highways england

A303 Stonehenge

Amesbury to Berwick Down
Scheme Assessment Report

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Foreword

The A303/A358 corridor is a vital connection between the South West and London and the South East. While most the road has been dualled, there are still over 35 miles (56 km) of single carriageway. These sections act as bottlenecks for users of the route resulting in congestion, particularly in the summer months and at weekends, causing delays to traffic travelling between the M3 and the South West and an increased risk of accidents. The A303 passes through the Stonehenge, Avebury and Associated Sites World Heritage Site, severely limiting the enjoyment of the wider site.

The A303 Stonehenge – 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 dual-carriageway expressway. The A303/A358 package was identified in the 2014 National Infrastructure Plan as one of the country's top 40 priority infrastructure projects.

This Scheme Assessment Report (SAR) is produced as part of Highways England's Project Control Framework (PCF - Stage 2 Option Selection) "to provide a summary of the Technical Appraisal Report (TAR) and the Report on Public Consultation and to recommend a preferred option". In arriving at the recommendation, the SAR describes the options assessment that has been undertaken since the public consultation was held in early 2017.

Executive Summary

Purpose of report

This Scheme Assessment Report (SAR) summarises the feedback on the route options taken to consultation, presents the development of modifications to the route options to incorporate the consultation feedback, reports on the appraisal of the modified route options and recommends a Preferred Route for the scheme.

Problems and opportunities

The A303 Stonehenge, Amesbury to Berwick Down scheme will address the following issues:

- **Stonehenge, Avebury and Associated Sites World Heritage Site (WHS)** – At its closest point the existing A303 passes within 165 metres of the Stonehenge monument and creates highly intrusive sights and sounds of traffic, detracting from an otherwise tranquil rural setting for the Stones. The existing A303 runs through the heart of the WHS dividing it in two. This impacts on people's experience and understanding of the WHS, by limiting the safe mobility of visitors and opportunities to explore the area south of the A303.
- **Local and regional economy** – The A303 is a strategic route to the South West. Enhancing this corridor will deliver region-wide economic benefits by improving regional connectivity, facilitating planned growth in housing and jobs, and by improving the perceptions of tourists who use the A303 to travel to the region.
- **Strategic traffic issues** – This section of the A303 operates at almost twice its capacity with an Annual Average Daily Traffic (AADT) of 24,000 vehicles. The congestion experienced at weekends and during the summer months' results in lengthy delays for users, with increased journey times westbound past Stonehenge of up to an hour.
- **Local traffic issues** – Local communities are directly affected both by traffic on the A303, and that which is seeking to avoid congestion and delays on the main route by using the local network. This has a severe impact at busy times. For example, on a typical Friday in August, traffic volumes on the B3086 through Shrewton are around 60% higher than on a normal weekday.
- **Safety** –The rate of personal injury accidents on this section of the A303 is higher than the national average for A roads.
- **Environment and community** – The A303 passes through a rural area of gentle rolling chalk downland with expansive views. The tranquillity of the landscape in the WHS is disturbed by views of traffic on the A303 and the associated constant background noise. The A303 passes through the village of Winterbourne Stoke, much of which is a Conservation Area to the south of the road. Existing road safety and traffic calming infrastructure have a damaging effect on the character and setting of the village. High traffic noise levels impact on the quality of everyday life for residents.
- **Local communities and the WHS** – The A303 creates a physical barrier between the WHS and the local community of Amesbury. The scheme presents an opportunity to reconnect Amesbury with the WHS.

Scheme objectives

The scheme objectives have been formulated both to address the identified problems and to take advantage of the opportunities that new infrastructure would 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:

- **Transport** – To create a high-quality route that resolves current and predicted traffic problems and contributes towards the creation of an Expressway between London and the South West.
- **Economic growth** – In combination with other schemes on the route, to enable growth in jobs and housing by providing a free flowing and reliable connection between the South East and the South West peninsula.
- **Cultural heritage** – To contribute to the conservation and enhancement of the WHS by improving access both within and to the site.
- **Environment and community** – To contribute to the enhancement of the historic landscape within the WHS, to improve biodiversity along the route and to provide a positive legacy to communities adjoining the road.

Success will constitute the delivery of a scheme which aligns with and realises these objectives.

Stage 1 Options identification

A three-stage process of options identification and sifting was undertaken, to develop and shortlist route options for detailed appraisal and determination of the route options to take to public consultation, as shown in Figure 1.

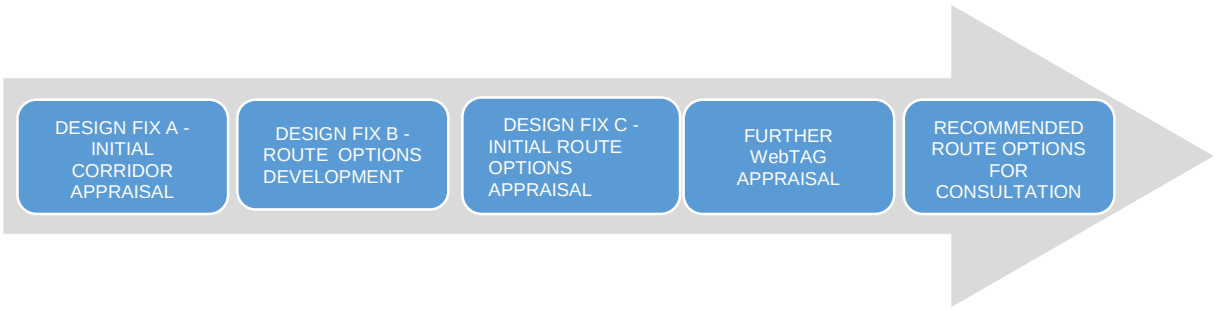


Figure 1 Options identification process

From the option development, sifting and appraisal undertaken, the route options taken forward for public consultation were as follows and as shown in Figure 2.

- **Route Option 1N (Northern Bypass)** – comprising a 2.9km long tunnel with route running north of Winterbourne Stoke.
- **Route Option 1S (Southern Bypass)** – comprising a 2.9km long tunnel with route running south of Winterbourne Stoke.

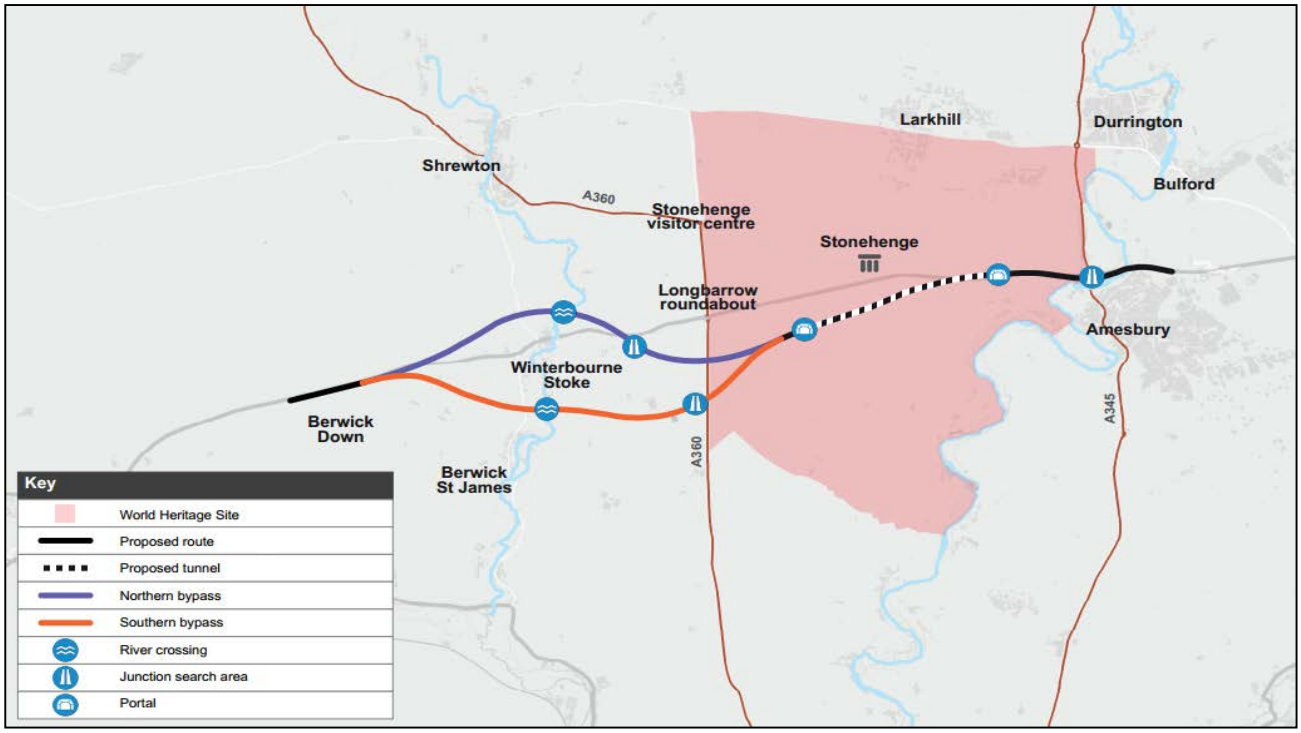


Figure 2 Consultation proposals for the A303 Stonehenge: Amesbury to Berwick Down

Public Consultation

The principal purposes of the non-statutory public consultation, were to (a) inform the public about the proposals being considered for the A303 Stonehenge scheme and (b) receive feedback to inform the decision-making on the choice of Preferred Route.

The main features of the scheme, from west to east, on which views were invited were as follows:

- A bypass north or south of Winterbourne Stoke, with a new viaduct crossing of the Till Valley.
- A new grade-separated junction between the A303 and A360, also accommodating access from Winterbourne Stoke to the A303.
- A 2.9 kilometre (1.8 mile) long, twin-bore tunnel, with west and east portals located within the World Heritage Site, but out-of-sight from Stonehenge.
- A new grade-separated junction between the A303 and A345.

There were more than 9,000 responses to the consultation, either via questionnaire responses, email or letter correspondence, or proforma-type email responses, using templates provided by Friends of the Earth or the Stonehenge Alliance expressing opposition to the scheme proposals.

Of the questionnaire responses, 51% strongly agreed or tended to agree with the proposals, and 43% strongly disagreed or tended to disagree. Of those expressing a preference for the choice of route for bypassing Winterbourne Stoke, nearly two-thirds preferred the northern option.

The key considerations raised from the consultation that have informed the selection of the Preferred Route, can be separated into those relating to the route of the bypass of Winterbourne Stoke, and the route through the western part of the WHS. These are summarised in the Table 1-1 below**.**

Table 1-1 Key Considerations for the Preferred Route selection

Route section	Key considerations
North vs. South of Winterbourne Stoke	• Impacts on the communities of Winterbourne Stoke and Berwick St James, including the effects of traffic noise. • Environmental impacts on protected sites, including the River Till Special Area of Conservation (SAC) & Site of Special Scientific Interest (SSSI), Parsonage Down National Nature Reserve/SAC/SSSI and the scheduled Barrow Groups north of Winterbourne Stoke. • Landscape considerations, in terms of integrating the new road into the local topography and minimising the visual and physical intrusion of the viaduct crossing of the Till. • Ease of road access to and from Winterbourne Stoke and Berwick St James and avoiding the possibility of generating rat-running traffic using the B3083 from Shrewton. • Effects on local businesses and amenities.
Route through western part of WHS	• Effects on the Outstanding Universal Value (OUV) attributes of the WHS, due to impacts of the western tunnel portal and the route on the integrity and authenticity of the Neolithic and Bronze Age funerary landscape. • Impact on the winter solstice alignment viewed from Stonehenge, as perhaps the single-most important sightline in the WHS. • Damage to undiscovered buried archaeology. • Impact on the RSPB reserve on Normanton Down. • Effects due to junction locations with the A360 adjacent to the WHS.

Development of Route Options following Public Consultation

A programme of further archaeological surveys was undertaken following public consultation, to inform the continuing appraisal of options. Along the Option 1S corridor, these surveys identified several possible round barrows within ‘The Park’ just to the west of the A360, a possible Roman settlement just west of the River Till and a possible network of buried archaeology to the south of The Diamond in the WHS.

Earlier surveys identified two Neolithic long barrows and a henge-type enclosure along the route of Option 1N. This newly found archaeology was considered by Historic England and the National Trust to be of schedulable quality, causing them to describe the grouping as a new “Diamond Barrow Group”. The Option 1N route would run through this newly identified barrow grouping and was therefore no longer considered to be an acceptable

route by Historic England and the National Trust, as was made clear in their consultation responses.

The findings of these surveys, along with the considerations raised from the public consultation, were used in reviewing the route options presented for consultation to determine what improvements could be made to them. The review considered various modifications to Options 1N and 1S and, from it, three options were shortlisted for further appraisal. They are summarised as follows and shown on Figure 3 below.

- **Option 1Na –** As per previous Option 1N but with a local horizontal realignment to the west of the WHS through Oatlands Hill and across the existing A303; with an approximate 2.9km long tunnel and 300m cut and cover tunnel extension at the western portal within the WHS; and with the new road in cutting between the western tunnel portal and the western boundary of the WHS. The new A360 junction would be located close to the crossing of the existing A303 as with Option 1N, with the existing Longbarrow Roundabout replaced by a simple 'T' junction.
- **Option 1Nd** – A variation on Option 1N with a similar approximate 2.9km long tunnel and 300m cut and cover tunnel extension at the western portal within the WHS but with the western portal moved north to a location just to the south of the existing A303 and with the new road in cutting between the western tunnel portal and the western boundary of the WHS. The new A360 junction would be located closer to the existing A360 than with Option 1N, replacing the existing Longbarrow Roundabout.
- **Option 1Sa –** As per previous Option 1S with a similar approximate 2.9km long tunnel and a 300m cut and cover tunnel extension at the western portal within the WHS and with the new road in cutting between the western tunnel portal and the western boundary of the WHS and The Park to the west. The new A360 junction would be located close to the existing A360 within The Park as with Option 1S.

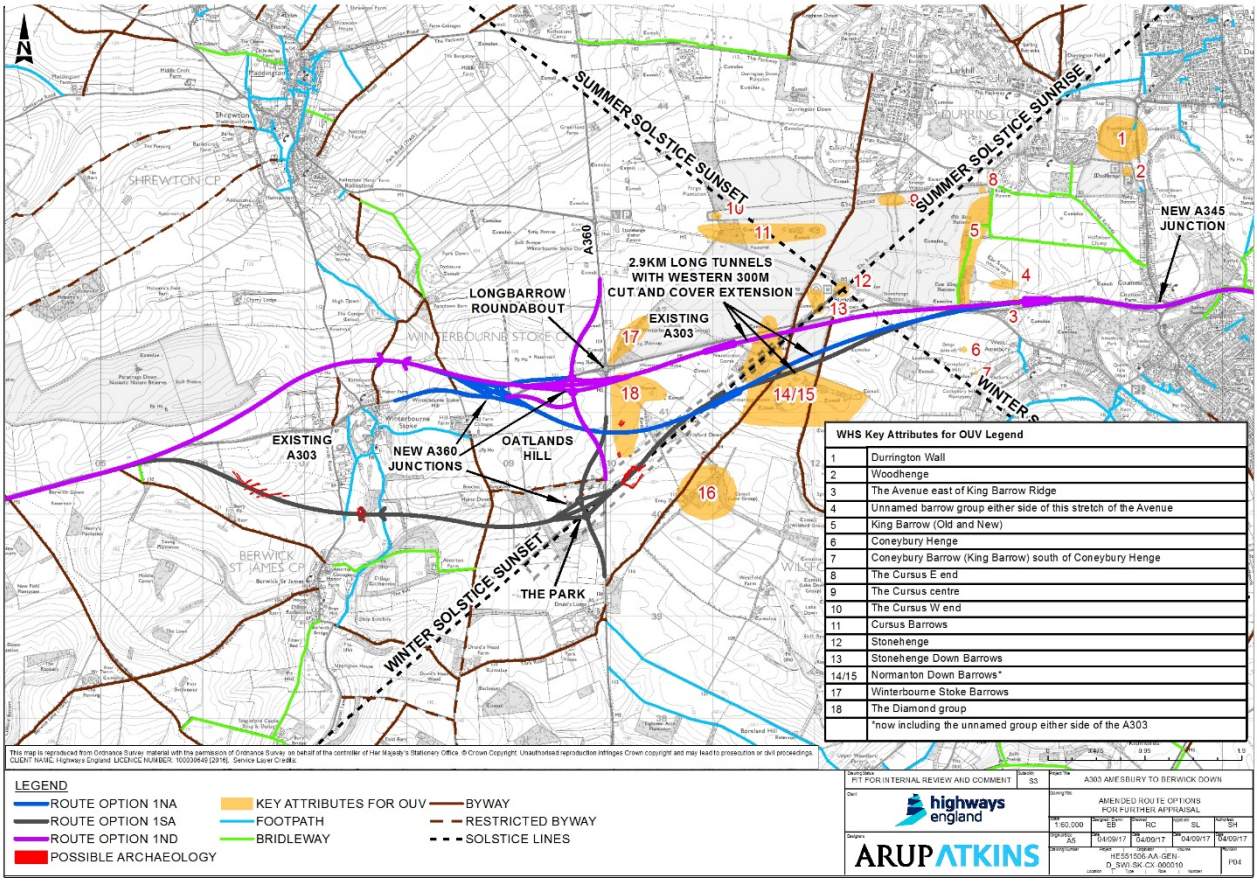


Figure 3 Modified route options

Assessment of Modified Route Options

Engineering and safety assessment

The engineering design of all options was based on the DMRB for an all-purpose road with a 120kph design speed to Expressway Standards and all would therefore perform similarly in terms of engineering assessment.

In relation to Construction, Design, and Management safety assessment, all route options would involve similar tunnel and viaduct construction; these involve significant but manageable construction risks. Construction safety is not a differentiator between options.

Traffic and journey times

All options would have a positive impact on road safety as the existing A303 has a higher than average accident record for A roads and all options would provide the same safe increases in capacity.

Option 1Nd would be approximately 0.3km shorter than Options 1Na and 1Sa. There would therefore be marginally shorter journey times and slightly improved safety performance on the route itself because of its shorter length.

Scheme Costs

Indicative, most likely, scheme outturn costs are similar for all route options at between £1.5bn and £1.6bn.

Economic assessment

The results of the economic assessment are similar for all three options. All options would be expected to deliver 'medium' Value for Money with a Benefit to Cost Ratio of around 1.7.

Operational, technology and maintenance assessments

In terms of performance against the assessment criteria relating to operation, technology and maintenance, all options would perform similarly.

Environmental assessment

The SAR provides a comparison of the three route options informed by both a full WebTAG appraisal of each option and a more detailed comparison based on DMRB Guidance to inform the process, focussing on those environmental aspects, particularly historic environment, landscape, biodiversity, and people and communities, and locations where the potential impacts of options 1Na, 1Sa and 1Nd are likely to differ.

In relation to the Historic Environment and the WHS, there is a preference for Option 1Nd. This is on the basis that the alignment would facilitate a preferred exit route from the WHS through a shallow topographic shoulder of land in proximity to the Winterbourne Barrow Group that would avoid:

- Concerns about conflicts with the Winter Solstice Sunset alignment (as viewed from Stonehenge) arising with Option 1Sa;
- The need for a large cutting through Oatlands Hill, that would be required for Option 1Na, that would result in a greater impact on the setting of the WHS and many scheduled monuments, as well as the open landscape character and views from visual receptors on Public Rights of Way (PRoW), local roads and open access land; and
- Impacts on several newly discovered archaeological sites.

Option 1Nd would also provide more opportunities for mitigation of impacts on the OUV of the WHS through design development of the route.

In relation to the wider environment and local community, the route alignment of 1Nd would result in a lesser impact on several key environmental receptors, as follows:

- Lower risk of adverse effects to the River Avon SAC/River Till SSSI, and the aquatic ecology of the River Till, when compared with Option 1Sa which would cross the River Till at a location which is considered more likely to support the qualifying species for the River Avon SAC, as well as other protected and notable species.
- Avoids the more complex valley landscape to the south of Winterbourne Stoke that would be affected by 1Sa, and affects the visual amenity of fewer residential and leisure receptors near Winterbourne Stoke and Berwick St James than would be affected with 1Sa.
- Avoids direct impacts on landscape features, e.g. The Diamond and the wooded enclosure to the Park, and is located further from the RSPB Normanton Down Nature Reserve, reducing the potential for adverse effects on protected and notable species, including Stone Curlew, when compared with Options 1Na and 1Sa.

- Located closer to the current A303 than Options 1Na and 1Sa through the western part of the WHS, in an area already disturbed by existing infrastructure.

Based on the above, Option 1Nd is the preferred option from an environment and cultural heritage perspective.

Social impact assessment

The Social Impacts assessment on the modified route options considered the impact on residents and users of the transport network. The assessment confirmed no significant differences between the three route options, with a slight preference for options to the north of Winterbourne Stoke.

Distributional impacts assessment

The distributional impacts assessment considered the variance of transport intervention impacts across different social groups. Overall, there would be no significant difference in impact between the three route options.

Client Scheme Requirements

The performance of the route options was assessed against the Client Scheme Requirements (CSR) and the relevant national and local policy objectives. The results of the CSR assessment showed, in overall terms, all route options would have a strong alignment with the CSRs and the relevant national and local policy objectives.

Appraisal Summary

Appraisal Summary Tables (ASTs) have been produced for each of the three route options in line with WebTAG and DMRB guidance, to collate all the assessments against the criteria of Economy, Environmental, Social and Distributional impacts and Public Accounts.

Consultation Responses Assessment

Each of the options have also been considered against the key considerations raised from consultation and given a ranking from 1 to 3, with a rank of “1” representing the best performing option. This is presented in Table 1-2 below. No weighting was applied to the rankings, with each impact being given equal importance.

The table is not a summary of the environmental assessment. The table aims to provide an overall understanding of how the headline considerations raised at consultation are addressed comparatively by the options and can potentially be differentiated across options.

The table shows that Option 1Nd is the best performing option against the consultation response considerations.

Table 1-2 Ranking of route options against key considerations raised at public consultation

Key Considerations from Public Consultation	Option 1Na	Option 1Nd	Option 1Sa
Impact on local communities of Winterbourne Stoke(WBS)/Berwick St James (BSJ)	1	1	2
Access to and from WBS/BSJ via the new A360 junction and minimising rat running	2	1	2
Impact on local businesses and amenities	2	1	3
Biodiversity Issues	2	1	2
Historic Environment Issues	3	1	2
Landscape and Visual Issues	2	1	1
Engineering and Safety Assessment (inc. route length, earthworks strategy, and maintenance)	2	1	2

Programme

All route options could be delivered to the same delivery programme.

The Preferred Route

On the basis of the appraisal and assessment work that has been undertaken, Option 1Nd is the recommended Preferred Route and is shown below in Figure 4.

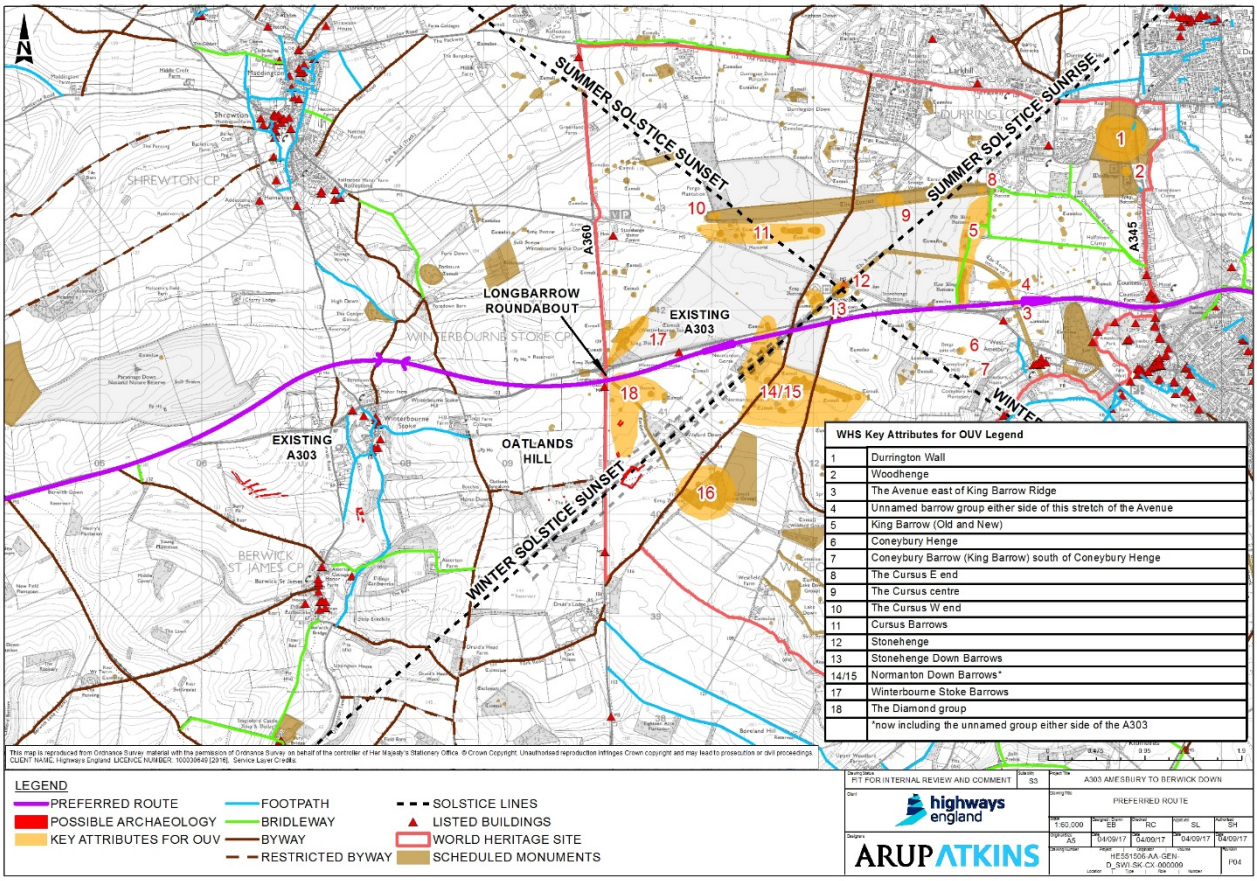


Figure 4 Recommended Preferred Route

1. Introduction

1.1 Purpose of this Report

1.1.1 This Scheme Assessment Report (SAR):

- Provides a summary of the scheme's history and explains the existing conditions along the study area.
- Summarises the options identification process detailed in the scheme's Technical Appraisal Report.
- Summarises the Report on Public Consultation.
- Presents the development of route options taking into consideration public consultation feedback.
- Reports on the appraisal of route options, including policy, engineering, safety, traffic, economic, cost, operational, technology & maintenance, environmental, social and distributional impact assessments.
- Recommends a Preferred Route.

1.1.2 This report has been produced by an Arup Atkins Joint Venture (AAJV), who were commissioned by Highways England to complete Project Control Framework (PCF) Stages 1 (option identification) and Stage 2 (option selection). At the conclusion of PCF Stage 2, Highways England makes a recommendation of a Preferred Route to the Secretary of State (SoS) for Transport. The SoS considers the recommendation and decides which option is chosen as the Preferred Route, which will be made public in a 'Preferred Route announcement' (PRA).

1.1.3 Following PRA, the Preferred Route will be developed in more detail during PCF Stage 3 (preliminary design), including further public consultation, for submission of a Development Consent Order (DCO) during PCF Stage 4 (statutory procedures and powers).

1.2 Scheme Context

1.2.1 The A303 Amesbury to Berwick Down scheme forms part of the A303/A30 trunk route, as illustrated in Figure 1-1. The route provides vital east-west connectivity between London and the South West and is also part of the Trans-European Network-Transport (TEN-T).

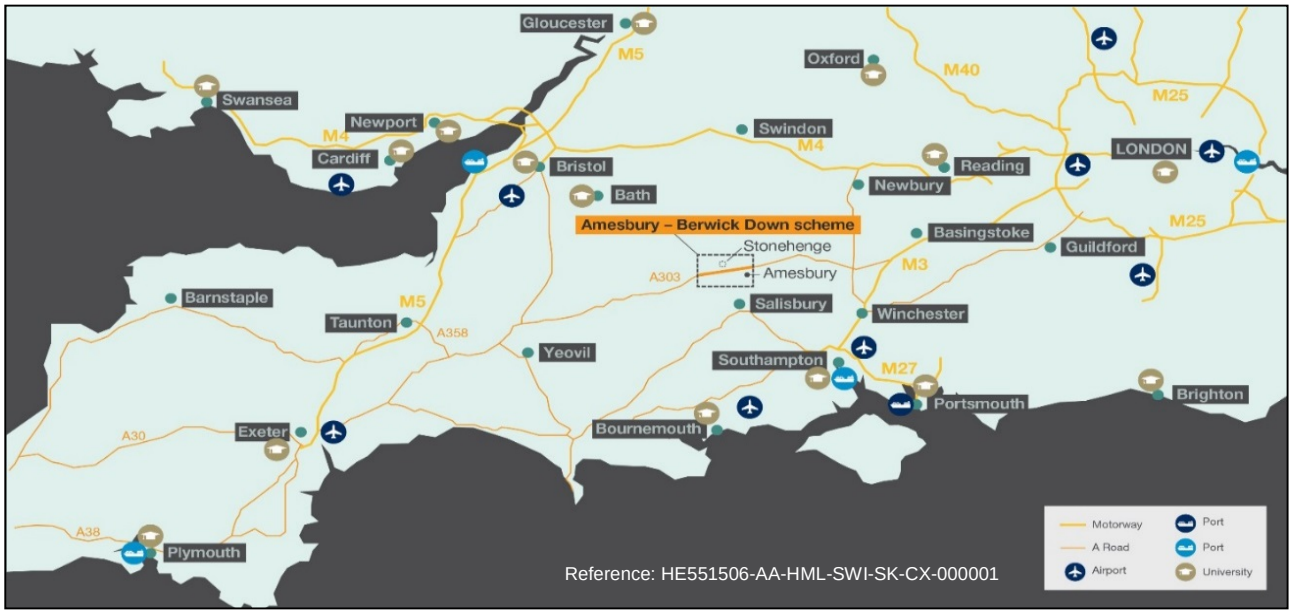


Figure 1-1 A303/A30 trunk route and Amesbury to Berwick Down scheme

1.2.2 The A303 runs for approximately 150km from Junction 8 of the M3 near Basingstoke towards Taunton and Exeter. After 135km, the A303 reaches Ilminster and the Southfields Roundabout junction with the A358, which then continues for 15km to Taunton and Junction 25 with the M5. The A303 continues towards Exeter, passing through the Blackdown Hills Area of Outstanding Natural Beauty (AONB). About 10km before Honiton it joins the A30 and then continues as the A30 for some 35km to J29 with the M5 at Exeter. From here the A30 continues for another 175km to Penzance.

1.2.3 As well as serving long distance traffic, the A303 also serves intermediate regional and sub-regional destinations via connecting major north-south route options, including:

- A34 trunk road which runs between Southampton and the Midlands, carrying considerable freight traffic to and from the port.
- A338 principal road which runs from Bournemouth, via Salisbury, towards Marlborough and Swindon.
- A345 secondary road which connects Salisbury and Marlborough.
- A360 secondary road which links Salisbury and Devizes.
- A36 trunk road which links Southampton and Salisbury with Warminster, Trowbridge and onwards to Bath and Bristol.

- A350 principal road which runs from Poole, via Blandford Forum, Shaftesbury and Warminster, towards Trowbridge and on to Chippenham.
- A37 principal road which connects Weymouth, Dorchester and Yeovil to Bristol.

1.2.4 The A303 also has an important local function - providing access to various small and medium sized settlements along the route.

1.2.5 The A303 'spine', and its wider network connections, are therefore vital to the economic prosperity of the South West by enabling the efficient movement of people and goods. However, current levels of service do not reflect the importance of the route as part of the Strategic Road Network (SRN). In particular, there are several single carriageway sections (totalling more than 55km) where customers suffer unreliable journeys, with long delays and an increased risk of accidents. Congestion problems are acute on weekends and during summer months, when over an hour can be added to a typical journey from London to Exeter. This causes disruption for many of the six million visits to the South West made annually via the A303 by residents of London and the south-east, as well as many of the two million overseas visitors to the region.

1.2.6 An economic impact assessment carried out in July 2016 by PricewaterhouseCoopers estimated that upgrading the corridor to dual carriageway standard between the M3 and Taunton, in conjunction with other road infrastructure improvements, could lead to the creation of 11,500 jobs by 2040 and increase GDP by £3.3bn over 60 years.

> *'Transformation of the A303/A30/A358 route to the south-west will revolutionise perceptions of the region's accessibility, bring about a step-change in unlocking our area's competitive potential and deliver a more prosperous economy'* [24]
>
> Chairman of the Heart of the south-west Local Enterprise Partnership

Expressway to the South West

1.2.7 Recognising the importance of the A303/A30/A358 Corridor and the problems along it, the Government has committed in its Road Investment Strategy (RIS) [1] to create an 'Expressway' to the South West via the A303/A358 route by 2029. The Expressway is intended to transform connectivity to and from the South West, providing a consistent and dependable service to customers. A key aspiration is to achieve 'mile-a-minute' journey times by creating free-flowing traffic conditions along the whole route.

1.2.8 Creating the Expressway involves upgrading the A303/A358 route between the M3 and Taunton to dual carriageway standard and upgrading junctions to remove congestion bottlenecks. A series of eight major improvement schemes along the A303/A358 was identified as part of an overall investment package for the entire A303/A358/A30 corridor. The eight schemes along the A303/A358 route are illustrated in Figure 1-2 below, along with the section of A303/A30 from Southfields to Honiton, which will not be part of the Expressway, but where smaller-scale measures are proposed to improve safety and journey quality for road users.

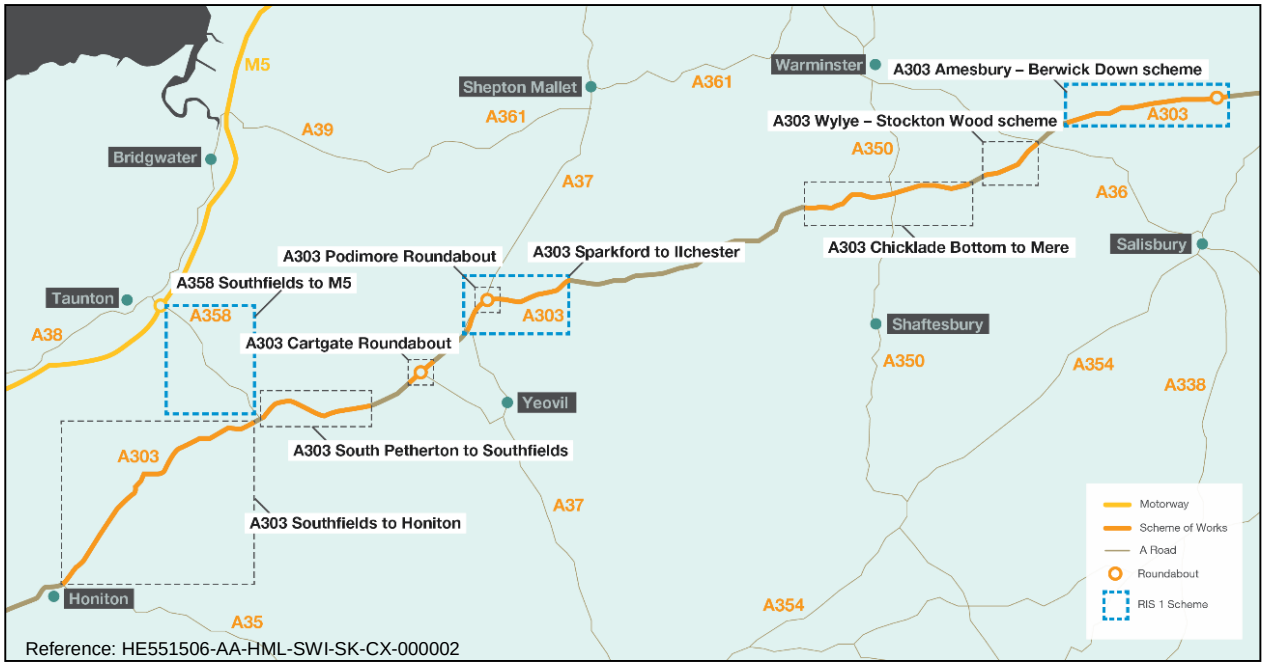


Figure 1-2 Schemes to deliver an Expressway to the South West

1.2.9 Within the RIS, three major improvements were prioritised and committed to start before the end of the first RIS period (2015/16 to 2019/20):

- Dualling the A358 between Taunton and Southfields.
- Dualling the A303 between Sparkford and Ilchester.
- Dualling the A303 between Amesbury and Berwick Down, including the construction of a tunnel at least 2.9km long as the road passes Stonehenge.

1.2.10 This sets the wider strategic context for the Stonehenge scheme, which has an extensive background history in the search for an affordable, acceptable solution, as described below.

1.3 Scheme History

1.3.1 Proposals for the improvement of the A303 between Amesbury and Berwick Down have been the subject of extensive study and consultation since 1991. The main events providing background context to the current scheme are as follows, with further detail below.

- 1991-93: Initial route identification
- 1993: Public Consultation
- 1994-95: Further route identification
- 1995: Planning Conference
- 1996: Scheme withdrawn from Roads Programme
- 1998: Scheme re-introduced to Roads Programme
- 1999: Public Consultation

- 1999: Preferred Route announced (with 2km cut-and-cover tunnel)
- 2000-02: Review of tunnel options
- 2002: 2.1km bored tunnel announced
- 2003-04: Draft Orders and Public Inquiry
- 2005-07: Post-Inquiry Scheme Review
- 2007: Scheme withdrawn from Roads Programme
- 2013: New Visitor Centre opened for Stonehenge
- 2014: A303/A30/A358 Corridor Feasibility Study
- 2014: Scheme re-introduced to Roads Programme

1.3.2 **1991-93: Initial route identification** - Over 60 possible route options were considered for the scheme; the range of options is illustrated in Figure 1-3 below. Shortlisted options were selected for presentation to the Landscape Advisory Committee (LAC) in July 1992, whose advice indicated a preference for a northern bypass of Winterbourne Stoke (Red or Blue route) and a 500m long tunnel past Stonehenge (Yellow route). The Grey (surface) route was recommended for further consideration if the Yellow (tunnel) route was rejected.

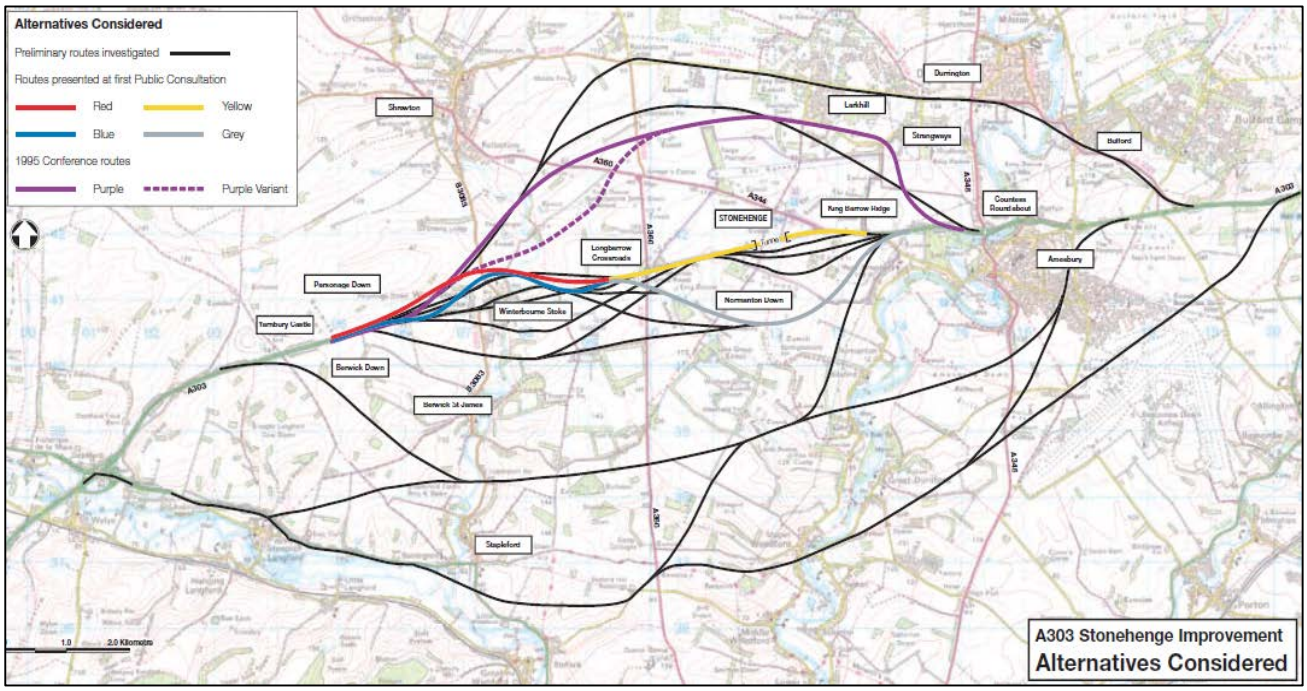


Figure 1-3 Examples of alternative routes considered [2]

1.3.3 **1993: Public consultation** - Following the recommendations of the LAC, the Red, Blue, Yellow and Grey route options were taken forward for Public Consultation in April 1993. No consensus on a preferred solution was reached so it was decided to investigate further options.

1.3.4 **1994-95: Further route identification** - In February 1994, the Royal Fine Art Commission (RFAC) stated that the Grey route would impinge on the fine but not

unique landscape, but believed it would "provide a humane solution for the motorist which the long tunnel would not" [3]. They considered that partial tunnelling could address the problem of National Trust inalienable land and encouraged further investigation of northern route options. Then, in July 1994, a one-day international conference was hosted by English Heritage and the National Trust to debate solutions both for a road improvement and a new visitor centre for Stonehenge. The Yellow and Grey route options were withdrawn by the Minister for Transport at the conference because of widespread concerns regarding their environmental impact on the WHS. The finding of the conference was in favour of further investigation of northern route options and longer tunnel solutions, which led to the Purple route options being developed.

1.3.5 **1995: Planning conference** - In September 1995, the Highways Agency held a Public Exhibition on the new route options. Additionally, an independently chaired Planning Conference was held in November 1995 to explore and debate options. The Conference rejected the surface northern route options, because their impacts were deemed unacceptable, and instead supported, in principle, a 4km long tunnel under the WHS, but recognised the difficulty of funding such a scheme from the Roads Programme. The Conference also recognised the urgent need for a bypass of Winterbourne Stoke.

1.3.6 **1996: Scheme withdrawn from roads programme** - The 4km long tunnel solution favoured by the Planning Conference was not considered an affordable solution, even recognising the importance of the WHS. The Government made it clear that, without an alternative source of funding being found, there was no prospect of the longer tunnel solution being pursued. The scheme was therefore withdrawn from the Roads Programme in 1996.

1.3.7 **1998: Scheme re-introduced to roads programme** - Proposals were reviewed in an attempt to find an acceptable, affordable solution. The Stonehenge Improvement (including the Winterbourne Stoke Bypass) with a 2km cut-and-cover tunnel was announced as an 'Exceptional Environmental Scheme' in 'A New Deal for Trunk Roads in England' in July 1998 [4]. The support of English Heritage and the National Trust meant that it was seen as being deliverable. However, the higher cost and lower economic return of this tunnel option meant that at least a third of the funding was to be provided from heritage sources, in recognition that the tunnel was being provided specifically to secure environmental benefits for Stonehenge WHS.

1.3.8 **January 1999: Public consultation** - The scheme announced in July 1998 formed an integral part of the Government's vision for the WHS as set out in the 'Stonehenge Master Plan' [5], which included a proposed new Visitor Centre adjacent to the A303/A345 Countess Roundabout. Public Consultation commenced in January 1999. There was general support between stakeholders on the significant environmental benefits afforded to the WHS by the 2km cut-and-cover tunnel, with only limited opposition.

1.3.9 **June 1999: Preferred route announcement** - A Preferred Route, incorporating an on-line 2km cut-and-cover tunnel, was announced in June 1999. This was the first time that the Highways Agency had been able to promote the A303 scheme with widespread support (including from the International Committee on

Monuments and Sites, ICOMOS) and a realistic prospect of funding. It was the agreement of Treasury to innovative joint funding from transport and heritage sources (in recognition of the environmental benefits), combined with the support of the major landowner - the National Trust - that provided the basis of a partnership that was seen as being able to secure the delivery of the scheme. The Secretary of State for Transport made a follow-up announcement, in July 2000, confirming that grade-separated improvement of Countess Roundabout would also be included in the scheme.

1.3.10 **2000-02: Review of tunnel options -** Following the Preferred Route announcement, other tunnel options were reviewed to ensure the best investment decision could be taken to provide a solution, including looking at bored tunnelling (with a lower potential for damaging undiscovered archaeological assets). A tunnel extension 100m in an easterly direction was identified as bringing significant benefits by taking the tunnel portal further away from King Barrow Ridge and Stonehenge Cottages. Numerous stakeholders wished to compare the benefits and costs of a longer bored tunnel, therefore a 4.5km bored tunnel was considered, similar to that identified at the 1995 Planning Conference. A further intermediate option (2.7km long) was also identified. The comparison between all the assessed tunnel options was reported in A303 Stonehenge Improvement Comparison of Tunnel Options [6] and presented to Ministers in late 2002.

1.3.11 **December 2002: 2.1km bored tunnel announced -** On 10 December 2002 the Secretary of State for Culture, Media and Sport and the Secretary of State for Transport jointly announced that: "after reviewing the options, and taking advice from English Heritage, we have agreed that the Government's preferred option is a 2.1km bored tunnel. This will enable the long overdue improvements at Stonehenge to go ahead in a way which protects the unique environment of Stonehenge as well as improving journey times and safety for vehicles travelling to and from the South West." [3] Ministers were persuaded that the tunnel length should be extended from 2.0km to 2.1km and that the method of construction should change from cut-and-cover to bored, but they were not persuaded that the longer tunnel options would secure sufficient additional environmental benefits to justify the further additional costs. The funding agreement between DCMS and DfT was revised to the effect that DCMS would contribute a fixed sum of £70m towards the construction cost.

1.3.12 **2003-04: Draft orders and public inquiry -** The draft line, de-trunking, slip road, side road and compulsory purchase Orders and Environmental Statement for the A303 Stonehenge Improvement, with its 2.1km bored tunnel were published in June 2003 on the basis of the Published scheme illustrated in Figure 1-4 below.

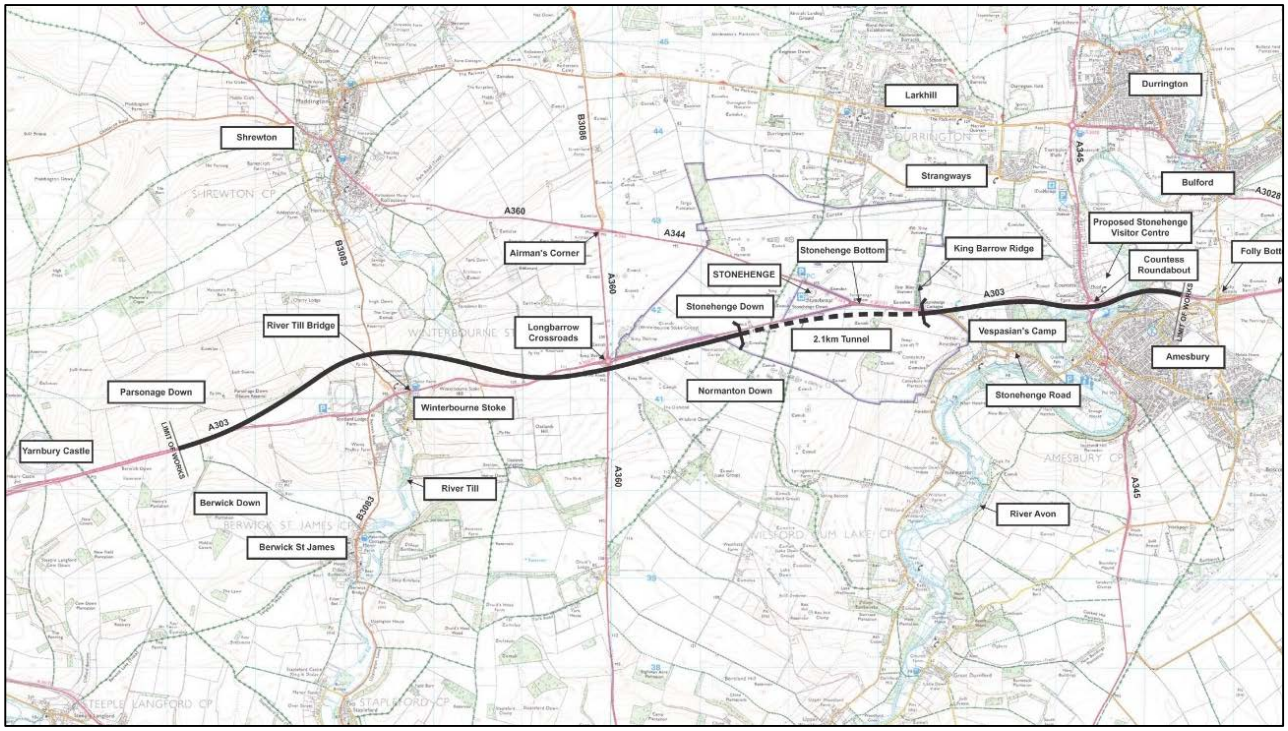


Figure 1-4 Scheme published in 2003 for A303 Stonehenge Improvement [2]

1.3.13 **Objections to the draft orders were received** – This led to a public inquiry being held into the Published scheme between 17 February 2004 and 11 May 2004. The Inspector's report was published on 20 July 2005 with recommendations that the Orders for the Published scheme be made as drafted, subject to minor modifications [7].

1.3.14 2005-07: Post-inquiry review - Coincident with the publication of the Inspector's report in July 2005, the Government announced that a detailed review of options would be carried out before taking a final decision on the Inspector's report. The reason for the review was that there had been a significant increase in the estimated construction cost of the scheme since the public inquiry (from £192m to £292m at 2003 prices). The review was overseen by a cross-Government Steering Group and included public consultation (January - April 2006), comparing shortlisted options with the Published scheme. Overall the review confirmed that there was no ready solution that satisfied all the criteria of being affordable, acceptable and deliverable. [8]

1.3.15 December 2007: scheme withdrawn from roads programme - Following the post-inquiry review, the scheme was withdrawn from the roads programme on 6 December 2007 with the accompanying Government statement: "…we have now concluded that due to significant environmental constraints across the whole of the WHS, there are no acceptable alternatives to the 2.1 km bored tunnel scheme. However, when set against our wider objectives and priorities, we have concluded that allocating more than £500 million for the implementation of this scheme cannot be justified and would not represent best use of taxpayers' money…". At the same time, the Government recognised that their decision to withdraw the scheme meant that English Heritage's proposals for a new Stonehenge Visitor Centre adjacent to Countess Roundabout could not proceed as planned.

Accordingly, the Government made a commitment to exploring alternative ways of improving the immediate setting of Stonehenge and the visitor experience, which included means by which the A344 junction with the A303 could be safely closed.

1.3.16 December 2013: New visitor centre opened for Stonehenge - Working in partnership, English Heritage, National Trust, Highways Agency and Wiltshire Council developed alternative plans for a new Visitor Centre located at Airman's Corner (A360/B3086 junction), accommodated by junction upgrading at Longbarrow Roundabout (A303/A360) and Airman's Corner designed to facilitate safe access and enable closure of the A344. Planning consent was granted in February 2010, and the new Centre was opened in December 2013. This was followed by removal of the old Visitor Centre from its site next to the Stones and 'grassing' of the A344, which has served to provide a significant improvement to the immediate setting of Stonehenge, as illustrated in Figure 1-5 below.

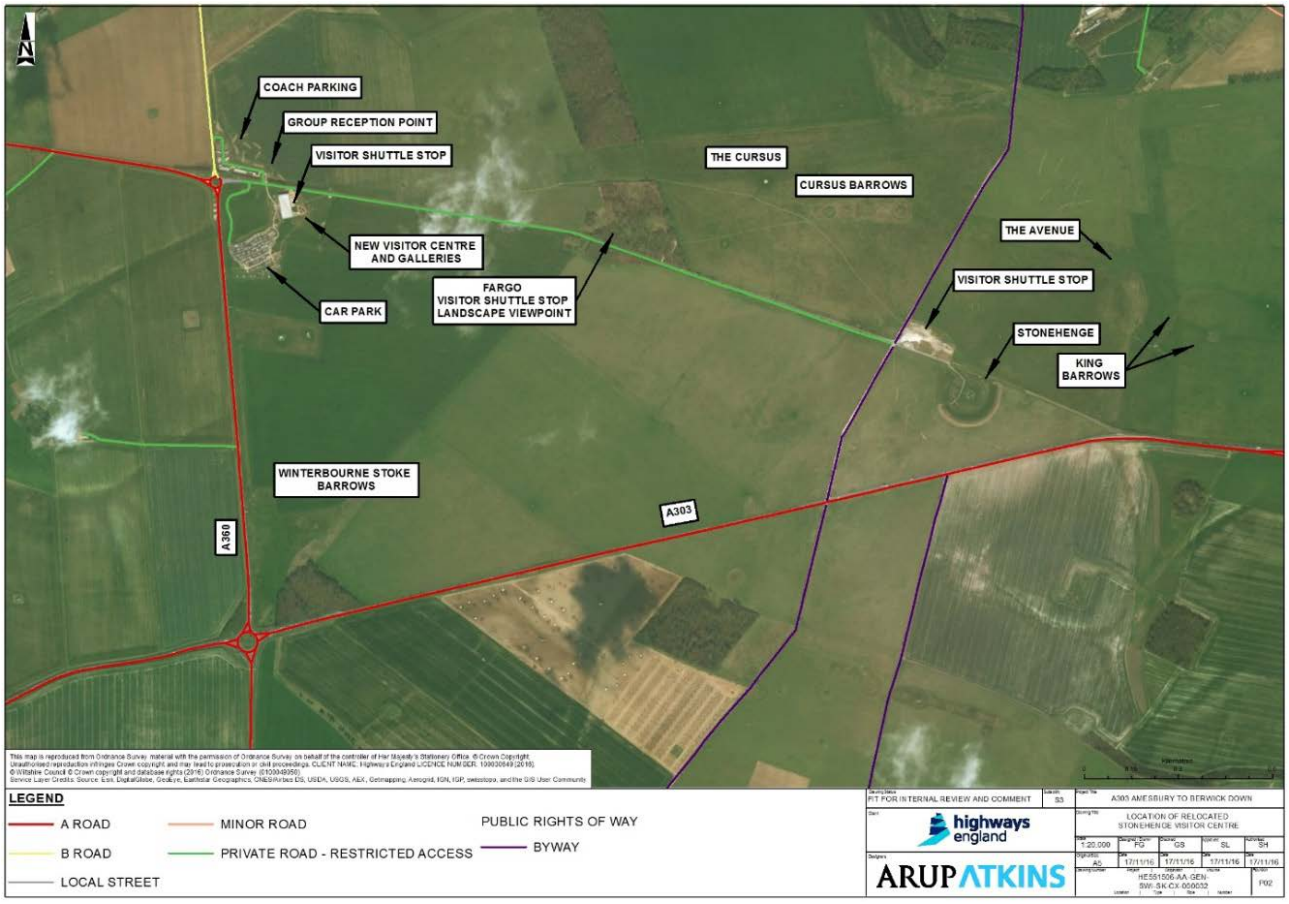


Figure 1-5 Plan showing location of relocated Stonehenge Visitor Centre

1.3.17 The changing context at Stonehenge has fed into revisions of the WHS Management Plan. The current (2015) version also includes the Statement of Outstanding Universal Value (OUV) for the WHS that was developed since the withdrawal of the scheme in 2007, and was approved by UNESCO in 2013. These Management Plan revisions and Outstanding Universal Value set a different framework for assessing the impact on the WHS compared with the scheme that was taken through public inquiry in 2004.

1.3.18 **2014: A303/A30/A358 Corridor Feasibility study** - Notwithstanding the improvements secured for the Stonehenge WHS and its visitors by the new facilities, significant problems remain - the A303, as the main trunk route to the South West, continues to run through the heart of the WHS, severing the northern and southern areas, and road users continue to suffer from regular congestion. The problems of congestion continue to arise further west along the route where the standard drops from dual to single carriageway. This prompted a South West multi-agency group of partners (including Somerset, Devon and Dorset County Councils, Wiltshire Council and the Heart of the South West Local Enterprise Partnership) to campaign strongly for a whole route improvement of the A303/A30/A358 corridor on the basis of the substantial economic benefits it would bring to the region [9]. This campaigning and business case evaluation fed into the Government's 2013 spending review, following which it announced plans for the biggest ever upgrade of the strategic national roads network. The accompanying HM Treasury document, 'Investing in Britain's Future' [10], set out the programmes of infrastructure investment, including an A303/A30/A358 feasibility study designed to "identify and fund solutions to tackle some of the most notorious and longstanding road hotspots in the country'. The study was carried out in 2014, it incorporated, inter alia, options appraisal of modal and route alternatives, culminating in a final report containing a Strategic Outline Business Case for investments along the A303/A30/A358 corridor [11]. For the section of the A303 past Stonehenge, the study's Business Case considered two tunnel options of either 2.5km or 2.9km in length (as well as a surface level northern route option just south of Larkhill). The tunnel options were informed by parallel work undertaken by English Heritage and National Trust as reported in Preliminary Outline Assessment of the impact of A303 improvements on the OUV of the Stonehenge Avebury and Associated Sites World Heritage property (December 2014). English Heritage and National Trust assessed the impacts of the following options (benchmarked against the existing road and a 4.5km long tunnel which had its origins in the 1995 planning conference):

- 2.1km tunnel as presented at the 2004 public inquiry.
- 2.5km tunnel, with portal locations extended 200m beyond the portal locations for the withdrawn 2.1km tunnel close to the line of the existing A303.
- 2.9km tunnel, as for the previous option but with the western portal extended by a further 400m westwards close to the line of the existing A303.
- 2.9km tunnel, as previous option but with the western portal taken to a location south of the existing A303 in the bottom of a dry valley to screen its presence.

1.3.19 Their conclusion was that the 2.1km tunnel option would have "negligible beneficial impact of slight significance" on the WHS, but that any of the 2.5km or 2.9km tunnel options would achieve "a beneficial change of large/very large significance in the impact of the A303 on the Stonehenge component of the Stonehenge, Avebury and Associated Sites World Heritage property."

1.3.20 December 2014: Scheme re-introduced to roads programme - On 1 December 2014, the Government published its Road Investment Strategy for 2015-20;

informed by the A303, A358 and A30 corridor feasibility study, inclusive of options appraisal. The strategy contained proposals for creating an A303/A358 Expressway to the South West including dualling of the A303 from Amesbury to Berwick Down, with a twin-bored tunnel at least 2.9km long through the WHS. The Government has also included the A303/A30/A358 corridor (with the dualling of the A303) in its National Infrastructure Plan as one of its 'Top 40 priority infrastructure investments'. Another subsequent event of note in 2015 was the joint World Heritage Centre / ICOMOS Advisory Mission to the Stonehenge, Avebury and Associated Sites [12], the accompanying report stated that "with good design and construction controls, and respecting essential archaeological and heritage management measures, the tunnelled length of the road would be expected to have a beneficial impact on the attributes of Outstanding Universal Value (OUV). However, the siting and design of the tunnel portals, approach cuttings/embankments, entry/exit ramps, mitigation measures and the temporary construction works have the potential to adversely impact Outstanding Universal Value". This was balanced against the potential for adverse impact on the OUV caused by the location of the tunnel portals and by the surface works within the WHS. Among its recommendations, ICOMOS wished to see Heritage Impact Assessments (HIAs) for assessing impacts on OUV being undertaken in accordance with the ICOMOS Guidance on Heritage Impact Assessments (2011), and particularly wished to see consideration being given to locating the eastern portal to the east of where The Avenue crosses the line of the existing A303.

1.3.21 PCF Pre-Project Stage 2015 – The above description informed the Pre-project Strategy, Shaping and Prioritisation of the A303 Stonehenge Amesbury to Berwick Down scheme, illustrated in Figure 1-6 below as the start of Highways England's Project Control Framework (PCF). PCF Stage 0 was completed at the end of 2015 by a Mott MacDonald Grontmij Joint Venture.

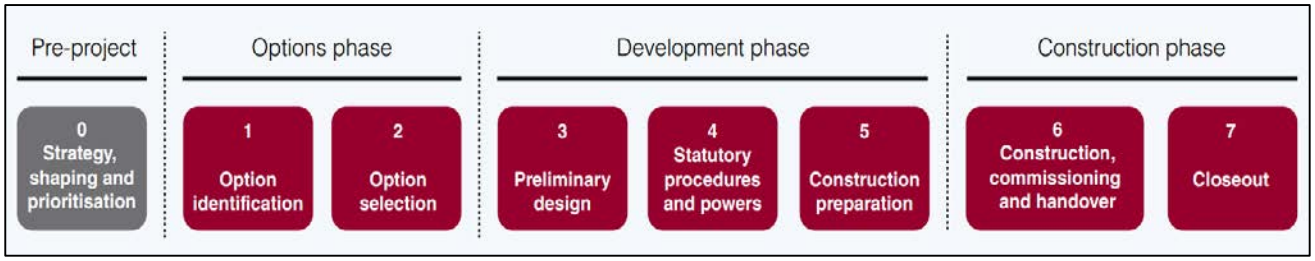


Figure 1-6 Highways England's Major Projects Lifecycle [13]

1.3.22 **Next steps** - Highways England commissioned the Arup Atkins Joint Venture (AAJV) in January 2016 to undertake the Options Phase for the scheme (PCF Stages 1 and 2), starting in January 2016. This Scheme Assessment Report represents the conclusion of the Options phase, leading into a Preferred Route Announcement and the subsequent Development phase.

1.4 Structure of this Report

1.4.1 This report is structured into the following chapters:

Chapter 1: Introduction - Gives an overview of the purpose of the report and summarises the scheme's background.

Chapter 2: Existing Conditions and Need for the Scheme – A statement of the problem, description of the existing conditions and summary of the consequences of doing nothing.

Chapter 3: Planning Factors - Description the Scheme Brief from Highways England, capturing the Client Scheme Requirements (CSRs) and relevant local and national policy.

Chapter 4: Option Identification (PCF 1) – Summary of the Technical Appraisal Report with brief description of the option identification process and a summary of the alternative options considered, with a commentary on the degree to which each provided a solution to the identified problem.

Chapter 5: Public Consultation Summary – Summary of the Report on Public Consultation [www.highways.gov.uk/a303stonehengepra].

Chapter 6: Option Selection (PCF 2) – Description of the development and sifting process following public consultation to produce refined route options for further assessment, to inform the choice of Preferred Route.

Chapter 7: Engineering and Safety Assessment – Assessment of the developed route options against engineering and safety requirements. Including a statement that the proposed solutions are technically feasible considering the ground conditions identified.

Chapter 8: Client Scheme Requirements and Policy Assessment – Assessment of the developed route options against the Client Scheme Requirements and relevant local and national planning, transport and economic policy objectives.

Chapter 9: Traffic Assessment – Summarises the traffic modelling and analysis that has been undertaken and the relative benefits of the developed route options.

Chapter 10: Economic Assessment – Summarises the economic analysis that has been undertaken and the relative economic benefits of the developed route options.

Chapter 11: Operational Assessment - Assessment of the developed route options against the safe and economic operation and maintenance of the completed scheme.

Chapter 12: Technology and Maintenance Assessment - Assessment of the developed route options against the requirements for additional road-side technology and the ability to provide maintenance in a safe manner on the completed scheme.

Chapter 13: Environmental Assessment and Design - Assessment of the developed route options against their impacts on noise, air quality, greenhouse

gases, landscape, townscape, historic environment, biodiversity and the water environment.

Chapter 14: Social Assessment - Assessment of the developed route options on commuting and other users, capturing the social impacts on accidents, physical activity, security, severance, journey quality, option values, accessibility and personal affordability.

Chapter 15: Distributional Impact Assessment - Assessment of the developed route options impact on different social groups across a range of indicators, namely user benefits, noise, air quality, accidents, security, severance, accessibility and personal affordability.

Chapter 16: Appraisal Summary – Summary of the positive and negative aspects of the developed routes, taking into consideration all the above assessments and presents the Appraisal Summary Tables.

Chapter 17: Conclusions and Recommendations – Summarises the relative merits of each of the route options assessed post-consultation and recommendation of a Preferred Route.

2. Existing Conditions and Need for the Scheme

2.1 Introduction

2.1.1 The scheme is to improve the approximately 12km long section of the existing A303 single and dual carriageway between west of the village of Winterbourne Stoke at Berwick Down and just east of the Countess Roundabout in Amesbury. The scheme assessment area is shown in Figure 2-1.

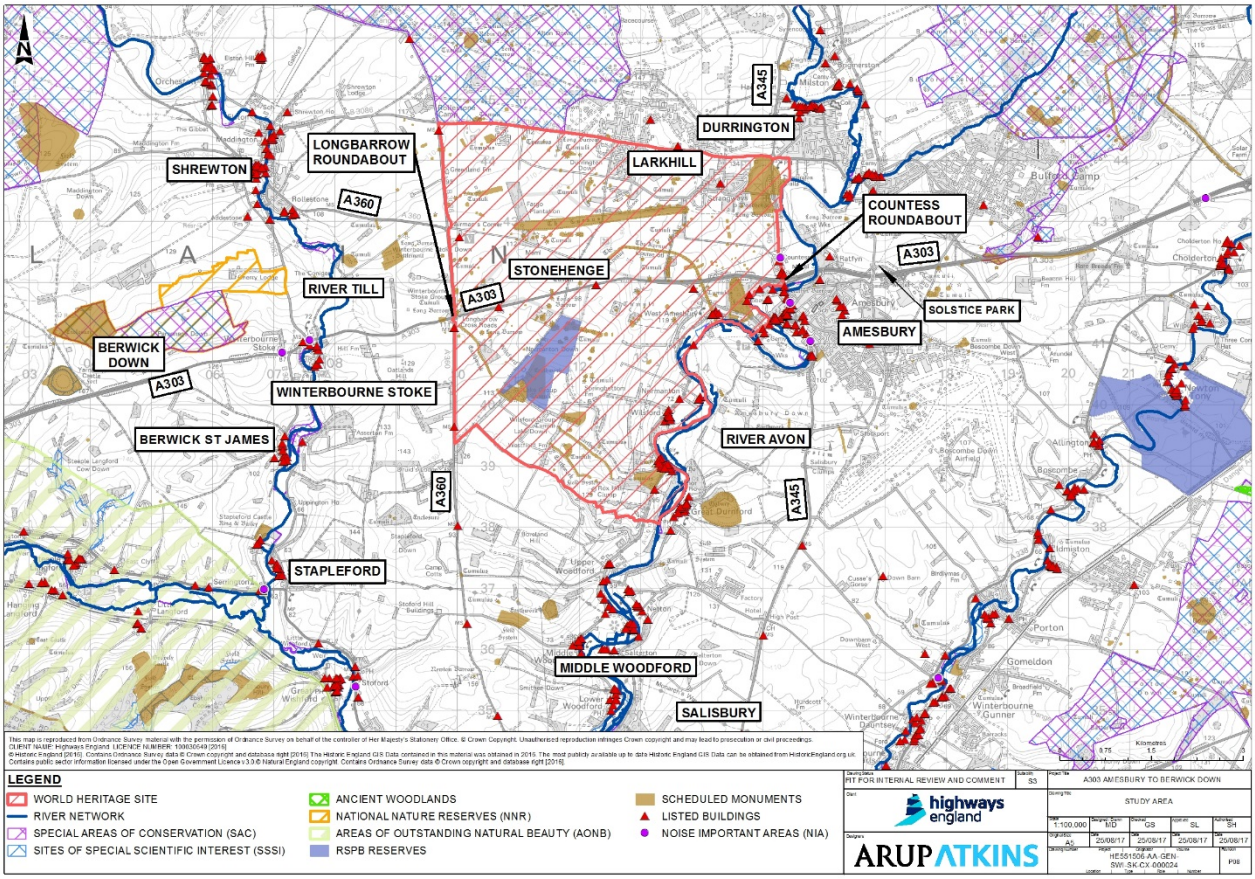


Figure 2-1 A303 Stonehenge: Amesbury to Berwick Down - study area

2.1.2 The study area is generally rural in character, with substantial areas of arable farming.

2.1.3 The main settlements are Amesbury, Winterbourne Stoke, Berwick St. James, Bulford, Durrington, Larkhill, Shrewton, Stapleford, Middle Woodford, villages in area of Lower Woodford and other villages along Avon Valley. The city of Salisbury lies just to the south of the study area.

2.1.4 The main roads within the study area are the A303 Basingstoke to Honiton trunk road, A36 Southampton to Bath, A338 Poole to Besselsleigh (Oxford), A345 Salisbury to Marlborough and A360 Salisbury to Devizes.

2.1.5 The study area is dominated by the presence of the Stonehenge, Avebury and Associated Sites World Heritage Site (WHS), which occupies an area of

approximately 27km2 and is bounded by the A360 and A345 and bisected by the A303. The WHS attracts more than 1.3m visitors each year, generating over 300,000 car trips and 30,000 coach trips to and from the site. At its closest point the A303 is only approximately 165 metres from the world-famous Stonehenge Monument as shown in Figure 2-2.

Figure 2-2 Proximity of Stonehenge to the A303

2.1.6 The study area contains several Ministry of Defence installations, primarily at Boscombe Down airfield, Bulford Camp, Larkhill Camp. The Porton Down Defence Science and Technology Laboratory and the Salisbury Plain Defence Training Estate both lie close to the study area.

2.1.7 In addition to the WHS, the study area contains several nationally and internationally important environmental areas. These include: Special Areas of Conservation (SAC - European designation); Sites of Special Scientific Interest (SSSI) (national designation); National Nature Reserve (NNR) (national designation), Area of Outstanding Natural Beauty (AONB) (national designation). These are located along the River Till, River Avon and River Wylye Valleys and north east of Bulford camp (SAC), Yarnbury Castle and Parsonage Down National Nature Reserve (SSSI), Parsonage Down National Nature Reserve (NNR), Cranborne Chase (AONB).

2.2 Statement of the Problem

Traffic

2.2.1 This section provides details of the existing traffic conditions for the A303 between Amesbury and Berwick Down. For further details of existing traffic conditions and journey time delays refer to Chapter 10 of the A303 Stonehenge Technical Appraisal Report, January 2017 for further details.

2.2.2 The A303/A30/A358 suffers from high levels of congestion and poor journey time reliability. In part this is because much of the route is accommodating levels of traffic flow well in excess of its capacity.

Traffic Characteristics of the A303 Amesbury to Berwick Down

2.2.3 A corridor feasibility study [11] published in 2015 identified the section between Amesbury and Berwick Down amongst five sections of the corridor with the greatest transport issues and challenges. The A303 Stonehenge caters for 3.9 million journeys per annum in each direction. As illustrated in Figure 2-3, its strategic importance is reflected in the fact that nearly half (48%) of journeys past Stonehenge are long distance with both origin and destination being more than 30 miles (48 km) away with an additional 33% having either an origin or destination further than 30 miles (48 km). In contrast, only 11% of journeys on this section of the A303 are wholly within 10 miles (16 km) of Stonehenge.

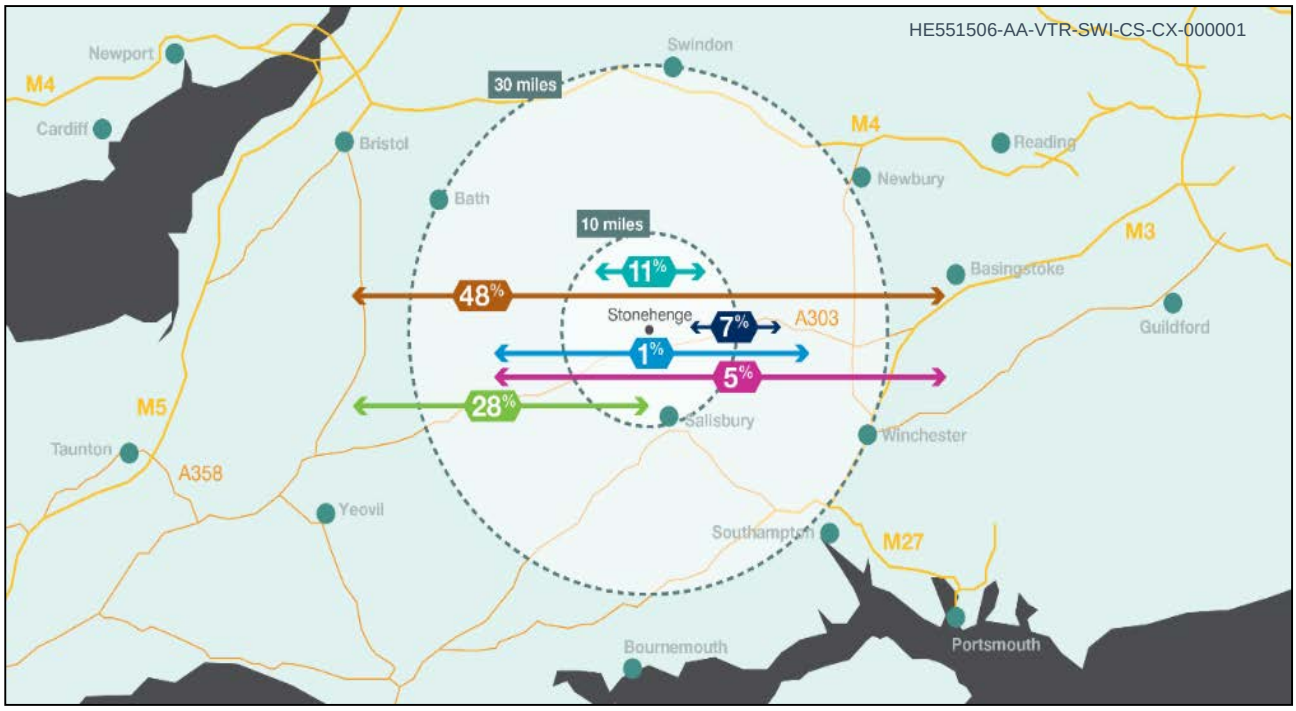


Figure 2-3 Distribution of traffic on the A303 at Stonehenge

2.2.4 The highest traffic flows along the existing route are found at the eastern and western extremities of the A303/A358 corridor, with flows varying between 35,000 and 50,000 vehicles per day. Many of the sections towards the middle of the corridor have flows between 20,000 and 25,000 vehicles per day.

2.2.5 From roadside interviews undertaken in 2015, around 25% of vehicles on the Stonehenge section of the A303 were found to be vans or goods vehicles. Of the remaining 75% car traffic, the bulk of trips (40%) are made for leisure reasons with 25% commuting and 10% for business purposes.

Traffic characteristics - Seasonality and weekly variation

2.2.6 Figure 2-4 and Figure 2-5 show the distribution of daily traffic volume across the year (2013) using data from Highways England Traffic Information System (HATRIS) database. They demonstrate the significance of the summer period as the peak traffic level occurs in July (westbound) and August (eastbound).

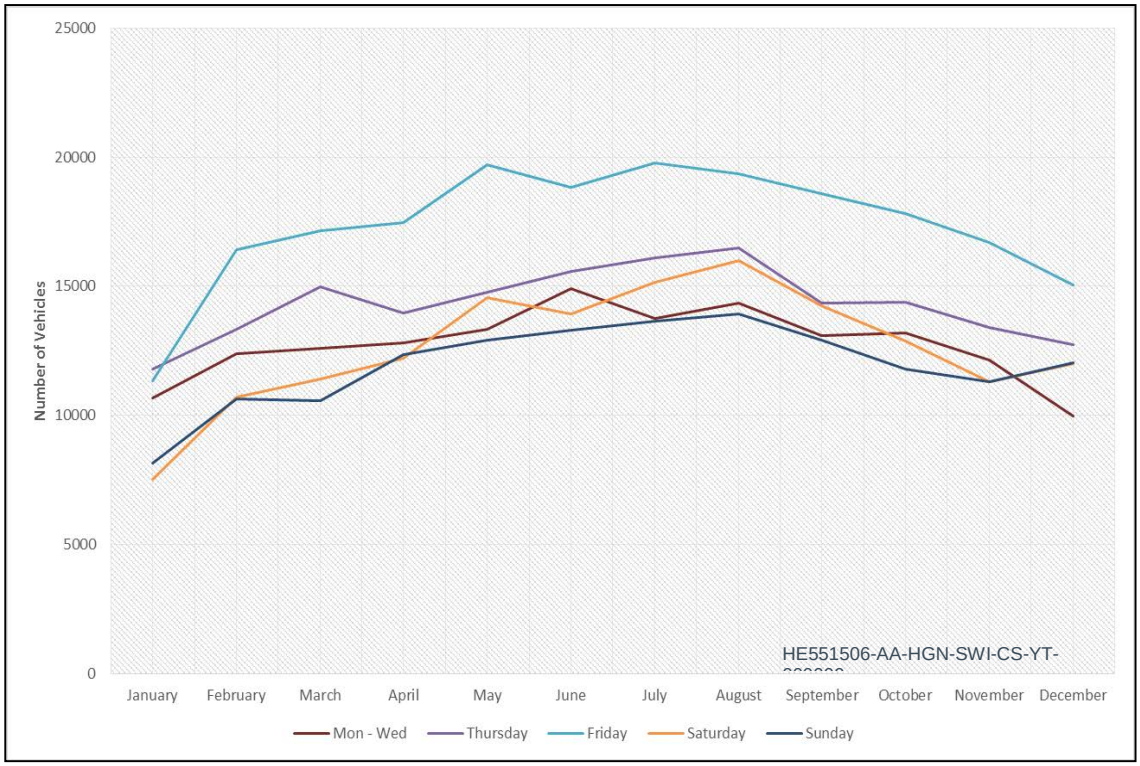


Figure 2-4 A303 – Westbound daily traffic by day and month

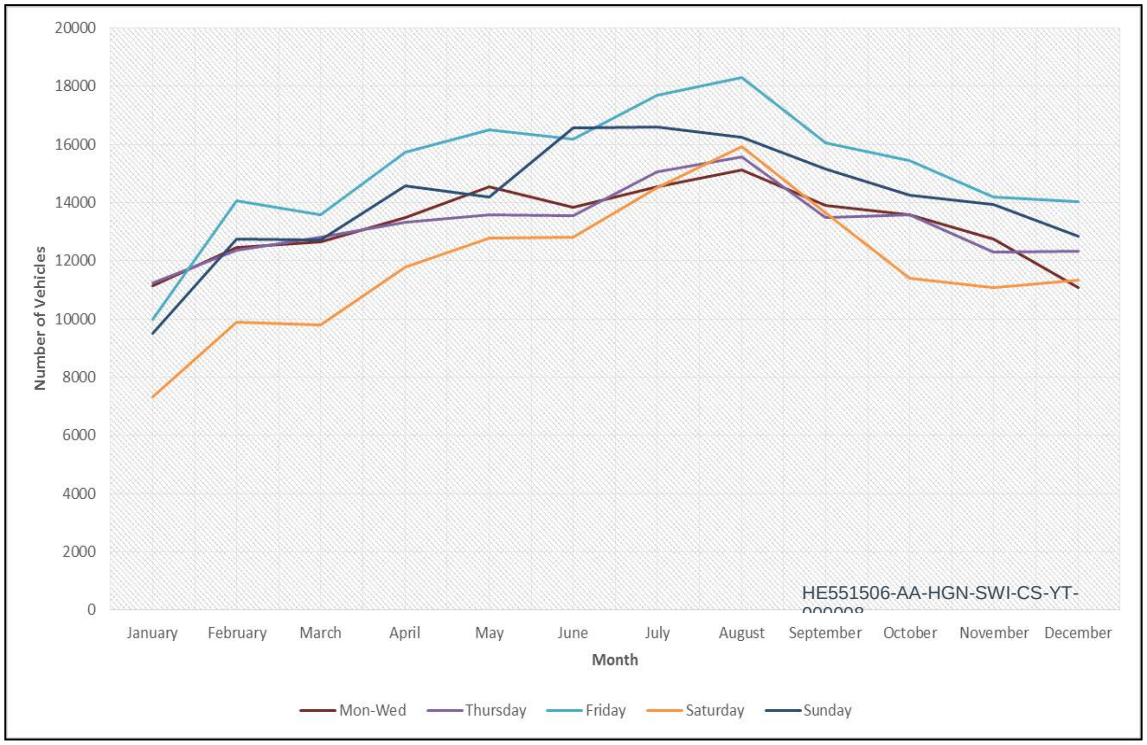


Figure 2-5 A303 – Eastbound daily traffic by day and month

2.2.7 Additionally, there is a noticeable difference in the patterns of demand between the two directions. In the westbound direction, Friday carries the largest traffic volumes throughout the year whilst in the opposite eastbound direction, Friday is still the busiest day of the week although not by the same margin, with Sunday tending to have the next highest volumes. This suggests the general trend of travel

to the South West at the end of the week with the reverse journey occurring on Sundays.

