	Direction	No. Sites	Total			Car		
			GEH	Flow	Either	GEH	Flow	Either
East of the Scheme	EB	4	3	4	4	3	4	4
East of the Scheme	WB	4	3	4	4	3	4	4
North of A303 Stonehenge	NB	7	6	7	7	6	7	7
North of A303 Stonehenge	SB	8	7	6	8	6	7	7
South of A303 Stonehenge	NB	11	9	11	11	9	11	11
South of A303 Stonehenge	SB	10	8	10	10	9	10	10
East of A345	EB	3	1	1	1	1	1	1
East of A345	WB	3	1	2	2	1	2	2
West of B3083	EB	4	3	4	4	3	4	4
West of B3083	WB	4	4	4	4	4	4	4
Screenline Link Summary					**95%**			**93%**
TOTAL (AoDM)					**95%**			**93%**

Link flow validation

3.4.52 As with the link flow calibration, the individual link flows that are wholly independent and used for validation have first been compared with those from the standard SWRTM DF3.0 model. Table 3-9 shows the percentage of link counts meeting the WebTAG link flow criteria.

Table 3-9: Comparison of link flow validation: SWRTM vs 'A303 Stonehenge SWRTM (DCO)' model

Link classification	Time Period	GEH <5.0		Flow criterion		GEH or Flow criterion	
		SWRTM	A303	SWRTM	A303	SWRTM	A303
Validation	AM	60.2%	65.3%	85.7%	84.2%	86.6%	84.4%
	IP	65.8%	60.1%	87.9%	78.2%	89.2%	78.8%
	PM	57.6%	59.0%	81.0%	76.5%	81.4%	77.5%
Total (Cal + Val)	AM	59.2%	62.5%	89.3%	88.7%	89.9%	89.2%
	IP	64.7%	64.1%	94.1%	90.0%	94.4%	90.2%
	PM	59.2%	61.2%	89.6%	87.0%	89.7%	87.5%

3.4.53 The models show similar performance in terms of independent validation links in the AM average hour, with a small reduction in the interpeak and average PM hours. Considering all link counts, calibration and validation, the two models show very similar values, with the 'A303 Stonehenge SWRTM (DCO)' model exceeding the 85% acceptability guideline. Overall, the results suggest no significant change in the rest of the Fully Modelled Area as a result of the AoDM refinements.

3.4.54 Further to this, independent link validation has been undertaken at 145 separate locations throughout the AoDM for the neutral month time periods. These comprise counts on the local road network from the 2017 surveys, counts at the edges of the AoDM and within the AoDM as provided by Wiltshire County Council, and a small number of WebTRIS counts on the SRN.

3.4.55 Table 3-10 presents the summary results of the link validation for the neutral month time periods. These show that, for all time periods, overall validation either meets or exceeds the acceptability guideline of 85% of sites meeting either GEH or flow criterion measures as set out in WebTAG Unit M3.1.

3.4.56 The results show that performance is similar across all time periods for modelled flows compared against the Wiltshire monitoring sites on the edges of the AoDM, with all sites exceeding 90% compliance against either of the link flow validation measures.

3.4.57 For the October 2017 surveys within the AoDM, performance is also very good, with both total vehicles and cars in the AM and IP meeting either of the link flow validation criteria in more than 89% of cases. Only the PM total vehicle comparison does not meet the 85% acceptability guideline, with 82% of the October 2017 survey sites meeting the criteria – this is still considered a good result.

3.4.58 The overall link validation of the neutral month time period models in the AoDM is strong and demonstrates that modelled link flows are representative of observed values.

Table 3-10: Independent link validation (neutral month time periods), AoDM

Location / Source	Direction	No. Sites	Average AM Hour						Average Interpeak Hour						Average PM Hour					
			Total			Car			Total			Car			Total			Car		
			GEH	Flow	Either	GEH	Flow	Either	GEH	Flow	Either	GEH	Flow	Either	GEH	Flow	Either	GEH	Flow	Either
Wiltshire monitoring sites	Various	29	25	26	27	23	28	28	28	29	29	28	29	29	24	27	27	22	27	27
Wiltshire monitoring sites (independent)					**93%**			**97%**			**100%**			**100%**			**93%**			**93%**
Ad-hoc validation links (TRACSIS)	Various	114	88	99	101	85	103	103	87	104	104	91	110	110	79	93	94	82	98	99
Ad-hoc validation links					**89%**			**90%**			**91%**			**96%**			**82%**			**87%**
Ad-hoc validation links (WebTRIS)	Various	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Ad-hoc validation links (WebTRIS)					**100%**			**100%**			**100%**			**100%**			**100%**			**100%**
TOTAL	Various	145	115	127	130	110	133	133	117	135	135	121	141	141	105	122	123	106	127	128
TOTAL (AoDM)					**90%**			**92%**			**93%**			**97%**			**85%**			**88%**

Turning count validation

3.4.59 Independent turning count validation was undertaken at 35 locations in the AoDM, covering all movements at 14 junctions on the A303 and 21 junctions on the local road network. Turning count validation was undertaken for the three neutral time periods and the busy day time period.

3.4.60 Turning count validation was measured against both the WebTAG flow criterion and the GEH criterion. The percentage of each of the possible turning movements across the 35 junctions that meet these criteria was calculated.

3.4.61 For the neutral month time periods, turning movements used for independent validation meet either the GEH and flow criterion acceptability guidance (85% of movements) for all vehicle types and for total vehicles. In all cases, the performance of the SRN junctions exceeds that of the local junctions, showing that the turning movements along the A303 corridor between the A338 and the A36 are generally well represented.

3.4.62 For the busy day model, the results generally show a good level of model performance, with 89% of total turning flows passing one or other validation criteria. Validation of turning movements at the A303 junctions is good, with 87% of total vehicle flows passing one or other criteria (or 86% for car only flows).

3.4.63 Table 3-11 shows a summary of the turning count validation performance by model time period.

Table 3-11: Turning count validation summary

Time Period	Vehicle Type	GEH <5			Flow criterion			Either		
		Total	A303 Jct	Local Jct	Total	A303 Jct	Local Jct	Total	A303 Jct	Local Jct
AM	Car	88%	92%	87%	99%	100%	98%	99%	100%	92%
	LGV	100%	100%	99%						
	HGV	99%	100%	99%						
	TOTAL	87%	91%	86%	98%	100%	97%	98%	100%	91%
IP	Car	91%	97%	89%	100%	100%	99%	100%	100%	99%
	LGV	100%	99%	100%						
	HGV	99%	99%	99%						
	TOTAL	90%	97%	87%	99%	100%	98%	98%	100%	98%
PM	Car	87%	95%	82%	97%	100%	95%	97%	100%	95%
	LGV	100%	100%	99%						
	HGV	100%	100%	99%						
	TOTAL	83%	94%	78%	96%	99%	95%	97%	100%	95%
Busy Day	Car	89%	86%	90%	72%	76%	69%	89%	86%	90%
	LGV	99%	97%	100%						
	HGV	85%	76%	91%						
	TOTAL	72%	78%	68%	89%	86%	90%	89%	87%	90%

Journey time validation

3.4.64 As with the count data, modelled journey times in the neutral month time periods have been compared with SWRTM DF3.0 to ensure no detriment to the rest of the model as a result of the updates to networks and demand in and through the AoDM.

3.4.65 The percentage of routes meeting the validation criteria are given below. The criteria defined as ‘near’ is a RTM measure, where travel times exceed the 15% difference stated in WebTAG, but are within 25% of observed times. As the comparison demonstrates, journey time validation between SWRTM DF3.0 and the ‘A303 Stonehenge SWRTM (DCO)’ model across the Fully Modelled Area is almost identical, with differences of – at most – 1% noted.

Table 3-12: Comparison of journey time validation performance

Time Period	Journey Time Element	SWRTM DF3.0			A303 Stonehenge (DCO)		
		Pass	Near	Fail	Pass	Near	Fail
AM average hour	Full Routes	93%	7%	0%	94%	6%	0%
	Groups	81%	11%	8%	82%	11%	7%
IP average hour	Full Routes	97%	3%	0%	97%	3%	0%
	Groups	86%	10%	4%	87%	9%	4%
PM average hour	Full Routes	97%	2%	1%	97%	2%	1%
	Groups	82%	10%	8%	82%	9%	8%

Note: Figures may not sum to 100% in all cases due to rounding

3.4.66 The similarity of these results suggests that the impact of the local area refinement has not materially changed the representation of travel times throughout the Fully Modelled Area.

3.4.67 Within and through the AoDM and for key alternative routes to the A303, journey time validation against the 2017 Trafficmaster data has been undertaken for all three neutral month time periods and for the busy day time period. As previously noted in the neutral month time periods, an additional route – Route 13 – representing the B3083 is shown in the comparisons; this route was derived from MCO surveys due to a lack of Trafficmaster data for the route.

3.4.68 Detailed validation statistics by route are presented in the Transport Model Package (Appendix B to the Combined Modelling and Appraisal Report). A summary of the model validation to observed travel times by route and segment is given in Table 3-13.

Table 3-13: Summary of route and segment validation

Journey Time Element	AM	IP	PM	Summer 10:00-19:00
No. Routes	24	24	24	23
No. Routes <15%	24	24	23	23
% Route validation	100%	100%	96%	100%
No. Segments	68	68	68	67
No. Segments <15%	67	67	61	65

% Segment validation	99%	99%	90%	97%

3.4.69 The journey time validation exceeds the WebTAG criterion of 15% in almost all cases, exceeding the 85% acceptability guideline suggested.

3.4.70 In the AM, IP and busy day time periods all journey time routes have modelled times within 15% of observed. In the PM only one route – Route 1 (London to Exeter via the M4 / M5), eastbound – fails to meet the criteria and just exceeds the 15% criteria. This is due to the segment between the M25 Junction 13 and the M4 Junction 13 (Chieveley, A34) being too slow – the majority of which is outside of the RoF for SWRTM and is in the external buffer network. The segments within the simulation network tend to perform within the 15% criterion.

3.4.71 In all time periods, the only segments which fail to meet the criterion are those on the longer London to Exeter routes that are located in the buffer network. The exception to this is in the AM, where Route 1 (London to Exeter via the M4 / M5) segment 2 (M4 Junction 13, Chieveley to M4 Junction 18, Bath) is just outside the criterion, with modelled times too slow by 15.6%.

3.4.72 Focussing on the A303, the neutral month time periods are all slightly too slow compared to the median observed times, with segments on Route 11 (A303 between A34 and Podimore roundabout) being slower than observed times by between 5% and 11%. In the summer, the same route has modelled times that are quicker than observed in the westbound direction by 4% and slower in the eastbound direction by 5%. Compared to the mean travel times on this route (which are not used for formal validation), the modelled travel times in the neutral time periods are within 2% of observed.

3.4.73 Overall, the model represents observed travel times in the AoDM and on key strategic corridors of importance to the A303 Amesbury to Berwick Down scheme well and thus provides a sound base from which to assess the travel time related impacts of the Scheme.

Statement of convergence

3.4.74 For the 'A303 Stonehenge SWRTM (DCO)' model, convergence stopping criteria have been adopted in-line with WebTAG guidance and the original SWRTM DF3.0 development, both for proximity and stability. The following stopping criteria have been adopted (SATURN parameters are given in brackets):

a. Proximity: A %GAP value of 0.025% (STPGAP), well within the 0.1% recommended by WebTAG Unit M3.1 §3.3. This must be achieved over four successive iterations (NISTOP).

b. Stability: 98% of links (RSTOP) demonstrating a change in assigned flows of less than 1% (PCNEAR) over four successive iterations (NISTOP).

3.4.75 The convergence criteria have been achieved in all modelled time periods and within a reasonable number of assignment loops (fewer than 40 in all time periods) and run-times. The models are suitably converged for the purposes of preparing model forecasts.

AoDM flow summary

3.4.76 Modelled AADT flows are provided in Figure 3-14. Sections 4.2.12 to 4.2.13 summarise how model time period flows are converted to AADT volumes.

