# A303 Amesbury to Berwick Down (Stonehenge)

## Volume 2 – Scope

Part 2 – Design and Technical Requirements

**April 2022**

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# Table of Contents

## Section Page

# 1 Introduction

## 1.1 General

1.1.1 The *works* shall be provided in accordance with

- the Obligations of the DCO and
- the requirements of the Scope.

1.1.2 The *Client* shall

- not be prevented from discharging its Obligations of the DCO and
- be assisted with discharging its Obligations of the DCO.

1.1.3 The *works* shall be provided to enable the Performance Requirements to be complied with.

1.1.4 The *works* shall be provided to

- comply with the design requirements of the Design Manual for Roads and Bridges (DMRB) [1] and
- be constructed in accordance with the Manual of Contract Documents for Highway Works (MCHW) [2], and as extended by the Scope.

1.1.5 The *works* shall be provided to optimise the following within the Affordability Threshold

- whole life costs,
- operational performance,
- environmental mitigation and enhancement and
- support delivery of the *Client's* safety targets.

1.1.6 The *works* shall provide the Authorised Development[1].

1.1.7 Departures required to Provide the Works shall be obtained in accordance with the requirements contained in section 24 (Departures) of this document.

1.1.8 The *works* shall be provided which

- develops the design to deliver the Design Vision[2],
- is in accordance with the Design Principles,
- achieves the requirements of the commitments fixed in the Design Commitments and
- includes consultation on relevant aspects[3] where there are requirements for stakeholder consultation.

1.1.9 The *works* shall be futured proofed in accordance with the requirements in section 22 (Future Proofing Requirements) of this document.

1.1.10 The *works* shall be provided to support the *Client* in discharging its duties with respect to the safety of road workers, Road Users and other parties in accordance with the requirements of GD 304 'Designing health and safety into maintenance' [3].

1.1.11 The *works* and Equipment required within the WHS shall be minimised.

[1] Refer to DCO Schedule 1 (Authorised Development), Articles [2] and [4].
[2] The images shown in Annex A.4 of the Outline Environmental Management Plan (OEMP) [5] represent the *Client's* visual expectation of how key elements of the works could look when designed in accordance with the Design Vision, Design Principles and Design Commitments.
[3] Refer to action or commitment MW-G7 of the OEMP [5].

1.1.12 Where the Obligations of the DCO state that materials (including plans, registers, documents and drawings) are to be made available in electronic form to allow inspection by the public, those materials shall be provided electronically in the portable document format (PDF) [4].

# 2 Environment

## 2.1 General

2.1.1 The *works* shall be undertaken to deliver the commitments contained in the following documents

- the Outline Environmental Management Plan (OEMP)[4] [5],
- the Detailed Archaeological Mitigation Strategy (DAMS)[5] [6] and
- the Consolidated Environmental Mitigation Schedule (CEMS) [7].

2.1.2 Proposals shall not give rise to any materially new or materially different environmental effects in comparison with those reported in the Environmental Statement[6].

2.1.2a Proposals shall demonstrate and justify that the *works* and Providing the Works is in compliance with 2.1.2.

2.1.2b When requested by the *Project Manager*, the *Contractor* shall

- provide any further analysis, information and materials and
- attend such meetings, including consultations,

required to support the *Client* in seeking any approvals for such proposals made under paragraph 2.1.2 that reduce the temporary or permanent significant adverse effects on the OUV of the WHS environmental effects in comparison with those reported in the Environmental Statement.

2.1.3 Environmental management plans listed in the OEMP [5] shall be provided in accordance with the Obligations of the DCO.

2.1.4 The Construction Environmental Management Plan[7] (CEMP) shall demonstrate that the following are complied with

- the Obligations of the DCO and
- the requirements of the Scope.

2.1.5 Until Completion of *section* 4, environmental management plans shall be refined and updated to capture changes required to the proposed mitigation and management of environmental effects resulting from

- new or updated survey data,
- changes in the physical characteristics of the Site,
- changes in the design and mitigation assumptions,
- changes in the level of understanding of the current state of the environment and the potential effects of the *works*,
- changes in legislation, policy, guidance and advice,
- changes due to *Client* and stakeholder consultation and
- changes required by the *Project Manager*.

[4] Refer to DCO Schedule 2 (Requirements), Part 1 (Requirements), section 4, Article [4]
[5] Refer to DCO Schedule 2 (Requirements), Part 1 (Requirements), section 5, Article [4]
[6] Several documents that comprise the ES were corrected, replaced or added to during the DCO examination. A document has been prepared which lists out the documents that comprise the ES that have been corrected, replaced or added to since submission of the DCO application and includes links to these documents. Refer to document TR010025 001993 [120] contained in the examination library on the national infrastructure planning website.
[7] Refer to action or commitment MW-G5 of the OEMP [5].

2.1.6 In addition to the requirements of the OEMP [5]

- the Traffic Management Plan[8] shall also comply with the requirements contained in section 7.9 (Traffic Impact) of this document and
- the Ground Movement Monitoring Strategy[9] shall also comply with the requirements contained in section 15.6 (Damage Assessment, Instrumentation and Monitoring) of this document.

2.1.7 The Handover Environmental Management Plan[10] (HEMP) shall describe how the Landscaping Scheme is to be managed to sustain the OUV of the WHS.

## 2.2 Landscaping

2.2.1 A Landscape and Ecology Management Plan (LEMP) shall be developed which

- complies with the Obligations of the DCO,
- complies with the requirements of the Scope,
- is based on the outline LEMP contained in the Environmental Statement,
- aligns to the objectives of the WHS Management Plan [8],
- adopts the relevant guiding management principles contained in Natural England's National Character Area (NCA) profile 132 (Salisbury Plain and West Wiltshire Downs) [9],
- sets out the approach by which the Landscaping Scheme is to integrate into the surrounding landscape and environment,
- uses the results of all available environmental survey and monitoring data to inform the Landscaping Scheme,
- contains the principles for the creation, management and maintenance of the Landscaping Scheme,
- identifies requirements and timeframes for immediate, short-term and long-term maintenance, management and monitoring of the Landscaping Scheme,
- defines the Landscaping Scheme targets, triggers and thresholds for management actions and
- sets out the monitoring and reporting of the implementation of commitments made for the Habitat Regulations Assessment (HRA) [10, 11].

2.2.2 A Landscaping Scheme shall be produced.

2.2.3 The Landscaping Scheme shall

- be in accordance with the LEMP,
- have consideration to the OUV of the WHS and the intervisibility of monuments and
- be based on the illustrative Environmental Masterplan contained in the Environmental Statement.

2.2.4 Ecological connectivity for bats, badgers, birds, reptiles and invertebrates shall be provided by the Landscaping Scheme.

2.2.5 The biodiversity value of the Landscaping Scheme shall be evidenced by assessment and reporting using a metric approach to quantifying biodiversity net gain in accordance with the Biodiversity Metric 2.0 [12] (or updated metric as at the time of the Landscaping Scheme submission).

[8] Refer to action or commitment MW-TRA2 of the OEMP [5].
[9] Refer to action or commitment MW-CH8 of the OEMP [5].
[10] Refer to action or commitment MW-G11 of the OEMP [5].

2.2.6 The Landscaping Scheme for Parsonage Down National Nature Reserve (NNR) and the adjoining land shall respond to the landscape character and management objectives of the NNR.

2.2.7 Trees within the Nile Clumps protected under a Tree Preservation Order shall not be directly affected by the *works*.

2.2.8 Areas of agricultural land under temporary possession during the *works* shall be restored

- to the condition on the *access date*[11],
- to the condition recorded in the Record of Condition[12],
- in accordance with the Soils Management Strategy[13] and
- in accordance with the provisions of MW-COM4, MW-COM5 and MW-COM7 of the OEMP [5].

## 2.3 Weed Control, Planting and Seeding

### Weed Control

2.3.1 The *works* shall be managed to control invasive, non-native and nuisance species

- that are listed as invasive non-native species (INNS) by the GB Non-Native Species Secretariat [13],
- that are listed on schedule 9 of the Wildlife and Countryside Act 1981,
- that are prescribed as injurious weeds in the Weeds Act 1959,
- which could cause a nuisance to adjacent landowners or
- which could become invasive in the riparian zone of the River Avon or other local semi-natural habitats.