Public transport

2.2.8 There is only one bus stop that lies directly on the existing A303 within the scheme limits. This is in the centre of Winterbourne Stoke at the T-junction between the A303 and the B3083, travelling northbound towards Shrewton. Other bus stops are spread across the study area, with a higher concentration in close proximity to the local towns including Amesbury, Bulford, Durrington, Larkhill and Shrewton.

Existing capacity

2.2.9 Road capacity is the theoretical limit of the average number of vehicles per hour that can travel along a section of road. For high flows, i.e. between the full capacity and 85% of the capacity, the interaction between vehicles on the road becomes significant, leading to a fall in average journey times and increased variability in these journey times.

2.2.10 Reviews of flow versus capacity of the existing network have focussed on three key sections of the A303 Stonehenge scheme which currently operate as a single carriageway:

- West of Winterbourne Stoke.
- Between Winterbourne Stoke and A360.
- Between A360 and A345.

2.2.11 The typical one direction hourly capacity of a single carriageway road such as represented by these sections is estimated at 1,250 vehicles. This is based on the Department for Transport (DfT) WebTAG Unit M3.1 (Highway Assignment Modelling). The corresponding 85% of capacity level, at which point flow breakdown begins to occur, is estimated at 1,050 vehicles per hour per direction. Examination of the average hourly flows across the full year suggest that for long periods the section of the existing A303 between A360 and A345 operates at above the 85% of capacity level. As the analysis considers average traffic flow levels over the whole year and hence does not specifically identify the much higher flow levels experienced in the summer months and at weekends when flows exceed the capacity levels by significant amounts, the scale of the issue is significantly worse during these periods. Although the section west of Winterbourne Stoke experiences lower average flows, the existence of the lower speed limit of 40 mph and the signalised pedestrian crossing would act to reduce the effective capacity of the section below the 1,250 vehicles used in the analysis.

Congestion and stress

2.2.12 An approach to understanding the impact of traffic flow on network performance is to calculate the network "stress" using traffic flow data compared with the Congestion Reference Flow (CRF). The CRF is the maximum achievable hourly throughput on a link expressed in terms of Annual Average Daily Traffic (AADT). Links which operate with flows in excess of this value (i.e. above 100%) are likely to suffer from operational issues and congestion, including flow breakdown and

queuing. Where the stress factor lies between 85% and 100% turbulent traffic conditions and flow disruption will also be experienced during peak periods.

2.2.13 As expected, when the CRF is determined for the A303 adjacent to Stonehenge, stress factors above 1.0 are evident for each direction in both neutral month and summer periods, as shown in Table 2-1. The section to the west of Winterbourne Stoke (Section 1) also exhibits high stress levels, particularly in the summer.

Table 2-1 Corridor CRF and stresses without scheme – neutral and summer months (2015)

No.	Section	No. of lanes	Neutral Month (March), both directions - 2015			Summer Month (August), both directions - 2015		
			CRF	ADT	Stress factor	CRF	ADT	Stress factor
1	A36 - B3083 (W. Stoke)	1	25,289	20,833	0.82	20,672	27,916	1.35
2	B3083 (W. Stoke) - A345 (Countess)	1	22,466	25,440	1.13	23,724	34,090	1.44
3	A345 (Countess) - A3028 (Double Hedges)	2	88,248	26,187	0.3	81,387	35,091	0.43
4	A3028 (Double Hedges) - A338	2	80,312	27,357	0.34	68,717	36,658	0.53

Impact on Other Routes

2.2.14 The issue of 'rat running' through local communities was investigated by analysing the ANPR data gathered in August 2014. Figure 2-6 highlights the alternative route options followed by traffic travelling west along the A303 and diverting off the trunk road in August. Weekend and weekday traffic movements were compared. In the normal Monday to Thursday weekday period only 4% of the traffic is encouraged by congestion to leave the main A303 route. However, the situation changes on Fridays and Saturdays when 18% and 16% of traffic respectively leaves the A303 and uses local roads.

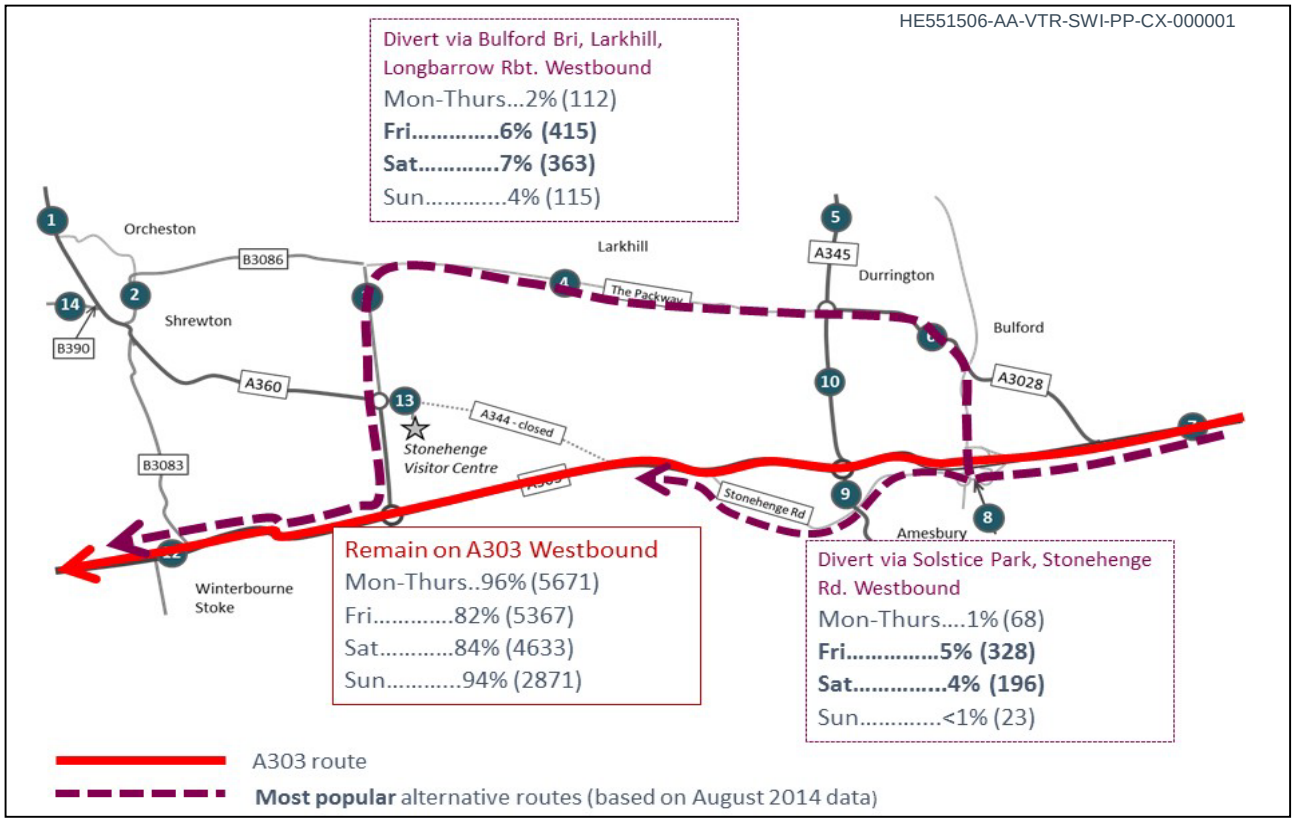


Figure 2-6 A303 through traffic (Hampshire border to Winterbourne Stoke)

2.2.15 The volume of eastbound traffic which diverts onto local roads shows a similar distribution to those for westbound traffic, although the volumes are lower, because the eastbound delays are not as large and hence the traffic diverting from the A303 is lower.

2.2.16 Analysis of the cumulative effects of traffic leaving the A303 corridor to travel on minor roads through the local communities to the north of Stonehenge, shown in Figure 2-7, demonstrates the severe impacts on these communities, particularly in summer, with the B3086 in Shrewton experiencing a 62% increase due to diverting traffic while for The Packway in Larkhill the rise is 49%.

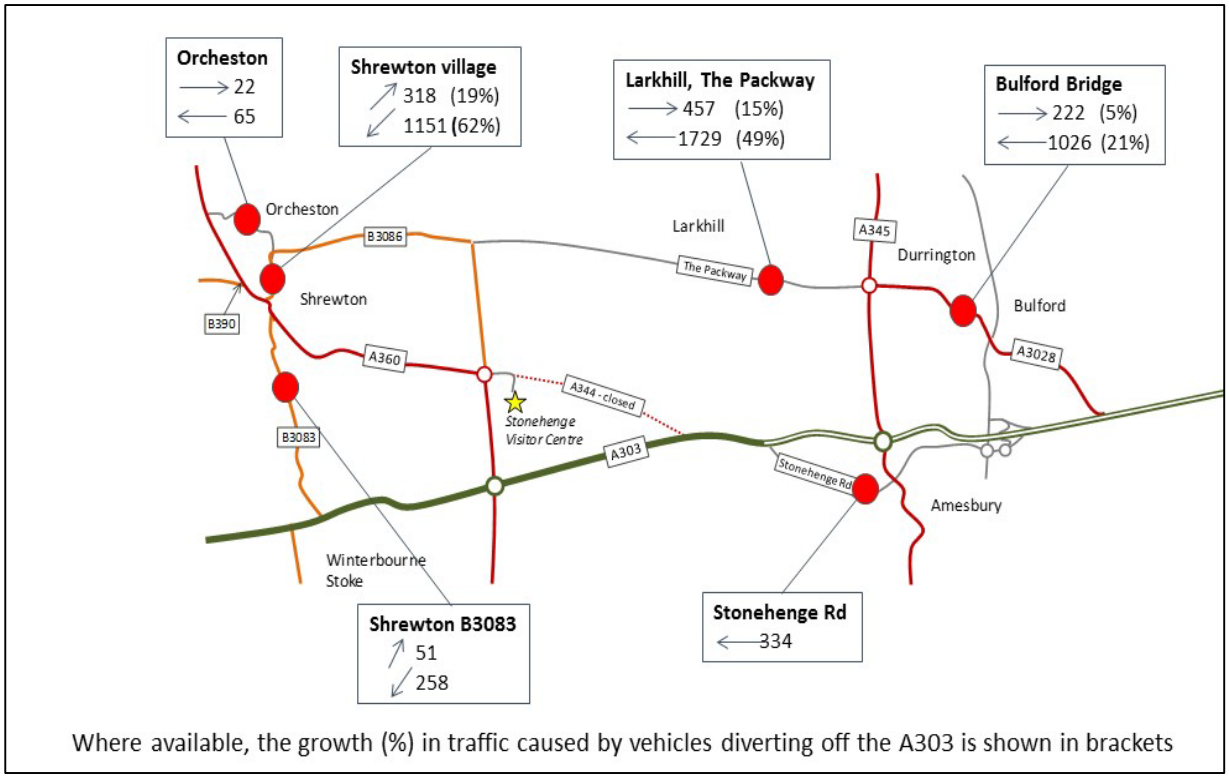


Figure 2-7 Cumulative traffic flows diverting from A303 at Stonehenge

2.2.17 Furthermore, given the busy nature of the A303 during heavily trafficked periods, motorists undertaking strategic journeys may consider using wider route options to bypass the A303 completely. For example, instead of using the M3, A303, A350 and A30 to travel between the M25 and Exeter, motorists may choose to use alternative route options (e.g. the M4, M5, or the M3, M27, A31, A35 and A30).

2.2.18 The use of inappropriate route options by through traffic, including Heavy Goods Vehicles (HGVs), represents a safety issue whilst also adding to air and noise pollution in the villages affected.

Journey times and reliability

2.2.19 The congestion caused by peak traffic levels and limited capacity create significant delays for traffic on the A303 between Amesbury and Berwick Down. This is reflected in measures of journey time reliability. The 'On Time Reliability' measure, calculates the proportion of journeys on a section of the network which are completed within a set reference time, based on historical data on that particular section of road. For the A303 Amesbury to Berwick Down, the On Time Reliability Measure, shows that, of the 3.9 million annual journeys in each direction on this stretch, just 67% of eastbound journeys and 59% of westbound journeys are 'on time'; hence westbound journeys are less reliable than eastbound.

2.2.20 In particular, the road suffers from unreliability during the inter-peak (10.00 to 16.00) period and the PM period (16.00:19:00); this reflects the higher traffic flows in the inter-peak and PM peak periods, particularly in the westbound direction, as demonstrated in Figure 2-8 and Figure 2-9.

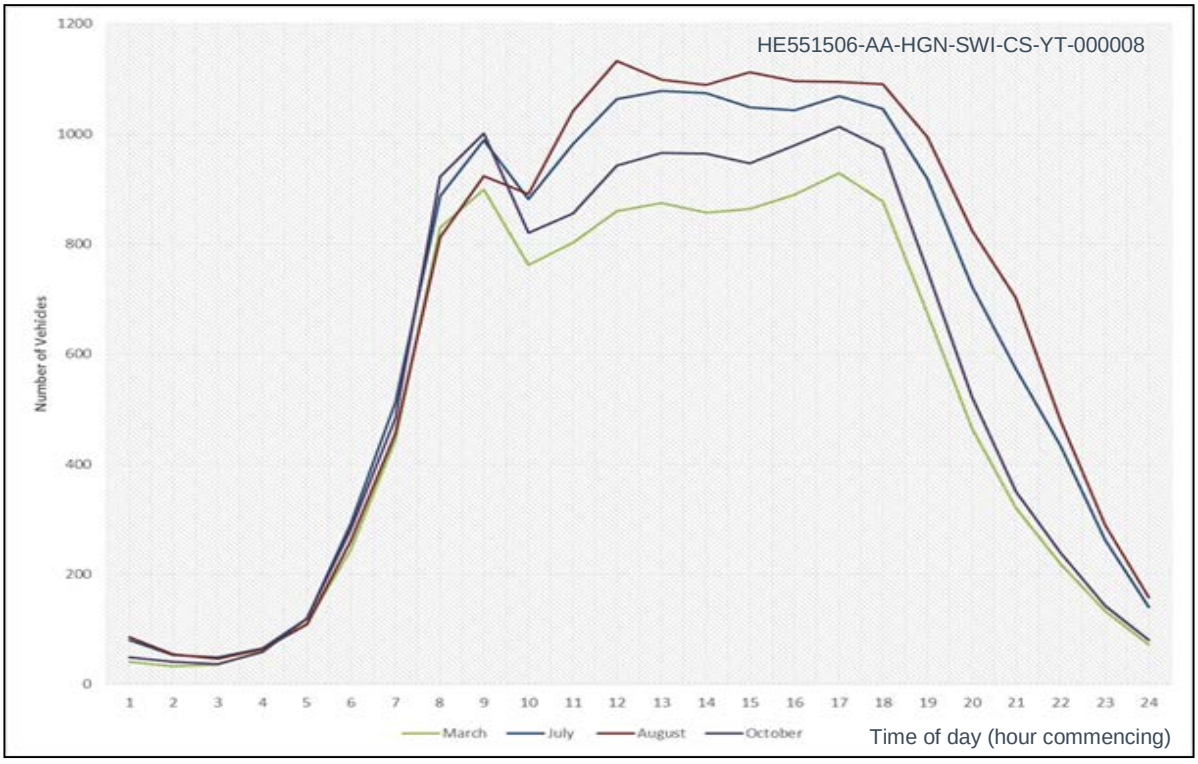


Figure 2-8 A303 – Eastbound Average Daily Traffic (ADT) by hour and month (March, July, August and October only)

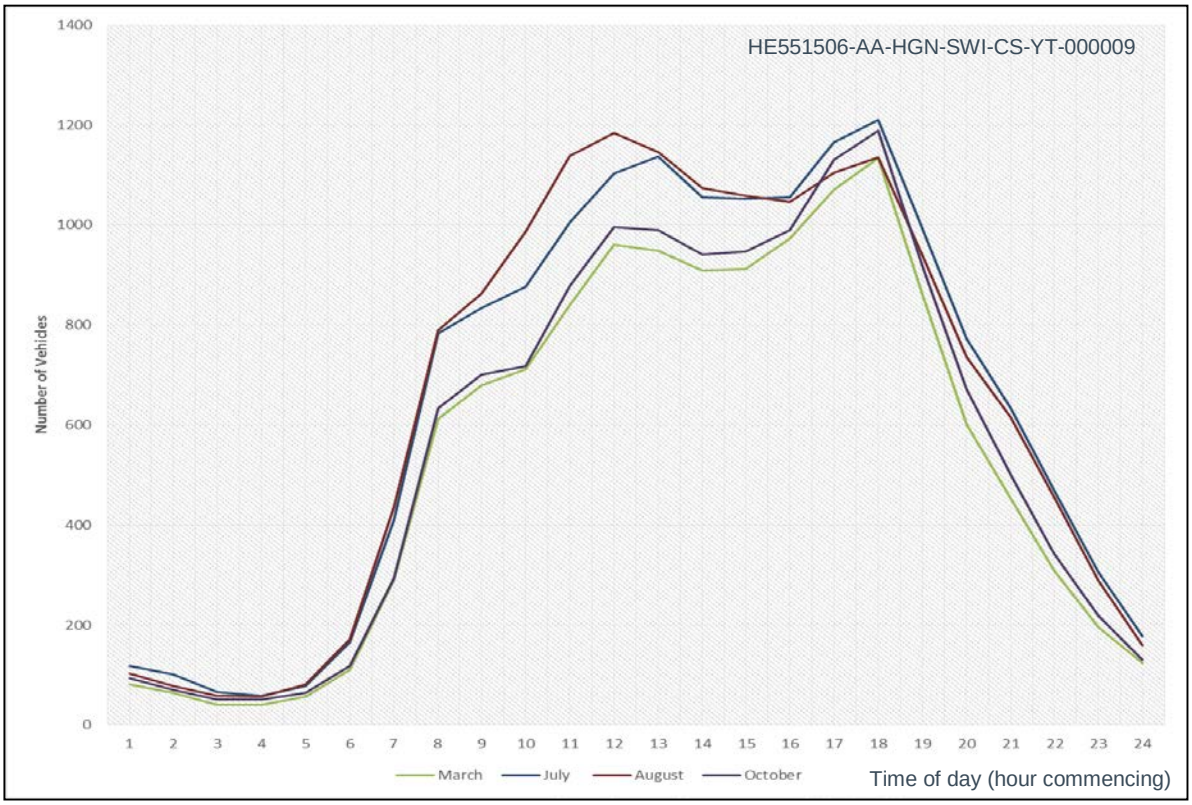


Figure 2-9 A303 – Westbound Average Daily Traffic (ADT) by hour and month (March, July, August and October only)

2.2.21 Reliability is particularly poor on Fridays. This aligns with the fact that traffic flows are significantly higher on Fridays than other weekdays as shown previously in Figure 2-4 and Figure 2-5.

2.2.22 Vehicle tracking data, shown in Figure 2-10 and Figure 2-11, indicates average journey times for a trip from Exeter to London increase from 2 hours and 32 minutes on a weekday (Monday to Thursday) in March to 3 hours 51 minutes on a Friday in August – an increase in average journey times of 1 hour and 19 minutes, or more than 50%. A large part of the delays for the whole corridor occur on the section of the A303 past Stonehenge with delays approaching 50 minutes on a Friday in August for this section alone, as shown in Figure 2-12 and Figure 2-13.

AM (07.00 – 10.00)

PM (peak time)

HE551506-AA-VTR-SWI-CS-YT 000003

Figure 2-10 Average journey times: Exeter to London (Westbound)

AM (07.00 – 10.00)

PM (peak time)

HE551506-AA-VTR-SWI-CS-YT 000003

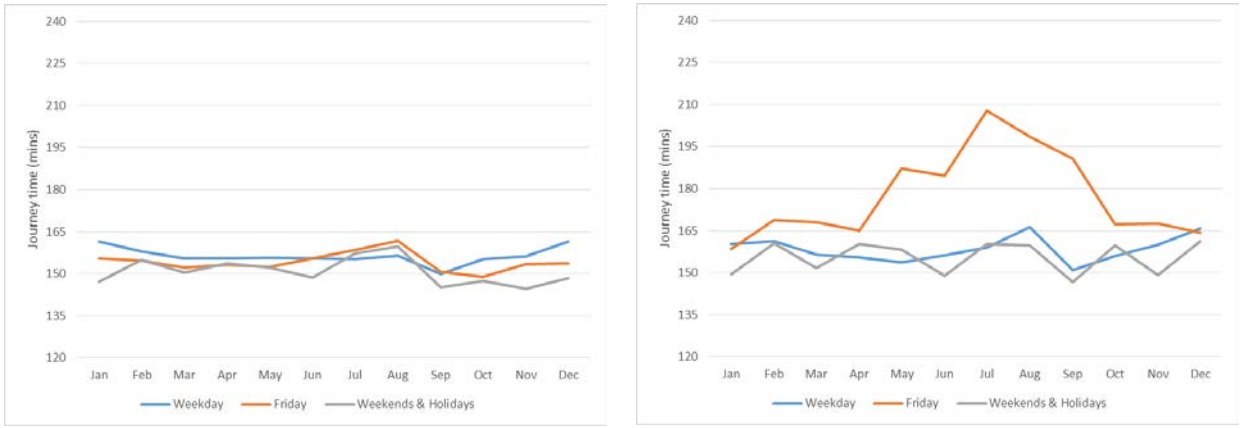


Figure 2-11 Average journey times: London to Exeter (Eastbound)

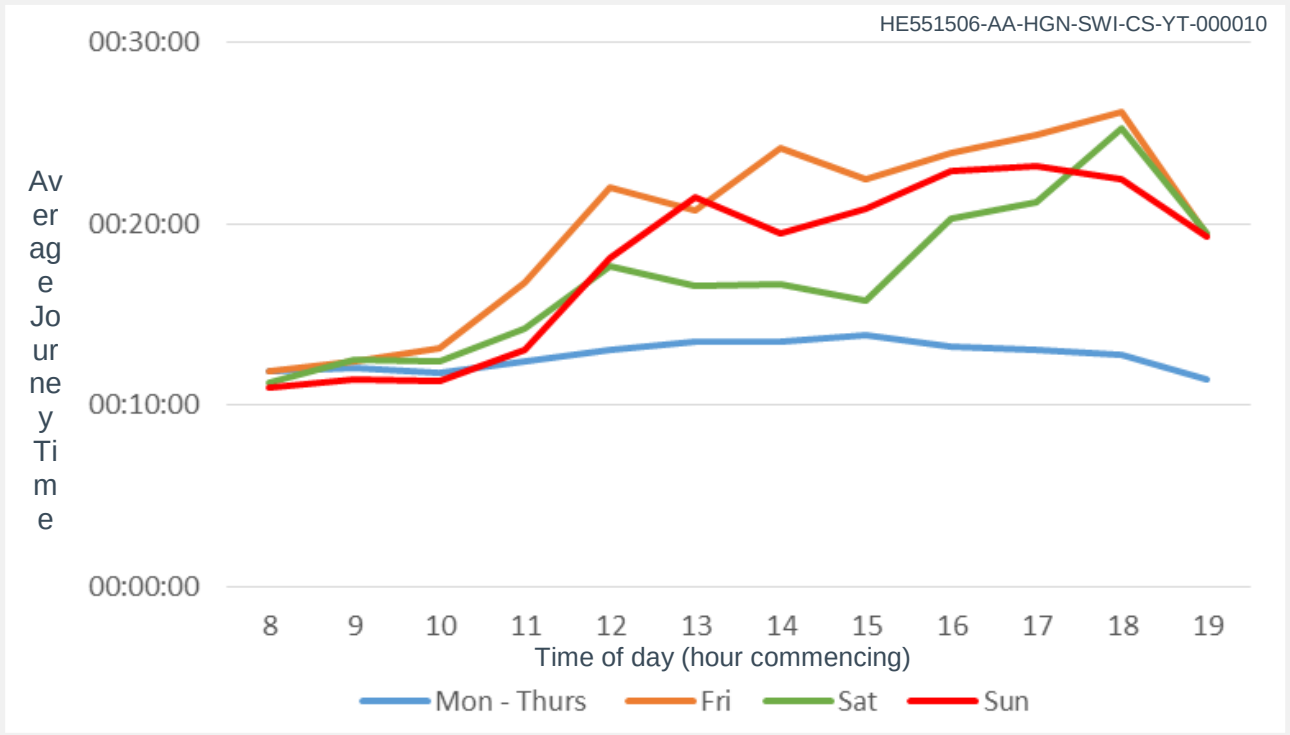


Figure 2-12 Eastbound journey times (minutes) by time of day (August 2014), Winterbourne Stoke to Hampshire border

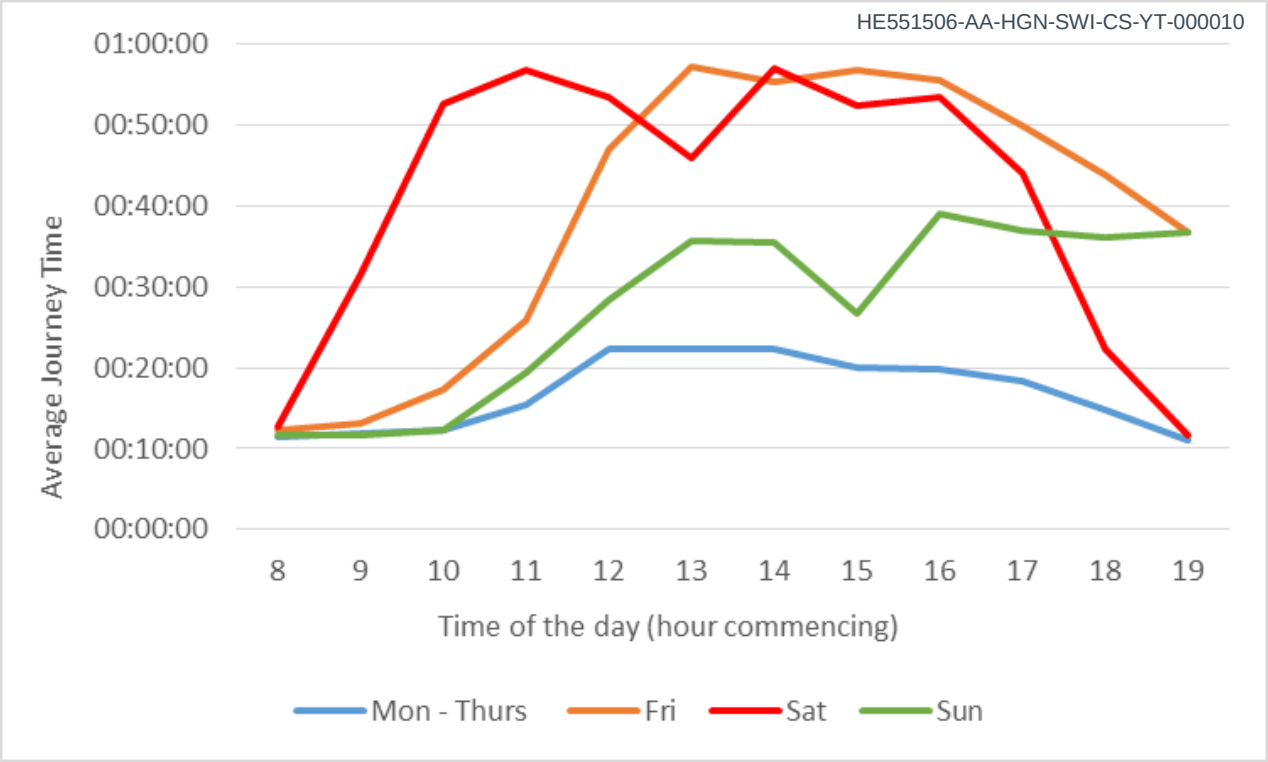


Figure 2-13 Westbound journey times (minutes) by time of day (August 2014), Hampshire border to Winterbourne Stoke

2.2.23 Further details can be found in Appendix A4 of the A303 Stonehenge Technical Appraisal Report, January 2017.

Accidents

2.2.24 Personal Injury Accident (PIA) data was obtained for the most recent ten-year period (2005 to 2014) for the section of the A303 between Amesbury to Berwick Down and split up into four separate sections:

- Dual carriageway section to the east of the single carriageway section.
- Countess Roundabout.
- Longbarrow Roundabout.
- Remaining single carriageway section.

2.2.25 Figure 2-14 illustrates the four sections of the study corridor; a buffer of 100m was applied to the corridor to capture the accidents at the junctions.

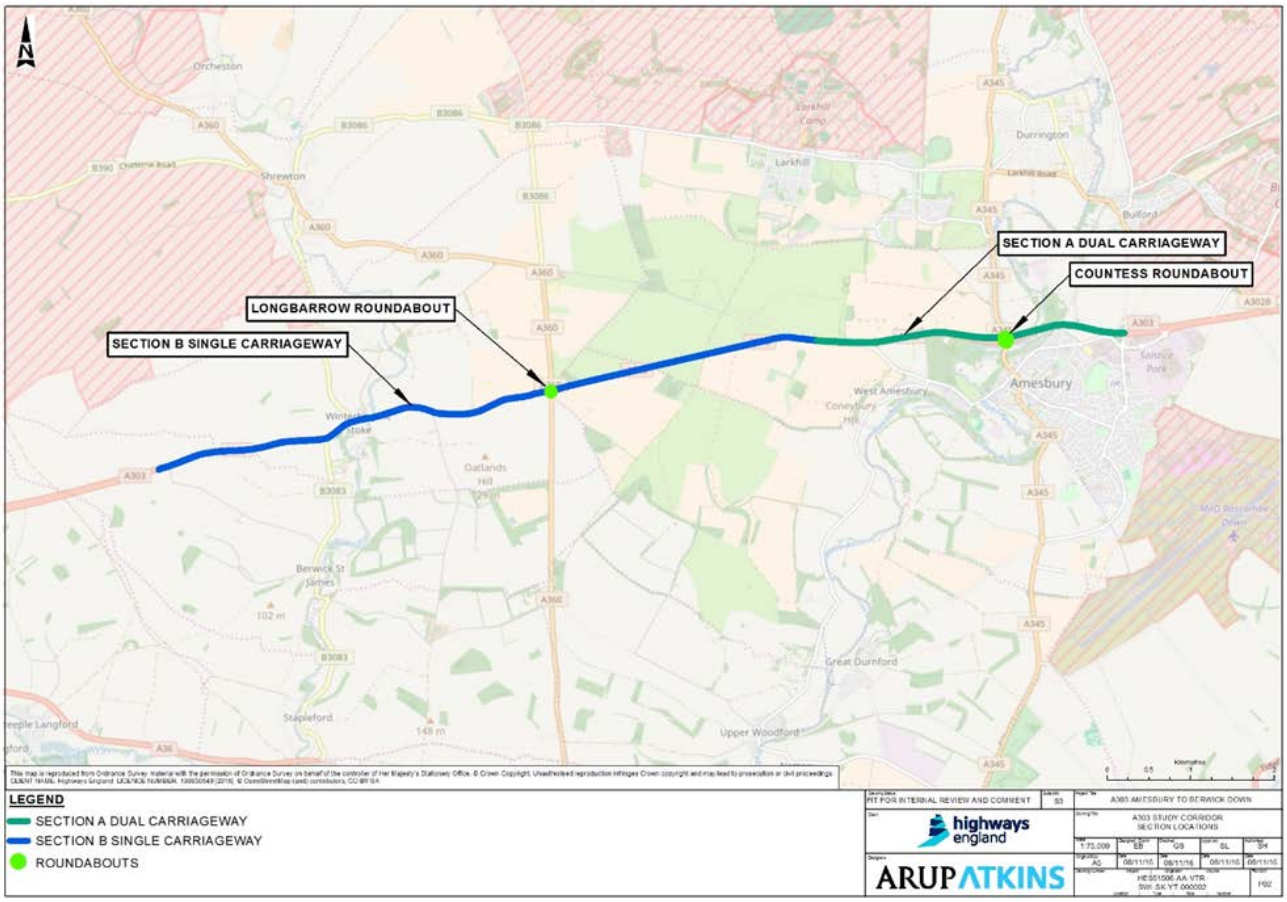


Figure 2-14 Accident section locations

2.2.26 Table 2-2 shows the breakdown of PIAs on the A303 study corridor from Amesbury to Berwick Down. The table shows that there was a total of 215 accidents on the corridor for the ten-year period, with 17% (36) Killed or Seriously Injured (KSIs). The overall yearly accident totals are shown to be decreasing. The five-year period 2005-2009 accounts for 60% (130) of all accidents, with 58% (21) of KSIs. The subsequent five-year period 2010-2014 shows an average of 17 accidents per

year. Although the 2012 the total drops to 9 accidents, this includes two fatal and two serious (44% KSI). The closure in June 2013 of the junction between A303 and A344 adjacent to Stonehenge removed an accident black spot and therefore improved the accident record.

Table 2-2 Accidents by severity and year

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
Fatal	0	1	2	0	1	0	1	2	0	1	8
Serious	2	6	5	1	3	4	4	2	1	0	28
Slight	27	16	29	18	19	14	15	5	17	19	179
Total	29	23	36	19	23	18	20	9	18	20	215

2.2.27 Figure 2-15 shows how the 215 accidents are distributed across the four sections of the A303 between Amesbury to Berwick Down. The 8km single carriageway section accounts for 55% (119) of the accidents, with a significant proportion of KSIs (58%). The dual carriageway section (although shorter at 3.5km) accounts for 13% (27) of accidents, although that includes 25% (9) of the total KSIs. The Countess Roundabout that adjoins the dual carriageway section has the second highest total (37) although this comprises mainly slight accidents (91%). Similarly, at Longbarrow Roundabout the accidents are almost all slight in severity.

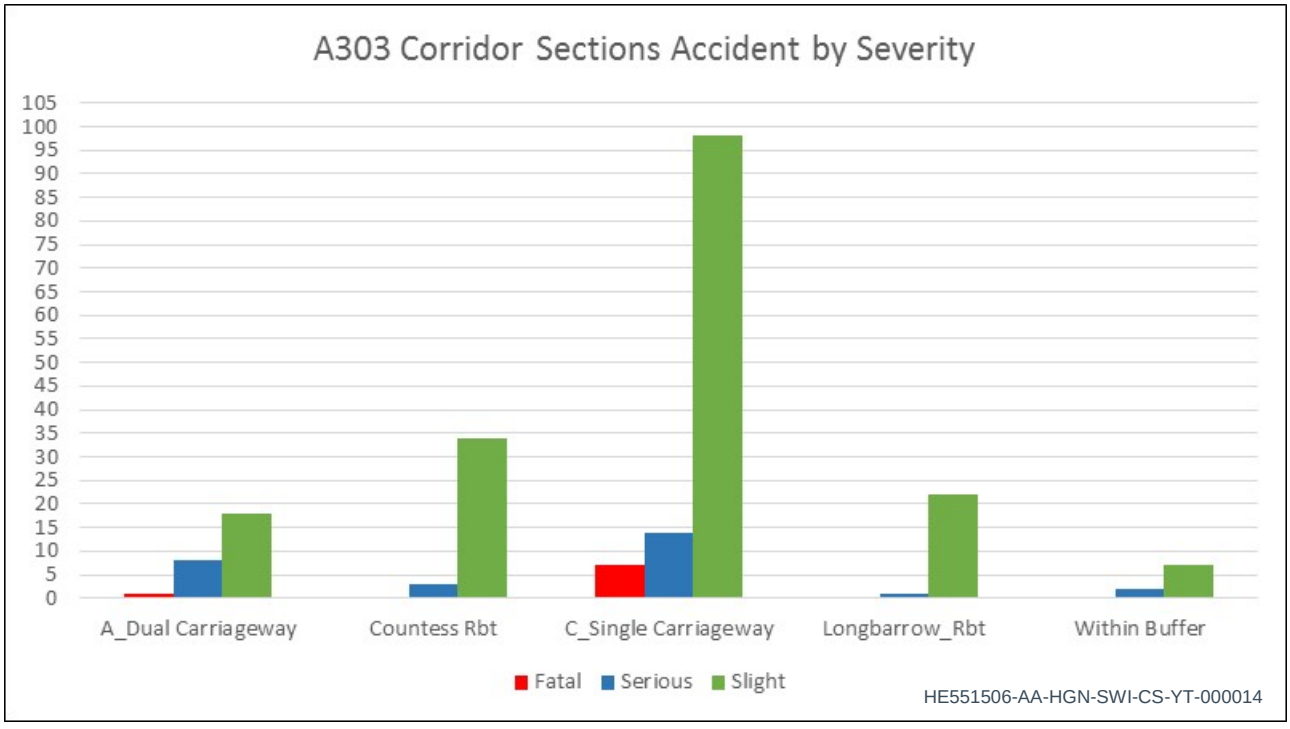


Figure 2-15 Distribution of Accidents between Amesbury and Berwick Down

2.2.28 Accidents within a 3km buffer around the current A303 have also been analysed to understand accident patterns on the surrounding road network. Drivers may use

these roads as alternative route options during periods of congestion. This analysis helps inform the impact of the scheme on the wider road network and the following key points were identified.

2.2.29 Analysis of accident rates between 2005 and 2014 within the 3km buffer suggests that there is a higher rate of accidents in the summer than in the winter, which aligns with higher daily traffic flows; Wednesday had the highest number of accidents. Whilst accidents on the A303 concentrated towards the extremities of the 3km buffer, there is a more general distribution of accidents on local roads including The Packway and A345.

2.2.30 Overall the section of the A303 at Stonehenge experiences an accident rate which is 50% higher than the national average for A roads. The Stonehenge section comprises only 6% of the whole A303/A358 corridor, but experiences 9% of total accidents and 12% of fatal accidents.

2.3 Engineering Conditions

Topography, land Use, property and industry

2.3.1 The existing A303 lies within the Salisbury Plain and West Wiltshire Downs National Character Area (NCA) 132. The Salisbury Plain and West Wiltshire Downs is strongly influenced by the underlying chalk, the chalk downs having a characteristic rounded landform containing dry valleys running down into larger more fertile river valleys which contain settlements.

2.3.2 The downland landscape is typically composed of large arable fields with few hedges or trees (with lowland calcareous grassland covering 14% of the NCA), punctuated by geometric copses (mixed woodland covers 4% of the NCA), and with extensive views, particularly from the ridgelines. In contrast, the river valleys contain low lying small-scale fields, woodland on valley slopes and settlements, and are much more enclosed.

2.3.3 The Stonehenge WHS is a unique prehistoric landscape. It contains a remarkably intact and complete grouping and disposition of interrelated monuments and assets. Within and outside the WHS there is considerable potential for as yet undiscovered archaeology of schedulable quality.

2.3.4 Three European nature conservation sites are located within the study area: the River Avon Special Area of Conservation (SAC), Salisbury Plain SAC and Salisbury Plain Special Protection Area (SPA). Parsonage Down National Nature Reserve (NNR) is also within the study area. A further two European nature conservation sites designated for their bat populations are located within 30km.

2.3.5 The principal communities are Amesbury to the east and Winterbourne Stoke to the west. Also within the study area are a number of villages including Berwick St James and Stapleford along the B3083 and Little Durnford, Lower Woodford, Middle Woodford, and Upper Woodford along the River Avon.

2.3.6 Numerous Public Rights of Way (PRoW) including, bridleways, byways, footpaths and cycle routes are located within the area. Although recreational land uses occur

at Stonehenge and Woodhenge, the land use is principally agricultural, dominated by arable crops and permanent pasture on steep slopes and around archaeological sites. The banks of the Rivers Till and Avon are managed for fishing.

2.3.7 Several employment sites exist across the study area, particularly in the east at Amesbury but also to the south of Amesbury at High Post.

Geology and hydrogeology

Regional geology

2.3.8 The area comprises primarily Chalk geology with a weathered mantle of varying thickness. The Chalk is overlain by Head deposits in dry valleys and alluvial deposits in river valleys as shown in Appendix A.1. The chalk outcropping at the surface is predominantly Seaford Chalk which is almost pure calcium carbonate with frequent flint bands.

2.3.9 Bodies of phosphatic chalk, a variably cemented sandy chalk with pelletal phosphatic grains, were identified to the south of Stonehenge. The presence of the phosphatic chalk was not known prior to the ground investigations carried out for the previous published scheme between 2000 and 2002.

Hydrogeology

2.3.10 The permeability of the chalk is typically high but spatially variable. It is generally highest beneath river valleys and dry valleys and lowest within the intervening interfluve areas. Due to the permeable nature of the chalk, direct runoff of rainfall is negligible but sub-surface flow beneath dry valleys can be substantial. The Rivers Avon and Till are fed mainly by groundwater issuing from the chalk aquifer.

2.3.11 Groundwater levels in the chalk aquifer respond rapidly to recharge events at the surface and significant changes in groundwater level can occur over a short period of time and between summer and winter.

Climate

2.3.12 The nearest Met office climate station is located at Boscombe Down. The climate is classified as Cfb by the Köppen-Geiger system, equating to a temperate climate with a warm summer and without a dry season. The location of the proposed scheme experiences significant rainfall throughout the year. The minimum average rainfall of 48.9 mm is experienced in July and maximum average rainfall of 84 mm is experienced in November. The average annual rainfall is 749 mm with the temperature rarely below -4°C or exceeding 26°C.

2.3.13 The altitude throughout the scheme study area varies, with Boscombe Down situated at 126 m above mean sea level. The average annual wind speed at 10 m is 9 knots at Boscombe Down and an average of 1690 hours of sunshine are experienced annually. The likelihood of snow falling is highest in early February.

Maintenance & Repair

Current maintenance

2.3.14 The A303 is a trunk road and is part of the Strategic Road Network (SRN). It is owned, maintained and operated by Highways England and its area teams and contractors. The A303 falls under the Area 2 region of the network, covering a total of 1,094km of carriageway, 1,253 structures and 63km of footways and performs the following services:

- Network management.
- Routine and cyclical maintenance.
- Winter maintenance.
- Maintenance and improvement scheme delivery.
- Bridge maintenance.
- Scheme development, design and delivery.
- Asset management.

2.3.15 Highways England's service provider advised that they undertake the following maintenance regimes:

- Routine Maintenance – Clearing of gullies. No programmed dates.
- Reactive Maintenance – Due to the reactive nature of this maintenance regime, ongoing assessments take place with maintenance taking place as required.
- Weekly inspections – Carried out every Saturday with fortnightly safety inspections carried out on Wednesdays.

2.3.16 Maintenance activities can be carried out from the existing maintenance facilities (see para. 2.4.12-13). Notably, there are few such facilities available within the study area of the scheme (refer to the scheme Stage 1 Technical Appraisal Report [1].

Winter maintenance

2.3.17 The service provider undertakes winter and severe weather maintenance in accordance with Highways England's specified requirements. There are no formal arrangements between the service provider and Wiltshire Council, however, a representative from Wiltshire Council recently attended the Severe Weather Desk Exercise.

2.3.18 The service provider has identified three vulnerable areas along the A303 during severe weather conditions in the vicinity of the scheme:

- Solstice Park to Cholderton – Long and steep gradient causing heavy goods vehicles (HGVs) to lose traction and consequently obstruct both traffic and snow clearance / de-icing operations.

- Winterbourne Stoke to Yarnbury – Risk of snow drifting particularly at field accesses, causing localised drifts which can catch drivers by surprise on an otherwise clear road.
- Deptford and Berwick Down – Long and steep gradient.

2.3.19 The service provider has identified potential sites to accommodate National Vehicle Recovery Manager (NVRM) resources. These resources could operate to clear stricken HGVs on the steep gradients to the top or to the side of the road, respectively. This option had never been exercised at the time of writing of this report.

Traffic management restrictions for maintenance

2.3.20 There are no known traffic management restrictions for maintenance, other than the high volumes of traffic and delays currently experienced by road users within the study area.

Programmed works

2.3.21 Future programmed maintenance and repair works within the study area have been requested from Highways England. The existing structures within the study area were next subject to general inspections in April 2017. Principal inspections are due to take place in 2018.

Existing structures

2.3.22 AAJV has undertaken a study of the existing structures along the existing A303 corridor. This includes all structures supporting the highway with a span/diameter greater than 900mm and all structures spanning over the highway.

2.3.23 The study compiled information provided by Highways England, namely the latest Principal Inspection and the historic drawings. A site visit and walkover survey was undertaken by AAJV (12/08/2016) to validate this information. Additionally, the site visit sought to identify any visible and obvious defects or features which might impact on any option for the A303 scheme. A summary of this study is provided in Table 2-3.

Table 2-3 Existing structures

Structure & location	Detail	Notes
Ratfyn Bridleway Overbridge MP: 109.50	Supporting	Bridleway
	Form	3-span steel footbridge, 55m long, 2.4m wide
	Date built	1969
	Condition	Fair
	Capacity	Pedestrian
	Actions	A303 anticipated to use existing alignment. Structure to be retained.
	Supporting	A303

Structure & location	Detail	Notes
River Avon Bridge MP: 109.30	Form	Single span concrete highway bridge, 20m long, 34m wide
	Date built	1969
	Condition	Fair
	Capacity	40t + 45 Units HB
	Actions	A303 anticipated to use existing alignment. Structure to be retained.
Pedestrian Underpass MP: 108.90	Supporting	A303
	Form	Concrete box culvert, 2.5m long, 78m wide
	Date built	1969
	Condition	Fair
	Capacity	40t + 45 Units HB
	Actions	A303 will need to bridge over the underpass or rebuild the underpass
Cattle Creep MP: 107.90	Supporting	A303
	Form	Single span concrete highway bridge, 7m long, 34m wide
	Date built	1969
	Condition	Fair
	Capacity	40t + 45 Units HB
	Actions	Bridge anticipated to be used for local traffic and NMU. Structure to be retained.
Winterbourne Stoke Underbridge MP: 101.00	Supporting	A303
	Form	Single span concrete highway bridge, 7m long, 10m wide
	Date built	1939
	Condition	Fair
	Capacity	40t + 45 Units HB
	Actions	Bridge anticipated to be used for local traffic and NMU. Structure to be retained.

2.3.24 The study concluded that there were no obvious visual defects with these existing structures that could significantly impact on the scheme.

2.3.25 Existing structures are inspected in accordance with the Area 2 AMOR and BD63/07. The maintenance is programmed in the Safety Management Information

System (SMIS) and involves a general inspection every 2 years and a principal inspection every 6 years. Routine maintenance is carried out on an annual basis.

Road pavement

2.3.26 The road pavement condition varies along the length of the study area. The pavement was resurfaced numerous times due to prolonged use of the route. It comprises a number of overlaid and inlaid pavement layers of varying thickness up to 133mm across a combination of thin surfacing, high friction surfacing and hot rolled asphalt.

2.3.27 40mm of inlay resurfacing work of sections within the study area took place most recently in November 2015, at the western extent of the study area. There are currently no pavement schemes in the forward programme, however, there are two sites in early planning:

- A303 Longbarrow Roundabout Eastbound and Westbound.
- A303 Winterbourne Stoke to Yarnbury Castle Eastbound and Westbound.

Carriageway lighting

2.3.28 The three main areas of carriageway lighting on the A303 within the study area are at Winterbourne Stoke, Longbarrow Roundabout and Countess Roundabout. Additionally, the slip roads on and off the existing A303 are lit at Solstice Park and the Solstice Park Porton Road flyover is lit.

2.3.29 Table 2-4 summarises the locations of existing lights, based on lighting plans received from Highways England.

2.3.30 The Longbarrow Roundabout is lit by ceramic (CPO) luminaires on aluminium street lighting columns. It is understood that this equipment was installed during the remodelling of the Longbarrow roundabout in the last 5 years and that obsolescence and non-availability of replacement components is becoming a problem. There is no lighting of route destination signs, such as advanced direction signs. The ‘Turn Left’ signs and ‘Keep Left’ bollards are lit with LEDs on the roundabout islands and splitter islands respectively.

2.3.31 The Countess Roundabout is lit by standard fluorescent (MCF/U) luminaires on street lighting columns. There is no lighting of route destination signs, such as advanced direction signs. The ‘Turn Left’ signs and ‘Keep Left’ bollards are lit on the roundabout islands and splitter islands respectively.

2.3.32 The single carriageway through Winterbourne Stoke is lit by high pressure sodium (SON/T) luminaires on steel street lighting columns. A number of street signs are lit with standard fluorescent (MCF/U) luminaires.

Table 2-4 Carriageway lighting

Location	Lighting columns	Lit signs	Lit bollards	Subway
Countess Roundabout	37	14	2	1

Location	Lighting columns	Lit signs	Lit bollards	Subway
Longbarrow Roundabout	16	6	2	0
Winterbourne Stoke	15	2	0	0
Solstice Park slip roads (north)	25	7	0	0
Solstice Park slip roads (south)	8	4	0	0

2.4 Highways Network

Existing highway network

2.4.1 Heading east from Berwick Down, the road reduces from dual two-lane carriageway to a two-lane single carriageway with a total width of approximately 7.3m. The road then drops at a maximum grade of 7% into the valley of the River Till at Winterbourne Stoke over a distance of approximately 2.2km.

2.4.2 Traffic calming measures in Winterbourne Stoke include a reduction from the national speed limit to 40mph. Speed limit signage and road markings, a signalised pedestrian crossing, street lighting and a speed camera are all situated within Winterbourne Stoke. There are also direct frontage housing / commercial uses, as well as a number of minor road priority junctions, including the B3083 which links the A360 at Shrewton to the A36 towards Salisbury.

2.4.3 At Winterbourne Stoke, the width of the carriageway reduces to approximately 6.3m at the River Till Bridge, remaining below 7.3m for a further 380 m in the easterly direction. The single carriageway then climbs out of Winterbourne Stoke, beyond the River Till at a 7% gradient and into a sharp horizontal curve. The road widens back to approximately 7.3m east of Winterbourne Stoke and follows a winding alignment for 2.2km to the junction with the A360 at Longbarrow Roundabout.

2.4.4 The single carriageway then follows the existing topography east of the Longbarrow Roundabout, along a relatively straight alignment to Stonehenge where the alignment then drops at a grade of approximately 5% to Stonehenge Bottom.

2.4.5 There are a number of accesses to Byways Open to All Traffic (BOAT) through this section which provide access to the WHS landscape.

2.4.6 The carriageway is on a 6m high embankment at the location of the now closed A344 junction. This junction, between the existing A303 and the A344, was closed in 2013 as part of improvements to visitor facilities and the A344 largely removed in this area.

2.4.7 East of Stonehenge Bottom, the road climbs at a 4.5% gradient and transitions back to a dual carriageway west of the former A344 junction. The dual carriageway passes through a cutting of approximately 10 m before meeting the A345 north of

Amesbury at the Countess Roundabout. This junction was designed with future provision for grade separation.

Junctions

2.4.8 Excluding minor accesses, there are five existing major junctions on this section of the A303 which are listed from west to east as follows:

- Staggered priority junction with the B3083 in Winterbourne Stoke.
- Priority T-junction with Church St in Winterbourne Stoke.
- Priority roundabout junction with the A360 at Longbarrow Roundabout.
- Westbound slip road, Stonehenge Road from Amesbury onto A303.
- Priority roundabout junction with the A345 at Countess Roundabout.

2.4.9 Various minor public and private accesses have also been identified along this section of the A303; see Section 3.1 of A303 Stonehenge Technical Appraisal Report, January 2017 [1] for further details.

Traffic regulation orders (TROs)

2.4.10 Two Traffic Regulation Orders (TROs) currently apply within the study area:

- Temporary TRO 2016 No. 918 – Prevention of any vehicle proceeding westwards on the A303 to turn right into Byway 12.
- TRO 2001 No. 2919 – Prevention of any vehicle to wait on any part of any carriageway, other than a layby, except upon the direction of, or with the permission of, a police constable in uniform or a traffic warden.

Byways and non-motorised user facilities

2.4.11 Travelling west to east along the scheme length, the following Non-Motorised User (NMU) routes directly intersect with the existing A303:

- Around 600m east of Yarnbury Castle, Byways Steeple Langford 3 and Berwick St James 4 cross the existing A303. This is a non-signalised crossing, with a gap in the central reservation.
- At the northern end of Bridleway Berwick St James 3 where it meets the existing A303 on Berwick Down.
- At the junction between Footpath Winterbourne Stoke 3, Winterbourne Stoke High Street and Berwick Road.
- At the junctions; between Bridleway Winterbourne Stoke 4, Winterbourne Stoke Church Street and Winterbourne Stoke High Street; and between Footpath Winterbourne Stoke 7 and Winterbourne Stoke High Street.
- At the junctions; between Byway Winterbourne Stoke 6B and Winterbourne Stoke High Street; and between Winterbourne Stoke High Street and an Unclassified Road heading south from the existing A303.
- At the intersection between Byway Amesbury 12 and the existing A303, about 500m east of Stonehenge.

- At the junction between Bridleway Amesbury 10, on King Barrow Ridge, and the existing A303, immediately to the west of Stonehenge Cottages.
- Bridleway Amesbury 44 passes over the existing A303 via a footbridge, around 500m east of Countess Roundabout.

Maintenance facilities

2.4.12 This section of the existing A303 comprises both dual and single carriageway standard with no hard strips. It is expected that full lane closures are implemented throughout periods of maintenance using roadside equipment, and that this would include contraflow under traffic management on the single carriageway sections. Various laybys were identified in the Highways England Asset Visualisation Information System (AVIS) database, that are assumed to be used by the Asset Support Contractor (ASC) for temporary lay down of equipment and vehicles while undertaking maintenance activities.

2.4.13 See Section 3.1 of the A303 Stonehenge Technical Appraisal Report, January 2017 [1] for further details regarding existing maintenance facilities.

Drainage

2.4.14 The means of collection of the highway surface water runoff along the length of the existing A303 (within the limits of the proposed works) is either by a kerb and gully system or filter drains. Both systems discharge into soakaway ditches, which run adjacent to the highway verges. These ditches are dry most of the time (except during or after a rainfall event) though in some locations, particularly in the vicinity of Countess Roundabout, they may remain wet due to the presence of a high water table. No highway surface water runoff attenuation, spillage containment and/or treatment areas were identified within the study area.

2.4.15 Although the section of highway between Countess Roundabout and Stonehenge Cottages appears to have been constructed more recently (in comparison with the single two-lane section to the west), the drainage systems are of a similar nature and do not include any pollution treatment or attenuation of surface water runoff. To the west of Countess Roundabout, a soakaway ditch adjacent to the eastbound carriageway connects into one adjacent to the westbound carriageway via a culvert beneath the A303; this in turn discharges into the River Avon.

2.4.16 A survey undertaken by the Balfour Beatty Carillion Joint Venture (BBCJV) suggests that the existing drainage system along the Countess Roundabout to Stonehenge Cottages section of the route was functioning inadequately.

2.4.17 In addition to the existing culvert to the west of Countess Roundabout, the survey also identified another culvert beneath the existing A303 to the east of the roundabout. A soakaway ditch adjacent to the eastbound carriageway has been found to connect to one adjacent to the westbound carriageway via this culvert, which in turn discharges into the River Avon.

2.4.18 The existing drainage system does not include any silt/pollution containment devices, therefore there is a high potential that a pollution incident could be washed directly into the River Avon. Apart from the two A303 culverts near

Countess Roundabout, no other culverts were found that cross beneath the existing A303 between the eastern and western limits of the scheme.

2.4.19 To the west in the Till valley a kerb and gulley system discharges direct into the River Till via one-way flap valves.

Public utilities

2.4.20 Twenty-eight statutory undertakers and other third party organisations were contacted to investigate existing public utilities. Fourteen have confirmed that they have apparatus in the study area.

2.4.21 As shown in the Existing Public Utilities plans in Appendix A.2, public utilities exist predominately parallel to the existing A303 corridor and near the Countess Roundabout junction with the A345. A review of the information received from the affected utility providers has identified the following assets within the study area:

- High and Low voltage electricity cables.
- Foul sewers.
- Water mains.
- Fibre optic cables.
- Gas mains.
- Petroleum products pipeline.
- Telecommunication cables.

2.4.22 See Section 3.1 of the A303 Stonehenge Technical Appraisal Report, January 2017 [1] for further details of the existing public utilities within the study area.

Existing technology

2.4.23 Details of existing technology equipment including communications networks and traffic signals within the scheme study area were provided by Highways England.

2.4.24 The following key technology assets were identified:

- Countess Roundabout is traffic signalised.
- Traffic signalised pedestrian crossing in Winterbourne Stoke.
- Various Traffic Monitoring Units (TMUs) electronic loops located throughout study area.
- Automatic Number Plate Recognition (ANPR) unit located at the Porton Road overpass (Solstice Park).
- Traffic Appraisal Modelling and Economics (TAME) and Emergency Roadside Telephone (ERT) located approx. 300m east of Longbarrow Roundabout, on northern side of carriageway.
- Closed Circuit Television (CCTV) located at Solstice Park, on the south-eastern side of the Porton Road overpass.
- Fixed speed camera at Winterbourne Stoke.

2.4.25 See Section 3.1 of the A303 Stonehenge Technical Appraisal Report, January 2017 [1] for further details.

2.5 Environmental

Environmental status

2.5.1 The A303 passes through the WHS. The WHS is internationally important for its complexes of outstanding prehistoric monuments. The WHS monuments include Stonehenge, The Avenue, the Cursus, Durrington Walls, Woodhenge and the densest concentration of burial mounds in Britain currently known.

2.5.2 The Cranborne Chase and West Wiltshire Downs AONB lies within the South West of the study area.

2.5.3 The River Avon Special Area of Conservation (SAC) includes the Rivers Till to the west and River Avon to the east of the WHS, which both run north to south through the study area. The Salisbury Plain SAC and Special Protection Area (SPA) which comprises several component parts, and includes several Sites of Special Scientific Interest (SSSI), is located to the north and east of the study area.

2.5.4 Within the study area the main human receptors comprise settlements at Winterbourne Stoke, Amesbury, Berwick St James, Larkhill, Shrewton, Durrington and Bulford, close to the existing A303 corridor and further settlements to the south including Salisbury, Stapleford and numerous villages within the Woodford Valley.

Environmental conditions

2.5.5 A general description of environmental conditions and constraints within the study area are set out below. These have been mapped as shown in Appendix A.3.

Noise

2.5.6 The study area is predominantly rural in nature. Road traffic noise from the A303 is a readily appreciable source of noise that affects the setting of the WHS. Other sources of road traffic noise include the A360 and A36. The A303 passes close to residential properties at Winterbourne Stoke, and the A345 runs through Amesbury and adjacent to Larkhill and Durrington. The area is subject to occasional aircraft noise from light aircraft and military aircraft.

2.5.7 There are two noise Important Areas (IAs) identified by Highways England associated with the A303 in Winterbourne Stoke and three IAs associated with local authority roads in Amesbury.

Air quality

2.5.8 The air quality study area for the scheme is within the boundaries of Wiltshire Council, Test Valley Borough Council, North Dorset District Council and South Somerset District Council.

2.5.9 Diffusion tube monitoring undertaken by Highways England suggests that exceedances of the annual mean NO2 Air Quality Strategy (AQS) objective are unlikely to occur near the A303. Wiltshire Council has however declared a total of

eight Air Quality Management Areas (AQMAs) due to exceedances of the annual mean NO2 objective, three in Salisbury and one each in Bradford-on-Avon, Westbury, Marlborough, Devizes and Calne. However, the nearest AQMAs to the scheme are those in Salisbury, which is approximately 7-11km from the study area.

Greenhouse gases

2.5.10 The total CO2 emissions from the road transport sector for the local authorities included in the study area are shown in Table 2-5.

2.5.11 As Wiltshire contains a longer road network and a greater population, this results in higher emissions from road transport compared to the other authorities.

Table 2-5 CO2 emissions associated with road transport in Wiltshire, South Somerset and North Dorset for 2014 [14]

Local Authority	CO_2 Emissions (kilotonnes)
North Dorset	120.9
South Somerset	339.8
Wiltshire	1,173.0
Test Valley	285.5

Landscape

Landscape Character

2.5.12 According to the Natural England, National Character Assessment, the baseline area falls within the Salisbury Plain and West Wiltshire Downs NCA 132. The chalk downs have a characteristic rounded landform containing dry valleys running down into larger more fertile river valleys which contain settlements. The downland landscape is typically composed of large arable fields with few hedges or trees, punctuated by geometric copses and with extensive views, particularly from the ridgelines. In contrast the river valleys contain low lying small-scale fields, woodland on valley slopes and settlements, and are much more enclosed.

2.5.13 Regional and local landscape character areas as defined in the South Wiltshire/Salisbury District Landscape Character Assessment (2008) form the basis of the Web-based Transport Analysis Guidance (WebTAG) assessment. Those covered by the study area for all route options include:

- Bourne Chalk Valley.
- Boscombe Chalk Downland.
- Upper Avon Chalk Valley.
- Larkhill Winterbourne Downland.
- Till Chalk Valley.
- Tilshead Chalk Down

Landscape designations

2.5.14 The Stonehenge, WHS covers a large part of the study area. The quality of the WHS landscape within the study area was improved since its inscription in 1986 through the extensive reversion of arable fields to permanent grassland on National Trust land. The decommissioning and restoration to grassland of the former visitor facilities, together with the stopping up and grassing over of the A344 road between its junction with the A303 (Stonehenge Bottom) and its junction with Byway AMES12, has improved the landscape setting of the Stonehenge Monument by reducing the visual and noise intrusion of traffic. The WHS landscape within the study area is therefore considered to be a landscape receptor of high sensitivity.

2.5.15 A small part of the West Wiltshire Downs and Cranborne Chase AONB extends into the study area to the south west of Winterbourne Stoke. The AONB comprises a nationally recognised landscape and is considered to be a landscape receptor of high sensitivity.

2.5.16 The remainder of the study area falls within the 'Special Landscape Area' as designated in the Wiltshire Core Strategy (Saved policy C6 from the Salisbury District Local Plan 2011) [26]. The relevant section of the Local Plan states that the landscape in these areas, whilst generally not of as such high quality as within the Cranborne Chase and West Wiltshire Downs AONB, is considered worthy of being preserved.

2.5.17 Registered Parks and Gardens within the study area include Amesbury Abbey (Grade II*), Heale House (Grade II*), Lake House (Grade II) and Wilbury (Grade II). These are considered to be landscape receptors of high sensitivity.

2.5.18 There are a large number of heritage Conservation Areas throughout the study area, particularly along river valleys. These are considered to be landscape receptors of high sensitivity.

2.5.19 North of the A303, west of the Countess Roundabout there is a group of small clumps of trees, known as the 'Nile Clumps' which are of historical interest and are subject to a Tree Preservation Order (TPO275). Small belts of trees South West of the Countess Roundabout (TPO52) and within the grounds of St Mary Church (TPO6) are also subject to Tree Preservation Orders.

Townscape

2.5.20 The townscape baseline considers urban settlements within the study area that were not classified within landscape character areas in the South Wiltshire/Salisbury District Landscape Character Assessment (2008). Small settlements and villages are inherently covered in the landscape assessment for the landscape character area within which they reside. However, there is a gap in the coverage of landscape character areas within the study area as Amesbury, Durrington and Bulford were considered 'urban' and therefore did not form part of the South Wiltshire/Salisbury District Landscape Character Assessment.

2.5.21 Amesbury lies 12km north of Salisbury on the southern edge of Salisbury Plain, and partly within the WHS. The settlement is likely to have developed at a crossing

point of the River Avon. Amesbury was the centre for a widespread royal estate during the Saxon period, and the abbey was founded in AD979. It is probable that the town itself grew up around these establishments [15]. By medieval times, an important route from London to the South West passed through the town, now represented by the A303 to the north.

2.5.22 Amesbury is primarily a residential settlement. It is a historic town, recognised as being the oldest continuously inhabited settlement in the UK. Part of the town centre is a Conservation Area, along with Amesbury Park and Amesbury Abbey (Amesbury CA) and Coneybury House (West Amesbury CA). The historic core lies within a meander in the River Avon which contains it to the north, west and south.

2.5.23 Durrington lies about 1.9km to the north of the A303 and approximately 2km to the north of Amesbury. It is located on the south-eastern edge of Salisbury Plain just outside and adjacent to the north-eastern corner of the WHS. The historic part of the settlement, to the north of the village, has been a focus for settlement since Saxon times. Recent domestic development, mainly to the south of the settlement, has impacted on the quality of the historic core, which has lost much evidence of its agricultural origins. Main streets are aligned north-south, reflecting the two manors that the original village was based around. The northern part of the village is a Conservation Area.

2.5.24 Bulford lies approximately 1.2km to the north of the A303 and 1.7km northeast of the Countess Roundabout at Amesbury. It is located on the south-eastern edge of Salisbury Plain, 1.3km outside the north-eastern corner of the WHS. Bulford Conservation Area is located at the north-western side of the village, where it abuts the south-eastern tip of Durrington, as the A3028 crosses the River Avon. The area has been associated with the military since about 1897 and Bulford Camp is located to the east of the village.

Historic Environment

2.5.25 The A303 currently passes through the WHS. The part of the WHS around Stonehenge contains numerous nationally and internationally important monuments which together constitute one of the world's finest assemblages of prehistoric remains. The agreed Statement of Outstanding Universal Value (SOUV) for the WHS states that "*The World Heritage property Stonehenge, Avebury and Associated Sites is internationally important for its complexes of outstanding prehistoric monuments. Stonehenge is the most architecturally sophisticated prehistoric stone circle in the world, while Avebury is the largest. Together with inter-related monuments, and their associated landscapes, they demonstrate Neolithic and Bronze Age ceremonial and mortuary practices resulting from around 2000 years of continuous use and monument building between circa 3700 and 1600 BC. As such they represent a unique embodiment of our collective heritage*."

2.5.26 There are also a large number of designated and non-designated assets within the study area. This includes 100s of scheduled monuments, predominately prehistoric barrows and associated sites; listed buildings and non-designated buildings of historic interest in and around Amesbury and the villages along the river valleys; conservation areas focussed on the main settlements; and the

Amesbury Abbey registered park and garden. There are also numerous archaeological assets, including the Mesolithic site at Blick Mead, numerous Neolithic and Bronze Age sites and later Roman, Medieval and Post-Medieval features. Recent archaeological work for the Scheme has identified new remains including Neolithic long barrows and a hengi-form feature, Bronze Age round barrows, a possible roman or medieval building, and prehistoric field systems.

Biodiversity

2.5.27 There are a large number of designated sites within the study area including those listed in Table 2-6 which are valued on whether they are of international, national or local value.

2.5.28 The study area varies depending on the receptors considered, e.g. 2km for internationally designated sites, 1km for national and 500m for local sites and priority habitats.

Table 2-6 Statutory and non-statutory designated sites

Designated site	Valuation of resource
River Avon SAC	International (European)
Salisbury Plain SAC	International (European)
Salisbury Plain SPA	International (European)
River Avon System SSSI	National
River Till SSSI	National
Parsonage Down SSSI	National
Parsonage Down NNR	National
Yarnbury Castle SSSI	National
Steeple Langford Down SSSI	National
Porton Meadows SSSI	National
Salisbury Plain SSSI	National
Countess Farm Swamp CWS (Country Wildlife Site)	Local
Countess Cutting CWS	Local
Normanton Down RSPB Reserve	Local
Parsonage Down CWS	Local
Little Down, Upper Woodford CWS	Local
Little Down East CWS	Local
High Post Golf Course CWS	Local
Idmiston Down CWS	Local

Designated site	Valuation of resource
Ogbury Ring CWS	Local
Boscombe Down Railway Line CWS	Local
Porton Meadow – East CWS	Local
Yarnbury Castle Verge WCC 2-25 PRV (Protected Road Verge)	Local
Berwick St. James Road Verge. WCC 2-28 PRV	Local

2.5.29 There are a number of priority habitats within the study area. Priority habitats are taken as principal habitats for the conservation of biodiversity listed under Section 41 of the Natural Environment and Rural Communities Act 2006. Priority habitats in the study area include deciduous woodland, lowland fens, lowland calcareous grassland, coastal and floodplain grazing marsh, good quality semi-improved grassland and lowland meadows.

2.5.30 There are a number of hedgerows present within the study area of varying quality and include four broad categorisations: intact mature hedgerow, defunct mature, intact managed and tree lines.

2.5.31 A desk study search for records of protected and notable species of fauna and flora identified SPA/Schedule 1 birds, bats, otter, great crested newts, water vole, lichens (Stonehenge Lichens), reptiles (slow worm, common lizard and grass snake), badgers and NERC Act 2006 S41 mammals (brown hare, polecats, West European hedgehogs).

2.5.32 Within the River Avon and River Till and their associated floodplains, there are various water dependant endangered species, e.g. Desmoulin's whorl snail, white-clawed freshwater crayfish, brown trout.

Water environment

Surface water

2.5.33 There are three Water Framework Directive (WFD, 2000/60/EC) surface water bodies within the study area. These include:

- The River Avon (Upper).
- River Bourne (Hampshire Avon).
- The Till (Hampshire Avon).

2.5.34 These fall within the South West River Basin District (RBD) as set out within the River Basin Management Plan (RBMP) [16] and are designated by the Environmental Assessment (EA) as Protected Areas under the WFD.

2.5.35 There are other surface watercourses which are not classified under the WFD, but which may contribute to the overall quality and status of the classified waterbodies

and may potentially interact with the route corridors. The location and number of these will be confirmed at the next assessment stage.

Groundwater

2.5.36 The study area is underlain by an extensive Chalk Aquifer which is named as a WFD groundwater body called the Upper Hampshire Avon. The groundwater body has a chemical status of good and was assigned as very high importance.

2.5.37 The Chalk has a high fracture permeability and a high porosity, meaning that the aquifer can usually provide a high level of water storage. These types of aquifer may support water supply and/or river base flow on a strategic scale.

2.5.38 To the east of the River Avon, the study area passes through an outer groundwater Source Protection Zone (SPZ). SPZs are zones that show the risk of contamination from any activities that might cause pollution to public drinking water supply. The SPZ within the study area is classified as SPZ 2 which represents the outer zone and is defined by a 400 day travel time from a point below the water table.

2.5.39 Due to the chalk environment, there are significant groundwater flows in the area, particularly in Stonehenge Bottom which it understood is a highly permeably zone. Water levels are known to fluctuate over the course of a year.

2.5.40 A large part of the flow in the Avon is derived from groundwater but the Avon also has other inputs including flow from the Gault Formation and Upper Greensand Formation aquifer to the north and runoff inputs from the town of Amesbury, other settlements to the north and the A345.

2.5.41 The River Till is also a chalk stream which rises within the study area. This is thought to be entirely groundwater fed in its upper reaches. North of Winterbourne Stoke is Winterbourne Stream which only flows above ground for certain periods of the year.

Fluvial flood risk

2.5.42 Both the River Avon and River Till have Flood Zone 2 and Flood Zone 3 associated with them which are within areas with limited existing development.

2.5.43 Other surface watercourses, drainage ditches, pluvial, groundwater and other sources of flood risk are unknown at the time of reporting but will be confirmed as part of the next assessment stage.

Water dependent ecology

2.5.44 Within the River Avon and River Till and their associated floodplains, there are various water dependant endangered species, e.g. Desmoulin's Whorl Snail, White-clawed Freshwater Crayfish and Brown Trout

Materials

2.5.45 Based on previous ground investigation information, it is anticipated that a mixture of non-hazardous, inert and hazardous wastes may arise from the scheme.

2.5.46 Summarised below is a description of anticipated waste arisings:

- The A303 Countess Roundabout Safety Scheme Ground Investigation Report [17] identified an area of potentially hazardous waste within the Made Ground at Countess Roundabout due to elevated concentrations of hydrocarbons. Other waste arisings in this area were characterised as non-hazardous.
- Phosphatic chalk that has been encountered south of Stonehenge may be classified differently to 'normal chalk' (usually classified as inert waste) on account of the different chemical make-up. However, there is currently insufficient data to assess the classification. The leachability of the phosphate and the geotechnical properties of the phosphatic chalk will impact on whether it can be reused and if so how and where it can be placed.
- The A303 Longbarrow Roundabout Improvement Scheme Ground Investigation Report [17] highlights that all three tested samples (around Longbarrow Roundabout) contained exceedances for benzo(a)pyrene and one out of the three samples contained exceedances of chrysene when compared to human health criteria using Soil Screening Values (SSVs) (residential with garden). The report concluded that waste arisings from the improvement works at Longbarrow Roundabout were to be disposed of as non-hazardous waste, and that any pavement that contained coal-tar based tarmac should be disposed of as hazardous waste.
- The A303 Stonehenge Improvement Interpretive Report on Phase 2 Ground Investigation [18] identified an area of historic landfilling, to the north-east of Winterbourne Stoke, which potentially contains demolition debris and asbestos. A borehole sample in this area contained elevated levels of poly-aromatic hydrocarbons (PAHs). Furthermore, the report identified Made Ground at the historic Yarnbury Castle area along the A303, which comprised sandy gravel with tarmac and glass. Asbestos waste is classified as hazardous, while the other waste arisings may be classified as non-hazardous and/ or inert.
- Within the Stapleford area, The A36 Wylye Earthworks Ground Investigation Report identifies material classed as hazardous waste in a soil sample located in that area.

People and Communities

2.5.47 The existing conditions for People and Communities are largely covered in the following Social and Distributional Conditions section. Therefore, this section covers agricultural land and farm holdings only.

2.5.48 Farm buildings, often arranged in small complexes are infrequent and scattered throughout as are several copses and plantations. The existing A303 alignment severs farmsteads and fields situated either side of the route.

2.5.49 The study area is predominantly rural with an agricultural landscape dominated by arable crops, principally winter cereals and oil seed rape. Ley grass is a common break crop and there is permanent pasture on steep slopes and around sites of

archaeological importance. Livestock is mainly sheep, but there are some beef cattle and outdoor pig enterprises. Small paddocks for horses are common near settlements.

2.5.50 Small areas of woodland are scattered throughout the landscape, some of which contain stands of coniferous trees indicating commercial management (although this may be historic). Management of game for commercial shoots, principally pheasants, is an important activity and the survival of small woodlands on the otherwise open downland is linked to this.

2.5.51 Farms are generally large but smaller holdings are found around settlements such as Winterbourne Stoke and the Woodfords where a more diversified land use includes campsites and paddocks for horses, ponies, goats and alpacas.

2.5.52 No fieldwork has been carried out to examine soils and Agricultural Land Classification (ALC) in the study area, apart from a survey of part of the area carried out in 2006, and so the assessment presented here is based on published information.

2.5.53 Best and Most Versatile (BMV) land is ALC Grades 1, 2 and Subgrade 3a. The published Ministry of Agriculture, Fisheries and Food (MAFF) 1:250,000 Provisional ALC Map provides only a broad indication of land quality and should not be used definitively on specific sites smaller than 80 ha in size. Moreover, the published map does not subdivide Grade 3 into Subgrades 3a and 3b and so cannot be used definitively in areas that are marginal to BMV. The study area covering all three Options is shown as an area of mainly Grade 3 (good to moderate quality) with a small area of Grade 2 (very good quality) in a dry valley.

2.5.54 A detailed ALC survey was carried out in 2006 for A303 Stonehenge Improvement Environmental Statement. Most of the land, in both the Andover and Icknield associations, is classed as Subgrade 3a, with Subgrade 3b on steep slopes (where gradients exceed 7 degrees) and a little Grade 2 in valley bottoms. In the study area, a very small proportion of the land has gradients greater than 7 degrees. Therefore, overall, it is likely that over 90% of the land in the study area is of BMV quality.

2.6 Existing Social and Distributional Conditions

Physical activity

2.6.1 The existing alignment of the A303 through Winterbourne Stoke includes provision of pedestrian footpaths on both sides of the road. These pavements are provided to the eastern and western extents of the village.

2.6.2 A footway is provided along the west-bound side of the carriageway between Stonehenge Road and an undesignated pedestrian crossing which joins the pedestrian route along the decommissioned A344 on the east-bound side of the A303. This crossing does not constitute a designated safe crossing point as there are no road signs warning motorists of the crossing.

2.6.3 At Countess Roundabout, pedestrian footways are limited with pedestrian access between the northern and southern sides of the junction provided via a subway which is not considered to be very attractive to users.