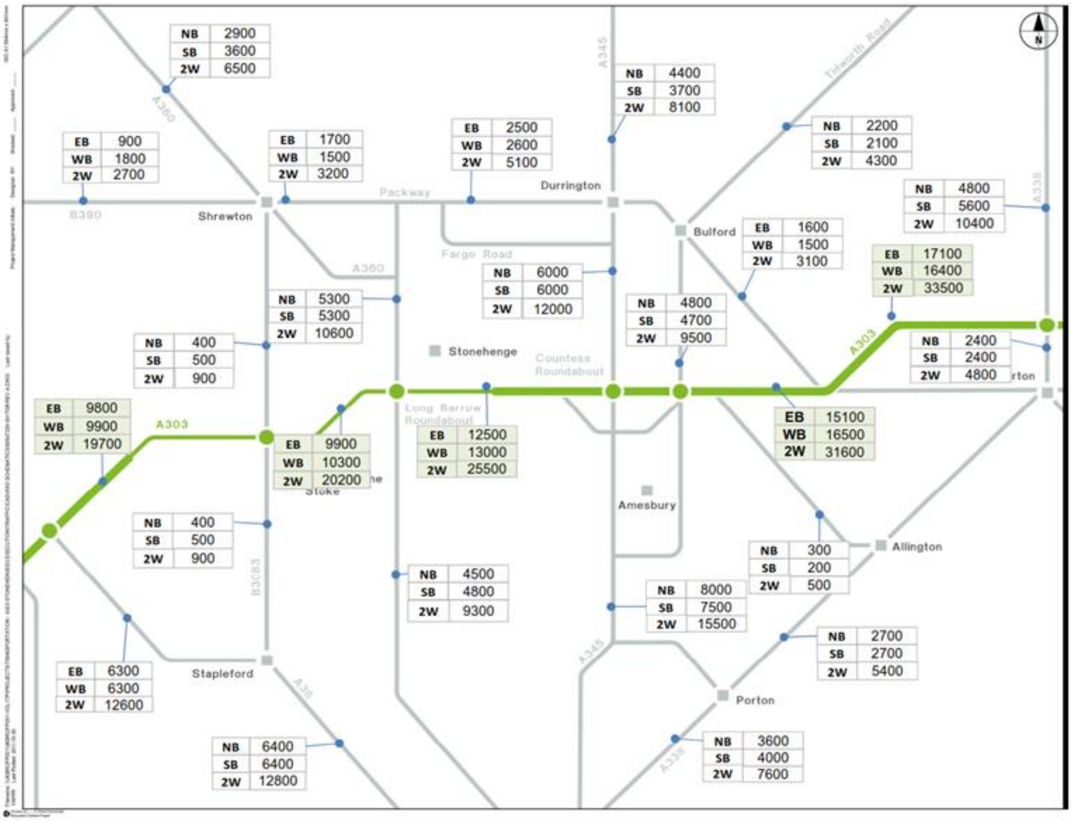


Figure 3-14: Modelled annual average daily traffic, base 2017

4 Forecasting

4.1 Introduction

4.1.1 This section of the report summarises the forecasting assumptions and traffic forecasts.

4.2 Assumptions

Process

4.2.1 The development of forecasts follows a process which is summarised as:

a. develop a reference demand for travel reflecting forecast changes to land use and demographics;

b. develop a representation of the without-scheme highway network and rail costs;

c. apply the reference demand to the without-scheme highway network within the demand model;

d. allow the demand model to reach a stable estimate for demand of travel for each modelled period and within a day, referred to as the core demand, taking account of costs of highway travel and rail travel;

e. develop a representation of the with-scheme network; and

f. apply the reference demand to the with-scheme networks in the demand model to reach a stable forecast of demand for highway travel for each modelled period and within a day.

4.2.2 An uncertainty log was developed to define forecasting assumptions and inform the trip generation, in line with WebTAG Unit M4 Appendix A. A list of planning permissions was collated for all developments within the county of Wiltshire and the Test Valley district within Hampshire. Development sites were allocated to certain forecast years based on the proposed build out rate and completion date identified in the uncertainty log.

4.2.3 NTEM is a national database which considers changes in population and employment at Local Authority level and changes to economic factors such as household incomes at the national level. Growth forecasts for cars have been calculated using the TEMPro 7.2 software and NTEM 7.2 dataset. Growth forecasts have been calculated for 2026, 2031, 2041 and 2051 for the following geographical areas:

a. Test Valley & Wiltshire at district level (i.e. Wiltshire 001, 002 etc.) using alternative assumptions based on information captured in the uncertainty log;

b. SW & SE at county level (i.e. Winchester, Southampton etc.); and

c. everything else at regional level (i.e. East Midlands, Wales etc.).

4.2.4 WebTAG Unit M4 defines reference forecasts as an intermediate step to producing the without-scheme and with-scheme forecasts. It uses the growth in trip ends over the forecasting period (which are constrained to NTEM 7.2 growth using the TEMPro software at a suitable level of spatial detail), but does not take into account changes in cost. Alternative assumptions were applied to the NTEM v7.2 growth forecasts using the TEMPRO software, based on the household and job growth expected from the proposed development information listed in the uncertainty log. Growth rates for Middle Layer Super Output Areas (MSOAs) within Wiltshire and Test Valley were adjusted accordingly and constrained at a district level.

4.2.5 The reference demand additionally includes trips from the Army Basing Programme (ABP) for Salisbury Plain. The Single Living Accommodation (SLA) developments on existing Ministry of Defence (MoD) land are not represented in the standard TEMPro forecasting process so SLA trip generation has been calculated and included in the forecast demand.

4.2.6 The reference demand assumes that travel costs remain the same over time, so is only considered to be the starting point before travel costs start to influence travel decisions. It is assumed that costs only influence demand for person related travel; growth in freight trips are based on the National Transport Model Road Traffic Forecasts 2015.

4.2.7 The variable demand model (VDM) applies changes in travel generalised cost to forecast changes in travel behaviour. The responses modelled include macro time period choice, mode choice and destination choice.

4.2.8 The future demand for the busy day model was derived by applying growth factors derived from the neutral month interpeak models.

4.2.9 To develop the without-scheme networks, the uncertainty log was used to identify schemes which are likely to be in place by each forecast year.

Forecast years

4.2.10 Traffic forecasts have been developed for the following years and each model period:

a. 2026 which has been taken as the opening year of the Scheme;

b. 2031 which provides an estimate of the scheme impact relatively soon after opening;

c. 2041 which provides an estimate of the scheme impact 15 years after opening; and

d. 2051 which is the year furthest in the future for which national travel demand projections are available.

Forecast scenarios

4.2.11 Traffic forecasts have been developed for scenarios with and without the A303 Amesbury to Berwick Down scheme implemented.

4.2.12 As well as the core growth scenario a number of sensitivity tests have been developed to examine the impact of different growth assumptions and different development assumptions on the 'A303 Stonehenge SWRTM (DCO)' model.

4.2.13 The high and low growth scenarios modify the reference case demand in each year by a standard factor following WebTAG guidance. The purpose of these tests is to demonstrate whether the Scheme is resilient to lower or higher overall demand. The high growth test is also used to examine whether the infrastructure is resilient to dealing with greater volumes of traffic. A scenario has also been developed which includes potential development at Boscombe Down. The purpose of the scenario is to test the resilience of the Scheme to a substantial increase in employment adjacent to it.

4.2.14 A sensitivity test was undertaken following updates to WebTAG and emerging DfT advice on freight growth.

4.2.15 Forecasts have also been developed to consider construction impacts.

Table 4-1: Summary of forecast scenarios

Scenario		Modelled Years	Demand	Supply
1.	Core	2026, 2031, 2041, 2051	Near certain and more than likely developments. Constrained to TEMPRO, plus army rebasing	Near certain and more than likely infrastructure schemes.
2.	High growth		Proportion of base year demand added to demand in the core scenario.	As core scenario
3.	Low growth		Proportion of base year demand subtracted from demand in the core scenario.	As core scenario
4.	Alternative growth		As core scenario plus Boscombe Down.	As core scenario, plus access for Boscombe Down
5.	Sensitivity		As core scenario	As core scenario
6.	Construction	2022, 2024	As 2026 plus construction traffic.	Main traffic management phases: 2022: before Winterbourne Stoke bypass is part-opened 2024 subsequent period to complete tunnel construction

Scheme assumptions

4.2.16 The Scheme is a dual carriageway tied in with the existing A303 dual carriageway at Berwick Down, west of Winterbourne Stoke. A diagram showing an overview of the Scheme is shown in Figure 1-1.

4.2.17 The following assumptions, presented from west to east along the A303 mainline, with a final sub-section providing information related to any scheme works off of the A303, have been made:

Winterbourne Stoke bypass

a. The A303 mainline will pass over the B3083.

b. It is understood that the B3083 underbridge is being constructed offline, to allow for the B3083 to remain open during construction works.

c. The realigned B3083 will be 5.5 metres wide as it passes under the new A303.

Longbarrow interchange

d. The overbridge between the two dumb-bell roundabouts will be dual carriageway with two lanes in each direction for the A360, separated by a central reservation.

e. Both of the dumb-bell roundabouts will feature two circulatory lanes.

f. All of the on- and off-slips to / from the A303 mainline will be single lane. These will flare to two lanes at the roundabout stoplines. Flare lengths will be determined to accommodate forecast traffic volumes.

g. The current assumption is that there will be no signal control at Longbarrow junction during day time hours. However, it is understood that, due to issues surrounding lighting in the vicinity of the World Heritage Site, the junction will be unlit and therefore will require traffic signal operation at night. As the traffic modelling is for neutral and busy days between 07:00 and 19:00, it is assumed that the junction will not be under signal operation in these periods.

h. The arrangement and location of Longbarrow junction is based on the planned 3.3 kilometre long tunnel.

Stonehenge tunnel

i. The tunnel will be dual carriageway throughout.

j. The tunnel is 3.3 kilometres long (as above).

Countess roundabout

k. Stonehenge Road will be closed for public traffic as part of the Scheme.

l. Single lane slip-roads (both on- and off-slips) are to be assumed, flaring to two lanes at the roundabout stoplines. Flare lengths will be designed to accommodate the forecast traffic volumes.

m. The circulatory is assumed to be three lanes.

n. The A303 flyover will be dual-carriageway (i.e. two lanes).

o. The current scheme assumption is that the gyratory will be signalised. This is due to the need to provide pedestrian crossings on east-facing slips, so signalising the whole gyratory is required to ensure the gyratory is not blocked when the pedestrian crossings are called.

Eastern end of the Scheme

p. The route will tie-in to the east of the River Avon.

q. The existing A303 mainline beyond this point will be retained as is.

Solstice Park junction

r. It is assumed that there are no changes to Solstice Park junction as part of the Scheme.

Minor at-grade accesses east of Solstice Park

s. Amesbury Road, north of the A303, will be converted to a northbound only movement for general traffic between the A303 and the A3028 Double Hedges.

t. The A3028 Double Hedges will be retained mostly as is – i.e. as a single carriageway, southbound only slip to the A303. The assumption for coding in the model is that there are no changes from the current arrangement.

u. Allington Track will be stopped-up, with no access to the A303. The existing private track between Allington Track and Amesbury Road will be upgraded, providing a connection between Allington Track and Solstice Park via a connection at Equinox Drive.

Rollestone Cross junction

v. This is the only scheme works assumed off the A303.

w. The existing B3086 (southern arm) will be realigned (to the west of the existing B3086) to provide a wider turning circle to The Packway (eastern arm) as part of the upgrade of the route for high-vehicles / diversion.

x. New priorities will exist at this junction. The existing priority movement (The Packway east-to-west) will be removed. Priority will instead be given to the movements between The Packway (eastern arm) and the B3086 (southern arm). The Packway, B3086 (western arm) will become the minor arm and have to give-way.

Speed limits

4.2.18 The speed limit assumptions for the Scheme, as per the current design are:

a. The mainline will be assumed to be national speed limit for dual carriageway throughout (i.e. 70 mph, or 113 km/h).

b. The new slip roads at Countess roundabout and Longbarrow interchange will be national speed limit (i.e. 60 mph, or 97 km/h).

c. The local roads approaching Longbarrow interchange (the re-routed A360 and the old, de-trunked A303 from Winterbourne Stoke) will be national speed limit (i.e. 60 mph, or 97 km/h).

d. The A345 approaches to Countess roundabout will retain their current speed limits. The A345 has a speed limit of 30 mph (48 km/h) south of the roundabout and 40 mph (64 km/h) north of the roundabout.

e. The realigned B3086 at Rollestone Cross will have a reduced 40 mph (64 km/h) speed limit through the new arrangement.

Annualisation factors

4.2.19 The annualisation factors were obtained by dividing the total flow recorded at four count sites across the year by the observed flow in the modelled period as shown in Table 4-2. The four count sites considered were as follows:

a. west of Winterbourne Stoke traffic monitoring unit (TMU) site 5588/1 (westbound) and TMU site 5588/2 (eastbound); and

b. west of Solstice Park TMU site 5593/1(eastbound) and TMU site 5594/1(westbound).

4.2.20 The hours of the year were aligned to the four periods represented in the transport model as follows:

a. busy day: 10 am – 7pm on the 64 days of the year with the largest observed delay;

b. AM Peak: 7-10 am on all working weekdays;

c. PM Peak: 4-7 pm on all working weekdays that do not occur on busy days; and

d. interpeak: all other hours of the year.

Table 4-2 Annualisation factors by period

Period	Period Traffic	Annual Traffic	Annualisation Factor
Busy	4,265	2,520,082	591
AM Peak	3,523	2,741,734	778
PM Peak	3,998	2,519,848	632
Inter Peak	3,886	12,255,928	3,154

4.2.21 The 24 hour AADT flow was calculated from the individual modelled hours (AM, IP, PM and busy) and identified annualisation factors using the below formula:

$$\text{24hour AADT} = \frac{(\text{busy} \times 591) + (\text{AM Peak} \times 778) + (\text{PM Peak} \times 632) + (\text{IP} \times 3154)}{365}$$

4.3 Traffic forecasts

Convergence

4.3.1 Well converged models are required to provide stable, consistent and robust model results and to differentiate between changes related to an intervention from those associated with model instability or noise. This section outlines the convergence and stability performance of the traffic forecasts.

4.3.2 The core scenario assignment models almost all converge to WebTAG criteria. The only assignment model which fails to meet the criteria is the 2031 without scheme PM peak core model and this model only fails marginally. The poorly converging nodes in this model are located away from the Area of Detailed Modelling (AoDM) in Bridgwater, Bristol and Bidford-on-Avon.

4.3.3 The forecast demand model convergence meets the criteria, with the one exception being the 2051 with scheme scenario.