### Planting and Seeding

2.3.2 Planting and seeding of any species shall be undertaken, using

- UK native species characteristic of the surrounding landscape and
- UK origin, sourced and grown stock and seeds.

2.3.3 The *works* shall not include INNS or other invasive and nuisance species.

2.3.4 The planting of shrubs which sucker shall not be permitted except

- within woodland interiors and
- as part of maintained hedgerows.

2.3.5 Shrub species shall be chosen to minimise intrusion from roots that could damage archaeological remains.

2.3.6 Shrubs shall only be planted in

- areas already subject to archaeological mitigation,
- areas of existing road embankment where there is minimal possibility of disturbing archaeological remains or
- existing woodland or hedges.

[11] Record information of the condition of the soils is contained in the Data Room [17].
[12] Refer to action or commitment MW-COM8 of the OEMP [5].
[13] Refer to action or commitment MW-GEO3 of the OEMP [5].

### Countess Junction

2.3.7 Planting at the four quadrants and north and south of the central roundabout of Countess Roundabout shall be undertaken which

- provides a high scenic quality,
- softens the views of the flyover,
- includes semi-mature and specimen trees and shrubs and
- provides year-round visual interest.

2.3.8 Planting and seeding at Countess Roundabout may include non-native species.

### Drainage Treatment Areas

2.3.9 In drainage treatment areas where there is free-draining substrate forming an infiltration drainage system, calcareous grassland shall be provided.

2.3.10 Areas of drainage treatment with impermeable or low permeability substrate shall be provided with aquatic or pond margin habitat, except in locations where reed or other vegetation is provided for the treatment process.

## 2.4 Vegetation on Temporary Earthworks Construction

2.4.1 Vegetation on temporary earthworks and soil storage bunds shall be established which

- protects against erosion of the bund,
- avoids the establishment and spread of species which can cause a nuisance on adjacent farmland and
- avoids the establishment and spread of invasive and nuisance species.

2.4.2 On the faces of temporary earthworks and soil storage bunds, vegetation shall be established which quickly reduces the visual intrusion of the bund.

2.4.3 Where temporary earthworks and soil storage bunds are in place for more than twelve (12) months, the vegetation establishment and management Should

- provide opportunities for local scarce arable flora present in the soil seedbank to regenerate and
- be planted with calcareous grassland.

## 2.5 Calcareous Grassland

### General

2.5.1 Calcareous grassland shall be provided in the locations shown on the illustrative Environmental Masterplan[14].

2.5.2 Calcareous grassland shall be

- species rich and
- low fertility.

[14] Refer to proposed vegetation / habitat reference type LE1.3 (Species Rich Chalk Grassland).

2.5.3 Calcareous grassland shall provide ecological connectivity along the length (west-east) of the Site except at

- roads or other infrastructure,
- the River Till valley and
- locations where other treatments are required, as identified on the illustrative Environmental Masterplan.

### Calcareous Grassland Composition

2.5.4 Calcareous grassland shall provide

- a mosaic of early-successional calcareous grassland and associated habitats at a range of scales and at indicative targets of cover,
- diversity of grassland structure and composition,
- areas with sward height, composition and density with the potential to provide shelter for a range of invertebrates which are characteristic of calcareous grassland and
- a diversity of habitat types to provide visual interest for Road Users.

2.5.5 Calcareous grassland and associated habitats shall provide a diversity of types as follows

- sparsely vegetated open sward calcareous grassland,
- closed sward short calcareous grassland,
- transition zones of tall calcareous grassland between short calcareous open or closed sward and areas of scrub and woodland and
- targeted patches of stony ground.

2.5.6 Sparsely vegetated open sward calcareous grassland shall

- comprise bare ground forming 10%-50% total cover within vegetated areas of this type,
- comprise wildflowers characteristic of calcareous substrate forming at least 50% of the cover of vegetation and
- limit negative indicator species for calcareous grassland to less than 5% of the total cover.

2.5.7 Closed sward short calcareous grassland shall

- comprise grassland with greater than 30% total cover of wildflowers characteristic of calcareous grassland (including cover of sedges, but not cover of white clover, creeping buttercup and injurious weeds),
- limit bare ground to less than 10% of the total cover within vegetated areas of this type and
- limit negative indicator species for calcareous grassland to less than 5% of the total cover.

2.5.8 Within the WHS, except where required for reptile mitigation, closed sward short calcareous grassland shall be provided.

2.5.9 Targeted patches of stony ground shall

- comprise bare ground (chalk and stone) forming more than 50% total cover,
- use a variety of size of chalk and stone,
- comprise areas that provide potential basking and shelter opportunities for reptiles and
- provide potential habitat for characteristic and scarce invertebrate species which require stony chalk substrate.

2.5.10 The LEMP shall include the methods to achieve mosaics at indicative targets of cover of calcareous grassland and associated habitat types.

### Calcareous Grassland Soil and Substrate

2.5.11 Except where stated otherwise, the planting substrate used to create and support calcareous grassland shall

- provide a heterogenous planting medium of different textures and particle sizes,
- be a shallow, infertile lime-rich material,
- be well draining,
- restrict the growth and colonisation of competitive species and
- maximise the use of excavated materials in accordance with the Materials Management Plan[15].

2.5.12 In areas where calcareous grassland is to be created by arable reversion, the existing topsoil shall be retained.

2.5.13 Transition zones between woodland, hedgerows or scrub and calcareous grassland shall be provided with a planting substrate to support the varying nutrient requirements of the vegetation seeded and planted within the transition zone.

### Calcareous Grassland Seeding and Planting

2.5.14 Calcareous grassland seed mixes shall

- create early successional calcareous grassland,
- provide the basis for future development of lowland calcareous grassland Priority Habitat,
- be in line with the Wiltshire Biodiversity Action Plan 2008 [14] for Calcareous Grassland and Wiltshire and Swindon Wildlife Sites Handbook 2016 [15] and
- omit coarse grass species.

2.5.15 Within calcareous grassland, seeding and planting shall include butterfly attracting plants characteristic of unimproved calcareous grassland, including food plants for the larvae of

- Adonis blue (Polyommatus bellargus),
- Duke of Burgundy (Hamearis lucina),
- marsh fritillary (Euphydryas aurinia),
- small blue (Cupido minimus),
- dingy skipper (Erynnis tages) and
- chalk hill blue (Polyommatus coridon).

2.5.16 The number of calcareous grassland seed mixes required shall be determined based on the requirements for establishing the calcareous grassland communities and diversity of habitat.

2.5.17 Wild-harvested seed shall not be used in calcareous grassland except where

- the source and composition of the seed is recorded prior to use,
- the plots where the seed is to be used are identified and
- it is demonstrated how the seeded areas are to be managed to achieve calcareous grassland if the seed contains rye-grass, white clover, creeping buttercup, injurious weeds or other negative indicator species for calcareous grassland.

[15] Refer to action or commitment MW-MAT2 of the OEMP [5].

2.5.18 Characteristic wildflower species of calcareous grassland that are difficult to germinate from seed shall be planted

- as plugs in targeted areas and
- at a stage of grassland development that supports their establishment.

2.5.19 Targeted areas for wildflower plug planting for calcareous grassland shall include

- areas which have the potential to attract butterflies characteristic of calcareous grassland,
- areas where they contribute to visual amenity,
- areas identified for environmental enhancement,
- the area east of Parsonage Down,
- Parsonage Down Land Bridge (Green Bridge 1) and
- environmental bunds south of Parsonage Down.

2.5.20 Scrub shall not be planted within areas of calcareous grassland except where required for environmental mitigation.

2.5.21 If required in areas of calcareous grassland, scrub shall be planted

- as separate, scattered pockets or individual bushes of low-competitive, native shrub species and
- with characteristics typical of the calcareous downland habitat of the Salisbury Plain.

2.5.22 Transition zones between woodland, hedgerow or scrub and calcareous grassland shall include patches of tall or dense grassland and wildflowers to provide cover for

- reptiles,
- small mammals and
- invertebrates.