2.6.4 A series of Public Rights of Way (PRoW) cross and adjoin the A303. This network of PRoW provides access for NMUs between rural communities and Amesbury and is of recreational and amenity value to users. Signage distinguishing footways is provided at each instance where a PRoW crosses the A303, however there is no existing provision for safe designated crossings. In addition to the provision for non-motorised users along the A303 being limited, the user experience of the PRoW is poor and route options are undesirable for users due to high traffic flows and vehicle speeds.

2.6.5 Within the River Till and River Avon Valleys an extensive network of Public Rights of Way link the villages of Berwick St James, Stapleford, Winterbourne Stoke, Upper, Middle and Lower Woodford, Great Durnford and Little Durnford. This network provides access to the wider countryside and is of recreational and amenity value to users. The small size of these villages and the linear nature of development along minor C class roads results in a high level of interconnectivity in terms of access to Woodford Valley Primary School, a number of churches, pubs and other community facilities and services.

Journey quality

2.6.6 Solstice Park provides access from the A303 to roadside services including a filling station, convenience store, a range of restaurants and a hotel. In addition, the village of Winterbourne Stoke and the Countess Roundabout service area provide facilities for both motorised travellers and non-motorised users.

2.6.7 The existing alignment provides open views of the rural landscape associated with the WHS on the east and west approaches to Stonehenge contributing to views of Stonehenge within 165m of the road.

2.6.8 Congestion along the single carriageway section of the route between Amesbury and Berwick Down is common and severe during peak periods resulting in congestion and long queues on both approaches. The resulting high traffic volumes and low traffic speed triggers high driver stress and frustration.

Security

2.6.9 Most of the existing A303 is unlit, with limited lighting at Longbarrow Roundabout, Countess Roundabout and through Winterbourne Stoke. There is informal surveillance provided by the constant flow of traffic along the road.

Accessibility

2.6.10 There is only one bus stop that lies directly on the existing A303. This is located in the centre of Winterbourne Stoke at the T-junction between the A303 and the B3083, travelling northbound towards Shrewton. The other bus stops are spread across the study area, with a higher concentration in close proximity to the local towns including Amesbury, Bulford, Durrington, Larkhill and Shrewton.

Affordability

2.6.11 There are no tolls on the existing route and no public transport services with associated fares travelling along the existing alignment, although there are bus services in the wider area and one that crosses the existing route on the B3083. Vehicle operating costs are currently high due to congestion on the route.

Severance

2.6.12 The A303 severs the community of Winterbourne Stoke and a number of Public Rights of Way in the vicinity of the village. Within Winterbourne Stoke a number of community facilities including a pub and petrol station are situated on the north side of the A303 whereas the majority of the village's population is situated to the south. Within the WHS a number of PRoWs which provide access to Stonehenge from surrounding communities are severed by the A303. No designated pedestrian crossings are provided in these instances. The existing A303 creates severance for residents of Countess Road when accessing facilities in Amesbury, an underpass of a substandard design provides the only designated crossing point.

2.6.13 An extensive network of PRoWs provide links between neighbouring villages of Winterbourne Stoke, Berwick St. James and Stapleford in the River Till Valley and the villages of Upper, Middle and Lower Woodford, Great Durnford and Little Durnford in the River Avon Valley. This network provides non-motorised access to services and community facilities within these villages.

2.6.14 Within the villages of Shrewton, Larkhill and Durrington rat running associated with the congested A303 results in increased severance for residents accessing community facilities and services.

Option values

2.6.15 There are no railway stations or bus services travelling along the existing A303, although there are bus services in the wider area and one that crosses the existing alignment on the B3083.

Distributional conditions

2.6.16 No Lower Super Output Areas1 (LSOAs) in the most deprived quintile for income (Index of Deprivation, 2015) were identified close to the scheme.

2.6.17 There are lower concentration levels of children in the scheme area than in England as a whole, but pockets with high concentration of children can be found in Amesbury, Larkhill, Durrington, Bulford and Shrewton, and there are also several schools in the area. Levels of older people in the area are higher than the national average, with concentrations in Amesbury, Durrington, Berwick St James, Lower and Middle Woodford and Porton.

2.6.18 Levels of households without access to cars are lower than the national average, and particularly low for areas close to the surface route, although there is one pocket with high levels of no car households in central Amesbury.

[1] A geographic area used for the reporting of statistics in the Census – LSOAs have a population of 1000-3000 and contain 400-1200 households.

2.6.19 Levels of people claiming Disability Living Allowance are slightly lower than the national average, with no areas with high concentrations close to the scheme.

2.6.20 Levels of women in the scheme area are in line with the national average, with concentrations in Shrewton, Durrington, Amesbury and Great Durnford.

2.6.21 Levels of Black and Minority Ethnic residents are far below national levels, with no concentrations close to the scheme.

2.7 Corridor

2.7.1 The A303/A30/A358 Feasibility Study [11] identified eight highway improvements along the corridor. The DfT's RIS 2015/16 - 2019/20 Road Period (RIS 1) [1] identified the following three schemes to start construction within the period:

- A303 Amesbury to Berwick Down.
- A303 Sparkford to Ilchester.
- A358 Southfields to M5 Motorway (Junction 25).

2.7.2 The other schemes are scheduled to start within the future RIS periods.

2.7.3 Due to the common timescales for the three RIS 1 schemes, there was a coordinated approach between the three schemes. This was based around regular liaison meetings with the teams designed to share research and analysis, experience and best practice, particularly in the modelling and appraisal of the schemes.

2.8 Do-Nothing Consequences

Traffic Flow Ranges

2.8.1 The following traffic analysis is based on the PCF Stage 1 traffic model as published in Chapter 10 of the A303 Stonehenge Technical Appraisal Report (TAR), January 2017.

2.8.2 The Design Manual for Roads and Bridges (DMRB) recommends traffic flow ranges for new rural road links based on the Annual Average Daily Traffic (AADT) flows. Table 2-8 summarises the indicative range of traffic flows within which different carriageway layouts are likely to be economically justified (not absolute capacity).

Table 2-7 Opening Year AADT flow ranges for different carriageway standards (DMRB 46/97 - Table 2.1)

Carriageway standard		Opening year AADT	
		Minimum	Maximum
Single carriageway	S2	Up to 13,000	
Wide single carriageway	WS 2	6,000	21,000

Dual 2 lane all purpose	D2 AP	11,000	39,000
Dual 3 lane all purpose	D3 AP	23,000	54,000

2.8.3 Forecast opening year traffic flows for the Do Minimum (without scheme) scenario are summarised in Table 2-9. The Do Minimum forecast flows are greater than the maximum flows for a wide single carriageway cross-section.

Table 2-8 Forecast AADT flows on A303

Scenario	Opening year (2024) AADT		
	Low	Core	High
Do Minimum	25,450	27,150	29,000

Congestion and Stress

2.8.4 In relation to the existing situation, an approach to understanding the impact of traffic flow on network performance is to calculate the network "stress" using traffic flow data compared with Congestion Reference Flow (CRF). The CRF is the maximum achievable hourly throughput on a link expressed in terms of AADT. Links which operate with flows in excess of this value (i.e. above 100%) are likely to suffer from operational issues and congestion, including flow breakdown and queuing. Where the stress factor lies between 85% and 100% turbulent traffic conditions will also be experienced during peak periods.

2.8.5 Table 2-10 and Table 2-11 show the forecast road stress ratios for the existing case (Do Minimum) for a neutral and summer (worst case) month for the same sections for 2015, 2024, 2031, 2039 and 2051. The analysis clearly demonstrates the increase in stress levels in the future on the single carriageway sections between Amesbury and Berwick Down if no improvements are made. A stress factor of less than 85% is shown in green, between 85% and 99% is highlighted in amber and above 100% is shown in red.

Table 2-9 Future Corridor CRF and stresses without scheme – Neutral month (March)

No	Section	No. of lanes	CRF	Both directions									
				ADT					Stress factor				
				2015	2024	2031	2039	2051	2015	2024	2031	2039	2051
1	A36 - B3083 (W. Stoke)	1	25,289	20,833	20,835	22,393	23,215	25,924	0.82	0.82	0.89	0.92	1.03
2	B3083 (W. Stoke) - A345 (Countess)	1	22,466	25,440	28,679	31,203	33,221	36,848	1.13	1.28	1.39	1.48	1.64
3	A345 (Countess) - A3028 (Double Hedges)	2	88,248	26,187	38,390	41,387	44,206	48,867	0.30	0.44	0.47	0.50	0.55
4	A3028 (Double Hedges) - A338	2	80,312	27,357	34,524	37,061	39,370	43,369	0.34	0.43	0.46	0.49	0.54

Table 2-10 Future Corridor CRF and stresses without scheme - Summer month (August)

No	Section	No. of lanes	CRF	Both directions									
				ADT					Stress factor				
				2015	2024	2031	2039	2051	2015	2024	2031	2039	2051
1	A36 - B3083 (W. Stoke)	1	20,672	27,916	27,919	30,007	31,108	34,738	1.35	1.35	1.45	1.50	1.68
2	B3083 (W. Stoke) - A345 (Countess)	1	23,724	34,090	38,430	41,812	44,516	49,376	1.44	1.62	1.76	1.88	2.08
3	A345 (Countess) - A3028 (Double Hedges)	2	81,387	35,091	51,443	55,459	59,236	65,482	0.43	0.63	0.68	0.73	0.80
4	A3028 (Double Hedges) – A338	2	68,717	36,658	46,262	49,662	52,756	58,115	0.53	0.67	0.72	0.77	0.85

2.8.6 The existing network stress analysis presented above demonstrates that the single carriageway sections are operating with high levels of stress which, if not corrected, will increase significantly in the future. In addition, average traffic volumes significantly exceed the 85% capacity levels for many hours in the average day meaning significant congestion would be experienced.

3. Planning Factors

3.1 Introduction

3.1.1 The scheme is defined as a Nationally Significant Infrastructure Project (NSIP) and will seek development consent under the provisions of the Planning Act 2008.

3.1.2 This chapter provides an overview of the legislation and planning policy which is relevant to the scheme and sets out the relevant European Directives, UK legislation and national policy that will need to be complied with as part of an application for development consent.

3.1.3 The Planning Brief for the A303 Stonehenge Amesbury to Berwick Down scheme is set out in the Department for Transport's (DfT's) Client Scheme Requirements (CSRs). They cover a high-level definition of the transport challenges and issues, objectives, project outputs and value for the scheme.

3.2 Planning Brief (CSRs)

Client Scheme Requirements

3.2.1 The objectives of the scheme are defined in the four CSRs as follows:

- **Transport** – To create a high quality route that resolves current and predicted traffic problems and contributes towards the creation of an Expressway between London and the South West.
- **Economic growth** – In combination with other schemes on the route, to enable growth in jobs and housing by providing a free flowing and reliable connection between the South East and the South West peninsula.
- **Cultural heritage** – To contribute to the conservation and enhancement of the WHS by improving access both within and to the site.
- **Environment and community** – To contribute to the enhancement of the historic landscape within the WHS, to improve biodiversity along the route and to provide a positive legacy to communities adjoining the road.

Expansion on headline requirements

3.2.2 The CSRs provide an overall framework of objectives. However, to assist with measuring performance against the CSRs, each of the four headline CSRs was expanded to provide a series of more detailed requirements.

Transport

- The road will be designed to modern standards and, in addition, to perform as an Expressway.
- The design of the road and connections with the local network will address issues of congestion, resilience and reliability. It will reduce risk of traffic diverting onto local roads.

- Road safety will be improved to at least the national average for a road of this type.

Economic growth

- The road capacity, together with Non-Motorised User (NMU) provision, will be increased to dual carriageway all-purpose between Amesbury and Berwick Down, linking with existing dual carriageways to the East and West.
- Grade separated junctions will be introduced to create a road that meets Expressway standards, designed to accommodate foreseeable traffic growth.
- Grade separation will also assist traffic and NMU wishing to cross the A303 and so stimulate local economic activity and reduce severance.

Cultural heritage

- The existing road will be downgraded as it passes through the WHS for use by non-motorised users and for access.
- The strategic route will be redirected so as to reduce its site and sound impacts on the WHS. The redirected route will treat archaeological features with sensitivity and will protect the Outstanding Universal Value (OUV) of the WHS. It will seek to minimise any damage to or loss of archaeology.
- Grade separated junctions will be introduced in place of at-grade junctions on the A303 within the length of the scheme, improving access onto and off the A303, with well-designed signing to access the WHS.
- Where the road passes through the WHS it will have an iconic identity and be of good design. As far as is practicable and without compromise to safety, the design will seek to accommodate the specific needs of the WHS.
- Learning associated with any excavation within the WHS will be ensured, by working sensitively and in close collaboration with key heritage stakeholders.

Environment and community

- Land no longer forming the public highway within the WHS will be returned to the adjoining landowner. Where practicable and with the permission of the owner, it will be landscaped in accordance with the adjoining land.
- Biodiversity within new landscaping along the route will ensure a net addition over that which exists currently.
- The A303 will bypass Winterbourne Stoke and the existing road will be de-trunked as it passes through the village. This will improve the quality of life for the residents of the village.
- Disruption to road users and local residents during the construction of the scheme will be minimised as far as is reasonably practicable. Also, opportunities for materials re-use will be sought as far as is practicable. Opportunities for mitigating impacts will be actively pursued in close consultation with communities.

- Learning and finds during the development of the scheme will be presented to local schools and communities. Presentations will be given to local and regional forums to raise awareness of the scheme, its timing and the potential economic benefits likely to result from an improved road network, as well as employment and supply chain opportunities during construction.
- The scheme will aspire to achieve a Civil Engineering Environmental Quality Assessment and Award scheme (CEEQUAL) rating of excellent.

3.3 UK Legislation and European Directives

Planning Act 2008 (the Act)

3.3.1 As the proposed scheme is for the construction and alteration of a highway in England, for which the Secretary of State is the Highways Authority, it is a Nationally Significant Infrastructure Project under Section 14 of the Act. This means the scheme requires a Development Consent Order (DCO) to be granted by the Secretary of State, following a recommendation by the Planning Inspectorate.

3.3.2 The Planning Act 2008 sets out the process for the consideration of applications for development consent. It requires the developer to carry out consultation before making an application. Once an application is made, there are statutory time limits placed on most stages of its consideration.

3.3.3 Section 104 of the Act prescribes that a decision on whether or not to grant consent must have regard to:

- Any National Policy Statement (NPS) which has effect in relation to the type of development.
- Any marine policy documents (if relevant).
- Any local impact report.
- Any matters prescribed in relation to the type of development.
- Any other matters which are important and relevant.

3.3.4 In the case of highways, an application will be considered primarily against the National Policy Statement for National Networks (NPSNN).

Habitats Directive and Habitats Regulations

3.3.5 The Habitats and Wild Birds Directives conserve particular habitats and species across the European Union by protecting a network of functionally linked sites. These are known as the Natura 2000 network. The UK is also obligated to protect these sites by virtue of a number of international agreements such as The Convention on Wetlands of International Importance, called the Ramsar convention.

3.3.6 The Habitats Regulations transpose into UK law the requirements of these Directives. They set out the iterative process by which plans, projects or programmes should be assessed by a "Competent Authority" (the Secretary of

State for Transport in this case), in order to ensure they do not have an adverse effect on the integrity of a European designated site.

3.3.7 This is ascertained through a screening process to establish whether likely significant effects could occur as a result of the project, based on the outputs of the environmental assessment. If effects are likely, the onus is on the developer to provide enough information for the Competent Authority to carry out an Appropriate Assessment. This will consider whether any likely effects will adversely affect the integrity of the site in view of its conservation objectives. This assessment will have to be provided as part of an application for development consent. Natural England is the statutory nature conservation body who will inform the Competent Authority (Secretary of State for Transport, in this instance), regarding impacts on European designated sites.

3.3.8 If an adverse effect on the integrity of a European site is shown to occur as a result of the Appropriate Assessment, derogation can be pursued which would allow the decision-maker to grant consent. The sequential tests which would be applied to this are:

- There must be no feasible alternative to the plan or project.
- There must be Imperative Reasons of Overriding Public Interest (IROPI) for the scheme.
- Compensatory measures must be secured (prior to construction) to maintain the coherence of the network. It will need to be proven that like for like compensatory habitat is secured and deliverable to the decision-maker.

Environmental Impact Assessment

3.3.9 The Environmental Impact Assessment (EIA) Regulations (The Infrastructure Planning (EIA) Regulations 2009) set out the process of environmental impact assessment for nationally significant schemes. This includes that the applicant may request a Scoping Opinion from the Planning Inspectorate, who will consult with a number of statutory consultees on the proposed scope of the assessment. The regulations also stipulate that scheme promoters of Nationally Significant Infrastructure Projects (NSIPs) must state in their Statement of Community Consultation how they will consult on Preliminary Environmental Information.

3.3.10 Schedule 5, Part 1 of the Regulations states the information which should be included in an environmental statement, principally:

- Description of the development.
- An outline of the alternatives studied.
- Description of the aspects of the environment likely to be affected.
- Description of the likely significant effects of the environment.
- Measures to reduce prevent and offset these effects.
- A non-technical summary.

3.3.11 The EIA Directive (2014/52/EU) was transposed into UK law on 16 May 2017.

3.4 National Policy

National Policy Statement for National Networks (NPSNN)

3.4.1 The NPSNN [19] sets out Government policy for the need for, and delivery of, nationally significant road and rail projects. The policy states that the Government will deliver national networks that meet the long term needs of the country and support a thriving and prosperous economy.

3.4.2 Chapter 2 of the NPSNN sets out the following strategic objectives:

- Networks with the capacity and connectivity and resilience to support national and local economic activity and facilitate growth and create jobs.
- Networks which support and improve journey quality, reliability and safety.
- Networks which support the delivery of environmental goals and the move to a low carbon economy.
- Networks which join up our communities and link effectively to each other.

3.4.3 It states a critical need to improve the road network to address congestion, providing safe, resilient and expeditious networks which support social and economic activity. These improvements may also address impacts of networks on quality of life and the environment (NSPNN paragraph 2.2). A well-functioning road network is stated as critical to supporting national and regional economies (NSPNN paragraph 2.13).

3.4.4 The Government's policy to address this need is to bring forward enhancements and improvements to the existing network. This includes improvements to trunk roads, in particular dualling of single carriageway strategic trunk roads to increase capacity and improve performance and resilience.

3.4.5 Chapter 3 of NPSNN sets the need for improvements to the road network in the context of wider Government policies. These include:

- Environment and social impacts: networks should be designed to minimise social and environmental impacts and improve quality of life; the principles of the National Planning Policy Framework (NPPF) and Planning Practice Guidance (PPG), as well detailed policy set out in Chapter 5 of the NPSNN should be followed to mitigate effects.
- Emissions: the Government supports the switch to Ultra Low Emission Vehicles (ULEVs), and predicts that increases to emissions as a result of improvements to the road network will be very small as a result of current and future commitments to meet legally binding targets.
- Safety: the Government intends to remain a world leader in road safety, and scheme promoters are expected to take opportunities to improve road safety, employing the most modern and effective safety measures where proportionate.
- Technology: innovative technologies will be monitored for their benefits and risks, but are not expected to alleviate the need to address current

congestion problems or negate the need for improvements to the road network.

- Sustainable transport: the Government expects applicants to use reasonable endeavours to address the needs of pedestrians and cyclists. This includes investing in locations where the national road network severs communities and acts as a barrier to cycling and walking by addressing historic problems, retrofitting solutions, and ensuring safety for cyclists on junctions.
- Accessibility: applicants should improve access wherever possible through delivering schemes which take all opportunities for improvements in accessibility for all users, including disabled users, of the strategic road network.
- Road tolling and charging: the Government's policy is not to introduce road pricing for key trunk roads on the strategic road network.

3.4.6 Chapter 4 sets out the assessment principles for the consideration of highway schemes. In particular, it states that subject to the detailed policies and protections in this NPSNN, and the legal constraints set out in the Planning Act, that there is a presumption in favour of granting development consent for NSIP projects, such as the proposed scheme.

3.4.7 When considering an application for development consent, the Secretary of State will consider its benefits including for economic growth, job creation, and environmental improvement. This will be considered against adverse impacts of the scheme including long-term cumulative impacts. Such applications are required to be supported by a business case prepared in accordance with Treasury Green Book principles.

3.4.8 The policy states that projects subject to The Infrastructure Planning EIA Regulations 2009 should include an environmental statement with the application. As part of this, the impacts from reasonably foreseeable schemes should be considered in the assessment. The maximum extent of the project's possible impact should be assessed where there are details which are yet to be finalised. The policy also sets out that the application should provide sufficient information for the carrying out of an appropriate assessment by the Secretary of State for Transport, where proposals are likely to have a significant effect on a European designated site.

3.4.9 In relation to alternatives, it is stated that all schemes should be subject to an options appraisal, which should also consider viable modal alternatives. However, where schemes were subject to an options appraisal to achieve their status within road investment strategies, option testing need not be considered by the decision maker.

3.4.10 The policy requires principles of good design to inform projects from their inception. The design should work to mitigate the impact of the project in terms of the environment, safety and sustaining operational efficiency. Proposed schemes which are fit for purpose and sustainable can contribute towards the area in which they are located; applicants should demonstrate how the design process has contributed to these aims.

3.4.11 Applicants must consider climate change adaptation in the siting, location, design, construction and operation of proposed schemes. This includes demonstrating that there are no critical features that will be affected by the effects of climate change in the long term; this is to be based on the Government's climate change risk assessment and consultation with statutory bodies. The policy also sets out that pollution control, nuisance and statutory nuisance, safety, security, and health should be considered by applicants in the design of their schemes.

3.4.12 Chapter 5 of the NPS sets out the assessment framework against which the application will be considered. The contents of this chapter will be used by the decision maker to establish whether the applicant has considered the necessary areas of assessment. The areas which must be considered are outlined below:

- Air quality.
- Carbon emissions.
- Biodiversity.
- Waste management.
- Civil and military aviation and defence interests.
- Coastal change.
- Dust, odour, artificial light, smoke, steam.
- Flood risk.
- Land instability.
- The historic environment (this includes impacts on WHS).
- Land use including open space, green infrastructure, and greenbelt.
- Noise and vibration.
- Impacts on transport networks.
- Water quality and resources.

3.5 Other Relevant Policy and Strategy

3.5.1 In addition to the NPSNN, other documents which may be considered important and relevant to the scheme are summarised below.

National Planning Policy Framework (NPPF)

3.5.2 The NPPF provides a framework for the designation of local plans by local authorities and for the consideration of planning applications in England. The policy puts a presumption in favour of sustainable development at the heart of decision making for planning applications made to the local authority.

3.5.3 Paragraph 3 of the NPPF confirms that the framework does not contain any specific policies for nationally significant infrastructure projects as contained in national policy statements. However, paragraph 3.3 of NPSNN expects applicants to avoid and mitigate environmental and social impacts of schemes in line with the principles set out in the NPPF and the Government's planning guidance.

Road Investment Strategy 1 (RIS 1)

3.5.4 The Road Investment Strategy [1] commits the Government to delivering a series of improvements and upgrades during the investment period. There is a requirement under section 3 of the Infrastructure Act 2015 for the Secretary of State and Highways England to deliver the commitments within the strategy.

3.5.5 The RIS sets out eight 'performance areas' for improved performance. These form the basis of the Performance Specification, setting out specific expectations for the SRN over the period to 2020 (chapter 7). Performance areas relevant to the scheme include:

- Making the network safer.
- Improving user satisfaction.
- Supporting the smooth flow of traffic.
- Encouraging economic growth.
- Delivering better environmental outcomes.
- Helping cyclists, walkers and other vulnerable users of the network.

3.5.6 In recognition of the strategic importance of the A303 corridor, the Government has committed to the creation of an Expressway between the South-East and the South West by 2029. A package of eight potential improvement projects was identified. As part of this, a scheme involving a 2.9km twin bored tunnel past Stonehenge, and a bypass for Winterbourne Stoke, was identified to be delivered as part of the investment period in RIS 1.

The Stonehenge and Avebury WHS Management Plan

3.5.7 The purpose of this Management Plan is to guide the care of the WHS in order to sustain its Outstanding Universal Value (OUV). The priority for the Management Plan is to encourage the sustainable management of the WHS, balancing its needs with those of the farming community, nature conservation, access, the landowners and the local community.

3.5.8 Part 2, Section 11 of the document sets out the issues relating to the management of roads and traffic in relation to the WHS. It states that roads and traffic have an adverse effect on the area of the WHS and its attributes of OUV.

3.5.9 The negative impact on setting and character within the WHS as a result of roads is primarily related to: loss of tranquillity; signage; related clutter; inappropriate design and light pollution.

3.5.10 The significant impacts of the A303 on the OUV of the WHS are described as: the division of the landscape and severance of key monuments; the setting of Stonehenge and The Avenue and other monuments of OUV (including several Barrow cemeteries); and visual and noise intrusion.

3.5.11 The Management Plan states that any solution for the A303 would need to be assessed for its likely impact on the WHS and its attributes of OUV. This includes the interrelationships of monuments, their settings and relationship to the

landscape and integrity of the wider WHS landscape. The document refers to "Guidance on Heritage Impact Assessments for Cultural World Heritage Properties (ICOMOS, 2011)" for how significant developments should be assessed when proposed in the WHS.

3.5.12 The Management Plan prioritises the future of the A303 as the major road and traffic issue facing the Stonehenge area of the WHS.

3.5.13 Part 3 of the Management Plan outlines the aims and policies which govern the long and short term goals of managing the WHS; these are derived from the issues and opportunities identified in Part 2.

3.5.14 Aim 3 of the plan is to sustain the OUV of the WHS through conservation and enhancement of the whole site and is attributes. To achieve this, policy 3d prioritises the improvement of the WHS landscape by the removal, redesign or screening of existing infrastructure where opportunities arise.

3.5.15 Aim 6 of the plan regards the significant reduction of the negative impacts of roads and traffic on the WHS and its attributes, while increasing sustainable access to the WHS. Policy 6a states the need to reduce the impacts of roads and traffic on the WHS, and increase safety to improve the ease and confidence where visitors can explore the WHS.

3.6 Local Policy

Wiltshire Core Strategy (WCS)

3.6.1 Wiltshire Council's WCS was adopted in January 2015. It contains policies relevant to all development decisions in Wiltshire. It does not include specific policies for the upgrading of the A303 between Amesbury and Berwick Down, and NPSNN contains the primary policy framework for the scheme. However, specific elements of local policy may be considered as important and relevant to the proposals. These include:

Table 3-1 Wiltshire Core Strategy strategic objectives and core policies

Strategic objective	Relevant core policies
Strategic objective 1: delivering a thriving economy	Core policy 37: military establishments
Strategic objective 4: helping to build resilient communities	Core policy 48: supporting rural life
Strategic objective 5: protecting and enhancing the natural, historic and built environment	Core policy 50: biodiversity and geodiversity
	Core policy 51: landscape
	Core policy 55: air quality
	Core policy 56: contaminated land

Strategic objective	Relevant core policies
	Core policy 59: the Stonehenge, Avebury and Associated Sites WHS and its setting. This policy states the obligation to protect, conserve, present and transmit to future generations the OUV of WHSs should be given precedence in decision-making.
Strategic objective 6: ensuring that adequate infrastructure is in place to support our communities	Core policy 66: strategic transport network.
	Core policy 67: flood risk
	Core policy 68: water resources
	Core policy 69: protection of the River Avon Special Area of Conservation (SAC)
Amesbury area strategy	Core policy 4: Spatial strategy for the Amesbury Community Area. As part of this the policy the Council intends to work collaboratively with the relevant agencies, such as Highways England, the Department for Transport and English Heritage, to achieve an acceptable solution for the dualling of the A303. This should be a solution which does not adversely affect the WHS and its setting.
	Core policy 6: Stonehenge. This policy sets out criteria for development affecting the WHS.

Wiltshire Local Transport Plan (LTP)

3.6.2 The Wiltshire LTP for 2011-2026 sets out Wiltshire Council's objectives, plans and indicators for transport in Wiltshire. The LTP includes supporting objectives to sit underneath the national transport goals, which provide the overarching priorities for transport in the county. Goals and objectives relevant to the proposals include:

Table 3-2 Wiltshire Local Transport Plan goals and strategic objectives

Goal	Relevant strategic objectives
Support economic growth	SO1: To support and help improve the vitality, viability and resilience of Wiltshire's economy and market towns
	SO4: To minimise traffic delays and disruption and improve journey time reliability on key routes
	SO10: to encourage the efficient and sustainable distribution of freight in Wiltshire
	SO16: To improve the resilience of the transport system to impacts such as adverse weather, climate change and peak oil
Reduce carbon emissions	SO11: To reduce the level of air pollutant and climate change emissions from transport

Goal	Relevant strategic objectives
Contribute to better safety, security and health	SO8: To improve safety for all road users and to reduce the number of casualties on Wiltshire's roads
	S09: To reduce the impact of traffic speeds in towns and villages
	SO14: To promote travel modes that are beneficial to health
Promote equality of opportunity	SO5: To improve sustainable access to a full range of opportunities particularly for those people without access to a car
	SO15: To reduce barriers to transport and access for people with disabilities and mobility impairment
Improve quality of life and promote a healthy environment	SO3: To reduce the impact of traffic on people's quality of life and Wiltshire's built and natural environment
	SO7: To enhance Wiltshire's public realm and street-scene
	SO17: To improve access to Wiltshire's countryside and provide a more useable public rights of way network
	SO18: To enhance the journey experience of transport users

Swindon and Wiltshire Local Enterprise Partnership (LEP) Strategic Economic Plan (SEP)

3.6.3 The SEP sets out strategic objectives to stimulate investment in the Swindon and Wiltshire area over the period to 2026. These include:

- Transport infrastructure improvements: we need a well-connected, reliable and resilient transport system to support economic and planned development growth at key locations;
- Place shaping: we need to deliver the infrastructure required to deliver our planned growth and regenerate our City and Town Centres, and improve our visitor and cultural offer; and
- Business development – to strengthen the competitiveness of small and medium sized businesses and attract a greater share of foreign and domestic investment into the area.

4. Option Identification (PCF Stage 1)

4.1 Options Identification

Process

4.1.1 A three stage process of options identification and sifting was undertaken to develop and shortlist route options and then take the better performing through the further more detailed appraisal to confirm the route options for consultation.

4.1.2 The three stages of options identification and sifting are outlined in Figure 4-1 below and were defined as follows:

- **Design Fix A** – Initial Corridor Options appraisal to identify preferred corridor options.
- **Design Fix B** – Development of possible route options within preferred corridors.
- **Design Fix C** – Initial route options appraisal to identify options for further appraisal.

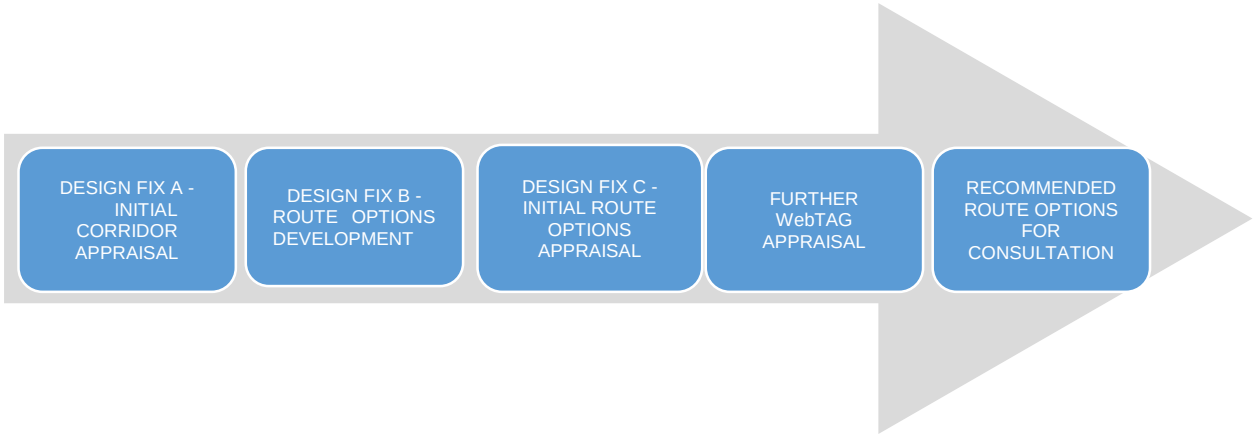


Figure 4-1 Options identification process

4.2 Initial Corridor appraisal – Design Fix A

Identification of corridor options

4.2.1 There have been a wide range of proposed solutions to the traffic problems on the A303 at Stonehenge over many years. A review was undertaken of the more than 60 route options that have been proposed by Government, stakeholders and the public in the past, shown on Figure 4-2 and Appendix B.1. These options were grouped into a series of corridors which contained route options with similar characteristics. This resulted in eight corridors, representing the groups of route options described as follows, and illustrated in Figure 4-3 and Appendix B.2:

- Corridor A – Surface routes north of the existing A303 (wholly outside WHS).
- Corridor B – Surface routes north of the existing A303 (partially inside WHS).

- Corridor C – Surface routes within 1.0 km of the existing A303 (as the route options pass through the WHS).
- Corridor D – Routes including a tunnel (at least partially within the WHS).
- Corridor E – Surface routes south of the existing A303 (at least partially inside WHS).
- Corridor F (north) – Surface routes south of the existing A303 (wholly outside WHS) and north of Salisbury.
- Corridor F (south) – Surface routes south of the existing A303 (wholly outside WHS) and north of Salisbury, further south than Corridor F (north).
- Corridor G – Surface routes south of the existing A303 (wholly outside WHS) and south of Salisbury.

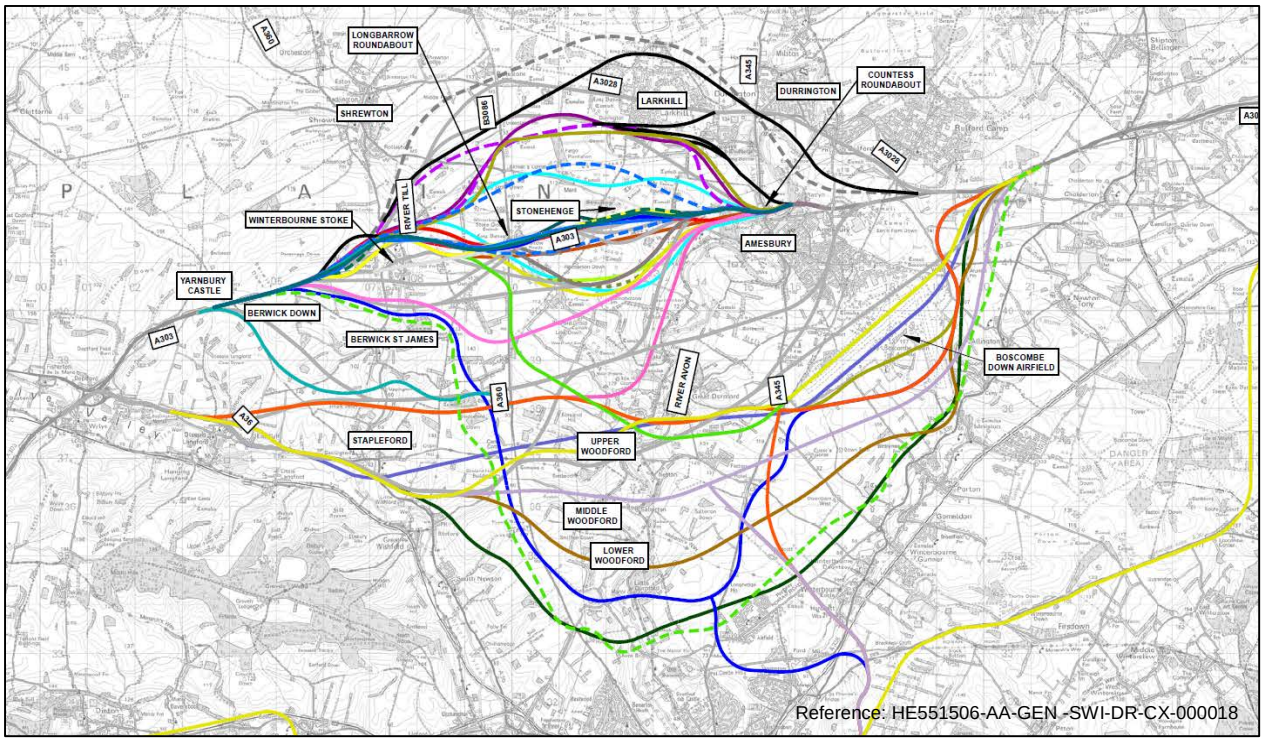


Figure 4-2 Historical Route Options

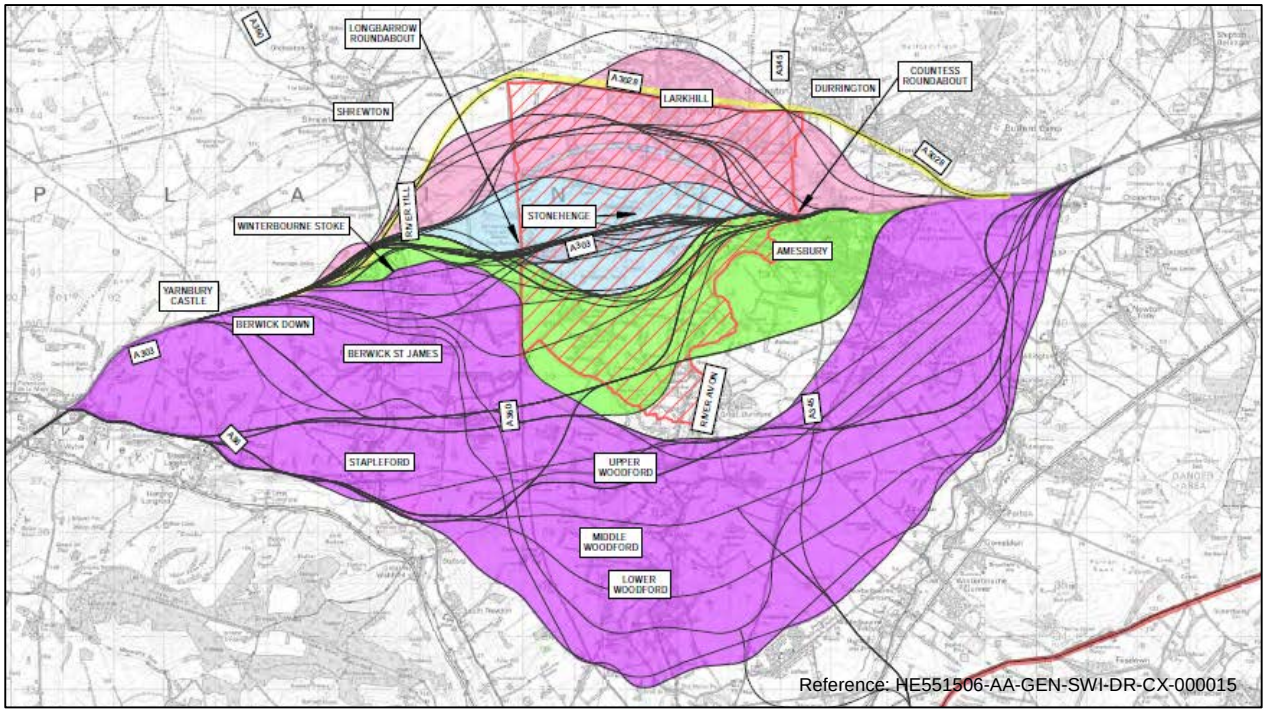


Figure 4-3 Corridors Identified

4.2.2 The objective of this phase of the selection process (Design Fix A) was to undertake a multi-criteria assessment of the eight corridors and ultimately to recommend corridors to be taken forward for further consideration.

4.2.3 The assessment and appraisal methodology were based around the following three criteria:

- Client Scheme Requirements.
- Web-based Transport Appraisal Guidance's (WebTAG) Early Assessment and Sifting Tool (EAST).
- National Policy Statement for National Networks (NPSNN) environmental aspects.

Key outcomes of the appraisal

Surface route options within the WHS (Corridors B, C and E)

4.2.4 Surface route options within the WHS would offer transport benefits and could be delivered at a lower cost than a tunnelled solution but would be considered unacceptable from a cultural heritage point of view.

4.2.5 A surface route close to the existing A303 would fail to reduce severance within the WHS and would cause substantial harm to the Outstanding Universal Value (OUV) of the site.

4.2.6 Options involving a surface route to the north or south of the existing A303 would reduce the visual and noise impacts of the road on the Stonehenge monument

itself but any such route would still affect the character of the WHS and would also cause substantial harm to the OUV of the site.

4.2.7 National Trust and Historic England have identified that a surface route through the WHS has the potential to 'compound and multiply' the harmful effects of the existing A303 and they would be unable to support surface dualling due to these very large adverse effects. They considered the harmful effects to be of such a large scale that it would likely lead to the inclusion of the WHS within the UNESCO's World Heritage "in danger" list and may even lead to the loss of the WHS designation for Stonehenge and Avebury.

Tunnelled Routes within the WHS (Corridor D)

4.2.8 A tunnelled route through the WHS would reduce severance within the WHS and improve the setting of key assets such as Stonehenge. The surface elements may cause adverse effects on the character of the WHS but it is considered that substantial harm can be avoided with appropriate design. A tunnelled route has the potential to contribute to the enhancement of the historic landscape within the WHS. Notwithstanding its high capital cost, a tunnelled route would deliver transport and economic benefits in line with the objectives for the scheme.

Surface Routes outside the WHS (Corridors A, F (north and south) and G)

4.2.9 Because of the location of adjacent settlements, there is limited scope to realign the A303 to the north of the WHS (Corridor A), however, a route that would skirt the northern boundary of the WHS was considered. Such an option would reduce severance within the WHS, but it would also have substantial harmful impacts on other sensitive assets. On balance, the harmful impacts would outweigh the benefits associated with the removal of the A303 through the WHS.

4.2.10 Corridor F surface route options to the south of the WHS would remove the A303 from the WHS in its entirety. This would bring substantial benefits by reducing severance and improving the setting of key assets, including the Stonehenge monument. These benefits would need to be balanced against adverse environmental effects of constructing a longer route within a high quality, unspoilt landscape with the associated loss of habitats.

4.2.11 Surface route options to the south of the WHS would also offer a less direct route for through traffic and would therefore offer reduced transport benefits. More traffic would also remain or divert onto local roads, giving rise to adverse impacts on local villages and communities.

4.2.12 A surface route to the south of Salisbury was also considered (Corridor G). The length of such an option would lead to substantially increased habitat loss and severance compared to other corridors and it would also impact a significant number of communities and designated nature conservation sites. This option, whilst offering improved access to Salisbury would also fail to reduce journey times for users of the A303 through this section. On this basis, the corridor was not considered to meet the transport and environmental objectives of the scheme.

Best performing corridor options

4.2.13 On the basis of the initial assessments, as summarised above, Corridors A, B, C, E and G were not taken forward for further consideration. This left tunnel options within Corridor D and surface options within Corridor F (north) and Corridor F (south) to be taken forward for further consideration in Design Fix B. These are shown in Appendix B.3 and in Figure 4-4 below.

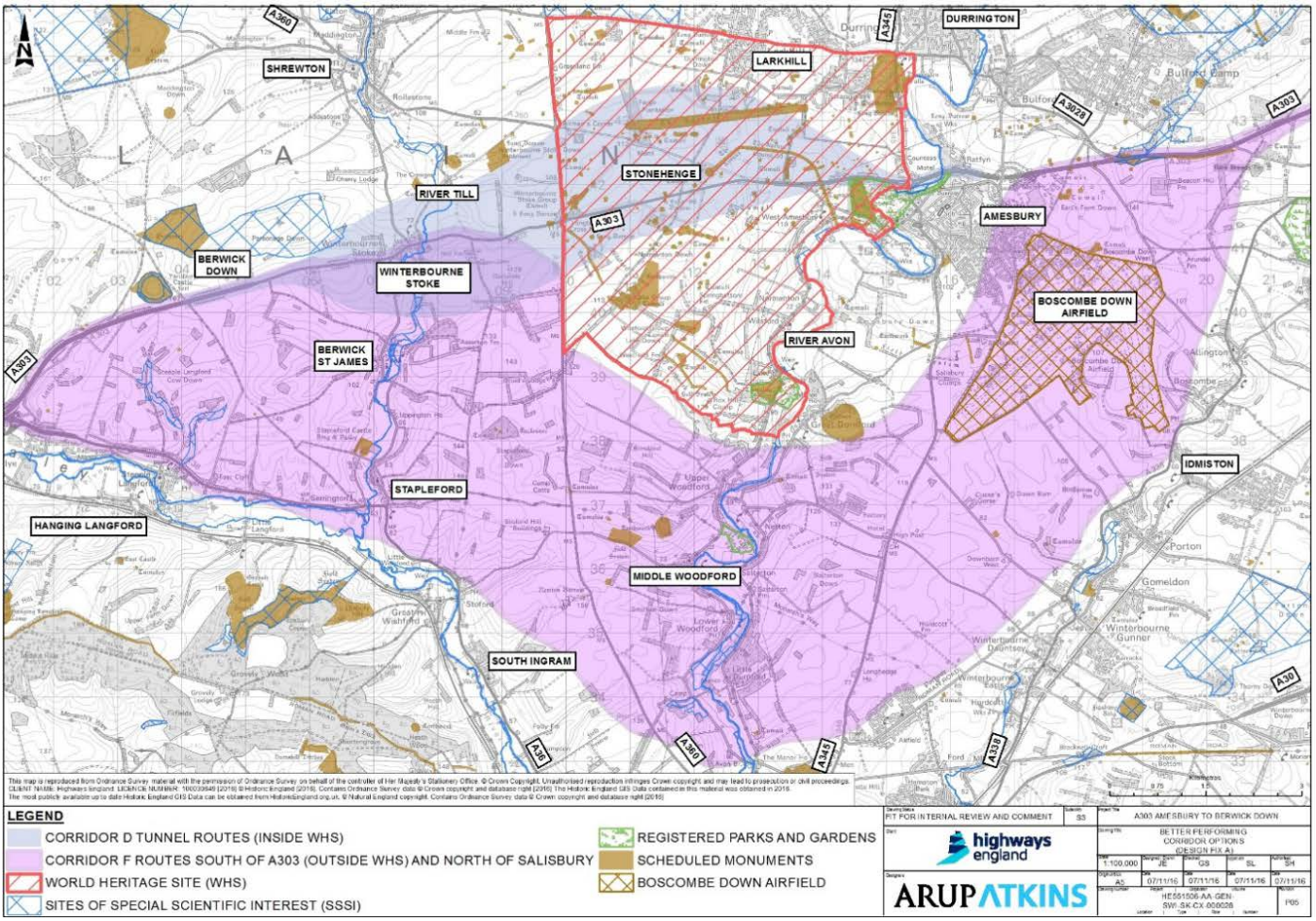


Figure 4-4 Best performing corridor options (Design Fix A)

4.3 Development of route options within corridors – Design Fix B

4.3.1 Design Fix B involved identifying the most appropriate route options for assessment within the two better performing corridors identified from Design Fix A. The route options were chosen to best represent the range of historical routes within each corridor.

Corridor D route options – Tunnelled options through the WHS

4.3.2 The purpose of a tunnelled solution would be to remove the A303 from the most sensitive part of the WHS, thereby reducing severance and enhancing the character of the WHS.

4.3.3 In respect of the length of the tunnel, an appropriate balance would need to be achieved between affordability and impact. The Road Investment Strategy (RIS)

outlines the Government's intention to construct a tunnel of at least 2.9 km. A tunnel of approximately 2.9km would deliver benefits to the setting of significant features in the Stonehenge landscape and would also allow the portal locations to be sited optimally to the west of the Normanton Down Barrow Group and to the east of the ceremonial route of The Avenue.

4.3.4 A range of alternative tunnel alignments with various portal locations were developed with the tunnel portals positioned such that the road would no longer be visible from Stonehenge.

4.3.5 A number of options with longer 4.5km tunnel solutions were also developed with the tunnels running the full width of the WHS. This removed any surface route sections of these options within the WHS resulting in increased benefits for the WHS.

4.3.6 To the western end of the scheme, a bypass of Winterbourne Stoke was included in line with scheme requirements. Route options both to the north and south of Winterbourne Stoke were considered.

Corridor F route options - Surface route options to the south of the WHS

4.3.7 Within the surface corridor to the south of the WHS, three possible route options were identified which sought to minimise impacts on local villages in this area and to reduce adverse impacts on the high quality landscape and biodiversity.

4.3.8 The most northerly option would pass close to the southern boundary of the WHS and to the south of Winterbourne Stoke before re-joining the A303 at Berwick Down. The most southerly option would pass to the south of the village of Little Dunford, passing between Berwick Down and Stapleford, avoiding the Area of Outstanding Natural Beauty (AONB), before reconnecting with the existing A303 to the west of Winterbourne Stoke. All route options were aligned to avoid impact to Boscombe Down Airfield.

4.3.9 In general terms, the more southerly route options would cost more and would deliver reduced transport benefits by increasing the length of the A303 for through traffic. Additionally, the further south that the A303 is realigned, the more traffic remains on or diverted to local roads, with adverse impacts on local villages and communities.

4.4 Initial route options appraisal – Design Fix C

Assessment methodology

4.4.1 The methodology used to appraise and sift the route options, within the better performing Corridors D and F, followed the same principles of the corridors' assessment and used the Options Assessment Framework contained in the WebTAG Transport Appraisal Process, based around the Transport Business Case Five Case Model criteria. The assessment primarily focused on the Strategic Fit assessment (fit with policy and CSRs) and the Value for Money assessment which includes impact on the economy and the environment.

Corridor D route options initial appraisal

4.4.2 Route options incorporating 4.5km tunnels were assessed as having significantly higher estimated scheme costs that were considered to be unaffordable and were not considered further in the assessment.

4.4.3 The remaining Corridor D route options each incorporated a 2.9km tunnel under part of the WHS and were approximately 13km in overall length. These are illustrated in Figure 4-5, and are summarised as follows:

- **Route Option D001:** Approximately 2.9km length tunnel with route running north of Winterbourne Stoke, eastern tunnel portal located east of The Avenue and the western tunnel portal located west of Normanton Gorse to minimise visual impact to and from Stonehenge.
- **Route Option D003:** Approximately 2.9km length tunnel with route running south of Winterbourne Stoke, eastern tunnel portal located east of The Avenue and the western tunnel portal located west of Normanton Gorse to minimise visual impact to and from Stonehenge.
- **Route Option D021:** Approximately 2.9km length tunnel with route running north of Winterbourne Stoke, eastern tunnel portal located west of The Avenue and the western tunnel portal located further west of Normanton Gorse.
- **Route Option D022:** Approximately 2.9km length tunnel with route running south of Winterbourne Stoke, eastern tunnel portal located west of The Avenue and the western tunnel portal located further west of Normanton Gorse.

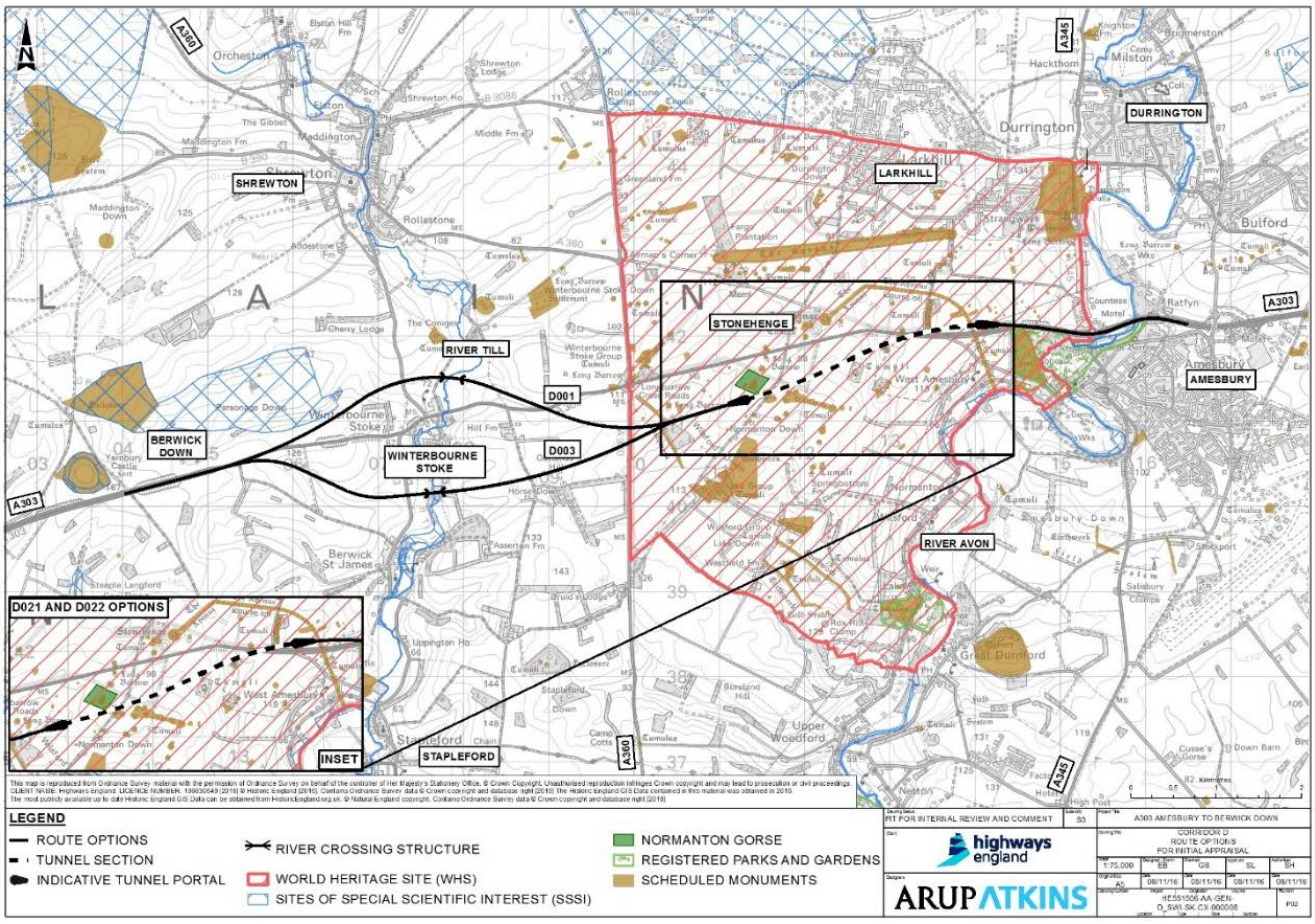


Figure 4-5 Corridor D route options for initial appraisal

4.4.4 The assessment and comparison of these four Corridor D route options demonstrated all options were comparable in terms of the Strategic Fit (fit with policy and CSRs), Financial (scheme costs) and Delivery (deliverability and acceptability) cases. However, there were notable differences within the Value for Money assessment, specifically in terms of environmental impact.

4.4.5 In terms of their impact on the WHS, all of the options would improve the setting of many Scheduled Monuments central to the OUV of the WHS, including Stonehenge itself.

4.4.6 The eastern tunnel portal location for options D001 and D003 would enable the reconnection of The Avenue which is considered a very substantial benefit. The resulting western tunnel portal location with options D001 and D003 has the potential to cause substantial harm to the Normanton Down Barrow Group and other important monuments, ultimately harming the OUV of the WHS. Careful attention to the design and associated mitigation would be required during design development of both options, to reduce its impact on these key assets.

4.4.7 In comparison, Options D021 and D022 perform less well. Whilst the western tunnel portal location lies further west away from the Normanton Down Barrow Group than options D001 and D003, with the impacts here being lower in scale and number, there are still a number of significant adverse effects on the setting of scheduled monuments, including the Normanton Down Barrow Group. In

addition, the eastern tunnel portal location to the west of The Avenue would result in additional severance of The Avenue that would likely directly affect the OUV of the WHS.

4.4.8 There was little to differentiate between the options of routing to the north or south of Winterbourne Stoke.

4.4.9 Of the four remaining Corridor D options, it was concluded that the likely best performing, affordable route options were Options D001 and D003 with the environmental benefits of the eastern tunnel portal being east of The Avenue.

Corridor F route options initial appraisal

4.4.10 The three options considered within Corridor F would run south of the WHS connecting to the existing A303 west of Winterbourne Stoke and east of Amesbury. Completely removing the A303 from within the WHS would substantially improve the setting of over 100 Scheduled Monuments and would provide significant benefits for the WHS in terms of conservation, access and visitor experience.

4.4.11 These route options are shown on Figure 4-6 below, and are summarised as follows:

- **Route Option F004:** Surface route running from the A303 in the west between Berwick St. James and Stapleford avoiding the AONB. The route continues between Middle Woodford and Lower Woodford, crossing the River Avon avoiding existing buildings and then passes to the south of Boscombe Down Airfield before connecting back to the existing A303 east of Amesbury.
- **Route Option F005:** Surface route running from the A303 in the west between Berwick St. James and Stapleford avoiding the AONB. The central section runs south of the Little Durnford and then passes to the south of Boscombe Down Airfield, following the same alignment as route F004 before reconnecting with the existing A303 east of Amesbury.
- **Route Option F010:** Surface route running from the A303 in the west between Winterbourne Stoke and Berwick St. James. The route then continues east, keeping to the south of the WHS boundary but north of Upper Woodford before running south of the Boscombe Down Airfield following the same alignment as Route Options F004 and F005 before reconnecting with the existing A303 east of Amesbury.

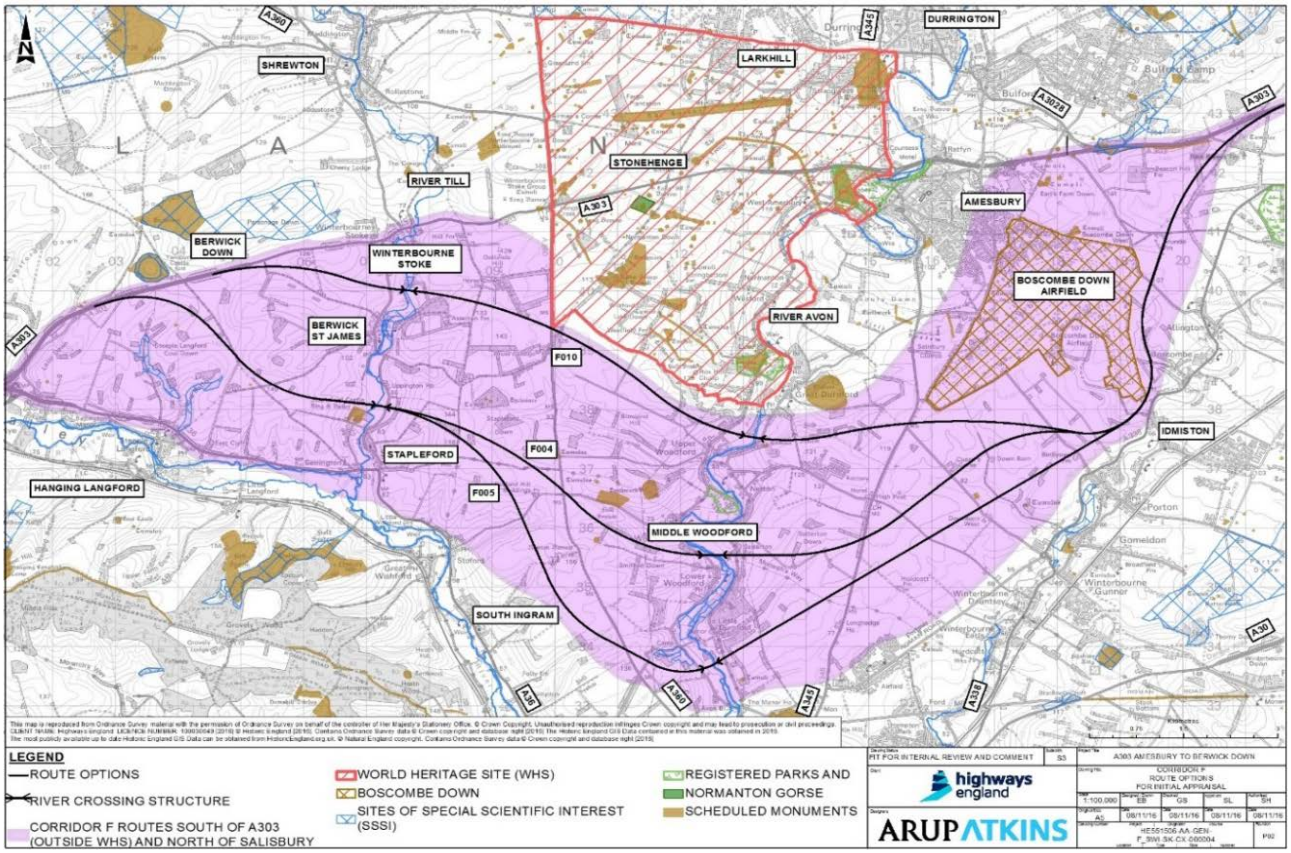


Figure 4-6 Corridor F route options for initial appraisal

4.4.12 The assessment and comparison of the three Corridor F route options clearly demonstrated that option F010 out-performed the other two route options across all the assessment criteria, with its shorter length and associated journey time and economic benefits and with the reduced environmental and social impacts.

4.5 Further route options appraisal

Further development of Corridor D route options

4.5.1 Further design development was undertaken on the position of the eastern portal in relation to the existing A303. It was found that the portal could be moved further to the south to be as close as practicable to the existing road whilst allowing traffic flow on the existing road to be maintained during construction. The decision was made to incorporate this change into these route options and by doing so D001 was updated and re-named as D031 and D003 was updated and re-named as D032.

4.5.2 As part of the option selection and assessment work on revised Route Options D031 and D032, a programme of geophysical surveys was undertaken to investigate the possible presence of buried archaeological features along the two options. This identified two Neolithic long barrows and a henge-type enclosure to the east of the A360 and within the likely construction footprint of both options. These were considered to be important archaeological features that contribute to the OUV of the WHS. These features were considered to be adversely affected by the D031 and D032 route options and the decision was made to adjust both route

options by moving them locally further to the south to avoid physical impact on these assets.

4.5.3 The amendment of the two route options also aimed to accommodate the junction intentions for each option and maintain full standard highway geometry, whilst minimising impact on key environmental constraints and maintaining the balanced earthworks strategy where possible. These changes were introduced into D031 and D032 and the revised route options were re-named as D061 and D062 respectively.

4.5.4 The further WebTAG route options appraisal, assessed the three route options as D061, D062 and F010 as shown on Figure 4-7.

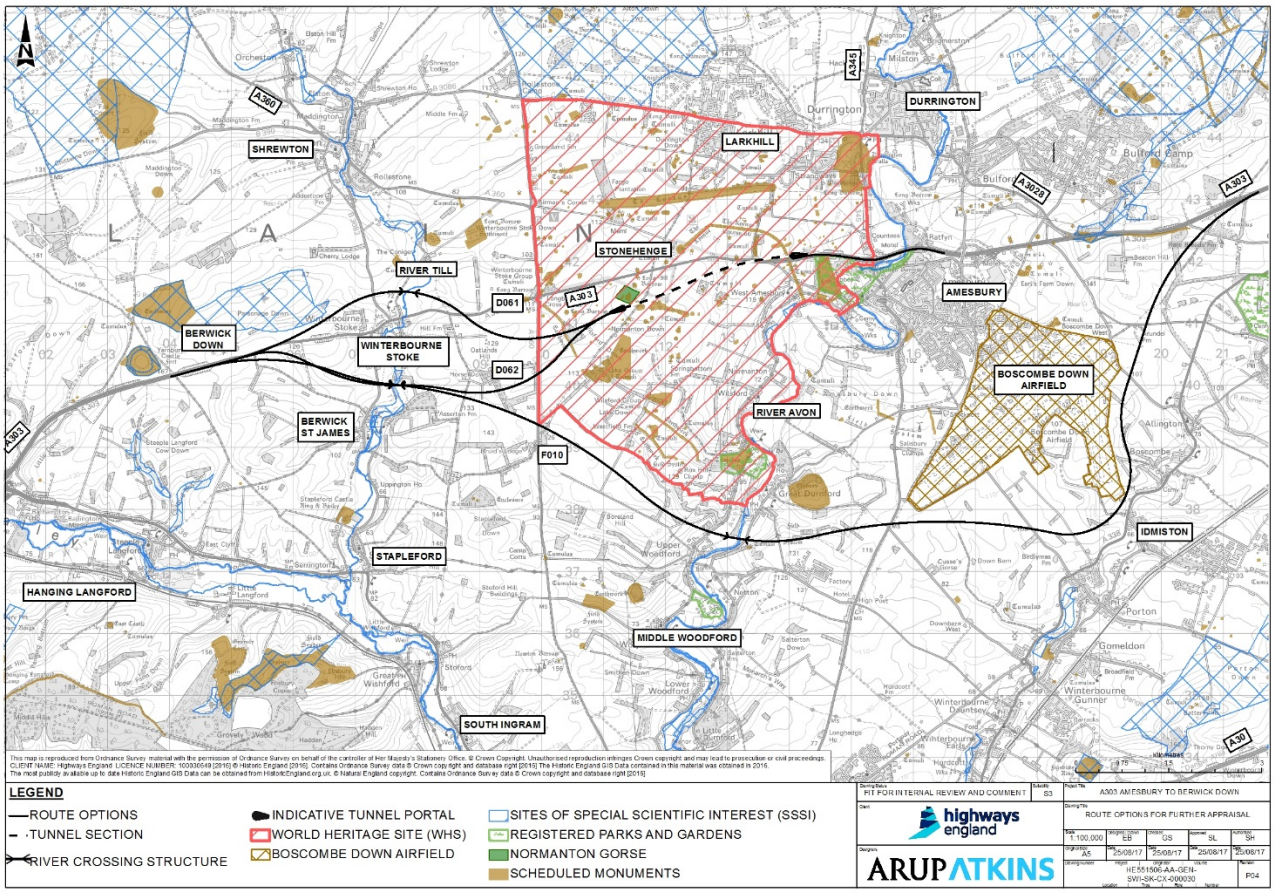


Figure 4-7 Route options for further appraisal

Further appraisal of Route Options

4.5.5 The best performing amended route options D061, D062 and F010 were then subjected to a further full WebTAG appraisal to determine the route options to be taken forward to public consultation and further design development.

Traffic and journey times

4.5.6 The increase in the new overall A303 route length with the three route options and the associated journey time savings were calculated between the adjacent existing intersections with the A36 and the A338 outside of the scheme and the results are provided in Table 4-1 below.

Table 4-1 Route options length and journey time comparison

Route options	Approximate increased length of route between A36 and A338 compared with existing (km)	Average journey time between A36 and A338 (mins)	Average journey time savings from do-minimum (mins)
D061	0.4	13.00	4.00
D062	0.4	13.00	4.00
F010	4.1	14.25	2.75

4.5.7 The modelling also indicated that the longer F010 route option would lead to more long-distance traffic using the local road network (rat running), more than doubling the volume of traffic currently diverting through the villages of Durrington, Larkhill and Shrewton. This would lead to increased noise, worsened air quality and a greater likelihood of accidents along the unsuitable local roads and through the local communities.

Scheme Costs

4.5.8 Indicative scheme costs, discounted to 2010 prices, appropriate to this stage in the scheme development were developed.

4.5.9 Perceived scheme benefits for each of the options were also developed based upon the traffic forecast model in order to inform the emerging Appraisal Summary Tables (ASTs) as well as allowing the reporting of indicative Benefit to Cost Ratios (BCRs).

Economic assessment

4.5.10 The purpose of the economic assessment was to provide a quantified assessment of value for money. The results of the economic assessment are summarised in the BCR for the scheme options.

4.5.11 The economic assessment of the scheme options was undertaken in accordance with WebTAG guidance. Typically, the appraisal of transport schemes is focussed on the benefits delivered to users in respect of faster journeys and reduced vehicle operating costs. However, in view of the objectives of the scheme, an innovative approach to the economic assessment was taken which considered impacts on the WHS, so far as they could be monetised.

4.5.12 If assessed only on the basis of those impacts which are typically monetised in transport appraisal, the BCRs for the three options were as follows:

- Route Option D061 - 0.5
- Route Option D062 - 0.6
- Route Option F010 - 0.3

4.5.13 On this basis, the tunnelled options (Route Option D061 and D062) were slightly preferred to the surface route option (F010) on transport and economic grounds.

There was no significant difference between the economic performances of the two tunnelled options.

4.5.14 However, given the considerable environmental implications of this scheme, it was decided that the final judgement of value for money for the A303 Stonehenge: Amesbury to Berwick Down must also consider the impacts on the WHS and the wider non-monetised landscape and environmental impacts.

4.5.15 Quantifying impacts on the WHS is highly challenging and required an innovative approach. In accordance with HM Treasury Green Book guidance, a Contingent Valuation study was undertaken which sought to place a value on the benefits of removing the A303 from the vicinity of Stonehenge. The study focussed on the value placed on the scheme, in relation to noise reduction, increased tranquillity, visual amenity and reduced landscape severance at Stonehenge, by visitors to Stonehenge, A303 road users and the population of the UK more widely.

4.5.16 The benefits of removing the road from the WHS were balanced against monetised estimates of the adverse impacts of the scheme options on the landscape more generally. Such impacts would be particularly severe for F010 which would involve the construction of an offline dual carriageway through an otherwise tranquil rural environment.

4.5.17 The ranged BCRs for the scheme options when such impacts were included were as follows:

- Route Option D061 - 1.3 – 1.5
- Route Option D062 - 1.4 – 1.6
- Route Option F010 - 1.4 – 1.7

4.5.18 With this broader perspective, the scheme would deliver benefits in excess of costs, whilst the BCRs for all options were of a similar magnitude.

4.5.19 It should also be noted that the appraisal results at this stage were likely to understate the benefits of the scheme. A complementary approach to wider economic benefits assessment was implemented which is intended to provide a more tailored assessment of the economic impact of the scheme. This assessment indicated that wider economic benefits were likely to be higher than the WebTAG based Wider Impacts methodology suggests.

4.5.20 Furthermore, analysis was undertaken which demonstrates that the transport and economic benefits of the A303 Amesbury to Berwick Down scheme are greater when considered as part of the overall Expressway programme.

4.5.21 Taking these factors into account, at this stage of the assessment, the A303 Amesbury to Berwick Down scheme was assessed as being a ‘medium’ value for money scheme.

Social Impact assessment

4.5.22 The Social Impacts assessment considered the impact of the scheme on both local residents and users of the transport network. The assessment identified no

differences between Route Options D061 and D062. The key differentiators between F010 and D061/D062 were Physical Activity and Severance, with F010 performing worse with the increased number of communities and numbers of pedestrians considered to be affected. F010 also scored slightly worse in terms of affordability with the increased length and vehicle operating costs.

Distributional impacts assessment

4.5.23 The distributional impacts assessment considered the variance of transport intervention impacts across different social groups. Overall, there was no significant difference in impact between Route Options D061 and D062, and these performed better than the surface route option with fewer criteria having adverse impacts.

Safety assessment

4.5.24 All options were assessed to have a positive impact upon on road safety as the existing section of the route has a high accident record, and all new options would increase capacity and be designed to high safety standards. As a result of having shorter travel distances, options D061 and D062 were assessed to have the potential to deliver greater in-service accident benefits over option F010.

4.5.25 In relation to Construction, Design, and Management (CDM) safety assessment, Options D061 and D062 would involve significant tunnel construction, a highly specialised and technically complex activity, which was considered to be a significant construction risk activity, but was assessed as manageable. The options would also include the construction of a significant viaduct across the River Till, which would mean a significant amount of working at height over a water hazard, another significant but manageable construction risk. Route Option F010 would require two significant viaducts over the River Till and River Avon.

Operational, technology and maintenance assessments

4.5.26 In terms of performance against the assessment criteria of operation, technology and maintenance, all options performed to a similar level with Route Options D061 and D062 requiring enhanced operation and maintenance technology features specific to the tunnel.

Engagement with public body stakeholders

4.5.27 Engagement with statutory consultees was an ongoing activity throughout the study period to keep stakeholders informed of the development and appraisal of corridors and route options with feedback incorporated into the process.

Environmental assessment

4.5.28 WebTAG environmental appraisals were undertaken on each of the three route options.

4.5.29 For all options, it was predicted that properties affected in the study area would experience low levels of change in noise, with a small number of properties assessed as experiencing noise nuisance. All options would provide noise benefits, with the level of noise reduction around Winterbourne Stoke better for

Route Option D062 and Route Option F010 having further noise benefits for properties in Amesbury.

4.5.30 In terms of greenhouse gases all options would result in an increase in user carbon, with F010 resulting in the greatest increase due to vehicle flows and the much longer distance travelled. For air quality, the increase in vehicle flows and the much longer distance travelled for F010 would also result in the highest NOx emissions. For all options air quality receptors within 200m would experience a reduction in exposure to PM10 emissions, leading to improved local air quality. This improvement is offset for all options by the overall increase in exposure to NOx leading to an overall reduction in air quality.

4.5.31 In terms of landscape both D061 and D062 would have a Moderate Adverse effect with scope for further mitigation during design development. For F010 the magnitude of change and the sensitivity of the high quality rural landscape along the approximate 22km length and the visual impacts of the highly intrusive crossing of the Upper Avon Valley would result in a Very Large Adverse effect on the landscape with limited scope for mitigation.

4.5.32 For the historic environment, both Route Options D061 and D062 would result in an overall Neutral score compared with a Large Beneficial effect for F010. In terms of the WHS, F010 would also result in a Large Beneficial effect, whilst D061 would result in a Slight/Moderate Beneficial effect and D062 a slightly greater Moderate Beneficial effect. These differences are due to the routing of D062 west of the western portal where it would avoid important archaeological remains and uses local topography to better fit into the landscape of the WHS.

4.5.33 For Route Options D061 and D062 biodiversity and the water environment have both been assigned the same level of Large Adverse effect, with potential effects on water environment predicted to substantially reduce post construction. For biodiversity, mitigation through design development was predicted to result in a reduction in the scale of impact. Route Option F010 would cross 2.4km a Special Protection Zone 2 (SPZ) which is reflected in the Moderate Adverse assessment for water environment. For biodiversity F010 is nearly twice the length of D061 and D062 and at surface level would result in a Very Large Adverse effect. This is due to the direct adverse impacts to internationally (European) and nationally designated ecological sites.

Client Scheme Requirements

4.5.34 The performance of the route options was assessed against the Client Scheme Requirements and the relevant national and local policy objectives. The results of the CSR assessment are illustrated within Table 4-2 below based on a three-point scale (3 – Strong alignment; 2 – Moderate alignment; and 1 Weak alignment).

Table 4-2 CSR assessment summary

Document	Client Scheme Requirements	D061	D062	F010
Client Scheme Requirements	Transport: to create a high quality route that resolves current and predicted traffic problems and contributes towards the creation of an Expressway between London and the South West	3	3	2
	Economic growth: in combination with other schemes on the route, to enable growth in jobs and housing by providing a free flowing and reliable connection between the South East and the South West peninsula	3	3	2
	Cultural heritage: to contribute to the conservation and enhancement of the WHS by improving access both within and to the site	2	2	3
	Environment and community: to contribute to the enhancement of the historic landscape within the WHS, to improve biodiversity along the route, and to provide a positive legacy to communities adjoining the road	3	3	2

4.5.35 In overall terms, Route Options D061 and D062 aligned more closely with CSRs and the relevant national and local policy objectives than F010.

4.6 Appraisal summary

4.6.1 Appraisal Summary Tables (ASTs) were produced for each of the three route options to collate all the assessments against the criteria of Economy, Environmental, Social and Distributional impacts and Public Accounts, as presented in the A303 Stonehenge Technical Appraisal Report, January 2017 [1].

4.6.2 A comparison of the ASTs for each of the options concluded that Options D061 and D062 would perform better than option F010 in terms of the assessed impacts. Key differentiators are F010 being a significantly longer route which would pass through a largely unspoilt, high quality, tranquil landscape. It would have a much larger footprint and a greater overall environmental impact, despite having greater benefits for the WHS. There would be disbenefits for road users having to travel on a longer F010 route, offsetting lower construction costs. F010 would also not interact effectively with the local road network, leaving higher levels of rat-running traffic adversely affecting the quality of life in local communities.

4.7 Overall Summary

4.7.1 From the appraisal undertaken, the following route options were taken forward to Stage 2 for public consultation and further design development and appraisal to determine the Preferred Route for the scheme:

- **Route Option D061** (Published as 'Option 1N' for consultation) – 2.9km length tunnel with route running north of Winterbourne Stoke, the eastern

tunnel portal located east of The Avenue and the western tunnel portal located west of Normanton Gorse.

- **Route Option D062** (Published as ‘Option 1S’ for consultation) – 2.9km length tunnel with route running south of Winterbourne Stoke, the eastern tunnel portal located east of The Avenue and the western tunnel portal located west of Normanton Gorse.

5. Public Consultation Summary

5.1 Introduction

5.1.1 Public consultation on proposals for the A303 Stonehenge improvement was carried out between 12 January 2017 and 5 March 2017. This chapter summarises the consultation and the key considerations raised that have informed the choice of Preferred Route. The public consultation is documented in full in the 'A303 Stonehenge, Amesbury to Berwick Down: Report on Public Consultation – September 2017' [20].