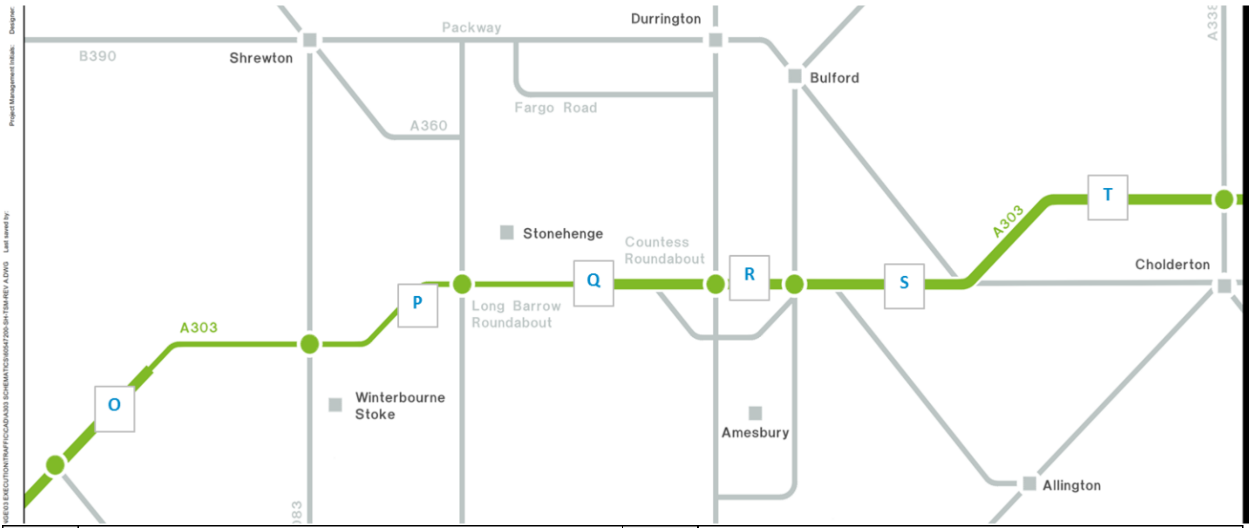
4.3.4 To check the stability of the demand model, an exploratory test was run on an earlier version of the 2051 forecast. The demand model was run for an additional loop and this showed no appreciable impact on traffic flows within the Area of Detailed Modelling across the neutral month peak hour models. Analysis of traffic flow changes in the wider model area showed some changes in Portsmouth, Bristol and Basingstoke.

4.3.5 In summary model flows are shown to be stable and robust in the AoDM. The results are therefore suitable for use in the scheme appraisal and the operational and environmental assessments in this area.

4.3.6 There are some areas of instability in the wider model area which have been investigated further in the economic assessment.

Core scenario without scheme

4.3.7 Annual average daily traffic (AADT) is presented to show how traffic volumes increase over time on each section of the A303 in the AoDM without the Scheme. Figure 4-1 shows the sections of the A303 for which flows are reported and Table 4-3 shows the AADT in the without scheme scenario for the base year 2017 and all forecast years (2026, 2031, 2041, 2051).



O	North of Wylye (A36 to B3083)	**R**	East of Amesbury (Countess to Solstice Park)
P	East of Winterbourne Stoke (B3083 to Longbarrow)	**S**	South of Bulford (Allington Track to Double Hedges)
Q	West of Amesbury (Longbarrow to Countess)	**T**	North of Cholderton (Double Hedges to A338)

Figure 4-1: Location of A303 sections

Table 4-3: A303 AADT without scheme

Section of A303		Direction	2017	2026	2031	2041	2051
O	North of Wylye (A36 to B3083)	EB	9,800	11,700	12,400	13,400	13,900
		WB	9,900	11,500	12,100	12,900	13,300
P	East of Winterbourne Stoke (B3083 to Longbarrow)	EB	9,900	11,800	12,500	13,400	14,000
		WB	10,300	12,000	12,600	13,300	13,800
Q	West of Amesbury (Longbarrow to Countess)	EB	12,500	14,300	15,200	16,000	15,900
		WB	13,000	15,100	15,700	16,100	16,000
R	East of Amesbury (Countess to Solstice Park)	EB	13,800	16,800	17,800	19,200	20,000
		WB	12,800	15,100	15,900	17,100	17,900
S	South of Bulford (Allington Track to Double Hedges)	EB	15,100	18,500	20,000	21,400	22,000
		WB	16,500	19,400	20,700	21,900	23,000
T	North of Cholderton (Double Hedges to A338)	EB	17,100	21,000	22,700	24,400	25,200
		WB	16,400	19,300	20,500	21,700	22,800

AADT rounded to nearest 100.

4.3.8 The increases are consistent for sections and years except for the section between Longbarrow and Countess where the operational capacity appears to constrain the AADT (two-way) to approximately 30,000 vehicles per day.

Core scenario with scheme

4.3.9 Table 4-4 below shows the change in traffic volume between the without and with scheme scenarios.

Table 4-4: A303 AADT without and with scheme scenarios 2041

Section of A303		Direction	2041 without scheme	2041 with scheme	Difference	% Difference
O	North of Wylye (A36 to B3083)	EB	13,400	17,300	3,900	29%
		WB	12,900	17,800	4,900	38%
P	East of Winterbourne Stoke (B3083 to Longbarrow)	EB	13,400	17,300	3,900	29%
		WB	13,300	17,800	4,500	34%
Q	West of Amesbury (Longbarrow to Countess)	EB	16,000	22,700	6,700	42%
		WB	16,100	22,800	6,700	42%
R	East of Amesbury (Countess to Solstice Park)	EB	19,200	23,600	4,400	23%
		WB	17,100	21,400	4,300	25%
S	South of Bulford (Allington Track to Double Hedges)	EB	21,400	24,600	3,200	15%
		WB	21,900	24,700	2,800	13%
T	North of Cholderton (Double Hedges to A338)	EB	24,400	27,400	3,000	12%
		WB	21,700	24,500	2,800	13%

AADT rounded to nearest 100.

4.3.10 The with scheme traffic volumes are greater than the without scheme flows by a notable amount, particularly where the constraint on the volume of traffic between Longbarrow and Countess has been removed, as the two-way AADT by 2041 is forecast to increase by over 40% to more than 45,000 vehicles.

4.3.11 The evidence from Table 4-3 and Table 4-4 demonstrates that demand along the A303 without the Scheme is being constrained. This constraint on the route is removed when the Scheme is implemented.

4.3.12 The variable demand evidence does indicate that there is an element of redistribution of trips which is contributing to the increased volume of traffic on the A303, for example there are more trips between the Cornwall, Devon and Somerset sector and the South East throughout the day.

Local roads – Impact of the Scheme

4.3.13 Figure 4-2 shows the change in daily traffic flows on the local road network forecast to result from the Scheme in 2041, by direction and for the total two way volume (2W).

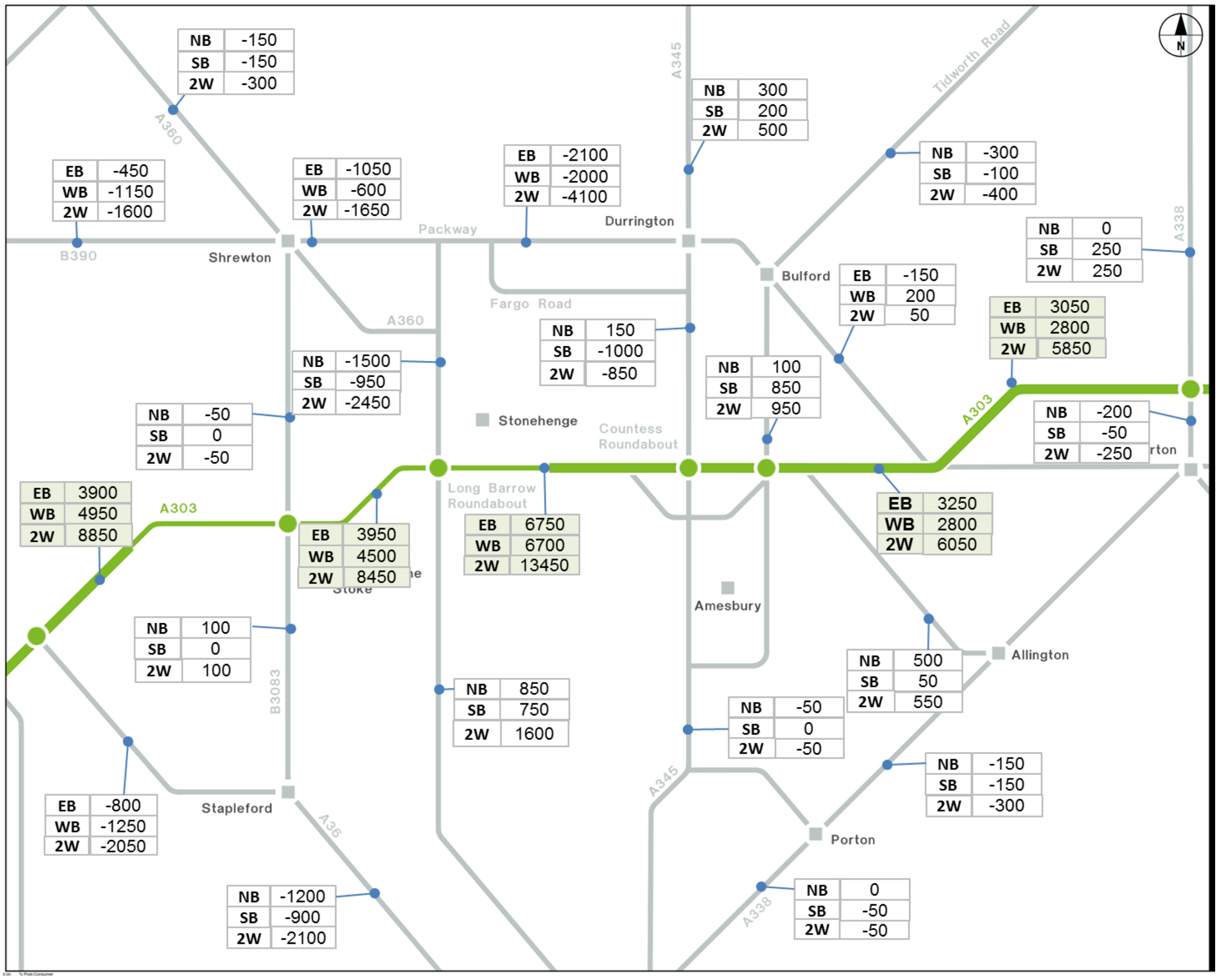


Figure 4-2: Change in daily traffic (2041 AADT vehicles) forecast to result from the Scheme

4.3.14 The main local impacts of the Scheme are the reduction of trips on the existing A303 alignment through Winterbourne Stoke and the reduction in trips on The Packway which is shown in Figure 4-2.

4.3.15 This reduction along The Packway is complemented by other reductions north of the A303 including the B390 through Shrewton and the A360/B3086 between Longbarrow roundabout and Rollestone Cross. These changes represent a reduction of just over 40% of traffic that would be forecast to use these roads without the Scheme.

4.3.16 These reductions in flow reflect effects of:

a. local re-routeing to benefit from the reduced journey times delivered by the Scheme along the A303, for example by using the A303/A36 between Amesbury and Warminster rather than The Packway/B390; there are larger changes forecast westbound on the B390 west of Shrewton reflecting the forecast delays turning right onto the A36, relative to the ease of turning left from the A36 to travel eastbound; and

b. through A303 traffic which diverts (rat-runs) onto the local road network to avoid severe delays on busy days without the Scheme in place; combining both effects, the traffic volumes on busy days along The Packway are forecast to reduce by 75% as a result of the Scheme.

4.3.17 Little change in traffic is forecast for traffic flows on the B3083 north/south through Winterbourne Stoke, the main change being access to Berwick St James for the A303 west becoming to the south and via the A36. There is some re-routeing at the Rolleston Cross junction with vehicles forecast to access the A360 at Airman's Corner (Stonehenge Visitor Centre), rather than through the centre of Shrewton.

4.3.18 The Scheme is forecast to have little net impact on traffic volumes to the east for Durrington. While there are routeing changes evident on The Packway the increase in traffic from Bulford and Durrington accessing the A303 rather than using The Packway is offset by a reduction in traffic from Amesbury accessing The Packway. The main change evident is a forecast increase in use of Salisbury Road between Bulford and Solstice junction (950 vehicles represents less than a 10% increase), together with a corresponding reduction (850 vehicles per day, about 5%) in traffic forecast to use the A345 between Durrington and Countess roundabout.

4.3.19 To the south of the A303 the largest change is forecast to be some re-routeing for areas to the north west of Salisbury to access the A303 west via the A360 rather than the A36, due to the journey time savings delivered by the Scheme along the new Winterbourne Stoke Bypass relative to the existing route through Winterbourne Stoke. The forecast reduction of just over 2000 vehicles per day on the A36 and 1600 vehicles on the A360 represent a change of about 10%.

4.3.20 Within north Amesbury, the closure of the existing A303 means that Stonehenge Road can no longer serve traffic from Amesbury to the west. The dominant change is forecast to be re-routeing of approximately 500 vehicles per day from Woodford Valley and Stonehenge Road, instead to use Church Street and High Street to access the A303 via Countess roundabout with the Scheme.

4.3.21 To the east of Amesbury, the Scheme would include stopping up of the direct connection between Allington Track and the A303 and instead providing a link to Equinox Drive within Solstice Park. While traffic volumes are low, this is forecast to improve access to north Amesbury and through Solstice junction to Bulford, with an increase of about 500 vehicles per day forecast to use Allington Track rather than taking alternative minor routes from the A338 to the A345.

4.3.22 The traffic forecasts indicate no material changes on the A345 south of Amesbury or A338 and other roads to the north of Salisbury (other than the re-routeing between A360 and A36 previously discussed). On busy days the forecasts suggest that there may be some small additional demand for the A338/A36 route, arising from delays on the A303 past Stonehenge without the Scheme, that the Scheme would alleviate.