### Calcareous Grassland Targets

2.5.23 Targets shall be determined for the condition of calcareous grassland and associated habitat types, including

- the extents of habitat types,
- positive and negative indicators for each habitat type and
- the management regime.

2.5.24 The targets for calcareous grassland and associated habitats shall be defined in the LEMP.

2.5.25 Calcareous grassland targets set shall

- not be less than the eligibility requirements in the Countryside Stewardship requirements for unimproved grassland in Higher Tier Stewardship [16] and
- not be less than Good to Moderate as defined in the relevant category or categories for Biodiversity Net Gain [12].

2.5.26 Targets for calcareous grassland and associated habitats shall comply with the values defined in Table 2-1 (Targets for Calcareous Grassland and Associated Habitats).

### Table 2-1 Targets for Calcareous Grassland and Associated Habitats

| Habitat Type[1)] | Year of Opening[2)] | 5 Years After Opening[3)] |
|---|---|---|
| Sparsely vegetated open sward calcareous grassland | 70-90% (includes areas with <1 growing season) | 40-85% |
| Closed sward short calcareous grassland | 4-15% | 10-40% |
| Transition zones of tall calcareous grassland between short calcareous open or closed sward and areas of scrub and woodland | 1-10% | 4-15% |
| Targeted patches of stony ground | 1-5% | 1-5% |

1 Indicative habitat types are shown in the technical note "Calcareous Grassland and Associated Habitats" contained in the Data Room [17].

2 Or the following first growing season if the year of opening is at end of the calendar year.

3 Corresponding to the post opening project evaluation (POPE) stage.

## Calcareous Grassland Trials

2.5.27 The methodology for the establishment of calcareous grassland on tunnel arisings shall be determined based on growth trials to demonstrate compliance with the requirements of the Scope.

2.5.28 Calcareous grassland growth trials shall be undertaken

- on the area east of Parsonage Down,
- at the periphery of where processed tunnel arisings are proposed to be used,
- on a minimum area of ground of 0.5ha in size,
- with a minimum one (1) metre depth of tunnel arisings substrate and
- for a minimum of one growing season.

2.5.29 Processed tunnel arisings Should be used for calcareous grassland growth trials.

2.5.30 If processed tunnel arisings are not available for calcareous grassland growth trials, other chalk materials may be used providing the material is processed to replicate the expected properties of tunnel arisings generated by the *works*.

2.5.31 Proposals for calcareous grassland growth trials shall address the following

- processing requirements for tunnel arisings,
- method of material placement,
- method of surface treatment,
- composition of planting substrate,
- composition of seed mix and
- monitoring and reporting of the trials.

2.5.32 Proposals for calcareous grassland growth trials shall be accepted by the *Project Manager* prior to calcareous grassland growth trials commencing.

2.5.33 Calcareous grassland creation shall not commence in areas where processed tunnel arisings are used in the planting substrate until

- calcareous grassland growth trials have demonstrated that the calcareous grassland proposals achieve the requirements of the Scope and
- the *Project Manager* accepts the results of the calcareous grassland growth trials.

2.5.34 Until Completion of *section* 4, areas used for calcareous grassland growth trials shall be

- retained,
- monitored and
- managed in accordance with the requirements of the Scope.

### Calcareous Grassland Grazing

2.5.35 Where grazing is required for calcareous grassland management, grazing infrastructure shall be provided[16].

2.5.36 The requirements of affected landowners for grazing infrastructure for calcareous grassland management shall be coordinated through the Agricultural Liaison Officer[17].

## 2.6 Woodland and Hedgerow Retention

2.6.1 Unless otherwise required to be removed, existing trees, woodland and hedgerows shall be retained.

2.6.2 Except within the WHS, hedgerows to be retained shall be gapped up to form a continuous hedgerow.

2.6.3 Where gapping up of retained hedgerows is undertaken, the planting shall, except for non-native species, match the existing hedgerow species composition.

2.6.4 Existing trees, woodland and hedgerows which are proposed to be removed during the *works* shall

- have the reason for removal justified,
- not be removed without the agreement of the *Project Manager* and
- if required, be reinstated.

## 2.7 Woodland and Hedgerows Creation

2.7.1 Tree and shrub species forming woodland and hedgerows shall be

- a mixture of native, non-competitive species,
- a variety of slow and fast-growing species and
- planted as a range of age classes where required for immediate visual effect.

2.7.2 Hedgerow and areas of woodland shall tie-in to adjacent areas of existing or planted woodland and hedgerows.

2.7.3 Where hedgerow and areas of woodland tie-in to adjacent areas of existing or planted woodland and hedgerows, the planting shall, except for non-native species, match the existing hedgerow and woodland species composition.

2.7.4 The woodland belts provided between Parsonage Down Land Bridge (Green Bridge 1) and the B3083 Underbridge (Shrewton Road) shall

- be established from the Completion of *section* 3,
- be nominally twenty (20) metres wide,
- be on and adjacent to the environmental bunds along the north and south sides parallel to the new A303 and
- comprise a range of tree and shrub sizes forming a dense woodland edge on the side of the woodland nearest the new A303.

[16] Refer to the relevant drawings contained in Volume 4 (Contract Drawings) of the contract
[17] Refer to Table 2.1 Roles and Responsibilities during construction in the OEMP [5].

## 2.8 Maintenance and Monitoring

2.8.1 Calcareous grassland areas shall be maintained and monitored until the Completion of *section* 4.

2.8.2 Scarification shall only be used for the periodic management of localised patches of bare stony ground within calcareous grassland.

2.8.3 Calcareous grassland shall by managed by mowing until handover.

2.8.4 All mowing arisings shall be removed.

2.8.5 The success of the calcareous grassland creation shall be demonstrated through the monitoring and verification of the targets for calcareous grassland and associated habitats defined in the LEMP.

2.8.6 Calcareous grassland creation undertaken prior to the *starting date* using translocated calcareous grassland from Parsonage Down Site of Special Scientific Interest (SSSI)[18] shall be

- retained,
- monitored and
- managed in accordance with the requirements of the Scope.

2.8.7 Calcareous grassland areas shall be monitored to permit comparative assessments including the following habitat creation methods

- calcareous grassland created through translocation during preliminary works,
- calcareous grassland created on processed tunnel arisings,
- calcareous grassland created on excavated chalk,
- calcareous grassland created on arable soil and
- existing calcareous grassland within Parsonage Down SSSI (control area).

2.8.8 The monitoring of the calcareous grassland shall

- be developed following consultation with relevant Others,
- be detailed in the LEMP,
- provide the data to permit a quantitative and qualitative evidence-based assessment of calcareous grassland habitat creation methods to be undertaken and
- be agreed with the *Project Manager*.

2.8.9 The monitoring of invertebrates of calcareous grassland shall

- be developed following consultation with relevant Others,
- be detailed in the LEMP,
- provide the data to assess the contribution of the *works* to ecological network connectivity of calcareous grassland in accordance with Natural England's Porton to Plain project [18],
- include monitoring for butterflies of calcareous grassland and
- be agreed with the *Project Manager.*

2.8.10 Shrub planting shall be maintained, controlled and managed to sustain the OUV of the WHS so that shrubs do not spread or grow excessively large and tall.

[18] Refer to the relevant drawings contained in Volume 4 (Contract Drawings) of the contract

## 2.9 Special Ecological Measures: Mammal Tunnels and Fencing

2.9.1 Safe crossings of temporary and permanent roads for mammals shall be provided to minimise the effects of severance by the *works*.

2.9.2 Routes of badgers and other mammals shall be determined.

2.9.3 Tunnels for badgers and other mammals, except for deer, shall be provided at locations

- of known and potential future routes (east-west and north-south) and
- indicated on the illustrative Environmental Masterplan.

2.9.4 The entrance to mammal tunnels shall be screened from public view by providing earthworks, shrubs or both.

2.9.5 Fencing shall be provided to direct mammals towards the entrances of mammal tunnels.

2.9.6 Where mammal-proof fencing is provided, it shall be incorporated into the highway boundary fencing, or into the livestock-fencing where this is used.