5.2 Scheme Proposals Presented for Consultation

5.2.1 The proposals put forward for consultation are illustrated on below.

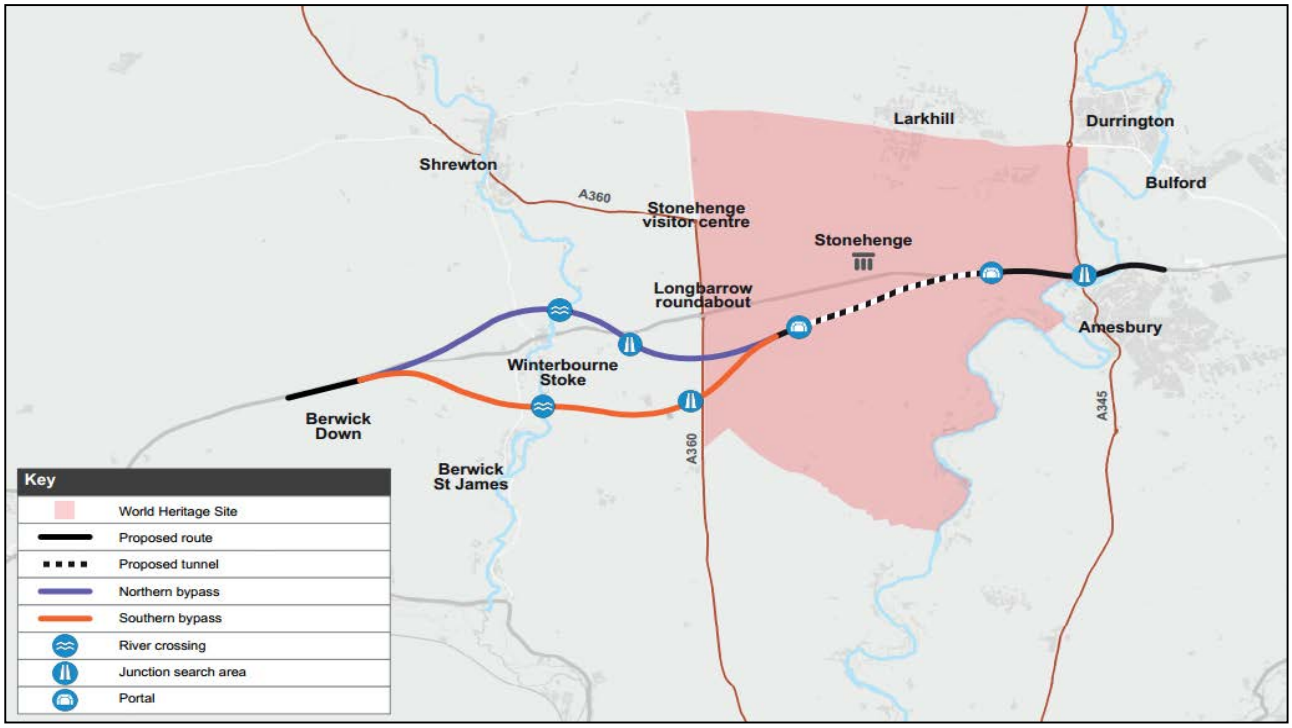


Figure 5-1 A303 Stonehenge: Amesbury to Berwick Down consultation proposals

5.2.2 The main features on which views were invited are, from west to east:

- A bypass north or south of Winterbourne Stoke, with a new viaduct crossing of the Till Valley.
- A new grade-separated junction between the A303 and A360, also accommodating access from Winterbourne Stoke to the A303.
- A 1.8 mile (2.9 kilometre) long twin-bore tunnel, with west and east portals located within the World Heritage Site, but out-of-sight from Stonehenge.
- A new grade-separated junction between the A303 and A345.

5.2.3 These proposals were summarised in a Consultation Booklet available at http://www.highways.gov.uk/a303stonehengepra .

5.3 Consultation Arrangements

5.3.1 A variety of methods were used to inform everyone about the consultation, including a leaflet sent to 17,000 addresses, adverts in local, regional and national newspapers and use of social media. Public exhibitions of the schemes proposals were also held on ten occasions at eight different venues, mainly in the local vicinity of the scheme, but also further west along the A303 route in Mere, and in London at the Society of Antiquaries to accommodate wider audience participation. Some 2,500 people attended the exhibitions.

5.3.2 A consultation website (www.highways.gov.uk/a303stonehenge/consultation) was maintained throughout the consultation period to provide information on the scheme and to enable people to submit their feedback questionnaires online. People were also able to submit their feedback by Freepost or email.

5.4 Consultation Response

Overall Response

5.4.1 More than 9,000 people responded to the consultation, by:

- questionnaire responses;
- email or letter; or
- proforma-type email responses, using templates provided by Friends of the Earth or the Stonehenge Alliance expressing opposition to the scheme proposals.

5.4.2 A breakdown of the total numbers is provided in Table 5-1 below.

Table 5-1 Breakdown of total consultation responses

Response format	Number of responses received
Questionnaire responses via the consultation webpage	2,547
Questionnaire responses received by hand or by Freepost	956
Emails and letters	111
Emails using Stonehenge Alliance proforma	1,686
Emails using Friends of the Earth proforma	3,943
Total	9,243

5.4.3 The consultation feedback revealed a wide range of public opinion about the scheme as a whole, as shown on Figure 5-2 below.

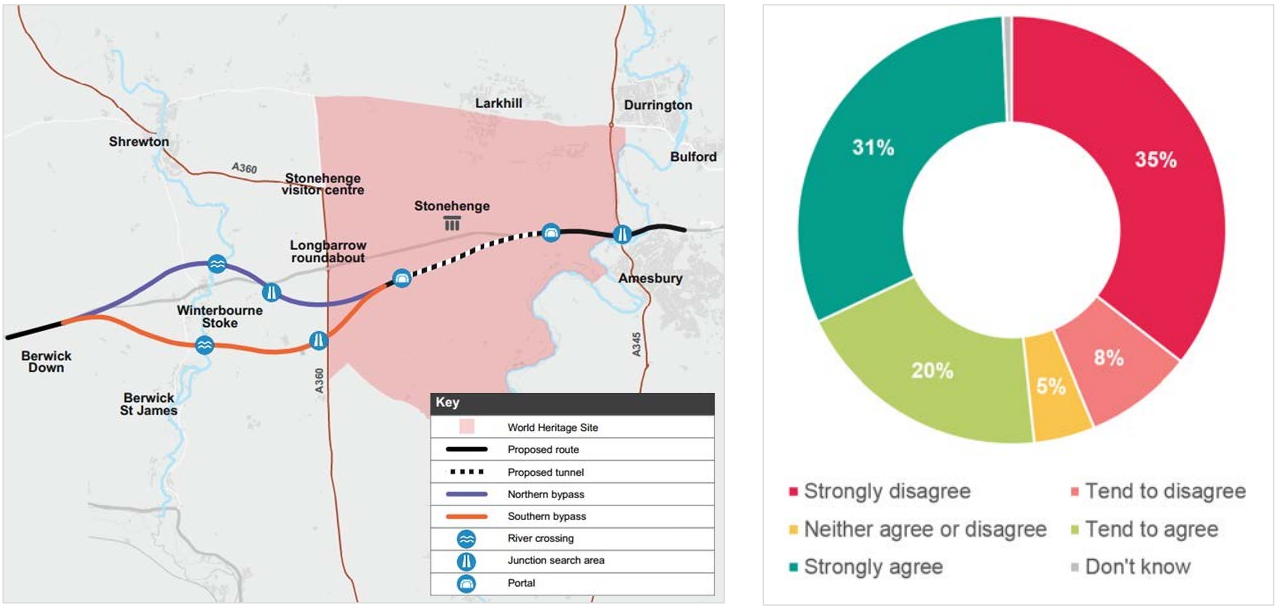
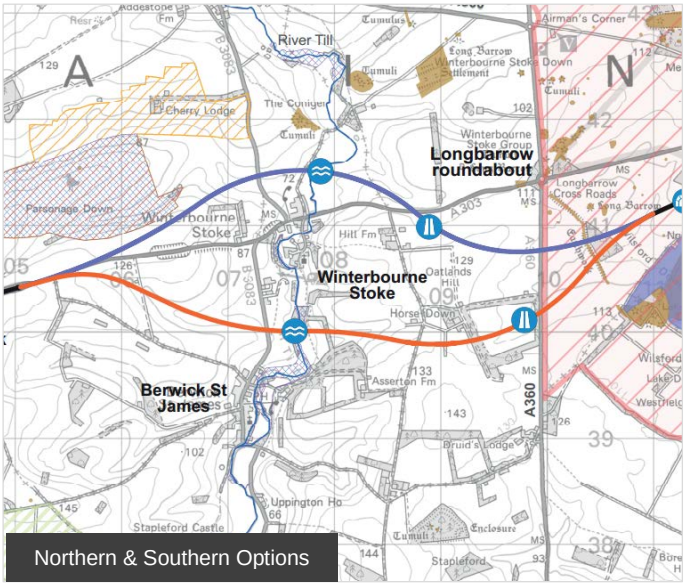


Figure 5-2 Views on scheme proposals from questionnaire responses

5.4.4 The feedback revealed much agreement about the need to address the problems on the A303, but there were differences about what should be done. Views ranged from: dualling the existing road, to building a longer tunnel, to diverting the A303 outside the WHS, to options that do not involve building new roads.

5.4.5 Notwithstanding the wide-range of views expressed about the scheme as a whole, there was little disagreement about the need for Winterbourne Stoke to have a bypass. However, there were strong local views about whether a northern (Option 1N) or southern (Option 1S) route should be chosen. The balance of preference from the questionnaire responses is illustrated on Figure 5-3 below.



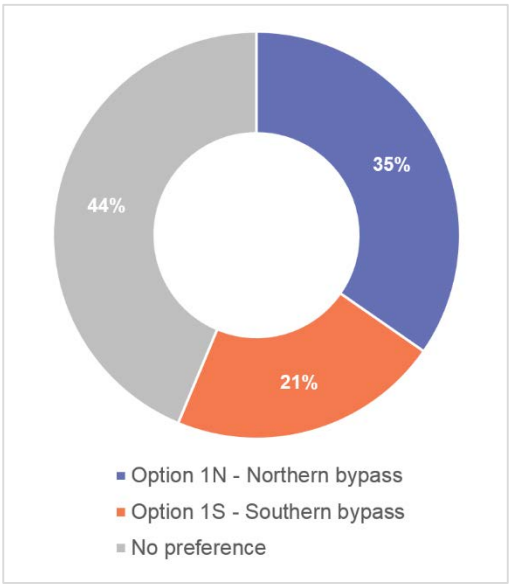


Figure 5-3 Preferences for Winterbourne Stoke Bypass

5.5 Key considerations

5.5.1 Aside from expressions of support for or opposition to the scheme proposals put forward for consultation, comments received fell broadly into three categories:

- Comments relating to options that have previously been considered and discounted as part of the option appraisal and sifting undertaken prior to consultation;
- Comments raising issues that have informed the further appraisal and assessment of options, leading to the choice of preferred route; and
- Comments about the scheme that will be taken into consideration as part of its continuing development.

5.5.2 Comments which have informed the choice of preferred route have been separated into key considerations relating to (a) the choice of a northern or southern bypass for Winterbourne Stoke and (b) the choice of route through the western part of the WHS, as summarised in the Table 5-2 below.

Table 5-2: Key considerations informing choice of preferred route

Route section	Key considerations
North vs. South of Winterbourne Stoke	• Impacts on the local communities of Winterbourne Stoke and Berwick St James, including the effects of traffic noise on people in and outside their homes. • Environmental impacts on protected sites, including the River Till Special Area of Conservation (SAC) & Site of Special Scientific Interest (SSSI), Parsonage Down National Nature Reserve/SAC/SSSI and the scheduled Barrow Groups north of Winterbourne Stoke. • Landscape considerations, in terms of integrating the new road into the local topography as much as possible, including minimising the visual and physical intrusion of the viaduct crossing of the Till. • Ease of road access to and from Winterbourne Stoke and Berwick St James via the A360, avoiding the possibility of generating rat-running traffic using the B3083 from Shrewton. • Effects on local businesses and amenities.
Route through western part of WHS	• Effects on the Outstanding Universal Value (OUV) attributes of the WHS, arising from impacts of the western tunnel portal and new expressway on the integrity and authenticity of the Neolithic and Bronze Age funerary landscape, with its unique concentration and disposition of Barrow Groups. • Impact on the winter solstice alignment viewed from Stonehenge, as perhaps the single-most important sightline in the WHS. • Damage to undiscovered buried archaeology. • Impact on the RSPB reserve on Normanton Down. • Effects arising from possible junction locations with the A360 adjacent to the WHS.

5.5.3 These considerations have been reviewed alongside the findings of further archaeological and ecological surveys undertaken during and since consultation. This review has informed the choice of preferred route.

6. Option Selection (PCF Stage 2)

6.1 Introduction

6.1.1 A three stage option selection process was followed, taking into consideration feedback from the public consultation and the latest survey information, to inform the choice of a Preferred Route.

6.1.2 The three stages of option development, sifting and selection are outlined in Figure 6-1 below and were defined as follows:

- Modified route options – Development of modifications to consulted route options utilising public consultation feedback and additional survey results.
- Sifting of options – modified route options sifted using initial assessments against the key considerations from consultation, to produce the better performing modified route options.
- Further route options appraisal – Full WebTAG assessment of the better performing modified route options to inform the choice of a Preferred Route.

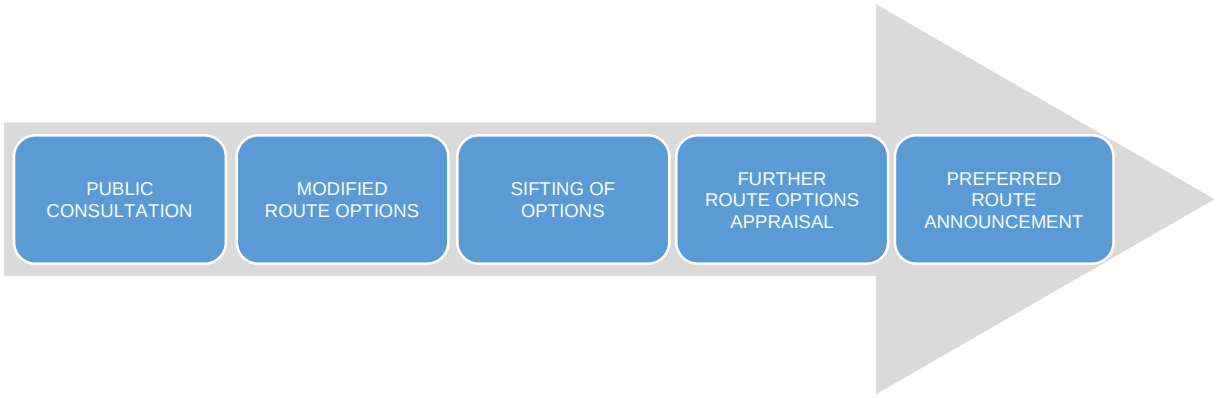


Figure 6-1 Preferred Route option selection process

6.2 Development and Sifting of Modified Route Options

Consultation Feedback and Further Archaeological Investigation

6.2.1 The feedback from the public consultation is summarised in Chapter 5, with Section 5.5 highlighting the key considerations raised that have been taken into account in a review of the route options undertaken since consultation.

6.2.2 As part of their respective responses to consultation, Historic England and the National Trust submitted a report detailing their outline assessment of the impact of published route options on the OUV of the WHS, including the Winter Solstice Sunset Alignment (viewed from Stonehenge) and two Neolithic long barrows and a henge-type enclosure to the east of the A360 that had been identified through geophysical surveying and archaeological evaluation undertaken as part of the scheme development process. Their report considered the newly discovered archaeology to be of national importance and described the grouping as a new 'Diamond Barrow Group'. Historic England and the National Trust concluded that

the Option 1N route would sever this new-found barrow grouping and could no longer be considered an acceptable route.

6.2.3 In the light of the Historic England and National Trust report, along with consultation feedback from others about potential impacts in the western part of the WHS, modifications of the options presented at the consultation were considered. Importantly these modifications included options that could avoid severance of the newly identified 'Diamond Barrow Group' by passing either to the north or south of the Group.

6.2.4 To inform this continuing assessment of options, a programme of further geophysical surveys was undertaken along the Option 1S route to investigate the possible presence of buried archaeological features, extended to the cover the area to the south of the 'Diamond Barrow Group'. These additional geophysical surveys identified several possible round barrows within The Park (just west of the A360), a possible Roman settlement site just west of the River Till and a possible network of buried archaeology to the south of The Diamond.

6.2.5 To allow for the possibility of Option 1N being modified to run to the north of the 'Diamond Barrow Group' the results of previous surveys undertaken close to the existing A303 (along a corridor similar to that followed by the previous scheme taken through a public inquiry in 2004) were reviewed.

Development of Modified Route Options

6.2.6 The findings of the recent and historical archaeological surveys, along with the considerations raised from the public consultation, were used in reviewing the route options presented for consultation to determine what improvements could be made to them. The various modifications to Options 1N and 1S (between the western portal and the River Till) that were developed for review are summarised as follows and shown in Appendix C1:

- **Option 1Na** – As per previous Option 1N but with the new road in cutting through the World Heritage Site to reduce the visibility of the A303 traffic. The horizontal realignment to the west of the WHS through Oatlands Hill and across the existing A303 remained unchanged..
- **Option 1Nb** – modification of Option 1N with a western tunnel portal orientated away from the Winter Solstice Sunset Alignment; the route moving south of The Diamond and the newly identified long barrows, better using the existing valley feature; crossing the A360 closer to its low point; passing through Oatlands Hill to better follow the existing valley feature to the north; and re-joining the Option 1N route east of the River Till crossing. Also running in cutting through the World Heritage Site to reduce the visibility of the A303 traffic.
- **Option 1Nc** – as per 1Nb but with the route moved further south of The Diamond and of the newly identified long barrows and closer to the low point at the crossing of the A360.
- **Option 1Nd** – modification of Option 1N with the western tunnel portal moved north to just south of the existing A303 and the route running north of The Diamond and between the newly identified 'Diamond Barrow Group'

and the Winterbourne Stoke Barrow Group, before crossing the existing A360 and A303, better following the existing valley feature to the north of the A303, and then re-joining the Option 1N route east of the River Till crossing. Also running in cutting through the World Heritage Site to reduce the visibility of the A303 traffic.

- **Option 1Sa** – As per previous Option 1S but running in cutting through the WHS and The Park to the west, to reduce the visibility of the A303 traffic.
- **Option 1Sb** – modification of Option 1S with the western tunnel portal orientated away from the Winter Solstice Sunset Alignment; and the route running south of The Diamond and of the newly identified 'Diamond Barrow Group' before moving to the north to cross the A360 just north of The Park, through an alternative grazing area of the Dairy Unit, and re-joining the Option 1S route just east of the River Till crossing. Also running in cutting through the World Heritage Site to reduce the visibility of the A303 traffic.
- **Option 1Sc** – modification of Option 1S with the western tunnel portal orientated away from the Winter Solstice line; and the route running south of The Diamond and of the newly identified 'Diamond Barrow Group' before re-joining the Option 1S route within The Park, east of the River Till crossing. Also running in cutting through the World Heritage Site to reduce the visibility of the A303 traffic.

Review of Modified Route Options

6.2.7 All modified route options (1Na, 1Nb, 1Nc, 1Nd, 1Sa, 1Sb and 1Sc) were subject to a high level review that screened the options against the key considerations raised from the public consultation, and the associated key engineering and environmental assessment topics, as well as the results of further geophysical surveys, to identify the better performing route options. The review is presented in Table 6-1 and Table 6-2.

6.2.8 For comparative purposes, each of the reviewed options were given a ranking from 1 to 3 based upon how they were considered to perform against each of the key considerations raised from public consultation, a rank of "1" representing the best performing option. This ranking is presented in Table 6-3 and Table 6-4. It is noted that no weighting was applied to the rankings, with each consideration being given equal importance.

Table 6-1 High-level review of Option 1N modified route options

Key Considerations from Public Consultation	Option 1Na	Option 1Nb	Option 1Nc	Option 1Nd
Impact on local communities of WBS/BSJ	All Option 1N modified route options are common around WBS/BSJ	All Option 1N modified route options are common around WBS/BSJ	All Option 1N modified route options are common around WBS/BSJ	All Option 1N modified route options are common around WBS/BSJ.
Access to and from WBS/BSJ via the new A360 junction and minimising rat running	Proposed A360 junction is closer to WBS but perceived to be too far from the A360 leading to rat running problems through WBS and BSJ	Proposed A360 junction is closer to WBS but perceived to be too far from the A360 leading to rat running problems through WBS and BSJ	Proposed A360 junction is closer to WBS but perceived to be too far from the A360 leading to rat running problems through WBS and BSJ	Preference as the proposed A360 junction is close to WBS and slightly closer to the A360 than the other options to cater for the A360 traffic and minimise the rat-running through BSJ and WBS
Impact on local businesses and amenities	Preference for northern bypass of WBS for the impact on local businesses and farming operations	Preference for northern bypass of WBS for the impact on local businesses and farming operations	Preference for northern bypass of WBS for the impact on local businesses and farming operations	Preference for northern bypass of WBS for the impact on local businesses and farming operations with this option having the least impact
Biodiversity Issues				
River Till SAC/SSSI	All northern routes cross the River Till north of WBS where the water flow is seasonal and the truly aquatic species are considered less likely to be present	All northern routes cross the River Till north of WBS where the water flow is seasonal and the truly aquatic species are considered less likely to be present	All northern routes cross the River Till north of WBS where the water flow is seasonal and the truly aquatic species are considered less likely to be present	All northern routes cross the River Till north of WBS where the water flow is seasonal and the truly aquatic species are considered less likely to be present
Parsonage Down National Nature Reserve SAC/SSSI	All northern routes pass in proximity to Parsonage Down	All northern routes pass in proximity to Parsonage Down	All northern routes pass in proximity to Parsonage Down	All northern routes pass in proximity to Parsonage Down
The Diamond (within WHS east of A360)	Direct impact on The Diamond and associated habitats, including breeding site for hobby, potential roost sites for bats, foraging and commuting ground for bats and presence of badger setts	Avoids direct impact on The Diamond and associated habitats, including breeding site for hobby, potential roost sites for bats, foraging and commuting ground for bats and presence of badger setts, however is in proximity	Avoids direct impact on The Diamond and associated habitats, including breeding site for hobby, potential roost sites for bats, foraging and commuting ground for bats and presence of badger setts, however is in proximity	Preference as avoids The Diamond and the associated habitats, including breeding site for hobby, potential roost sites for bats, foraging and commuting ground for bats and presence of badger setts
RSPB Reserve and breeding stone curlew	Proximity to the RSPB Reserve and breeding stone curlew	Proximity to the RSPB Reserve and breeding stone curlew	Proximity to the RSPB Reserve and breeding stone curlew	Preference as furthest from RSPB Reserve and breeding stone curlew
Historic Environment Issues				
Attributes of OUV of the WHS (authenticity and integrity)	Significant impact on the OUV of the WHS with route passing between barrow groups and also with the	Significant impact on the OUV of the WHS with route passing between barrow groups and also directly affecting newly discovered buried	Significant impact on the OUV of the WHS with route passing between barrow groups and also directly affecting newly discovered buried	Significant impact on the OUV of the WHS with route passing between barrow groups and also with the

Key Considerations from Public Consultation	Option 1Na	Option 1Nb	Option 1Nc	Option 1Nd
	significant cutting through Oatlands Hill to the west of the WHS	archaeology to the south of The Diamond. Also, significant cutting through Oatlands Hill to the west of the WHS	archaeology to the south of The Diamond. Also, significant cutting through Oatlands Hill to the west of the WHS	cutting through the northern edge of Oatlands Hill to the west of the WHS
Setting of Scheduled Monuments and relationship to Barrow Groups	All route options have an impact on setting of Scheduled Monuments and relationship to Barrow Groups	All route options have an impact on setting of Scheduled Monuments and relationship to Barrow Groups	All route options have an impact on setting of Scheduled Monuments and relationship to Barrow Groups	All route options have an impact on setting of Scheduled Monuments and relationship to Barrow Groups
Winter solstice sunset as viewed from Stonehenge	Significant new infrastructure through the winter solstice line for approximately 500m	Significant new infrastructure through the winter solstice line for approximately 500m	Significant new infrastructure through the winter solstice line for approximately 500m	Preference as within enclosed tunnel across full extent of the winter solstice line
Non-designated archaeological remains	Direct impacts on non-designated archaeological remains	Direct impacts on non-designated archaeological remains	Direct impacts on non-designated archaeological remains	Direct impacts on non-designated archaeological remains
Exit from WHS to the west	Cutting through Oatlands Hill would introduce a major new feature in the wider landscape and would be visible from the WHS with limited opportunity to mitigate	Cutting through Oatlands Hill would introduce a major new feature in the wider landscape and would be visible from the WHS with limited opportunity to mitigate	Cutting through Oatlands Hill would introduce a major new feature in the wider landscape and would be visible from the WHS with limited opportunity to mitigate	Preference as cutting through the edge of Oatlands Hill would follow the existing valley and would be largely masked by the undulating topography.
Scheduled Barrow complexes north of Winterbourne Stoke	All route 1N options would adversely affect the setting of the two barrow groups north of Winterbourne Stoke in the Till Valley	All route 1N options would adversely affect the setting of the two barrow groups north of Winterbourne Stoke in the Till Valley	All route 1N options would adversely affect the setting of the two barrow groups north of Winterbourne Stoke in the Till Valley	All route 1N options would adversely affect the setting of the two barrow groups north of Winterbourne Stoke in the Till Valley
Landscape and Visual Issues				
Across the River Till Valley landscape	Impact on the River Till valley landscape - lowering height of crossing reduces impact on views but increases visual separation of valley landscapes either side of Scheme.	Impact on the River Till valley landscape - lowering height of crossing reduces impact on views but increases visual separation of valley landscapes either side of Scheme.	Impact on the River Till valley landscape - lowering height of crossing reduces impact on views but increases visual separation of valley landscapes either side of Scheme.	Impact on the River Till valley landscape - lowering height of crossing reduces impact on views but increases visual separation of valley landscapes either side of Scheme.
Exit from WHS to the west and through Oatlands Hill landscape	Cutting through Oatlands Hill would introduce a major new feature in the wider landscape and would be visible from the WHS with limited opportunity to mitigate	Cutting through Oatlands Hill would introduce a major new feature in the wider landscape and would be visible from the WHS with limited opportunity to mitigate	Cutting through Oatlands Hill would introduce a major new feature in the wider landscape and would be visible from the WHS with limited opportunity to mitigate	Preference as cutting through the edge of Oatlands Hill would follow the existing valley and would be largely masked by the undulating topography.
Through the WHS landscape	Cutting and the 'notch' through The Diamond would have an adverse impact on views, although The Diamond would also provide some localised screening for some views	Cutting would have an adverse impact on landscape character and views	Cutting would have an adverse impact on landscape character and views	Cutting would have an adverse impact on landscape character and views although preference as cutting through the WHS would follow the existing valley and would be masked by the undulating topography.

Key Considerations from Public Consultation	Option 1Na	Option 1Nb	Option 1Nc	Option 1Nd
Opportunities to mitigate landscape issues - River Till Valley	Cutting through Oatlands Hill would introduce a new manmade feature in the wider landscape including views from the River Till Valley with limited opportunity to mitigate.	Cutting through Oatlands Hill would introduce a new manmade feature in the wider landscape including views from the River Till Valley with limited opportunity to mitigate.	Cutting through Oatlands Hill would introduce a new manmade feature in the wider landscape including views from the River Till Valley with limited opportunity to mitigate.	Preference as cutting through Oatlands Hill would follow the existing valley and would reduce impact on the River Till valley.
Engineering and Safety Assessment (inc. route length, tunnel length, earthworks strategy and maintenance)	Lower preference as the route is slightly longer, increasing excavated volumes, engineering costs and safety risks	Lower preference as the route is slightly longer, increasing excavated volumes, engineering costs and safety risks	Lower preference as the route is slightly longer, increasing excavated volumes, engineering costs and safety risks	Preference as the route length is shorter than the alternative options, reducing excavated volumes, engineering costs and safety risks

Table 6-2 High-level review of Option 1S modified route options

Key Considerations from Public Consultation	Option 1Sa	Option 1Sb	Option 1Sc
Impact on local communities of WBS/BSJ	All Option 1S modified route options are common around WBS/BSJ	All Option 1S modified route options are common around WBS/BSJ	All Option 1S modified route options are common around WBS/BSJ
Access to and from WBS/BSJ via the new A360 junction and minimising rat running	Proposed A360 junction is closer to A360 but is furthest from WBS	Proposed A360 junction is closer to A360 but is furthest from WBS	Proposed A360 junction is closer to A360 but is furthest from WBS
Impact on local businesses and amenities	All options impact on local businesses, including Druids Lodge Estates (and associated Dairy Unit), Stonehenge campsite and River Till Angling activities	All options impact on local businesses, including Druids Lodge Estates (and associated Dairy Unit), Stonehenge campsite and River Till Angling activities	All options impact on local businesses, including Druids Lodge Estates (and associated Dairy Unit), Stonehenge campsite and River Till Angling activities
Biodiversity Issues			
River Till SAC/SSSI	All southern routes cross the River Till in the same location south of WBS where the water flow is permanent and the truly aquatic species are more likely to be present	All southern routes cross the River Till in the same location south of WBS where the water flow is permanent and the truly aquatic species are more likely to be present	All southern routes cross the River Till in the same location south of WBS where the water flow is permanent and the truly aquatic species are more likely to be present
Parsonage Down National Nature Reserve SAC/SSSI	All southern routes rejoin the A303 to the south west of Parsonage Down	All southern routes rejoin the A303 to the south west of Parsonage Down	All southern routes rejoin the A303 to the south west of Parsonage Down
The Diamond (within WHS east of A360)	Severs and has direct impact on The Diamond and associated habitats, including breeding site for hobby, potential roost sites for bats, foraging and commuting ground for bats and presence of badger setts	Avoids direct impact on The Diamond and associated habitats, including breeding site for hobby, potential roost sites for bats, foraging and commuting ground for bats and presence of badger setts, however is in proximity	Avoids direct impact on The Diamond and associated habitats, including breeding site for hobby, potential roost sites for bats, foraging and commuting ground for bats and presence of badger setts, however is in proximity
RSPB Reserve and breeding stone curlew	Close to the RSPB Reserve and breeding stone curlew	Close to the RSPB Reserve and breeding stone curlew	Close to the RSPB Reserve and breeding stone curlew
Historic Environment Issues			
Attributes of OUV of the WHS (authenticity and integrity)	Significant impact on the OUV of the WHS with route potentially affecting the Winter Solstice Sunset alignment and newly discovered round barrows within The Park	Significant impact on the OUV of the WHS with route potentially affecting the Winter Solstice Sunset alignment and newly discovered round barrows within The Park	Significant impact on the OUV of the WHS with route potentially affecting the Winter Solstice Sunset alignment and newly discovered round barrows within The Park
Setting of Scheduled Monuments and relationship to Barrow Groups	All route options have an impact on setting of Scheduled Monuments and relationship to Barrow Groups although to a slightly lesser degree than 1N options	All route options have an impact on setting of Scheduled Monuments and relationship to Barrow Groups although to a slightly lesser degree than 1N options	All route options have an impact on setting of Scheduled Monuments and relationship to Barrow Groups although to a slightly lesser degree than 1N options
Winter solstice sunset as viewed from Stonehenge	Junction within the Park has the risk of affecting the Winter Solstice Sunset Alignment and there is	Junction alongside the Park very likely to affect appreciation of the Winter Solstice Sunset Alignment and there is new infrastructure through	Junction within the Park has the risk of affecting the Winter Solstice Sunset Alignment and there is new infrastructure through and

Key Considerations from Public Consultation	Option 1Sa	Option 1Sb	Option 1Sc
	new infrastructure through and following the winter solstice line for approximately 2km	and following the winter solstice line for approximately 2km	following the winter solstice line for approximately 1km
Non-designated archaeological remains	Direct impacts on non-designated archaeological remains	Direct impacts on non-designated archaeological remains	Direct impacts on non-designated archaeological remains
Exit from WHS to the west	Route avoids Oatlands Hill to the south and the significant cutting through the A360 is part screened by the mature existing landscaping around The Park	Cutting through the southern flank of Oatlands Hill and new junction north of the Park would introduce major new features in the wider landscape and would be visible from the WHS with limited opportunity to mitigate	Route avoids Oatlands Hill to the south and the significant cutting through the A360 is part screened by the mature existing landscaping around The Park
Scheduled Barrow complexes north of Winterbourne Stoke	All southern routes pass away from the Scheduled Barrow complexes north of Winterbourne Stoke	All southern routes pass away from the Scheduled Barrow complexes north of Winterbourne Stoke	All southern routes pass away from the Scheduled Barrow complexes north of Winterbourne Stoke
Landscape and Visual Issues			
Across the River Till Valley landscape	Impact on the River Till valley landscape character resulting in a change to range of landscape elements comprising pasture, arable, wet woodland and scrub, beech stands, individual mature trees and mixed woodland blocks.	Impact on the River Till valley landscape character resulting in a change to range of landscape elements comprising pasture, arable, wet woodland and scrub, beech stands, individual mature trees and mixed woodland blocks.	Impact on the River Till valley landscape character resulting in a change to range of landscape elements comprising pasture, arable, wet woodland and scrub, beech stands, individual mature trees and mixed woodland blocks.
Exit from WHS to the west and through Oatlands Hill landscape	Route avoids Oatlands Hill to the south and the significant cutting through the A360 is part screened by the mature existing landscaping around The Park	Cutting through the southern flank of Oatlands Hill would introduce a new manmade feature in the wider landscape and would be visible from the WHS with limited opportunity to mitigate	Route avoids Oatlands Hill to the south and the significant cutting through the A360 is part screened by the mature existing landscaping around The Park
Through the WHS landscape	Cutting and the 'notch' through The Diamond would have a significant adverse impact on views, whilst The Diamond would provide some localised screening for some views. Avoids Oatlands Hill to the south and the significant cutting through the A360 is part screened by the mature existing landscaping around The Park	Cutting would have a significant adverse impact on views. Cutting through the southern flank of Oatlands Hill would introduce a new manmade feature in the wider landscape and would be visible from the WHS with limited opportunity to mitigate	Cutting would have a significant adverse impact on views. Avoids Oatlands Hill to the south and the significant cutting through the A360 is part screened by the mature existing landscaping around The Park
Opportunities to mitigate landscape issues - River Till Valley	Impact on the River Till valley landscape better screened by the associated mature woodland – provides framework for additional planting	Impact on the River Till valley landscape better screened by the associated mature woodland– provides framework for additional planting	Impact on the River Till valley landscape better screened by the associated mature woodland – provides framework for additional planting
Engineering and Safety Assessment (inc. route length, tunnel length, earthworks strategy and maintenance)	Lower preference as the route and tunnel are slightly longer, increasing excavated volumes, engineering costs and safety risks	Lower preference as the route and tunnel are slightly longer, increasing excavated volumes, engineering costs and safety risks	Lower preference as the route and tunnel are slightly longer, increasing excavated volumes, engineering costs and safety risks

Table 6-3 Ranking of Option 1N modified route options

Key Considerations from Public Consultation	Option 1Na	Option 1Nb	Option 1Nc	Option 1Nd
Impact on local communities of WBS/BSJ	1	1	1	1
Access to and from WBS/BSJ via the new A360 junction and minimising rat running	2	2	2	1
Impact on local businesses and amenities	2	2	2	1
Biodiversity Issues				
River Till SAC/SSSI	1	1	1	1
Parsonage Down National Nature Reserve SAC/SSSI	1	1	1	1
The Diamond (within WHS east of A360)	3	2	2	1
RSPB Reserve and breeding stone curlew	2	3	3	1
Historic Environment Issues				
Attributes of OUV of the WHS (authenticity and integrity)	1	2	2	1
Setting of Scheduled Monuments and relationship to Barrow Groups	1	1	1	1
Winter solstice sunset as viewed from Stonehenge	2	2	2	1
Non-designated archaeological remains	1	2	2	1
Exit from WHS to the west	2	3	3	1
Landscape and Visual Issues				
Across the River Till Valley landscape	1	1	1	1

Key Considerations from Public Consultation	Option 1Na	Option 1Nb	Option 1Nc	Option 1Nd
Exit from WHS to the west and through Oatlands Hill landscape	2	3	3	1
Through the WHS landscape	2	2	2	1
Opportunities to mitigate landscape issues - River Till Valley	2	2	2	1
Engineering and Safety Assessment (inc. route length, tunnel length, earthworks strategy and maintenance)	2	2	2	1

Table 6-4 High-level review of Option 1S modified route options

Key Considerations from Public Consultation	Option 1Sa	Option 1Sb	Option 1Sc
Impact on local communities of WBS/BSJ	1	1	1
Access to and from WBS/BSJ via the new A360 junction and minimising rat running	1	1	1
Impact on local businesses and amenities	1	1	1
Biodiversity Issues			
River Till SAC/SSSI	1	1	1
Parsonage Down National Nature Reserve SAC/SSSI	1	1	1
The Diamond (within WHS east of A360)	3	2	2
RSPB Reserve and breeding stone curlew	2	3	3
Historic Environment Issues			
Attributes of OUV of the WHS (authenticity and integrity)	1	3	2

Key Considerations from Public Consultation	Option 1Sa	Option 1Sb	Option 1Sc
Setting of Scheduled Monuments and relationship to Barrow Groups	1	2	1
Winter solstice sunset as viewed from Stonehenge	1	2	1
Non-designated archaeological remains	1	2	2
Exit from WHS to the west	1	2	1
Scheduled Barrow complexes north of Winterbourne Stoke	1	1	1
Landscape and Visual Issues			
Across the River Till Valley landscape	1	1	1
Exit from WHS to the west and through Oatlands Hill landscape	1	2	2
Through the WHS landscape	2	2	2
Opportunities to mitigate landscape issues - River Till Valley	1	1	1
Engineering and Safety Assessment (inc. route length, tunnel length, earthworks strategy and maintenance)	1	1	1

6.3 Better performing Modified Route Options for appraisal

6.3.1 On the basis of the high level review of the modified route options for 1N and 1S against the key considerations identified at public consultation, it was concluded that the modified Options 1Nb, 1Nc, 1Sb and 1Sc would be rejected in favour of other alternatives, based on them having a less favourable fit within the western part of the WHS and wider landscape and closer proximity RSPB Nature Reserve.

6.3.2 For the northern bypass options, it was concluded that both 1Na and 1Nd both have the potential to deliver viable routes through the WHS, although 1Na is in proximity to the RSPB Nature Reserve and would have a direct impact on The Diamond but noting that it would also provide localised screening for some views.

6.3.3 1Sa is the best performing of the modified southern bypass options through the WHS. Options 1Sb and 1Sc would have a direct impact on newly discovered undesignated archaeology to the south of The Diamond, as well as the Winter Solstice Sunset Alignment (viewed from Stonehenge). The options would also be in proximity to the RSPB Nature Reserve.

6.3.4 Options 1Nb and 1Nc are considered to be the most poorly performing of the modified northern bypass options. This is primarily due to the impact on Oatlands Hill and views from within the WHS, and for 1Nb the newly discovered undesignated archaeology south of the Diamond.

6.3.5 It was concluded that with all options, the western tunnel portal needed to be moved further away from Normanton Down Barrow Group. This could be achieved by a cover structure extending beyond the start of the bored tunnel section, with the ground level restored above the structure to match existing ground levels.

6.3.6 The route options shortlisted for more detailed PCF Stage 2 WebTAG appraisal were as follows and as shown in Appendix C1:

- **Option 1Na** – As per previous Option 1N but with a local horizontal realignment to the west of the WHS through Oatlands Hill and across the existing A303; with an approximate 2.9km long tunnel and 300m cut-and-cover tunnel extension at the western portal within the WHS; and running in cutting between the western tunnel portal and the western boundary of the WHS. The new A360 junction would be located close to the crossing of the existing A303 as with Option 1N, with the existing Longbarrow Roundabout replaced by a simple 'T' junction.
- **Option 1Nd** – A variation on Option 1N with a similar approximate 2.9km long tunnel and 300m cut-and-cover tunnel extension at the western portal within the WHS but with the western portal moved north to a location just to the south of the existing A303 and with the new road running in cutting between the western tunnel portal and the western boundary of the WHS. The new A360 junction would be located closer to the existing A360 than with Option 1N, replacing the existing Longbarrow Roundabout.
- **Option 1Sa** – As per previous Option 1S with a similar approximate 2.9km long tunnel and a 300m cut-and-cover tunnel extension at the western portal within the WHS and running in cutting between the western tunnel portal and the western boundary of the WHS and The Park to the west. The new A360 junction would be located close to the existing A360 within The Park as with Option 1S.

7. Engineering and Safety Assessment

7.1 Introduction

7.1.1 This chapter describes the three Route Options 1Na, 1Nd and 1Sa that were taken forward for further assessment and the key engineering design criteria associated with each option as shown in Appendix C2.

7.1.2 The further appraisal of these three route options is reported in Chapters 7 to 15 of this report with the assessments summarised in the Appraisal Summary Tables in Chapter 16.

7.1.3 The assessment and working assumptions for the three route options against the key engineering criteria are described below along with the assessment against the safety impact on the road user, with a review of accident statistics and a road safety review, and the impact of the options during construction, maintenance, operation and demolition in accordance with the Construction, Design and Management (CDM) Regulations 2015.

7.1.4 The design details described (e.g. heights of embankments and depths of cuttings) are preliminary designs adopted for the purposes of like-for-like comparison of the route options. These preliminary details will be subject to change as the chosen preferred route is developed further, to optimise its design which will include measures to mitigate its impacts.

7.2 Engineering Design and Assessment

Description of Route Options for further Appraisal

7.2.1 The three modified Route Options 1Na, 1Nd and 1Sa, developed and sifted for Stage 2 further appraisal, are described below along with the associated key engineering design criteria, and are shown in Appendix C2.

Route Option 1Na

7.2.2 Option 1Na is a part surface / part tunnelled route through the WHS with a bypass to the north of Winterbourne Stoke. This closely mirrors the consulted route Option 1N, with the proposed A303 on a lower vertical alignment between the western portal and where it crosses the existing A303.

7.2.3 From the west, the route begins at the end of the existing A303 dual carriageway just east of Yarnbury Castle. It runs eastwards, adding a second carriageway to a section of the existing A303 before breaking away to the north of the existing road in order to bypass Winterbourne Stoke. It then heads north-east approximately at ground level, parallel to the boundary with Parsonage Down National Nature Reserve before dropping on a downward gradient into a cutting approximately 5m deep.

7.2.4 The route maintains its downward gradient and follows a right hand curve towards the south east before emerging onto an embankment to the north of Scotland Lodge farm. This embankment would have a maximum height of approximately

20m in order to navigate the steep topography. The alignment then remains on embankment and on a right-hand curve passing over the B3083 at a height of approximately 8m. It would cross the Till Valley (which contains a Special Area of Conservation, SAC) on a 230m long viaduct structure approximately 8-10 m above existing ground level, bridging the River Till and its flood plain.

7.2.5 After crossing the River Till the route climbs at a gradient similar to the surrounding topography on an embankment of varying height (maximum of approximately 4m above the slopes of a side valley) and in a 5m cutting to screen HGV's. It then crosses under the existing A303 with a new junction on the north-west flank of Oatlands Hill, before moving into a cutting up to 19m deep at approximately 97m Above Ordnance Datum (AOD).

7.2.6 The new junction is proposed as an all-movement, grade separated (two level) junction to provide access to the A360, the WHS and Winterbourne Stoke and allow free flowing traffic on the A303. A link road connects the new junction eastwards to the existing A303 and its connection with the A360 at Longbarrow, which would be modified from a roundabout to a simple T-junction. A link road connects the new junction westwards to the existing A303 into Winterbourne Stoke.

7.2.7 On entering the WHS, the route option remains in cutting, crossing a linear archaeological earthwork feature and passing through The Diamond, all in a cutting approximately 7-10m deep. The route then enters the bored tunnel section via a cover structure (ground level restored to existing) approximately 300m long.

7.2.8 The tunnel portal was located to provide a minimum of 6m of cover from the existing ground level to the tunnel crown. The 2.9km tunnel drops to a low point at Stonehenge Bottom at which point the tunnel crown is approximately 10m below ground level. The tunnel alignment then rises again until arriving at the eastern portal located approximately 80m east of The Avenue. The horizontal alignment throughout the tunnel is a gentle "S" curve.

7.2.9 To the east of the tunnel section, the alignment ties back into the existing A303 alignment, with Vespasian's Camp located to the south of the road. It then rises up to a height of approximately 8m at the Countess Roundabout to pass over the proposed new junction with the A345.

7.2.10 It is proposed that an all-movement grade-separated junction would be provided at this location in order to maintain connectivity to Amesbury and the existing A345. The layout of the junction at Countess Roundabout is constrained by properties to the north and the River Avon and a conservation area to the south.

7.2.11 From Countess Roundabout, the alignment continues eastwards, dropping down and joining the existing A303, before it crosses the River Avon on the existing bridge structure.

Route Option 1Nd

7.2.12 Option 1Nd is a part surface / part tunnelled route through the WHS with a bypass to the north of Winterbourne Stoke. It has the A360 junction closer to the existing A360 than Option 1N and a lower vertical alignment through the WHS.

7.2.13 The route follows a very similar horizontal and vertical alignment to Route Option 1Na from the western end across the River Till to the point it crosses the existing A303. The route then stays close to the existing A303 on its south side, passing through Oatlands Hill in a cutting of up to 10m deep and through the potential new A360 junction location at approximately 99m AOD on the north east flank of Oatlands Hill, to the west of the existing A360.

7.2.14 The new junction is proposed as an all-movement, grade-separated (two level) junction to provide access to the A360, the WHS and Winterbourne Stoke and allow free flowing traffic on the A303. The A360 is realigned to the west of the existing Longbarrow Roundabout to connect directly to the new junction, with the existing Longbarrow Roundabout and approach roads removed. A new link road connects the existing A303 from Winterbourne Stoke to the new junction.

7.2.15 To the east of the new junction, the route moves across the existing A360, that is to be removed as part of the new junction, and then on entering the WHS remains in cutting between 5-8m deep close to the existing A303 to the south, across the dry valley towards the tunnel.

7.2.16 The western tunnel entrance is located northwest of Normanton Gorse in an 8m deep cutting with a proposed cover structure (ground level restored to existing) of approximately 300m long leading into the bored tunnel section.

7.2.17 To the east of the tunnel section, the route reverts to the same horizontal and vertical alignment as Option 1Na.

Option 1Sa

7.2.18 Option 1Sa is a part surface / part tunnelled route option through the WHS with a bypass to the south of Winterbourne Stoke. This option closely mirrors the consulted route option 1S, with the proposed A303 crossing the WHS and the existing A360 on a lower vertical alignment.

7.2.19 From the west, the alignment begins at the end of the existing A303 dual carriageway just east of Yarnbury Castle. It runs eastwards, adding a second carriageway to a section of the existing A303 before breaking away to the south on a right-hand curve in order to bypass Winterbourne Stoke. It then heads south-east, on an embankment of varying height up to a maximum of approximately 14m following the line of a natural valley.

7.2.20 The alignment then turns through a left-hand radius to head east and crosses the line of the B3083 close to ground level. The side road would be raised onto an embankment approximately 8m high to pass over the A303. The route option crosses the Till Valley on a viaduct structure approximately 200m long and 10-13m above existing ground level, bridging the River Till and its flood plain.

7.2.21 After crossing the River Till the route continues on an upward gradient on an embankment of varying height (with a maximum of approximately 10m). The route option follows a left-hand curve, the vertical alignment flattens off and the route enters a cutting as far as the Oatlands Dairy Unit which the route passes to the south. The route traverses an area known as The Park on a left-hand curve

dropping into a cutting between 10-15m deep where it crosses the existing line of the A360.

7.2.22 An all-movement, grade separated junction is proposed near the existing A360. This would provide access to the A360, the WHS and Winterbourne Stoke and allow free flowing traffic on the A303. The connection of the existing A303 with the A360 at Longbarrow would be modified from roundabout to a T-junction.

7.2.23 The route option enters the WHS on a left-hand curve in a cutting, reducing to 7-10m deep heading in a north-easterly direction. It then changes to a right-hand curve. It crosses a linear archaeological earthwork feature and passes through The Diamond before swinging to a more easterly bearing before entering the bored tunnel section via an approximate 300m cover structure south west of Normanton Gorse.

7.2.24 The eastern portal location and the remainder of the route option to the east of this point is the same as that described above for option 1Na.

Highway design relaxations and departures from standards

7.2.25 The new highway would be a Dual 2-Lane All-Purpose Expressway. The design of the route options has been based on the DMRB requirements for an all-purpose road with a design speed of 120kph (70mph), in conjunction with design principles outlined in the Expressways Technical Note, ahead of publication of the Expressway Interim Advice Note (IAN). A more detailed assessment of the application of the Expressway IAN would take place in the next stage.

7.2.26 The existing Countess Roundabout geometry was designed for future provision of an overpass on the A303 and in order to maximise retention of the existing road geometry, there could be possible minor visibility and minor horizontal curvature departures on the approaches to any new grade separated junction at this location including with the adjacent tie-in with the existing A303. The departures are common to all route options and are subject to design development at the next stage. Departures would either be designed out completely or subject to the formal Highways England departure approvals process. With the exception of the existing horizontal geometry at Countess Roundabout and the adjacent eastern tie-in to the existing A303, the new A303 scheme design is proposed to adopt at least desirable minimum design standards, and there are no further departures to note at this stage in the scheme development.

Junction and side roads strategy

7.2.27 The junction and side roads strategy for the three route options was developed at a high level based on the Highways England Expressway Technical Note, in addition to anticipated requirements in the upcoming Expressway IAN. These documents specify the use of grade separated junctions and the aim to minimise the number of junctions onto the Expressway.

7.2.28 The junction strategy was developed in accordance with the following principles:

- All-movement grade-separated junctions where the new route crosses existing "A" roads, to maintain optimum integration with the wider strategic road network.
- Where minor side roads, byways, bridleways, footpaths or private accesses cross the route options, it is proposed that these would be accommodated by either an overpass, underpass or be diverted. The specific treatment at each location would be the subject of further assessment and design development during the next stage.

7.2.29 Assessment of the mainline traffic flows concluded in the Technical Appraisal Report [21] that full grade separated junctions to DMRB TD 22/06 (Figure 5-4), are likely to be required at the proposed A360 and A345 junctions. These would likely comprise a single grade separated roundabout with two bridges over or under the mainline, or two grade separated roundabouts with one bridge for the connector road over or under the mainline, together with slip roads to and from the mainline. The final junction forms would be confirmed in the design development of the Preferred Route, ensuring that the impact of the junctions on their surrounding environment is minimised.

7.2.30 The general assumptions across all options are as follows:

- The existing A303 is closed between Countess Roundabout and Longbarrow Roundabout for general traffic except for local access and NMUs;
- At Countess Roundabout, the current access arrangements to the motel/service area would be retained;
- No additional mitigation measures to be included at this stage to counter the re-routeing of traffic as a result of a particular option;
- Access between Winterbourne Stoke and the scheme is assumed to be from the east; and
- No junctions would be lit apart from the circulatory carriageway on the A345 Junction where the existing lighting would be replaced.

7.2.31 The specific junction proposals with each option are as follows:

Route Option 1Na

- Grade-separated junctions with A345 at Countess Roundabout;
- Grade-separated junctions with A360/A303 between Winterbourne Stoke and Longbarrow Roundabout with new junction connector and link roads passing above new A303.
- No junction with A303 west of Winterbourne Stoke – traffic to/from Winterbourne Stoke would access from A360/A303 (east) or (for some local traffic) B3083.

Route Option 1Nd

- Grade-separated junctions with A345 at Countess Roundabout.

- Grade-separated junctions with A360/A303 between Winterbourne Stoke and Longbarrow Roundabout with new junction connector and link roads passing above new A303.
- No junction with A303 west of Winterbourne Stoke – traffic to/from Winterbourne Stoke would access from A360/A303 (east) or (for some local traffic) B3083.

Route Option 1Sa

- Grade-separated junctions with A345 at Countess Roundabout.
- Grade-separated junctions with A360 within The Park with new junction connector and link roads passing over the new A303.
- No junction with A303 west of Winterbourne Stoke – traffic to/from Winterbourne Stoke would access from A360/A303 (east) or (for some local traffic) B3083.

Carriageway lighting

7.2.32 The provision of lighting would be subject to a detailed risk assessment by a Road Safety Engineer, in accordance with TA 49/07, consistent with the industry standard procedure for the introduction of lighting on a scheme.

7.2.33 At this early stage in the scheme development, and for the purpose of assessment ahead of the TA 49/07 lighting appraisal, lighting assumptions have been adopted that are in accordance with design standards and common dual carriageway lighting practice throughout the UK. They introduce no departures from standard.

7.2.34 It was assumed that the mainline would be unlit for all route options, other than within the tunnel. Except at Countess Roundabout, junctions and their approaches on slip roads and side roads are also assumed to be unlit for all route options and the inside of the tunnels would be lit with carriageway lighting in accordance with BS 5489-2:2016. At this stage in the assessment it is assumed that the existing lighting on the circulatory carriageway and the immediate approaches at the Countess Roundabout would be retained as part of the new A345 grade-separated junction and this lighting would comprise full cut off LED lighting.

7.2.35 The detailed lighting assessment would be undertaken at the next stage of assessment after selection of a Preferred Route.

Impact on existing utilities

7.2.36 The key known utilities interacting with all route options include:

- Oil pipeline (Esso Petroleum Company Ltd).
- Gas mains (Southern Gas Networks).
- High voltage electricity cables (Southern Electric Power Distribution).
- Low voltage electricity cables (Southern Electric Power Distribution).
- Foul sewers (Wessex Water).
- Water mains (Wessex Water).

- Fibre optic cables (Various).

7.2.37 Information relating to services located on adjacent Ministry of Defence (MOD) land has not been included in the assessment. Details would be reviewed when available.

7.2.38 The level of impact of existing utilities and any associated diversion requirements would be assessed and confirmed throughout subsequent design development of the Preferred Route. At this stage an allowance has been included within the cost estimate for each route option for potential diversions.

7.2.39 Advanced works have been identified to protect the existing oil pipeline and electrical power supply requirements to the portal areas for the tunnel construction; these would be progressed in the next stage of design development.

Proposed structures

7.2.40 The proposed structures for each of the route options for this stage of assessment have been identified and their details would be developed during the preliminary design of the Preferred Route.

7.2.41 Route Option 1Na

7.2.42 Six major proposed structures were identified for route option 1Na from west to east as follows:

- Underpass on the B3083.
- Multi-span viaduct over River Till Special Area of Conservation (SAC).
- Grade-separated junction in the vicinity of the existing A303 with side road above the mainline.
- Underpass of the A360.
- Twin-bore tunnel.
- Grade-separated junction with A345 at the current location of Countess Roundabout with retaining structures and an overpass carrying the mainline A303.

7.2.43 Five major proposed structures were identified for route option 1Nd from west to east as follows:

- Underpass on the B3083.
- Multi-span viaduct over River Till SAC.
- Grade-separated junction in the vicinity of the existing A360 and Longbarrow Roundabout, with side road above the mainline.
- Twin-bore tunnel.
- Grade-separated junction with A345 at the current location of Countess Roundabout with retaining structures and an overpass carrying the mainline A303.

7.2.44 Five major proposed structures were identified for route option 1Sa from west to east as follows:

- Overpass on the B3083.
- Multi-span viaduct over River Till SAC.
- Grade-separated junction in the vicinity of the A360 within The Park, with side road above the mainline.
- Twin-bore tunnel.
- Grade-separated junction with A345 at the current location of Countess Roundabout with retaining structures and an overpass carrying the mainline A303.

7.2.45 In addition to these structures there would be structures required with grade separated crossings for PRoW (see below) and for private accesses as accommodation works.

Public Rights of Way (PRoW)

7.2.46 A Non-Motorised User (NMU) Context Report has been produced [22], that identifies the existing NMU network and its operation across the study area and sets the objectives for the NMU design development and audit going forward. This included engagement with the numerous stakeholders, including local councils and town councils and the various user groups.

7.2.47 NMU crossings of the proposed route options would need to be grade separated either over or under the new A303 mainline. Where possible existing NMU routes would be maintained, but where this is not feasible, they would be diverted along a suitable alternate route. NMU provisions would maintain or enhance connectivity for users, particularly within the WHS. Redundant lengths of existing roads would be reclassified for NMUs and local restricted access.

7.2.48 The proposals for the A303 Stonehenge scheme would be assessed in full against the objectives identified within the NMU Context Report, at a number of stages through the project, in accordance with DMRB HD42/05:

- Preliminary design: following the completion of preliminary design, prior to the Stage 1 Road Safety Audit.
- Detailed design: following the completion of detailed design, prior to the Stage 2 Road Safety Audit.
- Post-construction: following completion of construction. This should accompany the Stage 3 Road Safety Audit, and should be completed prior to the undertaking of any Stage 4 Road Safety Audit.

Tunnel design

7.2.49 An accelerated design development of the tunnel was undertaken in PCF Stage 2 in order to confirm the viability of the route options.

7.2.50 The existing site, environmental and archaeological conditions, current geotechnical information, and highway design requirements were used to inform

the tunnel alignment and geometry and to assess the impacts and potential mitigation measures.

Tunnel alignment

7.2.51 The horizontal alignment of the tunnel was established based upon the following considerations:

- Safe highway curvature and gradients.
- Connection with A303 beyond the tunnels portals.
- Topography.
- Environment and cultural heritage considerations.
- Position of portals and tunnel approaches.

7.2.52 In order to establish the vertical alignment of the tunnel, the minimum ground cover (distance between the ground level and the tunnel crown) at Stonehenge Bottom was assumed as 10m. This figure was selected based on the following:

- Safe excavation with tunnelling techniques must have sufficient cover. Crown stability dependent on structural arch behaviour in soil or rock mass. Deeper chalk is also likely to be less fractured, which reduces the risk of crown collapse or face collapse.
- Minimising disturbance to the topsoil and subgrade to protect archaeology and ecology.
- In the permanent operational phase, highest permeability in the dry valley is in the top ground layer. Therefore, maximising cover at Stonehenge Bottom to avoid damming the groundwater in this zone minimises potential environmental impacts.
- Due to the presence of groundwater, enough cover is required to prevent buoyancy effects. The ground cover provides a counterweight against the buoyancy forces. Initial calculations suggest 6m as the minimum requirements.

7.2.53 Additionally, to allow for safe excavation to commence, a minimum cover of 10m is required at the portals.

Tunnel sizing

7.2.54 The tunnel would generally be constructed as a twin-bore tunnel in order to accommodate a dual carriageway highway cross section. Each of the tunnel bores would have an internal diameter of between 11 and 12m.

7.2.55 The tunnel cross section may be circular or semi-oval, depending on the method of construction (Tunnel Boring Machine (TBM) or Sprayed Concrete Lining (SCL) tunnelling methods). The lining thickness has been assumed indicatively as 350mm thick for the primary and 375mm thick for the secondary lining, or 450mm thick for the segmental lining. This assessment would be reviewed in subsequent design stages.

7.2.56 Given the tunnel length and predicted traffic volumes Highways England Engineering Standards (BD 78/99) classifies the tunnel as Category AA.

Cross passages

7.2.57 Cross passages are required for evacuation and access for the emergency services. It is proposed that the cross passages are located at 100m intervals and would also house the electrical distribution panels, ventilation panels and emergency refuge and exit points.

Tunnel portals

7.2.58 The possible location of the portals was based upon a combination of highway geometry, the existing topography and mitigation of the environmental impacts.

7.2.59 Tunnel bore separation at the portal was estimated as one tunnel diameter between the outsides of the tunnel bore construction. Separation is required to prevent the recirculation of polluted exhaust air between the tunnels, otherwise an anti-recirculation wall must be provided. The separation would be optimised after further aerodynamic analysis and collaboration with architects at the next design stage to arrive at an optimised design that is both functional and aesthetically acceptable in this critical WHS landscape.

Tunnel construction

7.2.60 A number of viable safe methods of construction were identified as being appropriate for the construction of the main tunnel bores and cross passages, including:

- SCL excavation.
- Open face shield machine tunnelling.
- Earth Pressure Balance (EPB) TBM.
- Slurry TBM.

7.2.61 A final decision on the form of construction would be taken later in the design process once all contributing factors have been collated and assessed.

Tunnel drainage

7.2.62 Highway drainage at the portal should capture surface water before entering the tunnel. The tunnel itself would be waterproofed for operational and maintenance reasons with only minimal seepage envisaged through the lining. Highway drainage within the tunnel is designed to capture tunnel maintenance cleaning liquid runoff, firefighting water and liquid spillages. The tunnel drainage system would connect to a low point sump where it is pumped out of the tunnel into an impounding sump for discharge outside of the tunnel bore.

Geotechnical issues

7.2.63 Geotechnical issues that may be factors in the selection of tunnel construction method include:

- Phosphatic chalk – The extent and distribution of phosphatic chalk and its engineering characteristics.
- The local hydrogeology – How variations in permeability and sub-surface groundwater flows would influence requirements for control of groundwater during construction.

7.2.64 These would be evaluated further during the development of the Preferred Route.

Earthworks

Cuttings

7.2.65 Cuttings would generally be located within the higher ground where there is a thin mantle of weathered chalk over the chalk bedrock. Factors that would influence the design of cutting slopes include:

- Potential presence of unfavourable jointing in the chalk.
- Control and mitigation of surface degradation/ravelling (maintenance).
- Impacts on the OUV of the WHS.
- Landscape and visual impact within the WHS.
- Extent of physical footprint and potential risk to archaeological resource.

7.2.66 Existing cutting slopes on the existing A303 in the vicinity of Winterbourne Stoke and Amesbury vary from 1(V):2(H) to 1:1 with no evidence of instability.

7.2.67 For this stage of assessment, cutting slopes have been assumed to be 1(V):2(H).

Embankments

7.2.68 Within dry valleys and areas of higher ground, embankments would generally be founded on the chalk or Head deposits which are expected to provide stable foundation conditions.

7.2.69 Within the River Till and Avon valleys embankments would be founded on alluvial deposits. These may include some soft or compressible deposits.

7.2.70 Side slopes of 1 in 3 are typically adopted for embankments constructed from chalk fill on competent ground. Shallower slopes may be required on soft ground or for landscaping.

7.2.71 For this stage of assessment, embankment slopes have been assumed to be 1(V):3(H).

Re-use of excavated materials

7.2.72 The scheme would aim to minimise generation of waste and maximise onsite use in keeping with the Waste Framework Directive through cut and fill balance, and in environmental mitigation measures (such as landscaping for visual or noise mitigation or to enhance biodiversity).

7.2.73 The majority of the excavated arisings would comprise chalk. The feasibility of using arisings from tunnel excavation in the earthworks would be dependent on the tunnel construction method and would be subject to further study.

7.2.74 Chalk arisings from previous highway tunnels constructed using open face methods has generally not been reused in the works or used in landscaping only. This is likely to be because the excavation and handling of the material in the tunnel construction is not compliant with the requirements of the SHW method specification for a class 3 material. However, chalk arisings from the North Downs tunnel on High Speed 1 were successfully used in an embankment for the M2 motorway by adopting an end-product specification based on earthworks trials and a similar approach to re-use the material will be considered for this scheme.

7.2.75 Arisings from tunnels excavated in chalk using a TBM are in the form of a slurry or paste which generally requires treatment to render it suitable for handling and transport. Arisings from TBM excavations in chalk are not believed to have previously been used in highway earthworks. If the arisings from TBM excavations cannot be suitably treated for re-use it is anticipated that they would be used in landscaping and increased biodiversity areas along the route or may need to be transported off-site and deposited in permitted or exempt sites in the vicinity to create additional areas of increased biodiversity.

Surface water drainage

7.2.76 The proposed method of surface water disposal across the scheme is infiltration, the preferred method of discharge in the DMRB. Furthermore, the chalk which is prevalent in the area is naturally suited to allow surface water to infiltrate.

7.2.77 Previous Ground Investigation included soakaway testing which indicated that infiltration would be a feasible solution for highway drainage. However, groundwater levels were not recorded during the tests, and this could affect the infiltration results.

7.2.78 The groundwater table fluctuates highly in different seasons. In order to be successful, the water table should be a minimum of 1m below the base of the infiltration device. This would be confirmed during further Ground Investigation.

7.2.79 Highway drainage would collect all the highway runoff from the mainline, slip roads and associated side roads. Drainage could be collected through a variety of different means including surface water channels, kerb and gullies, kerb drainage units and grassed channels (swales).

7.2.80 Water would be conveyed from the carriageway to Drainage Treatment Areas (DTAs), where the water would be treated (reduce suspended solids, dilute de-icing salts and mitigate pollution) and then discharge through infiltration. An overflow from the infiltration basin would be placed where the infiltration is located near a watercourse. This overflow would be restricted to a rate agreed with the Environment Agency.

Cross drainage

7.2.81 With the exception of the Rivers Till and Avon there are no other watercourses which are crossed by the route options. However, there are several 'dry valleys' where it is assumed that water soaks away into the underlying chalk strata.

7.2.82 Where the highway crosses these dry valleys the earthworks would dam the surface water flow path before it infiltrates. Over a long period, this could cause erosion and instability in the embankment. To counteract this, a drainage blanket layer would be placed at these locations, to convey flows under the embankments.

Pre-earthworks and cuttings drainage

7.2.83 At the top of cuttings, cut-off ditches would be provided to intercept overland flows from adjacent land. The anticipated negligible flows would be either diverted to the nearest watercourse, or permitted to infiltrate into the ground.

7.2.84 At cuttings, groundwater flows would be assessed. In areas where groundwater seepage is anticipated into the cuttings, grips consisting of filter stone material would convey this water to the base of the cutting where it could be drained, either using a separate filter drain system where possible, or the wider highway drainage system. The design would ensure that groundwater would not transfer between catchments in order to be compliant with the Water Framework Directive (WFD).

Portal drainage

7.2.85 Carriageway runoff would be intercepted before entering the tunnel bores. Soakaway pits would be located at the tunnel portals to achieve this. Water would be treated prior to discharge to ensure it had appropriate quality for discharge to groundwater.

Constructability

Constructability considerations applicable to all route options

7.2.86 Given the traffic volumes, the strategic importance of the route and the Government's aim to reduce disruption to roads users, it is vital that the existing network remains operational during construction.

7.2.87 All route options would require traffic management at various times and locations for a number of purposes including:

- Construction works in the vicinity.
- Plant to cross the highway.
- Access and egress to site compounds.

7.2.88 Lane width reductions and temporary speed limits would be required at each tie-in location. Temporary speed limits would be imposed along these sections together with reduced lane widths. There may also be the need for short term temporary closures and diversions of both roads and PRoW to allow tie-ins with the new infrastructure to be constructed. Where appropriate and possible these are likely to take place during the night. As part of the construction operation there

would also be a need to move materials from one part of the site to another and to import materials and plant to site.

7.2.89 All traffic management proposals and permitted access routes would be incorporated into a Traffic Management Plan which would be agreed with the relevant highway authority. This would minimise the level and duration of impact on users and ensure their safety.

7.2.90 The more detailed design, after selection of a Preferred Route, would optimise the cut/fill earthworks balance. For the tunnel options, there are opportunities to investigate a cut/fill earthworks deficit to make use of tunnel arisings, reducing or removing any surplus of excavated material with the scheme.

Cost effectiveness

7.2.91 The approach to ensuring cost effective construction and maintenance would include standardisation of components such as structures, drainage and road restraint systems, and enabling the use of familiar and conventional construction and maintenance techniques. This approach should also help maximise the health and safety performance of the scheme during construction and operation.

7.2.92 Designers would collaborate with Highways England's construction and maintenance supply chain partners to ensure opportunities to improve cost effectiveness are identified and implemented.

Tunnel

7.2.93 All route options assessed include an approximate 2.9km bored tunnel with a 300m cover extension at the western portal. Buildability advice was obtained from experienced tunnelling contractors acting as Highways England's construction advisors. The type of construction method was left open so as not to limit the options at this stage.

7.2.94 Each construction method has its advantages and disadvantages and would involve different hazards, risks and opportunities. The probable construction options are to use either an Earth Pressure Balance Tunnel Boring Machine (TBM) or a Sprayed Concrete Lining (SCL), based on factors including construction programme and complexity of material re-use and/or disposal.

7.2.95 The chalk material to be excavated from the tunnels would produce spoil with different characteristics with the two different construction methods. The opportunities to re-use this material elsewhere within the works is dependent upon these characteristics and their compliance with the Specification for Highway Works. Using the SCL method it may be possible through adoption of an end-product specification in combination with earthworks trials to re-use arisings from the tunnel excavation in road embankment construction.

7.2.96 Due to the environmental and historic sensitivity of the locality, working space would only be permitted within the permanent scheme site boundary in the WHS. Thus, any materials storage areas, TBM assembly and launch areas, materials processing or storage areas and site offices would need to be located in a very

constrained area. This would present logistical challenges requiring careful planning.

7.2.97 The east tunnel portal has been located adjacent to the existing A303; allowing construction while also allowing two-way traffic flow on the existing road.

East of the Tunnel to Countess Roundabout

7.2.98 To the east of the tunnel the route options would follow a similar line to the existing road. Within this area temporary speed limits would be imposed together with reduced lane widths and possibly contraflow operation.

7.2.99 On the approach to Countess Roundabout the route options would rise on embankment and viaduct over the roundabout to form an all-movement, grade-separated junction with the A345. The construction work at Countess Roundabout would be assisted by the geometry of the existing roundabout which was designed for future provision of an overpass but traffic management measures would be required during construction of the tie-in points.

Conclusion

7.2.100 All three proposed route options offer good buildability for the predominantly off-line construction, while construction of on-line tie-ins in close proximity to traffic are achievable through traffic management and construction phasing. Minor closures or diversions throughout the construction phase would take place outside of peak traffic conditions.

7.3 Safety Assessment - Impact on Road User

Assessment methodology

7.3.1 This safety assessment reviews the proposed route options with reference to the road safety targets contained within the Highways England Delivery Plan. It then considers the effective construction traffic management that would be required. The remainder of the section reviews the potential implications for operational safety of the three options 1Na, 1Nd and 1Sa.

7.3.2 The road safety element has assessed the following aspects:

- Overall alignments.
- General highway design features.
- Junction strategy.
- Tie-in points.
- Tunnel options.
- Severance and implications for the local highway network.

7.3.3 This assessment reviews the design from a road safety perspective. Observations and recommendations are made about road safety aspects for consideration in future design development.

Delivery plan and national incident and casualty reduction plan

Policy context

7.3.4 The Highways England Delivery Plan 2015-2020 (and, subsequently, the National Incident and Casualty Reduction Plan) sets out a target of reducing the number of people killed or injured on the network as close as possible to zero by the year 2040. More specifically, the target is to reduce the number of collisions involving fatal or serious injuries on the Highways England network to 1,393 per year by 2020. This would represent a reduction of 40% on the baseline of the 2005 to 2009 averages.

Collision history

7.3.5 Over the length of the existing A303 within the scheme extents there were 8 recorded personal injury collisions resulting in fatal injuries and 28 serious injury collisions in the ten-year period 2005 to 2014. 7 of the 8 fatal collisions and 15 of the 28 serious injury collisions occurred on the single carriageway section. In addition, 6 of the 12 serious injury collisions occurred at or near at grade junctions.

7.3.6 It is noted that 1 serious collision occurred at the former A303/A344 junction that has since been removed.

Implications of the proposals

7.3.7 A significant proportion of the existing A303 within the scheme extents consists of single carriageway, part of which passes through the village of Winterbourne Stoke. Existing highway features include:

- At-grade side road junctions.
- Residential and field accesses.
- Laybys.
- Access to a services area via a slip road immediately east of Countess Roundabout.

7.3.8 The proposed route options using an Expressway would eliminate most or all of these highway features. In addition, the horizontal and vertical alignments and associated forward visibility would be significantly improved relative to the existing situation. This would be expected to lead to a decrease in the number of collisions on the trunk road. Specifically, the fatal and serious injury collision rate highlighted above would be decreased given that the single carriageway and at grade features of the existing alignment would be removed.

7.3.9 With all route options, the existing A303 and most of its highway features would either be downgraded as part of the local road network or a new NMU facility. Therefore, the level of risk and the likely number of collisions associated with these features would be expected to reduce significantly due to lower traffic flows.

Safety review

Overall alignments

7.3.10 The horizontal alignment of all three route options includes curves that are greater than the desirable minimum for a 120kph design speed. The horizontal alignment of all options includes a desirable minimum curve (1020m radius) through the proposed A345 junction that, in conjunction with any reduced stopping sight distance, would introduce departures. The stopping sight distance requirements and provisions would be considered further in the next stage on the Preferred Route and although the preference would be to avoid departures wherever possible, minor combination departures at this location could be acceptable with drivers being aware of the junction as they pass over it on an elevated structure. Therefore, the vertical and horizontal geometry is not a differentiator between options.

7.3.11 Gradients along all three route options are acceptable and do not raise concerns for road safety. It is noted that the River Till crossing for all route options would take the proposed alignment structure above the river level. There are no road safety concerns subject to the appropriate provision of parapets and vehicle restraint systems.

General highway design features

7.3.12 Forward visibility and associated widening on bends would be expected to be provided within standards wherever possible and therefore there are no specific concerns with the horizontal curvature at this stage. In addition, highway features such as signs and structural elements would be expected to lie outside the visibility splays and not create road safety problems.

7.3.13 The Expressway cross-section consists of two standard 3.65m wide lanes in each direction with a central reserve and a 1.0 m hard strip. The hard strip would be expected to accommodate drainage features such as gullies to ensure they are located away from live traffic. In addition, during heavy rainfall events any areas of standing/running water would be accommodated within the hard strip to avoid any impact upon live traffic lanes.

7.3.14 The choice of central reserve vehicle restraint system would be influenced by a number of factors including the Expressway design requirements, WHS visual impact implications and the safety performance of the different options. Once the requirements of the forthcoming design standard for Expressways are known, the options and associated performance for the central reserve vehicle restraint system should be investigated.

7.3.15 There are five laybys of varying designs present along the existing A303 within the scheme extents that present the opportunity for road users to stop. The Expressway design is likely to include variable message signs with an Emergency Refuge Area (ERA) for use by road users in emergency situations (including road users who have left their vehicles to become pedestrians). Consideration should be given to the location of these refuge areas such that they do not block forward visibility on the inside of bends. In addition, users should be able to enter and exit the bays with good visibility.

7.3.16 Street lighting is not included in the proposals anywhere along the route (except through the tunnels) or at any junctions, including the replacement junction at the site of the existing Longbarrow Roundabout. It is assumed the existing lighting at Countess Roundabout would be retained. Street lighting at junctions along the Expressway would be expected to reduce the likelihood of accidents at night-time or in poor weather collisions. However, it is recognised that the proposals are within the vicinity of the WHS and therefore other factors would need to be taken into account when considering the provision of junction lighting.

7.3.17 TA 49/07 Appraisal of New and Replacement Lighting on the Strategic Motorway and All Purpose Trunk Road Network indicates that the road safety benefits of lighting provision are unlikely to be as great as might be expected although it provides little or no indication of expected benefits at junctions. It recommends that a road safety engineer undertakes an assessment to estimate the likely personal injury accident saving through the provision of street lighting.

7.3.18 The choice of junction layout at each location should therefore take account of overall operational safety of each type of junction particularly with respect to clarity of layout and the presence/movements of other users at night.

7.3.19 During the development of landscaping proposals their impact upon road users should be taken into account at an early stage in order to incorporate any required mitigation into the design and to ensure that sufficient land-take is identified.

7.3.20 At this stage of design development, it is not known whether Variable Message Signage (VMS) would be incorporated into the scheme over the extents of the WHS. This is due to the visual impact upon the WHS. In addition, the formal requirements for provision of VMS on an Expressway are not yet known. The omission of VMS over an extended length may raise operational safety concerns that messages about incidents or road conditions cannot be relayed to road users whilst travelling along the scheme. If VMS are not to be included over various sections of the scheme, then the road safety implications should be investigated in more detail and mitigation should be identified where appropriate.

7.3.21 Signs (including VMS) and other roadside features should, where possible, be located away from high risk areas where errant vehicles may be more likely to leave the carriageway. The potential for these features to be struck and thus the need to include vehicle restraint systems should be considered as the design is developed.

7.3.22 Vehicle restraint systems would be required at specific hazards and at significant earthworks. Further consideration of these systems would be given as the design is developed.

Junction strategy

7.3.23 Junction locations for the route options are described earlier in this chapter. The exact location and form of the junctions would be determined at the next stage of design development after selection of a Preferred Route.

7.3.24 For all route options, a junction at the current location of Countess Roundabout may result in a short weaving length to the adjacent Solstice Park junction. This

would be reviewed at the next stage when developing the form and location of each junction to take through the statutory process for planning and land acquisition.

7.3.25 Initial indications are that these weaving lengths would be close to the desirable minimum figure of 1km. Whilst this may have implications for Departures from Standards, the variation in weaving length by relatively small amounts is unlikely to have a significant impact upon the operational road safety of the road layout. Irrespective of the weaving lengths being marginally over or under the desirable minimum figure specified in TD 22 Layout of Grade Separated Junctions, they would appear to be of an order that would justify the investigation of mitigation measures such as additional traffic signs or reduced speed limits at the next stage of design development.

7.3.26 The spacing of junctions along each route option has the following potential impacts upon road safety:

- Increased spacing may discourage some users from joining the Expressway and thus traffic levels may not decrease as much as expected on the local road network. This could reduce the road safety benefits of the scheme.
- Larger distances between junctions provide fewer opportunities for users to leave the network if they experience difficulties with their vehicle or wish to stop for non-emergency purposes. This would result in a greater need for safe places of refuge out of the live traffic lanes.
- Emergency services accessing an incident may face greater challenges and therefore slower response times. This could also have a detrimental impact upon the severity of the incident or worsening of congestion and congestion related safety concerns.

7.3.27 Junction spacing with all options would be approximately 6.5km between the A360 and A345, as existing. However, to the west of the A360 junction, spacing to the Wylye Interchange with the A36 would be approximately 11km without any intermediate junction.

7.3.28 The choice of junction layout at each location would take account of traffic flows and turning movement proportions to minimise the risk of collisions. The junction layouts may also pose problems for vulnerable users wishing to proceed on the local road network who are required to negotiate the junction. The needs of these users would be considered at the next design stage.

Tie-in points

7.3.29 The carriageway standard of the route options would be similar to the existing A303 at tie-in points at each end of the scheme.

7.3.30 The western tie-in of all route options has a horizontal alignment that is relatively straight with good forward visibility. Whilst the vertical alignment is undulating, forward visibility does not appear to be compromised and thus there are no obvious road safety concerns regarding the alignment.

7.3.31 The eastern tie-in of the route options would be immediately east of Countess Roundabout, prior to the Solstice Park Junction on the A303. This section of dual carriageway currently has a vehicle restraint system in the central reserve and no hard strip. It is noted that an alignment making use of existing horizontal geometry at Countess Roundabout and the eastern tie-in may result in minor Departures from Standards as detailed earlier in this chapter. The horizontal and vertical alignments do not raise any significant concerns for road safety at this stage given the similarity between existing and proposed alignments and cross-sections.

7.3.32 None of the tie-ins are located close to junctions or other significant highway features. The proposed A345 junction would include slip roads which would introduce forward visibility departures on the westbound A303 approach.

Tunnel options

7.3.33 For all route options the tunnel would be subject to the particular safety provisions within the Road Tunnel Safety Regulations 2007 (RTSR 2007) and BD 78/99, and would be expected to be similar to other tunnels on the Highways England network. Advantage would be taken of proven design features used elsewhere to minimise road safety risks. A comparison of these features with the requirements of an Expressway would form part of the design development.

7.3.34 Hazards with a much higher potential severity such as major incidents involving multiple vehicles or fire would be expected to have an increased risk as a result of the closed nature of the tunnel. Despite the potential high severities associated with some tunnel hazards, well-tested mitigation measures to reduce the risk levels would be incorporated into the scheme.