Journey times

4.3.23 Figure 4-3 and Figure 4-4 show the journey time routes considered.

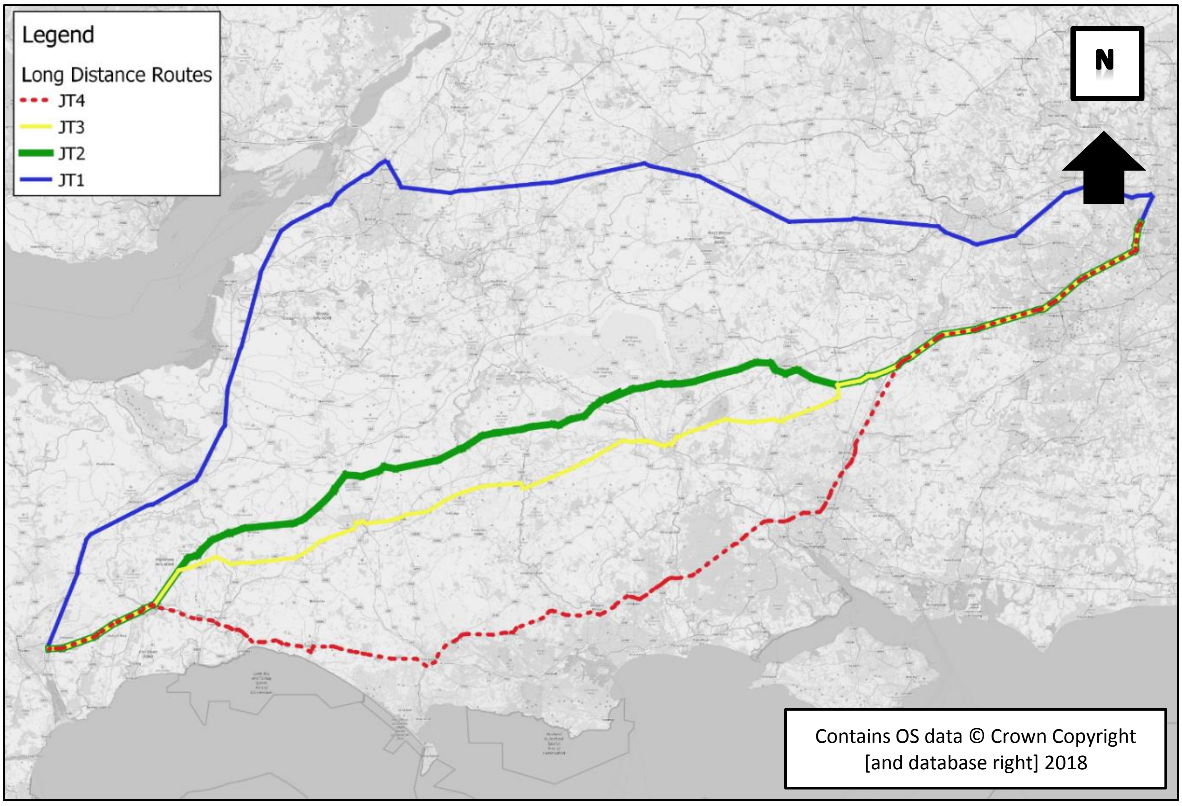


Figure 4-3: Journey time routes (long distance)

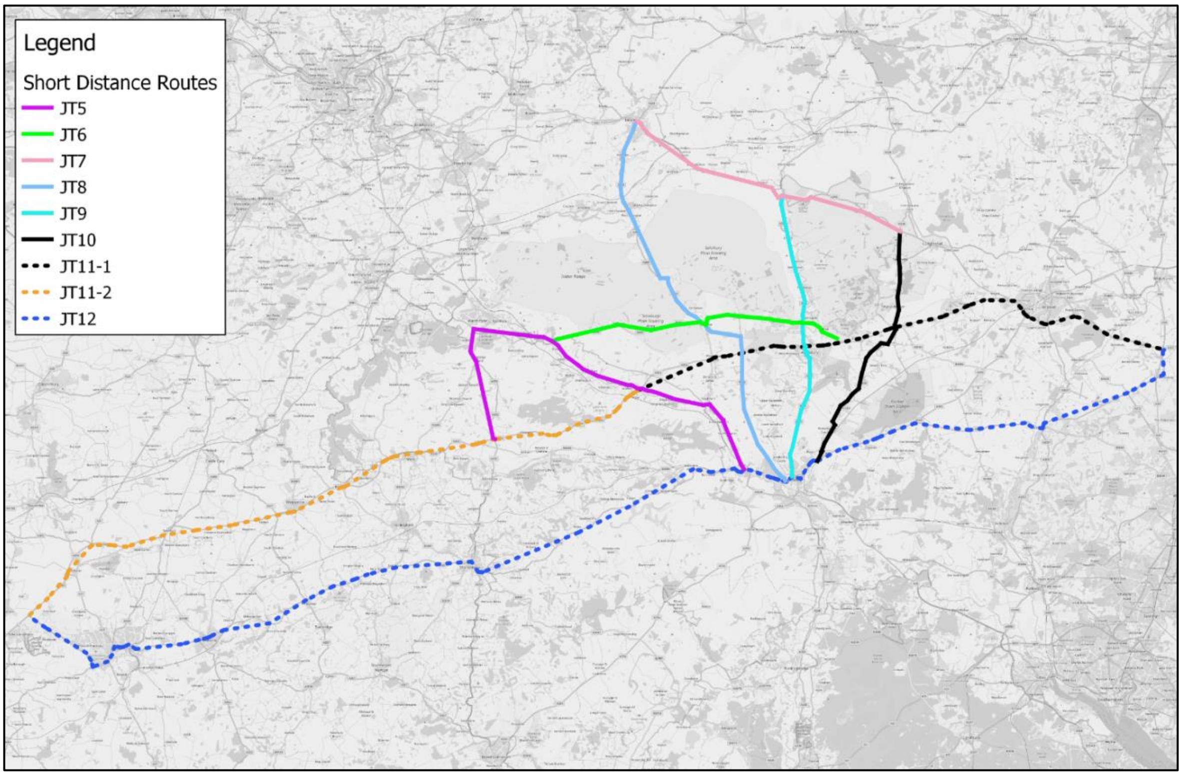


Figure 4-4: Journey time routes (short distance)

Scheme extent

4.3.24 Table 4-5 shows journey times for 2017, 2026 and 2041 for the A303 between the A34 and A36, without the Scheme.

Table 4-5: A303 - A34 to A36 journey times, without scheme

Without scheme					
Route	Time Period	Direction	2017 (hh:mm:ss)	2026 (hh:mm:ss)	2041 (hh:mm:ss)
11-1 A303: A34 to A36	AM	WB	00:29:57	00:30:42	00:32:12
		EB	00:31:46	00:33:22	00:35:45
	IP	WB	00:30:21	00:31:03	00:32:24
		EB	00:30:09	00:30:57	00:32:39
	PM	WB	00:31:06	00:32:12	00:34:30
		EB	00:29:59	00:30:54	00:32:03
	Busy day	WB	00:40:36	00:43:24	00:50:32
		EB	00:37:57	00:42:33	00:48:53

4.3.25 There are consistent forecast increases in journey times on the section of the A303 between the A34 and A36 for all neutral time periods; the increase in the 2041 forecast compared to 2017 is between two and nearly four minutes. The increase in 2041 in the busy period is almost 10 minutes westbound and 11 minutes eastbound.

4.3.26 Table 4-6 shows journey times for the year 2041 for route 11-1, which includes the Scheme section of the A303.

Table 4-6: A303 - A34 to A36 journey times, 2041

2041						
Route	Time Period	Direction	Without scheme (hh:mm:ss)	With scheme (hh:mm:ss)	Difference	% Difference
11-1 A303: A34 to A36	AM	WB	00:32:12	00:27:55	-00:04:17	-13%
		EB	00:35:45	00:29:55	-00:05:50	-16%
	IP	WB	00:32:24	00:28:12	-00:04:12	-13%
		EB	00:32:39	00:28:23	-00:04:16	-13%
	PM	WB	00:34:30	00:29:46	-00:04:44	-14%
		EB	00:32:03	00:28:26	-00:03:37	-11%
	Busy Period	WB	00:50:32	00:31:05	-00:19:27	-38%
		EB	00:48:53	00:30:38	-00:18:15	-37%

4.3.27 In the scheme design year (2041) there are modelled journey time savings in both directions on the A303 between the A34 and A36 as a result of the Scheme. This applies to all time periods during the neutral months, with journey time savings of at least 4 minutes, with the exception of eastbound during the PM peak. For a busy day, the average journey time saving due to the Scheme is more than 18 minutes in both directions.

Local journey time routes

4.3.28 Table 4-7 provides selected local journey times for the year 2041.

Table 4-7: Selected local journey times (6 – The Packway, 8 - A360, 9 – A345), 2041

2041						
Route	Time Period	Direction	Without scheme (hh:mm:ss)	With scheme (hh:mm:ss)	Difference	% Difference
6	AM	WB	00:27:21	00:26:41	-00:00:40	-2%
		EB	00:27:09	00:26:24	-00:00:45	-3%
	IP	WB	00:25:57	00:25:32	-00:00:25	-2%
		EB	00:25:17	00:25:24	00:00:07	0%
	PM	WB	00:27:54	00:27:02	-00:00:52	-3%
		EB	00:25:54	00:26:00	00:00:06	0%
	Busy day	WB	00:29:40	00:26:19	-00:03:21	-11%
		EB	00:29:31	00:25:36	-00:03:55	-13%
8	AM	NB	00:38:30	00:39:00	00:00:30	1%
		SB	00:39:10	00:39:50	00:00:40	2%
	IP	NB	00:37:09	00:37:36	00:00:27	1%
		SB	00:37:39	00:38:09	00:00:30	1%
	PM	NB	00:38:21	00:39:00	00:00:39	2%
		SB	00:38:59	00:39:36	00:00:37	2%
	Busy day	NB	00:37:41	00:38:15	00:00:34	2%
		SB	00:38:18	00:38:51	00:00:33	1%
9	AM	NB	00:28:49	00:28:31	-00:00:18	-1%
		SB	00:32:03	00:31:29	-00:00:34	-2%
	IP	NB	00:28:08	00:28:04	-00:00:04	0%
		SB	00:29:13	00:29:08	-00:00:05	0%
	PM	NB	00:30:59	00:30:51	-00:00:08	0%
		SB	00:30:36	00:30:24	-00:00:12	-1%
	Busy day	NB	00:28:33	00:27:50	-00:00:43	-3%
		SB	00:31:18	00:29:30	-00:01:48	-6%

4.3.29 The forecasts show that there is an increase in modelled journey times of around 30 seconds in all time periods for the route on the A360 (route 8). The increase in journey time is due to the length of this route being extended by 0.4km around Longbarrow junction with the Scheme in place.

4.3.30 In the busy period the journey times on The Packway (route 6) improve with the Scheme by over three minutes westbound and nearly four minutes eastbound. This is due to traffic routeing via the A303 with the Scheme instead of using The Packway. There is also a reduction in journey times of almost two minutes on the A345 southbound (route 9).

4.3.31 The journey time routes illustrate a modest net improvement to local travel conditions arising from the Scheme.

A303 corridor

4.3.32 Table 4-8 shows forecast journey times for the year 2041 for the wider A303 corridor. This includes route 2, which runs from Junction 13 of the M25 to Junction 29 of the M5 via the A303 together with the shorter section, route 11 running from the A30/A34 junction to the east of Andover to Martock, which is further broken down into two sections, 11-1 and 11-2. 11-1 was discussed previously, while 11-2 includes the section of the A303 to the west of the Scheme (the route sections are illustrated in Figure 4-3 and Figure 4-4).

Table 4-8: A303 corridor journey times, 2041

2041						
Route	**Time Period**	**Direction**	**Without scheme (hh:mm:ss)**	**With scheme (hh:mm:ss)**	**Difference**	**% Difference**
2	AM	WB	02:48:31	02:45:05	-00:03:26	-2%
		EB	02:49:06	02:45:02	-00:04:04	-2%
	IP	WB	02:50:31	02:48:13	-00:02:18	-1%
		EB	02:42:19	02:39:05	-00:03:14	-2%
	PM	WB	02:59:29	02:57:03	-00:02:26	-1%
		EB	02:43:36	02:41:16	-00:02:20	-1%
	Busy day	WB	03:25:14	03:13:04	-00:12:10	-6%
		EB	03:10:12	02:59:53	-00:10:19	-5%
11	AM	WB	01:12:17	01:08:43	-00:03:34	-5%
		EB	01:13:59	01:09:09	-00:04:50	-7%
	IP	WB	01:14:17	01:11:37	-00:02:40	-4%
		EB	01:10:39	01:07:01	-00:03:38	-5%
	PM	WB	01:15:28	01:12:26	-00:03:02	-4%
		EB	01:08:46	01:05:46	-00:03:00	-4%
	Busy day	WB	01:44:50	01:31:00	-00:13:50	-13%
		EB	01:32:24	01:20:09	-00:12:15	-13%
11-2	AM	WB	00:40:04	00:40:47	00:00:43	2%
		EB	00:38:13	00:39:14	00:01:01	3%
	IP	WB	00:41:53	00:43:25	00:01:32	4%
		EB	00:37:59	00:38:38	00:00:39	2%
	PM	WB	00:40:58	00:42:40	00:01:42	4%
		EB	00:36:42	00:37:20	00:00:38	2%
	Busy day	WB	00:54:18	00:59:55	00:05:37	10%
		EB	00:43:30	00:49:31	00:06:01	14%

4.3.33 In 2041 there are forecast journey time savings for those travelling the full length of the corridor from Junction 13 of the M25 to Junction 29 of the M5 and in reverse (route 2), especially in the busy period model. These are, however, of a smaller magnitude to the savings experienced along the main A303 section (route 11), suggesting that there are secondary impacts elsewhere along the corridor when traffic is no longer delayed on the Stonehenge section.

4.3.34 This is confirmed by considering Route 11-2, which runs to the west of the Scheme, which is forecast to experience increases in journey time in all time periods. In particular, during the busy day an increase in journey time of about 6 minutes is forecast. Overall however, there are still time savings, and these are larger in the busy period model.