## 2.10 Special Ecological Measures: Bat and Bird Mitigation, Bat Roosting and Hibernation Structures

2.10.1 Temporary mitigation shall be provided to direct bats and birds to safely traverse existing and proposed roads where existing navigation routes are severed by the *works.*

2.10.2 The Landscaping Scheme shall create new opportunities for permanent navigation routes.

2.10.3 Temporary bat and bird mitigation shall be maintained until either

- the permanent mitigation has been provided or
- the mitigation planting has become effective.

2.10.4 The closure of the Vespasian Camp Cattle Underpass, which is a known bat navigation route, shall be mitigated by

- retaining the shrubs on the southern embankment of the existing A303,
- providing new shrub planting to facilitate connectivity for bats to the west and southwest of the eastern Stonehenge Tunnel portal and
- providing new planting to assist connectivity for bats to Countess Farm.

2.10.5 Bat roosting and hibernation Structures shall be provided in the following locations

- Bat Hibernation Structure – River Till (refer to section 13.9 (Bat Hibernation Structure – River Till)) of this document and
- Bat Hibernation Structure – Vespasian Camp (refer to section 14.7 (Bat Hibernation Structure – Vespasian's Camp) of this document).

2.10.6 Bat roosting and hibernation structures shall

- be provided with secure access which prevents unauthorised human access but does not impede access for bats,
- be safely accessible for internal inspection without disturbing bats which are using the structure,
- not be a Confined Space and
- have a minimum of two internal chambers.

2.10.7 Internal chambers of the bat roosting and hibernation structures shall

- provide roosting and hibernation features for all bat species identified in the area,
- permit and encourage the free passage of bats into and within the Structure,
- be provided with materials and surface finishes to facilitate bat roosting and hibernation,
- have elements or features to provide rough crevices for bats,
- have an internal environment (ventilation, temperature and humidity) suitable for the roosting and hibernation of identified bat species,
- be free draining,
- have a minimum three (3) metre internal headroom and
- have a minimum three (3) metre internal clear distance between walls.

## 2.11 Special Ecological Measures: Stone Curlew Breeding Plot

2.11.1 A stone curlew breeding plot shall be created at Winterbourne Down RSPB Reserve[19].

2.11.2 The stone curlew breeding plot shall be

- provided in accordance with the stone curlew breeding plot specification [19] and
- maintained subject to a regime of management measures in accordance with those contained in the stone curlew breeding plot specification.

2.11.3 The stone curlew breeding plot shall have an S-shaped landscaped bund created on an area adjacent to the plot which

- uses scraped material from the plot to create the bund and
- is reinstated with calcareous grassland.

2.11.4 The stone curlew breeding plot shall be protected from predators with electrified mammal and livestock proof fencing.

2.11.5 Stone curlew breeding plot fencing shall be provided with a single, three (3) metre minimum clear width, mammal and livestock proof gated entrance.

2.11.6 Stone curlew breeding plot fencing shall be provided with bird deterrent spikes on the fence posts.

2.11.7 The electrical wires on stone curlew breeding plot fencing shall be set at heights around the fence which are in accordance with the guidance and recommendations contained in the Higher-Level Countryside Stewardship FG7: Anti-predator combination fencing [20].

2.11.8 The proposed power supply and electrical wire heights on stone curlew breeding plot fencing shall be

- determined in consultation with the RSPB and
- agreed with the *Project Manager*.

[19] Refer to the relevant drawings contained in Volume 4 (Contract Drawings) of the contract

# 3 Archaeology

## 3.1 General

3.1.1 The *works* shall be undertaken in accordance with the Detailed Archaeological Mitigation Strategy (DAMS) [6].

3.1.2 A Heritage Management Plan[20] (HMP) shall be developed which complies with

- the Obligations of the DCO,
- the OEMP [5] and
- the DAMS [6].

3.1.3 For locations / sites outside the WHS, the HMP shall be prepared in consultation with

- Wiltshire Council and
- Historic England.

3.1.4 For locations / sites within or affecting the WHS, the HMP shall be prepared in consultation with the Heritage Monitoring and Advisory Group (HMAG)[21].

## 3.2 Access for Archaeological Mitigation

3.2.1 The *Client's* archaeological contractor shall be permitted access to the Site to undertake archaeological mitigation.

3.2.2 The *Client's* archaeological contractor shall be permitted to use the *Contractor's* welfare facilities throughout the Site.

3.2.3 The *Client's* archaeological contractor shall be provided with the required information to plan and undertake the archaeological mitigation in areas of the Site in advance of the areas being required for the *works*.

## 3.3 Unexpected archaeological finds

3.3.1 Where unexpected Archaeological Finds are identified as requiring further mitigation or investigation, unexpected Archaeological Finds shall be dealt with in accordance with the procedures outlined in the DAMS[22].

3.3.2 Procedures for the protection of unexpected Archaeological Finds shall be addressed within the HMP.

[20] Refer to action or commitment MW-CH1 of the OEMP [5].
[21] The members of HMAG are Historic England, Wiltshire Council, National Trust and English Heritage.
[22] Refer to section 6.1.19 of the DAMS [6].

# 4 Fencing, Gates and Hoardings

## 4.1 General

4.1.1 Provision of temporary and permanent fencing in the WHS and within in the WHS setting shall be developed in consultation with the Stakeholder Design Consultation Group (SDCG)[23].

4.1.2 All temporary and permanent fencing, gates and hoarding shall comply with the OEMP [5].

4.1.3 Fencing and gates in the WHS and within in the WHS setting shall

- be visually recessive and
- have a low reflectivity finish.

4.1.4 Where post and wire fencing is required, post and wire fencing shall be provide to HCD drawing number H1[24].

## 4.2 Temporary Fencing and Hoardings

4.2.1 Temporary fencing and hoardings shall be provided for

- safety and security,
- livestock control and
- the protection of heritage and environmental features.

4.2.2 Hoardings shall be

- of a colour to aid integration into the landscape,
- kept free from graffiti and posters and
- kept well maintained.

4.2.3 The SDCG shall be consulted on the colour of hoardings.

4.2.4 Samples of proposed hoardings shall be provided[25].

4.2.5 Hoardings shall not contain advertising or promotional information.

4.2.6 Fencing and hoardings in areas that are at risk of flooding shall be made permeable to floodwater.

4.2.7 Fencing installed around the Nile Clumps prior to the *starting date* shall be maintained until the *works* in the vicinity are complete.

4.2.8 Fencing shall be provided to protect existing water features from degradation and physical damage during construction.

[23] The Stakeholder Design Consultation Group is a group established by the *Client* who is to be consulted in relation to specific areas of the *works*. The SDCG is administered by the *Client* with membership comprising representation from English Heritage Trust, Historic England, The National Trust and Wiltshire Council.
[24] Refer to MCHW Volume 3 – Highway Construction Details (HCD) – H Series [100].
[25] Refer to paragraph S611 Volume 1 Part 1 (General Requirements) of the contract.

## 4.3 Permanent Fencing

4.3.1 Permanent fencing shall be provided

- for safety and security,
- for livestock control,
- as required by the Landscaping Scheme and
- for accommodation works.

4.3.2 A continuous boundary fence to the new A303 shall be provided.

4.3.3 Within the WHS, all fencing above the top of the tunnel portal approach retaining structures, Longbarrow Land Bridge (Green Bridge 4) and the cut and cover section of Stonehenge Tunnel shall be

- post and wire with livestock-proof netting and
- consistent with other fencing within the WHS.

4.3.4 The top of new highway boundary fencing within the western cutting shall be no higher than the ground level at the top of the cutting alongside which the fencing runs.

### River Till Viaduct

4.3.5 Permanent fencing shall be provided beneath the River Till Viaduct which

- limits livestock within the River Till Special Area of Conservation (SAC),
- forms a continuous livestock-proof boundary,
- extends between the northern and southern *boundaries of the site*,
- extends a minimum twenty-five (25) metres either side of the centreline of the River Till and
- has water-gates at the upstream and downstream ends.

### Public Rights of Way

4.3.6 Fencing to Public Rights of Way (PRoW) shall be

- a minimum 1.2m high,
- offset a minimum 0.5m distance from the edge of the PRoW and
- placed at the back of the verge (where a verge is provided).

4.3.7 At locations where an equestrian route is adjacent to a hazard, equestrian fencing shall be

- a minimum 1.8m high and
- provided with solid infill panels at least 600mm high at the bottom of the fence.