7.3.35 The east west alignment of the tunnels may create problems during times when the sun is low in the sky and may dazzle road users emerging from the tunnels. There are software packages that can forecast the solar azimuth angle and solar elevation for any time of the day on any day of the year. This type of information, in conjunction with knowledge of the alignment geometry, could identify if there are particular times when the sun might be expected to cause problems for road users emerging from the tunnels. Mitigation measures could then be sought to reduce the impact of a low sun.

Severance

7.3.36 The tunnel section of all route options would reduce severance and associated road safety concerns for users crossing the new A303. Over the whole length of the routes, Route Options 1Na and 1Nd would bisect five Public Rights of Way (PRoW) including three byways and two bridleways, whilst Option 1Sa would bisect six PRoW including two footpaths, two bridleways and two byways. The redundant section of A303 created by the implementation of the new route options would become a route for Non-Motorised Users (NMUs), reducing the severance impacts of the scheme.

7.3.37 Vulnerable users such as pedestrians, cyclists and equestrians have a lower capacity for diversion than vehicular users. Where existing route options are severed by the route options and vulnerable users are likely to be affected, the diversion route would have a significant impact upon the safety of those users. If

the diversion route is long, then users may be persuaded to take an inappropriate route or even cross the Expressway; if the diversion route involves high volumes and speeds of motorised traffic then this may significantly increase risks for vulnerable users. Such diversions would therefore be avoided where possible.

7.3.38 Equestrians and cyclists would require special consideration for any proposed crossings.

Relaxations and Departures from Standards

7.3.39 Relaxations and Departures from Standards would be identified and mitigated where possible as the design is developed. Highway geometry Departures were identified with all route options at the Countess Roundabout and the eastern tie-in, which would need to be assessed in more detail during the design development of the Preferred Route, but are not considered to cause a significant safety concern at this stage.

7.4 Safety Assessment - Impact during Construction, Maintenance, Operation and Demolition (CDM)

7.4.1 Throughout the design process, construction, maintenance, operational and future demolition hazards have been identified, considered and recorded. The project CDM risk register is the record of hazards identified by designers throughout the early design. This has been produced as a single multi-disciplinary register to facilitate early identification of hazards and possible mitigation that can be applied through cross-discipline working.

7.4.2 Historic construction information and pre-construction information was gathered from Highways England (and others) and further surveys, investigations, searches were undertaken to identify and gather more information about the existing conditions and hazards at this design stage. Possible mitigation has also been recorded for consideration for future design stages.

7.4.3 Design risk workshops have been held to identify hazards and risks that may be applicable to this project and the risk assessments were regularly reviewed. The three route options are all along similar alignments and the significant hazards across each have been summarised below.

Significant hazards identified for all route options in the construction phase

7.4.4 Key hazards identified in all route options during construction activities are:

- Unexploded ordnance (WW1, WW2 and small munitions (MoD and pheasant shooting).
- Substantial movement of earthworks and tunnel excavation material including moving material by road.
- One river crossing (working at height above water, River Till).
- Farm disposal (burn pits) holding suspected asbestos containing materials.
- Work over a high-pressure oil pipeline.

- Working under overhead high voltage electricity cables and around buried utilities (including MoD utilities).
- Working in and/or adjacent to live traffic (connections into the existing live network both ends of the route option and at new junctions).
- Personnel at tunnel face during unsupported ground conditions/under unstable lining.
- Poor ground conditions specific to phosphatic chalk and faulted ground conditions.
- Low ground cover causes ground collapse during excavation, buoyancy issues and, for certain construction methodologies, blowout during excavation.

Specific hazards for all route options during maintenance

7.4.5 Key additional hazards identified with the route options are:

- Inspecting and replacing tunnel luminaires at height.
- Fixed tunnel equipment can make tunnel maintenance onerous and require frequent access, including potential unplanned maintenance – interface with live highway.
- Tunnel washing activity could lead to potential water ingress into enclosures containing electricity, causing electrocution hazards and contamination.
- Maintenance at height – River Till structure.
- Difficult access to cross passages, portal buildings, mid tunnel slump and plant room from highway.
- Setting up a contraflow or diversion route – maintenance workers on foot in vicinity of live highways during set up and take down.
- VMS and other signs and street furniture require safe working areas for maintenance – live traffic interface with maintenance workers.
- Grass cutting on earthworks slopes – hazard to maintenance workers adjacent to live highway.
- Access to top sections of EDPs (and VPs in case of jet fans) in the cross passages could be awkward – working at height and awkward reaching.

Specific hazards for all route options during operation

- Risk of terrorism within the tunnel
- Tunnels are unique structures on the UK road network, unfamiliar driver response to entering/exiting portals, sun dazzle, limited SSDs, emergency situations etc.
- Malfunction of any of the tunnel fixed equipment during a possible fire event due to damage or slow/incomplete emergency response when there is fire in the tunnel causing risk to users.

- The existing compact grade separated junction east of Solstice Park Junction (connecting to the scheme) may have capacity issues and its close proximity to the Countess Junction may lead to increased traffic collisions.
- Absence of street lighting to maintain dark skies zone may lead to increased traffic collisions.

Hazards mitigation

7.4.6 Design mitigation that has already been incorporated includes:

- Re-aligning the eastern tunnel portal so that is it north (off-line) of the existing A303, reducing impact of working alongside live traffic.
- Bypassing Winterbourne Stoke (to north or south) to avoid operational risks running heavy traffic through a local community with local traffic and NMUs.
- The majority of all the route options are off-line, allowing for construction away from live traffic.
- Early ground investigation was scoped to inform the DCO application and de-risk key aspects. These key aspects include developing a better understanding of the engineering properties and geometry of the phosphatic chalk, and developing a better understanding of the local groundwater regime including pumping tests. The works completed to date predominantly comprise intrusive works for the installation of groundwater monitoring instrumentation and for infiltration rate testing. A reduced scope was completed for the investigation of the phosphatic chalk, however good quality samples were retrieved from the positions available. These have been tested and factual information is available. No pumping tests were carried out.

7.4.7 The CDM Design Risk Register has recorded mitigation opportunities identified by the designers to be considered as design progresses.

7.4.8 Further design work would be undertaken in the preliminary design development for the Preferred Route. This would allow a more thorough understanding of the specific hazards and the opportunity to mitigate these.

7.5 Summary and Conclusions

7.5.1 The route options are very similar and all would be expected to have a positive impact upon road safety and contribute to the Highways England target of reducing the number of people killed or seriously-injured on the trunk road network. It is recommended that as the design progresses the potential road safety issues highlighted in this safety assessment are taken into consideration.

7.5.2 This assessment recommends further consideration is given to the road safety implications of the following areas as the design is developed:

- Locations of and protection for roadside features.
- Implications of junction spacing on weaving, fatigue, alternative route options and emergency access.

- Comparison of best practice tunnel safety features, Expressway requirements and Smart Motorway technology and operation
- Implementation of tunnel safety provisions
- Suitable facilities for non-motorised users.
- Relaxations and Departures from Standard.
- Extent of lighting, especially at junctions.
- Implications of night-time road safety upon choice of junction form.
- Provision for non-emergency stopping.
- Locations and spacing of variable message signs and Emergency Refuge Areas.
- Weaving lengths between Solstice Park and a grade separated junction at Countess Roundabout, together with any appropriate mitigation measures.
- Options for the central reserve vehicle restraint system, particularly within the WHS.
- The impact of landscaping proposals.

7.5.3 Throughout the design process, construction, maintenance, operational and future demolition hazards have also been identified, considered and recorded in the project CDM risk register throughout this early design stage. This is a single multi-disciplinary register to facilitate early identification of hazards and possible mitigation that can be applied through cross-discipline working and the register has recorded mitigation opportunities to be considered as the design progresses.

7.5.4 The further design development with the preliminary design for the Preferred Route would allow a more thorough understanding of the specific hazards and further opportunities to mitigate these.

8. Client Scheme Requirements and Policy Assessment

8.1 Introduction

8.1.1 Further to the assessments undertaken through PCF Stage 1, this section presents the assessment of the better performing route options for their alignment with the Client Scheme Requirements (CSRs), and with relevant local and national planning, transport and economic policies objectives.

8.1.2 A summary of the assessment and the resulting conclusions is set out below, with the full assessment tables for each route option provided in Appendix D.

8.2 Assessment methodology

8.2.1 The assessment updated the previous strategic fit assessment undertaken at Stage 1, drawing on the Web-based Transport Analysis Guidance (WebTAG) environmental, traffic, economic and social assessments in order to assess the three route options identified for detailed assessment ahead of the selection of the Preferred Route against relevant national and local policy and the CSRs for the scheme.

Client Scheme Requirements

8.2.2 The three route options were assessed against the following main CSRs:

- Transport: To create a high quality route that resolves current and predicted traffic problems and contributes towards the creation of an Expressway between London and the South West.
- Economic growth: In combination with other schemes on the route, to enable growth in jobs and housing by providing a free flowing and reliable connection between the East and the South West peninsula.
- Cultural heritage: To contribute to the conservation and enhancement of the WHS by improving access both within and to the site.
- Environment and community: To contribute to the enhancement of the historic landscape within the WHS, to improve biodiversity along the route and to provide a positive legacy to communities adjoining the road.

8.2.3 The three route options were assessed against the scheme objectives defined in the four main CSRs, with reference to the detailed requirements which sit underneath these objectives as listed in Chapter 3 of this report.

8.2.4 The assessment tables provided in Appendix D provide detailed assessments against each of the four main CSRs. A summary assessment of each of the options against the detailed requirements is also provided.

Relevant policies

8.2.5 The three route options were also assessed against relevant high level goals and policy objectives set out in the following documents:

- National Policy Statement for National Networks (NPSNN).
- Road Investment Strategy (RIS1 2015-2020).
- Wiltshire Core Strategy.
- Third Wiltshire Local Transport Plan (LTP).
- Swindon and Wiltshire Local Enterprise Partnership (LEP) Revised Strategic Economic Plan (SEP)
- Stonehenge, Avebury and Associated Sites WHS Management Plan, 2015.

8.2.6 Chapter 3 of this report provides further detail on each of these objectives and the reasoning behind their inclusion in the assessment.

8.2.7 In line with the approach taken at PCF Stage 1, options were assessed for strategic fit with high level goals and strategic objectives, rather than with individual policies. Further information is provided in A303 Stonehenge Technical Appraisal Report [1] Chapter 7.

Assessment scoring

8.2.8 Route options were scored against each CSR and policy objective using the following three point Red-Amber-Green (RAG) scale:

3	Strong alignment. Route option makes a substantial positive contribution towards meeting relevant objectives.
2	Moderate alignment. Route option makes some contribution towards meeting relevant objectives.
1	Weak alignment. Route option makes little or no contribution towards meeting relevant objectives.

8.2.9 The CSR assessment undertaken at PCF Stage 1 included the use of a five point scoring scale, as required by Early Assessment and Sifting Tool (EAST). A three point scale was then considered appropriate for the later Stage 1 strategic fit assessments and a similar approach was taken for this assessment of the three PCF Stage 2 route options against CSRs and local and national policies, drawing on the WebTAG findings.

8.3 Assessment

Client Scheme Requirements assessment

8.3.1 Table 8-1 provides a summary of this assessment for each of the route options. Additional detail is provided in the full assessment tables for each route option included in Appendix D.

Table 8-1 Client Scheme Requirements summary table

Client Scheme Requirements	Option 1Na	Option 1Nd	Option 1Sa
Transport: to create a high quality route that resolves current and predicted traffic problems and contributes towards the creation of an Expressway between London and the South West	3	3	3
Economic growth: in combination with other schemes on the route, to enable growth in jobs and housing by providing a free flowing and reliable connection between the East and the South West peninsula	3	3	3
Cultural heritage: to contribute to the conservation and enhancement of the WHS by improving access both within and to the site	3	3	3
Environment and community: to contribute to the enhancement of the historic landscape within the WHS, to improve biodiversity along the route, and to provide a positive legacy to communities adjoining the road	3	3	3

8.3.2 All options align closely with all CSRs, including cultural heritage. While there is some variation in performance against specific criteria, each option has been scored similarly in terms of broad, high level alignment with the CSRs.

8.3.3 Changes to the alignment of route options made in response to consultation feedback have reduced adverse impacts on the WHS such that it is now considered that all options would result in a Moderate Beneficial effect on the WHS overall. All route options would remove the road from a key part of the WHS and allow the reconnection of the Avenue, a scheduled monument of high importance that is currently severed by the existing road, and King Barrow Ridge. These are very notable benefits which, when balanced against adverse effects on important assets resulting from the introduction of major new infrastructure into the WHS, would contribute to the overall Moderate Beneficial effect. All three options would also reduce severance within the WHS and improve access to the site, and would therefore make a substantial contribution to this CSR.

8.3.4 All options also perform strongly against the other three CSRs, providing benefits in terms of increased capacity, improved reliability, and journey time savings. Improved connectivity between the East and South West would help to support growth in jobs and housing across the region, and improved traffic conditions at the local level would have the potential to improve access to key sites in the Amesbury area such as Solstice Park Business Park. Strategic alignment in terms of transport and economic growth is therefore considered to be strong.

8.3.5 There is the potential for some adverse environmental impacts; however, all route options would reduce the impact of traffic on Winterbourne Stoke, reduce severance effects in villages to the north of the existing A303 that are currently affected by rat-running, and result in a net improvement in local air quality (although there is an increase in overall NOx emissions across the scheme area

as described in Chapter 13). Route Option 1Sa could potentially introduce severance for residents travelling between Berwick St James and Winterbourne Stoke; however this would be mitigated through the provision of new crossings.

8.3.6 There is some variation between route options in terms of noise. The majority of noise increases would be the result of the volumes of traffic travelling on local roads to use the A303 and generating noise levels for residential properties around Amesbury and local villages. All options would result in adverse impacts on biodiversity overall. Within the WHS, however, there would be opportunities for landscape reconnection and habitat restoration to balance these adverse impacts.

National policy assessment

8.3.7 Table 8-2 provides a summary of national policy alignment for the three route options. Additional detail is provided in the full assessment tables for each route option included in Appendix D.

8.3.8 All route options generally align closely with national policy objectives, offering journey time savings and, as such, contributing directly to policy objectives relating to connectivity and economic growth. All route options would also improve journey quality, reliability and safety for through traffic.

Table 8-2 National policy summary table

Document	Relevant objectives	Option 1Na	Option 1Nd	Option 1Sa
National Policy Statement for National Networks (NPSNN)	Networks with the capacity and connectivity and resilience to support national and local economic activity and facilitate growth and create jobs	3	3	3
	Networks which support and improve journey quality, reliability and safety	3	3	3
	Networks which support the delivery of environmental goals and the move to a low carbon economy	2	2	2
	Networks which join up our communities and link effectively to each other	3	3	3
Road Investment Strategy: for the 2015/16 – 2019/2020 Road Period (RIS1)	Making the network safer	3	3	3
	Improving user satisfaction	3	3	3
	Supporting the smooth flow of traffic	3	3	3
	Encouraging economic growth by working to minimise delay	3	3	3
	Delivering better environmental outcomes	2	2	2
	Helping cyclists, pedestrians and other vulnerable users	3	3	3

8.3.9 In terms of environmental objectives, all route options would have broadly the same impact on greenhouse gas emissions, biodiversity, landscape and the water environment. However, there would be benefits in terms of biodiversity, including the opportunities for landscape reconnection and habitat restoration mentioned above, which could lead to a reduction in road fatalities and increase in wildlife movement.

Local policy assessment

8.3.10 Table 8-3 provides a summary of local policy alignment for the three route options. Additional detail is provided in the full assessment tables for each route option included in Appendix D.

8.3.11 All route options perform strongly against relevant policy objectives in relation to the economy, transport infrastructure, and community resilience. There is more moderate alignment with objectives relating to the natural and historic environment, and equality of opportunity. Alignment with local policies for the Amesbury Community Area is considered to be moderate, as both route options would potentially improve traffic conditions for journeys to and from the town to some extent.

Table 8-3 Local policy summary table

Document	Relevant objectives	Option 1Na	Option 1Nd	Option 1Sa
Wiltshire Core Strategy [26]	Strategic Objective 1: Delivering a thriving economy	3	3	3
	Strategic Objective 4: Helping to build resilient communities	3	3	3
	Strategic Objective 5: Protecting and enhancing the natural, historic and built environment	2	2	2
	Strategic Objective 6: Ensuring that adequate infrastructure is in place to support our communities	2	2	2
	Core Policy 4: Spatial strategy for the Amesbury Community Area	2	2	2
	Core Policy 6: Stonehenge	2	2	2
	Core Policy 59: The WHS and its setting	2	2	2
Wiltshire Local Transport Plan	Support economic growth	3	3	3
	Reduce carbon emissions	1	1	1
	Contribute to better safety, security and health	3	3	3
	Promote equality of opportunity	2	2	2

Document	Relevant objectives	Option 1Na	Option 1Nd	Option 1Sa
	Improve quality of life and promote a healthy natural environment	2	2	2
WHS Management Plan	Aim 3: Sustain the OUV of the WHS through the conservation and enhancement of the Site and its attributes of OUV.	2	2	2
	Aim 6: Reduce significantly the negative impacts of roads and traffic on the WHS and its attributes of OUV and increase sustainable access to the WHS.	3	3	3
Swindon and Wiltshire LEP, Strategic Economic Plan	Transport infrastructure improvements: we need a well-connected, reliable and resilient transport system to support economic and planned development growth at key locations	3	3	3
	Place shaping: we need to deliver the infrastructure required to deliver our planned growth and regenerate our City and Town Centres, and improve our visitor and cultural offer	3	3	3
	Business development: to strengthen the competitiveness of small and medium sized businesses and attract a greater share of foreign and domestic investment into the area.	3	3	3

8.3.12 All three route options would result in an increase in greenhouse gas emissions compared with the do-minimum, and therefore align weakly with the goal set out in Wiltshire LTP to reduce carbon emissions. Strategic Objective 6 of the Wiltshire Core Strategy includes reductions in greenhouse gas emissions associated with transport as a key outcome, alongside the provision of new or improved infrastructure, reductions in delays and disruption, improved road safety, and better access to jobs and services. Alignment with this strategic objective is considered to be moderate for all three route options as all would perform reasonably well against other associated key outcomes.

8.3.13 In terms of cultural heritage, all three route options are considered to have a moderate strategic fit with policies relevant to the WHS set out in the Wiltshire Core Strategy. Core Policy 6 focuses on visitor facilities and the visitor experience, and Core Policy 59 on the OUV of the site. Alignment with Aim 6 of the WHS Management Plan is considered to be strong, principally because all three options would reduce the impact of roads and promote sustainable access to the site, including by NMUs and residents of local communities.

8.4 Summary and conclusions

8.4.1 All route options align strongly with all four CSRs. All route options would remove the existing A303 and the sight and sound of associated road traffic from a key part of the Stonehenge WHS, and would have very notable benefits. However, there would also be adverse effects resulting from the introduction of major new infrastructure into the WHS and the impact of this on important assets that contribute to the site's OUV. Overall, a Moderate Beneficial effect for the WHS is recorded. All route options would also improve access both within and to the site, contributing to the requirements of this CSR.

8.4.2 All route options align strongly with national policy objectives with regards to improving safety, increasing user satisfaction, supporting the flow of traffic, encouraging economic growth, connecting communities and supporting vulnerable users. While Route Option 1Sa could potentially introduce severance for residents travelling between Berwick St James and Winterbourne Stoke, this would be mitigated through the provision of new crossings. All options would increase capacity and improve conditions for through traffic and local traffic, supporting economic growth and reducing severance in communities to the north of the existing A303 which are currently affected by rat-running.

8.4.3 There is more moderate alignment with policy objectives relating to delivering better environmental outcomes, where all three options would have the potential for a range of adverse and beneficial impacts. All route options would have beneficial impacts on noise and air quality (in terms of reductions in exposure to particulate matter), and would give rise to similar degrees of potential impacts on biodiversity and greenhouse gas emissions, landscape, and the water environment. There would, however, be opportunities for mitigation through design development, as well as some benefits in terms of biodiversity within the WHS.

8.4.4 In terms of regional and local policy alignment, all route options would align strongly with relevant objectives in terms of delivering transport infrastructure, improving traffic conditions for local traffic and strategic road users, encouraging economic growth, and supporting local communities. Alignment with objectives relating to protecting the natural and historic environment is again more moderate, reflecting the broad range of adverse and beneficial impacts associated with these policies. There is weak alignment with the goal set out in the Wiltshire Local Transport Plan to reduce carbon emissions.

8.4.5 In overall terms, therefore, all route options are considered to align closely with the CSRs and relevant national and local policy objectives.

9. Traffic Assessment

9.1 Introduction

9.1.1 The transport model was developed to assess the options for the scheme as well as providing inputs to the environmental appraisal, highway and junction design, economic assessment and distributional impacts.

9.1.2 A transport model of the A303/A358 corridor is required to enable transport demand forecasts to be developed, which can then form the basis for the assessment of the A303 Stonehenge scheme's impacts. The modelling approach also needs to be capable of reflecting the impacts of the other improvements proposed by Highways England along the A303/A358 corridor as part of the Expressway to the South West.

9.1.3 The key requirement of any traffic model is that it accurately represents the base year traffic patterns on the road network and therefore forms a robust basis on which to forecast future year network conditions, both without (Do Minimum or DM) and with (Do Something or DS) changes to the transport network in the area.

9.1.4 The application of the traffic modelling for the A303 Stonehenge scheme has evolved in three stages during the development of the scheme:

- In the pre-feasibility study, the traffic modelling used the existing London to the South West and South Wales Multi-Modal Study (SWARMMS) model. The modelled network was strategic in nature using speed/flow curves to reflect the impact of congestion on travel times rather than detailed junction modelling. The trip matrices were based on the updated (2013 base year) SWARMMS matrices with future years of 2021 and 2041 based on DfT NTEM 6.2 forecasts.
- For PCF Stage 1, a hybrid model was developed combining the network from the Highways England South West Regional Traffic Model (SWRTM) including junction modelling in the local area with the coarser SWARMMS network in the outer (buffer) area. The trip matrices were based on the updated (2013 base year) SWARMMS matrices supplemented with data from roadside interview surveys undertaken in October 2015 and extensive count data used in the matrix estimation process. The forecasts for 2024, 2031, 2039 and 2051 were based on DfT NTEM 7.0 projections.
- For PCF Stage 2, a new model was built from the completed SWRTM including variable demand modelling. The network included widespread junction modelling across the local and outer areas. New trip matrices, constructed in SWRTM from mobile phone data, were supplemented with the Stage 1 roadside interview data, with matrix estimation using extensive count data. The A303 Stonehenge model forecasts used NTEM 7.2 with future years of 2026, 2041 and 2051. The SWRTM model for the programmatic assessment used NTEM 7.0.

9.1.5 Due to the need to assess the A303 Stonehenge scheme both in isolation and as part of the overall A303/A358 corridor, two separate traffic models were applied in the Stage 2 assessment:

- The ‘core’ SWRTM model was used for the programmatic (corridor) assessments.
- The A303 Stonehenge Stage 2 model (outlined above) formed the basis all other traffic modelling.

9.1.6 Details of the development and application of the different models within Stage 2 are described in further detail later in this chapter.

9.1.7 The initial specification of the modelling approach in each PCF stage was outlined in the Appraisal Specification Report (ASR) for that stage, with the Stage 1 ASR published in May 2016 and the Stage 2 version in January 2017.

9.1.8 Further supporting evidence on the traffic model is provided in the following reports:

- The Traffic Data Collection Report (TDCR) for the A303 Stonehenge scheme issued in June 2016.
- The Local Model Validation Report (LMVR) for the scheme issued in September 2016 for Stage 1 and March 2017 for Stage 2.
- The Traffic Forecasting Report (TFR) for the scheme issued in September 2016 for Stage 1 and June 2017 for Stage 2.

9.2 Traffic Modelling Methodology

9.2.1 The development and application of the PCF Stage 1 traffic model was described in the Technical Appraisal Report (TAR) and hence only the main features of the Stage 1 work are recorded in this section before moving onto a more detailed description of the newly-developed Stage 2 model.

Stage 1 Model description/outline specification

9.2.2 The Stage 1 modelling methodology was based on the updated SWARMMS model, with a 2013 base year, supplemented by preliminary data from the SWRTM, which was then under development, to create a model designed specifically to assess the local impacts of the A303 Stonehenge scheme. The modelling process was designed to be compliant with principles in the DfT Web-based Transport Analysis Guidance (WebTAG).

9.2.3 The local model area was identified by using the original SWARMMS model to determine the Area of Detailed Modelling (AoDM). This involved using the SWARMMS model in the DM and DS situations to identify those links where significant changes in traffic volumes were likely to occur because of the scheme. The AoDM is shown in Figure 9-1. Within the AoDM, the model network was enhanced to include full junction simulation. Initial coding of the network in this area was informed by details made available from the under-development SWRTM.

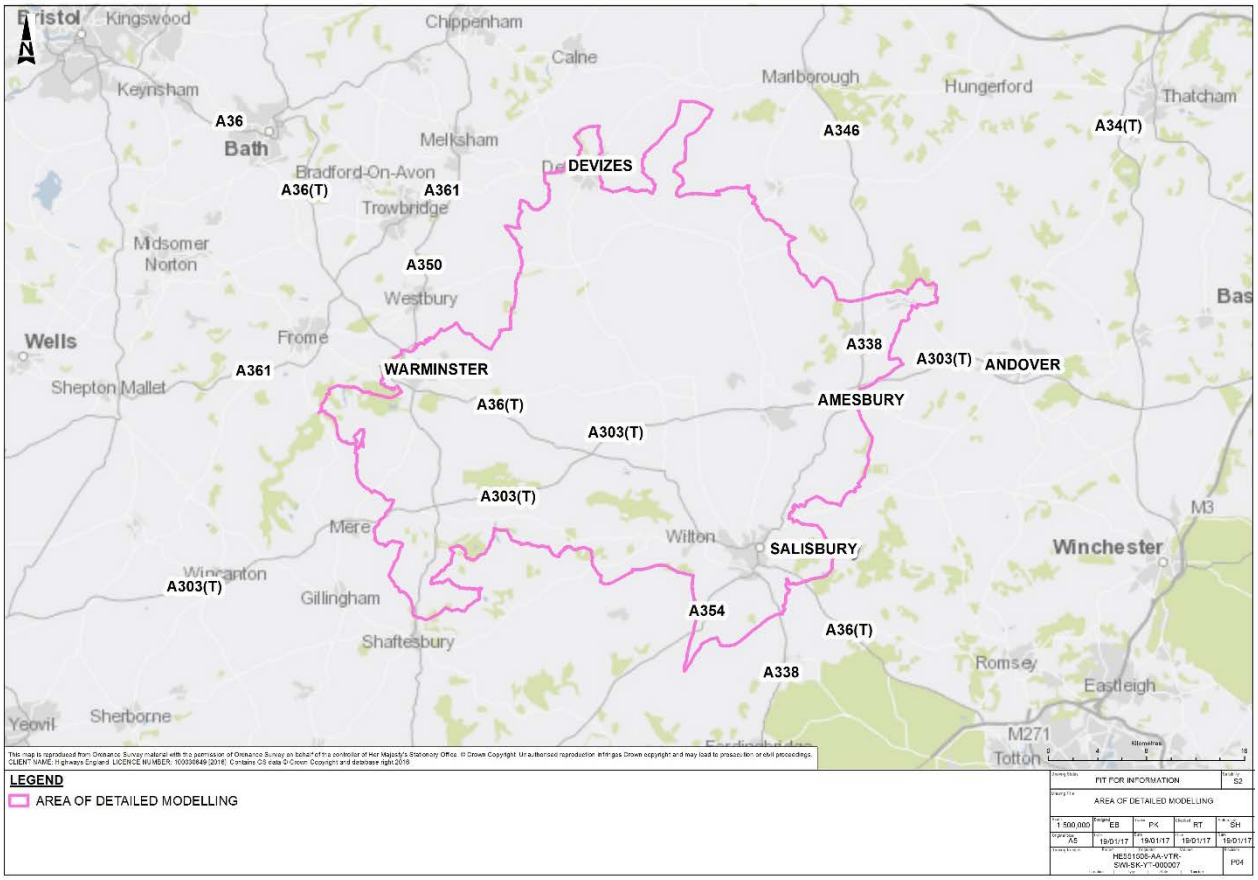


Figure 9-1 Area of Detailed Modelling

9.2.4 The zoning systems for the updated SWARMMS model and the SWRTM were the starting point for the development of a zoning system for the detailed local area modelling, taking into account the extent of highway options to be assessed.

9.2.5 Within the AoDM, the network from the SWRTM was used as the starting point for the specification of the highway network, with additional links as necessary in the immediate vicinity of the A303 Stonehenge scheme to reflect local roads not included in the SWRTM network. Outside the local area, the SWARMMS model formed the basis for the network definition.

9.2.6 The trip matrices in Stage 1 were derived from the SWARMMS model (with disaggregation to align with the amended zone system), supplemented by data from roadside interview surveys undertaken in October 2015 specifically for the A303 Stonehenge scheme development.

9.2.7 The 2013-based SWARMMS model was a highway-only model, which had no variable demand modelling function. Given the low level of public transport alternatives available for traffic in this area, a highway-only model using fixed demand was considered acceptable for the purpose of assessing alternative alignments for this stage of the A303 Stonehenge scheme.

9.2.8 The modelled time periods used in the PCF Stage 1 model were those used in the original 2013 SWARMMS model:

- AM peak hour (08:00 - 09:00).
- Inter-peak hour (average hour between 10:00 and 16:00).
- PM peak hour (17:00 - 18:00).

9.2.9 Likewise, the trip matrices were derived from the 2013 SWARMMS model, and so comprised the same user classes, based on travel purpose and type of vehicle:

- Cars/light goods vehicles: commuting trips.
- Cars/light goods vehicles: business trips.
- Cars light goods vehicles: other trips.
- Heavy goods vehicles (HGVs).

9.2.10 This allowed the model to take account of differences in users' Value of Time (VoT) and Vehicle Operating Cost (VOC).

9.2.11 Demand in the SATURN traffic assignment is expressed in terms of Passenger Car Units (PCUs). The factors used to convert from vehicles to PCUs are listed in Table 9-1.

Table 9-1 Passenger car unit (PCU) factors

Vehicle type	PCU factor
Car / LGV Work	1.00
Car / LGV Business	1.00
Car / LGV Other	1.00
HGV	2.51

9.2.12 The PCU factor for HGVs was a weighted average of the factors given in WebTAG for Rigid Goods Vehicles and Articulated Goods Vehicles. The weighting was applied using goods vehicle type splits on major roads within the study area from the DfT's Annual Average Daily Flow - Data by Direction Major Roads.

9.2.13 The Local Model Validation Report details the validation of the PCF Stage 1 highway model. Four validation sites were identified on the A303, together with two screenlines running parallel to the A303 Stonehenge route options – to the north and to the south. These count sites were kept separate as independent validation sites.

9.2.14 The remaining count sites were used in the matrix estimation process for calibrating the model, which adjusted the trip matrices to better reflect observed count data.

9.2.15 The model validation results show that, in the AM Peak, all the sites on the A303 passed the WebTAG validation criteria (TAG Unit M3-1 Highway Assignment Modelling, January 2014), although three of the four screenline totals failed to meet the appropriate criteria. Of all the individual sites, 87% met either the flow or

GEH[2] criteria set in the WebTAG guidelines, marginally lower than the recommended level.

9.2.16 Similar results were achieved in the Inter Peak, again with all the A303 sites passing the criteria, while all four screenline totals failed to meet the flow validation criteria. The validation of all the independent sites, however, also met the criteria, with 94% of sites passing the flow and GEH criteria.

9.2.17 Results in the PM Peak were less good. Two of the four A303 sites failed to meet the criteria in the eastbound direction, and one failed in the westbound direction. In addition, three of the four screenline totals failed to meet the criteria, while 74% of sites met the flow or GEH criteria set in the guidelines.

9.2.18 The results indicated that there was some scope for further improvements in the validation of the Stage 1 model to ensure that the total flow across the screenlines provided a closer match to observed flows. The most important comparison of flows along the A303 itself achieved a good validation in the AM and Inter Peak time periods, but the PM Peak model needed further work in this respect as well.

9.2.19 The results showed that the validation of journey times in each modelled time period met the WebTAG requirements on most of the surveyed routes. In the AM Peak, the total number of routes which met the validation criteria was marginally below the 85% requirement.

9.2.20 In the Inter Peak, the 85% requirement was exceeded, with only three routes not meeting the validation criteria. This included the long-distance routes via the M4/M5 in both directions.

9.2.21 As with the flow validation, the journey time comparison in the PM Peak was less good, with 79% of routes achieving the 85% requirement.

9.2.22 The PCF Stage 1 model represented an interim model and the subsequent PCF Stage 2 SWRTM-based model awaited the release of the base year and future year Do Minimum SWRTM models. The development of the PCF Stage 1 model for future years was based on growth factors derived from the DfT NTEM 7.0 forecasts. The release of National Trip End Model (NTEM) Version 7.0 in July 2016 enabled a revision of the forecast years from those used in the earlier modelling, with the extension of the horizon (the furthest that forecasts are available) to 2051. As a result, forecasts using the Stage 1 model were developed for the following future years:

- 2024 - Year of opening.
- 2031 - Intermediate year.
- 2039 - Design year (15 years after opening).
- 2051 - Horizon year (the latest year for which forecasts are available from NTEM).

[2] The GEH statistic is a form of chi square test that incorporates both relative and absolute errors.

9.2.23 NTEM 7.0 was used to derive the forecasts for light vehicle user classes with the trip end growth, fuel and income adjustment factors being applied via the Furnessing procedure to the base year trip matrices. For HGVs, the growth from the National Transport Model was used to provide the growth up to the NTM horizon year of 2040, beyond which a trend extrapolation was applied to derive 2051 forecasts.

9.2.24 For the opening year of 2024, the forecast growth in demand was about 10% above the demand in the 2015 base year. By the design year of 2039, demand was forecast to be 27-30% higher than the base year, and 40-44% higher by 2051.

9.2.25 The Stage 1 Traffic Forecasting Report included outputs from the modelling of the Do Minimum and options for Corridors D and F, including the journey times in the future for each time period and network plots showing the forecast flows in 2024 and 2039 for each time period and the difference in flows between the option and the Do Minimum.

Stage 2 Model description/outline specification

Introduction

9.2.26 The Design Fix 2 (DF2.1) SWRTM model was used as the foundation for the traffic model for the PCF Stage 2 (Option Selection) stage. The Base Year for the PCF Stage 2 traffic model was 2015.

9.2.27 The Stage 2 Traffic Model used SATURN (Simulation and Assignment of Traffic to Urban Road Networks) (version 11.3.12U), which is a 'congested assignment' software package that has been developed over more than 30 years by the Institute for Transport Studies at the University of Leeds. It is widely used, both in the UK and overseas, for the evaluation of a wide variety of highway systems and proposals, and is recognised as an 'industry standard' traffic assignment model that satisfies the WebTAG requirements for modelling highway networks.

9.2.28 SATURN provides the foundation for the development of a combined traffic simulation and assignment model for the analysis of road proposals ranging from traffic management schemes over relatively localised networks to major infrastructure improvements. One of SATURN's key features is its ability to simulate the operation of junctions in some detail, including the prediction of queues and delays, the effect of queues blocking back on adjacent junctions, and the influence of congestion at specific points in the network on route choice.

9.2.29 The basic inputs to the SATURN model are the transport demands, in the form of a matrix of trip movements between zones, and the 'supply' through a detailed description of the road network. The highway modelling process is illustrated in Figure 9-2. Following the network building procedure, the trip matrix is assigned to the network using an iterative series of loops between 'assignment' and 'simulation' until the model has converged.

9.2.30 The 'assignment' process calculates the minimum cost routes for trips in terms of a weighted combination of time and distance plus any toll charges. The 'simulation' stage then simulates the operation of each junction in the network. As route costs can depend upon the routes taken by other vehicles (and therefore the delays they

impose), the junction simulation can lead to a different set of minimum cost routes. Thus, the process is repeated, until successive assignment-simulation loops produce an acceptably low level of change in vehicle flows; at this point the model is deemed to have achieved convergence.

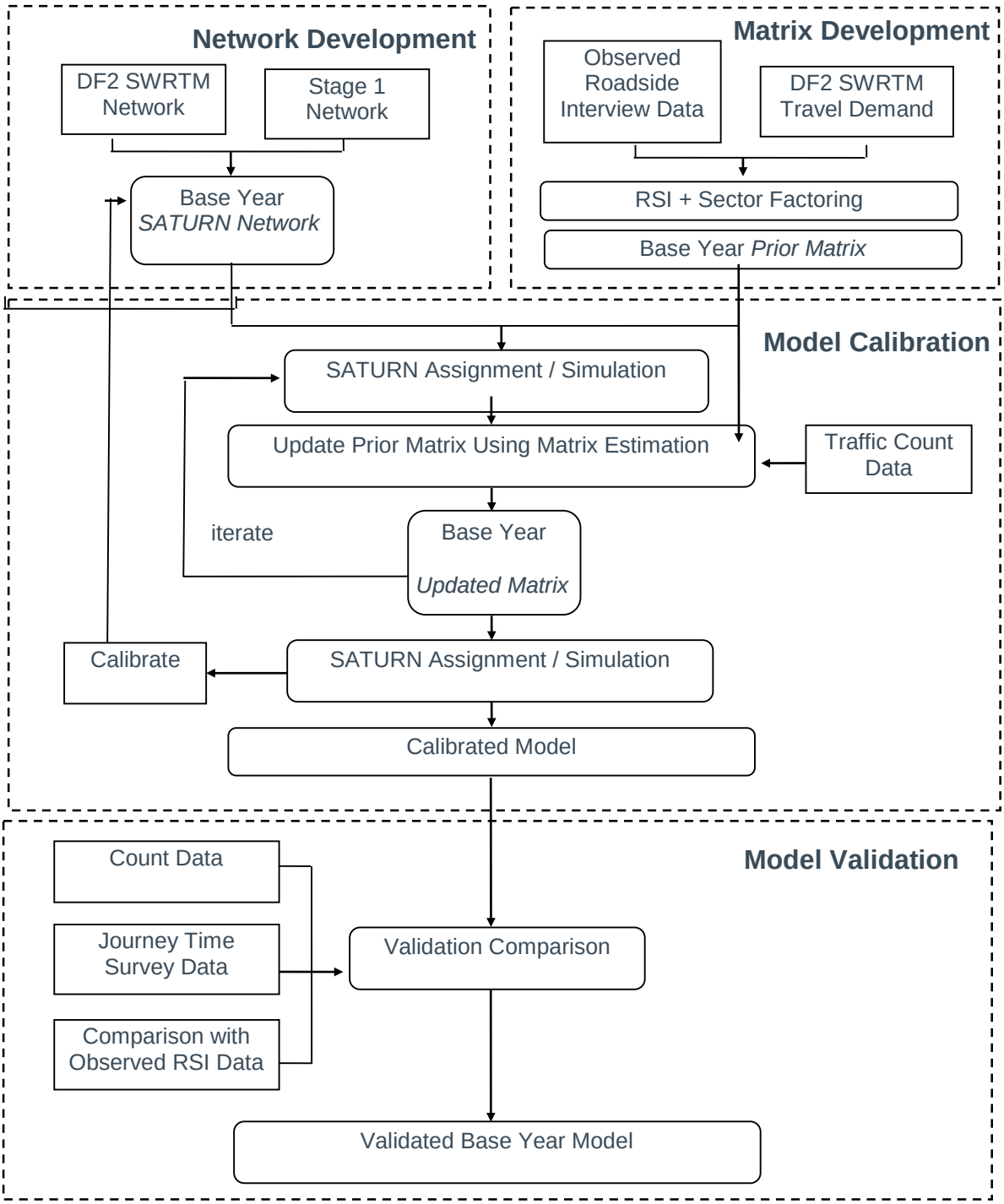


Figure 9-2 SATURN Highway Modelling Process

9.2.31 To confirm that the model is calibrated, the modelled number of vehicles on the network is compared with the observed counts. The description of the road network (supply) is checked carefully and a matrix estimation procedure is used to adjust the trip patterns in the trip matrices (demand), if required, to better match observed behaviour.

9.2.32 The final stage is to validate the model. Comparisons are made between modelled flows and a separate and independent set of traffic count data that was not used

in the calibration process. Modelled journey times are also compared with observed times.

Stage 2 Model Development

9.2.33 In PCF Stage 2, the SWRTM SATURN model was supplemented using local traffic and network inventory information. This process created a model for assessing the local impacts of the A303 Stonehenge scheme. The modelling process has been designed to be compliant with DfT WebTAG guidance.

9.2.34 The development of the Stage 2 AoDM involved refining the DF2.1 SWRTM model in the local area (see Figure 9-2) with disaggregation of the zone system and increased detail in the network specification. The zoning system for the DF2.1 SWRTM was the starting point for the development of a zoning system for the detailed local area modelling of the A303 Stonehenge scheme, taking into account the extent of options to be assessed by the model.

9.2.35 Within the AoDM, detail was added to the DF2.1 SWRTM network in the immediate vicinity of the A303 Stonehenge scheme. Outside the AoDM, the unchanged SWRTM model formed the basis for the network definition.

9.2.36 The zone system was developed in a similar way. In the AoDM, the DF2.1 SWRTM zones were disaggregated to be consistent with the finer zone definition required for PCF Stage 2. The DF2.1 SWRTM 'prior' trip matrices were disaggregated based on AddressBase Plus to align with the amended zone system and supplemented by origin-destination data obtained from the A360 and A345 RSI surveys, carried out in October 2015. These prior matrices were further enhanced by sector factoring between regions to more closely match observations before using the adjusted prior matrix as the starting point for matrix estimation.

9.2.37 The two A303 RSI surveys were used to check the trip lengths and overall distribution of the DF2.1 SWRTM prior matrices.

9.2.38 The model represented an average weekday (Monday to Friday) in March 2015 with three time periods:

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

9.2.39 It should be noted that in Stage 2 the peak time periods differed from the earlier Stage 1 definition, which considered the single hour (08:00-09:00 and 17:00-18:00). In contrast, the Stage 2 model contained the average hour over the three-hour period.

9.2.40 The model had five assignment trip matrices for each time periods. These differed from the earlier Stage 1 structure in which LGVs were combined with the car user classes.

- user class 1 – cars on employer's business.
- user class 2 – cars commuting.

- user class 3 – cars on other trip purposes.
- user class 4 – light goods vehicles (LGV).
- user class 5 – heavy goods vehicles (HGV).

9.2.41 The model included simulation (i.e. junction delay and queue modelling) for most of the key junctions in South West England, with a high level of detail in the A303 corridor close to the A303 Stonehenge scheme.

9.2.42 In general, a comparison of the observed and modelled screenline flows, link flows and journey times, in the AoDM met the WebTAG validation acceptability criteria. The changes resulting from matrix estimation were also considered to be within acceptable tolerances.

9.2.43 A check on the model outside the AoDM, using traffic count screenlines developed for the SWRTM model calibration and validation, showed that the A303 Stonehenge model produced results which were consistent with the DF2.1 SWRTM performance.

9.2.44 The traffic model had to be capable of providing forecasts for input to the air quality and noise appraisal for the A303 Stonehenge scheme. It also had to be suitable to provide inputs for the economic appraisal of the scheme, including consideration of the scheme in the context of Highways England's plans for the A303 Expressway corridor.

Modelling of 'Programmatic' Schemes

9.2.45 The A303 Stonehenge traffic model, outlined above, was developed from the Highways England SWRTM to provide the basis for an assessment of the A303 scheme between Amesbury and Berwick Down. The focus of the model was therefore concentrated on this section of the overall A303/A358 corridor. However, the A303 Stonehenge scheme is one element of the wider Expressway to the South West package which includes a further seven schemes, as shown in Figure 9-3.

9.2.46 The 'programmatic' impact of the eight schemes along the A303/A358 corridor, and the contribution made by the A303 Stonehenge scheme, was identified as a key element in the overall assessment. However, the A303 Stonehenge traffic model included a more detailed representation of the A303 Stonehenge scheme than for the other schemes in the corridor. As this would potentially influence the 'programmatic' appraisal of the corridor, a different approach was adopted, based on the original SWRTM. Rather than use the A303 Stonehenge model, the 'programmatic' appraisal was therefore based on the SWRTM in which all eight schemes would be represented on a consistent basis.

9.2.47 The traffic model derived from the DF2.1 SWRTM for PCF Stage 2 was also compatible with the models for other schemes along the A303 and elsewhere in the South West, providing a consistent foundation for the appraisal of major Highways England schemes being progressed in RIS1 and beyond.

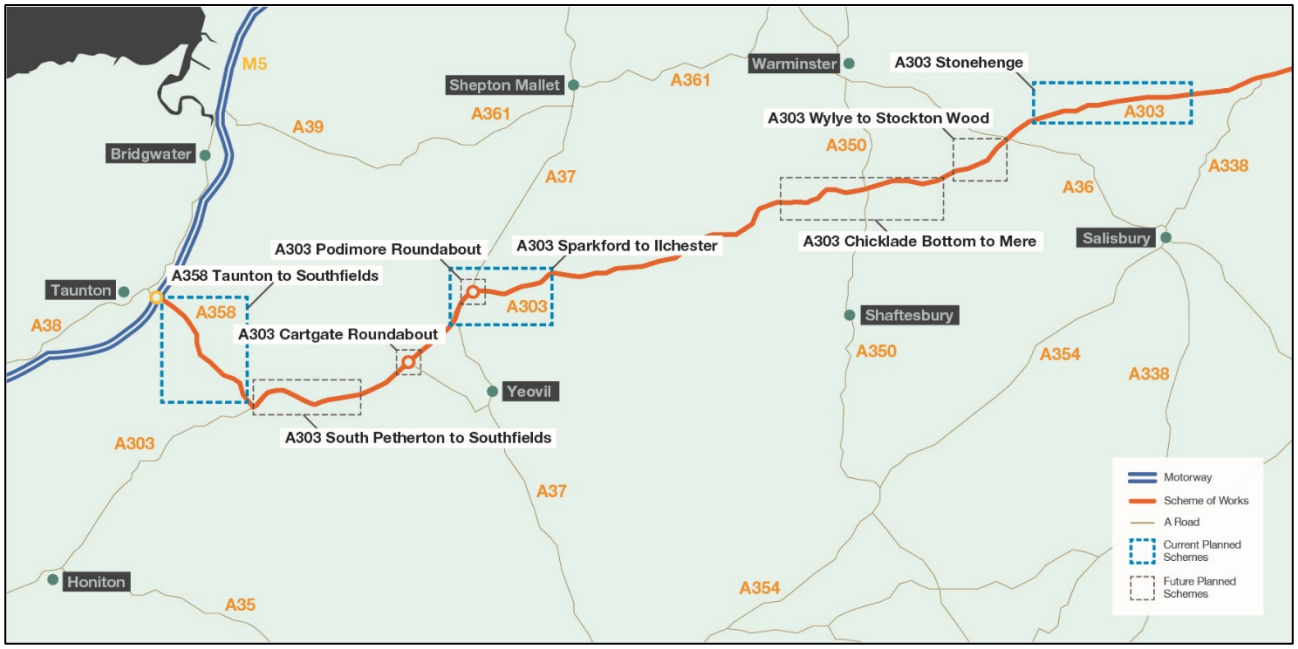


Figure 9-3 Expressway to the South West

Variable Demand Modelling

9.2.48 For PCF Stage 2, the traffic model included the capability of producing variable demand forecasts which reflect that the quantity and pattern of traffic demand responds to the costs of travel. Adding highway capacity would tend to reduce the costs of travel, and hence encourage additional discretionary trip making, and increase the attractiveness of particular areas. Conversely, traffic congestion, or other measures that increase the costs of travelling by car, would have the reverse effect. In line with WebTAG, a variable demand model (VDM) was required to capture these aspects of travel behaviour.

9.2.49 The VDM was based on the corresponding component of the SWRTM, with revisions to accommodate the more detailed zone system and network definition incorporated into the A303 Stonehenge traffic model. In the SWRTM, and hence also in the A303 Stonehenge VDM model, the following choice response mechanisms were modelled:

- trip frequency.
- mode choice.
- destination choice.
- time of travel.

9.2.50 The VDM was implemented using the DfT's DIADEM (Dynamic Integrated Assignment and Demand Modelling) software (version 6.3.3). DIADEM was designed to enable the implementation of VDM models that are consistent with the WebTAG advice. It facilitates a link between the SATURN assignment model and the VDM demand model. DIADEM also provides a means of achieving convergence between assignment (supply) and demand models.

9.2.51 DIADEM was implemented using the Highways England Interactive DIADEM Interface (HEIDI) software. HEIDI has a number of functions, in particular:

- to control the application of DIADEM.
- to enable the consistent application of DIADEM.
- to simplify file management.
- to organise and implement forecast model runs.
- to assemble trip end information.
- to undertake multiple DIADEM runs.
- to provide a template for reporting of VDM runs.

9.2.52 Travel times and costs for input to DIADEM were obtained from SATURN. Trip matrices, reflecting changes in travel times and costs between scenarios, were output by DIADEM for assignment in SATURN.

9.2.53 The VDM was subjected to realism tests involving changing car fuel costs by +20% and public transport fares by +20% to check on the elasticities of demand within the model. These tests demonstrated that the VDM model was producing results that were both consistent with the SWRTM and in accordance with WebTAG guidance.

Forecasting – the future year traffic models

9.2.54 The release of the DfT NTEM 7.2 forecasts in February 2017 enabled new traffic forecasts to be developed for the following future years:

- 2026 – year of opening.
- 2041 – design year (15 years after opening).
- 2051 – horizon year (the latest year for which forecasts are available from NTEM).

9.2.55 NTEM 7.2 was used to derive the Reference Case forecasts for car trips with the trip end growth, fuel and income adjustment factors being applied via the Furnessing procedure to the 2015 base year trip matrices. For light and heavy goods vehicles, the growth from the National Transport Model (NTM) was used to provide the increase up to the NTM horizon year of 2040. Beyond 2040 a trend extrapolation was applied to derive growth factors for 2051.

9.2.56 For the opening year of 2026, the Reference Case forecast growth in demand was about 13% above the demand in the 2015 base year. By the design year of 2041, demand was forecast to be 28% higher than the base year and 39% higher by 2051.

9.2.57 Future year Do Minimum networks were created by taking the 2015 Base Year network and adding road improvement schemes in the South West, that had been constructed since 2015 or were considered ‘near certain’ or ‘more than likely’ to proceed in the future. In the assignment process, the parameters which represent the drivers’ value of time and distance were updated using the WebTAG Databook.

9.2.58 A variety of indicators were assembled to measure the performance of the transport model in the future years and the characteristics of the traffic volumes on the Do Minimum and Do Something networks indicating the changes in traffic flows as a result of the different options for the A303 Stonehenge scheme. The detailed analysis included:

- statistics on the convergence of the model.
- total distance travelled in each year and time period.
- total travel time in each year and time period.
- average speed in each year and time period.

9.2.59 The presentation of the traffic assignments for the Do Minimum and A303 Stonehenge schemes concentrated on the flows in each time period in the three modelled years (2026, 2041 and 2051). In addition to the absolute traffic levels, network diagrams were used to demonstrate the changes in traffic levels between the Do Minimum and each Do Something, thereby highlighting the impact of the scheme on flows along the A303 corridor and on parallel and connecting routes in the vicinity of the A303 Stonehenge.

9.2.60 Changes in cost between the Base Year and the Do Minimum (without scheme) and Do Something (with scheme) scenarios in forecast years were taken into account through the VDM. The VDM process modified the Reference Case forecasts to reflect the impacts of increasing congestion on the road network in the Do Minimum, and then relief of congestion in the Do Something scenario.

9.2.61 This overall forecasting approach is summarised in the flowchart in Figure 9-4, taken from WebTAG.

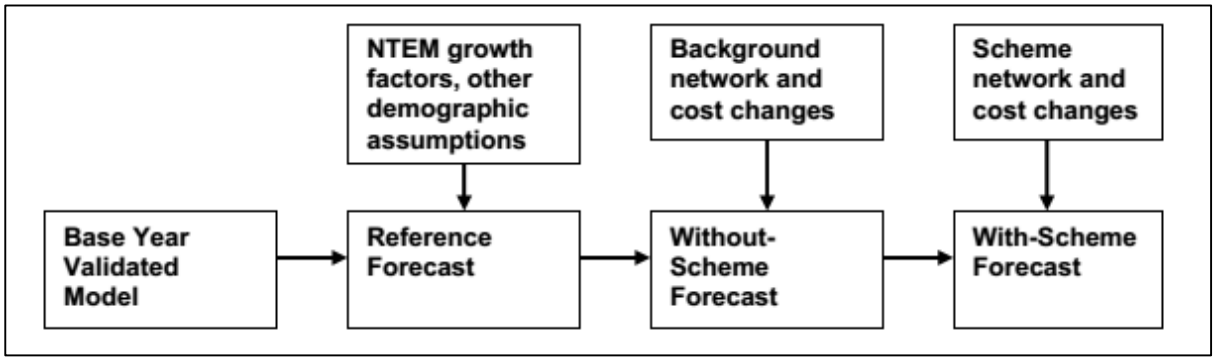


Figure 9-4 Overview of Forecasting Process

9.2.62 WebTAG recommends that all known assumptions and uncertainties in the modelling and forecasting approach should be set out in an uncertainty log. The purpose of the uncertainty log is to record the central forecasting assumptions that underpin the Core Scenario and record the degree of uncertainty around these central assumptions.

9.2.63 Uncertainty in transport models often results from national uncertainty. For example, there is inherent uncertainty in national projections such as demographic data (population, households and employment), GDP growth and fuel price trends. In the Core Scenario, the impact of changes in demographic data were based on

the NTEM 7.2 dataset, growth in most other parameters was based on the values given in the current WebTAG Databook. For the separate core SWRTM model the forecasting continued to use the NTEM 7.0 dataset.

9.2.64 Local uncertainty would depend on whether developments or other planned transport schemes in the vicinity of the A303 Stonehenge scheme go ahead. Benefits can be extremely sensitive to local sources of uncertainty. Therefore, careful consideration was given to this aspect. The uncertainty log highlighted all sources of uncertainty that were likely to affect the traffic forecasts and the delivery of scheme benefits. This included planned land-use developments (housing, commercial, retail and distribution centres) and transport improvement schemes.

9.2.65 Details of planned transport schemes were obtained from local planning documents (e.g. Local Transport Plans). Information gathered included details such as:

- planning status.
- political uncertainty as to whether a transport project (other than the A303 Stonehenge being appraised) would go ahead.
- timing.
- location and layout.

9.2.66 Through consultation with Wiltshire Council, details of all of the relevant land use development proposals in the A303 corridor were obtained.

9.2.67 In the uncertainty log, in line with the guidance in WebTAG, all of the key inputs were classified according to the likelihood that they would occur, using the distinction in Table A2 of Unit M4 (Forecasting and Uncertainty) between 'near certain', 'more than likely', 'reasonably foreseeable' and 'hypothetical'. Where an input was considered 'near certain'" or 'more than likely' to occur, it would be included in the model's Core Scenario.

9.2.68 With regards to overall traffic growth, the uncertainty log summarised the assumptions that were used to develop Low and High traffic growth sensitivity tests in recognition of the uncertainty inherent in the assumptions underlying the Core Scenario, particularly with respect to economic growth, fuel prices and demographics. Table 9-2 summarises the definition of the Low and High growth assumption as identified in the uncertainty log. The change was made from the Base Year Matrix (using standard uncertainty ranges from WebTAG) and was combined with the core central case.

Table 9-2 Uncertainty Log – National Uncertainty

Input	Forecast Year	Description of Model Central Assumption	Uncertainty Assumptions (Alternative Scenario Options)
Growth in demand	2026	NTEM	±8.3%
	2041	NTEM	±12.75%

Input	Forecast Year	Description of Model Central Assumption	Uncertainty Assumptions (Alternative Scenario Options)
	2051	NTEM	±15.0%

9.2.69 The SWRTM uncertainty log detailed the RIS and major Local Authority schemes within the model's Region of Focus and those in the intermediate and external areas that were deemed significant to the model. Highways England provided a list of schemes within the SWRTM Region of Focus to be considered for inclusion in the uncertainty log for the A303 Stonehenge scheme. Also, at the suggestion of Highways England, some additional local schemes were considered following contact with the corresponding local authorities.

9.2.70 The schemes included in the SWRTM Do Minimum scenarios were local authority schemes with a likelihood of at least 'more than likely' and Highways England non-RIS schemes announced in the Transport Spending Review 2010 (SR10) and 2013 (SR13). However, there were none of the latter type of schemes in the list from Highways England for the SWRTM Region of Focus.

9.2.71 The regional models included schemes identified in the RIS 1 as 'Do Something' schemes unless the RIS scheme had opened by March 2015 in which case it was included in the base year model. This enabled the assessment of the RIS1 programme by each regional model.

9.2.72 Within the Wiltshire Council area, NTEM 7.2 forecasts were used to act as a control on the overall growth after applying the increases from local developments. Outside the Wiltshire Council area, the NTEM 7.2 forecasts formed the basis for growth in the rest of the modelled area.

9.2.73 NTM provides estimates for the growth in road traffic between 2010 and 2040. Growth factors are produced for LGVs, articulated heavy vehicles and rigid heavy vehicles by region. The NTM growth forecasts for the South West region were used as the basis for calculating the HGV growth rates for the A303 Stonehenge scheme. The NTM provided forecast vehicle-miles for 2026 and 2041; extrapolation was used to calculate the corresponding values for 2051. The resulting factors are summarised in Table 9-3.

Table 9-3 Goods Vehicle Growth Factors

Period	LGV Factor	HGV Factor
2015 to 2026	1.30	1.10
2015 to 2041	1.67	1.21
2015 to 2051	1.92	1.29

9.2.74 The impact of applying these factors on the trip matrices for each of the forecast years is summarised in Table 9-4 with the total number of trips by trip purpose.

Table 9-4 Reference Case Highway Trip Matrix Totals (24 hour average weekday)

Trip Purpose	Format	Base 2015	Development Only		(including Developments and County Balancing, Pre VDM)		
			2026	Post 2031	2026 Central Ref Case	2041 Central Ref Case	2051 Central Ref Case
HBEB	PA	1,275,411	1,905	2,109	1,394,587	1,516,440	1,614,780
HBW	PA	10,205,559	11,225	13,169	10,853,991	11,670,935	12,306,995
HBO	PA	15,729,205	12,703	14,458	17,541,516	19,714,207	21,083,161
NHBEB	OD	2,489,424	1,560	1,770	2,678,428	2,898,493	3,066,367
NHBO	OD	9,609,722	948	1,035	10,583,430	11,716,828	12,465,170
Fixed (Ports)	OD	28,335	-	-	37,497	55,707	68,520
LGV	OD	8,194,593	9,984	11,439	10,645,527	13,696,833	15,731,040

Trip Purpose	Format	Base 2015	Development Only		(including Developments and County Balancing, Pre VDM)		
			2026	Post 2031	2026 Central Ref Case	2041 Central Ref Case	2051 Central Ref Case
HGV	OD	4,077,837	6,636	7,896	4,454,967	4,892,412	5,174,472
Car (All)		39,337,660	28,341	32,541	43,089,109	47,572,273	50,604,674
Freight (LGV + HGV)		2,272,430	16,620	19,335	15,100,494	18,589,254	20,905,476
Total		51,610,090	44,961	51,876	58,189,603	66,161,855	71,510,150

Notes: Trip numbers are for an average weekday (Mon-Fri) in March.

9.2.75 The forecast traffic growth for the entire SWRTM model area was broadly consistent with overall NTEM growth of 13% between the 2015 Base Year and 2026. Between 2015 and 2041 the forecast growth is 28% and up to 2051 the growth is 39%.

9.2.76 The highest forecast growth for car trips was for Home Based Other trips at 34% between 2015 and 2051. Taking all vehicles types into account, the highest anticipated level of growth was in LGV traffic at 92% between 2015 and 2051.

9.3 Analysis of Scheme Performance

9.3.1 In order to provide an indication of the impact of the 1Na, 1Sa and 1Nd schemes on traffic volumes on the road network in the vicinity of Stonehenge, Figure 9-5 to Figure 9-10 present the link flows for Options 1Na, 1Sa and 1Nd in the 2041 PM Peak together with the difference from the Do Minimum or 'without scheme' situation, with reductions in flows on links shown in green and increases in red.

9.3.2 The difference plots demonstrate the reductions in flows through the villages to the north of the A303 and on some roads to the south while there are increases

on key routes which access the improved A303, particularly the A345 and A360. For the difference plot for Option 1Nd in Figure 9-10, because the scheme follows a route close to the exising A303, the traffic flows (in red) on the scheme are beneath the (green) reduction on the existing road.

9.3.3 In overall terms there is little to distinguish between the options in terms of traffic performance. The differences are wholly attributable to the location of the junction between the new A303 and the A360 which would influence which local roads some local traffic would choose to use to access the A303.

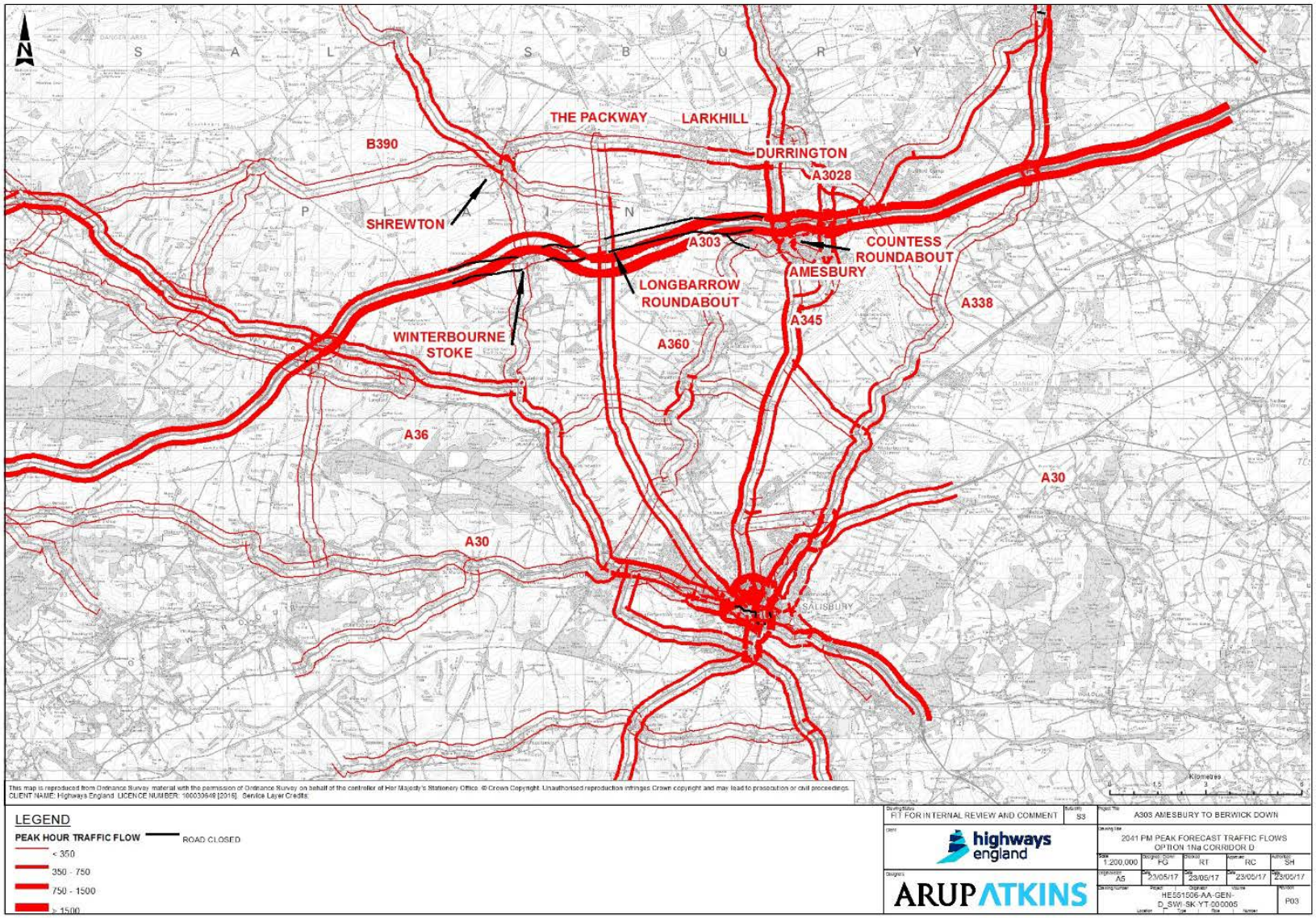


Figure 9-5 2041 PM Peak Forecast Traffic Flows Option 1Na

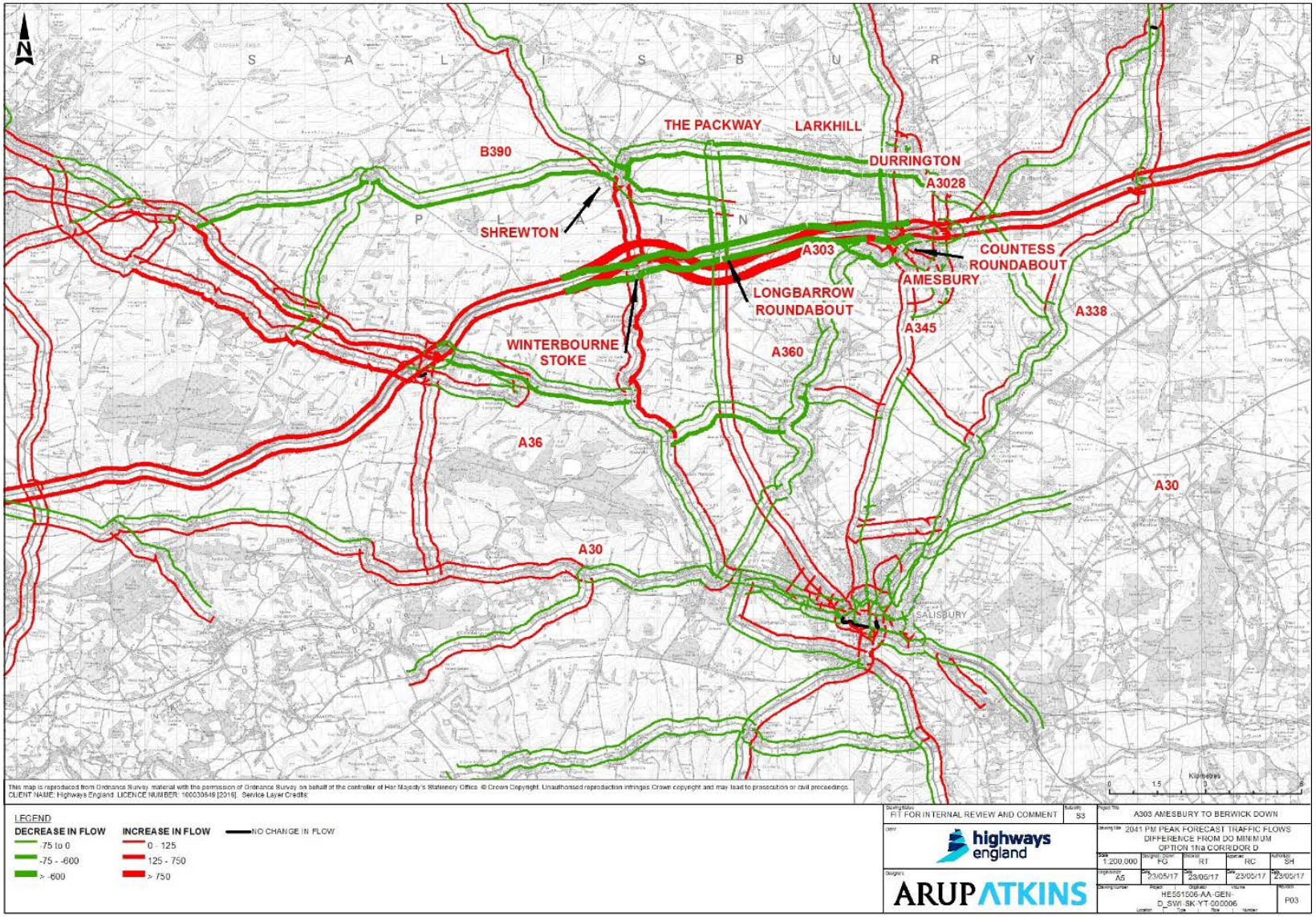


Figure 9-6 2041 PM Peak Forecast Traffic Flows – Difference from Do Minimum Option 1Na

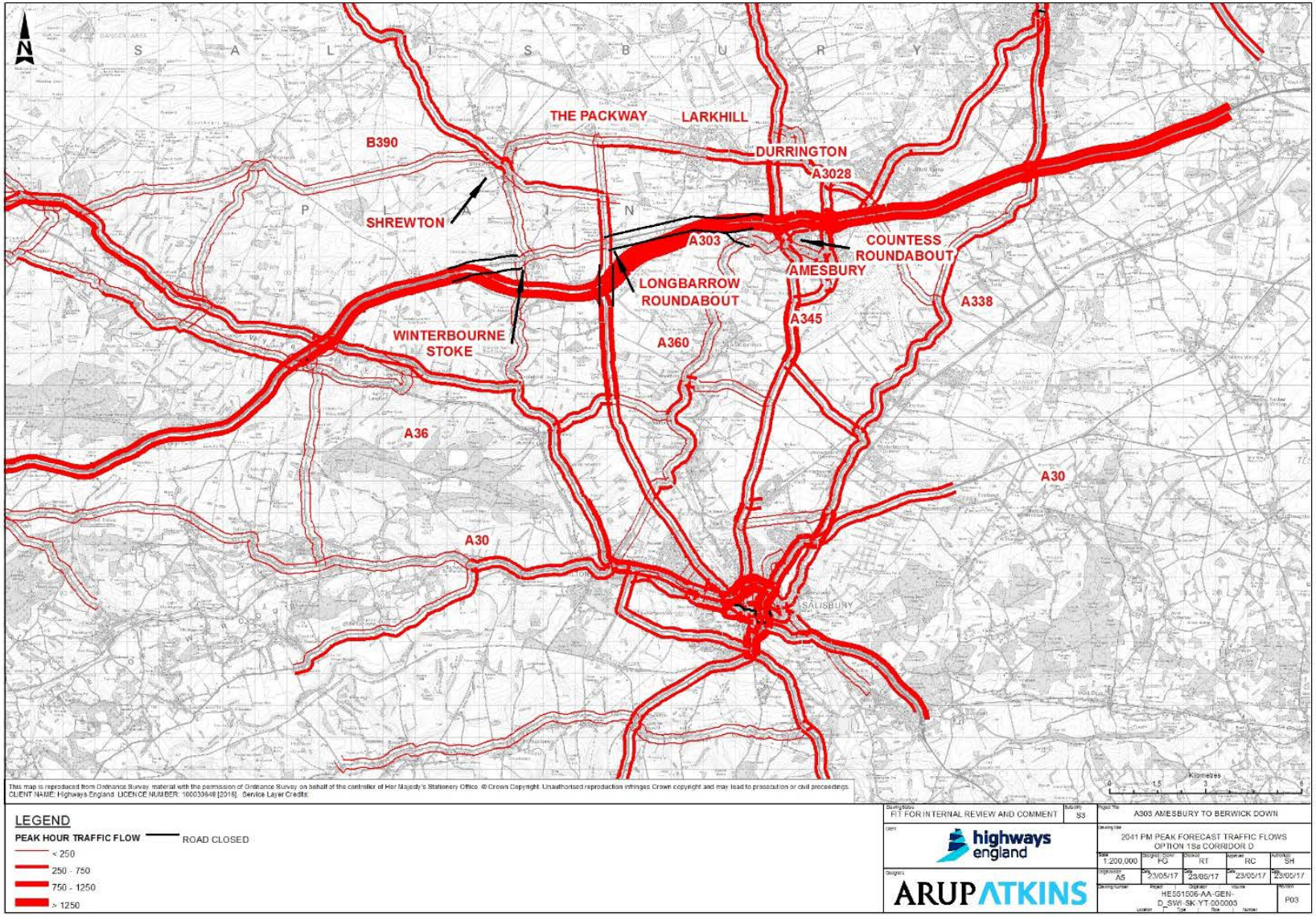


Figure 9-7 2041 PM Peak Forecast Traffic Flows Option 1Sa

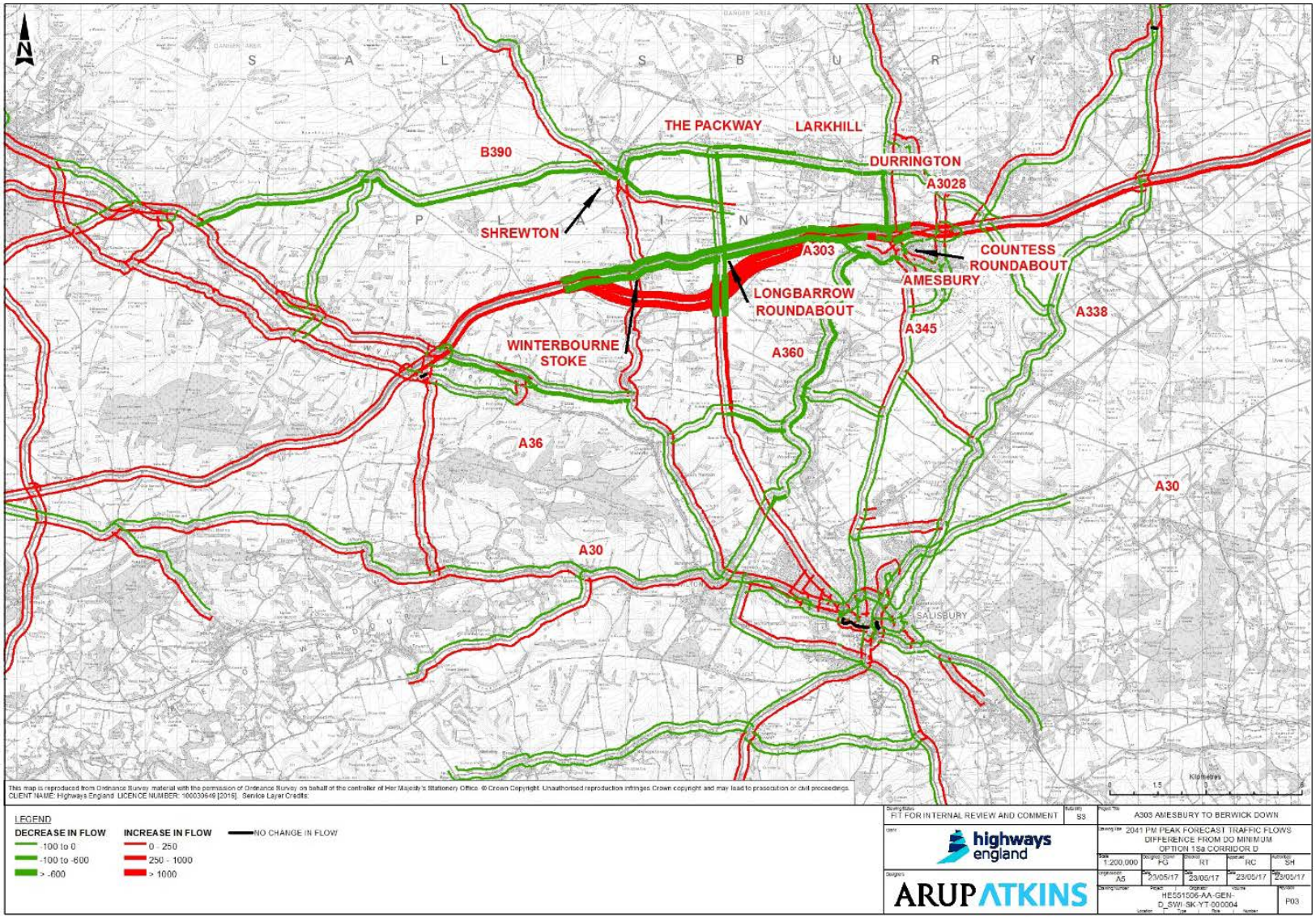


Figure 9-8 2041 PM Peak Forecast Traffic Flows – Difference from Do Minimum Option 1Sa

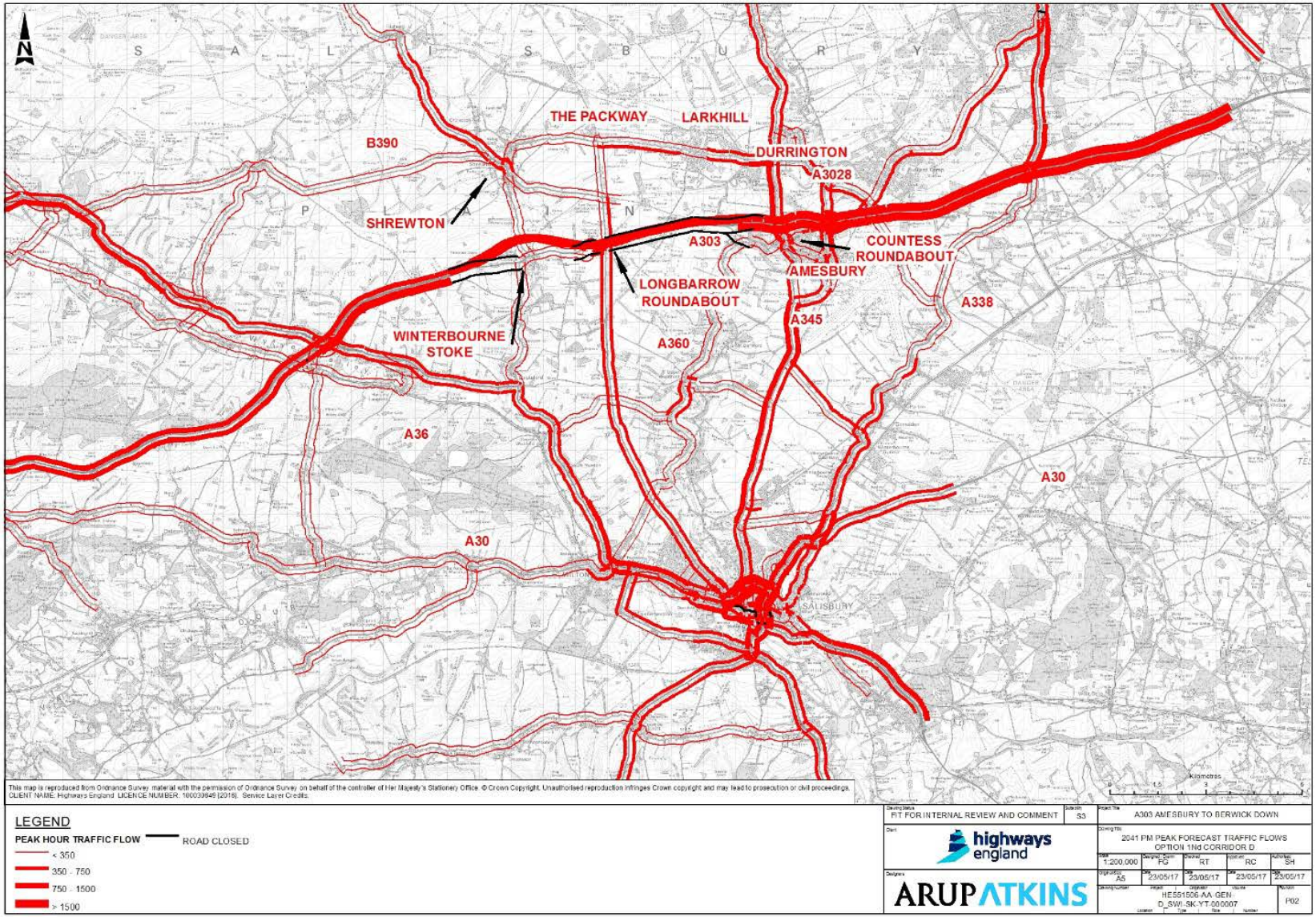


Figure 9-9 2041 PM Peak Forecast Traffic Flows Option 1Nd

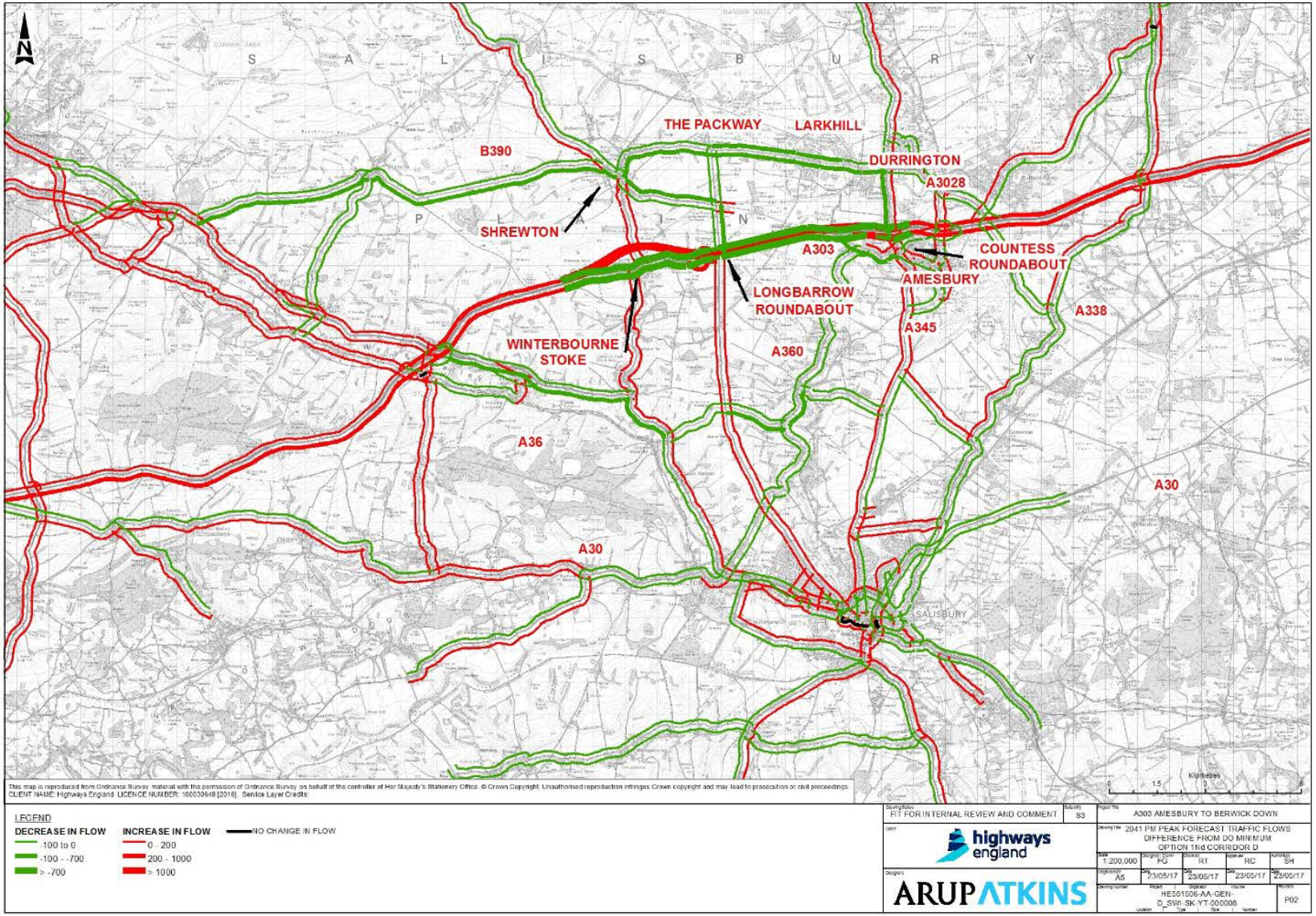


Figure 9-10 2041 PM Peak Forecast Traffic Flows – Difference from Do Minimum – Option 1Nd

10. Economic Assessment

10.1 Introduction

10.1.1 This section summarises the results of the economic assessment of the three route options taken forward for detailed economic appraisal. The economic assessment or 'cost benefit analysis' provides a quantified assessment of the value for money of the scheme. Further detail on the assessment is provided in the Economic Assessment Report, the Appraisal Summary Tables (ASTs) and the Supporting Worksheets Report.