4.3.35 It can be seen that journey time improvements experienced around the Scheme (route 11-1) are partly eroded by an increase in delay forecast along other parts of the A303 corridor (route 11-2) which are not assumed to be improved for these forecasts. Overall there is still a net modelled journey time benefit along the A303 corridor especially during the busy days.

5 Economic appraisal

5.1 Economic appraisal approach

Introduction

5.1.1 Economic appraisal is the determination of the user benefits of a transport scheme using information on travel demand, traffic flows, journey times and other data derived from a transport model. The benefits calculated from the appraisal are compared to the Scheme costs to produce a benefit to cost ratio (BCR) representing the value for money (VfM) of the Scheme.

Transport user benefits

5.1.2 Considering the nature of the A303 Amesbury to Berwick Down scheme and its potential impacts on the economy, environment, tourism and social well-being, the key transport benefits are derived from reductions to delays and improved travel times through the corridor.

5.1.3 Other transport-related benefits and disbenefits that are likely to be associated with the Scheme will arise from: changes in the number of accidents; changes in vehicle operating costs (VOCs); changes in indirect taxes; greenhouse gas emissions; air quality and noise benefits; social impacts; and delays during construction.

5.1.4 To capture the planned period of scheme development and implementation, the economic appraisal period was defined to end in the year 2085, 60 years after the scheme opening year of 2026. It should be noted that regular maintenance and renewal of the A303 Amesbury to Berwick Down scheme will take place, meaning that the lifetime of the asset will, in all likelihood, exceed the 60 year appraisal period. The assessment of a 60 year appraisal period is in line with WebTAG Unit A1.1, and whilst it is recognised that there is residual value in the Scheme after this period, this was not appraised.

5.1.5 The impacts of the Scheme were based on the difference between forecasts of the without-scheme (Do-Minimum) and with-scheme (Do-Something) scenarios. Transport user benefits were calculated by comparing demand, travel costs and traffic flows in these two scenarios.

5.1.6 Transport user benefits, arising from changes in travel times and vehicle operating costs, as well as changes in revenue from indirect taxation have been calculated using the Department for Transport's (DfT's) 'Transport User Benefits Appraisal' (TUBA) software. Similarly, economic benefits arising due to changes in the number and severity of accidents have been quantified using the DfT's standard 'Cost and Benefit to Accidents – Light Touch' (COBALT) software.

5.1.7 To ensure consistency in appraisal of the forecasts, the economic parameter file used in TUBA and COBALT for the appraisal of the Scheme has made use of data from the interim May 2018 WebTAG Databook. Interim economic parameter files corresponding with the interim Databook were provided direct by the DfT incorporating the relevant changes and replaced the standard economic files supplied with the software.

5.1.8 As detailed in WebTAG Unit A1.3 'User and Provider Impacts', costs to existing transport users due to the construction of a scheme and costs to users arising during future maintenance should be recorded in the economic assessment results where they are likely to be significant. The construction of the Scheme is likely to lead to increased delays and travel times for users due to on-line working and reduced speed limits and these were assessed in the DfT's TUBA software. Consultation with the solutions workstream noted that maintenance would generally be undertaken overnight when affected traffic volumes are lower than in the modelled periods. Given the small number of users affected, the net economic consequence of routine maintenance is expected to be negligible and would not materially impact the expected VfM of the Scheme. Therefore costs to users arising during future maintenance were not assessed.

5.1.9 This appraisal of conventional transport user benefits follows the guidance set out in the WebTAG A1 series of units covering 'Cost Benefit Analysis'.

Annualisation of user benefits

5.1.10 Benefits were calculated for the four forecast years within the appraisal period defined in paragraph 4.2.10. The 'A303 Stonehenge SWRTM (DCO)' model was used to extract information on the number of trips, travel times and distances, and traffic flows to inform the assessment. These models represent traffic conditions during an average AM hour; an average interpeak hour; and an average PM hour for a neutral month as well as an average hour during a 'busy day'.

5.1.11 In order to convert the benefits derived from the model outputs to represent a full year, annualisation factors were applied. The factors used were the same as those presented in Table 4-2. Additional factors were applied to the interpeak and busy day to account for differences in the composition of trip purposes between the model time slice being expanded and the full period being expanded to:

a. the interpeak forecasts represent trip making during an average hour in the middle of an average weekday and therefore have higher proportions of business trips than would occur during the off-peak and non-busy weekends which they are extrapolated to represent; and

b. the busy day forecasts represent average hour demand across a busy Friday-Sunday and were derived from the neutral month interpeak model, therefore including higher proportions of business and commute trips when reflecting on the mix of weekday and weekend days over which the model outputs are extrapolated.

5.1.12 Annualised benefits were interpolated between each of the forecast years and extrapolated from the final forecast year to cover the full 60 year appraisal period as described in TAG Unit A1.1 §2.1.1. The additional factors, presented in Table 5-1, were then applied to the annualised benefits for these periods to ensure that they represented the average trip purpose splits across the extrapolated period as derived from National Travel Survey (NTS) and roadside interview (RSI) data.

Table 5-1: Purpose split factors

Purpose Factor	Employer's Business	Home-based Work	Other
Neutral Interpeak Factors	0.66	1.45	0.92
Busy Day Factors	0.72	1.04	1.05

Masking of user benefits

5.1.13 As explained in paragraph 4.3.6, tests of model convergence identified some areas of instability in the wider model area. Accordingly a masking system was developed for the assessment of transport user benefits excluding local trips within these areas from the TUBA assessment, while retaining movements to, from, within and through the AoDM and adjacent area.

5.1.14 The masking of movements in the assessment of transport user benefits reduced the total benefits from £397 million to £370 million in 2010 prices, discounted to 2010 present values. This represents a decrease of 7%; a small change representing the uncertainty within the transport model and which shows that the masking has no material impact on the appraisal.

5.1.15 Movements which are not masked in the assessment are reasonably expected to experience changes in travel time or distance, and therefore cost, as a result of the Scheme. These changes could either be as a direct result of the Scheme, for example reductions in travel time for trips travelling along it, or knock-on effects from wider re-routeing into the corridor. The benefits and disbenefits arising for these movements are therefore included in the final assessment of transport user benefits.

5.1.16 In addition to appraising transport user benefits, including those arising due to accidents and construction, an assessment of the environmental impacts of the Scheme, quantifying and monetising air quality, greenhouse gas and noise benefits where there are large forecast changes in traffic flows has been undertaken in line with WebTAG Unit A3 'Environmental Impact Appraisal'.

5.1.17 Conventional transport user benefits including impacts during construction and maintenance, accident impacts and environmental impacts are monetised and form part of the initial BCR. They are included in the Transport Economic Efficiency (TEE) table and as part of the TEE elements in the Analysis of Monetised Costs and Benefits (AMCB) table.

Wider impacts

5.1.18 An assessment of the wider economic impacts of the Scheme, which are supplementary to the conventional transport user benefits, was undertaken in line with the WebTAG A2 series of units. The wider economic impacts appraisal quantified agglomeration benefits, changes in labour supply and increased business output using the DfT's 'Wider Impacts in Transport Appraisal' (WITA) software.

5.1.19 The wider impacts study area was limited to the SWRTM Region of Focus (RoF) – the full area in which the model is calibrated and validated and thus provides a sufficiently reliable estimate of generalised costs of travel.

5.1.20 Similarly, due to the fixed speed network coding adopted by the Regional Traffic Models (RTMs) in urban areas, which result in instability in the adjacent network, changes in generalised cost for trips wholly within these areas between the without-scheme and with-scheme scenarios have been excluded. By assuming no cost change for trips within these areas between the without-scheme and with-scheme scenarios, there is no change in accessibility calculated in the assessment of wider impacts.

Journey time reliability

5.1.21 An assessment of the impacts of changes in journey time reliability was undertaken in line with WebTAG Unit A1.3 'User and Provider Impacts' §6. The journey time reliability impacts assessment quantified the changes in the variation to journey times that users are unable to predict and is supplementary to the conventional transport user benefits.

Cultural heritage impacts

5.1.22 A contingent valuation study was undertaken to understand the value that visitors place on the removal of the A303 from its current location.

5.1.23 This contingent valuation study was completed by Simetrica on behalf of Highways England at PCF Stage 2. The study methodology, survey design and key results have been externally peer reviewed by the DfT and consultants appointed by the DfT and Highways England and found to reflect best-practice. Similarly, a further peer review of the survey has been undertaken by Highways England to show that the results are not impacted by potential survey 'scope effects' where contingent valuation studies can be unreliable due to the difficulty for individuals in identifying the value of the subject of the survey.

5.1.24 Wider economic impacts, journey time reliability impacts and cultural heritage impacts are monetised and form part of the adjusted BCR. They are therefore not included in the TEE or AMCB tables.

Comparison of costs and benefits

5.1.25 Costs and benefits occur in different years throughout the appraisal period. Benefits are realised in the sixty years following the implementation of the Scheme. The Scheme could be funded directly through the public sector or with investment through private finance mechanisms. The assessment of the benefits against the costs of the Scheme has appraised both public and private financing strategies from the perspective of public sector spending. Depending on the funding strategy taken forward, there may be up-front costs associated with construction of the Scheme or this could be spread across a number of years of the appraisal period as a unitary charge paid by Highways England. Regular public sector operational and maintenance expenditure is also assumed to occur throughout the appraisal period.

5.1.26 Benefits and costs were deflated and discounted to a 2010 price base and 2010 present value using the standard DfT discount rates of 3.5% per year for the first thirty years following 2018 (appraisal date) and then 3.0% per year for the remainder of the appraisal period.

5.1.27 Reflecting the A303 Amesbury to Berwick Down project's status as a 'Tier 1' scheme, the DfT provided an early version of its forthcoming May 2018 WebTAG Databook to use in forecasting and economic appraisal. The deflation of benefits to 2010 prices was undertaken using GDP deflators supplied by the DfT; however, analysis has shown that these have changed slightly in the official release. Similarly, the GDP deflators used in the preparation of scheme costs have used the standard inflation profile as provided in Highways England's inflation forecast. The differences between these deflators are shown in Table 5-2.

Table 5-2: GDP deflator comparison

Year	Interim Advice Databook GDP Deflator	Highways England CapEx & OpEx GDP Deflator	% Difference to Interim	May 2018 Databook GDP Deflator	% Difference to Interim
2010	100.00	100.00	0.0%	100.00	0.0%
2016	110.04	108.83	-1.1%	110.01	0.0%
2026	132.45	134.17	1.3%	132.82	0.3%
2031	147.67	150.32	1.8%	148.08	0.3%
2041	183.57	188.71	2.8%	184.08	0.3%
2051	228.20	236.89	3.8%	228.84	0.3%

5.1.28 Scheme costs have been converted into the market price unit of account and 2010 prices, in line with WebTAG Unit A1.2 §4.1.

5.2 Scheme benefits

Transport user benefits

5.2.1 Transport user benefits are derived from the changes in forecast travel time, vehicle operating cost and user charges during construction and during normal operation after opening of the Scheme.

5.2.2 The profile of user benefits over the sixty year appraisal period is shown in Figure 5-1.

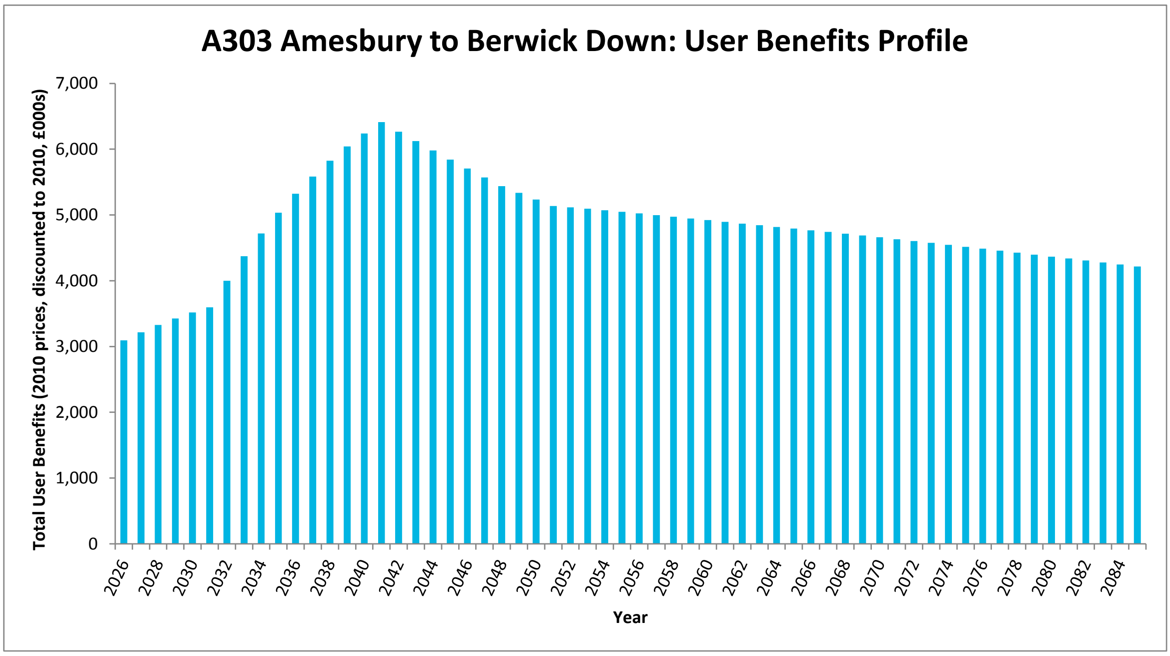


Figure 5-1: Transport user benefits by year

5.2.3 After the Scheme is open, travel times through the study area will, in general, be reduced. Similarly, re-routeing of traffic and changes in congestion may cause changes in travel times on other routes. Table 4-6 shows how the travel times change on the A303 with and without the Scheme.