### Grazing Plot Fencing

4.3.8 Grazing plot fencing shall be post and wire with livestock-proof netting.

4.3.9 Access points into each of the grazing plots shall be agreed with the *Project Manager*.

### Accommodation Works Fencing

4.3.10 Accommodation works fencing shall be provided in accordance with Volume 2 Part 6 (Accommodation Works) of the contract.

4.3.11 Fencing for Others shall be identified through liaison with landowners by the Agricultural Liaison Officer[26].

[26] Refer to Table 2.1 Roles and Responsibilities during construction in the OEMP [5].

## 4.4 Mammal and Stone Curlew Breeding Plot Fencing

4.4.1 Mammal fencing shall be provided in accordance with the requirements in section 2.9 (Special Ecological Measures: Mammal Tunnels and Fencing) of this document.

4.4.2 Stone curlew breeding plot fencing shall be provided in accordance with the requirements in section 2.11 (Special Ecological Measures: Stone Curlew Breeding Plot) of this document.

## 4.5 Gaps, Gates and Styles

4.5.1 Access controls to PRoW and PMAs shall

- be selected according to use,
- prevent the passage of animals that need to be controlled,
- prevent access to those not entitled to use the PRoW or PMA and
- be provided in accordance with the requirements of BS 5709 'Gaps, gates and stiles – Specification' [21].

4.5.2 Gates shall be provided at all access points from the Carriageway to Restricted Byways, Bridleways and Footpaths which

- are offset at least five (5) metres from any adjacent Carriageway edge,
- are lockable and
- minimise un-authorised vehicle parking.

4.5.3 Unless otherwise required, gates (permanent or temporary) within the WHS shall be

- of timber construction and
- provided to HCD drawing number H21 or H22[27].

4.5.4 Unless otherwise required, gates outside the WHS shall be

- of steel construction and
- provided to HCD drawing number H17, H18, H19 or H20[28].

4.5.5 Gates to PMAs shall be provided

- in accordance with Volume 2 Part 6 (Accommodation Works) of the contract and
- offset at least twelve (12) metres from any adjacent Carriageway edge.

4.5.6 Gates required for accommodation works shall be provided in accordance with Volume 2 Part 6 (Accommodation Works) of the contract.

4.5.7 New gates shall not be provided on Byways Open to All Traffic (BOATs).

4.5.8 Restricted Byways shall be provided with Kent carriage gaps[29] at each access point from a Carriageway.

4.5.9 Bridleways and Footpaths shall be provided with a minimum clear width of three (3) metres at each access point from a Carriageway.

[27] Refer to MCHW Volume 3 – Highway Construction Details (HCD) – H Series [100].
[28] Refer to MCHW Volume 3 – Highway Construction Details (HCD) – H Series [100].
[29] As defined in BS 5709 'Gaps, gates and stiles – Specification' [21].

# 5 Road Restraint Systems

## 5.1 General

5.1.1 The use of Road Restraint Systems (RRS) shall be minimised.

5.1.2 Unless otherwise stated, H2 containment level and Class B Impact Severity Level (ISL) rigid concrete safety barrier RRS shall be provided on the new A303 central reserve between the western and eastern tie in to the existing A303 (Approx. chainage Ch. 0+800 to Ch. 12+400).

5.1.3 In the Stonehenge Tunnel portal areas from where the new A303 bifurcates to the bored tunnel entrance, metal safety barrier RRS may be provided.

5.1.4 The central reserve RRS on the existing A303 shall be upgraded between the following locations

- Yarnbury Castle crossing point (approx. market post 142/3 + 70m at the end of the existing P1 barrier terminal) and tie in to the new A303 at approx. chainage Ch. 0+800 and
- 30m east of Solstice Park Overbridge (approx. marker post 129/2) and tie in to the new A303 at approx. chainage Ch. 12+400.

5.1.5 Where the central reserve RRS on the existing A303 is to be upgraded, H2 containment level and Class B Impact Severity Level (ISL) rigid concrete safety barrier RRS Should be provided.

5.1.6 If the geometry of the existing A303 does not permit a rigid concrete safety barrier RRS to be provided in the central reserve which complies with the requirements of CD 377 'Requirements for road restraint systems' [22], steel safety barrier RRS shall be provided.

5.1.7 The *works* shall be future proofed for the provision of RRS in accordance with the requirements in section 22 (Future Proofing Requirements) of this document.

# 6 Drainage

## 6.1 General

6.1.1 Highway drainage systems shall be designed for a rainfall event ("Design Rainfall Event") which comprises

- a rainfall event and
- an increase in the rainfall event intensity for the effects of climate change.

6.1.2 The rainfall event return period shall be selected according to the required frequency to be used for the relevant drainage element.

6.1.3 The following minimum increases in the rainfall event intensity shall be adopted for the effects of climate change

- 30% for highway surface runoff and
- 40% for surface water runoff.

6.1.4 The risk of flooding from groundwater during extreme groundwater events shall be mitigated.

6.1.5 Sustainable drainage features shall be provided to treat and attenuate all runoff from the highway prior to discharge or infiltration.

6.1.6 Drainage systems shall not discharge directly within groundwater source protection zones (SPZ).

6.1.7 Highway surface water runoff shall be treated prior to infiltration or discharge.

## 6.2 Drainage Strategy

6.2.1 A drainage strategy shall be prepared which includes proposals for

- the highway and Stonehenge Tunnel drainage systems,
- the management of surface water and foul drainage,
- the treatment of runoff,
- pollution control, including the containment of contaminant spillages,
- attenuation and infiltration,
- the management of flows from catchments external to the highway,
- independent drainage systems for highway and land drainage,
- the management of slope drainage for surface and near-surface flows,
- the management of sub-surface groundwater flows and
- the management and incorporation of existing drainage systems.

6.2.2 The drainage strategy shall

- be based on the mitigation measures included in the Environmental Statement[30],
- demonstrate that the *works* do not result in an increase in the risk of flooding,
- maintain or improve the quality of water entering the ground and
- use drainage treatment areas to create additional wetland and grassland habitats and increase levels of biodiversity.

[30] Refer to Environmental Statement Appendix 11.3 (Road Drainage Strategy) [93].

## 6.3 Existing Drainage

6.3.1 For those parts of the existing drainage system proposed to be incorporated into the *works*, the following shall be undertaken

- establish its location, condition and suitability for inclusion,
- prove the extent of the drainage system to its outfall,
- empty and thoroughly clean[31], including all chambers, gullies and gully connections and
- CCTV survey after cleaning to verify both the adequacy and condition of the connection and the existing pipe work.

6.3.2 A report and detailed drawings shall be prepared for those parts of the existing drainage system proposed to be incorporated into the *works* detailing

- the location, level and condition of the existing drainage system,
- the extent of the drainage system to its outfall and
- an assessment of the suitability for inclusion.

6.3.3 Until the existing drainage system is replaced or made redundant by the *works*, the existing drainage system shall either

- have the existing drainage system functionality maintained or
- be replaced with a temporary drainage system of equivalent functionality.

## 6.4 New Drainage

6.4.1 Except for bridge deck drainage, for the new A303, the highway drainage system shall comprise concrete surface water channels or kerb and gullies with a positive piped system.

6.4.2 For the new A303, the highway drainage system shall outfall into sustainable drainage features to treat and attenuate all runoff from the highway prior to discharge or infiltration.

6.4.3 For highways other than the new A303, the drainage system shall comprise verge side soakaways to intercept and infiltrate runoff from the carriageway.

6.4.4 A separate highway drainage and Stonehenge Tunnel drainage system shall be provided.

6.4.5 The highway drainage system shall only receive the liquids discharged from the Stonehenge Tunnel drainage system which are not required to be impounded.

6.4.6 The highway drainage system shall not discharge into the Stonehenge Tunnel drainage system.

6.4.6a Between chainage Ch. 6+000 and Ch. 10+800 the highway drainage system shall be provided so that there is no flooding of the carriageway in a 1 in 100-year Design Rainfall Event, including the minimum increase in rainfall event intensity for the effects of climate change.