10.2 Overview

10.2.1 The main purpose of the economic assessment is to undertake a cost benefit analysis of the scheme options to support the choice of the Preferred Route. The cost benefit analysis assesses the impact of each option over a 60-year appraisal period in comparison with a base case or 'Do Minimum' scenario. To allow comparison of costs and benefits that accrue at different points in time, all monetised impacts are discounted and converted to a present value. The results of the analysis are summarised in the Net Present Value (NPV) and Benefit Cost Ratio (BCR) for each option.

10.2.2 In seeking to quantify the impacts, the A303 Stonehenge scheme poses a number of unique challenges as summarised below.

Impacts on cultural heritage and the environment

10.2.3 Impacts on heritage and environment are a key consideration for the scheme. Diverting the road away from the WHS, by constructing a tunnel, results in higher capital costs than would otherwise be the case. The additional costs adversely impact the value for money of the scheme which results in a lower BCR for each tunnelled option.

10.2.4 In view of this, we undertook an innovative Contingent Valuation ('Willingness to Pay') study to elicit a monetary value for removing the road from part of the WHS. This involved undertaking surveys of Stonehenge visitors and UK residents which asked respondents to consider the monetary amount they would be willing to pay to realise the impacts.

10.2.5 The Contingent Valuation study focussed on the value that UK residents put on the removal of the A303 from its current location within the WHS, in relation to noise reduction, increased tranquillity, visual amenity and reduced landscape severance in the vicinity of Stonehenge. However, notwithstanding cultural heritage benefits, each of the options have adverse consequences for landscape more generally. In view of this, Department for Transport (DfT) guidance on the valuation of landscape impacts has also been applied to take account of the impact of the construction of new or widened surface highway in an otherwise rural environment.

10.2.6 Whilst these methodologies are, by their nature relatively imprecise, combining these two elements provides an indication of the value for money of the scheme

from a broader perspective, taking into account the heritage and landscape impacts which are a key element of the overall economic case for the scheme.

Wider economic benefits of improved inter-regional connectivity

10.2.7 Enabling economic growth is an objective of the scheme and one of the key considerations for the delivery of the Expressway as a whole. It is expected that the Expressway would deliver wider economic impacts beyond the direct benefits to users measured by savings in travel times and vehicle operating costs. Examples of wider economic benefits include: (i) indirect and induced impacts; (ii) the impacts on productivity as a result of improving connectivity to far-away centres of economic density (this is sometimes called “long-distance connectivity” or “between region productivity effects”); and (iii) the impacts on tourism demand.

10.2.8 These effects are real impacts that are not fully captured as part of the ‘Wider Impacts’ methodology for calculating Wider Economic Benefits given in WebTAG guidance. It is important, therefore, to consider how changes in transport costs and accessibility translate into real economy impacts and, furthermore, to consider where such impacts represent additional benefits to those captured in the conventional cost benefit analysis.

10.2.9 An approach is required which takes into account the major economic impacts of the Expressway to the South West and therefore supplementary wider economic benefits assessment was undertaken. It is anticipated that the scheme would deliver wider economic impacts by reducing transport costs, improving connectivity between the South East and South West regions of the UK, which improves business productivity in the South West.

The benefits of the Expressway programme

10.2.10 The scheme is part of a larger planned programme of 8 schemes which together form an Expressway to the South West which would improve regional connectivity and deliver a range of wider economic benefits. Achieving the Expressway and delivering these benefits depends on overcoming the bottleneck between Amesbury and Berwick Down.

10.2.11 The economic assessment of the A303 Stonehenge needs to be set within the context of the overall Expressway. Undertaking a cost benefit analysis of the A303 Stonehenge scheme in isolation does not take account of the positive interactions and inter-dependencies of all the proposed schemes that make up the Expressway.

10.2.12 To account for this, a ‘programmatic’ approach was taken to the cost-benefit analysis. The programmatic approach compares the benefits of the improvement programme both with and without the A303 Stonehenge scheme. By doing so we are able to estimate the benefits of the scheme assuming that all other schemes in the A303-A358 corridor are also delivered.

10.2.13 The results of the cost benefit analysis are presented both using the programmatic approach and a scheme level approach in which the scheme is considered in isolation from the rest of the corridor.

10.3 Presentation of results

10.3.1 The appraisal has been undertaken in a structured manner to capture the range of monetised impacts in three levels reflecting decreasing levels of certainty associated with the analysis. For those impacts which are more difficult to measure, or for which appraisal methodologies are less well developed, there is a lesser degree of certainty over the magnitude of the impacts. In accordance with the DfT guidance on value for money assessment, the results of the economic assessment are presented with and without such impacts. As a result, there are a range of alternative formulations of the NPV and BCR for the scheme options, depending on which quantified impacts are included. The various BCRs are presented for the scheme when assessed in isolation. The additional programmatic impact and seasonality benefits of the scheme are added as a sensitivity to the core value for money results.

10.3.2 The impacts included in each analysis are set out below:

- **Initial BCR (Typically Monetised Benefits)** – This appraisal includes impacts that are typically monetised for transport schemes, comprising:
  - Journey time savings / vehicle operating costs (under normal operating conditions)
  - Accidents
  - Greenhouse gas emissions
  - Noise
  - Air quality
  - Indirect Tax

- **Adjusted BCR (Other Transport and Economic Benefits)** – additional areas of benefits are included to inform the 'adjusted BCR'. These include:
  - Reliability benefits
  - Wider Impacts (WEIs) with fixed land use, namely
    - Agglomeration
    - Labour market impacts
    - Output in imperfect competition

- Adjusted BCR plus additional benefits – this includes:
  - Impacts in relation to the cultural heritage experience at Stonehenge
  - Monetised impacts on the landscape,

- A sensitivity on the Adjusted BCR plus additional benefits to include wider economic impacts assessed by complementary economic modelling – A sensitivity test has been undertaken which uses supplementary economic modelling techniques which seek to capture a range of wider economic benefits not covered by standard methodologies. This level of analysis seeks to capture the net national economic impacts of transformational land-use change as a consequence of the improvements in transport connectivity and access the scheme introduces.

- **Additional sensitivity** – It is recognised that the standard approach to quantified appraisal of the scheme may understate the true benefits of investment to transport users for two reasons. Firstly, modelling approaches based on average weekday conditions will fail to reflect the seasonal nature of traffic flows on the A303. Secondly, assessing the scheme in isolation will fail to account for the positive interaction between the various schemes which make up the Expressway programme as a whole. Analysis has been undertaken to provide an indication of the scale of these additional benefits. These benefits help inform the decision making from a broader perspective. However, addressing these issues requires use of non-standard approaches and are therefore presented as sensitivity tests.

10.4 Economic Appraisal Approach

10.4.1 This section details the approach taken to quantifying the primary impacts listed above. The costs and benefits of the three route options have been calculated using standard WebTAG economic appraisal tools and approaches. The cost benefit analysis assessed the impact of each option over a 60-year appraisal period in comparison with a base case or 'Do Minimum' scenario. In line with the DfT guidance, to allow comparison of costs and benefits that accrue at different points in time, all monetised impacts were expressed as discounted 2010 present values[3]. The results of the analysis are summarised in the Net Present Value (NPV)[4] and Benefit Cost Ratio (BCR)[5] for the scheme.

Transport user benefits

10.4.2 The economic appraisal was undertaken using the DfT Transport User Benefit Appraisal (TUBA) software (version 1.9.8 Interim). The economic impacts of a scheme are derived by comparing the future year situation with the scheme (Do Something scenario) to the situation without the scheme (Do Minimum).

10.4.3 TUBA uses data forecasts taken from the future years' traffic model on the number of trips, average journey times and average journey distances to calculate journey time impacts, vehicle operating costs, indirect tax effects and greenhouse gas emission impacts in accordance with the WebTAG methodology and databook.

10.4.4 All three route options would deliver significant travel time savings in comparison with the existing A303. Travel time savings result from the combined effect of increased capacity, higher speed limits and grade separated junctions. User benefits calculated for the three route options are similar in magnitude.

Accidents and safety

10.4.5 The accident and safety impacts were assessed quantitatively and monetised to be incorporated into the overall economic assessment. Accident saving benefits were calculated separately using Cost and Benefit to Accidents – Light Touch

[3] Discounting is a technique used to compare costs and benefits that occur in different time periods. It is based on the principle that, generally, people prefer to receive goods and services now rather than later. This is known as 'time preference'. The discount rate used to convert all costs and benefits to present values is the HM Treasury Green Book social time preference rate.
[4] The Net Present Value is the difference between the Present Value of Benefits (PVB) and the Present Value of Cost (PVC) of an option.
[5] The ratio of Present Value of Benefits (PVB) to Present Value of Costs (PVC).

(COBA-LT). COBA-LT compares accidents by severity and associated costs across the network in the Do Minimum with those in the Do Something scenario. Accident rates and costs used in COBA-LT are consistent with those defined in the Design Manual for Roads and Bridges (DMRB). The resulting safety benefits calculated by COBA-LT were then added to the main TUBA assessment.

10.4.6 The assessment demonstrates that all options would reduce accidents due to the replacement of the existing single carriageway with a grade-separated dual carriageway. It is estimated that this would save 6 accidents per year for the scheme.

Reliability benefits

10.4.7 The impact of the scheme upon reliability was assessed, where reliability refers to journey time variability. Journey time reliability was measured by calculating the standard deviation of journey times. For single carriageways, there is no single established approach to modelling the effects of increased road capacity on journey time variability[6]. However, in the case of the A303 it was possible to infer the likely change in variability by comparing the level of variability on different sections of the route options.

10.4.8 For the purposes of this analysis, journey time variability was measured for two sections of the A303: the section between Amesbury to Berwick Down, and the dual carriageway section of the route option between Andover and Amesbury. It was assumed that, once dualled, users of the section between Amesbury to Berwick Down would experience the level of variability that users experience between Andover and Amesbury. Variability was measured across a sample of journey time observations taken from the vehicle tracking database, Trafficmaster. No account was made for changes in variability that may occur over time due to demand growth and therefore the analysis builds in a level of conservatism.

10.4.9 To ensure that the analysis captures unpredictable variation only, journey time variability was measured and compared separately across specific times of the day (AM, Interpeak, and PM periods), days of the week (Monday – Thursday, Friday, and Saturday – Sunday) and months of the year (July-August, and all other months).

Wider economic impacts

10.4.10 It is expected that the Expressway would deliver wider economic impacts beyond the direct benefits to customers measured by savings in travel times and vehicle operating costs. These effects are real impacts that are not fully captured as part of existing appraisal methods. It is important, therefore, to consider how changes in transport costs and accessibility translate into real economy impacts and, furthermore, to consider where such impacts represent additional benefits to those captured in the conventional cost benefit analysis.

[6] The DfT's transport analysis guidance (WebTAG) states that for journeys predominantly on single carriageways outside urban areas it is not possible to estimate monetised reliability benefits.

10.4.11 The analysis of Wider Economic Benefits relies on both the standard WebTAG 'Wider Impacts' methodology, as well as the complementary modelling referred to above.

Wider impacts approach

10.4.12 A framework for the calculation of impacts was established by the DfT and is formalised in WebTAG. Under the guidance, wider impacts relate to three effects:

- **Agglomeration effects** - Transport can act to increase the accessibility of an area to a greater number of firms and workers, thereby impacting on the level of agglomeration. Increased agglomeration is empirically associated with higher productivity. Therefore, improved access can result in higher productivity and Gross Domestic Product (GDP).
- **Output change in imperfectly competitive markets** – Reducing transport costs lowers the costs of production that firms face (under normal market conditions). This allows an increased output of goods that require the use transport.
- **Labour market impacts** – where transport improvements reduce the costs of commuting, they effectively act to reduce barriers to employment and improve access to employment opportunities. Encouraging more people into the labour market brings societal benefits in respect of higher tax revenues. Wider impacts can also result where a transport scheme results in a transfer of employment from low to high productive jobs, also resulting in higher tax revenues.

10.4.13 The above impacts were modelled using the WITA (Wider Impacts on Transport Appraisal) software using outputs from the traffic model.

Cultural Heritage Impacts – The Value of Removing the Road from the World Heritage Site

10.4.14 Current appraisal guidance (WebTAG) does not monetise or seek to quantitatively value impacts on historic environment. It instead relies on qualitative scores. In some respects, the value of cultural heritage assets is intangible. However, techniques exist which seek to monetise the value that people place on cultural heritage assets.

Willingness to Pay Research

10.4.15 A Contingent Valuation study has been undertaken to provide a more balanced quantitative assessment of value for money. The aim of this study was to understand the value that visitors to the World Heritage Site (WHS), A303 users, and UK residents put on the removal of the A303 from its current location within the Stonehenge WHS, in relation to noise reduction, increased tranquillity, visual amenity and reduced landscape severance.

10.4.16 The research elicited a value for the benefits of the scheme as perceived by visitors to the WHS and UK residents. Respondents to the WTP were asked to consider what (hypothetically) they would be willing to pay in an increase in annual taxation to realise the benefits of the scheme. The survey responses were used to generate estimates of the aggregate willingness to pay of the UK population as a

whole or, put another way, the overall value that society attributes to these benefits.

10.4.17 The willingness to pay research provides an assessment of the public value attributed to removing the road from the WHS. It provides a partial assessment of the benefits of the scheme which complements qualitative assessment based on expert opinion. Nonetheless, by understanding the value that people place on the benefits of the scheme, the research helps us to better understand the trade-offs between cost and impact.

10.4.18 The research was primarily concerned with the impact of removing the road from part or all of the WHS and was undertaken on the basis of a tunnelled option. In respect of cultural heritage impacts, the scheme would deliver transformative benefits for parts of the WHS by improving the setting of scheduled monuments, including Stonehenge itself, and by removing the physical barrier that currently divides the Site into two parts.

Valuing Impacts on the Landscape beyond Stonehenge

10.4.19 As noted, for all options, the benefits of removing the road from the WHS must to be balanced against the negative impacts of the construction of a new or widened surface highway in an otherwise rural environment. As for heritage impacts, quantifying such effects is highly challenging. Where landscape impacts are highly material (i.e. scored as moderate or large), DfT has identified that an illustrative monetisation of landscape impacts can help inform the overall value for money assessment of a scheme.

10.4.20 The DfT landscape valuation method employs monetary values for a range of landscape types, such as agricultural land, forested land and natural or semi-natural land. The landscape values are derived from an extensive literature review of studies which have placed a value on different land types (using techniques such as contingent valuation).

10.4.21 A detailed mapping exercise has been undertaken which identifies the presence of each of the different land types identified in the guidance. The mapping exercise considers a 500m corridor either site of the proposed alignment of the A303. In order to provide improved granularity a different weight has been placed on the landscape between 0 and 250 metres of the road alignment and the landscape between 250 and 500 metres of the road. Furthermore, the scheme would involve some elements of on-line widening, an adjustment has been made to reflect the fact that the change in landscape quality would (all things being equal) be less for highway widening, than for the construction of a new highway in the landscape.

10.4.22 Each of the options involves the construction of new sections of highway as well as the removal of part of the existing A303 from the WHS landscape. To avoid double counting with the Contingent Valuation study, the landscape benefits of removing the road have been excluded and only the negative impacts of highway widening or construction have been included. For conservatism, the negative impacts of the new sections of dual carriageway within the WHS have been included.

10.4.23 The overall values provide an indication of the broad magnitude of impacts but, as for heritage impacts, the analysis is intended to complement rather than replace the more detailed qualitative assessment.

Complementary approach to wider economic benefits

10.4.24 The complementary appraisal method is a bespoke approach, designed to capture the expected benefits of the Expressway. Whilst the results of the complementary appraisal should be treated with care owing to their innovative nature, it is important to recognise that the analysis was undertaken with a very high degree of rigour and is consistent with the approach set out in the DfT's recently published consultation on the approach to Wider Economic Impacts.

10.4.25 A Spatial Computable General Equilibrium (S-CGE) model was developed to estimate the knock-on impacts of the scheme. This technique captures the various dynamic clustering and other impacts that can be associated with projects of this nature. Equally importantly, innovative but rigorous statistical analysis was undertaken to assess key relationships, notably the impact on productivity of connectivity over long distances, to supplement the Wider Impacts methodology.

10.4.26 When combined with other analysis, it is possible to quantify the "Total Economic Impact" of a project and assess its potential impact on:

- Gross Value Added (GVA) and employment.
- The extent to which the scheme could be self-financing by triggering a long-term increase in economic activity and therefore higher tax receipts.
- How different regions could be affected.

10.4.27 Some of the above impacts, in particular those for GVA and employment, are likely to be of interest to many stakeholders, and serve as a useful complement to the welfare impacts. The wider economic impact assessment considers two main impacts:

- Long-distance Connectivity - The productivity effect of connecting peripheral regions with higher economic activity.
- SCGE effects - Estimates of how the planned improvements to the corridor could affect economic output and employment at a regional and national level. The approach captures not just the "direct" economic impacts, but also the "knock-on" effects of the scheme.

10.4.28 Such effects are in addition to the agglomeration effects included in the Wider Impacts framework and are considered as a complementary analysis. Therefore, the results of this assessment are only added to provide an indication of the overall economic impact of the scheme.

Programmatic assessment (A303/A30/A358 corridor)

10.4.29 Including the A303 Stonehenge there are eight schemes which comprise the Expressway programme. Three of these schemes are being delivered during RIS 1 (Dualling of the A303 between Sparkford and Ilchester, dualling the A358 between Taunton and Southfields; and the A303 Stonehenge). A further five

schemes were identified in the A303/A30/A358 Corridor Feasibility Study. These schemes would be delivered in subsequent Road Investment Strategy periods.

10.4.30 Undertaking a cost benefit analysis of the A303 Stonehenge scheme in isolation does not take account of the interactions and inter-dependencies of all proposed schemes. Therefore, a programmatic appraisal was undertaken to assess the benefits of the Expressway programme both with and without the Amesbury to Berwick Down scheme. The programmatic appraisal involves the construction of two scenarios: a 'do minimum scenario' which assumes that seven of the corridor schemes are delivered (excluding A303 Stonehenge); and, a 'do something' scenario which assumes all eight corridor schemes are delivered.

10.4.31 Comparing these two scenarios provides an estimate of the benefits of the scheme including the benefits of the positive interaction between the A303 Stonehenge scheme and all other schemes in the corridor.

10.4.32 A description of each of the schemes is given in Table 10-1.

Table 10-1 A303/A30/A358 corridor scheme assumptions

Section	Location	Description
1	A303 Stonehenge	12km of dual carriageway and junction improvements
2	A303 Wylye to Stockton Wood	3.9km mainly 'on-line' dual carriageway
3	A303 Chicklade Bottom to Mere	12km of part 'on-line' and part 'off-line' dual carriageway and associated junction improvements
4	A303 Sparkford to Ilchester	5.5km of part 'on-line' and part 'off-line' dual carriageway and associated junction improvements
5	A303 Podimore Roundabout	Junction improvement (grade separated)
6	A303 Cartgate Roundabout	Junction improvement (grade separated)
7	A303 South Petherton to Southfields	10km of 'on-line' dual carriageway
8	A358 Southfields to M5 Motorway (Junction 25)	14km of part 'on-line' and part 'off-line' dual carriageway and associated junction improvements

Scheme costs

Capital costs

10.4.33 Highways England has developed the costs of the scheme, based on its database of development and construction costs and applying its forecast rate of construction inflation, in line with Highways England best practice.

10.4.34 This follows a clear and rigorous assessment of risks and the valuation of them at different confidence intervals (i.e. the probability of the overall costs being at each level). Both programme level risks (i.e. those risks that would affect all projects being developed by Highways England) and project specific risks have been considered and valued. This method has replaced previous costing methods that included optimism bias adjustments

10.4.35 Capital cost estimates were forecast in 2016 Q1 prices and inflated using Highways England's major projects inflation forecast. The cost estimate used in the cost benefit analysis is the 'most likely cost' or P50 estimate.[7] However, sensitivity tests have also been undertaken which apply the 'lower' and 'upper' bound cost estimates.

10.4.36 Cost estimates for the three scheme options are shown in Table 10-2. In accordance with WebTAG guidance, costs and benefits are converted to 2010 Market Prices.

Table 10-2 Indicative Scheme Capital Costs at 2016 and Present Value at 2010 prices and values discounted to 2010 (£m)

Route Option	Capital Costs £m 2016 factor cost			PVC £m 2010 market prices and values discounted to 2010		
	Lower Bound	Most Likely	Upper Bound	Lower bound	Most likely	Upper bound
Option 1Na	966	1,327	2,143	680	934	1,509
Option 1Sa	969	1,330	2,148	682	937	1,512
Option 1Nd	966	1,327	2,143	680	934	1,509

Operating, maintenance and renewals costs

10.4.37 Tunnelled roads are associated with higher on-going costs – associated with tunnel operations, maintenance and renewals – than standard overland roads.

10.4.38 An indicative allowance for tunnel operation, maintenance and renewal costs has been included in the cost benefit analysis. This allowance has been based on recently produced cost estimates for a tunnel of a similar type and length taken from the Lower Thames Crossing scheme.

[7] The P50 estimate is the middle estimate in a range of cost estimates for which a level of certainty is defined. 50% of estimates exceed the P50 estimate (and by definition, 50% of estimates are less than the P50 estimate).

10.4.39 Allowance has also been made for the costs of maintaining the surface carriageway for each option, although such costs are relatively small in comparison with tunnel maintenance costs.

10.4.40 Initial maintenance costs are forecast to be in the region of £7 million annually in current prices, while the total maintenance and renewal cost over a 60-year period amounts to £212 million in 2010 market prices discounted to 2010.

10.5 Results

Results – Transport user benefits – Initial BCR

10.5.1 The Initial BCR for the scheme is calculated only on the basis of impacts which are typically monetised in transport appraisal. Table 10-3 summarises the results of the economic assessment of the scheme options when appraised in isolation (assuming that none of the other corridor schemes are delivered). The results are presented using the 'most likely' cost estimates. As noted, the Initial BCR for the scheme is calculated only on the basis of impacts which are typically monetised in transport appraisal.

10.5.2 The 'typically monetised' benefits of the three route options, including lower journey costs and increased vehicle operating costs for users, reduced accidents and monetised environmental impacts, are (PVB 2010 prices):

- Option 1Na £504m
- Option 1Sa £474m
- Option 1Nd £542m

10.5.3 Comparing the costs and benefits of each option, the Initial BCR are 0.4 for Options 1Na and 1Sa, and 0.5 for option 1Nd. Overall, Option 1Nd delivers the highest level of user benefits.

Table 10-3 Core Scheme Economic Appraisal: Initial BCR

£m 2010 prices and values discounted to 2010	Option 1Na	Option 1Sa	Option 1Nd
Journey Times	602	577	635
Vehicle Operating Costs	-142	-152	-141
Accident Benefits	14	15	14
Total User Benefits	474	439	508
Greenhouse Gas Benefits	-76	-78	-75
Noise	-1.0	0.8	-0.4
Air Quality	-0.6	-0.5	-0.5
Indirect Tax Revenues	107	112	110

Initial Present Value of Benefits, PVB	504	474	542
Capital Costs	934	937	934
Maintenance Costs	212	212	212
Present Value of Costs, PVC	1,146	1,148	1,146
Initial Net Present Value, NPV	-642	-674	-604
Benefit-to-Cost Ratio, Initial BCR	0.4	0.4	0.5

Results: Economic Appraisal: Adjusted BCR (including Reliability and Wider Impacts)

10.5.4 Other transport and economic impacts of improved reliability and WebTAG based wider economic benefits ('Wider Impacts') are included in the 'Adjusted BCR' for the scheme options.

10.5.5 When these benefits are considered, the combined effect is to increase the PVB to between £608m to £669m, resulting in an Adjusted BCRs of 0.5 to 0.6.

Table 10-4 Scheme Only Appraisal: Adjusted BCR

£m 2010 Prices and Values discounted to 2010	Option 1Na	Option 1Sa	Option 1Nd
Initial PVB	504	474	542
Reliability Benefits	61	61	61
Wider Impacts	73	74	66
Adjusted PVB	637	608	669
PVC	1,146	1,148	1,146
Adjusted NPV	-509	-540	-478
Adjusted BCR	0.6	0.5	0.6

Economic Appraisal: Adjusted BCR plus Cultural Heritage Impacts and Landscape Impacts

10.5.6 The Adjusted BCR does not take into account the benefits that the scheme will deliver by removing the traffic on the existing A303 from at least part of the WHS. As introduced earlier in this section, a Contingent Valuation study was undertaken to provide a more balanced quantitative assessment of value for money. For comparability with the overall cost benefit analysis the results of this assessment have been converted to 2010 prices and values discounted to 2010 to give a value of £955m.[8]

[8] Further detail can be found in the Valuing Heritage Impacts report.

10.5.7 The benefits of removing the traffic from the WHS need to be balanced against the negative impacts of construction. DfT has identified that an illustrative monetisation of landscape impacts can help inform the overall value for money assessment of a scheme. Therefore, together with the WTP results, these have been added to the Adjusted BCR. The results are presented in Table 10-5.

Table 10-5 Scheme Only Appraisal: Adjusted BCR plus WTP and Landscape Impacts

£m 2010 Prices and Values discounted to 2010	Option 1Na	Option 1Sa	Option 1Nd
Adjusted PVB	637	608	669
Willingness to Pay for removing the road from the WHS (WTP)	955	955	955
Monetised Landscape Impacts (excluding removed section of existing A303)	-183	-197	-241
Adjusted PVB plus WTP and Landscape Impacts	1,409	1,366	1,383
PVC	1,146	1,148	1,146
Adjusted NPV plus WTP and Landscape Impacts	263	218	236
Adjusted BCR plus WTP and Landscape Impacts	1.2	1.2	1.2

10.5.8 The appraisal demonstrates that monetised heritage and landscape impacts are highly material to the overall value for money assessment. Overall, the combined effect of these impacts is to increase the PVB for the scheme to between £1,366m to £1,409m, resulting in an Adjusted BCR of 1.2.

Results – Additional Benefits Sensitivity: including long distance connectivity and S-CGE economic impacts

10.5.9 Enabling economic growth is an objective of the scheme and one of the key considerations for the delivery of the Expressway as a whole. It is expected that the Expressway would deliver wider economic impacts beyond the direct benefits to customers measured by savings in travel times and vehicle operating costs. As discussed, examples of wider economic benefits include: (i) indirect and induced impacts; and (ii) the impacts on productivity as a result of improving connectivity to far-away centres of economic density (this is sometimes called “long-distance connectivity” or “between region productivity effects”).

10.5.10 These effects are real impacts that are not fully captured as part of the ‘Wider Impacts’ methodology for calculating Wider Economic Benefits given in WebTAG guidance. It is important, therefore, to consider how changes in transport costs and accessibility translate into real economic impacts and, furthermore, to consider where such impacts represent additional benefits to those captured in the conventional cost benefit analysis. Therefore, these wider economic benefits are added to the BCR as a sensitivity. When Long Distance Connectivity and S-CGE benefits are taken into account the BCR for all options is 1.4.

10.5.11 The comparative transport economic appraisal and cost benefit analysis results are similar across the three options: Option 1Nd slightly outperforms Option 1Sa and is similar to Option 1Na in terms of monetised economic impacts. The BCRs for all three options are similar, as shown in Table 10-6.

Table 10-6 Scheme Only Appraisal: Adjusted BCR (plus WTP and Landscape Impacts) including complementary economic modelling

£m 2010 Prices and Values discounted to 2010	Option 1Na	Option 1Sa	Option 1Nd
Adjusted PVB	1,409	1,366	1,383
WEI - Long distance connectivity	75	79	65
WEI - SCGE model impacts	166	159	171
Adjusted Benefits of complementary economic modelling Subtotal	241	238	236
Adjusted PVB including complementary economic modelling	1,650	1,604	1,618
PVC	1,146	1,148	1,146
Adjusted NPV including complementary economic modelling	504	456	472
Adjusted BCR including complementary economic modelling	1.4	1.4	1.4

Value for Money Assessment

10.5.12 In overview, the preliminary results of the economic appraisal suggest that the benefits of the scheme are likely to outweigh its costs. Based on those impacts that can be quantified, the Scheme is likely to lie within the low-medium value for money category of schemes. The comparative transport economic appraisal and cost benefit analysis results are similar across the three options: Option 1Nd slightly outperforms Option 1Sa and is similar to Option 1Na in terms of monetised economic impacts.

Results – Additional monetised impacts sensitivity - Seasonality and Programmatic Impacts

10.5.13 As noted above the A303 Stonehenge scheme is part of a wider corridor improvement programme and therefore the impact of the scheme would increase when viewed as a critical link in delivering the wider corridor improvement. The Expressway to the South West would deliver a transformational change in connectivity between the South East and the South West. Considered in isolation, the impact of the corridor schemes is more modest, but each scheme contributes to the overall objectives of the Expressway. Our approach therefore also considers the role that could be played by the Stonehenge scheme in unlocking the wider economic impacts from the corridor as a whole. Comparing the results of the corridor scenarios allows us to isolate the net effect of adding the A303 Stonehenge scheme to the Expressway programme.

10.5.14 The appraisal results shown in **Error! Reference source not found.** to Table 10-6 treat the A303 Stonehenge as if it were a standalone scheme. Applying a programmatic approach takes into account the positive interaction between the A303 Stonehenge and the other corridor schemes. Under this approach, additional benefits of the scheme as a critical part of unlocking the benefits of the Expressway

are estimated at £237m. Seasonality impacts provide an additional benefit of £48m. Including these additional benefits increases the BCR to 1.7 for Options 1Na and 1Nd, and to 1.6 for Option 1Sa.

10.5.15 The results of the programmatic and seasonality appraisal of the scheme are presented in Table 10-7.

Table 10-7 Appraisal Results including Seasonality and Programmatic Impacts

£m 2010 Prices and Values discounted to 2010	Option 1Na	Option 1Sa	Option 1Nd
Adjusted PVB including complementary economic modelling	1,650	1,604	1,618
Seasonality benefits	45	42	48
Incremental Programmatic impact	237	237	237
Adjusted PVB including complementary economic modelling and Programmatic and Seasonality impact sensitivities	1,932	1,883	1,904
PVC	1,146	1,148	1,146
Adjusted BCR including complementary economic modelling and Programmatic and Seasonality impact sensitivities BCR	1.7	1.6	1.7

10.6 Variable Cost, Demand and Cultural Heritage Valuation Sensitivity Tests

10.6.1 A series of sensitivity tests were undertaken with the objective of understanding the robustness of the appraisal to underlying assumptions.

Cost Variability

10.6.2 Sensitivity tests were undertaken to allow for a range of cost estimates. At the current stage of development of the scheme, the capital costs are subject to a degree of uncertainty. Upper and lower bound cost estimates have been produced in addition to the 'most likely' costs. The upper and lower bound estimates have been used as the basis for sensitivity testing.

10.6.3 Table 10.8 gives the results of the appraisal on the basis of the lower and upper bound cost estimates. For simplicity, values of willingness to pay for removal of the road from the WHS are based only on a central point, rather than a range. This cost sensitivity testing has been carried out only within the scheme level appraisal.

10.6.4 Due to the high level of uncertainty in current cost forecasts, the variability in resultant BCRs is also high. Under the low capital cost scenario, the scheme level Adjusted BCR including complementary economic modelling is 1.8.

Table 10-8 Sensitivity Test: Low, Central and High Capital Cost (£m 2010 prices and values discounted to 2010)

		Option 1Na			Option 1Sa			Option 1Nd		
		Low Cost	Central Cost	High Cost	Low Cost	Central Cost	High Cost	Low Cost	Central Cost	High Cost
Scheme Costs	PVC	892	1146	1721	894	1148	1724	892	1146	1721
Scheme Level Appraisal Initial BCR	PVB	504	504	504	474	474	474	542	542	542
	NPV	-388	-642	-1217	-420	-674	-1250	-388	-604	-1179
	BCR	0.6	0.4	0.3	0.5	0.4	0.3	0.6	0.5	0.3
Scheme Level Appraisal Adjusted BCR	PVB	637	637	637	608	608	608	669	669	669
	NPV	-255	-509	-1084	-285	-540	-1116	-224	-478	-1053
	BCR	0.7	0.6	0.4	0.7	0.5	0.4	0.7	0.6	0.4
Scheme Level Appraisal Adjusted BCR plus WTP and Landscape impacts	PVB	1409	1409	1409	1366	1366	1366	1383	1383	1383
	NPV	517	263	-312	473	218	-358	490	236	-339
	BCR	1.6	1.2	0.8	1.5	1.2	0.8	1.5	1.2	0.8
Scheme Level Appraisal Adjusted BCR including complementary economic modelling	PVB	1650	1650	1650	1604	1604	1604	1618	1618	1618
	NPV	758	504	-71	711	456	-120	726	472	-103
	BCR	1.8	1.4	1.0	1.8	1.4	0.9	1.8	1.4	0.9

Variable Growth in Traffic Demand

10.6.5 In accordance with DfT guidance, the impact of variations in future economic and traffic growth was examined. This involved developing Low and High Growth traffic forecasts using the methodology recommended in WebTAG Unit M4 on Forecasting and Uncertainty.

10.6.6 WebTAG recommends that the High Growth scenario should consist of forecasts that are based on the addition of a proportion of base year demand to the demand from the core scenario. This is achieved by factoring the trip matrices used in the model and hence the appraisal. The proportion of base year demand to be added is based on a parameter (p). The proportion is calculated as follows:

- for 1 year after the base year, proportion (p) of base year demand is added to the core scenario;
- for 36 or more years after the base year, proportion 6*p of base year demand is added to the core scenario; and
- between 1 and 36 years after the base year, the proportion of base year demand should rise from p to 6*p in proportion with the square root of the number of years. (So, for example, 16 years after the base year the proportion is 4*p).

10.6.7 In this case, where highway demand is being forecast, the value of p used was 2.5%, which is in line with the guidance in WebTAG Unit M4 and is consistent with the application of uncertainty in the National Transport Model (NTM), based on the macro-economic variables that influence the main drivers of travel demand.

10.6.8 The trip matrices are adjusted on a cell by cell basis, to reflect the range of uncertainty by taking the appropriate proportion of the model base year matrix and adding it to the future year core scenario matrix. For example, for a forecast of the High Growth scenario, the proportion of the 2015 base year matrix that was added for each future year was:

- for 2026, the growth was 8.29% (i.e. 2.5% x √11);
- for 2041, the growth was 12.75% (i.e. 2.5% x √26); and
- for 2051, the growth was 15.00% (i.e. 2.5% x √36).

10.6.9 In the Low Growth scenario, the adjustment was based on the same ranges as the High Growth but the adjustment involves the subtraction of the proportion of the base year trip matrix from the future year trip matrices.

10.6.10 Table 10-9 sets out the sensitivity of the BCR to low and high demand scenarios. Values are based on the central cost estimate. The range of uncertainty in the generation of benefits in relation to forecast demand levels is considerably lower than the uncertainty surrounding costs. The demand range indicates an Adjusted BCR of above 1.0 in all cases.

Table 10-9 Sensitivity Test: Low, Central and High Demand Growth (£m 2010 prices and values discounted to 2010)

		Option 1Na			Option 1Sa			Option 1Nd		
		Low demand growth	Central case	High demand growth	Low demand growth	Central case	High demand growth	Low demand growth	Central case	High demand growth
Scheme Costs	PVC	1146	1146	1146	1148	1148	1148	1146	1146	1146
Scheme Level Appraisal Initial BCR	PVB	407	504	558	383	474	526	438	542	600
	NPV	-739	-642	-588	-765	-674	-623	-708	-604	-547
	BCR	0.4	0.4	0.5	0.3	0.4	0.5	0.4	0.5	0.5
Scheme Level Appraisal Adjusted BCR	PVB	630	637	650	605	608	627	661	669	679
	NPV	-516	-509	-496	-543	-540	-521	-486	-478	-468
	BCR	0.5	0.6	0.6	0.5	0.5	0.5	0.6	0.6	0.6
Scheme Level Appraisal Adjusted BCR plus WTP and Landscape impacts	PVB	1305	1409	1477	1272	1366	1437	1271	1383	1450
	NPV	159	263	330	124	218	289	125	236	304
	BCR	1.1	1.2	1.3	1.1	1.2	1.3	1.1	1.2	1.3
Scheme Level Appraisal Adjusted BCR including complementary economic modelling	PVB	1513	1650	1749	1487	1604	1717	1471	1618	1712
	NPV	367	504	602	339	456	568	325	472	566
	BCR	1.3	1.4	1.5	1.3	1.4	1.5	1.3	1.4	1.5

Cultural Heritage Valuation Sensitivity

10.6.11 It is recognised that the Cultural Heritage valuation is subject to a degree of uncertainty. Therefore, upper and lower bound estimates have been produced in addition to the central estimate. The upper and lower bound estimates have been used as the basis for sensitivity testing. Table 10-10 gives the results of the appraisal on the basis of the range estimates.

10.6.12 The variability in resultant BCRs is modest. The sensitivity analysis for the upper and lower bounds of the contingent valuation impacts, return a BCR of 1.3 at the lower end of the estimates and a BCR of 1.5 for the upper end of estimates (Table 10-10).

Table 10-10 Sensitivity Test: Low, Central and High Contingent Valuation (£m 2010 prices and values discounted to 2010)

		Option 1Na			Option 1Sa			Option 1Nd		
		Low CHV	Central CHV	High CHV	Low CHV	Central CHV	High CHV	Low CHV	Central CHV	High CHV
Scheme Costs	PVC	1146	1146	1146	1148	1148	1148	1146	1146	1146
Scheme Level Appraisal Adjusted BCR plus WTP and Landscape impacts	PVB	1310	1409	1507	1267	1366	1464	1284	1383	1481
	NPV	164	263	361	119	218	316	137	236	334
	BCR	1.1	1.2	1.3	1.1	1.2	1.3	1.1	1.2	1.3
Scheme Level Appraisal Adjusted BCR including complementary economic modelling	PVB	1551	1650	1748	1505	1604	1702	1519	1618	1716
	NPV	405	504	602	357	456	554	373	472	570
	BCR	1.4	1.4	1.5	1.3	1.4	1.5	1.3	1.4	1.5

10.7 Economic assessment conclusions

10.7.1 A conventional approach to appraisal, which focusses on the traffic related benefits delivered to users of the road network, would suggest that the scheme has low value for money. However, this fails to capture the full range of benefits of the scheme and doesn't include the value of removing the current road from Stonehenge WHS which is a key benefit of the new scheme.

10.7.2 When the full range of monetised impacts are included the BCR based on all three options is 1.4 (Adjusted BCR plus WTP and monetised landscape impacts), with there being very little difference between the options in terms of economic performance. It should also be noted that the ranking of options is sensitive to key assumptions (most notably project costs) for which there is some uncertainty at this stage.

10.7.3 The appraisal results presented in Table 10-6 are likely to understate the benefits of the scheme. A programmatic analysis has been undertaken which demonstrates that the transport and economic benefits of the A303 Stonehenge scheme are greater when considered as part of the overall Expressway programme. When these impacts are considered the BCR for Options 1Nd and 1Na increases to 1.7, and the BCR for Option 1Sa increases to 1.6.

11. Operational Assessment

11.1 Introduction

11.1.1 Route Options 1Na, 1Nd and 1Sa would significantly improve the operation of the road network by reducing accidents, minimising delays and maintaining traffic flows, providing better current information to road users and providing community enhancements.

11.1.2 The key operational design criteria expected to be specified in the upcoming Expressway standards and applicable to the A303 scheme are as follows:

- Dual 2 lane all-purpose road operating at the national speed limit.
- 1m hard strips.
- Clearway.
- Grade separated junctions.
- Emergency Refuge Areas (ERAs).
- No central reserve gaps.
- No right turning movements.
- No direct public access other than at junctions, ERAs service/ rest areas or laybys.

11.1.3 The upcoming Expressways standards are not expected to be explicit in their application to road tunnels. The tunnels in the proposed route options would be subject to the operational and design principles set out in DMRB BD78/99, as well as applying good practice by meeting the design requirements of Road Tunnel Safety Regulations (RTSR) 2007 and most importantly an ALARP approach to tunnel safety.

11.1.4 Non-Motorised Users (NMUs) would not be permitted on the scheme regardless of the route option selection. The needs and requirements for all classes of NMU would be considered in the design of NMU facilities provided and this would be detailed in the NMU context report in the next stage after selection of a Preferred Route.

11.1.5 As detailed in section 12 of the report, Variable Message Sign (VMS) positioning relative to the WHS requires more detailed landscape and visual impact assessment. The opportunity to locate VMS signs within the WHS and immediately outside of the tunnel portals may be dependent in part on junction location and slip road arrangements.

11.2 Scheme's Operating Regime

Operating regimes

11.2.1 The following operating regimes are expected during normal periods:

- All lanes available for traffic use.

- VMS (where provided) would remain blank (if not required for campaign messages) unless required for incident or congestion management.
- National speed limit would apply without signalling.
- Inclusion of Variable Mandatory Speed Limits (VMSL) to be assessed at a later stage in the scheme.

11.2.2 The adopted design speed for the A303 scheme is 120 kph.

11.2.3 With the new scheme and new all movement junctions, movements would not be subjected to the existing waiting periods at Longbarrow roundabout or traffic signals at Countess Roundabout or the signalised pedestrian crossing in Winterbourne Stoke.

11.2.4 Operation of the A303 would be overseen by the Traffic Officer Service (TOS) through a new or existing control centre and mobile patrols.

11.2.5 Technology systems would be beneficial to the TOS during operation of the scheme including, for example:

- Environmental sensors to identify weather conditions.
- Vehicle detection to identify traffic status.
- CCTV to support incident assessment.
- Variable signs and signals for traffic control and information provision.

Tunnel Operation

11.2.6 The operation of the tunnel has a significant influence on the requirements for the tunnel geometry. The current geometrical proposal is for twin-bore tunnels each comprising 2 lanes.

11.2.7 For this stage of the assessment, ERAs and emergency stopping lanes are not assumed to be provided within the tunnel. Laybys/ERAs, which have the potential to be used as maintenance facilities, could be provided on the tunnel approaches.

11.2.8 A 1.5m wide raised verge would be provided between the tunnel wall and roadway to form emergency walkways. This meets the requirements set out in Design Manual for Roads and Bridges (DMRB) BD 78/99 with improved provision for impaired mobility access. Consultation with mobility user groups would be undertaken to agree emergency access and egress needs.

11.2.9 The tunnel would require traffic control systems to assist in closing the tunnel during an incident or for maintenance. The location of traffic control equipment would need to be considered in relation to the portals, emergency services access points and preceding junctions.

11.2.10 Lane control signals would be installed to control the traffic in the tunnel. Variable mandatory speed limit signals may also be necessary. The distance between the signs and the combination of signs would be determined to meet safety and operational requirements.

11.2.11 Breakdowns, traffic collisions and other incidents may cause lane or single bore closure. In more extreme events such as vehicle fires, full tunnel closure of both bores would be necessary.

High and abnormal loads

11.2.12 The A303 within the study area is identified as a high load route option for vehicles with a maximum height of 6.1m and the tunnel would be suitable for normal height vehicles only. A maintained headroom clearance of 5.03m would be provided in the tunnel. This includes for typical buses, coaches and normal height HGVs. Requirements for heavy load route requirements are unknown at this stage.

11.2.13 It is proposed that a variation of the existing high load route option would divert high load vehicles north of the existing A303 and through the existing road network, as shown in Figure 11-1. The figure is indicative only and does not show the path through the proposed grade-separated junction to the west of the A360. There are no overbridges, underpasses, gantries or other forms of fixed overhead structures on the identified route option. The alternative provision is subject to approval by Highways England, the local authority and haulage industry review.

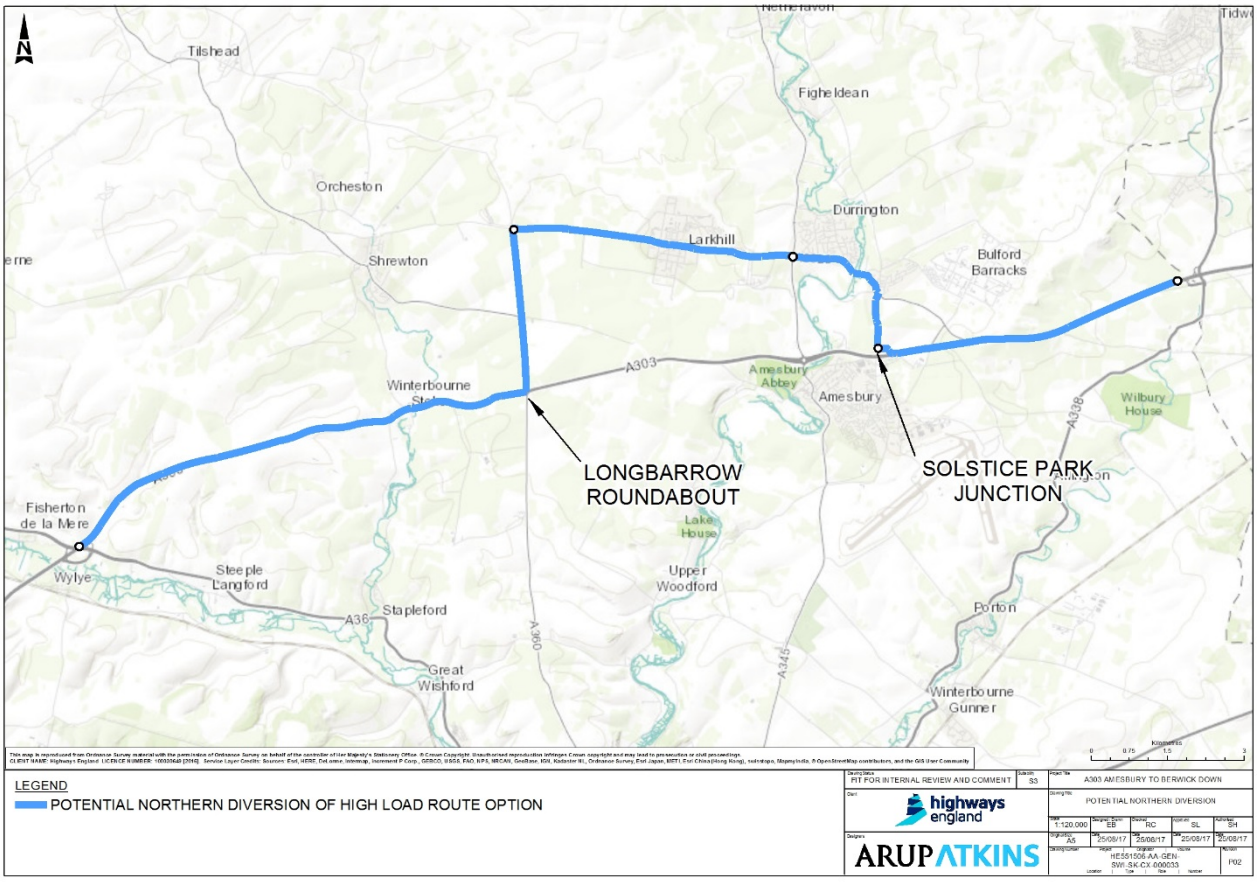


Figure 11-1 Potential northern diversion of high load route option

11.3 Driver Compliance

11.3.1 The layout of all route options is expected to have a net positive impact on driver compliance compared with the existing arrangement due primarily to the simplification of the carriageway design from a road user perspective. The use of

traffic signs would assist drivers to understand what to expect and what is expected of them once the new carriageway is commissioned.

11.3.2 A holistic approach was considered with regards to the tie-ins of all route options to the existing A303. It is expected that the carriageway design, in accordance with the upcoming Expressway standards, would ensure the operation phase behaviour would be as intuitive as possible for road users, to limit potential for driver non-compliance. Installation of Variable Mandatory Speed Limits (VMSL) would be considered at the next design stage.

11.4 Summary and Conclusions

11.4.1 The route options can all be developed to provide safe and economic operation and maintenance, with all having the same operational issue with no Variable Message Signs possible within the WHS.

11.4.2 There are minor geometric departures from standard applicable to all route options through the proposed A345 grade separated junction and at the eastern tie-in, although these are not considered to cause a significant concern at this stage. A detailed assessment of the application of the Expressway standard on the scheme would take place after its publication.

11.4.3 Design of the Preferred Route would develop in close consultation with the Overseeing Organisation, TOS and the Asset Management Team to optimise the operational characteristics of the scheme. A more detailed ‘Combined Operations' report would be prepared in the next stage in the design development.

12. Technology and Maintenance Assessment

12.1 Introduction

12.1.1 The A303 scheme is expected to adopt technology to support operational regimes which manage traffic and provide current information to drivers. Various technology equipment is expected to be required in accordance with the upcoming Expressway standard.

12.1.2 There are no known departures relating to the technology equipment on any of the proposed route options. A detailed assessment of the Expressway standard would take place after its publication. The tunnel component of Route Options D061 and D062 would be designed in accordance with the technology requirements of Road Tunnel Safety Regulations (RTSR) 2007 and Design Manual for Roads and Bridges (DMRB) BD 78/99. As with all route options, input from parties including the Highways England Tunnel Operations team would also be used to develop the design for operations and maintenance.

12.1.3 The route options would all introduce new maintainable assets requiring limited maintenance and repair in the short to medium term due to the design life of those assets.

12.1.4 These route options would be designed in accordance with the latest Design Manual for Roads and Bridges (DMRB) maintenance design standard, Interim Advice Note (IAN) 69/14, and the anticipated Expressway standard. There are no known departures relating to the maintenance and repair strategy for civil or technology assets on any of the proposed route options.

12.1.5 Additionally, the tunnel component would be designed in accordance with the maintenance requirements of Road Tunnel Safety Regulations (RTSR) 2007 and DMRB BD 78/99. As with all route options, input from parties including the Highways England Tunnel Operations team would be used to develop the maintenance design.

12.1.6 The route options would introduce additional maintenance associated with the tunnel. All route options propose the existing A303, where not forming part of the new scheme, to be downgraded from a trunk road, to either a Non-Motorised User (NMU) corridor with access only for the statutory authorities and local access, or to a local authority road from Amesbury for access to associated residential properties.

12.2 Option Design Implications of ITS Systems

12.2.1 A review of the technology assets to be installed would be undertaken on the Preferred Route at a later stage, with consideration of methods to enable simpler and faster repair or replacement of faulty equipment to reduce the time spent performing maintenance actions.

Surface sections of the Route Options

12.2.2 Emergency Refuge Areas (ERAs) would be located at defined centres along the route, co-located with technology devices to facilitate construction and maintenance access. Technology devices would be clustered at each ERA wherever practicable. The detailed layout and locations of ERAs and associated technologies would be considered in the next stage of scheme development. Where required, roadside support structures to mount technology equipment would be developed in consultation with the Overseeing Organisation and the Asset Management Team.

Tunnel

12.2.3 The technology necessary to meet the requirements of RTSR 2007 and DMRB BD 78/99, and to interface to the upcoming Expressway standards would comprise a range of traffic control and surveillance systems, and systems to support the safe operation of the tunnel.

12.2.4 At this stage in the scheme, it is assumed that a technology solution can be developed for the WHS that minimises landscape and visual impact. Compliance with design standards would be more accurately assessed at the next stage after selection of a Preferred Route, further development of a detailed highway geometric design and publication of the Expressway standard.

12.2.5 Plant rooms would be required to house power supply, control and communications equipment. Options for concealing or moving plant rooms to appropriate locations to alleviate landscape and visual impact would need to be considered.

12.2.6 Lighting would be provided inside the tunnel to minimise the risk of collisions and to manage the transition for road users between lighting conditions inside and outside of the tunnel. Mechanical ventilation, supported by air quality sensors and anemometers, would also be provided in order to maintain air quality for road users and road workers.

12.2.7 The tunnel lighting system would be connected to a controller system to adjust the lighting levels to suit the ambient outside light levels. The emergency lighting system would be connected to an Uninterruptible Power Supply (UPS) system to provide sufficient standby lighting in case of a power loss.

12.2.8 Tunnel fire safety provision would include fire detection, water supplies and, possibly, automatic suppression systems. Emergency points, equipped with ERTs and fire extinguishers, would be positioned in the tunnel as specified in RTSR 2007 and DMRB BD 78/99. Emergency exits within the tunnel would also be equipped with means of communication.

12.2.9 To control the traffic in the tunnel, lane control signals would be installed. Variable mandatory speed limit signals may also be necessary. The distance between the signs and the combination of signs would be determined to meet safety and operational requirements.

12.2.10 Automatic Incident Detection (AID) facilities would be installed to detect incidents on the road, such as stopped vehicles or debris. Traffic control systems (VMS and traffic signals) would assist in closing the tunnel during an incident.

12.2.11 Radio rebroadcast would be located throughout the tunnel to provide broadcast and mobile telephone capabilities for both the public and emergency services.

Regional Control Centre Systems and Sub-Systems

12.2.12 Technology equipment installed as part of the scheme would be integrated into the Highways England traffic management system, which is expected to utilise the Common Highways Agency Rijkswaterstaat Model (CHARM), and operated from a new or existing control centre such as the South West Regional Control Centre (SWRCC).

12.2.13 Control of tunnel plant and equipment would take place through a Plant Monitoring and Control System (PMCS) based on Supervisory Control And Data Acquisition (SCADA) principles. The system would monitor environmental conditions within the tunnel and the health of the equipment to determine automated responses under both normal and emergency conditions.

12.2.14 The combination of sensors would provide tunnel operators with a complete picture of conditions within the tunnel.

12.2.15 All plant within the tunnel would be capable of full remote monitoring and control from outside the tunnel, including resetting and restarting. This would avoid unplanned tunnel closures for minor issues. The control system would be configured so that it is resilient to faults. This would be achieved through providing dual control connections and power supplies.

12.3 Maintenance and Repair Strategy for Civils

12.3.1 The design of all route options would be undertaken with consideration of eliminating the need for future maintenance activities that would impose risks upon those that work on the highway.

12.3.2 Where the asset is deemed to be required and in accordance with IAN 69/14, civil engineering design principles would be considered where practicable to:

- Reduce the effort when maintaining i.e. avoid using hard to reach locations such as the underside of bridges for mounting point for maintainable assets such as lighting.
- Reduce the proximity of maintainers to hazards i.e. drainage to be designed to avoid locating manholes on running lanes or hard shoulders.
- Improve access i.e. walkways and ladders provided at structures.
- Improve management systems i.e. improve asset management standards to reduce site visits where possible by storing records of bolt types, fitting, lengths, etc.
- Provide safe and convenient diversion route options, where possible, such as the proposed northern diversion for high loads.

- Provide identifiers i.e. reduce time exposure to risk during maintenance by improved labelling of maintainable assets for rapid identification.
- Traffic management sub-group proposals i.e. Emergency Refuge Areas (ERAs) have been proposed which would double as safe pull-off areas for maintenance vehicles.
- Anti-theft/vandalism i.e. minimise triggers for maintenance by considering anti-graffiti coatings.

Surface sections

12.3.3 ERAs would be located at defined centres along the route, co-located with technology devices to facilitate construction and maintenance access. This would allow the maintaining organisation to set out nearside Temporary Traffic Management (TTM) signs from these ERA's to reduce risk of injury to maintenance personnel. The exact location and spacing of ERA's would be determined in the design development at a later design stage.

Tunnel

12.3.4 Tunnel maintenance would be subject to the provisions in RTSR 2007.

12.3.5 It is assumed that tunnel maintenance would be undertaken during the closure of one tunnel bore with contraflow in operation in the other bore. Tunnel closure for maintenance would take place on a cyclical basis only during night-time, quiet periods and excluding periods when more traffic than normal is expected.

12.3.6 The route diversion option in lieu of contraflow operations would operate along the identified high load route north of the A303 through the existing road network. Traffic management needs during tunnel maintenance is subject to further assessment.

12.4 Maintenance and Repair Strategy for Technology

12.4.1 As detailed in the Technology Assessment, technology assets within the scheme would be integrated into the Highways England traffic management system to be controlled from the Regional Control Centre (RCC). This would enable the appointed maintenance organisation to remotely access technology equipment, in coordination with the RCC, to minimise physical maintenance required on the Expressway.

Surface sections of route options

12.4.2 Any technology equipment introduced with the scheme would be clustered at standardised ERAs, where possible. This is expected to promote significant improvements in the maintenance of technology equipment on the surface route sections.

12.4.3 Maintenance Hardstand Areas (MHS) accessed via the ERA sites would facilitate maintenance vehicles to reverse to the back of the facility, parking on the hard standing with protection from an associated vehicle restraint system. Maintenance of the equipment would take place within the partially protected area without the need for TTM.

12.5 Summary and Conclusions

12.5.1 All route options can be progressed on the basis of integration of technology equipment, roadside support structures and communication network requirements. A large amount of technology is required due to requirements for safety, ventilation and lighting associated with the tunnel. The provision of technology devices on the approaches to the tunnel within the WHS would be very difficult to implement with the impact on the critical heritage landscape.

12.5.2 Detailed assessment of the technology integration into the Highways England traffic management system and Regional Control Centre (RCC) would be required with design development after the selection of a Preferred Route option.

12.5.3 Design development of the Preferred Route would require close consultation with the Overseeing Organisation and the Operations Directorate (OD) Senior User to optimise the adoption of technology. A more detailed 'RCC Technology and Capacity Implications Report' would be prepared for the selected Preferred Route option in later stages of the design development.

12.5.4 All three route options could implement the maintenance requirements for an Expressway based on DMRB IAN 69/14, and the anticipated Expressway standards. The options can all be developed to provide safe and suitable access to all maintainable assets on the new network, resulting in reduced health, safety and welfare risks.

12.5.5 There is no significant differentiation of maintenance between the options.

12.5.6 The tunnel maintenance would require bore closure outside of peak times using contraflow in the alternate bore or diversion via an alternative route through the existing road network. This tunnel maintenance procedure is considered routine.

12.5.7 The network occupancy periods for maintenance and quantity of maintenance procedures is expected to be minimised, reducing the exposure of workers to the hazards associated with working adjacent to live traffic.

12.5.8 A more detailed maintenance and repair strategy statement would be prepared in accordance with IAN 69/14 for the selected Preferred Route in the next stage of design development.

13. Environmental Assessment and Design

13.1 Introduction

13.1.1 The purpose of the Environmental Assessment and Design section is to assess:

- The impact of the route options on noise, air quality, greenhouse gases, landscape, townscape, historic environment, biodiversity, water environment, and people and communities;
- The relative environmental performance of the alternatives considered;
- The relative performance of the alternatives in achieving the scheme's Environmental Objectives; and
- The mitigation strategy and general approach to environmental design of the preferred option.

13.2 Assessment Methodology

General Approach

13.2.1 The SAR provides a comparison of the route options informed by both a full WebTAG appraisal of each option and a more detailed comparison of the impacts of key options based on DMRB Guidance to inform the process, focussing on those environmental aspects and locations where the potential impacts of options 1Na, 1Sa and 1Nd are likely to differ.

13.2.2 In order to draw out key differences and inform the selection of a Preferred Route option, this comparative assessment principally focuses on the potential environmental impacts resulting from the route section between the western tie-in with the existing A303 and the western tunnel portal. Between the western tunnel portal and the eastern tie-in with the existing A303 the three route options are broadly the same.

13.2.3 Environmental topics have been considered using the baseline information available at this stage and the defined methods, or refinements of those methods, to allow for a meaningful distinction to be drawn between options, and these topic areas therefore represent key factors in determining the selection of a preferred option. These topics are: Landscape and Visual; Biodiversity; Air Quality; Noise; Water Environment; and People and Communities. The Heritage topic is the subject of a separate Historic Environment Assessment (HEA) included in Appendix E, which has informed route selection as documented within the SAR. At Project Control Framework (PCF) Stage 2, this stage, the limitations of the available data identified as part of the assessment process are described topic by topic below.

13.2.4 The appraisal methodology for environmental factors is described in TAG Unit A3, Environmental Impact Appraisal (Department for Transport, 2015). The findings of this appraisal process are summarised under the Environmental Objective of the Appraisal Summary Tables (AST) included in Chapter 16 of this report and

presents the results of a transport scheme appraisal as part of the Value for Money business case based on quantitative and qualitative assessment.

Noise

13.2.5 Noise impacts were appraised following the guidance presented in Department for Transport TAG Unit A3, Chapter 2. A methodology for calculating noise impacts from road traffic is set out in the Calculation of Road Traffic Noise (DoT, 1998). Guidance on quantifying these is also provided in Design Manual for Roads and Bridges (DMRB) Volume 11.3.7

13.2.6 The noise study area was defined using the principles of DMRB Volume 11.3.7 to identify an appropriate study area. The noise modelling has taken into account full 3D terrain and alignment information. The assessment has been carried out in the absence of mitigation, with the exception of a low road noise surface, which has been assumed for all options (including the scenario where no scheme is put in place).

13.2.7 As per WebTAG guidance, the quantitative input shows the estimated numbers of households facing increases and decreases in noise levels as a result of the scheme in the last forecast year (i.e. 2041, which is the Design year, 15 years after opening). In addition, a value was given to the change in noise (either benefit or disbenefit) which was calculated based on the valuation of impacts on sleep disturbance, amenity, stroke, dementia and AMI (acute myocardial infarctions).

13.2.8 The monetised value has been calculated using the Department for Transport WebTAG assessment methodology (2016) to calculate the Net Present Value (NPV). WebTAG assigns a monetary value to the likely health effects and loss of amenity, based on the number of households affected and the change in noise level at these properties. Properties that would experience low levels of noise or low levels of noise change are not reported as either having a benefit or dis-benefit.

Air Quality

13.2.9 Local air quality impacts were assessed following the guidance presented in TAG Unit A Chapter 3. The air quality study area for the assessment was determined using the local air quality assessment criteria for affected roads given in DMRB Volume 11, Section 3, Part 1, HA 207/07. Pollutant concentrations at receptors sensitive to changes in local air quality were calculated within 200m of road links included in the study area for both the with and without scheme scenarios for an opening year (2026) and forecast year (2041).

13.2.10 Pollutant concentrations at prescribed distances from affected roads were calculated using the Draft DMRB screening method (2017 DMRB v5). This method uses speed banded emission factors derived from Defra's Emission Factors Toolkit (v7.0) as described in Highway England's Interim Advice Note 185/15. Vehicle emission factors are available within the DMRB screening method up to 2030 only and therefore were held at 2030 levels for the forecast year (2041). This limitation is considered conservative, given that vehicle emissions are expected to improve further with time and is consistent with industry practice for Highways England assessments.

13.2.11 Traffic data used in this Stage 2 assessment were taken from an updated version of the regional traffic model (SWRTM).

13.2.12 Road sources included in the traffic model were explicitly modelled using the DMRB air quality screening method. The tool required input of traffic flow, composition and speed data as well as the road width and road to receptor distances.

13.2.13 Traffic data can be input in to the DMRB air quality screening tool in a number of formats. For PCF Stage 2 Option Identification, traffic data were input as average LDV and HDV flows for the AM (07:00 – 10:00), IP (10:00 – 16:00), PM (16:00 – 19:00) and OP (19:00 – 07:00) periods:

- Speeds are input as a speed category. This category was determined in accordance with Interim Advice Note (IAN) 185/15 on speed banding, based on average speeds during each period.
- Corresponding NOx and PM10 rates based on the speed category were used.
- Road widths were assumed as a standard 3.65 metres per lane, with the number of lanes determined from aerial photography/project Geographic Information System (GIS) and scheme drawings.
- Road to receptor distances were determined from the project GIS data.

13.2.14 The approach to speed banding was based on the approach typically used in PCF Stage 2 studies. The approach used therefore included: comparison of observed and modelled vehicle speeds; speed pivoting (the method for correcting modelled speeds to more closely match observed speeds); and 'infilling' (applying the speed pivoting where observed vehicle speeds are not available).

13.2.15 The total number of properties across the study area modelled to experience an improvement or deterioration in particulate matter (PM10) or nitrogen dioxide concentrations (NO2) were calculated, based on the number of properties within defined distance bands up to 200m from affected roads. These are presented in the Appraisal Summary Tables and local air quality worksheets. The change in emissions of oxides of nitrogen (NOx) as a result of each option has also been calculated for the opening (2026) and forecast (2041) year.

13.2.16 The change in NOx emissions and the assessment score for PM10 concentrations were used to determine a Net Present Value (£) for local air quality for each option assessed.

Greenhouse gases

13.2.17 Changes in greenhouse gas emissions were assessed for each option following the guidance presented in TAG Unit A Chapter 4. The study area for the assessment was determined using the local air quality assessment criteria for affected roads given in DMRB Volume 11, Section 3, Part 1, HA 207/07, in line with TAG guidance (section 3.3.3) which states that the criteria for regional assessment set out in DMRB 11.3.1 may be used, but it may be more efficient to use the criteria used for the local air quality analysis.

13.2.18 Total CO2 emissions for all road links included in the study area were calculated for the 'with' and 'without' scheme scenarios for all options for an opening (2026), forecast (2041) and future (2051) year. Emissions were calculated using the Draft DMRB screening method (2015 DMRB v5) which includes emission rates derived from Defra's Emission Factors Toolkit (v7.0) as described in Highways England Interim Advice Note 185/15. As discussed above, emission rates are provided up to 2030 only, therefore emission rates were held at 2030 levels for the forecast (2041) and future (2051) years assessed.

13.2.19 The change in CO2 emissions as a result of the scheme options was calculated for every year over the 60-year appraisal period. A linear interpolation was applied to the change between the opening and forecast year and forecast and future year to provide the yearly change in emissions in both with and without scheme scenarios. CO2 emissions were held constant for 2051 onwards due to uncertainties regarding future traffic growth beyond this point.

Landscape

13.2.20 Impacts on landscape were appraised following the methodology guidance presented in TAG Unit A3, Chapters 5 and 6. Additional assessment work was also carried out to further appraise the three route options and examine potential impacts and effect in more detail. This gave the opportunity to assess further the potential visual effects as it has become clear during the assessment process that this is a key differentiator between the three options.

13.2.21 The further assessment work was carried out following the DMRB 2010 guidance on Landscape and Visual Effects Assessment of highways projects contained in IAN 135/10. Due to the scale of the proposals and the sensitive nature of the receptors, the assessment followed the methodology for a 'detailed assessment.' As IAN 135/10 is based on the now superseded 2002 Guidelines for Landscape and Visual Impact Assessment (GLVIA2); the principles of the 2013 Guidelines for Landscape and Visual Impact Assessment (GLVIA3) were also considered as this captures more recent best practice. The approach also had regard to the updated guidance on more effective, proportionate and efficient Environmental Assessment of highways projects provided in IAN 125/15.

13.2.22 The study area covered the general extent of the anticipated 'Zone of Theoretical Visibility' (ZTV) of the route options within a 4km wide corridor (2km offset from centre line). This study area comprises largely open agricultural land with occasional woodland blocks and hedgerows and small settlements as well as the larger town of Amesbury. Beyond this study area it was considered that any views towards the proposal would be unlikely to result in significant impacts due to the scale and massing of the proposal.

13.2.23 The assessment considered each route option based on its engineering design and alignment and considered the impacts as at year one of opening. This approach was undertaken due to the absence of a formal mitigation strategy at this stage of scheme development and to enable the comparison of the impacts of each route as a result of their physical presence in the landscape. The WebTAG worksheets do however provide a commentary on the potential for mitigation and the effect that this may have on the magnitude of impact.

13.2.24 The visual analysis was informed by a preliminary site survey and desk study using ZTV plans. The ZTV plans were prepared using superseded route alignments that differ slightly from those assessed within this report. They have therefore been used in combination with the study of landform, aerial and "street view" images and knowledge gained from site visits. This process allowed judgements to be made regarding the likely impacts that each route option would have on visual amenity of the various receptor groups.

Townscape

13.2.25 Impacts on townscape were appraised following the methodology guidance presented in TAG Unit A3, Chapters 5 and 7.

13.2.26 The study area covered the general extent of the anticipated ZTV of the route options within a 4km wide corridor comprising largely open agricultural land and woodland blocks and small settlements as well as larger settlements: Larkhill, Bulford and the town of Amesbury. Beyond this study area it was considered that any views towards the proposal would be unlikely to result in significant impacts.

13.2.27 The assessment considered each route option based on its engineering design and alignment and the impacts at year one of opening. This approach was undertaken due to the absence of a formal mitigation strategy and considered the comparison of the impacts of each route as a result of their physical presence.

Historic Environment

13.2.28 Impacts on the historic environment were appraised following the methodology guidance presented in TAG Unit A3, Chapter 8. The appraisal also followed guidance in DMRB Volume 11, Section 1, Part 1 (HA 200/08), in DMRB Volume 11, Section 2, Chapter 4 (HA 204/08) and in Interim Advice Note 125/1.

13.2.29 The assessment was also informed by an assessment of the impact of the route options on the Outstanding Universal Value of the WHS, undertaken using the "Guidance on Heritage Impact Assessments for Cultural World Heritage Properties" published by ICOMOS in January 2011. The assessment was also informed by consideration of the policy requirements of NPSNN (2015).

13.2.30 The assessment considered both physical and setting impacts on the known historic environment resource within the study areas. The assessment of setting and impacts on setting reflected the guidance set out in The Setting of Heritage Assets, Historic Environment Good Practice Advice in Planning: 3 (Historic England 2015).

13.2.31 The advice in section 5.3.19 and 5.3.20 of TAG Unit A3 has been taken into account when developing the overall assessment score for the historic environment. Given the complex mix of beneficial and adverse impacts a balancing approach to adverse and beneficial effects has been taken (which is one of the three approaches available in TAG UNIT A3) with the benefits for the setting and significance of numerous historic environment assets being balanced against the adverse impacts on similar attributes for other historic environment assets. The impacts have been considered on an asset-by-asset basis, including the WHS

as an asset in its own right, in Appendix E of this report; this provides sufficient detail to meet the requirements of TAG Unit A3.

13.2.32 Additionally, when undertaking the balance, the relative importance of the assets has also been weighed into the balance; this reflects guidance in NPSNN which states that "*When considering the impact of a proposed development on the significance of a designated heritage asset, the Secretary of State should give great weight to the asset's conservation. The more important the asset, the greater the weight should be.*" Finally, the scale of benefits and adverse impacts means that balancing has occurred in relation to major and moderate adverse impacts (as per DMRB terminology) this reflects the exceptional / unique nature of the scheme and its objectives in relation to cultural heritage.

13.2.33 The study area was split into two for the purpose of the assessment:

- 1.5km either side of the proposed route centre line for all designated heritage assets; and
- 250m either side of the proposed route centre line for all non-designated assets.

Biodiversity

13.2.34 Impacts on biodiversity were appraised following the methodology guidance presented in TAG Unit A3, Chapter 9. It followed guidance in DMRB Volume 11, Section 3, Part 4 (Ecology and Nature Conservation) and IAN 103/10. These guidelines set out a process of identifying the value of ecological resources and then characterising the predicted impacts.

13.2.35 The working assumptions included a working area 75m either side of the centre line of the route options (i.e. a 150m total width for each route option). The study area varied depending on the receptors considered, e.g. 2km for internationally designated sites, 1km for national sites and 500m for local sites and priority habitats. This distance was extended where hydrological links were present or where other potential impact pathways occur.

13.2.36 Additional comparative assessment on ecological receptors and on European Designated Sites follows guidance provided in Section 3, Part 4 (HA, 1993) and Section 4, Part 1 (HA, 2009) respectively of Volume 11 of the Design Manual for Road and Bridges (DMRB).

13.2.37 At this stage the appraisal is primarily qualitative, based on a Phase 1 Habitat Survey, protected species records and informed by professional judgement. Where available, the results of detailed ecological surveys have been taken into account. Such surveys would typically be conducted once a Preferred Route has been determined but are taking place now to minimise future risk.

Water Environment

13.2.38 Impacts on the water environment were appraised following the methodology guidance presented in TAG Unit A3, Chapter 10. The WebTAG methodology provided a qualitative assessment that used professional judgment in the absence of specific quantitative data which was not available at this stage of route selection.

13.2.39 The data was also set against both EU and UK legislative and regulatory policies that govern the water environment.

13.2.40 The spatial scope of the assessment included as a minimum, features of the water environment within 1km of each of the route options. A 3.5 km study area was applied around potential dewatering locations.

People and Communities

13.2.41 The WebTAG-based Social Assessment sub-topics: Physical Activity, Journey Quality, Accessibility (Access to Services) and Severance are dealt with in Chapter 14. Further consideration of people and community aspects of highway schemes is covered under environmental assessment (DMRB topic People and Communities IAN 125/15), capturing a broader range of topics and employing slightly different methodologies when compared to WebTAG. Accordingly, a comparative analysis of Options 1Na, 1Nd and 1Sa, in terms of their impacts on people and communities, is recorded here.

13.2.42 The study area for the comparative analysis stretches from the western tunnel portal to the western section tie in as this is the area where the route option impacts differ. For the People and Communities topic the following potential land use, severance and amenity effects, which aid understanding of differences between the options, have been identified in the study area:

- Farm Viability.
- Loss of Best and Most Versatile (BMV) agricultural land.
- Community severance between Winterbourne Stoke and Berwick St James associated with the provision of the new A303.
- Changes in community severance and amenity arising from redistribution of traffic on the affected road network.
- Direct (loss and severance) and indirect (amenity) impacts on, public rights of way (PRoW).

13.2.43 Overall the effect of each of the options on Motorised Travellers is beneficial. As there is no differentiation between the options, these receptors have been excluded from the comparative assessment.