5.2.4 With the Scheme open, journey times along the Scheme section are reduced by around four minutes under normal traffic conditions. TUBA was used to assess the impacts of changes in travel time across the model, monetising the results using values of time (VoT). The monetary travel time benefits calculated for each model period were annualised, interpolated and extrapolated to cover the whole 60 year appraisal period amounting to a total benefit of £370 million as shown in Table 5-3.

Table 5-3: Travel time benefits by period and user type (£000s)

Purpose and mode	AM	PM	IP & OP	BUSY DAYS	TOTAL
Non-Business: Commuting	7,000	3,000	15,000	7,000	32,000
Non-Business: Other	11,000	5,000	41,000	76,000	133,000
Business: Car and LGV	33,000	16,000	65,000	66,000	180,000
Business: Goods Vehicles	5,000	1,000	15,000	4,000	25,000
TOTAL	57,000	24,000	136,000	152,000	370,000

2010 prices, discounted to 2010. Full appraisal, rounded to nearest million

5.2.5 Nearly half (49%) of the total travel time benefits are realised by users travelling for business in a car or LGV. This reflects the higher values of time for these travellers than other purposes and the proportion of business travel along the A303. Across the day, travel time benefits are greatest during the busy periods reflecting the substantial congestion delay experienced on busy days without the Scheme and the alleviation of this delay that the Scheme provides.

5.2.6 Due to restrictions limiting the maximum speed of HGVs to 60mph, the time saving they experience along the A303 is around 15% less than car and LGV travellers after the Scheme is implemented. This, in combination with HGVs making up less than 10% of traffic using the A303 and the relatively low values of time for HGV drivers, results in relatively modest travel time benefits.

5.2.7 After the Scheme is implemented, changes in trip distance and average speed will occur for trips through the study area. Trips on the A303 will experience an increase in average speed due to reductions in journey times but will also travel further as a result of the new alignment of the corridor around Winterbourne Stoke. Other impacts will arise due to wider re-routeing into the corridor and congestion relief on local roads.

5.2.8 Changes in trip distance and average speed impact upon vehicle operating costs (VOCs) which consist of both fuel and non-fuel costs. As with the travel time benefits, TUBA was used to quantify the impacts of the Scheme on VOCs, including the annualisation, interpolation and extrapolation of the model period benefits and costs to cover the whole 60 year appraisal period. The assessment of VOC impacts resulted in a disbenefit of approximately £17 million in fuel VOC, and a disbenefit of approximately £65 million in non-fuel VOC as shown in Table 5-4.

Table 5-4: Fuel and non-fuel VOC benefits by time period and user type (£000s)

Purpose and mode	Fuel VOC	Non-Fuel VOC	TOTAL
Non-Business: Commuting	-2,000	-11,000	-13,000
Non-Business: Other	0	-63,000	-63,000
Business: Car and LGV	-8,000	5,000	-3,000
Business: Goods Vehicles	-7,000	4,000	-3,000
TOTAL	-17,000	-65,000	-82,000

2010 prices, discounted to 2010. Full appraisal, rounded to nearest million

Delays during construction

5.2.9 The construction of the Scheme is likely to lead to increased travel times for users. The assessment of the impacts of construction has been considered in two phases: construction of Winterbourne Stoke Bypass and new junctions at Longbarrow and Countess (Phase 1); and the completion of the tunnel section (Phase 2). The overall impacts of both phases were assessed using TUBA resulting in a disbenefit of approximately £31 million to users during the roughly five years of construction, including changes in indirect tax revenues. This is shown in Table 5-5.

Table 5-5: User benefits by benefit type during construction (£000s)

Benefit element	Phase 1	Phase 2	Total
Travel Time	-22,190	-5,550	-27,740
Fuel Vehicle Operating Costs	-1,850	-1,910	-3,760
Non-fuel Vehicle Operating Costs	-2,560	-1,350	-3,910
Indirect Tax	2,470	1,760	4,230
TOTAL	-24,140	-7,050	-31,190

2010 prices, discounted to 2010. Rounded to nearest ten thousand.

5.2.10 The primary driver of the overall disbenefit to users is the effect of the first phase of construction on travel times along the corridor. This is somewhat alleviated in the second phase when Countess flyover is open allowing for free-flowing traffic eastbound and westbound.

5.2.11 Overall the Scheme provides benefits of approximately £252 million to transport users across the 60 year appraisal period. The largest benefits occur in the vicinity of the Scheme showing that it has a strong positive impact for local travellers. Significant beneficial impacts are, however, spread across the South West region reflecting the improvements for travellers on longer distance trips. Some negative impacts are seen in other areas, such as central Somerset, where the Scheme results in wider re-routeing and higher traffic flows on sections of the corridor which have not been improved. The distribution of user benefits across the South West is shown in Figure 5-2.

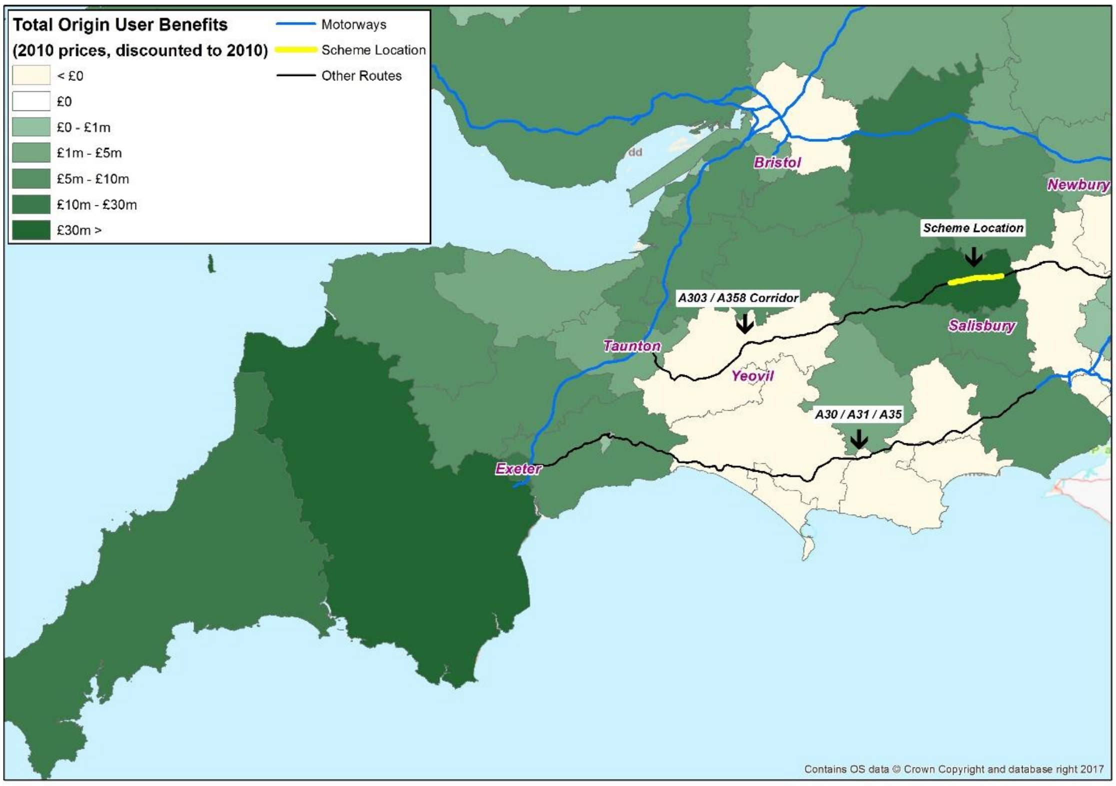


Figure 5-2: Total user benefits by sector (origin)

Accidents

5.2.12 The implementation of the Scheme causes wide changes in traffic routeing and volumes along the A303, M4 and M5, and other roads. The accident appraisal assessed all significant impacts of re-routeing and induced demand on the corridor, M4 and M5, and local roads within the AoDM. The Scheme is forecast to have an overall beneficial impact, reducing the number of accidents and producing a benefit of approximately £4 million across the 60 year appraisal period. This shown in Table 5-6.

Table 5-6: Summary of accident benefits

Accidents Saved	5
Casualties Saved	52
Economic Benefit (£000s)	4,390

2010 prices, discounted to 2010. Benefit rounded to nearest ten thousand

Environmental impacts

5.2.13 The impacts of the Scheme on air quality, noise and greenhouse gas emissions were assessed in accordance with WebTAG Unit A3.

5.2.14 The implementation of the Scheme results in an increase in greenhouse gas emissions due to induced traffic and re-routeing of trips onto the A303 corridor.

5.2.15 The Scheme is expected to significantly reduce the traffic noise levels experienced in Winterbourne Stoke and along the tunnelled section within the WHS with moderate decreases in noise in Larkhill, Chitterne and Shrewton. There are, however, expected to be moderate increases in noise within Amesbury due to increases in traffic. Overall the Scheme is expected to produce a small disbenefit resulting from changes in noise experienced by households in the local area.

5.2.16 The Scheme is expected to have a small beneficial impact on air quality in the local area. Concentrations of PM10 particles are expected to decrease slightly whilst NOx emissions are forecast to increase slightly as a result of changes in traffic flows and routeing.

5.2.17 Table 5-7 shows the expected benefits and disbenefits attributable to the impacts of the Scheme on local air quality, noise levels and greenhouse gas emissions.

Table 5-7: Environmental benefits (£000's)

Benefit Element	Benefit (£000's)
Total value of change in local air quality	300
Total value of change in noise	-330
Total value of change in greenhouse gas emissions	-86,460

2010 prices, discounted to 2010. Rounded to nearest ten thousand.

Reliability impacts

5.2.18 Following scheme opening, users of the A303 will likely experience less variation in travel times and less incident delay, improving the reliability of their journeys. The impact of the Scheme on journey time reliability has been assessed and monetised in line with WebTAG Unit A1.3 §6.

5.2.19 The results of the appraisal of journey time reliability showed that, across the 60 year appraisal period, the Scheme will produce benefits of approximately £61 million as shown in Table 5-8.

Table 5-8: Journey time reliability benefits by user type (£000s)

Commute	Business	Other	Goods vehicles	Total
10,000	9,000	36,000	6,000	61,000

2010 prices, discounted to 2010. Rounded to nearest million

Wider economic impacts

5.2.20 Wider economic impacts are additional benefits which arise due to distortions and market failures as the impacts of transport improvements are transmitted into the wider economy. They can include productivity gains resulting from improvements in how well businesses are connected to each other and the workforce as well as benefits arising due to the relocation of businesses and households.

5.2.21 Table 5-9 presents the results of the assessment of wider impacts, which produces a total benefit of approximately £35 million across the 60 year appraisal period.

Table 5-9: Wider economic impact benefits, core scenario

Wider Impact Measure	Benefit (£000s)
Agglomeration - manufacturing	1,000
Agglomeration – construction	1,000
Agglomeration - consumer services	3,000
Agglomeration - producer services	13,000
Agglomeration – Total	17,000
Labour supply impact	1,000
Increased output in imperfectly competitive market	17,000
The move to more/less productive jobs	0
Total	**35,000**

2010 prices and values discounted to 2010. Rounded to nearest million

5.2.22 As per WebTAG Unit A2.4, agglomeration benefits relate to the concentration of economic activity across an area. By improving the accessibility of an area to a greater number of firms and workers, transport schemes can deliver increases in Gross Domestic Product (GDP). The primary influences on determining agglomeration impacts are changes in travel costs, the number and location of workers, and the productivity of those workers. The A303 Amesbury to Berwick Down scheme is located close to large regional distribution centres as well as the urban areas of Amesbury, Salisbury and Andover. These provide employment opportunities and therefore by reducing travel costs and increasing accessibility to these areas, the Scheme promotes increased agglomeration leading to a benefit of approximately £17 million across the appraisal period.

5.2.23 Similarly, the Scheme is likely to have positive impacts on the potential labour supply for businesses in the area. As defined in WebTAG Unit A2.3, benefits arise due to both more people working and people working in more productive jobs. The main driver for potential labour supply is the cost of commuting and, as the Scheme will reduce travel times and therefore cost, it is likely that businesses will benefit from an increase in potential workers providing a benefit of approximately £1 million.

5.2.24 Described in WebTAG Unit A2.2, 'increased or decreased output in imperfectly competitive markets' relates to the changes in the output of goods that use transport. Reductions in transport costs to business and/or freight allows for an increase in the production or output of goods or service markets. The A303 also provides the most direct route between the South East and South West. By improving journey times and reliability between these two areas the Scheme will enable easier, and cheaper, travel for long distance business and freight trips providing benefits in the output of goods that use transport. This produces a benefit of around £17 million.

Cultural heritage impacts

5.2.25 The contingent valuation study derived net benefits for the removal of the A303 from its current location for three groups of people: visitors to Stonehenge; A303 road users; and the general population. The benefits to each of these groups are shown in Table 5-10.

Table 5-10: Benefits derived from willingness to pay/accept surveys

Group	National Benefit (£ million)
Visitors	24
Road Users	49
General Population	1,203
Total net present value (2016 prices and values)	**1,277**
Total net present value (2010 prices and values)	**955**

5.2.26 The assessment demonstrates that the benefits of removing the road from the WHS as perceived by Stonehenge visitors and the general public are substantial. The aggregate net benefit for the removal of the A303 from its current location within the WHS was £24 million for visitors to Stonehenge, while for A303 road users it was £49 million and for the general population it was £1.2 billion (in 2016 prices and values). Combining these together represents the overall value that society attributes to the impacts of removing the section of the A303 from this part of the WHS and results in an estimated aggregate NPV of £955 million in 2010 prices, discounted to 2010.

5.3 Scheme costs

5.3.1 The estimation of the costs of transport schemes is a crucial part of the scheme appraisal process. As WebTAG Unit A1.2 notes, unrealistic cost estimates will adversely affect the robustness of the assessment of affordability and can result in an inappropriate value for money (VfM) statement.