6.4.7 Except for the Stonehenge Tunnel drainage system, a pumped drainage system Should not be provided.

[31] The cleaning of existing drainage systems is covered by the requirements contained in MCHW Series 500 [116].

6.4.8 A pumped drainage system may be provided where it can be demonstrated that discharge flows from the drainage system in conjunction with extreme groundwater levels cannot, for the Design Rainfall Event, be

- attenuated and infiltrated to the ground or
- discharged by gravity flow to a receiving watercourse.

6.4.9 Except for land drainage, the drainage system west of Stonehenge Tunnel shall be provided as an infiltration drainage system with no discharge to surface watercourses.

6.4.10 The drainage system east of Stonehenge Tunnel shall be provided as

- an infiltration drainage system,
- an attenuation and controlled discharge system to existing highway surface watercourses or
- a combination of both an infiltration drainage system and an attenuation and controlled discharge system to existing highway surface watercourses.

6.4.11 The highway drainage system shall mitigate the risk of high groundwater impeding infiltration.

6.4.12 Discharges to the River Avon shall achieve a minimum 20% reduction of the existing discharge rates.

## 6.5 Drainage to Structures

6.5.1 Drainage to Structures shall

- avoid surface or sub-surface drainage continuation across, contained within, or suspended below the Structures,
- provide positive drainage,
- avoid direct discharge through bridge decks or surface water falling freely from the Structures and
- provide practical details for the interception, collection and removal of surface and sub-surface water from the Structures to piped drainage systems.

## 6.6 Stonehenge Tunnel Drainage System

6.6.1 Stonehenge Tunnel drainage system shall be a self-contained system to collect all liquid inflows into the tunnel.

6.6.2 Stonehenge Tunnel drainage system shall impound separately all liquids which cannot be discharged into the highway drainage system.

6.6.3 The discharge point of the impounding sump shall be positioned so that the impounding sump can be emptied

- safely and
- without disruption to Road Users on the new A303.

6.6.4 Stonehenge Tunnel drainage system shall connect to the highway drainage system high point east of Stonehenge Tunnel.

6.6.5 The connection between the Stonehenge Tunnel drainage system and the highway drainage system shall be controlled using a diverter valve.

6.6.6 The diverter valve between the Stonehenge Tunnel and highway drainage systems shall be provided so that it can be remotely operated by the *Client*.

6.6.7 The total capacity of the Stonehenge Tunnel sumps shall be sized for a minimum operational capacity to contain simultaneously

- one (1) hour of fixed firefighting system (FFFS) deployment,
- one (1) hour of hydrant discharge,
- one (1) tanker spillage,
- tunnel wash-down water after a fire and
- wall washing from a tunnel maintenance cycle.

6.6.8 The design volumes for the following shall be determined

- FFFS deployment,
- hydrant discharge,
- tunnel wash-down water after a fire,
- wall washing water from a tunnel maintenance cycle and
- infiltration through the tunnel lining.

## 6.7 Drainage Treatment Areas

6.7.1 Drainage treatment areas (DTAs) shall be provided which

- provide treatment prior to discharge or infiltration,
- are planted in accordance with the Landscaping Scheme,
- sympathetically integrate into the landscape and
- have shallow slopes around the perimeter.

6.7.2 Shallow slopes around the perimeter of DTAs shall not exceed a gradient of 1 in 5.

6.7.3 DTAs forming part of an attenuation and controlled discharge drainage system shall have impermeable bases.

6.7.4 DTAs forming part of an infiltration drainage system shall

- absorb contaminants through a filtration treatment system in the base area and
- be planted so that the planting does not compromise the operation or maintenance of the filter layer.

6.7.5 If required at Countess Roundabout for attenuation, linear DTAs shall be used to replace the existing ditches to which runoff from the carriageway currently outfalls to.

6.7.6 Until Completion of *section* 3*,* the DTAs shall be monitored and managed with the following tasks undertaken

- remove litter accumulation,
- remove invasive or non-native plant species,
- monitor the condition of the vegetation,
- undertake replanting and remedial measures and
- remove excess dense emergent vegetation where it exceeds 50% of the basin area.

6.7.7 Based on the results of soakaway tests undertaken at the infiltration DTA locations, the following parameters shall be proposed and justified

- the infiltration rate and
- the safety margin on the infiltration rate.

6.7.8 Invert levels for infiltration systems shall be provided which are

- a minimum of one (1) metre above the maximum recorded groundwater level in that locality and
- in accordance with the guidance and recommendations contained in CIRIA publication C753 'The SuDS Manual' [23].

6.7.9 The linear attenuation ponds provided adjacent to Countess Roundabout shall

- not be adversely impacted by the River Avon flood level and
- not cause a negative impact to the River Avon flood level.

6.7.10 Potential adverse effects of any drainage system on the hydrology present in the catchment adjacent to Blick Mead shall be avoided.

# 7 Highways

## 7.1 General

7.1.1 The road type shall be in accordance with Table 7-1 (Minimum Highway Link Requirements).

7.1.2 The new A303 between Longbarrow Junction and Countess Junction shall prohibit Non-Motorised Users (NMUs) and restricted vehicles[32].

7.1.3 Road safety audits shall

- be undertaken in accordance with GG 119 'Road safety audit' [24],
- be undertaken for the new A303 and local roads within the Site and
- have the stage 4 road safety audit undertaken two (2) years after Completion of *section* 3A.

## 7.2 Highway Links

### Alignment

7.2.1 The highway alignment shall be provided based on the linear works Nos. 1A-1H, 2, 3A-3C, 4 and 6 [33] and ancillary works described in the Authorised Development.

7.2.2 The highway alignment shall be developed from the Engineering Section Drawings (Plan and Profiles)[34] within the Limits of Deviation.

7.2.3 The highway alignment shall be provided for the design speed and category shown in Table 7-1 (Minimum Highway Link Requirements).

7.2.4 The *works* shall tie into the existing A303 dual carriageway in the following locations

- south of Yarnbury castle (approx. Ch. 0+800) and
- east of Countess junction (approx. Ch. 12+400).

7.2.5 The Paved Width of Countess Junction westbound merge slip road, including any temporary diversion, shall not extend southward outside the Paved Width of the existing A303.

7.2.5a The Paved Width of Countess Junction westbound diverge slip road, including any temporary diversion, between its tie-in point at Countess Roundabout and chainage Ch. 11+970, shall not extend southward outside the Paved Width of the existing A303.

### Cross Sections and Headrooms

7.2.6 The highway cross sections and headrooms shall be developed from the Engineering Section Drawings (Cross Sections)[35].

7.2.7 The highway cross section component shall be selected based on the road type and minimum cross section dimensions shown in Table 7-1 (Minimum Highway Link Requirements).

[32] Refer to DCO Schedule 10 (Traffic Regulation Measures), Part 2 (Clearways and Prohibitions), Article [47] and [48] and the Traffic Regulation Measures Plans (Clearways and Prohibitions).
[33] Refer to DCO documents 2.5 Works Plans [41].
[34] Refer to DCO documents 2.7 Engineering Section Drawings (Plan and Profiles) [102].
[35] Refer to DCO documents 2.8 Engineering Section Drawings (Cross Sections) [103].

7.2.8 The new A303 shall be provided with Standard Headroom for a high load route between

- Solstice Park Junction and the *boundaries of the site* and
- Longbarrow Junction and the *boundaries of the site*.

7.2.9 The new A303 between Solstice Park Junction and Longbarrow Junction shall be provided with Standard Headroom for as standard load route.

7.2.10 The *works* shall be provided so that the width of the existing River Avon Bridge is not altered.

## 7.3 Junctions

7.3.1 Longbarrow Junction[36] shall be provided as a dumbbell type junction consisting of two roundabouts linked by a dual two (2)-lane connector road over Longbarrow Junction Overbridge (Green Bridge 3) and four (4) slip roads providing access and egress from the new A303 in each direction.

7.3.2 The southern roundabout at Longbarrow Junction shall be provided with a Cycleway[37].

7.3.3 Countess Junction[38] shall be provided as a single roundabout with the new A303 fly-over and four (4) slip roads providing access and egress from the new A303 in each direction.