13.2.44 The assessment undertaken uses a methodology guided by the Design Manual for Roads and Bridges (DMRB) Volume 11 and Interim Advice Note (IAN) 125/15 Environmental Assessment Update. Given the absence of quantitative data on usage levels of PRoW and uncertainty regarding mitigation measures at crossing points, the DMRB approach has been modified accordingly.

13.2.45 Due to the current transitional stage of the DMRB, it combines the NMU component of DMRB 11.3.8 - Pedestrians, Cyclists, Equestrians and Community Effects, and DMRB 11.3.9 - Vehicle Travellers, DMRB 11.3.6 for Land Use (DMRB 11.3.6) and the Community Effects component of DMRB 11.3.8 (Pedestrians, Cyclists, Equestrians and Community Effects) in accordance with IAN 125/15.

13.2.46 The assessment incorporates data and information from public consultation and from the engagement with non-motorised user stakeholders including officers at Wiltshire Council.

13.2.47 The assessment of PRoW and community severance uses the most up to date traffic model.

13.2.48 For changes in journey lengths and travel patterns experienced by pedestrians, cyclists and equestrians a qualitative assessment has been undertaken using a three-point scale as follows:

- Neutral - no significant increase or decrease in journey length and/or travel patterns and no increase or decrease in opportunities for NMUs to access the wider network.
- Beneficial - significant decrease in journey length and/or travel patterns and increased opportunities for NMUs to access the wider network.
- Adverse - significant increase in journey length and/or travel patterns and decreased opportunities for NMUs to access the wider network.

13.2.49 In assessing amenity, a descriptive approach has been used which has given an overall indication of the change i.e. positive, negative or no change, in the amenity of the receptor.

13.2.50 There is no nationally recognised set of criteria for assessing the impact of infrastructure schemes on rural businesses and so a bespoke set has been developed to reflect the issues significant to this project. All impacts are considered to be adverse and are assessed on a three-point scale of slight, moderate and large as follows:

- Large adverse – Disruption to farms along a corridor >20 km.
- Moderate adverse – Disruption to farms along a corridor >8 km.
- Slight adverse – Disruption to farms along a corridor <8 km.

13.2.51 The agricultural assessment is based on desk study information using satellite and drone imagery collected in 2016 and by reference to published maps and reports.

13.2.52 The assumptions and limitations of the assessment are as follows:

- Where existing NMU routes are severed by the proposed alignment, connectivity would be maintained, although it remains uncertain at this stage whether connectivity would be maintained through the provision of bridges, tunnels or diversions.
- The assessment of impacts on public rights of way is based on desk study information and engagement with rights of way stakeholders. No primary user surveys have been undertaken.
- Access would be provided to parcels of severed agricultural land that are suitable in size and shape for farming.

13.3 Assessment Results

13.3.1 As described in Section 13.2, Assessment Methodology, the three route options were assessed against all WebTAG environment criteria, with the assessment findings described below and reported within the AST in Chapter 16. Additional comparative assessment to further inform the selection process is referred to, as relevant, in the topic sections below.

Noise

Table 13-1 Route options noise assessment

Methodology		1Na	1Nd	1Sa
Appraisal (WebTAG)	Net present value (NPV) of change in noise (£)	-£1,032k	-£358k	£762k (benefit)
	Households with increased daytime noise increase (2041):	545	763	597
	Households with reduced daytime noise (2041):	315	269	401

Route Comparison

13.3.2 The assessment indicated that there were nominal differences between the options in the monetary value (NPV) assigned to health effects and loss of amenity, based on the number of households affected and the change in calculated noise level at these residential properties in the last forecast year (i.e. 2041, which is the Design year, 15 years after opening). The overall results reflect the balance of calculated noise increases and decreases in Amesbury and Winterbourne Stoke. The calculations were undertaken on the basis of an assumed A303 flyover at Countess Roundabout and on either a southern or northern bypass of Winterbourne Stoke passing across the Till valley on a new viaduct, with corresponding traffic assignments for each option.

13.3.3 Option 1NA as modelled (with the new A360 junction to the west of Longbarrow) had fewer households experiencing noise increases than Options 1Nd and 1Sa. However, there were more properties experiencing higher increases in noise levels than the other two options, and conversely fewer properties experiencing a large decrease in noise levels. As a result, on the basis of the current WebTAG assessment in Table 13-1, Option 1Na had the worst NPV of all options.

13.3.4 Option 1Sa as modelled (with the new A360 junction adjacent to the existing road) resulted in generally lower traffic volumes on local roads than Options 1Na and 1Nd. This resulted in the largest number of households with reduced daytime noise levels of any option. Also, the majority of noise increases were small, and noise decreases larger than for other options. As a result, on the basis of the current WebTAG assessment in Table 13-1, Option 1Sa had the best NPV of all options.

13.3.5 Option 1Nd as modelled (with the new A360 junction to the west of Longbarrow, as with Option 1Na), with a marginally shorter journey time along the A303 (with its shorter length than Options 1Na and 1Sa), resulted in slightly higher forecast traffic volumes along some local roads through Amesbury providing access to the A303. This led to the calculations indicating more households experiencing noise increases and fewer households experiencing noise decreases than option 1Na. However, Option 1Nd performed better than Option 1Na in NPV terms as more of the noise increases were comparisons with low levels of existing road noise and more of the decreases were comparisons with high existing noise levels. As a result, on the basis of the current WebTAG assessment in Table 13-1, Option 1Nd had a higher NPV than Option 1Na, but a lower NPV than Option 1Sa.

13.3.6 When considering noise impacts, it is important to note that the lower monetary value (NPV) calculated for Options 1Na and 1Nd resulted largely from higher forecast traffic volumes on local roads. The assumed location of the A360 junction, some way to the west of Longbarrow, for the northern options was a key factor in assigning local traffic movements, and a junction located closer to the A360 is likely to keep traffic on the A360 and thereby deliver greater noise benefits. At this stage in the process there is still scope for the junction location and layout to evolve, and for other traffic management measures to be incorporated at the next stage of the design. Therefore, the noise impacts that have resulted from local traffic flow forecasts , associated with the A360 junction location that is subject to change, should be treated with caution.

13.3.7 It is also important to note that only Option 1Sa would bring A303 traffic closer to households away from the existing road network, causing adverse noise impacts.

13.3.8 For noise impacts within the World Heritage Site, the benefits of placing the road in a tunnel would be similar for each option. When considering prevailing wind conditions qualitatively, Option 1Nd would also have the lowest noise impact for Normanton Gorse and byway 12.

Air Quality

Table 13-2 Route options air quality assessment

Methodology	1Na	1Nd	1Sa
Appraisal (WebTAG)	Local Air Quality Assessment Score: PM_{10}: -48.3 NO_2: -168 Regional Emissions (Over 60 year appraisal period) NOx: +1,578 tonnes	Local Air Quality Assessment Score: PM_{10}: -63.70 NO_2: -185.70 Regional Emissions (Over 60 year appraisal period) NOx: +1,606 tonnes	Local Air Quality Assessment Score: PM_{10}: -91.40 NO_2: -269.20 Regional Emissions (Over 60 year appraisal period) NOx: +1,669 tonnes
	Monetary £(NPV) PM_{10} NPV: +196,000	Monetary £(NPV) PM_{10} NPV: +271,000	Monetary £(NPV) PM_{10} NPV: +322,000

Methodology	1Na	1Nd	1Sa
	NO_X NPV: -800,000 Total value of change in air quality: -604, 000	NO_X NPV: -813,000 Total value of change in air quality: -543,000	NO_X NPV: -847,000 Total value of change in air quality: -525,000

Route Option 1Na

13.3.9 The nearest Air Quality Management Areas (AQMAs) to the Scheme are those in Salisbury, approximately 11 km south of Option 1Na. There are unlikely to be any new exceedances based on assessments undertaken as part of PCF Stage 1. Option 1Na would change air quality at receptors in year of opening 2026 for NO2/PM10 by: improving 2,490/1,410, worsening 1,350/1,358, no change at 1,039/2,121 receptors. Overall there would be a net improvement in local air quality with the scheme (for PM10 and NO2) as a result of the realignment of the A303 away from sensitive receptors. There would be a negative impact on regional emissions for NOx due to the combination of increases in modelled AADT and HDV flows and the overall link distance travelled across the Affected Road Network compared with the 'do minimum'.

Route Option 1Nd

13.3.10 The nearest Air Quality Management Areas (AQMAs) to the Scheme are those in Salisbury, approximately 11 km south of Option 1Nd. There are unlikely to be any new exceedances based on assessments undertaken as part of PCF Stage 1. Option 1Nd would change air quality at receptors in year of opening 2026 for NO2/PM10 by: improving 2,804/1,367, worsening 1,397/1,076, no change at 679/2,439 receptors. As with Option 1Na, there would be a net improvement in local air quality (for PM10 and NO2) and a negative impact on regional emissions for NOx.

Route Option 1Sa

13.3.11 The nearest Air Quality Management Areas (AQMAs) to the Scheme are those in Salisbury, approximately 11 km south of Option 1Sa. There are unlikely to be any new exceedances based on assessments undertaken as part of PCF Stage 1. Option 1Sa would change air quality at receptors in year of opening 2026 for NO2/PM10 by: improving 3,339/2,332, worsening 1,525/1,038, no change at 15/1,509 receptors. As with Options 1Na and 1Nd, there would be a net improvement in local air quality (for PM10 and NO2) and a negative impact on regional emissions for NOx.

Route Comparison

13.3.12 Air quality is not a differentiator for choosing between options that take the bypass of Winterbourne Stoke to the north or south. This is because:

- For human health receptors - there are no modelled exceedances of the annual mean NO2 AQO either with or without the scheme, and local monitoring shows concentrations well below the objective. Only receptors predicted to exceed NO2 AQO are used in determining significance, so by

definition the impact of any bypass option would be “no significant adverse effect”.

- For designated ecological sites - there are no modelled exceedances of the vegetation AQO for NOx, by at least one standard deviation. Only receptors predicted to exceed NOx AQO are used in determining significance, so by definition the impact of any bypass option would be “no significant adverse effect”.
- For designated ecological sites – the nitrogen deposition rate exceeds the site relevant Critical Load now and in the future, with or without the Scheme. There would be a noticeable increase in deposition at the River Till SSSI with the Scheme at its closest point, but there would be no difference in this impact between route options. At the Parsonage Down SSSI there would be no significant change with the northern bypass (the Parsonage Down SSSI is not a relevant receptor for the southern bypass option). On this basis, the effect on designated ecological sites from nitrogen deposition is not a differentiator between the options.

Greenhouse gases

Table 13-3 Route options greenhouse gas assessment

Methodology	1Na	1Nd	1Sa
Appraisal (WebTAG)	Change in non-traded carbon over 60y (CO2e) 1,676, 541	Change in non-traded carbon over 60y (CO2e) 1,667,427	Change in non-traded carbon over 60y (CO2e) 1,732,525
	Monetary £(NPV) -75,514,628	Monetary £(NPV) -75,115,691	Monetary £(NPV) -78,006,285

13.3.13 The change in non-traded carbon dioxide emissions in the opening year 2026 would be 20,584 tCO2e, for Option 1Na, 20,993 tCO2e for Option 1Nd and 22,603 tCO2e for Option1Sa.

13.3.14 The TAG greenhouse gas assessment was completed to calculate the final Net Present Value of each route option over the 60-year appraisal period. The results show that over the 60-year period there would be relatively little difference between the route options, albeit that Option 1Nd would perform slightly better than Option 1Na, while Option 1Sa comes out worst overall.

13.3.15 The large difference in estimated CO2 emissions between PCF Stage 1, reported in the TAR, and Stage 2 reflects that the PCF Stage 2 traffic model (a) estimates a larger change in Vehicle Km (VKM) travelled (and hence larger CO2 emissions) in the air quality study area and (b) contains traffic growth forecasts extending a further 10 years to 2051, beyond the previous cut-off year of 2041.

13.3.16 The differences in VKM and CO2 emissions are primarily due to much larger changes in AADT flows on the A303 between PCF Stage 1 and Stage 2 (e.g. west of scheme +8,500 at Stage1 but +11,000 at PCF Stage 2; and east of scheme +3,500 at PCF Stage 1 but >+10,000 at PCF Stage 2).

Landscape

Table 13-4 Route options landscape assessment

Methodology	1Na	1Nd	1Sa
Appraisal (WebTAG)	Moderate adverse	Moderate adverse	Moderate adverse
Further comparative assessment	Ranking: 2 Same number of residential receptors affected as Option 1Nd. More other visual receptor groups significantly adversely affected than Option 1Nd but fewer than Option 1Sa. Large adverse effect on landscape pattern and landcover. Significant beneficial effects on the visual amenity of receptors visiting the open access areas across the Stonehenge landscape and Stonehenge itself. The removal of traffic would also re-establish some of the historic landscape pattern, improve tranquillity and reconnect the wider WHS landscape with Stonehenge.	Ranking: 1 Same number of residential receptors affected as Option 1Na. Fewer other visual receptor groups significantly adversely affected than Options 1Na or 1Sa Moderate adverse effect on landscape pattern and landcover. Significant beneficial effects on the visual amenity of receptors visiting the open access areas across the Stonehenge landscape and Stonehenge itself. The removal of traffic would also re-establish some of the historic landscape pattern, improve tranquillity and reconnect the wider WHS landscape with Stonehenge.	Ranking: 3 Notably greater number of residential receptors affected than Option 1Na. Greater number of other visual receptor groups significantly adversely affected than Options 1Na or 1Nd. Large adverse effect on landscape pattern and landcover. Significant beneficial effects on the visual amenity of receptors visiting the open access areas across the Stonehenge landscape and Stonehenge itself. The removal of traffic would also re-establish some of the historic landscape pattern, improve tranquillity and reconnect the wider WHS landscape with Stonehenge.

13.3.17 On the basis of WebTAG, the appraisal indicated that all options would result in similar types of impacts, due to comparable levels of effects on the same landscape resources. In this context, a Moderate Adverse WebTAG score was recorded for landscape.

13.3.18 Further comparative assessment was carried out in order to provide more differentiation between the options, as described in the methodology section above. The results are set out below.

Route Option 1Na

13.3.19 This route option would result in a range of Neutral to Moderate Adverse effects on landscape character along its length. An overall assessment of Moderate Adverse was assigned as a result of those impacts identified for the Tilshead Chalk Downland, Till Narrow Chalk River Valley and Larkhill Chalk Downland Landscape Character Areas (LCA). Key impacts are described briefly below.

13.3.20 Within the Tilshead Chalk Downland, Till Valley and Larkhill Chalk Downland LCA there would be moderate to large adverse impacts on the landscape pattern as a result of the landform being altered by earthworks around the tunnel entrance and associated with the substantial cuttings and embankments, river crossing (Viaduct) and by the introduction of a new dual carriageway into a rural landscape. The greatest adverse effects on landscape pattern would occur across the Larkhill Downland LCA as a result of the very substantial cutting that breaks through the ridgeline to the west of the A360 near to the high point of Oatlands Hill.

13.3.21 Beyond the tunnel entrance to the west, Option 1Na would create a decrease in tranquillity, reducing the quality of visual amenity and adversely affecting the scale and pattern of the landscape experienced by visual receptors. Tranquillity and visual amenity would be adversely affected primarily because of the visibility of the grade separated junction with the A303, the elevated offline section to the north of Winterbourne Stoke through the Till Narrow Chalk River Valley LCA (Moderate Adverse), the sections on a high embankment across the Tilshead Chalk Downland LCA (Slight Adverse) and the elevated section of the Scheme across the Countess Roundabout within the Avon Valley (Slight Adverse). The location of substantial lengths of Option 1Na within deep cuttings would reduce adverse impacts on tranquillity for surrounding areas but would have resultant adverse effects on landscape pattern and character. Overall there would be Slight Beneficial impacts on tranquillity for the Larkhill Chalk Downland LCA due to the removal of traffic from the landscape into deep cutting and tunnel sections. There would also be parallel benefits for cultural aspects due to the visual and physical reconnection of Stonehenge with the wider WHS area.

13.3.22 There would be a range of Neutral to Slight Adverse impacts on landcover. The landscape of the study area that would be directly affected by Option 1Na is dominated by large, open agricultural fields, there would be minimal impacts as a result of the loss of some hedgerows, riverside trees and woodland.

Route Option 1Nd

13.3.23 This route option would result in a range of Neutral to Moderate Adverse effects on landscape character along its length. An overall assessment of Moderate Adverse was assigned because of those impacts identified for the Tilshead Chalk Downland, Till Narrow Chalk River Valley and Larkhill Chalk Downland Landscape Character Areas (LCA). Key impacts are described briefly below.

13.3.24 Within the Tilshead Chalk Downland, Till Valley and Larkhill Chalk Downland LCA there would be Moderate Adverse impacts on the landscape pattern as a result of the landform being altered by earthworks around the tunnel entrance and associated with cuttings, embankments and river crossing. This route option would however sit more sensitively in the landscape, with lesser adverse impacts

than the other two route options. Cuttings and embankments would generally be of a smaller scale, with the horizontal and vertical alignments more sensitively aligned with the baseline landscape pattern. Additionally, the horizontal alignment within the Larkhill Chalk Downland LCA would lie relatively close to the existing A303; the baseline pattern and character of this landscape is therefore already defined by a busy highway corridor.

13.3.25 Beyond the tunnel entrance to the west, Option 1Nd would create a decrease in tranquillity, reducing the quality of visual amenity and adversely affecting the scale and pattern of the landscape as experienced by visual receptors. Tranquillity and visual amenity is adversely affected primarily because of the elevated offline section to the north of Winterbourne Stoke through the Till Narrow Chalk River Valley LCA (Moderate Adverse), the sections on a high embankment across the Tilshead Chalk Downland LCA (Slight Adverse) and the elevated section of the scheme across the Countess Roundabout within the Avon Valley LCA (Slight Adverse). The location of substantial lengths of this route option within cuttings would reduce adverse impacts on tranquillity for surrounding areas but would have resultant adverse effects on landscape pattern and character. Overall there would be Slight Beneficial impacts on tranquillity for the Larkhill Chalk Downland LCA to the east of the A360 due to the removal of traffic from the landscape into cutting and tunnel sections. There would also be parallel benefits for cultural aspects due to the visual and physical reconnection of Stonehenge with the wider WHS.

13.3.26 There would be mainly Neutral impacts on landcover as a result of 1Nd. The landscape of the study area that would be directly affected by this route option is dominated by large, open agricultural fields, there would be minimal impacts as a result of the loss of some hedgerows, riverside trees and woodland.

Route Option 1Sa

13.3.27 This route option would result in a range of Neutral to Moderate Adverse effects on landscape character along its length. An overall assessment of Moderate Adverse was assigned as a result of those impacts identified for the Tilshead Chalk Downland, Till Narrow Chalk River Valley and Larkhill Chalk Downland Landscape Character Areas (LCA). Key impacts are described briefly below.

13.3.28 Within the Tilshead Chalk Downland, Till Valley and Larkhill Chalk Downland LCA there would be Moderate to Large Adverse impacts on the landscape pattern as a result of the landform being altered by earthworks around the tunnel entrance and associated with the substantial cuttings and embankments and viaducts and by the introduction of a new dual carriageway into a rural landscape. The greatest adverse effects on landscape pattern would occur within the Till Valley as a result of the very substantial embankment and river crossing (viaduct) that would cross and bisects the valley floor.

13.3.29 Beyond the tunnel entrance to the west, Option 1Sa would create a decrease in tranquillity, reducing the quality of visual amenity and adversely affecting the scale and pattern of the landscape as experienced by visual receptors. Tranquillity and visual amenity would be adversely affected primarily because of the visibility of the elevated offline section to the south of Winterbourne Stoke through the Till Narrow Chalk River Valley LCA (Moderate Adverse), the sections on large embankment

across the Tilshead Chalk Downland LCA (Slight Adverse) and the elevated section of the Scheme across the Countess Roundabout within the Avon Valley LCA (Slight Adverse). The location of substantial lengths of this scheme option within deep cuttings would reduce adverse impacts on tranquillity for surrounding areas but would have resultant adverse effects on landscape pattern and character. Overall there would be Slight Beneficial impacts on tranquillity for the Larkhill Chalk Downland LCA due to the removal of traffic from the landscape into deep cutting and tunnel sections. There would be parallel benefits for cultural aspects due to the visual and physical reconnection of Stonehenge with the wider WHS area.

13.3.30 There would be a range of Neutral to Moderate Adverse impacts on landcover. South of Winterbourne Stoke, Option 1Sa would cross part of the Till Valley and the eastern valley side that is a more complex landscape than that to the north of the village, with a greater range of landscape elements and a more complex landscape pattern. It comprises a matrix of pasture, arable, wet woodland and scrub, beech stands, individual mature trees and mixed woodland blocks. A proportion of all of these elements would be removed to accommodate this route option with a Moderate Adverse significance of effect.

Route Comparison

13.3.31 All three route options have been assigned the same overall assessment score (Moderate Adverse) following the WebTAG assessment. This is because very similar types of impacts would result in comparable levels of effects on the same landscape resources.

13.3.32 Following further assessment in accordance with DMRB methodologies, which has allowed effects on the landscape to be assessed at a more detailed level, and visual effects to be more comprehensively considered, it is concluded that Option 1Nd is the Preferred Route from a landscape and visual impact perspective.

13.3.33 It is predicted that Option 1Nd would not have any significant adverse effects on landscape elements or features. It would however have a significant adverse effect on landscape character, with adverse impacts on landscape pattern and landcover. However, it is assessed this would be a Moderate Adverse significance of effect as opposed to a Large Adverse significance for Options 1Na and 1Sa.

13.3.34 Option 1Nd would adversely affect the same number of residential receptors as Option 1Na, but a notably lower number of residential receptors than Option 1Sa. It would adversely affect a lower number of other visual receptor groups than either Options 1Na or 1Sa. Two visual receptor groups would be adversely effected to a significant degree (visitors to Parsonage Down and users of PRoW in the Till Valley); as opposed to three receptor groups for Option 1Na and five receptor groups for Option 1Sa.

13.3.35 All route options would have significant beneficial effects on the visual amenity of receptors visiting the open access areas across the Stonehenge landscape and Stonehenge itself due to the removal of traffic from many views available across these landscapes. The removal of traffic would also re-establish some of the

historic landscape pattern, improve tranquillity and reconnect the wider WHS landscape with Stonehenge.

Townscape

13.3.36 For all route options, it is not anticipated that there would be any notable impacts on Amesbury, Durrington and Bulford Townscape Landscape Character Areas (LCA), therefore the effect is judged to be Neutral.

Historic environment

Table 13-5 Route options historic assessment

Methodology	1Na	1Nd	1Sa
Appraisal (WebTAG)	Historic environment- Slight beneficial WHS- Moderate beneficial	Historic environment- Slight beneficial WHS- Moderate beneficial	Historic environment- Slight beneficial WHS- Moderate beneficial
Further comparative assessment informed by Heritage Impact Assessment (Appendix E)	Ranking: 3 Large cutting through Oatlands Hill detrimental to setting of WHS and scheduled monuments; largely not-mitigatable	Ranking: 1 Avoids large cutting through Oatlands Hill, avoids Winter Solstice Sunset alignment. Considerable impact on setting of key barrow groups but with some potential for mitigation	Ranking: 2 Avoids concentration of key remains but risks affecting Winter Solstice Sunset alignment. Detailed mitigation design for Junction in the Park required to address impact on Winter Solstice Sunset alignment; potential for conflict with WHS Management Plan policies and objectives.

13.3.37 All three options (1Na, 1Sa and 1Nd) would have a complex mixture of beneficial and adverse impacts on the historic environment. In broad terms:

- Beneficial impacts would arise from the removal of the existing A303 from the eastern tunnel portal to Longbarrow Roundabout.
- Adverse impacts would arise from the physical impact of construction on assets and the impact of the new dual carriageway and its operational traffic on the setting of assets and the Outstanding Universal Value (OUV) of the World Heritage Site (WHS).

13.3.38 For all options, the removal of the existing A303 between Stonehenge Road (other than for local access) and Longbarrow Roundabout would deliver a range of very notable benefits for key monuments in the WHS:

- Removing severance for the Avenue.
- Removing severance for King Barrow Ridge, enabling the reconnection of the Old King Barrows and New King Barrows with the monuments and the landscape to the south.
- Removing the visual and aural presence of traffic on Stonehenge and its immediate environs.
- Removing the visual presence of traffic from views across the defined topographic bowl around Stonehenge, and between monuments.

13.3.39 All options would however have adverse impacts on the Normanton Down Barrow Group and listed buildings, conservation areas and registered parks and gardens to very similar degrees. Additionally, they would also physical impact on areas of non-designated but potentially important archaeology with Option 1Na affecting remains on Oatlands Hill and north of Winterbourne Stoke, Option 1Nd affecting similar remains, while Option 1Sa would affect prehistoric remains (barrows) in the Park, and potential prehistoric and roman settlement south of Winterbourne Stoke.

13.3.40 Appendix E provides more detail on the impacts associated with individual assets within the study areas, the following summarises this in terms of DMRB scoring terminology:

13.3.41 Option 1Sa:

- Impacts on scheduled monuments would result in:
  - 1 very large beneficial effect and 2 very large adverse effects;
  - 23 large beneficial effects and 21 large adverse effects;
  - 23 moderate beneficial and 16 moderate adverse effects;
  - 18 slight beneficial and 11 slight adverse effects; and
  - 40 neutral effects.
- Impacts on listed buildings would result in:
  - 7 moderate adverse effects;
  - 23 slight adverse effects and 10 slight beneficial effects; and
  - 78 neutral effects.
- Impacts on the Amesbury Abbey Registered Park and Garden would result in one moderate adverse effect.
- Impacts on Conservation Areas would result in:
  - 1 moderate adverse effect;
  - 1 slight adverse effect;
  - 1 moderate beneficial; and
  - 2 neutral effects.
- Impacts on non-designated assets would result in
  - 13 large adverse effects;

- 16 moderate adverse effects;
- 25 slight adverse effects and 28 slight beneficial effects; and
- 67 neutral effects.

13.3.42 Option 1Na:

- Impacts on scheduled monuments would result in:

  - 1 very large beneficial effect and 7 very large adverse effects;
  - 23 large beneficial effects and 20 large adverse effects;
  - 23 moderate beneficial and 15 moderate adverse effects;
  - 15 slight beneficial and 17 slight adverse effects; and
  - 45 neutral effects.

- Impacts on listed buildings would result in:

  - 7 moderate adverse effects;
  - 10 slight adverse effects and 10 slight beneficial effects; and
  - 77 neutral effects.

- Impacts on the Amesbury Abbey Registered Park and Garden would result in one moderate adverse effect.
- Impacts on Conservation Areas would result in:

  - 1 moderate adverse effect;
  - 1 moderate beneficial effect; and
  - 2 neutral effects.

- Impacts on non-designated assets would result in:

  - 21 large adverse effects;
  - 8 moderate adverse effects;
  - 37 slight adverse effects and 25 slight beneficial effects; and
  - 85 neutral effects.

13.3.43 Option 1Nd

- Impacts on scheduled monuments would result in:

  - 1 very large beneficial and 8 very large adverse effects;
  - 14 large beneficial effects and 21 large adverse effects;
  - 23 moderate beneficial and 26 moderate adverse effects;
  - 14 slight beneficial and 15 slight adverse effects; and
  - 54 neutral effects.

- Impacts on listed buildings would result in:

  - 7 moderate adverse effects;
  - 10 slight adverse effects and 10 slight beneficial effects; and

- 77 neutral effects.

- Impacts on the Amesbury Abbey Registered Park and Garden would result in one moderate adverse effect.
- Impacts on Conservation Areas would result in:

  - 1 moderate adverse effect;
  - 1 moderate beneficial effect; and
  - 2 neutral effects.

- Impacts on non-designated assets would result in:

  - 18 large adverse effects;
  - 13 moderate adverse effects, 1 moderate beneficial effect;
  - 40 slight adverse effects and 27 slight beneficial effects; and
  - 87 neutral effects.

13.3.44 For all options a Moderate Beneficial WebTAG score was recorded for impacts on the WHS, representing the considerable benefits associated with the removal of existing A303 from part of the WHS and the diversion of traffic through a tunnel, balanced against the adverse impacts on other areas of the WHS.

13.3.45 Based on DMRB Scoring criteria the effect on SMs that contribute to the OUV of the WHS are summarised below:

- **For Option 1Na,** of the 153 SMs that contribute to the OUV of the WHS, 3 SMs of very high importance would experience significant beneficial effects: moderate for The Cursus, large for The Avenue and very large for Stonehenge. For the remaining SMs of high importance, of the 58 SMs experiencing beneficial effects - this would be sub divided as follows: large 21, moderate 23 and slight 14, whereas for the 59 SMs experiencing adverse effects: very large 6, large 18, moderate 15, and slight 14.
- **For option 1SA**, of the 150 SMs that contribute to the OUV of the WHS, 3 SMs of very high importance would experience significant beneficial effects: moderate for The Cursus, large for The Avenue and very large for Stonehenge. For the remaining SMs of high importance, of the 62 SMs experiencing beneficial effects - this would be sub divided as follows: large 22, moderate 22 and slight 18, whereas the 59 SMs experiencing adverse effects: very large 2, large 20, moderate 15, and slight 13.
- **For option 1Nd**, of the 167 SMs that contribute to the OUV of the WHS, 3 SMs of very high importance would experience significant beneficial effects: moderate for The Cursus, large for The Avenue and very large for Stonehenge. For the remaining SMs of high importance, of the 49 SMs experiencing beneficial effects - this would be sub divided as follows: large 13, moderate 22 and slight 14, whereas the 68 SMs experiencing adverse effects: very large 7, large 20, moderate 27, and slight 14.

13.3.46 In terms of developing a balanced score (see paragraphs 13.2.31 and 13.2.32), the assessment indicates that, in purely numerical terms, the adverse effects

resulting from the route options would outweigh the beneficial effects, with Option 1Sa overall having a slightly less adverse impacts on heritage assets, particularly outside and to the west of the WHS.

13.3.47 However, as set out in the NPSNN (2015), great weight must be given to the changes to assets of the highest importance. In this regard the beneficial effect resulting from the changes to the WHS and also the beneficial impacts on Stonehenge and The Avenue and other highly important monuments must be accorded greatest weight. In this context, a Slight Beneficial WebTAG score was recorded for the historic environment, representing a balanced outcome between important beneficial impacts and a large number of adverse impacts on designated and non-designated heritage assets. This must however be understood in the context of there being a number of large adverse impacts on designated assets.

13.3.48 The definition of a Slight Beneficial Effect is set out in Unit A3. The three broad definitions indicate that the scheme:

- *is not in conflict with national, regional or local policies for the protection of the historic environment* – this is the case for the proposed options as the benefits to the historic environment are on balance beneficial given the weight that must be given to assets of the highest importance; although there are occasions where significant adverse impacts would occur which would require examination in policy terms.
- restores or enhances the form, scale, pattern or sense of place of the historic environmental resource through good design and mitigation – this is correct in terms of the WHS (in the round) and the options also have benefits for the sense of place of Winterbourne Stoke.
- removes or mitigates visual intrusion (or other indirect impacts) into the context of locally or regionally significant historic environmental features, such that appreciation and understanding of them is improved – this is the case in relation to a large number of scheduled monuments, the WHS and a smaller number of other assets. In fact, the removal relates to internationally and nationally important assets, as well as locally or regionally significant assets.

13.3.49 Given the similarity of outcome between the three options, further comparative assessment was carried out in order to provide more differentiation between them. The results are set out below.

13.3.50 The key differences between the routes are from the western portal onwards. Options 1Na and 1Nd both take a northerly route around Winterbourne Stoke with Option 1Sa running south of the settlement. All three routes take different courses through the western part of the WHS. All three routes would affect the WHS and numerous monuments and archaeological sites within and outside the WHS differently. In broad terms, some of the key differences include:

- The crossing of the River Till by Options 1Na and 1Nd would adversely affect the setting of two important barrow groups outside the WHS.
- Options 1Na and 1Nd would have a more significant impact on the setting of numerous scheduled barrows south of the existing A303 than Option 1Sa.

- All options would affect the relationships between a cluster of 9 long barrows in the area. Option 1Na would have the greatest impact, with Option 1Nd having a similar scale of impact. Option 1Sa would have the least impact of the three options.
- The Winter Solstice Sunset alignment crosses Option 1Sa through the location of the proposed junction. This poses risks for the alignment and OUV of the WHS. The other options are unlikely to affect the alignment.

13.3.51 There are further differentiating factors in terms of risks relating to deliverability and their ability to be mitigated through further design. These predominately relate to the manner in which the three options exit the WHS to the west.

13.3.52 For Option 1Na the exit location from the WHS would result in a large cutting through Oatlands Hill, which would have a detrimental impact on the setting of the WHS and many scheduled monuments, as well as adversely impacting on the open landscape character. This weighs against Option 1Na. There are also concerns about the alignment of Option 1Na where it passes between two newly discovered and potentially related Neolithic long barrows.

13.3.53 Option 1Sa would exit the WHS through the Park, and on the alignment of the Winter Solstice Sunset. While the existing woodland and potential landscaping would screen the route and associated junction there remains a risk that this option would interfere with the solstice alignment. A number of key stakeholders have indicated that this risk makes the route undesirable and could seriously adversely affect the OUV of the WHS. Although it should be possible to design the route to avoid these impacts this cannot be guaranteed at this stage in the design process.

13.3.54 Option 1Nd would exit the WHS in proximity to the Winterbourne Barrow Group. The route avoids the need for a wide cutting in Oatlands Hill and is located some distance from the Winter Solstice Sunset alignment. The route though the WHS would adversely affect the setting of a number of barrows and the OUV of the WHS, but not to a significantly worse degree than Options 1Na and 1Sa.

13.3.55 In relation to the historic environment there are substantive issues for all options. To the south there are a number of newly discovered archaeological sites including a potential Roman settlement. While to the north, the crossing of the Till would have a significant adverse impact on the setting of two important barrow complexes. The principal issue however with the route to the south is the need to exit the WHS using a route that crosses the Winter Solstice Sunset Alignment (as viewed from Stonehenge).

13.3.56 The route alignment of Option 1Nd would facilitate a preferred exit location from the WHS as it avoids the Winter Solstice Sunset alignment and the need for large cutting through Oatlands Hill. The route would also be closer to the current A303 and existing infrastructure through an area already subject to various levels of disturbance from noise, lighting etc. Whilst there still exists the potential for significant harm to the attributes of OUV and impacts on the fabric and setting of important archaeological remains Option 1Nd would provide more options to bring overall benefits to the WHS and opportunities for mitigation as part of the design development.

Biodiversity

Table 13-6 Route options biodiversity assessment

Methodology	1Na	1Nd	1Sa
Appraisal (WebTAG) (based on a precautionary approach)	Biodiversity – Large Adverse	Biodiversity – Large Adverse	Biodiversity – Large Adverse
Further comparative assessment	Ranking: 2 River Avon SAC/River Till SSSI habitats – Large Salisbury Plain (SAC) / Parsonage Down (SSSI, NNR) – Large Berwick St. James Road PRV (WCC 2-28) - None	Ranking: 1 River Avon SAC/River Till SSSI habitats – Large Salisbury Plain (SAC) / Parsonage Down (SSSI, NNR) – Large Berwick St. James Road PRV (WCC 2-28) - None	Ranking: 3 River Avon SAC/River Till SSSI habitats – Very Large Salisbury Plain (SAC) / Parsonage Down (SSSI, NNR) – Slight Berwick St. James Road PRV (WCC 2-28) - Slight

13.3.57 In terms of the WebTAG appraisal, a precautionary approach was taken to the assessment of potential adverse impacts on designated international and national ecological sites, including the River Avon SAC and the River Till and River Avon System SSSIs. This was considered appropriate at this stage given the construction of a tunnel, the uncertainty over construction methodology, and size/footprint of a new crossing over the River Till.

13.3.58 For all options, there would be a risk of adverse impacts arising from the construction of a new river crossing of the River Till. However, the area of the designated site directly affected by the route footprint is larger for Option 1Sa compared to Option 1Na and 1Nd.

13.3.59 Options 1Na and 1Nd pass close to Salisbury Plain SAC/Parsonage Down SSSI & NNR, while this is not a relevant receptor for Option 1Sa.

13.3.60 All options would directly impact on the Countess Cutting County Wildlife Site (CWS). Additional direct impacts would result from Option 1Na on one woodland (The Diamond) and several hedgerows, from Option 1Nd on one woodland (Normanton Gorse) and hedgerows, and Option 1Sa on six woodlands (including the Diamond). The direct impacts that occur include habitat change/loss; habitat severance and/or obstructions; hydrological connectivity change/loss; wildlife road fatalities; wildlife displacement; lighting; noise and vibration and pollution.

13.3.61 For all options, based on current information, it is considered unlikely that Steeple Langford Down SSSI or Yarnbury Castle SSSI would be impacted on, due to the distance between the sites and the route options.

13.3.62 The tunnelled section of all options would result in ecological benefits including landscape reconnection and habitat restoration leading to a reduction of road fatalities and increase in wildlife movement. These benefits are common to all options.

13.3.63 The WebTAG appraisal was limited in the extent to which it could differentiate between the potential impacts on biodiversity from the different route options. Further assessment was therefore carried out in order to provide more differentiation between the options, as described in the methodology section above. The results are set out below.

13.3.64 For all routes, the most sensitive ecological receptor is the River Till (part of the River Avon SAC). To help differentiate between options, a comparative assessment of the quality of habitat located in the areas of the northern and southern crossings of the River Till has been undertaken based on readily available desk study information, protected species records, and a Phase 1 Habitat survey of land where the land was accessible.

13.3.65 This comparative assessment identified that the River Till is 'winterbourne' at the location of the northern crossing (for Options 1Na and 1Nd) compared with the more permanently flowing nature of the River at the point of a southern crossing (for Option 1Sa). When comparing the quality of habitat, the river is identified as supporting greater habitat and species diversity at the southern crossing (for Option 1Sa) than with the northern crossing. Furthermore, the associated qualifying species, as well as other protected and notable species and locally important features are less likely to exist where Options 1Nd and 1Na cross the River Till. Taking the precautionary approach, and applying a system for assigning significance of effects adapted from DMRB, the effects on the River Till were assessed as Large for Options 1Na and 1Nd, and Very Large for Option 1Sa.

13.3.66 In terms of combined potential impacts on other statutory designated sites, the air quality assessment demonstrates that the northern route options would not result in a significant change at the Salisbury Plain SAC/Parsonage Down SSSI.

13.3.67 During construction, southerly wind conditions could present a slight risk of dust deposition on the southern slopes of Parsonage Down with regards to Options 1Na and 1Nd, but it is worth noting that in the context, for example, of dust produced during current agricultural practices, any effect of the construction activities on plant and animal communities in the vicinity would be largely undetectable, although localised effects on certain species might occur, but this would likely affect a few individual species and would not likely affect the population dynamics or the conservation objectives of the designated site, especially with the implementation of industry best practice dust suppression methods and any necessary further mitigation measures (such as planting of a wind break, which would also be beneficial during the operation).

13.3.68 With regards to operation, elevated concentrations of atmospheric pollutant such as nitrogen (i.e. NOx resulting from emissions) have the potential to damage the sensitive grassland habitats found at Parsonage Down (chalk grassland is particularly nitrogen-responsive). Potential effects of atmospheric pollutants have therefore been evaluated in terms of critical loads and critical levels (see Air

Quality section above). NOx results did not show any exceedances of objectives, but it is worth noting that at Parsonage Down, whilst the current maximum nitrogen deposition already exceeds the critical load, and would do so in the future, the change in nitrogen deposition from the Scheme would not be sufficient to be potentially significant, even before considering site integrity. The outcome of the 2017 botanical survey of Parsonage Down (in progress at the time of writing this report) would however need to be reviewed at the next stage of the project to find out about the presence (or absence) of any designation - qualifying species of plant communities that are sensitive to increases in nitrogen levels.

13.3.69 In terms of other differentiating factors, Option 1Nd would result in severance of three habitat corridors (hedgerows, tree-lines, woodland), Option 1Na would sever five habitat corridors (including 'the Diamond' woodland), and Option 1Sa would sever ten habitat corridors (including 'the Diamond' woodland, wet woodland surrounding the River Till, and large wooded belts at the Park). Options 1Na and 1Sa are located closer to, and therefore present a greater risk to, the Normanton Down RSPB reserve, an area of arable land being reverted to species-rich chalk grassland and being managed to encourage breeding stone-curlews and other birds such as lapwings and corn buntings.

13.3.70 It is noted that European Protected Species (EPS) are likely to be affected by all route options in some form and an EPS development licence would be required if any disturbance is to occur to these species. Based on information currently available, the most notable species potentially affected by Options 1Nd and 1Na is great crested newt, an EPS, which has been identified as breeding in a pond approximately 300m north of the route. The most notable EPS species potentially affected by Option 1Sa are bats (found roosting within the site footprint) and otters and water voles (likely using River Till on a regular basis subject to findings of surveys to in 2017 to confirm). Surveys carried out to date indicate that the risks of encountering protected species is greater along Option 1Sa than for other options.

13.3.71 Effects on other non-EPS protected and notable species (e.g. birds, badgers, notable mammals such as harvest mouse and brown hare) are likely to be similar for all route options. This also applies to breeding barn owls that are present to the north and south of Winterbourne Stoke and that would be potentially be affected by both bypass options

13.3.72 Overall, with regards to the River Avon SAC/River Till SSSI, Option 1Sa would present a higher risk in terms of Habitat Regulations Assessment and subsequent mitigation than Options 1Nd and 1Na, which were assessed as having a lesser impact on the habitats in terms of direct designated area lost. Furthermore, Option 1Sa would encounter higher quality habitat within the River Avon SAC/River Till SSSI boundary, and the associated qualifying species of the SAC, as well as other protected and notable species and locally important features. As such, Option 1Sa would require greater and more complex mitigation. Consequently, the northern routes (Options 1Nd and 1Na) are preferred to the southern bypass option (Option 1Sa).

13.3.73 When comparing Option 1Nd with 1Na, the likely effects are similar where the scheme bypasses Winterbourne Stoke. The main differences relate to the length

of the scheme and impacts arising as a result of the alignments between the western portal and Winterbourne Stoke. Overall Option 1Nd would have less direct land take than Option 1Na and therefore a smaller area of direct habitat loss. Option 1Nd is also identified to sever fewer habitat areas or corridors, and importantly avoids severance and habitat loss within 'The Diamond' woodland. Option 1Nd is further away from the Normanton Down RSPB reserve than Option 1Na. Otherwise, indirect impacts are likely to be similar for both routes.

13.3.74 In summary, based on current information and prior to mitigation, all route options have the potential to have an adverse effect on ecology and important ecological features, due to the presence of international, national and local designated sites. This would likely lead to direct effects on habitat connectivity at a landscape scale through habitat severance. All options would also require habitat removal and/or disturbance of habitats which could be suitable for legally protected species. Mitigation measures could be taken to avoid any direct impacts on Salisbury Plain SAC / Parsonage Down SSSI during the construction and operational phases of the scheme (such as the planting of screening vegetation along the roadside). Effects on species populations resulting from impacts including habitat loss and disturbance, can be mitigated to a certain extent through sensible measures (such as reducing footprint within woodlands/hedgerows and planting of new woodland) and habitat enhancement/reinstatement post-construction. Overall, in relation to biodiversity, Option 1Nd is preferred.

Water environment

Table 13-7 Route options water environment assessment

Methodology	1Na	1Nd	1Sa
Appraisal (WebTAG)	Large Adverse	Large Adverse	Large Adverse

Route Options

13.3.75 An overall score of Large Adverse was assigned to all route options in the WebTAG appraisal. This was a precautionary approach, recognising the risks of potentially significant effects on water environment features.

13.3.76 One of the construction methodologies may require dewatering of the Chalk aquifer over an extended period. Current assessment shows that a number of water environment features are within the potential area of influence of the Scheme including local groundwater abstractions for public water supply, surface and groundwater dependent biodiversity in the River Till and River Avon, flood risk and cultural assets such as Blick Mead Spring (where nationally important archaeological deposits have been found).

13.3.77 Regardless of its location, the bridge crossing over the River Till would have to be designed and built in a way that avoids any adverse effect on the designated features of the River Till (see biodiversity section). No changes to the current bridge arrangement over the River Avon is expected. On best available current evidence, there would be preference for a northern Till crossing.

13.3.78 De-risking survey, monitoring and modelling work would be used to evaluate the extent and magnitude of construction effects, offset by mitigation measures.

13.3.79 Operational risks are considered to be significantly lower than those associated with construction, and would also be addressed by mitigation measures.

People and Communities

Table 13-8 Route options for People and Communities assessment

Methodology	1Na	1Nd	1Sa
Further comparative assessment informed by DMRB criteria	Ranking: 1	Ranking: 1	Ranking: 3
Loss of Best and Most Versatile land	Large adverse	Large adverse	Large adverse
Farm Viability	Slight Adverse	Slight adverse.	Slight Adverse except Oakland Dairy where it is moderate to large adverse
Journey Length and Travel Patterns	Beneficial	Beneficial	Beneficial
Amenity	Positive	Positive	Positive
New Severance Relief from Severance	Slight Substantial	Slight Substantial	Slight to Moderate Substantial

Route Option 1Na

13.3.80 Key constraints / receptors and likely effects include:

- Large adverse effect arising from potential for loss of Best and Most Versatile land.
- The replacement of at-grade crossings on the existing A303 with grade separated NMU crossings on the realigned A303 would have a beneficial effect on Journey Length and Local Travel Patterns due to improved connectivity on PRoWs.
- Five PRoW adjoining the existing A303 alignment at Winterbourne Stoke would experience reduced severance due to predicted decreases in traffic of more than 60% along the A303 reducing journey time for PRoW users between Winterbourne Stoke and Berwick St James.

- The forecast reduction in traffic flows on the Packway and on the A303 through Winterbourne Stoke would likely result in a moderate to substantial relief in severance on around 10 PRoW near Shrewton.
- The downgrading of the existing alignment through Winterbourne Stoke would improve amenity for local residents, properties and PRoW users in that vicinity.
- A reduction in traffic flows on the redundant section of the A303 of over 60% represents a substantial level of relief from community severance in the village and between Berwick St. James and Winterbourne Stoke.
- Public consultation responses suggest low levels of NMU movement between Winterbourne Stoke and Shrewton. Therefore, with new NMU crossings incorporated into the highway design, the residual effect in terms of new severance is slight adverse.

Route Option 1Nd

13.3.81 Key constraints / receptors and likely effects are the same as for Option 1Na.

Route Option 1Sa

13.3.82 Key constraints / receptors and likely effects include:

- Large adverse effect arising from potential for loss of Best and Most Versatile land.
- A large dairy unit at Oatlands Farm would be severed from several grass fields to the south. The combination of land take and severance would have a moderate to large adverse effect.
- Between Winterbourne Stoke and Berwick St. James the replacement of the at grade crossing of the existing A303 with a grade separated crossing along the new alignment would enhance connectivity between PRoW north and south of the A303.
- A reduction in traffic on the redundant section of the A303 of over 60% would provide substantial relief from severance for five PRoW adjoining the existing A303 at Winterbourne Stoke.
- A reduction in traffic flows on The Packway would be likely to result in a moderate to substantial relief in severance on approximately 10 PRoW.
- The downgrading of the existing alignment through Winterbourne Stoke would substantially improve amenity for local residents, properties and PRoW users in that vicinity. However, the impact of the realigned route on the amenity of users of PRoWs and on several residential properties in terms of visual amenity is judged to be significant.
- A forecast reduction in traffic on the A303 through Winterbourne Stoke of 60% or more represents a substantial level of relief in community severance.
- Public consultation feedback demonstrates that a high value is attributed to NMU links between Winterbourne Stoke and Berwick St. James. Therefore,

with new NMU crossings incorporated into the highway design, the residual effect in terms of new severance is moderate adverse.

Route Comparison

13.3.83 The assessment has considered agriculture and farm holdings in terms of farm viability and loss of BMV land, and non-motorised users in terms of journey length and local travel patterns, amenity and community severance. A score is given for each sub-topic in the table at the head of this section.

13.3.84 All three options would be expected to have large adverse effects on BMV land. While all three options are assessed to have slight adverse effects in terms of viability of farms, Options 1Na and 1Nd are considered to have less of an adverse effect than Option 1Sa as this option has a significant adverse effect on Oakland Dairy.

13.3.85 Positive effects on travel patterns are expected for each of the three options. The comparative assessment concludes that the effects on amenity of community receptors is likely to be positive for all three options. In terms of community severance Options 1Na and 1Nd are both identified to have slight adverse effects in terms of new severance however the relief from existing severance would be substantial. While Option 1Sa is also identified to bring substantial relief from severance, the adverse effect of new severance would be slight-to-moderate .

13.3.86 On balance, Options 1Na and 1Nd would perform better than Option 1Sa, the latter taking more BMV land and having a significant adverse effect on Oatlands Dairy, and Winterbourne Stoke and Berwick St James communities. There are no noticeable differences between Options 1Na and 1Nd that have been identified through the comparative assessment, therefore both are determined to be the joint preferred options in terms of effects on People and Communities.

13.4 Assessment Conclusions

WebTAG

13.4.1 In terms of environmental effects, to facilitate ease of comparison across the three route options, Table 13-14 summarises the assessment outcomes together.

Table 13-9 Summary of environmental assessment outcomes

Parameter	1Na	1Nd	1Sa
Noise: Net Present Value (NPV) of change in Noise (£)*	-£1,032 000	-£358, 000	£762, 000
Air quality: Total value of change in air quality (£)*	-£604,000	-£543,000	-£525,000
Greenhouse Gases: NPV of change in Greenhouse gases (£)*	-£75,515,000	-75,116,000	-78,006,000
Landscape	Moderate Adverse	Moderate Adverse	Moderate Adverse

Parameter	1Na	1Nd	1Sa
Townscape	Neutral	Neutral	Neutral
Historic Environment	Slight Beneficial	Slight Beneficial	Slight Beneficial
Biodiversity	Large Adverse	Large Adverse	Large Adverse
Water environment	Large Adverse	Large Adverse	Large Adverse

* a positive value represents a benefit whilst a negative value a disbenefit

13.4.2 As described above further assessment work has been conducted, based on DMRB guidelines, to refine understanding and inform the Preferred Route selection.

Summary Assessment Findings

13.4.3 The summary assessment findings below are brought together in conclusion with a narrative on the relative performance of the alternatives in achieving the scheme's Environmental Objectives, in part addressed in Table 13-4 above.

Noise

13.4.4 The assessment indicates that there would be differences between the three options in terms of the monetised value (NPV) relating to the effects on health, based on the number of households affected and the change in noise level at these properties.

13.4.5 The calculated noise differences between the options were heavily influenced by the traffic flow forecasts on the local road network which in turn have been influenced by the assumed location of the A360 junction with the A303. A junction located closer to the A360 with Option 1Nd would be likely to deliver greater noise benefits, and the current results should be treated with caution, with limited weight placed on them as a key differentiator between options at this stage.

13.4.6 It is also important to note that only Option 1Sa would bring A303 traffic closer to households away from the existing road network, causing adverse noise impacts.

Air Quality

13.4.7 There would be a net improvement in local air quality (for PM_{10} and NO_2) within 200m for all options as a result of the realignment of the A303 away from sensitive receptors. This would also be a negative impact on regional emissions for NOx due to the combination of increases in modelled AADT and HDV flows and the overall link distance travelled across the Affected Road Network compared with the 'do minimum'.

13.4.8 Air quality is not a differentiator for choosing between options which take the bypass of Winterbourne Stoke to the north or south. This is because:

- For human health receptors - there are no modelled exceedances of the annual mean NO2 AQO either with or without the scheme, and local monitoring shows concentrations well below the objective. Only receptors predicted to exceed NO2 AQO are used in determining significance, so by definition the impact of any bypass option would be “no significant adverse effect”.
- For designated ecological sites - there are no modelled exceedances of the vegetation AQO for NOx, by at least one standard deviation. Only receptors predicted to exceed NOx AQO are used in determining significance, so by definition the impact of any bypass option would be “no significant adverse effect”.
- For designated ecological sites – the nitrogen deposition rate exceeds the site relevant Critical Load now and in the future, with or without the scheme. There is a noticeable increase in deposition at the River Till SSSI with the scheme at its closest point, but no difference in this impact between options. At the Parsonage Down SSSI there would be no significant change with the northern bypass (the Parsonage Down SSSI is not a relevant receptor for the southern bypass option). On this basis, the effect on designated ecological sites from nitrogen deposition would not be a differentiator between the options.

Greenhouse Gases

13.4.9 In terms of greenhouse gases, all route options would result in an increase in user carbon, due to increases in vehicle flows and the slightly longer distance travelled compared to the existing. The results show that over the 60-year period there would be relatively little difference between the route options, albeit that Option 1Nd would perform slightly better than Option 1Na, while Option 1Sa is worse overall.

Landscape

13.4.10 For landscape, all three route options have been assigned the WebTAG score of Moderate Adverse. This is because very similar types of impacts would result in comparable levels of effects on the same landscape resources. Further assessment, in accordance with DMRB methodologies, concluded that overall Option 1Nd is preferred from a landscape and visual impact perspective.

13.4.11 Whilst Option 1Nd is not predicted to have any significant adverse effects on landscape elements or features, it would have a significant adverse effect on landscape character, with adverse impacts on landscape pattern and landcover. However, it is assessed this would be a Moderate Adverse significance as opposed to a Large Adverse significance for Options 1Na and 1Sa. Option 1Nd would adversely affect the same number of residential receptors as Option 1Na, but a notably lower number of residential receptors than Option 1Sa. It would also adversely affect fewer other visual receptor groups to a significant degree than either Options 1Na or 1Sa.

13.4.12 All route options would have significant beneficial effects on the visual amenity of receptors visiting the open access areas across the Stonehenge landscape and Stonehenge itself due to the removal of traffic from many views available across

these landscapes. The removal of traffic would also re-establish some of the historic landscape pattern, improve tranquillity and reconnect the wider WHS landscape with Stonehenge.

Townscape

13.4.13 For all route options, it is not anticipated that there would be any notable impacts on Amesbury, Durrington and Bulford Townscape Landscape Character Areas (LCA), therefore the effect is judged to be Neutral.

Historic Environment

13.4.14 All three options (1Na, 1Sa and 1Nd) would have a complex mixture of beneficial and adverse impacts on the historic environment.

13.4.15 The Options, 1Na, 1Sa and 1Nd, would benefit the WHS as a whole, removing the A303 from a key part of the WHS, significantly improving that part of the WHS and the setting of Stonehenge and c. 50 other related monuments within the WHS. It would also reconnect the Avenue and King Barrow Ridge. These are very notable benefits associated with assets of predominately international and national value.

13.4.16 The Options 1Na, 1Sa and 1Nd, would also have adverse impacts on the setting of other scheduled monuments (SMs) within and outside of the WHS, and the fabric of one scheduled monument (SM) and numerous areas of non-designated archaeology of regional or local value. There would also be adverse and beneficial impacts to a similar degree on listed buildings, conservation areas and a registered park and garden. Additionally, they would have physical impact on areas of non-designated but potentially important archaeology with Option 1Na affecting remains on Oatlands Hill and north of Winterbourne Stoke, Option 1Nd affecting similar remains, while Option 1Sa would affect prehistoric remains (barrows) in the Park and a potential prehistoric and roman settlement south of Winterbourne Stoke.

13.4.17 Overall, the Options 1Na, 1Sa and 1Nd, would result in a greater number of adverse effects than beneficial effects on designated and non-designated heritage assets, although a greater number of assets of high and very high importance would experience significant beneficial effects, with 1Sa overall having a slightly less adverse impact on heritage assets, particularly outside and to the west of the WHS.

13.4.18 However, as set out in the NPSNN (2015), great weight must be given to the changes to assets of the highest importance. In this regard the beneficial effect resulting from the changes to the WHS and also the beneficial impacts on Stonehenge and The Avenue and other highly important monuments must be accorded greatest weight. In this context, a Slight Beneficial WebTAG score was recorded for the historic environment, representing a balanced outcome for each route option, between important beneficial impacts and a large number of adverse impacts on designated and non-designated heritage assets. This must however be understood in the context of there being a number of large adverse impacts on designated assets. Given the similarity of outcome between the three options, further comparative assessment was carried out in broad terms - some of the key differences include:

- The crossing of the River Till by Options 1Na and 1Nd would adversely affect the setting of two important barrow groups outside the WHS.
- Options 1Na and 1Nd would have a more significant impact on the setting of numerous scheduled barrows south of the existing A303 than Option 1Sa.
- All options would affect the relationships between a cluster of 9 long barrows in the area. Option 1Na would have the greatest impact, with Option 1Nd having a similar scale of impact. Option 1Sa has a least impact of the three options.
- The Winter Solstice Sunset alignment crosses Option 1Sa through the location of the proposed junction. This poses risks for the alignment and OUV of the WHS. The other options are unlikely to affect the alignment.

13.4.19 The route alignment of Option 1Nd would facilitate a preferred exit location from the WHS as it avoids the Winter Solstice Sunset alignment and the need for as large a cutting through Oatlands Hill. The route also runs closer to the current A303 and existing infrastructure through an area already subject to various levels of disturbance from noise, lighting etc. Whilst there still exists the potential for significant harm to the attributes of OUV and impacts on the fabric and setting of important archaeological remains option 1Nd provides more options to bring overall benefits to the WHS and opportunities for mitigation as part of the design development.

Biodiversity

13.4.20 For biodiversity whilst all route options would have the potential for adverse effects on ecology and important ecological features, in the context of international, national and local designated sites, route Option 1Nd is considered to be the preferred option with scope for mitigation on the River Till and on Salisbury Plain SAC/Parsonage Down SSSI & NNR.

13.4.21 Option 1Sa would present a higher risk in terms of Habitat Regulations Assessment and subsequent mitigation than options 1Nd and 1Na. Option 1Sa would encounter higher quality habitat within the River Avon SAC/River Till SSSI boundary, and the associated qualifying species of the SAC, as well as other protected and notable species and locally important features, that are more likely to exist where option 1Sa crosses the River Till. As such, option 1Sa would require greater and more complex mitigation. As a result, based on current information, the northern routes, options 1Nd and 1Na, are preferred to the southern bypass option 1Sa.

13.4.22 When comparing option 1Nd with 1Na, the likely effects are similar where the scheme bypasses Winterbourne Stoke crossing the River Till to the north. The main differences relate to the length of the scheme and impacts arising as a result of the different alignments between the western portal and Winterbourne Stoke.

13.4.23 Overall option 1Nd is shorter than option 1Na, requiring less direct land take and therefore a smaller area of direct habitat loss. Option 1Nd is also identified as severing fewer habitat areas or corridors, and importantly avoids severance and habitat loss within ‘the Diamond’ woodland. Option 1Nd is also located further away from the Normanton Down RSPB reserve, an area of being managed to

support breeding stone curlew that are part of the metapopulation of the Salisbury Plain SPA, than for other options.

Water Environment

13.4.24 For Water Environment, all route options have the potential for an adverse effect on a number of water environment features located within the potential area of influence of the scheme. Mitigation measures will be included in the scheme proposals at the next design stage to ensure the risk of adverse effects is avoided.

People and Communities

13.4.25 In terms of People and Communities all route options would have a large adverse effect arising from potential for loss of Best and Most Versatile land. Option 1Sa would also impact on a large dairy unit that would be severed from several grass fields to the south with a moderate to large adverse effect. The downgrading of the existing alignment through Winterbourne Stoke and a forecast reduction in traffic on the A303 through Winterbourne Stoke of 60% would bring a substantial level of relief in community severance for local residents, properties and PRoW users in that vicinity whilst improving amenity. There would, however, still be adverse amenity impacts on the local community from all three options due to their impact on the visual amenity of PRoW users and several residential properties. In terms of community severance all options would enhance connectivity providing relief to villages in the west. Options 1Na and 1Nd are preferred to Option 1Sa as they would result in slightly less impact in terms of new severance than Option 1Sa.

Comparative Assessment of Route Options

13.4.26 By bringing together the monetary value (NPV) rankings of noise, air quality and greenhouse gases, and the results of the refined landscape, historic environment, biodiversity and water environment assessments it is possible to consider the relative environmental performance of the alternatives considered.

13.4.27 The results are summarised in Table 13-15 below, indicating an emerging environmental preference for Option 1Nd.

Table 13-10 Comparative assessment ranking*

Topic	1Na	1Nd	1Sa
Noise	3	2	1
Air quality	3	1	2
Greenhouse Gases	2	1	3
Landscape	2	1	3
Historic Environment	3	1	2
Biodiversity	2	1	3
Water environment	1	1	3
People and Communities	1	1	3

*Ranking of route options from 1 to 3 based upon how they are considered to perform in relation to each environmental topic with a rank of "1" representing the best performing option.

13.4.28 In terms of a comparison of the Options 1Nd, 1Na and 1Sa, based on the information currently available, the main environmental differentiators are:

- Historic Environment – including potential impacts on the Stonehenge and Avebury WHS, the attributes of OUV of the WHS, setting of scheduled monuments, the relationships between barrows and barrow groups, the Winter Solstice Sunset Alignment (as viewed from Stonehenge), impacts arising from the exit from the WHS, and newly discovered and undesignated archaeological sites.
- Landscape - including potential impacts on landscape character, views from residential and other visual receptors (e.g. users of PRoW), and on visual amenity for receptors visiting open access areas across the Stonehenge landscape.
- Biodiversity – including potential impacts on the River Avon SAC/River Till SSSI, Salisbury Plain SAC / Parsonage Down SSSI, the The Diamond, the Normanton Down RSPB Nature Reserve, Normanton Gorse, and protected and notable species, including stone curlew, and potential severance of intact habitat blocks and corridors.
- People and Communities – potential for new instances of community severance between settlements and impact of land take and severance on Oatlands Farm.
- Scope for mitigation.

13.4.29 In relation to the Historic Environment and WHS overall, there is a preference for Option 1Nd. This is on the basis that the alignment facilitates a preferred exit location from the WHS through a shallow topographic shoulder of land in proximity to the Winterbourne Barrow Group that avoids:

- The Winter Solstice Sunset alignment (as viewed from Stonehenge) that is potentially affected by Option 1Sa.
- The need for a large cutting through Oatlands Hill that is required for 1Na, resulting in less of a detrimental impact on the setting of the WHS and many scheduled monuments, as well as the open landscape character and views from visual receptors on PRoW, local roads and open access land.
- Impacts on a number of newly discovered archaeological sites including what are likely to be round barrows in the vicinity of the Park, and a potential Roman settlement that would potentially be affected by Option 1Sa.

13.4.30 Whilst there still exists the potential for significant harm to the attributes of OUV and impacts on the fabric and setting of important archaeological remains, Option 1Nd would provide more options to bring overall benefits to the WHS and opportunities for mitigation as part of the design development.

13.4.31 In relation to the wider environment and local community, the route alignment of Option 1Nd is predicted to result in a lesser impact on a number of key environmental receptors, as follows:

- It presents a lower risk of adverse effects to the River Avon SAC/River Till SSSI, and the aquatic ecology of the River Till, when compared with Option 1Sa which would cross the River Till at a location which is considered more likely to support the qualifying species for the River Avon SAC, as well as other protected and notable species.
- It avoids impacting what is considered to be a more complex valley landscape to the south of Winterbourne Stoke than would be affected by Option 1Sa, and is likely to impact the visual amenity of fewer residential and leisure receptors in the vicinity of Winterbourne Stoke and Berwick St James than would be affected with Option 1Sa.
- It avoids direct impacts on landscape features such as The Diamond and the wooded enclosure within the Park, and is located further away from the RSPB Normanton Down Nature Reserve, reducing the potential for adverse effects on protected and notable species, including Stone Curlew, when compared with Options 1Na and 1Sa.
- It is located closer to the current A303 than Options 1Na and 1Sa, in an area which is already subject to various levels of disturbance from infrastructure.

13.4.32 On the basis of the above, Option 1Nd is the preferred option from an environment and cultural heritage perspective.

Performance of the alternatives in achieving environmental Client Scheme Requirements

13.4.33 The client scheme requirements (CSRs) relevant to the environment are:

- Cultural heritage – To contribute to the conservation and enhancement of the WHS by improving access both within and to the site.

- Environment and community – To contribute to the enhancement of the historic landscape within the WHS, to improve biodiversity along the route and to provide a positive legacy to communities adjoining the road.

13.4.34 As described in Chapter 8, all route options were found to have a strong alignment with the CSRs but the combined findings of the WebTAG and DMRB based assessments reinforces Option 1Nd.

Environmental Design and Mitigation

13.4.35 To date primary environmental mitigation considered includes:

- Route horizontal and vertical alignment.
- Junction design.
- Embankment design.
- Road crossings.
- Portal and approaches design.
- Tunnelling options and material arisings use.
- Portal location relative to WHS elements.
- Departures from emerging Expressway standards e.g. omission of highway lighting within the WHS.

13.4.36 Opportunities for secondary mitigation have also been considered and will inform the assessment as part of PCF Stage 3.

- Key drivers eg WHS Management Plan, issues and constraints.
- Vertical alignment and regrading.
- Within the WHS including the approach to planting.
- Habitat Creation/Mitigation.
- NMU access.

13.4.37 Notwithstanding the above, environmental issues that would require further detailed assessment and mitigation include:

- The vertical alignment to the south of the Winterbourne Stoke Barrow Group and tunnel entrance, in order to reduce the likely significant adverse effects on the attributes of the OUV, setting of scheduled monuments and relationship between barrows and barrow groups.
- The treatment of the Longbarrow junction and location of the new junction with the existing A303 west of the A360, to address and mitigate the likely significant adverse effects on the attributes of the OUV, setting of scheduled monuments within and outside of the WHS, relationship between barrows and barrow groups, and the wider landscape and views.
- The treatment and location of the new junction with the existing A303 west of the A360, to address and mitigate potential increases in traffic flows, and subsequent noise impacts, on local roads.

- The viaduct across the River Till in order to minimise visual impact, impacts on the setting of two important scheduled barrow groups and potential effects on the River.
- The results of ongoing archaeological evaluation and potential effects on undesignated archaeological assets.
- The results of ongoing ecological survey work and potential effects on protected and notable habitats and species.
- Potential effects on the Parsonage Down SSSI / Salisbury Plain SAC.
- Potential severance between the villages of Winterbourne Stoke and Shrewton.

14. Social Assessment

14.1 Introduction

14.1.1 WebTAG provides guidance for the completion of Social Impact appraisals.

14.1.2 Social Impacts consider the impact of transport on people including both local residents, and users of the transport network. The analysis of Social Impacts is mandatory in the appraisal process and is a constituent of the AST. Both beneficial and/or adverse Social Impacts of transport interventions need to be considered.

14.1.3 There are ten indicators for Social Impacts:

- Physical activity.
- Journey quality.
- Accessibility (Access to services).
- Security.
- Severance.
- Affordability.
- Option and non-use values.
- Commuting and other users.
- Reliability.
- Accidents.

14.1.4 Further detail on the social assessment is provided in the AST Report. The Commuting and Other users, Reliability and Accidents indicators are detailed in Chapter 10 Economic Assessment.

14.1.5 A range of qualitative and quantitative assessments for the other criteria were undertaken, as detailed below. At this stage, this assessment was undertaken without taking any mitigation into account.

14.2 Assessment Methodology

Physical activity

14.2.1 The assessment of the options against the physical activity indicator has followed the methodology established in WebTAG Unit A4.1 Social Impact Appraisal. However, at this stage the approach taken was qualitative due to the absence of data on the numbers of pedestrian, cyclists and equestrians using Public Rights of Way (PRoW) and Non-Motorised User (NMU) facilities.

14.2.2 The comparative analysis of options was based on the number of PRoW affected, not the number of NMUs affected nor the change in journey times. PRoW are likely to be affected directly (through the downgrading of the existing alignment and provision of the new alignment), and indirectly (as a result of changes in traffic

flows on the affected road network). The direct and indirect impacts on PRoW were considered in the assessment of impacts on physical activity.

Journey quality

14.2.3 The assessment guidelines for journey quality, as set out in WebTAG Unit A4.1, subdivides the topic into three groups:

- Traveller care.
- Traveller views.
- Traveller stress.

14.2.4 Traveller Care combines the assessments of:

- Cleanliness.
- Quality of transport facilities.
- Availability of travel information.
- The general transport environment.

14.2.5 Cleanliness of transport facilities and availability of travel information relate to public transportation facilities and are not relevant to a trunk road scheme. As such these were removed from the assessment of the three options. Quality of transport facilities considered the presence of service stations and facilities for motorists. This was therefore a relevant consideration for the three route options. The 'general transport environment' is generally only applicable to public transport schemes however there are certain criteria which would be relevant to the route options. Therefore, for Traveller care, route options were assessed only in terms of quality of transport facilities and the general transport environment. The assessment of general transport environment included consideration of temperature, noise and ventilation within the tunnelled sections. The quality of transport facilities focused solely on the level of facilities available to motorists at Solstice Park and Countess Services.

14.2.6 Traveller views required a qualitative assessment which judged the change in views from the route options compared to the baseline, taking into account how cuttings and artificial barriers might block and restrict views of the surrounding countryside and townscape. The assessment criteria are documented in the Environmental Assessment Report (EAR).

14.2.7 Traveller Stress is formed of three sub-factors:

- Frustration.
- Fear of potential accidents.
- Route uncertainty.

14.2.8 A qualitative approach was taken to each of these sub-factors. For frustration, the focus was on the change in travellers' ability to make good progress along each option in comparison to the baseline. Assessing fear of potential accidents required consideration of changes in road and junction layouts and conditions

among other factors. With regard to route uncertainty, the changes from the baseline in the ease of navigating route options, particularly in terms of junctions and provision of direction information, were factors which determined the assessment score.

14.2.9 An overall score for Traveller Stress was determined based on a balanced score of the three sub-factors. The assessment criteria are documented in the EAR.

14.2.10 Subsequently, scores for traveller care, traveller views and traveller stress were combined to feed into an overall, on-balance assessment score for Journey quality.

14.2.11 The overall assessment score for Journey quality was determined on balance by the assessment scores of the three sub-factors. The score was assessed using a seven point assessment scale as presented in Table 14-1 below.

Table 14-1 Journey quality assessment scale

Large adverse	Moderate adverse	Minor adverse	Neutral	Minor beneficial	Moderate beneficial	Major beneficial
Number of travellers affected daily >10,000	Number of travellers affected daily 500-10,000	Number of travellers affected daily <500	Balanced or no change	Number of travellers affected daily <500	Number of travellers affected daily 500-10,000	Number of travellers affected daily >10,000

WebTAG unit A4.1 social impact appraisal para. 6.2.7

Accessibility (Access to services)

14.2.12 As detailed in WebTAG Unit A4.1, this topic assesses access to services via public transportation. As the A303 Stonehenge is a trunk road scheme and all route options would provide adequate accessibility along the A303 route corridor in equal measure, this topic is considered to provide little differentiation between the options. As such, the options have not been assessed against the accessibility indicator.

Severance

14.2.13 The WebTAG assessment of Severance is defined as the separation of residents from services and facilities within their community. This assessment focuses exclusively on relief from existing and new severance impacts affecting local residents accessing facilities on foot, omitting private vehicle journeys, public transport and bicycle.

14.2.14 The assessment of severance was undertaken in two separate stages. Firstly, the difference in severance between the with-scheme and without-scheme scenarios was identified using the descriptions of levels of severance below:

- None – Little or no hindrance to pedestrian movement.

- Slight – All people wishing to make pedestrian movements would be able to do so, but there would probably be some hindrance to movement.
- Moderate – Pedestrian journeys would be longer or less attractive; some people are likely to be dissuaded from making some journeys on foot.
- Severe – People are likely to be deterred from making pedestrian journeys to an extent sufficient to induce a reorganisation of their activities. In some cases, this could lead to a change in the location of centres of activity or to a permanent loss of access to certain facilities for a particular community. Those who do make journeys on foot would experience considerable hindrance. For the benefit of assessing change in severance, 'Severe' relates to 'Large' in Table 14-2.

14.2.15 Table 14-2 below demonstrates the process taken to determine the level of change.

Table 14-2 Assessment of change in severance

Assessment of change in severance				
Without-scheme severance scoring	**With-scheme severance scoring**			
	None	**Slight**	**Moderate**	**Large**
None	None	Slight negative	Moderate negative	Large negative
Slight	Slight positive	None	Slight negative	Moderate negative
Moderate	Moderate positive	Slight positive	None	Slight Negative
Large	Large positive	Moderate positive	Slight positive	None

WebTAG unit A4.1 social impact appraisal. Table 5.1

14.2.16 Secondly, an overall score for severance was determined based on the number of pedestrians affected daily. This second stage assessment used a seven point assessment scale detailed below in Table 14-3.

Table 14-3 Overall severance assessment scale

Large adverse	**Moderate adverse**	**Minor adverse**	**Neutral**	**Minor beneficial**	**Moderate beneficial**	**Major beneficial**
Number of pedestrians	Number of pedestrians affected daily	Number of pedestrians	Balanced or no change	Number of pedestrians affected daily	Number of pedestrians affected daily	Number of pedestrians

Large adverse	Moderate adverse	Minor adverse	Neutral	Minor beneficial	Moderate beneficial	Major beneficial
affected daily >1,000	200-1,000	affected daily <200		<200	200-1,000	affected daily >1,000

WebTAG Unit A4.1 social impact appraisal

14.2.17 At this stage, the size of the population of communities affected by severance is unknown. An estimate of the relative sizes of the populations affected by severance was made for comparative purposes.

Security

14.2.18 This indicator considers changes in the perception of security, as well as actual changes to the level of security. A qualitative assessment was undertaken, looking at any changes in the security indicators including public transport waiting facilities / interchange facilities; pedestrian access; provision of lighting and visibility; landscaping; or formal or informal surveillance. Table 14-4 below demonstrates the process taken to determine the level of change for each of the security indicators.

Table 14-4 Assessment of change in security

Assessment of Change in Security				
Without-scheme Security Scoring	**With-scheme Security Scoring**			
	None	Poor	Moderate	High
None	None	Slight negative	Moderate negative	Large negative
Poor	Slight positive	None	Slight negative	Moderate negative
Moderate	Moderate positive	Slight positive	None	Slight Negative
High	Large positive	Moderate positive	Slight positive	None

14.2.19 Secondly, an overall score for security was determined based on the number of residents affected daily. This second stage assessment used a seven point assessment scale detailed below in Table 14-5.

Table 14-5 Overall security assessment scale

Large Adverse	Moderate Adverse	Minor Adverse	Neutral	Minor Beneficial	Moderate Beneficial	Major Beneficial
Number of travellers affected daily >1,000	Number of travellers affected daily 200-1,000	Number of travellers affected daily <200	Balanced or no change	Number of travellers affected daily <200	Number of travellers affected daily 200-1,000	Number of travellers affected daily >1,000

Affordability

14.2.20 This indicator identifies the potential user costs, including changes in public transport fares, tolls, and vehicle operating costs. A qualitative assessment of the potential impact on road users was undertaken. The score was assessed using a seven point assessment scale as presented in Table 14-6 below.

Table 14-6 Assessment of change in affordability

Large Adverse	Moderate Adverse	Minor Adverse	Neutral	Minor Beneficial	Moderate Beneficial	Major Beneficial
Large change to several types of cost	Large change to one type of cost or moderate change to several types of cost	Moderate change to one type of cost or slight change to several types of cost	Balanced or no change	Moderate change to one type of cost or slight change to several types of cost	Large change to one type of cost or moderate change to several types of cost	Large change to several types of cost

Option values

14.2.21 Option and non-use values considered if the scheme being appraised included measures that would substantially change the availability of transport services. The score was assessed using a seven point assessment scale as presented in Table 14-7 below.

Table 14-7 Overall option values assessment scale

Large Adverse	Moderate Adverse	Minor Adverse	Neutral	Minor Beneficial	Moderate Beneficial	Major Beneficial
Number of households affected >1,000	Number of households affected 250-999	Number of households affected 1-249	Balanced or no change	Number of households affected 1-249	Number of households affected 250-999	Number of households affected >1,000

WebTAG Unit A4.1 Social Impact Appraisal

Commuting and other users

14.2.22 The Commuting and Other Users assessment is detailed in Chapter 10.

Reliability

14.2.23 The Reliability assessment is detailed in Chapter 10.

Accidents

14.2.24 The Accidents assessment is detailed in Chapter 10.

14.3 Assessment Results

Physical activity

Route Options 1Na and 1Nd

14.3.1 By replacing the existing alignment and through the resulting changes in traffic flows on the affected road network, 1Na would reduce severance at approximately 18 PRoWs. Therefore, the experience for users of the PRoW network across the area would improve, potentially increasing physical activity. It is assessed that 1Na without mitigation, would cause severance at 9 PRoW, however on balance a **beneficial effect** is determined in terms of physical activity.

Route Option 1Sa

14.3.2 By replacing the existing alignment and through the resulting changes in traffic flows on the affected road network, Option 1Sa would reduce severance at approximately 18 PRoW. This would constitute an improvement to the condition of the PRoW network across the area. An improved user experience could result in increasing numbers of people engaging in physical activity. Without mitigation in the form of grade-separated crossings, it is assessed that 1Sa would cause severance at 10 PRoW. Overall a **beneficial effect** on physical activity is assessed for this alignment option.

Journey quality

Route Option 1Na

14.3.3 The tunnel with this option would be ventilated to minimise impacts from vehicle emissions. This would result in neutral effects in terms of the quality of the transport environment. Access to Solstice Park and Countess Services would maintain access to services for motorists, resulting in a neutral effect in terms of access and quality of traveller facilities. Overall, neutral effects are anticipated for Traveller Care.

14.3.4 In terms of Traveller Views, the loss of views of and within the Stonehenge and Avebury WHS, and in particular the complete loss of views to the Stonehenge monument, would represent a detrimental impact. While it is the intention, through architectural measures, to remind drivers they are travelling through an historic landscape, the tunnelled section of the alignment would provide travellers with no external views through the tunnel. Overall, a negative change to Travellers Views would be expected to result, with impacts affecting more than 10,000 travellers per day, resulting in a large adverse effect on Traveller Views.

14.3.5 Traveller Stress is assessed in terms of sub-factors, frustration, fear of potential accidents and route uncertainty. Regarding frustration, upgrading the A303 to a dual carriageway would reduce congestion and queuing and the provision of grade-separated junctions would improve travellers' ability to make good progress along the route. These two factors would reduce traveller frustration. The grade separated junctions would introduce merges and diverges that drivers would have to negotiate however the junctions would also reduce congestion. On balance a change for the better is expected in terms of fear of potential accidents. Similarly, the provision of grade-separated junctions may have a limited adverse effect in terms of route uncertainty. Overall, Option 1Na would result in a change for the better in terms of each of the three sub-factors under Traveller Stress and as these changes for the better would affect more than 10,000 travellers per day, a large beneficial effect is expected.