Public sector costs

5.3.2 The Scheme could be taken forward via private finance funding (PF2) mechanisms or could be funded directly by the public sector. Costs associated with both of these scenarios have been assessed from the perspective of the public sector to present the benefit to cost ratio and value for money of the Scheme.

5.3.3 A publicly funded solution would require up-front expenditure to cover the cost of preliminary works and construction associated with the Scheme. Highways England would assume responsibility for all risks associated with the Scheme and would be responsible for all operational and maintenance expenditure.

5.3.4 Through PF2, Highways England would fund the Scheme through the payment of an annual unitary charge to a Design, Build, Finance and Maintain (DBFM) contractor over an assumed period of 25 years post scheme opening. It is assumed Highways England would also retain the cost of preliminary works during construction, a negotiated share of risk, and some operating and maintenance costs. After expiration of the PF2 contract, it is assumed that Highways England would assume responsibility for the full cost of operating and maintaining the Scheme.

5.3.5 The costs used to determine the benefit to cost ratio and value for money are based on a scheme which includes a tunnel approximately 2 miles (3.3km) long, the construction of a northern bypass of Winterbourne Stoke and flyover at Countess roundabout and includes heritage mitigation with an approximately 150m wide green bridge and canopy and vertical retaining walls at the western end of the tunnel.

Maintenance costs and tax revenue

5.3.6 Should the Scheme be funded directly by the public sector, it is assumed that Highways England would have full responsibility for all operational and maintenance costs. These costs would be realised, in varying amounts, throughout the appraisal period post scheme opening.

5.3.7 Were the Scheme to be part funded through private sector investment, it is assumed that the majority of operating and maintenance costs would be borne out by the DBFM contractor with Highways England retaining a small annual cost to pay for traffic officers and other related expenses. Upon the expiration of the PF2 contract, it is assumed that Highways England will assume full responsibility for operating and maintaining the Scheme and therefore will pay the full operating and maintenance costs for the remainder of the appraisal period.

5.3.8 It is assumed that there is a cost saving to Highways England arising from the removal of the current A303 carriageway, although some maintenance cost is assumed to be transferred to the local highway authority for the section of A303 through Winterbourne Stoke which will be de-trunked upon completion of the Scheme.

5.3.9 Should the scheme procurement progress under private finance mechanisms, it is assumed that the Government will receive increased revenue from Corporation Tax during the lifetime of the PF2 contract. This increased revenue would arise as Highways England pays an annual unitary charge to the private DBFM contractor. This is captured in the Public Accounts (PA) and Analysis of Monetised Costs and Benefits (AMCB) tables as changes in indirect tax revenue for the privately financed solution.

Risk and optimism bias

5.3.10 As described in WebTAG Unit A1.2 §3.5, optimism bias is the demonstrated systematic tendency for appraisers to be overly optimistic about scheme costs and suggests that uplifts should be applied to the estimates of costs to account for the repeat of historically observed cost overruns.

5.3.11 An allowance for risk and optimism bias has been included in the cost estimate. Both portfolio (programme) level risks – risks which affect all projects being developed by Highways England – and project specific risks have been considered and valued in accordance with the Highways England cost manual.

5.3.12 Therefore the application of an optimism bias uplift factor is not necessary for the value for money assessment for the Scheme.

Cost profile and present value of costs

5.3.13 The estimated annual cost profile of the Scheme in 2010 market prices discounted to 2010, assuming the total cost of the Scheme is met in full through public sector funding, is shown in Figure 5-3. The publicly funded solution requires investment of approximately £1 billion, in 2010 market prices discounted to 2010 values, prior to scheme opening to finance preliminary works and construction costs. Operational and maintenance (O&M) costs begin from scheme opening in 2026 and are incurred for the remainder of the appraisal period.

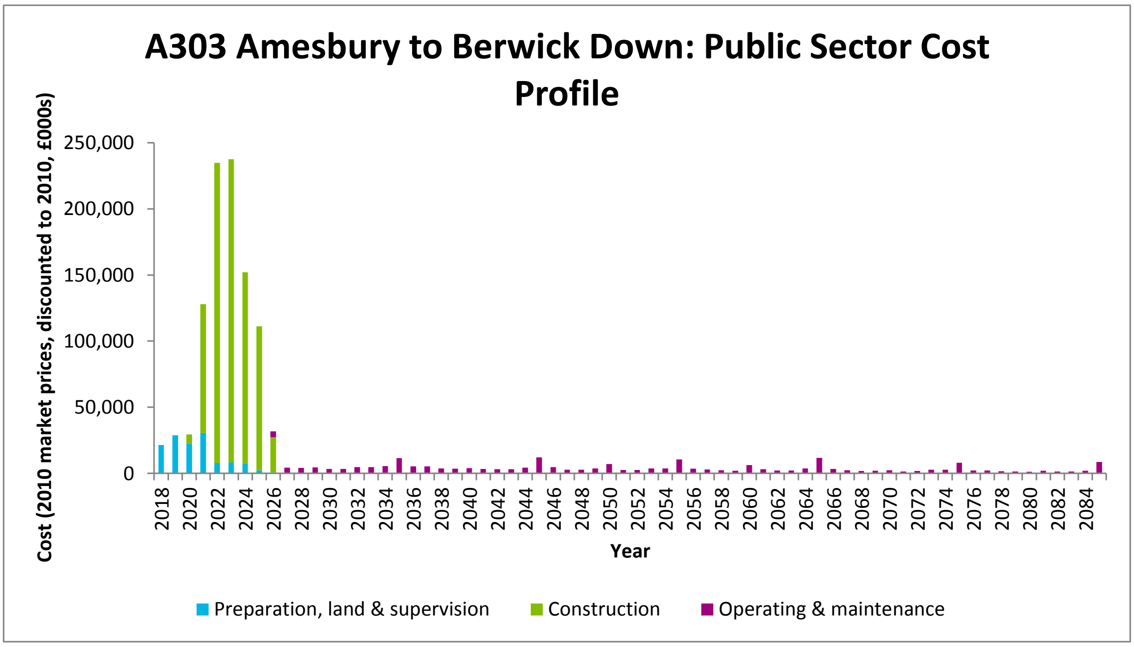


Figure 5-3: Cost profile of publicly funded scheme

5.3.14 Figure 5-4 presents the annual cost profile of the Scheme, in 2010 market prices and values, should the Scheme be funded through PF2 mechanisms. The annual unitary charge is shown in orange, decreasing in real, discounted terms over time. Due to the operating and maintenance (O&M) cost savings realised by Highways England through the PF2 contract, there are some small negative O&M costs during this period.

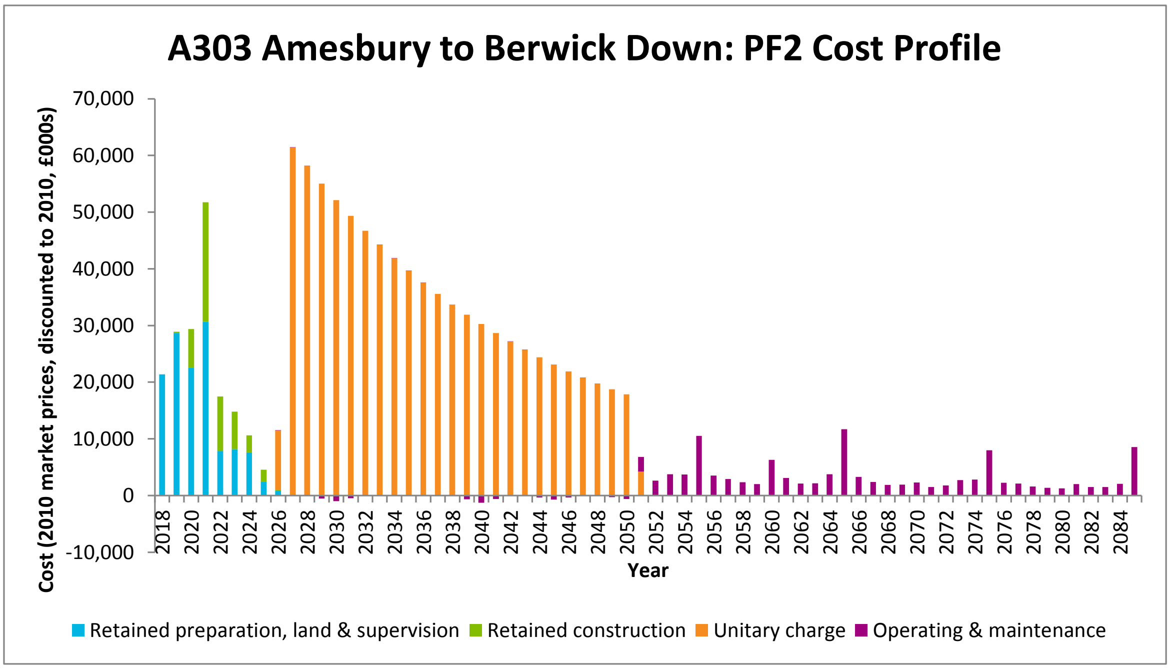


Figure 5-4: Cost profile of privately financed scheme

5.3.15 The Present Value of Costs (PVC) converted to 2010 prices, discounted to 2010 values and converted to the market price unit of account are summarised in Table 5-11 for both the publicly funded and privately financed solution.

Table 5-11: Scheme Present Value of Costs (£ million)

Cost Element	Public Sector Cost	PF2 Cost
Capital Expenditure	970	0
Retained Capital Expenditure	0	180
Unitary Charge	0	860
Operating Expenditure	235	109
Total	1,206	1,149

Presented in 2010 prices, discounted to 2010. Market price unit of account. Costs are rounded to nearest million.

6 Summary

6.1 Summary of the modelling impacts and economic appraisal

6.1.1 As part of PCF Stage 3, the A303 Amesbury to Berwick Down scheme, which includes a tunnel approximately 2 miles (3.3km) long and includes heritage mitigation with an approximately 150m wide green bridge and canopy and vertical retaining walls at the western end of the tunnel, has been appraised.

6.1.2 The Scheme has been assessed from the perspective of being either directly funded by the public sector or of being part-funded through private sector investment. A publicly funded scheme would require up-front expenditure to cover the costs of preliminary and construction works associated with the Scheme. Funding through investment from the private sector would require Highways England to pay an annual unitary charge to a DBFM contractor. This would form the bulk of the scheme costs to Highways England, with payments spread across 25 years following the scheme opening.

6.1.3 The appraisal of the Scheme showed that it results in lower and more reliable travel times on the A303 corridor as well as a reduction in the number of accidents and casualties on the network. As the Scheme slightly lengthens the A303 corridor there are disbenefits in vehicle operating costs.

6.1.4 The appraisal of the Scheme and its impacts has also shown that it is expected to produce benefits to the wider economy and to heritage. The summary of the scheme costs and benefits is shown in Table 6-1.

Table 6-1: A303 Amesbury to Berwick Down costs and benefits (£ million)

Component		Publicly Funded	Privately Financed
Costs	Capital expenditure*	970	180
	Unitary charge	0	860
	Operating expenditure*	235	109
	PVC	**1,206**	**1,149**
Initial PVB	TEE benefits (including construction), of which:	252	252
	(… Commuting user benefits)	*(…12)*	*(…12)*
	(… Other user benefits)	*(…61)*	*(…61)*
	(… Business user benefits)	*(…179)*	*(…179)*
	Indirect tax revenues	87	87
	Corporation Tax revenues	0	6
	Accident benefits	4	4
	Air quality	0	0
	Noise	0	0
	Greenhouse gas emissions	-86	-86
	Initial BCR	**0.21**	**0.23**
Adjusted PVB	Travel time reliability	61	61
	Wider Impacts	35	35
	Cultural heritage impacts	955	955
	Adjusted BCR	**1.08**	**1.14**

* Retained public sector costs under a PF2 contract

2010 market prices, discounted to 2010. Costs and benefits rounded to nearest million.

6.1.5 The following text follows the layout of the ComMA Summary Template.

High level benefits and costs

6.1.6 Table 6-2 presents the high level benefits and costs of the Scheme.

Table 6-2: High level benefits and costs

Benefit / Cost	Publicly Funded (£000s)	Privately Financed (£000s)
Present Value of Benefits (initial)	257,000	262,000
Present Value of Benefits (adjusted)	1,308,000	1,313,000
Present Value of Costs	1,206,000	1,149,000
Initial BCR	0.21	0.23
Adjusted BCR	1.08	1.14

2010 market prices, discounted to 2010. Costs and benefits rounded to nearest million.

Sources of costs

6.1.7 The costs used to determine the benefit to cost ratio and value for money are based on a scheme which includes a tunnel approximately 2 miles (3.3km) long, the construction of a northern bypass of Winterbourne Stoke and flyover at Countess roundabout and includes heritage mitigation with an approximately 150m wide green bridge and canopy and vertical retaining walls at the western end of the tunnel.

6.1.8 The Scheme could be funded directly by the public sector or part-funded through investment from the private sector through PF2 mechanisms. Estimates of scheme costs have been assessed for both of these funding strategies.

6.1.9 A publicly funded scheme would require up-front expenditure to cover the costs of preliminary and construction works associated with the Scheme. Additional expenditure would be required to operate and maintain the Scheme once it is open.

6.1.10 Should the Scheme be part-funded through private finance mechanisms, Highways England would pay an annual unitary charge to a DBFM contractor. This would form the bulk of the scheme costs to Highways England, spread across the assumed 25 years of the PF2 contract following scheme opening. It is assumed that Highways England would retain costs related to preliminary works for the Scheme as well as a share of the cost of operating and maintaining the Scheme.

6.1.11 Estimates of costs were received from Highways England commercial services. They were inflated and deflated to 2010 prices using the standard Highways England inflation forecasts as applied to all Major Projects. Final conversion to 2010 present values and market prices was undertaken in accordance with WebTAG guidance.