7.3.4 Countess Junction shall be provided with walkways[37,39].

7.3.5 The new A303 junctions shall be provided

- for the forecast design year traffic flows (2041) as shown in Figure 7-1 to Figure 7-4,
- so that the predicted degree of saturation / ratio of flow to capacity (RFC) is less than 85% and
- so that queues do not block back to upstream junctions or onto the new A303.

## 7.4 Crossovers

7.4.1 Crossovers shall be provided to

- facilitate the movement of vehicles between adjacent carriageways,
- permit the removal or turnaround of traffic on the approaches to Stonehenge Tunnel,
- allow for contraflows to be established in each of the Stonehenge Tunnel bores,
- prevent unauthorised use during normal operations and
- allow opening for emergency use.

7.4.2 Crossovers on the new A303 shall be provided in the locations shown in the Authorised Development.

7.4.3 Crossovers at Countess and Longbarrow Junctions shall be provided

- as Maintenance Crossing Points[40] and
- with a design speed of 85kph.

7.4.4 Crossovers on the approaches to the Stonehenge Tunnel portals shall be provided as "Open" Emergency Crossing Points[40].

[36] Refer to Work No. 4 described in the Authorised Development.
[37] Refer to DCO documents 2.9 General Arrangement Drawings [104].
[38] Refer to Work No. 1H described in the Authorised Development.
[39] As defined in CD 143 'Designing for walking, cycling and horse-riding' [98].
[40] As defined in CD 377 'Requirement for road restraint systems' [22].

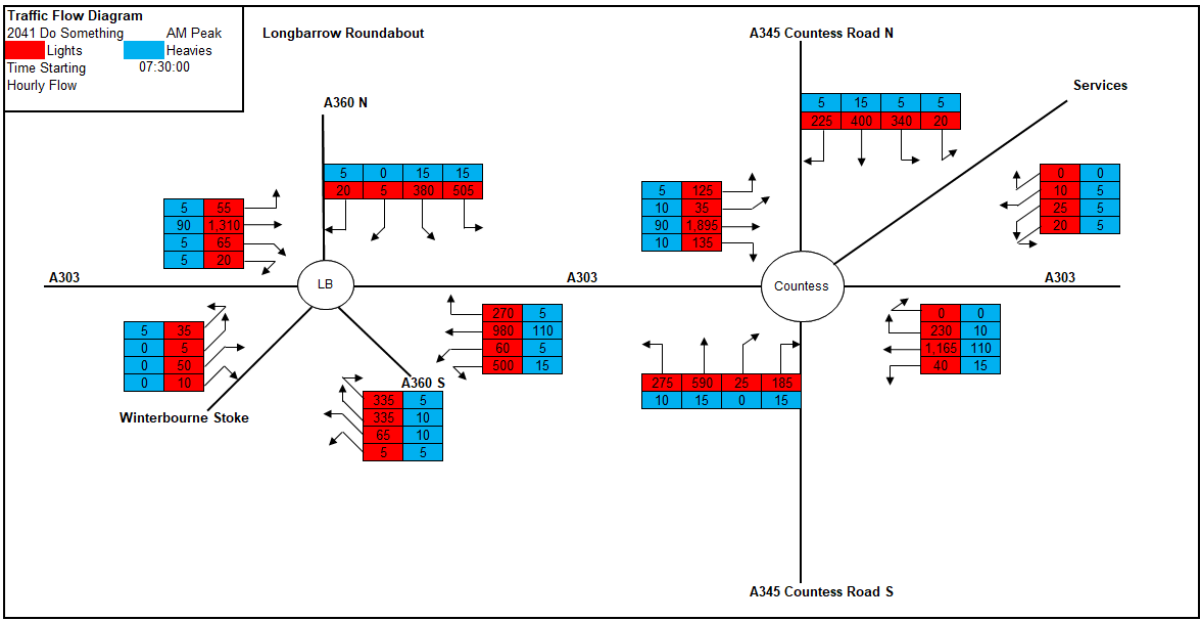



**Figure 7-1 2041 Design Year AM Peak Traffic Flow Diagram**

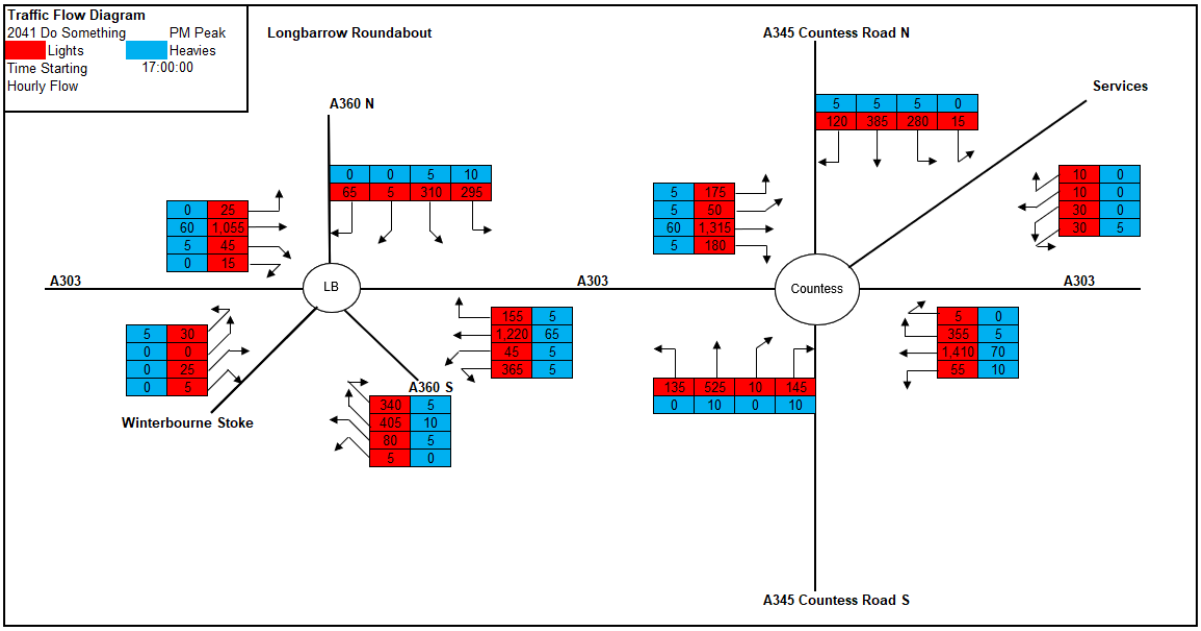
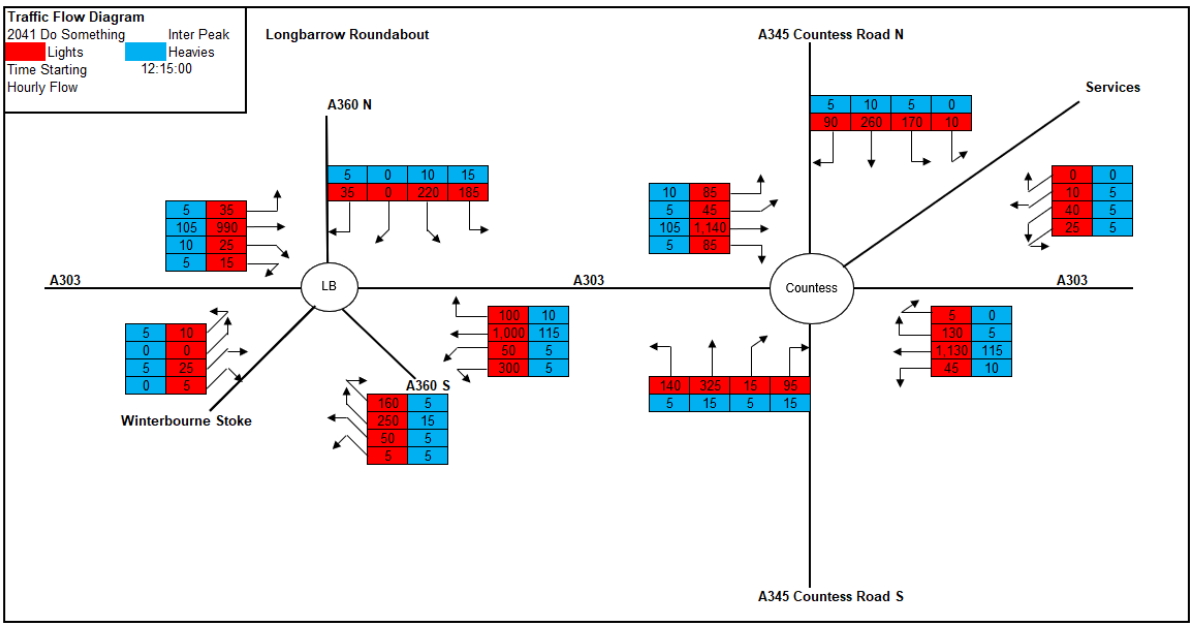
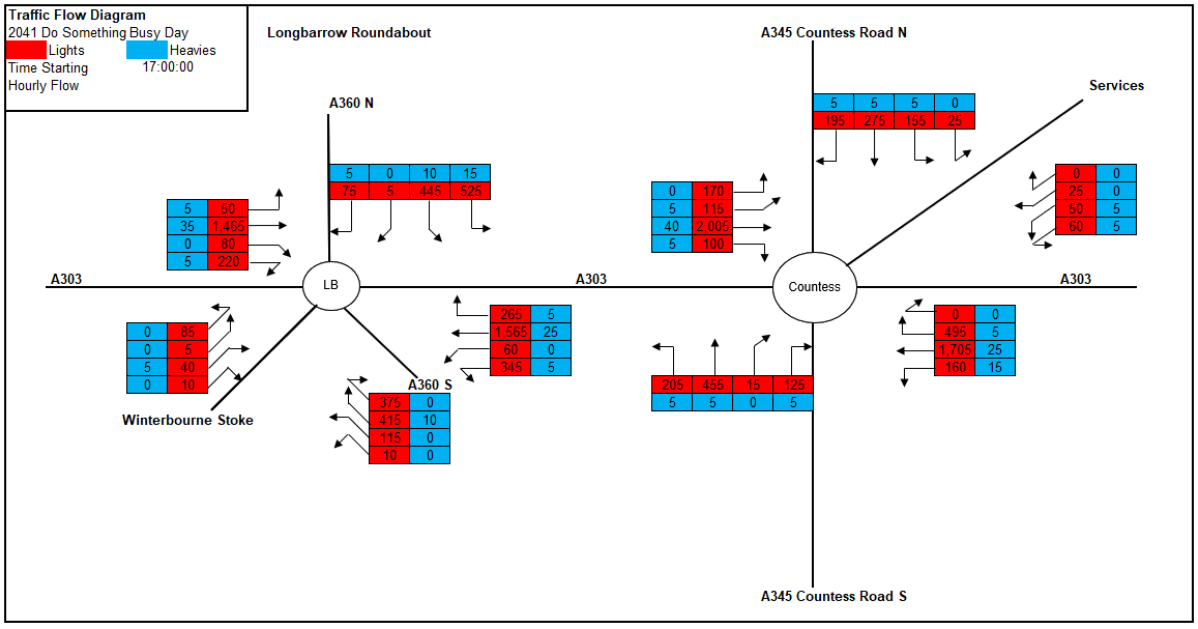