14.3.6 Taking account of the performance of the route option against all of the Journey Quality sub-factors, option 1Na is predicted to have a **moderate beneficial effect** on Journey Quality**.**

Route Option 1Nd

14.3.7 For the same reasons expressed for Route Option 1Na, the overall effect for Journey quality with Route Option 1Nd is determined to have a **moderate beneficial effect.**

Route Option 1Sa

14.3.8 For the same reasons expressed for Route Option 1Na, the overall effect for Journey quality with Route Option 1Sa is determined to have a **moderate beneficial effect.**

Accessibility (Access to services)

14.3.9 Accessibility was scoped out of this assessment.

Severance

Route Option 1Na

14.3.10 Route Option 1Na would divert the A303 to the north of Winterbourne Stoke, thus removing the road and associated traffic from passing through the village. This would result in a positive impact upon severance but, given the low numbers of people directly affected, was assessed to be slight beneficial. The provision of the tunnelled section would reduce severance within the WHS which would benefit local residents and visitors gaining access to the site.

14.3.11 A slight positive change in severance is anticipated between Berwick St James and Winterbourne Stoke. Due to the estimated number of people affected a slight beneficial effect is predicted. The tunnelled section of 1Na in the WHS would reduce severance for local residents gaining access to the site. Similarly, the provision of pedestrian facilities as part of the grade-separated junction at Countess Roundabout would result in a slight positive change in severance, therefore, slight beneficial effects are predicted given the estimated low number of people affected.

14.3.12 Moderate beneficial changes were assessed for the villages of Shrewton, Durrington and Larkhill. These beneficial impacts would be associated with a predicted reduction in through traffic diverting from the A303 onto the local road network (rat running) if Option 1Na was provided. A slight beneficial score was assessed for the villages within the Avon Valley as the fencing/gating of Byway AMES11 at its northern end would discourage unauthorised motorised use of the byway thereby improving conditions for pedestrians and cyclists. The reduction in severance is a slight positive effect.

14.3.13 Overall a **moderate beneficial effect** is predicted for Option 1Na in terms of Severance, as between 200 and 1000 daily travellers are expected to experience reduced severance.

Route Option 1Nd

14.3.14 For the same reasons expressed for Route Option 1Na, the overall effect on severance with Route Option 1Nd is determined to be **moderate beneficial.**

Route Option 1Sa

14.3.15 Route Option 1Sa would divert the A303 to the south of Winterbourne Stoke, thus removing the road and associated traffic from passing through the village. This would result in a positive impact upon severance but, given the low numbers of people directly affected, was assessed to be slight beneficial.

14.3.16 The tunnelled section of 1Sa in the WHS is considered to reduce severance for local residents gaining access to the site. A further slight positive change in severance is expected for residents of Countess Road when accessing facilities in Amesbury and based on the estimated number of residents to be affected, slight beneficial effects are anticipated.

14.3.17 Moderate beneficial changes were assessed for the villages of Shrewton, Durrington and Larkhill. These beneficial impacts would be associated with a predicted reduction in through-traffic diverting from the A303 onto the local road network (rat running) if Option 1Sa was provided. A slight beneficial effect was assessed for the villages within the Avon Valley as the fencing/gating of Byway AMES11 at its northern end would discourage unauthorised motorised use of the byway thereby improving conditions for pedestrians and cyclists. The reduction in severance is a slight beneficial effect.

14.3.18 Overall Option 1Sa is expected to have a **moderate beneficial** effect in terms of severance, as between 200 and 1000 daily travellers are expected to experience reduced severance.

Security

14.3.19 There would be no lighting along the mainline for any of the options (except in the tunnel and existing lighting at Countess Roundabout), but as the existing alignment is unlit except where it passes through Winterbourne Stoke, this would not constitute a change in lighting levels along the route. No significant impacts on personal security were identified and so all options were assessed as **neutral**.

Affordability

14.3.20 The affordability assessment considers the financial implications for users of the scheme with a particular focus on regular local users.

14.3.21 The distance to travel along the length of the route option would increase for all route options. In all options, residents of Winterbourne Stoke would have to travel greater distances to access the A303 westbound, as there would be no junction where the bypass re-joins the existing A303 alignment. For each of the options, a reduction in congestion would have some offsetting effect on vehicle operating costs.

14.3.22 On balance, for all options, an increase in travel distance means there would be an adverse impact on affordability, although improved traffic flows are likely to assist in offsetting this additional cost to users, to give an overall assessment of **neutral**.

Option values

14.3.23 It is unlikely this scheme would have any impact on Option Values for any of the options under consideration as there are no new provisions of public transport services or removal of existing services. The scheme was assessed as neutral for all options.

14.4 Summary and Conclusions

14.4.1 For option values, all options were assessed as neutral as there is no public transport element to the scheme.

14.4.2 For security, all options were assessed as neutral as no significant changes to personal security on the route were identified, but this may change when detailed arrangements on lighting and surveillance are determined during design development.

14.4.3 For affordability, all options were assessed as slight adverse as while there would be savings in vehicle operating costs from reduced congestion, this benefit would be counteracted by an increase in operating costs due to having to travel along a slightly longer route.

14.4.4 For severance, all three options were scored as moderate beneficial as severance would be reduced at a number of locations along the alignment and on the affected road network.

14.4.5 For journey quality, all three options scored moderate beneficial because of reductions in traveller stress.

14.4.6 For physical activity, all three options were scored as beneficial as, on balance, PRoW would experience reduced severance.

14.4.7 While the WebTAG guidance for social assessments does not lend itself to assessing an overall score for each of the route options in terms of social impacts, Table 14-8 demonstrates the scores for each topic for the benefit of comparing the three route options.

Table 14-8 Social impacts summary

Assessment Topic	Route Option 1Na	Route Option 1Nd	Route Option 1Sa
Physical Activity	Beneficial	Beneficial	Beneficial
Journey Quality	Moderate beneficial	Moderate beneficial	Moderate beneficial
Accessibility	N/a	N/a	N/a
Security	Neutral	Neutral	Neutral
Severance	Moderate beneficial	Moderate beneficial	Moderate beneficial
Affordability	Neutral	Neutral	Neutral

Assessment Topic	Route Option 1Na	Route Option 1Nd	Route Option 1Sa
Options and non-use values	Neutral	Neutral	Neutral

14.4.8 The social impact assessment identifies no differences between the route options.

15. Distributional Impact Assessment

15.1 Introduction

15.1.1 WebTAG provides guidance for the completion of distributional impact appraisals.

15.1.2 Distributional impacts (DI) consider the variance of transport intervention impacts across different groups in society. The analysis of DIs is mandatory in the appraisal process and is a constituent of the AST. Both beneficial and/or adverse distributional impacts of transport interventions need to be considered, along with the identification of groups likely to be affected.

15.1.3 There are eight indicators for distributional impacts:

- User Benefits.
- Noise.
- Air Quality.
- Accidents.
- Security.
- Severance.
- Personal Affordability.
- Accessibility.

15.1.4 A screening was undertaken to determine which distributional impact indicators are relevant for the A303. Accessibility was scoped out, as this indicator highlights any impact to public transport services and the scheme has no public transport along the existing A303 and limited public transport nearby.

15.1.5 The remaining seven indicators were subject to a full assessment. The full assessment used available model data (SATURN, COBA-LT, TUBA, air and noise models) and where this was not available qualitative information on the scheme to provide a qualitative assessment of DIs.

15.1.6 Further detail on the distributional impacts assessment is provided in the Appraisal Summary Tables (ASTs) Report.

15.2 Assessment methodology

15.2.1 All assessments were assessed using the 7 point scale detailed in Table 15-1.

Table 15-1 Distributional impacts scoring

Key to individual assessment of each Income quintile	
Beneficial and the population impacted is significantly greater than the proportion of the group in the total population	Large Beneficial
Beneficial and the population impacted is broadly in line with the proportion of the group in the total population	Moderate Beneficial

Key to individual assessment of each Income quintile	
Beneficial and the population impacted is smaller than the proportion of the group in the total population	Slight Beneficial
There are no significant benefits or disbenefits experienced by the group for the specified impact	Neutral
Adverse and the population impacted is smaller than the proportion of the population of the group in the total population	Slight Adverse
Adverse and the population impacted is broadly in line with the proportion of the population of the group in the total population	Moderate Adverse
Adverse and the population impacted is significantly greater than the proportion of the group in the total population	Large Adverse

15.2.2 WebTAG Unit A4.2 Distributional Impact Appraisal

User benefits

15.2.3 This indicator identifies the potential user benefits and assesses whether the benefits and/or disbenefits are distributed proportionately across users. User benefits including benefits to journey times and benefits to vehicle operating costs were identified and compared to the income category of indices of deprivation to identify any disproportionate impacts on low income groups.

Noise

15.2.4 A noise analysis was carried out to identify potential changes. This was undertaken by examining the forecast changes by noise receptors, in relation to the location and proportion of vulnerable groups within the 600m noise boundary.

Air quality

15.2.5 A qualitative air quality analysis was carried out to identify potential changes in air quality. This was undertaken by examining the forecast changes in NO_2 and PM10 by road link on the affected route network, in relation to the location and proportion of vulnerable groups within a 200m air quality boundary.

Accidents

15.2.6 The accident analysis examined the likely changes to accident levels (positive or negative) and compared this with the proportion of vulnerable groups within the scheme area. STATS19 data was used to identify if the area was an existing hotspot for accidents involving vulnerable users such as pedestrians, cyclists and young male drivers to identify if any changes in accident levels were likely to disproportionately affect them.

Security

15.2.7 This included a qualitative assessment on whether the scheme would improve or deteriorate the perception of personal security on vulnerable groups, including looking at changes to pedestrian access; changes to provision of lighting and visibility; changes to landscaping; and changes to formal or informal surveillance.

Severance

15.2.8 The ease with which people move around the area was examined, and a qualitative assessment undertaken of any changes to footbridges and public rights of way, as well as increases/decreases in traffic flows on highway links. This was examined on the concentration of vulnerable groups in the area including children, older people and those in households without access to a car to determine if there was likely to be any disproportionate impact on them.

Accessibility

15.2.9 This indicator was scoped out as noted above.

Affordability

15.2.10 This indicator identified the potential affordability benefits, and assessed whether the benefits and/or disbenefits are distributed proportionately across the users. Benefits related to the cost of travel (vehicle operating costs were the only relevant category for this scheme) were identified and compared to the income category of indices of deprivation to identify any disproportionate impacts on low income groups.

15.3 Assessment Results

User benefits

15.3.1 As detailed in Section 2.2, there are currently high levels of congestion and long journey times on this section of the A303, as it is a single carriageway section with limited capacity. All route options would be dual carriageway, which would increase capacity, and so reduce congestion and journey times, which would have time benefits for users of the scheme, especially in peak hours.

15.3.2 The distance to travel along the length of the route option would increase for all options, however, a reduction in congestion would have some offsetting effect on vehicle operating costs.

15.3.3 Overall there are net benefits associated with all route options for residents in the core modelled area. User benefits have a particularly large impact on people with income deprivation due to increases in the cost of undertaking journeys. Around 2% of the impact area within the user benefit appraisal are within the most deprived income quintile nationally. These residents experience proportionate benefits for all route options. Overall a moderate beneficial impact is considered for user benefits for all route options.

Noise

15.3.4 There are a total of five schools located within 600m of the noise receptors of all three options. Four of these (three primary schools and one secondary school) are located in Amesbury. The eastern extent of all three options also has a high proportion of children (top 20% nationally). In terms of noise from traffic flow changes and road position, all four schools would be subject to adverse impacts for all three options.

15.3.5 Option 1Na, has the most prominent adverse impact, while Options 1Sa and 1Nd have a more mixed impact, with all options showing largely negative noise impacts adjacent to schools with some beneficial noise impacts. One of the four schools is also located within an area where there are concentrations of children (top 20% nationally) – all three options have a largely negative noise impact within this location.

15.3.6 To the west, there is one primary school in Maddington. Option 1Sa is likely to reduce noise at all receptors within 600m of this school. The receptors closest to Option 1Na and 1Nd are likely to experience a decrease in noise, although there are several adverse receptors that are within 600m, and significantly more adverse receptors in the area for Option 1Na.

15.3.7 All three options have a largely adverse noise impact within Amesbury, where there are concentrations of children and moderately deprived residents. There are net disbenefits across all income deprivation quintiles for Option 1Na, and net disbenefits in all quintiles other than income quintile 5 (the least deprived quintile) for Options 1Sa and 1Nd.

15.3.8 For all route options, there are a mixture of beneficial and adverse noise impacts likely, and therefore overall a neutral impact on noise is anticipated. A full appraisal of noise impacts would be undertaken when detailed modelling information is available at PCF3.

Air quality

15.3.9 There are no Air Quality Management Areas (AQMAs) within 200m of the route options.

15.3.10 There are six schools within a 200m buffer of all three options. For NO_2, across all options, four of the six schools are projected to see a decrease in NO_2, and the remaining two schools an increase in NO_2. The schools to experience a decrease are all in the east, in Amesbury, Larkhill, Shrewton and Middle Woodford, with the two schools seeing an increase being located in the north-west of the impact area, south of Warminster.

15.3.11 To the east of the impact zone, there are a few areas where the numbers of children are in the top 20% nationally. In and around Amesbury and Larkhill however there are pockets of areas with the top 20% of children nationally. Within these areas, in eastern Amesbury, there is a road link with an increase in NO_2 for all options. To the south of Amesbury and in Larkhill meanwhile, the road links are forecast to decrease NO_2 for all options, except for Option 1Na south of Amesbury which would see no change.

15.3.12 For PM10 across all options, three of the six schools are projected to experience a decrease in PM10, two schools an increase and 1 school has no change in PM10 levels. To the east of the impact zone, there are a few areas where the numbers of children are in the top 20% nationally. In eastern Amesbury, a road link is expected to see an increase in PM10 for all options, in an area where there are high proportions of children. To the south of Amesbury and to the west of Amesbury in Larkhill, for Option 1Na, where there are high proportions of children, there are two road links with a decrease in PM10. For Option 1Nd, the link south

of Amesbury has a decrease in PM10 but no change in Larkhill. For Option 1Sa, both of these links experience no change.

15.3.13 For both PM10 and NO_2, there is expected to be both adverse and beneficial impacts on the affected route network. There appear to be more NO_2 and PM10 links within areas in income quintile 4. There are no assessed road links within the most deprived income quintiles (quintile 1 and 2). Overall therefore, a **neutral** impact on air quality is considered for both options.

Accidents

15.3.14 The A303 between Amesbury and Berwick Down is an accident blackspot with higher rates of traffic incidents than would normally be expected for a road of its type. Accident rates are twice those for the Corridor as a whole. The new alignment would be designed to current standards and would help to improve safety by creating a dual carriageway and managing junction access to maintain the flow of traffic. Accidents in tunnels, especially with operating with bi-directional flow, can be more severe, but the tunnels would be designed to the latest safety standards.

15.3.15 Higher than average levels of accidents involving older people were found in the impact areas. Accidents rates for all other vulnerable groups were below or in line with the national average.

15.3.16 For all options, no links included within the transport model were forecast to have an increase in accident rates, representing an overall slight beneficial impact on accidents. A moderate beneficial impact was noted for older people for 1Na and 1Sa due to a higher than average proportion of accidents involving this group within the impact area. A slight beneficial impact was noted for all other vulnerable groups considered within the assessment where there was representation of these groups in the casualty statistics as accident levels were in line or below national averages.

Security

15.3.17 With this section of the A303 closed to general traffic except for local access, it is possible that the level of informal surveillance could decrease, which could lead to an adverse impact on people's perception of security. This section of the A303 is mostly unlit, although there is some lighting as the route passes through Winterbourne Stoke. The mainline would not be lit for any of the route options (except for in the tunnel and re-providing lighting at Countess Roundabout where relevant), and so any impact from changes to lighting on security along the route is expected to be negligible.

15.3.18 Security is particularly important for children, older people, people with disabilities, and black and minority ethnic people (as identified in WebTAG). There are concentrations of children in Amesbury and to the north of the existing A303 and concentrations of older people along the existing A303 who may be impacted on by any changes to security. There are no areas with a high concentrations of people with disabilities or black and minority ethnic people close to the scheme, but there would still be people in these groups who may be impacted on by any changes to security.

15.3.19 Security issues would need to be considered within the scheme design, however at this stage, security measures/designs are unknown and therefore all scheme options have been assessed as neutral. A further assessment would be undertaken on the final option to assess the impact on security of vulnerable users.

Severance

15.3.20 Impacts of any changes in severance would have a particular impact on older people, children, people living in households without access to a car and people with disabilities.

15.3.21 A general reduction in severance is considered as a result of removing traffic from the existing A303 and displacing it to the bypass. All of the options may result in reductions in severance in several areas, including Winterbourne Stoke, the WHS, Shrewton, Durrington and Larkhill. In both Durrington and Larkhill there were high concentrations of children who would particularly benefit from this.

15.3.22 All options are assessed as slight beneficial. Children are considered to have a moderate beneficial impact as there are concentrations of children resident along the route and also three schools located within 1km of the route.

Accessibility

15.3.23 This indicator was scoped out of the assessment.

Affordability

15.3.24 The distance to travel along the length of the route would increase for all options, however a reduction in congestion would have some offsetting effect on vehicle operating costs.

15.3.25 Overall there are net affordability disbenefits associated with all options. Affordability changes have a large effect on people with income deprivation due to increases in the cost of undertaking journeys. Only around 2% of the impact area within the affordability appraisal are within the most deprived income quintile nationally. These residents experience benefits for all route options. The most deprived residents experience a considerably higher proportion of the affordability benefits than would be expected from a fair distribution, this presents a large beneficial impact for this group for these route options.

15.3.26 The remaining income quintiles all experience disbenefits for all options (ranging from slight to large). Overall, there are net disbenefits of the scheme for residents within the core modelled area, but beneficial impact on the most vulnerable residents within the impact area, presents an overall slight adverse impact on affordability for all options.

15.4 Summary and Conclusions

15.4.1 All options were assessed as moderate beneficial for user benefits, as no disproportionate impact on income deprived groups was identified and there were net benefits.

15.4.2 All options were assessed as moderate adverse for noise, as disbenefits were noted for noise within the study area, in particular, close to high proportions of children and schools.

15.4.3 All options were assessed as neutral for air quality, as there are mixed NO2 and PM10 forecast changes for all three options.

15.4.4 All options were assessed as overall slight beneficial for accidents, but the improvement in accidents would have a particular impact on older people who were considered to have a moderate beneficial impact for 1Na and 1Sa.

15.4.5 All options were assessed as neutral for security as so significant changes were identified.

15.4.6 All options were assessed as slight beneficial for severance as there would be overall benefits as a result of traffic displacement.

15.4.7 All options were assessed as slight adverse for affordability due to an increase in vehicle operating costs associated with longer routes, although net benefits were noted in each instance for the most deprived income quintile.

15.4.8 The summary scores are shown in Table 15-2 below.

Table 15-2 Distribution impacts summary

Assessment Topic	Route Option 1Na	Route Option 1Nd	Route Option 1Sa
User benefits	Moderate beneficial	Moderate beneficial	Moderate beneficial
Noise	Moderate adverse	Moderate adverse	Moderate adverse
Air quality	Neutral	Neutral	Neutral
Accidents	Slight beneficial	Slight beneficial	Slight beneficial
Security	Neutral	Neutral	Neutral
Severance	Slight beneficial	Slight beneficial	Slight beneficial
Accessibility	Neutral	Neutral	Neutral
Affordability	Slight adverse	Slight adverse	Slight adverse

15.4.9 Overall, there is no significant difference in Distributional Impact between the options.

16. Appraisal Summary

16.1 WebTAG Appraisal Summary Introduction

16.1.1 This section provides a summary of the more detailed WebTAG assessment and appraisal undertaken on the three better performing route options developed in response of the feedback from public consultation and further site surveys, as reported in Chapter 7 to 15. The assessments are also presented in WebTAG Appraisal Summary Tables that have been prepared for the three route options.

Engineering and Safety Assessment

16.1.2 The design of the route options for this stage have been based on the DMRB requirements for an all-purpose road with a 120kph design speed, in conjunction with design principles outlined in the Expressways Technical Note, ahead of publication of the Expressway Interim Advice Note (IAN).

16.1.3 The only departures from standard identified at this stage are with the geometry through the new A345 junction and the existing Countess Roundabout. The existing junction was designed for future provision of an overpass on the A303 and in order to maximise retention of the existing road geometry, there could be possible minor horizontal curvature and minor visibility departures on the approaches to any new grade separated junction at this location, including with the adjacent tie-in to the existing A303 further east. The departures are common to all route options and are subject to design development at the next stage.

16.1.4 With the proposed junction arrangements at the new A360 junction, there would be one less side road overbridge structure with Route Option 1Nd than with the other options.

16.1.5 All route options would include an approximately 2.9km long bored tunnel with an approximate 300m long cover extension at the western portal.

16.1.6 The safety assessment of the three options is reported in Chapter 7 and encompasses both impacts on the road user, via an accident and road safety review, as well as an assessment of the impact during construction and subsequent operation.

16.1.7 The outcome of the review was that, although individual differences were identified between the route options, none of the options raised significant concerns and the expectation was that all three route options would have a positive impact upon road safety.

16.1.8 In terms of safety during construction, hazards were identified for the three route options. The key risks are associated with the tunnelling works which would include underground working and the handling and removal of significant quantities of spoil.

16.1.9 On balance, it was assessed that the inclusion of a tunnel is likely to have slightly more significant risk associated with its construction. The risks are understood, however, and would be suitably mitigated by an experienced Contractor.

Client Scheme Requirements (CSRs) and Policy

16.1.10 An assessment of each option's performance against the CSRs as well as relevant local and national planning, transport and economic policy objectives is provided in Chapter 8.

16.1.11 In overall terms, all three options align well with the CSRs and relevant national and local policy objectives.

Traffic modelling

16.1.12 Chapter 9 sets out the traffic modelling which was carried out to understand the characteristics of the existing network and how this might change upon implementation of each of the options.

16.1.13 A comparison of the increase in the new A303 route option length between the intersections with the A36 and the A338 and the associated journey time savings of the three route options is provided in Table 16-1. Option 1Nd would reduce the journey times compared with options 1Na and 1Sa by a further approximately 12 seconds.

Table 16-1 Route options length and journey time comparison

Route options	Approximate increased length of route between A36 and A338 compared with existing (km)	Average journey time between A36 and A338 (mins)	Average journey time savings from do-minimum (mins)
1Na	0.4	13	4
1Nd	0.1	13	4
1Sa	0.4	13	4

16.1.14 The results indicate that all route options would provide significant average journey time savings compared with the do-minimum scenario.

Economy

16.1.15 Chapter 10 summarises the economic assessment which was carried out on the three selected route options.

16.1.16 The economic assessment of the options was undertaken in accordance with WebTAG guidance. Typically, the appraisal of transport schemes is focussed on the benefits delivered to users in respect of faster journeys and reduced vehicle operating costs.

16.1.17 Initial BCRs (transport impacts only) for the three options were as follows:

- Route Option 1Na - 0.4
- Route Option 1Nd - 0.5
- Route Option 1Sa - 0.4

16.1.18 Adjusted BCRs (including reliability and wider impacts) for the three options were as follows:

- Route Option 1Na - 0.6
- Route Option 1Nd - 0.6
- Route Option 1Sa - 0.5

16.1.19 On this basis, there is no significant difference between the transport economic performances of the options. However, the final judgement of value for money must consider the impacts on the WHS and the wider non-monetised landscape and environmental impacts.

16.1.20 Quantifying impacts on the WHS is highly challenging and required an innovative approach. In accordance with HM Treasury Green Book guidance, a Contingent Valuation study was undertaken which sought to place a value on the benefits of removing the A303 from the vicinity of Stonehenge. The study focussed on the value placed on the scheme – In relation to noise reduction, increased tranquillity, visual amenity and reduced landscape severance at Stonehenge – by visitors to Stonehenge, A303 road users and the population of the UK more widely.

16.1.21 The benefits of removing the road from the WHS were balanced against monetised estimates of the adverse impacts of the scheme options on the landscape more generally.

16.1.22 The Adjusted BCRs for the route options when such impacts were included are as follows:

- Route Option 1Na - 1.2
- Route Option 1Nd - 1.2
- Route Option 1Sa - 1.2

16.1.23 With this broader perspective the scheme would deliver benefits in excess of costs, whilst the BCRs for the options are of a similar magnitude, based on similar tunnel and surface section lengths.

16.1.24 Since the Adjusted BCRs understate the benefits, a complementary approach to wider economic benefits assessment was used to provide a more tailored assessment of the economic impacts. This assessment indicated that wider economic benefits were likely to be higher than the WebTAG based Wider Impacts methodology suggests.

16.1.25 Taking these factors into account, the project was assessed as being 'low' to 'medium' value for money with an Adjusted BCR of 1.4 that includes seasonality impacts and the wider economic benefits of knock-on effects (SCGE) and long distance connectivity.

16.1.26 Furthermore, analysis was undertaken which demonstrates that the transport and economic benefits of the A303 Stonehenge scheme are greater when considered as part of the overall Expressway programme, resulting in a BCR of 1.7 for the Preferred Route.

Operational Assessment

16.1.27 Chapter 11 of the report sets out an assessment as to how the three options compare in terms of their effect on the operation of the road network in the locality of the scheme.

16.1.28 The assessment concluded that all three options could be developed to provide safe and economic operation and maintenance.

Technology and Maintenance Assessment

16.1.29 The technology assessment is set out in Chapter 12. Technology would be adopted to support operational regimes and manage traffic through this section of the network. At this stage it has been assessed that all three options can be designed in accordance with the appropriate industry guidance, albeit with slightly more technology being required in order to service the tunnel element.

16.1.30 Chapter 12 discusses and records the outcome of the maintenance assessment of the three options.

16.1.31 All three options would introduce new maintenance liabilities onto the network but all are deemed capable of being maintained in accordance with current industry guidance and requirements.

16.1.32 Specific maintenance activities would be required for the tunnel but these are considered to be routine tunnel maintenance operations.

Environmental Assessment

16.1.33 Chapter 13 sets out the findings of the environmental assessment for each route option and topic.

16.1.34 WebTAG assessment scores are included Table 16-2 for ease of comparison. WebTAG to provide an overall score for each topic rather than prescribing the separate reporting of impacts on individual receptors.

Table 16-2 Summary of environmental assessment outcomes

Parameter	1Na	1Nd	1Sa
Noise: Net Present Value (NPV) of change in Noise (£)*	-£1,032 000	-£358, 000	£762, 000
Air quality: Total value of change in air quality (£)*	-£604,000	-£543,000	-£525,000
Greenhouse Gases: NPV of change in Greenhouse gases (£)*	-75,514,628	-75,115,691	-78,006,285
Landscape	Moderate Adverse	Moderate Adverse	Moderate Adverse
Townscape	Neutral	Neutral	Neutral
Historic Environment	Slight Beneficial	Slight Beneficial	Slight Beneficial

Parameter	1Na	1Nd	1Sa
Biodiversity	Large Adverse	Large Adverse	Large Adverse
Water environment	Large Adverse	Large Adverse	Large Adverse

* a positive value represents a benefit whilst a negative value a disbenefit

16.1.35 The WebTAG appraisal does not distinguish between the environmental performance of route options for several topics. Accordingly, where possible, further assessment work has been conducted, following DMRB guidelines, to refine understanding and inform selection. On the basis of further comparative assessment, Option 1Nd is the preferred option from an environment and cultural heritage perspective.

Social Impact

16.1.36 The assessment of Social Impacts is set out in Chapter 14. The Social Impacts assessment considered the impact of the scheme on both local residents and users of the transport network.

16.1.37 Table 16-3 summarises the scores for each topic for the benefit of comparing route options.

Table 16-3 Social impacts summary

Assessment Topic	Route Option 1Na	Route Option 1Nd	Route Option 1Sa
Physical Activity	Beneficial	Beneficial	Beneficial
Journey Quality	Moderate beneficial	Moderate beneficial	Moderate beneficial
Accessibility	N/a	N/a	N/a
Security	Neutral	Neutral	Neutral
Severance	Moderate beneficial	Moderate beneficial	Moderate beneficial
Affordability	Neutral	Neutral	Neutral
Options and non-use values	Neutral	Neutral	Neutral

16.1.38 The assessment confirmed no significant differences between the three route options, with a slight preference for options to the north of Winterbourne Stoke with the reduced number of Public Rights of Way affected.

Distributional Impact

16.1.39 The assessment of distributional impacts is set out in Chapter 15. Distributional impacts consider the variance of transport intervention impacts across different social groups.

16.1.40 A summary of the assessment carried out for the three options against the eight indicators, as defined by WebTAG, is included in Table 16-4 below.

Table 16-4 Distribution impacts summary

Assessment Topic	Route Option 1Na	Route Option 1Nd	Route Option 1Sa
User benefits	Moderate beneficial	Moderate beneficial	Moderate beneficial
Noise	Moderate adverse	Moderate adverse	Moderate adverse
Air quality	Neutral	Neutral	Neutral
Accidents	Slight beneficial	Slight beneficial	Slight beneficial
Security	Neutral	Neutral	Neutral
Severance	Slight beneficial	Severance	Slight beneficial
Accessibility	Neutral	Neutral	Neutral
Affordability	Slight adverse	Slight adverse	Slight adverse

16.1.41 The distributional impacts assessment considered the variance of transport intervention impacts across different social groups. Overall, there is no significant difference in impact between the three route options.

16.2 Appraisal Summary Tables (ASTs)

16.2.1 ASTs were produced for each of the three route options to collate the assessments summarised above and detailed in Chapters 7 to 15 of this report. Further details of the ASTs and supporting worksheets can be found in the Stage 2 Appraisal Summary Tables and Supporting Worksheets Report. The ASTs present a summary of the appraisals under the main headings of:

- Economy.
- Environmental.
- Social.
- Public Accounts.

16.2.2 The ASTs for each option are provided in Appendix F.

16.2.3 To assist the comparison of the route options, a summary of the quantitative and qualitative assessments from the ASTs is presented below in Table 16-5.

Table 16-5 AST assessment comparison

	Impacts	1Na	1Nd	1Sa
Econo	Business users & transport providers	£295,300,000	£309,300,000	£277,400,000

	Impacts	1Na	1Nd	1Sa
	Reliability impact on business users	£14,600,000	£14,600,000	£14,600,000
	Regeneration	Neutral	Neutral	Neutral
	Wider Impacts	£72,600,000	£66,100,000	£73,800,000
Environmental	Noise	-£1,032,000	-£358,000	£762,000
	Air Quality	-£604,000	-£543,000	-£525,000
	Greenhouse Gases	-£ 75,515,000	-£ 75,116,000	-£ 78,006,000
	Landscape	Moderate Adverse	Moderate Adverse	Moderate Adverse
	Townscape	Neutral	Neutral	Neutral
	Historic Environment	Slight Beneficial	Slight Beneficial	Slight Beneficial
	Biodiversity	Large Adverse	Large Adverse	Large Adverse
	Water Environment	Large Adverse	Large Adverse	Large Adverse
Social	Commuting and other users	£164,300,000	£184,100,000	£146,900,000
	Reliability impact on commuting and other users	£46,000,000	£46,000,000	£46,000,000
	Physical activity	Beneficial	Beneficial	Beneficial
	Journey quality	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial
	Accidents	£14,400,000	£14,200,000	£15,100,000
	Security	Neutral	Neutral	Neutral
	Accessibility	Neutral	Neutral	Neutral
	Affordability	Neutral	Neutral	Neutral
	Severance	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial
	Option and non-use values	Neutral	Neutral	Neutral
Public accounts	Cost to broad transport budget	£1,146,219,000	£1,146,219,000	£1,148,337,000

	Impacts	1Na	1Nd	1Sa
	Indirect Tax Revenues	-£107,040,000	-£110,339,000	-£112,384,000

* a positive value represents a benefit whilst a negative value a disbenefit

16.3 Key Considerations from Consultation

16.3.1 To assist the differentiation between the three route options, the key considerations raised from public consultation in relation to the choice of a preferred route have been reviewed against the options, as detailed in Table 16-6 below.

Table 16-6 Key considerations raised from Public Consultation

Key Issues Raised from Public Consultation	Option 1Na	Option 1Nd	Option 1Sa
Impact on local communities of Winterbourne Stoke/Berwick St James.	Of those expressing a preference, nearly two-thirds would like a northern bypass.	Some respondents linked their preference for a northern bypass to a route more closely following the existing A303 through the WHS.	Supported by one-third of those expressing a preference
	In terms of effects on people and communities, the downgrading of the existing alignment through Winterbourne Stoke in all options would remove east-west through traffic from the village, greatly improving amenity for local residents and PRoW users. Concerns were raised about the A360 junction location with Option 1Na, that it could encourage traffic from the north (via Shrewton) to use the B3083 through Winterbourne Stoke rather than the A360 to access the A303. This can be addressed by Option 1Nd, with the junction location moving closer to the line of the existing A360 at Longbarrow. The bypass options are predicted to result in small differences in effects on amenity and community severance. Option 1Sa would introduce new intrusion between Winterbourne Stoke and Berwick St James, where consultation feedback indicates a high amenity value and activity, such as enjoying the PRoW between the two villages. Conversely the feedback suggests lower levels of non-motorised movement between the villages of Winterbourne Stoke and Shrewton to the north. All three options are assessed to have slight adverse effects on farming operations, however Option 1Sa would impact directly on Oakland Dairy resulting in a more significant adverse effect compared to the other two options. All three options would be		

Key Issues Raised from Public Consultation	Option 1Na	Option 1Nd	Option 1Sa
	expected to have large adverse effects on BMV land, although Options 1Na and 1Nd are considered to have slightly less of an adverse impact than Option 1SA. On balance, Options 1Na and 1Nd are determined to be preferred in terms of effects on People and Communities.		
Access to and from Winterbourne Stoke/Berwick St James (WS/BSJ) via the new A360 junction and minimising rat-running via the B3083 between WS and Shrewton.	Least preference for minimising rat-running but better than Option 1Sa for access to and from WS/BSJ.	Best operational solution, as the proposed A360 junction will be closer to WS than with Option 1Sa and closer to the A360 than with Option 1Na, thereby avoiding any encouragement for traffic to rat-run via the B3083.	Least preference for access to and from WBS/BSJ, but better than Option 1Na for avoiding rat-running.
Impact on local businesses and amenities	Preference for northern bypass in balancing impacts on farming operations to the north and south, and on businesses such as the Stonehenge campsite and on amenity activities such as River Till angling.	As for Option 1Nd, with the added benefit that, in following the line of the existing A303 through the western part of the WHS, the route would be less disruptive to existing farm operations.	Least preference for a southern bypass in balancing impacts on farming operations to the north and south, and on businesses such as the Stonehenge campsite and on amenity activities such as River Till angling.
Biodiversity Issues	A key difference in ecological terms relates to the proposed locations of the River Till crossings and potential to impact on habitat and species associated with the River Till SSSI, which forms part of the European designated River Avon SAC. At the crossing point of a northern bypass, the river is 'winterbourne' with seasonally dry periods when the river has no water present. This means that the river at this location is less likely to support the qualifying species for the River Avon SAC (as well as other protected and notable species and locally important features) when compared with the crossing point of a southern bypass, where the river is permanently flowing and comprises high quality and		

Key Issues Raised from Public Consultation	Option 1Na	Option 1Nd	Option 1Sa
	sufficiently diverse riparian habitats to support all qualifying features of the SAC/SSSI designation. For the Salisbury Plain SAC/Parsonage Down SSSI & NNR to the north of Winterbourne Stoke, a potential impact arises from changes in air quality, but the assessment demonstrates that there would be no significant change arising from the route options. On this basis, the potential effects from nitrogen deposition is not a differentiator between the options. During construction, with southerly wind conditions, industry best practice dust suppression methods would mitigate the slight risk of dust being deposited on the southern slopes of Parsonage Down. Within the WHS Option 1Nd would also be further away from the RSPB reserve on Normanton Down and would avoid impact on The Diamond. Overall, based on the information currently available, it is considered that the southern bypass presents a higher risk in terms of Habitat Regulations Assessment and subsequent requirements for mitigation, and the northern bypass is preferred.		
Historic Environment Issues	In relation to the historic environment, there are substantive issues with both northern and southern bypass options. To the south there are a number of newly discovered archaeological sites including a potential Roman settlement, while to the north, the alignment and crossing of the River Till would have a significant adverse impact on the setting of two important barrow complexes. The principal issue however with Option 1Sa is that it would exit the WHS on the same alignment as the Winter Solstice Sunset Alignment (as viewed from Stonehenge), which is a key element of the Outstanding Universal Value of the WHS. Although it should be possible to design the route to avoid it being visible, this cannot be guaranteed and there might still be a night glow from vehicle headlights. Therefore, given this and the likely archaeological impacts, a northern bypass is preferred in historic environment terms, as it provides more options to bring overall benefits to the WHS and opportunities for mitigation as part of the design development.		
Landscape and Visual Issues	In terms of landscape effects, the southern bypass passes through a more complex valley landscape with a greater range of landscape elements, a proportion of which would be removed to accommodate the scheme, and would take many decades to replace. In comparison, the landscape in the area of the northern bypass, whilst very distinctive, is a simpler, more open landscape affecting a relatively small number of landscape elements.		

Key Issues Raised from Public Consultation	Option 1Na	Option 1Nd	Option 1Sa
	East and north east of Winterbourne Stoke there is the opportunity to integrate the proposed route and A360 junction into the existing landform and to screen views to a certain extent. In visual terms, the southern route would adversely affect a greater number of residential and leisure receptors overall. In addition, none of the receptors affected by the southern route would have their visual amenity improved by the removal of traffic from the existing A303 as this existing element is not visible from properties along this corridor. Overall, the northern bypass is preferred in landscape and visual terms.		
Water Environment	In relation to the water environment, the key issue is the hydrological regime along this section of the River Till, where the perennial (permanently flowing) section to the south of Winterbourne Stoke, suggests that the aquatic species for which the River Till is designated (e.g. Salmonids) are more likely to be present where the river is crossed by the southern route. There are also a number of groundwater boreholes located close to or within a precautionary sphere of influence of the southern route. Based on the data available at this stage, there is a preference for a route to the north of Winterbourne Stoke.		
Engineering and Safety Assessment (inc. route length, earthworks strategy and maintenance)	Lower preference as the route length is longer than Option 1Nd, increasing earthworks volumes, engineering costs and safety risks.	Preference for Option 1Nd as the route length is shorter than the other options, reducing earthworks volumes, engineering costs and safety risks.	Lower preference as the route length is longer than Option 1Nd, increasing earthworks volumes, engineering costs and safety risks.

16.4 Interim Ranking against Key Considerations from Consultation

16.4.1 For comparative purposes, each of the options have been given a ranking from 1 to 3 based upon how they were assessed to perform against each of the key considerations raised from public consultation, a rank of “1” representing the best performing option. This is presented in Table 16-7 below.

16.4.2 No weighting was applied to the rankings, with each impact being given equal importance.

Table 16-7 Ranking of Route Options against Key Considerations raised from Public Consultation

Key Considerations Raised from Public Consultation	Option 1Na	Option 1Nd	Option 1Sa
Impact on local communities of WBS/BSJ (eg noise)	1	1	2
Access to and from WBS/BSJ via the new A360 junction and minimising rat running	2	1	2
Impact on local businesses and amenities	2	1	3
Biodiversity Issues			
River Till SAC/SSSI	1	1	2
Parsonage Down National Nature Reserve SAC/SSSI	2	2	1
The The Diamond (within WHS east of A360)	2	1	2
RSPB Reserve and breeding stone curlew	2	1	2
Historic Environment Issues			
Attributes of OUV of the WHS (authenticity and integrity)	1	1	1
Setting of Scheduled Monuments and relationship to Barrow Groups	1	1	1
Winter solstice sunset as viewed from Stonehenge	2	1	3
Non-designated archaeological remains	1	1	1
Exit from WHS to the west	3	2	1
Scheduled Barrow complexes north of Winterbourne Stoke	2	2	1
Potential overall benefit to WHS and opportunities to mitigate issues	3	1	2
Landscape and Visual Issues			
Across the River Till Valley landscape	1	1	2

Key Considerations Raised from Public Consultation	Option 1Na	Option 1Nd	Option 1Sa
Exit from WHS to the west and through Oatlands Hill landscape	3	2	1
Through the WHS landscape	2	1	2
Opportunities to mitigate landscape issues - River Till Valley	2	2	1
Engineering and Safety Assessment (inc. route length, tunnel length, earthworks strategy and maintenance)	2	1	2

16.4.3 The table is not a summary of the environmental assessment. The table aims to provide an overall understanding of how the key considerations raised at consultation are addressed comparatively by the options and can potentially be used to differentiate between the options.

16.4.4 The table suggests that Option 1Nd is the best performing option against the considerations raised within responses to the consultation.

17. Conclusions and Recommendations

17.1.1 Proposals for the 'A303 Stonehenge: Amesbury to Berwick Down' scheme were included in the 2014 Road Investment Strategy following the A303, A358 & A30 Corridor Feasibility Study, carried out within the context of the Government's National Policy Statement for National Networks. The conclusion of the following PCF Options Phase is reported in this SAR.

17.1.2 The PCF Stage 1 (Option Identification) process involved the sifting of over 60 historical route options, assessing a shortlist to produce 2 route options that were taken to public consultation in January 2017 – Option 1N and Option 1S.

17.1.3 This PCF Stage 2 (Option Selection) has involved analysing and incorporating feedback from public consultation and further ongoing environmental and heritage surveys and assessments, to develop and sift eight modifications of the route options consulted on down to three options for further detailed WebTAG assessment.

17.1.4 The WebTAG assessment of the three modified route options is detailed in Chapters 7 to 15, with the Appraisal Summary Tables presented in Chapter 16.

17.1.5 The engineering design of all route options has been based on the DMRB requirements for an all-purpose road with a 120kph design speed, in conjunction with design principles outlined in the Draft Expressways Technical Note, ahead of publication of the Draft Expressway Interim Advice Note (IAN). The only departures from standard identified at this stage are with the geometry through the new A345 junction and the existing Countess Roundabout. The existing junction was designed for future provision of an overpass on the A303 and in order to maximise retention of the existing road geometry, there could be possible minor horizontal curvature and minor visibility departures on the approaches to any new grade-separated junction at this location, including with the adjacent tie-in to the existing A303 to the east. The departures are common to all route options and are subject to design development at the next stage.

17.1.6 All route options contain an approximately 2.9km long tunnel with 300m long cover extension at the western portal. With the proposed junction arrangements at the new A360 junction, there would be one less side road overbridge structure with Route Option 1Nd than with the other options.

17.1.7 All modified Stage 2 options were assessed to maintain a positive impact upon on road safety against the existing A303 which is an accident blackspot, and all new route options would increase capacity and be designed to high safety standards. All proposed route options would significantly reduce the risk of hazards to road users. Additionally, the horizontal and vertical alignments and associated forward visibility would improve significantly relative the existing conditions.

17.1.8 In relation to Construction, Design and Management (CDM) safety assessment, all three options would involve significant tunnel construction, a highly specialised and technically complex activity. However, the construction risks are understood and are manageable by a competent contractor.

17.1.9 The further appraisal set out in this report confirm that the modified route options would deliver the scheme objectives contained within the Client Scheme Requirements (CSRs) and meet the relevant local and national planning, transport and economic policy objectives.

17.1.10 Route Option 1Nd will provide a shorter, more direct route for through traffic along the A303 relative to Option 1Na and Option 1Sa. It accommodates the new A360 junction being located closer to the existing A360 (than with Option 1Na), avoiding the potential for rat-running along the B3083 between Shrewton and Winterbourne Stoke. It will deliver an average journey time saving of approximately 4 minutes compared to the existing case.

17.1.11 The economic appraisal undertaken provided an assessment of the overall value for money of the investment based on costs and benefits that can be monetised. If assessed based on traditional metrics of transport user benefits, there was very little to choose between the modified options, with the costs outweighing the benefits for all options. However, with the value of removing the A303 from the vicinity of Stonehenge included in the assessment, a positive economic case can be made for each of the options. In overall terms, when viewed from this broader perspective, the options performed similarly and the scheme was assessed as offering 'medium' value for money.

17.1.12 In terms of performance against the assessment criteria of operation, technology and maintenance, all options perform to a similar level with enhanced operation and maintenance features required that are specific to the tunnel.

17.1.13 In relation the historic environment, the preferred alignment is Option 1Nd as this route:

- Facilitates a preferred exit location from the WHS, avoiding the Winter Solstice Sunset alignment (Option 1Sa) and the need for a large cutting through Oatlands Hill (Option 1Na).
- Runs closer to the current A303, minimising wider intrusion and disturbance.
- Provides more opportunities for effective mitigation than Options 1Na and 1Sa, ensuring overall benefits to the WHS through the removal of much of the existing A303.

17.1.14 For the wider environment and local community, the route alignment of Option 1Nd is assessed to result in a lesser impact on a number of key environmental receptors, as follows:

- It presents a lower risk of adverse effects to the River Avon SAC/River Till SSSI, and the aquatic ecology of the River Till, when compared with Option 1Sa which would cross the River Till at a location which is considered more likely to support the qualifying species for the River Avon SAC, as well as other protected and notable species.
- It avoids impacting what is considered to be a more complex valley landscape to the south of Winterbourne Stoke that would be affected by Option 1Sa, and affects the visual amenity of fewer residential and leisure

receptors in the vicinity of Winterbourne Stoke and Berwick St James than would be affected by Option 1Sa.

- It avoids direct impacts on landscape features such as The Diamond and the wooded enclosure within The Park, and is located further away from the RSPB Normanton Down Nature Reserve, reducing the potential for adverse effects on protected and notable species, including Stone Curlew, when compared with Options 1Na and 1Sa.
- It is located closer to the current A303 infrastructure than Options 1Na and 1Sa, thereby creating less disturbance from the effects of traffic.

17.1.15 All three options perform well in terms of limiting the separation of residents from services and facilities within their community. This is due to reduced severance at several locations along the route and on the affected road network. The options remove traffic from Winterbourne Stoke, reduce traffic in other nearby settlements such as Shrewton, Durrington and Larkhill, and will include new non-motorised facilities at Countess Roundabout. Against the criteria of physical activity, all options perform well due to maintaining and improving Public Rights of Way (PRoW) facilities. All options were comparable in terms of journey quality due to reductions in traveller stress.

17.1.16 The distributional impacts assessment identified no significant differentiators between the route options, with overall fewer adverse impacts.

17.1 The Recommended Preferred Route

17.1.1 Based on the detailed WebTAG assessment and appraisal of the modified route options following the public consultation (January–March 2017), the recommended Preferred Route for the A303 Stonehenge scheme is Option 1Nd, as shown in Appendix G.

17.1.2 A bypass to the north of Winterbourne Stoke attracted greater public support than the route to the south as well as having a lesser impact on the key environmental disciplines of Heritage, Landscape and Biodiversity. In more closely following the existing A303 through the western part of the WHS, Option 1Nd again performs better against the key environmental topics of Heritage, Landscape and Biodiversity, and provides greater potential for impacts to be mitigated. Option 1Nd also performs better in the engineering assessment, with the slightly shorter route, and in responding to the key considerations raised from consultation.

17.1.3 In continuing the development of the Preferred Route, there are a number of environmental considerations to be reviewed as part of determining the optimum design solution. These include, but are not limited to:

- The vertical alignment and mitigation to the south of the Winterbourne Stoke Barrow Group and at the tunnel entrance, in order to avoid significant adverse effects on the attributes of the OUV, setting of scheduled monuments and relationships between barrows and barrow groups.
- The location and layout of the new A360 junction, accompanied by the removal of the existing Longbarrow Roundabout: (a) to avoid significant adverse effects on the attributes of the OUV, setting of scheduled

monuments within and outside of the WHS, relationships between barrows and barrow groups, and the wider landscape and views; and (b) to secure the best interaction with the local road network, avoiding and increases in traffic flows through local communities with associated adverse effects.

- The height of the viaduct across the River Till, in order to minimise visual impact and potential effects on the River Avon SAC/River Till SSSI.
- The findings of ongoing archaeological evaluation and mitigating potential effects on undesignated archaeological assets.
- The findings of ongoing ecological survey work and avoiding adverse effects on protected and species and notable habitats, including the Parsonage Down SSSI / Salisbury Plain SAC.
- Mitigating any adverse effects on Winterbourne Stoke and Amesbury.

Abbreviations List

AADT	Annual Average Daily Traffic
AAJV	Arup Atkins Joint Venture
AID	Automatic Incident Detection
AMOR	Asset Maintenance and Operational Requirements
ANPR	Automatic Number Plate Recognition
AOD	Above Ordnance Datum
AONB	Area(s) of Outstanding Natural Beauty
AQMA	Air Quality Management Areas
AQS	Air Quality Strategy
ARN	Affected Road Networks
ASC	Asset Support Contractor
ASR	Appraisal Specification Report
AST	Appraisal Summary Table
AVIS	Asset Visualisation Information System
BBCJV	Balfour Beatty Carillion Joint Venture
BCR	Benefit to Cost Ratio
BOAT	Byways Open to All Traffic
CABE	Commission for Architecture and the Built Environment
CBA	Council for British Archaeology
CCTV	Closed Circuit Television
CDM	Construction, Design, and Management
CEEQUAL	Civil Engineering Environmental Quality Assessment and Award scheme
CHARM	Common Highways Agency Rijkswaterstaat Model
COBA-LT	Cost and Benefit to Accidents – Light Touch
CPO	Cosmopolis (luminaire brand)
CPRE	Campaign for the Protection of Rural England
CRF	Congestion Reference Flow
CSR	Client Scheme Requirement
CWS	Country Wildlife Site
D2AP	All-purpose Dual Carriageway
DCMS	Department for Culture, Media and Sport
DCO	Development Consent Order
Defra	Department for Environment, Food and Rural Affairs
DETR	Department of the Environment, Transport and the Regions
DfT	Department for Transport
DI	Distributional Impact
DMRB	Design Manual for Roads and Bridges
DTA	Drainage Treatment Area
EAR	Environmental Assessment Report

EAST	Early Assessment and Sifting Tool
EPB	Earth Pressure Balance
ERA	Emergency Refuge Area
ERT	Emergency Roadside Telephone
GIS	Geographical Information Systems
GVA	Gross Value Added
HA	Highways Agency
HATRIS	Highways England Traffic Information System
HDV	Heavy Duty Vehicles
HGV	Heavy Goods Vehicle
HIA	Heritage Impact Assessment
IA	Important Area
IAN	Interim Advice Note
ICOMOS	International Council on Monuments and Sites
IROPI	Imperative Reasons of Overriding Public Interest
KSI	Killed or Seriously Injured
LAC	Landscape Advisory Committee
LCA	Landscape Character Assessment
LEP	Local Enterprise Partnership
LGV	Light Goods Vehicle
LTP	Local Transport Plan
MCF/U	Tubular Fluorescent
MHS	Maintenance Hardstand Area
MoD	Ministry of Defence
NCA	National Character Area
NCN	National Cycle Network
NIA	Noise Important Area
NMU	Non-Motorised User
NNR	National Nature Reserve
NOx	Nitrous Oxides
NPPF	National Planning Policy Framework
NPSNN	National Policy Statement for National Networks
NPV	Net Present Value
NSIP	Nationally Significant Infrastructure Project
NTM	National Transport Model
NVRM	National Vehicle Recovery Manager
OD	Operations Directorate
OUV	Outstanding Universal Value
PCF	Project Control Framework
PCU	Passenger Car Unit
PIA	Personal Injury Accident

PLC	Programmable Logic Controllers
PM10	Particulate matter less than 10µm aerodynamic diameter
PMCS	Plant Monitoring and Control System
PPG	Planning Practice Guidance
PRoW	Public Rights of Way
PRV	Protected Road Verge
RAG	Red-Amber-Green
RBD	River Basin District
RBMP	River Basin Management Plan
RCC	Regional Control Centre
RFAC	Royal Fine Art Commission
RIS	Road Investment Strategy
RIS1	Road Investment Strategy for the 2015/16-2019/20 Road Period
RSPB	Royal Society for the Protection of Birds
RTF	Road Traffic Forecast
SAC	Special Area of Conservation
SCADA	Supervisory Control and Data Acquisition
SCGE	Spatial Computable General Equilibrium
SCL	Sprayed Concrete Lining
SHW	Specification for Highway Works
SMIS	Safety Management Information System
SOBC	Strategic Outline Business Case
SON/T	High Pressure Sodium
SOUV	Statement of Outstanding Universal Value
SPA	Special Protection Area
SPZ	Source Protection Zone
SRN	Strategic Road Network
SSD	Stopping Sight Distance
SSSI	Site of Special Scientific Interest
STEM	Science, Technology, Engineering and Mathematics
WHS	Stonehenge, Avebury and Associated Sites World Heritage Site
SWRCC	South West Regional Control Centre
SWARMMS	South West and South Wales Multi-Modal Study
SWRTM	South West Regional Transport Model
TAG	Transport Analysis Guidance
TAME	Traffic Appraisal Modelling and Economics
TAR	Technical Appraisal Report
TBM	Tunnel Boring Machine
TEMPro	Trip End Model Presentation Program
TEN-T	Trans-European Network-Transport
TERN	Trans-European Road Network

TMU	Traffic Monitoring Unit
TOS	Traffic Officer Service
TPO	Tree Preservation Order
TRO	Traffic Regulation Order
TTM	Temporary Traffic Management
TUBA	Transport User Benefit Appraisal
ULEV	Ultra Low Emission Vehicles
UNESCO	United Nations Educational, Scientific, and Cultural Organization
UPS	Uninterruptible Power Supply
VMS	Variable-Message Sign
VMSL	Variable Mandatory Speed Limits
VOC	Vehicle Operating Cost
VoT	Value of Time
WANHS	Wiltshire Archaeological and Natural History Society
WCS	Wiltshire Core Strategy
WFD	Water Framework Directive
WebTAG	Web-based Transport Analysis Guidance
WHS	World Heritage Site
WITA	Wider Impacts on Transport Appraisal

Glossary

A New Deal for Trunk Roads in England	Department for Transport paper published in 1998 setting out the policy direction for the motorway and trunk road network.
Affected Road Network	The parts of the road network that would be affected by a change in traffic levels as the result of a transport scheme
Air Quality Management Area	An area identified where the National Air Quality Objectives are not likely to be achieved. The Local Authority is required to produce a Local Air Quality Action Plan to plan how air quality in the area is to be improved.
Amesbury to Berwick Down	The stretch of the A303 between the Countess Roundabout at Amesbury, and Berwick Down.
Annual Average Daily Traffic	The number of vehicles travelling on a particular stretch of road on an average day.
Appraisal Specification Report	A Project Control Framework (PCF) document required to outline the approach that will be undertaken during the transport modelling, economic, environmental and operational assessments of a Highways England Major Project and the approach to their inter-relationships.
Appraisal Summary Table	A table that appraises the performance of each option against economic, environmental, social and distributional sub-impacts and is used to directly inform the Value for Money assessment for the Economic Case.
Area of Outstanding Natural Beauty	An area outside a National Park designated for conservation due to its natural beauty.
Asset Maintenance and Operational Requirements	A Highways England document that sets out the Performance Requirements for the maintenance and operation of the Area Network
Asset Support Contract	A contract issued by Highways England for the maintenance, operation and improvement of the Highways England's network.
Asset Visualisation Information System	A web-based database used by Highways England to store and recall data about road network asset information

At grade	On the same level, for example, an at grade junction is two or more roads meeting or crossing on the same level.
Benefit (to) Cost Ratio	The ratio of Present Value of Benefits (PVB) to Present Value of Costs (PVC).
Best and Most Versatile	Defined as Grades 1, 2 and 3a of the Agricultural Land Classification as land which is most flexible, productive and efficient in response to inputs and which can best deliver future crops for food and non-food uses such as biomass, fibres and pharmaceuticals.
Biodiversity Action Plan	An internationally recognized program addressing threatened species and habitats and is designed to protect and restore biological systems. The original impetus for these plans derives from the 1992 Convention on Biological Diversity.
Campaign for the Protection of Rural England	Organisation that was the forerunner of the re-named 'Campaign to Protect Rural England' which is a national charity devoted to protecting and enhancing rural England.
CDM Regulations 2015	The main set of regulations for managing the health, safety and welfare of construction projects.
CEEQUAL	An evidence-based sustainability assessment, rating and awards scheme for infrastructure and celebrates the achievement of high environmental and social performance.
Client Scheme Requirements	The objectives of the A303 Amesbury to Berwick Down scheme.
Common Highways Agency Rijkswaterstaat Model	Specifies requirements for Advanced Traffic Management Systems that are used to support the operational processes of Traffic Management Centres.
Congestion Reference Flow	The maximum achievable hourly throughput of traffic on a particular stretch of road, expressed in terms of AADT.
Conservation Area	An area of special environmental or historic interest or importance, of which the character or appearance is protected by law against undesirable changes (Section 69 of the Planning (Listed Buildings and Conservation Areas) Act 1990).
Corridor	Refers to a group of route options related by a commonality in their alignment and concept (tunnel or

	surface options). Note these are specific for the A303 Amesbury to Berwick Down improvement scheme with the A303/A30/A358 corridor referring to the wider road network along the A303, A30 and A358.
Council for British Archaeology	Educational charity promoting appreciation and care of the historic environment in the United Kingdom.
County Wildlife Site	Areas of land of recognised value for wildlife, which fall outside the legal protection given to Sites of Special Scientific Interest (SSSI).
Defra	Defra is the Government department responsible for environmental protection, food production and standards, agriculture, fisheries and rural communities in the United Kingdom of Great Britain and Northern Ireland. Defra is a ministerial department, supported by 33 agencies and public bodies.
Department for Transport	Government department responsible for the transport network in England, and for aspects of the transport network in the devolved administrations.
Design Fix A	Corridor identification based on historic routes proposed for the A303 scheme and initial sifting of those corridors to recommend a consolidated list or corridors to be taken forward for further consideration.
Design Fix B	A rationalisation of the historical routes within the corridors recommended for further consideration at Design Fix A, with a review against the main environmental constraints and input from the key environmental stakeholders.
Design Fix C	Sifting of the route options, put forward for further consideration at Design Fix B, based on an appraisal of the Strategic Case, Value for Money Case, Financial Case, Delivery Case and Commercial Case to identify route options to take forward to public consultation.
Design Manual for Roads and Bridges	A series of 15 volumes prepared by the Department for Transport and Highways England that provide standards, advice notes and other published documents relating to the design, assessment and operation of trunk roads, including motorways, in the United Kingdom. Full listings are available here: http://www.standardsforhighways.co.uk/ha/standards/dmrb/index.htm

Distributional Impact Assessment	Describes the assessment of the scheme's (route options) impacts on different social groups across a range of indicators, namely: user benefits, noise, air quality, accidents, security, severance, accessibility and personal affordability
Do Minimum Scenario	The situation without implementation of the scheme.
Do Something Scenario	The future year situation with implementation of the scheme
Development Consent Order	The means of applying for consent to undertake a Nationally Significant Infrastructure Project (NSIP). NSIPs include, for example, major energy and transport projects.
Drainage Treatment Area	Takes surface water runoff from the highway and treats it with a range of processes for water quality before infiltrating to ground.
Early Assessment and Sifting Tool	Provides a framework for summarising options which is consistent with the "Transport Business Case Five Case Model".
Economic Assessment Report	Summarises the transport modelling process, details the data and justifies the assumptions used in the economic assessment. It combines the monetised costs and benefits for each assessed option in standard economic appraisal tables to produce economic performance indicators.
English Heritage	Charity that cares for the National Heritage Collection of state-owned historic sites and monuments across England, under licence from Historic England.
Environmental Assessment Report	The non-statutory environmental assessment report that forms part of the Project Control Framework's (PCF) Stage1: Options Identification (Options Phase). The report follows on from, and is underpinned by, the Stage 1: Environmental Scoping Report (ESR) (August 2015).
Expressway / Expressway Standard	A road with high quality performance and safety standards, as described in the July 2013 Action for Roads report.
Gross Value Added	A key indicator of economic performance, used in the estimation of GDP. GVA measures the contribution to the economy of each individual producer, industry or sector.

Heavy Goods Vehicle	Any vehicle with a gross combination mass (GCM) of over 3,500 kilograms
Historic England	Publicly funded body that champions and protects England's historic places, including Stonehenge and Avebury; also known as the Historic Buildings and Monuments Commission for England.
HM Treasury's Green Book	A guidance on how publicly funded bodies should prepare and analyse proposed policies, programmes and projects to obtain the best public value and manage risks. It covers the evaluation of policies, programmes and projects after implementation to find out how well they have achieved their original objectives and how well they have delivered within their original budgets and planned timescales. The Green Book guidance on assessing public value and risks applies to proposals and decisions about both spending public money and to changes in regulation.
ICOMOS Guidance on Heritage Impact Assessments (2011)	The World Heritage Committee is responsible for implementing the World Heritage Convention that was adopted by UNESCO in 1972 and ratified in the UK in 1984. The International Council on Monuments and Sites (ICOMOS) is one of three UNESCO World Heritage Advisory bodies that is named within the Convention and which advices the World Heritage Committee (which itself is responsible for implemented the World Heritage Convention).The ICOMOS 2011 Guidance on Heritage Impact Assessment provides a guide on the process for carrying out Heritage Impact Assessments for World Heritage properties in order to evaluate effectively the impact of potential development on the Outstanding Universal Value of properties.
Imperative Reasons of Overriding Public Interest	A test for derogation through the Habitats Regulations which is applied to plans and projects which are likely to have a significant adverse effect on a European designated site.
Index of Deprivation, 2015	The official measure of relative deprivation for small areas (or neighbourhoods) in England.
The Infrastructure Planning (Environmental Impact Assessment) Regulations 2009	The regulations governing the process of environmental impact assessment for nationally significant infrastructure projects considered under the Planning Act 2008.
International Committee on Monuments and Sites	Professional association that works for the conservation and protection of cultural heritage places

	around the world, and provides advice on World Heritage Sites to the United Nations Educational, Scientific and Cultural Organisation.
Interim Advice Note	Documents issued by Highways England containing specific guidance relating to works on motorways and trunk roads, subject to any specific implementation instructions.
Investing in Britain's Future	Government plan to build, repair and renew key infrastructure in Britain.
Landscape Advisory Committee	Organisation that no longer exists, but used to provide independent advice on the design of roads within their landscape setting.
Landscape Character Area	An area of the landscape that is based on a distinct and recognisable pattern of elements, or characteristics, in the landscape that make one area of the landscape distinct from another.
Local Enterprise Partnership	A voluntary partnership set up between local authorities and businesses to drive local economic growth and job creation activities. There are 39 LEPs across England.
Local Model Validation Report	A PCF product which summarises the development and calibration of the base year traffic model and reports on the validation of the model against observed data.
Lower Super Output Area	A geography for the collection and publication of small area statistics (including Census data). They have an average of roughly 1,500 residents and 650 households.
Lower Thames Crossing scheme	A proposed new crossing of the Thames estuary linking the county of Kent with the county of Essex through Thurrock, at or east of the existing Dartford Crossing.
Ministry of Defence	Government department responsible for the defence of the UK and its overseas territories, including the maintenance of the armed forces.
National Character Area	The subdivision of England into 159 distinct natural areas. Each area is defined by a unique combination of landscape, biodiversity, geodiversity, history, and cultural and economic activity. Their boundaries follow natural lines in the landscape rather than administrative boundaries.

National Infrastructure Plan	Document published by the UK Government, setting out its strategy for meeting the infrastructure needs of the UK economy.
National Nature Reserve	Reserves established to protect some of the most important habitats, species and geology in the United Kingdom, and to provide 'outdoor laboratories' for research.
National Planning Policy Framework	The primary national policy document guiding the designation of local plans and consideration of applications for planning permission by local authorities.
National Policy Statement for National Networks (2015)	Sets out the national roads policy framework, as presented to Parliament in December 2014.
National Transport Model	Developed by the Department for Transport to provide a systematic means of comparing the national consequences of alternative national transport policies or widely applied local transport policies.
National Trust	Charity that cares for historic houses, gardens, ancient monuments, countryside and other sites across England, Wales and Northern Ireland, including the Stonehenge landscape.
National Vehicle Recovery Manager	Acts as the Highways England's liaison with vehicle recovery operators, who are appointed to recover stranded vehicles.
Nationally Significant Infrastructure Project	A project which requires development consent to be granted by the relevant Secretary of State, as defined by the Planning Act 2008.
Natural England	An executive non-departmental public body responsible for the natural environment
Net Present Value	A measure of profitability calculated by subtracting the present value of cash outflows (costs) from the present value of cash inflows
Noise Important Area	Areas where the 1% of the population that are affected by the highest noise levels from major roads are located according to the results of Defra's strategic noise maps.
Non-Motorised User	Cyclists, pedestrians (including wheelchair users), and equestrians using the public highway.

On Time Reliability Measure	The percentage of journeys on the Strategic Road Network that are on time.
Outstanding Universal Value	To be included on the UNESCO World Heritage List, sites must be deemed to be of 'outstanding universal value'.
P50 Estimate	The middle estimate in a range of cost estimates for which a level of certainty is defined. 50% of estimates exceed the P50 estimate (and by definition, 50% of estimates are less than the P50 estimate).
Passenger Car Units	A method used in transport modelling to allow for the different vehicle types within a traffic flow group to be assessed in a consistent manner; typical values are 1 for a car or light goods vehicle and 2 for a bus or heavy goods vehicle. Related to vehicle length.
Personal Injury Accident	An accident that involves personal injury occurring on the public highway (including footways) in which at least one road vehicle or a vehicle in collision with a pedestrian in involved and which becomes known to the police within 30 days of its occurrence.
Planning Practice Guidance	A suite of documents setting out how specific matters should be considered and assessed in the planning process.
Preliminary Outline Assessment of the impact of A303 improvements on the Outstanding Universal Value of the Stonehenge Avebury and Associated Sites World Heritage property	Report prepared by English Heritage and National Trust assessing the impacts of different options for tunnelling the A303 past Stonehenge.
Project Control Framework	A joint Department for Transport and Highways England approach to managing major projects. The Framework comprises a standard project lifecycle; standard project deliverables; project control processes and governance arrangements.
Protected Road Verge	Verges that were deemed valuable miniature nature reserves, providing a refuge for a range of birds, small mammals and insects and acting as important wildlife corridors. As such these road verges were selected to receive special management so these rich habitats are not lost.

Public Right of Way	A way over which the public have a right to pass and repass. The route option may be used on foot, on (or leading) a horse, on a pedal cycle or with a motor vehicle, depending on its status. Although the land may be owned by a private individual, the public may still gain access across that land along a specific route option. Public rights of way are all highways in law.
Relaxations and Departures from Standards	Relaxations are written into design standards to introduce limited flexibility in certain circumstances allowing designers to design to less stringent requirements than those specified in a standard. These need to be agreed with but not approved by the Project Sponsor. A departure from standard is any other variation or waiving from a requirement contained within the design standards and requires formal approval from the Project Sponsor.
River Basin Management Plan	River basin management plans (RBMPs) set out how organisations, stakeholders and communities will work together to improve the water environment. The Water Environment has been divided nationally into River Basin Districts. There are 11 river basin districts in England and Wales. The Environment Agency manage the 7 RBDs in England.
Road Traffic Forecast 2013	A series of traffic forecasts issued by the Department for Transport using the National Transport Model to generate measures of traffic demand, congestion and emissions in England up to 2041.
Road Investment Strategy	The long-term strategy to improve England's motorways and major A roads. The first RIS (known as RIS1) was published in 2014 and covers the period 2015-2020. A second RIS (RIS2) was published in 2015, and covers the post-2020 period.
Safety Management Information System	A Highways England system for inventory and defect management of structures on the road network.
Scheduled Monument	A 'nationally important' archaeological site or historic building, given protection against unauthorised change and included in the Schedule of Monuments kept by the Secretary of State for Culture, Media and Sport. The protection given to Scheduled Monuments is given under the Ancient Monuments and Archaeological Areas Act 1979.
The scheme	The A303 Amesbury to Berwick Down scheme (where not implicit).

Severe Weather Desk Exercise	An exercise to simulate the implementation of a severe weather desk/control room which would have the ability to communicate directly with motoring organisations and local authorities and to listen to/watch local news/traffic media in severe weather, in accordance with the Highways England Network Management Manual.
Site of Special Scientific Interest	A conservation designation denoting to a protected area in the United Kingdom. The Sites are protected by law to conserve their wildlife or geology.
Source Protection Zone	Areas of land around over 2000 groundwater sources such as wells, boreholes and springs used for public drinking water supply. The zones show the risk of contamination from any activities that might cause pollution in the area. The closer the activity, the greater the risk. There are three main zones (inner, outer and total catchment) and a fourth zone of special interest, which is occasionally applied to a groundwater source. The zones are used in conjunction with the Groundwater Protection Policy to set up pollution prevention measures in areas which are at a higher risk, and to monitor the activities of potential polluters nearby.
South West and South Wales Multi-modal Study model	Transport model developed in 2002 for the London to the South West and South Wales Multi-modal Study encompassing the transport network between London and Cornwall to enable the assessment of transport measures identified by the study.
South West Regional Transport Model	A Highways England regional transport model of the South West of England, currently under development. The model simulates traffic movements within the strategic road network of the South West.
Spatial Computable General Equilibrium	A methodology that can be used in the appraisal of the wider economic impacts of a transport intervention.
Special Area of Conservation	A site designated under the Habitats Directive. These sites, together with Special Protection Areas (or SPAs), are called Natura sites and they are internationally important for threatened habitats and species.
Special Parliamentary Procedure	A procedure that has to be followed by Parliament which gives especially affected bodies the right to petition Parliament if they oppose legislation that is needed to secure powers that allows planned developments to proceed.

Special Protection Area	Areas of strictly protected sites classified in accordance with Article 4 of the EC Birds Directive (2009/147/EC) on the conservation of wild birds. They are classified for rare and vulnerable birds (as listed on Annex I of the Directive), and for regularly occurring migratory species.
Site of Special Scientific Interest (SSSI)	A conservation designation denoting a protected area in the United Kingdom. In England, the designating body for SSSIs, Natural England, selects SSSIs that have a particular landscape, geological or ecological characteristic.
Specification for Highway Works	Published as Volume 1 of the Manual of Contract Documents for Highway Works and in addition to the Introduction contains 27 Series and 8 Lettered Appendices
Statement of Outstanding Universal Value	Statements written for World Heritage Sites that are key references for their effective treatment and management.
Stonehenge Master Plan	Plan produced by English Heritage and National Trust in 1999 containing proposals for a new Stonehenge Visitor Centre adjacent to the roundabout junction of the A345 with the A303 that were later changed.
Strategic Economic Plan	A document produced by a Local Enterprise Partnership setting out its plans for the future and the funding that will be required to deliver these plans.
Strategic Outline Business Case	A business case produced for a project at an early stage in its development.
Strategic Road Network	The network of approximately 4,300 miles (6920 km)of motorways and major ‘trunk’ A roads across England, managed by Highways England.
Summary Consultation Report	A report summarising the results of the consultation and the responses received.
Trafficmaster	A system for the presentation of data collected from the Global Positioning Systems of from vehicles to plot the time spent to traverse sections of the road network at different times.
Traffic Data Collection Report	A PCF product which summarises the collection new traffic data (roadside interviews and automatic number plat recognition survey) or assembly of data (traffic counts) held by other sources.

Traffic Forecasting Report	A PCF product which summarises the development of the base year traffic model to generate traffic forecasts for future years 2024, 2031, 2039 and 2051. Summary of the key outputs from the future year traffic models.
Traffic Officer Service	An operational unit within the Highways England that undertakes certain general traffic and road management tasks, previously undertaken by the police force. The traffic officer service does not have enforcement powers and their vehicles are not classed as emergency vehicles.
Traffic Regulation Orders	A legal document required to support a range of measures, which govern or restrict the use of public roads, including double yellow lines, one-way streets, banned turning movements, bus lanes.
Transport Business Five Case Model	Transport business cases are developed in line with Treasury's advice on evidence-based decision making set out in the Green Book, and use its best practice five case model approach.
Transport Analysis Guidance	Guidance produced by DfT on the process of appraisal of transport interventions.
Trans-European Network Transport	A series of road, rail, air and water networks in the European Union, the programme for the improvement of which is designed to remove bottlenecks, improve infrastructure, and streamline cross-border transport operations for passengers and businesses across the EU.
Trans-European Road Network	A project to improve the internal road infrastructure of the European Union (EU). The TERN project is one of several Trans-European Transport Networks.
Transport User Benefit Appraisal	A computer programme developed by DfT and widely used to undertake economic appraisal for multi modal transport studies, in line with TAG guidance.
Trip End Model Presentation Program	A program used to analyse data about trip ends (destinations), journey mileage, car ownership and the population and workforce based on development information provided by local authorities. TEMPro is also often used to estimate traffic growth over a particular time and area.
Tunnel Design Authority report	Document providing an overview of the current tunnel design, standardising the information provided to the TDA across ongoing tunnel projects including retrofits. Used by the TDA to provide feedback and

	recommendations for the Stage Gate Assessment Reviews.
Ultra Low Emission Vehicles	Ultra low emission vehicles are those with emissions of CO_2 below 75 g/km, or fully electrically powered.
United Nations Educational, Scientific and Cultural Organisation (UNESCO)	The United Nations agency which promotes international collaboration through education, science and culture.
Water Framework Directive	An EU directive which aims to achieve good status of all water bodies (surface water, groundwater and the sites that depend on them, estuaries and near-shore coastal waters) and prevent any deterioration. It has introduced a comprehensive river basin management planning system to protect and improve the ecological quality of the water environment. It is underpinned by the use of environmental standards.
WebTAG Transport Appraisal Process	The Department for Transport's transport appraisal guide and toolkit consisting of software tools and guidance on transport modelling and appraisal methods that are applicable for highways and public transport interventions. The appraisal of transport interventions is a three step process including Option Development, Further Appraisal and Implementation, Monitoring and Evaluation.
Wider Impacts Framework	A framework to capture Wider Impacts (WIs), positive and negative, that include productivity and welfare changes associated with the impact of transport on agglomeration and labour supply.
Wiltshire Archaeological and Natural History Society	County-based organisation which runs the Wiltshire Museum in Devizes.
Wiltshire Core Strategy	The Local Development Plan for Wiltshire Council
World Heritage Site	A site listed by UNESCO because of its special natural or cultural value.
WHS Management Plan	A management plan that covers the management requirements of a WHS over a specified period of time. The WHS Management Plan 2015 covers the management requirements for this WHS in the period 2015-2021.
Wiltshire Local Transport Plan	Sets out the council's objectives, plans and indicators for transport in Wiltshire. Furthermore, as a document

developed through partnership working and extensive consultation, the LTP also provides the framework for all other organisations with a direct or in-direct involvement in transport in Wiltshire.

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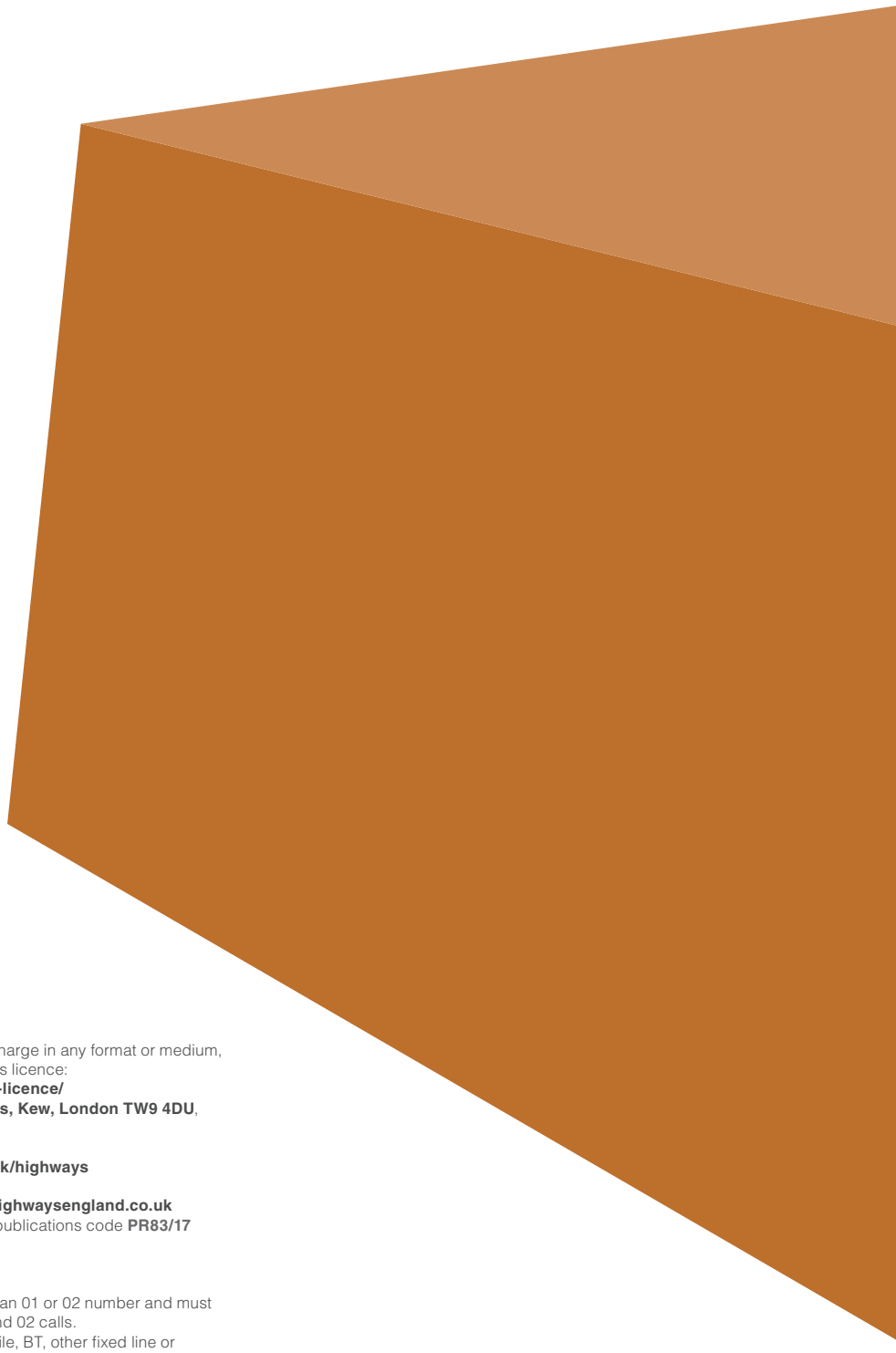

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