6.1.12 The total cost for a scheme funded directly by the public sector is approximately £1.2 billion in 2010 market prices, discounted to 2010. This includes nearly £1 billion in capital expenditure related to scheme construction and operational expenditure of approximately £235 million.

6.1.13 The overall cost of the Scheme when funded through PF2 mechanisms is approximately £1.1 billion in 2010 market prices, discounted to 2010. This includes the annual unitary charge payment, spread across 25 years post scheme opening and totalling approximately £860 million, as well as around £180 million in retained costs of preliminary works. Retained operational expenditure totals approximately £109 million.

Sources of benefits

6.1.14 Considering the current transport situation in the Scheme area, the nature of the A303 Amesbury to Berwick Down scheme, and its potential impacts on the economy, environment, tourism and social well-being, the key transport user benefits are derived from reductions to delays and improved travel times and journey time reliability along the corridor.

6.1.15 Other transport user benefits (and disbenefits) arise due to changes in the number of accidents; vehicle operating costs and associated tax revenues; and changes in greenhouse gas emissions, traffic noise and air quality. These are smaller in magnitude to the travel time benefits.

6.1.16 The Scheme also has wider impacts on the economy, resulting in benefits due to increased agglomeration and business output. This is due to the reductions in travel times, realised once the Scheme is implemented, increasing accessibility to areas of employment.

6.1.17 A significant benefit is expected to be realised through the removal of the current A303 from its position next to Stonehenge reducing noise, increasing tranquillity and reducing landscape severance in the WHS. One of the key objectives of the Scheme is to protect and enhance the WHS and the removal of the current highway is valued highly by current road users, visitors to Stonehenge and the general population in this regard.

Demand growth along the route (Do-Minimum)

6.1.18 Table 6-3 presents the forecast growth in annual average daily traffic (AADT) along the Scheme section in the without-scheme scenario.

Table 6-3: Demand growth along the Scheme section, Do-Minimum

Link	AADT (opening year)	AADT (design year)	AADT change (%)
A303: A36 to B3083	11,700	13,400	15%
A303: B3083 to A36	11,500	12,900	12%
A303: B3083 to A360	11,800	13,400	14%
A303: A360 to B3083	12,000	13,300	11%
A303: A360 to A345	14,300	16,000	12%
A303: A345 to A360	15,100	16,100	7%
A303: A345 to Salisbury Road	16,800	19,200	14%
A303: Salisbury Road to A345	15,100	17,100	13%
A303: Allington Track to A3028	18,500	21,400	16%
A303: A3028 to Allington Track	19,400	21,900	13%
A303: A3028 to A338	21,000	24,400	16%
A303: A338 to A3028	19,300	21,700	12%
Distance-weighted average	**14,900**	**16,800**	**13%**

AADT rounded to nearest 100.

Demand growth along the route (Do-Something)

6.1.19 Table 6-4 presents the forecast growth in annual average daily traffic (AADT) along the Scheme section in the with-scheme scenario.

Table 6-4: Demand growth along scheme section, Do-Something

Link	AADT (opening year)	AADT (design year)	AADT change (%)
A303: A36 to B3083	14,200	17,300	22%
A303: B3083 to A36	14,600	17,800	22%
A303: B3083 to A360	14,200	17,300	22%
A303: A360 to B3083	14,600	17,800	22%
A303: A360 to A345	18,500	22,700	23%
A303: A345 to A360	18,700	22,800	22%
A303: A345 to Salisbury Road	19,300	23,600	22%
A303: Salisbury Road to A345	17,700	21,400	21%
A303: Allington Track to A3028	20,500	24,600	20%
A303: A3028 to Allington Track	21,200	24,700	17%
A303: A3028 to A338	23,000	27,400	19%
A303: A338 to A3028	21,100	24,500	16%
Distance-weighted average	**17,700**	**21,400**	**21%**

AADT rounded to nearest 100.

Key monetised benefits and costs

6.1.20 Table 6-5 presents the key monetised benefits and costs, rounded to the nearest million, of the Scheme. It should be noted that consultation with the solutions workstream noted that maintenance would generally be undertaken overnight when affected traffic volumes are low and therefore assessment of the impacts of maintenance have not been undertaken.

Table 6-5: Key monetised benefits and costs

Category	Benefits and costs in £'000	
Business Users		
Journey Time Savings	205,000	
Vehicle Operating Costs	-6,000	
Non-Business users		
Journey Time Savings	165,000	
Vehicle Operating Costs	-76,000	
Reliability		
Business Reliability	15,000	
Non-business Reliability	46,000	
Safety		
Safety	4,000	
Environmental Impacts		
Noise	0	
Local Air Quality	0	
Greenhouse Gases	-86,000	
Landscape	Not assessed quantitatively	
Wider Economic Impacts		
Agglomeration	17,000	
Market Competition	17,000	
Dependent Development	No dependent development	
Labour Supply	1,000	
Customer Impact		
Traffic delays due to Construction	-35,000	
Traffic impacts due to Maintenance	Not assessed	
Journey Quality	Not assessed quantitatively	
Developer contributions		
Developer contributions	0	
Other Impacts		
Indirect tax Revenues	92,000	
[Other - please specify]	No other impacts	
Costs	Public funding	PF2 Funding
Cost to Broad Transport Budget:	1,206,000	1,149,000
Cost savings(where relevant)*	No relevant cost savings	

Benefits and costs in 2010 market prices, discounted to 2010. Rounded to nearest million.

Key quantified benefits and costs

6.1.21 Table 6-6 presents the key quantified benefits and costs of the Scheme. It should be noted that assessment of the impacts of maintenance have not been undertaken.

Table 6-6: Key quantified benefits and costs

Category	Quantified impacts	*Units*
Journey times		
Journey Time Savings	6	*(average saving per journey on scheme sections in minutes)**
Safety		
Accidents	5	*(total number saved)*
Fatalities	1	*(total number saved)*
Seriously injured	28	*(total number saved)*
Slightly injured	23	*(total number saved)*
Environmental Impacts		
Number of Noise important areas affected	5	*(number)*
Names of AQMAs	Not applicable	*(names)*
Change in NOx emissions	1,000	*(tonnes)*
Change in PM10 emissions	100	*(tonnes)*
Change in greenhouse gas emissions	1,956,000	*(tonnes CO2e)*
Customer Impact: Totals		
Traffic delays due to Construction	1,618,000	*(total loss on scheme sections in hours)*
Traffic impacts due to Maintenance	Not assessed	*(total impact on scheme sections in hours)*
Customer Impact: Per journey		
Traffic delays due to Construction (cars)	3	*(average loss per journey on scheme sections in minutes) **
Traffic delays due to Construction (LGVs)	3	*(average loss per journey on scheme sections in minutes) **
Traffic delays due to Construction (HGVs)	3	*(average loss per journey on scheme sections in minutes) **
Traffic impacts due to Maintenance (cars)	Not assessed	*(average impact per journey on scheme sections in minutes) **
Traffic impacts due to Maintenance (LGVs)	Not assessed	*(average impact per journey on scheme sections in minutes) **
Traffic impacts due to Maintenance (HGVs)	Not assessed	*(average impact per journey on scheme sections in minutes) **

*Defined as total saving or loss on all scheme sections per day divided by distance-weighted AADT on scheme sections

6.1.22 Table 6-7 presents the contribution of the Scheme to various key performance indicators (KPIs).

Table 6-7: Key performance indicators

Strategic Outcome	KPI	Scheme Contribution – Qualitative	Scheme Contribution - Quantitative
Making the network safer	The number of KSIs on the SRN.	The number of accidents and casualties on the A303 Amesbury to Berwick Down scheme section as well as the surrounding local roads are reduced by the Scheme. However, the impact of the Scheme on bringing additional traffic into the A303 corridor as a result of re-routeing and induced demand is to increase accidents on unimproved sections of the route. Overall, the number of accidents reduced by the Scheme dominates with a net reduction in forecast accidents and casualties.	Reduction in number of accidents: 5 Slight casualties saved by scheme: 23 Serious casualties saved by scheme: 28 Fatalities saved by scheme: 1
Delivery of better environmental outcomes	Noise: Number of Noise Important Areas mitigated. Biodiversity: Delivery of improved biodiversity, as set out in the Company's Biodiversity Action Plan.	Noise: Significant beneficial effect at 2 Noise Important Areas (NIAs) on the existing A303 in Winterbourne Stoke, which is bypassed by the Scheme. No significant effect at 3 NIAs on the A345 in Amesbury within 1km of the wider study area. Air quality: The Scheme would not result in a new exceedance of the NO2 or PM10 annual mean air quality objectives.	Not applicable
Helping cyclists / walkers and other vulnerable users	The number of new and upgraded crossings.	1 improved crossing (converted from underpass to signalised crossing). 4 new green bridges.	The Scheme will replace an existing underpass at Countess roundabout with an at-grade pedestrian crossing. Green bridges will provide traffic free access across the A303. The existing A303 between Winterbourne Stoke and Countess roundabout will be converted to a byway, passing over the A303 which is contained within a tunnel.

6.2 Consideration of results in light of scheme objectives

6.2.1 Table 6-8 below summarises the outcomes from the traffic and economics work which support the scheme objectives.

Table 6-8: Summary of objectives and outcomes

Objective	Outcome
Transport: To create a high quality route between the South East and the South West that meets the future needs of traffic	The traffic modelling work clearly demonstrates that the travel times are lower with the Scheme especially during the busiest periods. The forecast journey times are almost 20 minutes lower with the Scheme than without the Scheme on the section of the A303 between the A34 and the A36 as shown in Table 4-6. This demonstrates that the Scheme meets the future needs of traffic for uncongested and reliable journeys.
Economic Growth: To enable growth in jobs and housing by providing a free flowing and reliable connection between the South East and the South West	The wider impacts within the economy which have been estimated demonstrate that the Scheme will have a positive impact on agglomeration and productivity – see Table 5-9. This positive impact is a function of more efficient business operations and more people in employment.
Cultural Heritage: To help conserve and enhance the World Heritage Site (WHS) and make it easier to reach and explore	The WHS becomes easier to reach as demonstrated by reduced journey times on the A303 corridor from the A34 – A36 which is the main route from London and other major centres of population and tourist activity. The contingent value placed upon the removal of the highway and traffic from the WHS shown in Table 5-10 demonstrates the value placed upon the ability of the Scheme to conserve and enhance the WHS.
Environment and Community: To improve biodiversity and provide a positive legacy for nearby communities	The most prominent community benefit in relation to traffic forecasts is the removal of longer distance trips from the local network especially in the busiest periods. The Scheme provides a more direct and reliable route than diverting onto the local network which is presently a feature of busy periods. Traffic with the Scheme in place remains on the A303 and does not seek alternative routes. The scale of the reduction is shown in Figure 4-2.

6.2.2 Table 6-8 summarises how the evidence from the traffic models and the economic appraisal supports the argument that the Scheme meets the objectives it has been set.

Abbreviations List

AADT	Annual Average Daily Traffic
AAJV	Arup Atkins Joint Venture
ABP	Army Basing Programme
AM	Morning peak
AMCB	Analysis of Monetised Costs and Benefits
AmW	AECOM, mace and WSP – Technical Partner to Highways England
ANPR	Automatic Number Plate Recognition
AQMA	Air Quality Management Area
ATC	Automatic Traffic Count
BCR	Benefit to Cost Ratio
BYFM	Base Year Freight Matrices
CIP	Complex Infrastructure Project
CO2e	Carbon Dioxide equivalent
COBALT	Cost and Benefits to Accidents – Light Touch
ComMA	Combined Modelling and Appraisal
CSR	Client Scheme Requirements
CSRGT	Continuing Survey of Road Goods Transport
DBFM	Design, Build, Finance and Maintain
DCO	Development Consent Order
DfT	Department for Transport
FMA	Fully Modelled Area
GDP	Gross Domestic Product
GPS	Global Positioning System
HAM	Highway Assignment Model
HGV	Heavy Goods Vehicle
IP	Interpeak period
ITN	Integrated Transport Network

KPI	Key Performance Indicator
LGV	Light Goods Vehicle
MCO	Moving Car Observer survey
MCTC	Manual Classified Turning Count
MoD	Ministry of Defence
MSOA	Middle Super Output Area
NCSD	National Coach Services Database
NIA	Noise Important Area
NOx	Nitrogen Oxides
NSIP	Nationally Significant Infrastructure Project
NTEM	National Trip End Model
NTS	National Travel Survey
O&M	Operations and Maintenance
OD	Origin-Destination
OP	Off-peak period
OS	Ordnance Survey
PA	Public Accounts
PF2	Private Finance Contract
PCF	Project Control Framework
PINS	Planning Inspectorate
PM	Evening peak period
PM10	Particulate Matter with diameter smaller than 10μm
PPK	Pence Per Kilometre
PPM	Pence Per Minute
PVC	Present Value of Costs
RIS	Roads Investment Strategy
RoF	Region of Focus
RSI	Roadside Interview

RTF	Road Traffic Forecasts
RTM	Regional Traffic Model
SoW	Start of Works
SRN	Strategic Road Network
SWRTM	South West Regional Traffic Model
TDCR	Traffic Data Collection Report
TEE	Transport Economic Efficiency
TEMPro	Trip End Model Programme
TEN-T	Trans-European Network – Transport
TIS	Traffic Information System
TMU	Traffic Monitoring Unit
TNDS	Traveline National Data Set
TPG	Highways England's Transport Planning Group
TSGB	Transport Statistics Great Britain
VDM	Variable Demand Model
VfM	Value for Money
VOC	Vehicle Operating Cost
VoT	Value of Time
WebTAG	Web-based Transport Analysis Guidance
WebTRIS	Highways England's web-based Traffic Information System
WHS	World Heritage Site

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