**Figure 7-2 2041 Design Year PM Peak Traffic Flow Diagram**




## Figure 7-3 2041 Design Year Inter Peak Traffic Flow Diagram




## Figure 7-4 2041 Design Year Busy Day Traffic Flow Diagram

## Table 7-1 Minimum Highway Link Requirements

| Work No. | Road | Road Type[1)] | Design Speed and Category[2)] | Minimum Cross Section Dimensions | |
|---|---|---|---|---|---|
| | | | | Standard Cross Section Component | Exceptions and Restrictions |
| 1A | The new A303 | Rural all-purpose road mainline. Dual carriageway. | 120A | Dual 2 lane (D2AP) | Minimum verge width 3.5m. All dimensions to suit existing A303 at tie-in. |
| 1B | The new A303 on River Till Viaduct | Rural all-purpose road mainline. Dual carriageway. | 120A | Dual 2 lane (D2AP) | Minimum verge width 3.5m, except on River Till Viaduct. River Till Viaduct minimum verge widths shall be in accordance with Clause 3.6 of CD 127 increased as required to satisfy visibility requirements. |
| 1C | The new A303 | Rural all-purpose road mainline. Dual carriageway. | 120A | Dual 2 lane (D2AP) | Minimum Verge Width 3.5m. |
| 2 | B3083 Shrewton Road | Rural all-purpose road mainline. Single carriageway. | 85A | Single (S2) | Minimum verge width 1.5m, widening beneath B3083 over-bridge and a 10.0m length either side of bridge to provide a 3.0m wide (clear width) segregated PMA along east verge. |
| 1C | Longbarrow Junction slip roads | Rural all-purpose connector road. | 70A | Single lane (DG1C and MG1C) | None. |
| 4 | A360 between roundabouts | Rural all-purpose road mainline. Dual carriageway. | 100A | Dual 2 lane (D2AP) | Minimum verge width 2.5m. |
| 4 | A360 (excluding Countess Roundabouts and connector road) | Rural all-purpose road mainline. Single carriageway. | 100A | Single (S2) | Minimum verge width 3.5m. |
| 1D | The new A303 in retained cut | Rural all-purpose road mainline. Dual carriageway. | 120A | Dual 2 lane (D2AP) | Minimum verge width 3.5m. |
| 1E | The new A303 in cut & cover tunnel | Rural all-purpose road mainline. Dual carriageway. | 120A | Dual 2 lane (D2AP) | Refer to section 15.2 (Tunnel Structure) of this document for verge and hard strip requirements. |
| 1F | The new A303 in bored tunnel | Rural all-purpose road mainline. Dual carriageway. | 120A | Dual 2 lane (D2AP) | Refer to section 15.2 (Tunnel Structure) of this document for verge and hard strip requirements. |

| Work No. | Road | Road Type[1)] | Design Speed and Category[2)] | Minimum Cross Section Dimensions | |
|---|---|---|---|---|---|
| | | | | Standard Cross Section Component | Exceptions and Restrictions |
| 1G | The new A303 in cut & cover tunnel | Rural all-purpose road mainline. Dual carriageway. | 120A | Dual 2 lane (D2AP) | Refer to section 15.2 (Tunnel Structure) of this document for verge and hard strip requirements. |
| 1H | The new A303 in retained cut | Rural all-purpose road mainline. Dual carriageway. | 120A | Dual 2 lane (D2AP) | Minimum verge width 3.5m. |
| 1H | The new A303 | Rural all-purpose road mainline. Dual carriageway. | 120A | Dual 2 lane (D2AP) | Minimum verge width 3.5m. From east of countess to western tie-in, all Dimensions to suit existing A303. |
| 1H | The new A303 – Countess Roundabout Flyover and retained approach embankments | Rural all-purpose road mainline. Dual carriageway. | 120A | Dual 2 lane (D2AP) | Minimum verge widths shall be in accordance with Clause 3.6 of CD 127 increased as required to satisfy visibility requirements. |
| 1H | Countess Junction slip roads | Rural all-purpose connector road. | 70A | Single lane (DG1C and MG1C) | None. |
| 1H | Existing A345 | Single carriageway as existing. | 60B | N/A | None. |
| 3A – 3B | Link road to Winterbourne Stoke at Longbarrow Junction | Rural all-purpose road mainline. Single carriageway. | 100A | Single (S2) | Shared Use Cycle Track (Work No. 3A) (Refer to Table 8-1 (PRoW Requirements)) |
| 3C | Existing A303 section in Winterbourne Stoke | Single carriageway as existing. | 60B | N/A | Footway converted to Cycleway (Refer to Table 8-1 (PRoW Requirements)) with reduction to existing carriageway width. |
| 6 | Stonehenge Road | Single carriageway as existing. | 60B | N/A | None. |

1 As defined in CD 127 'Cross-sections and headrooms' [25].

2 As defined in CD 109 'Highway link design' [26].

## 7.5 Maintenance Hard Standing

7.5.1 Maintenance Hardstanding (MHS) shall be provided at

- the approaches to Stonehenge Tunnel and
- locations required to undertake maintenance activities.

7.5.2 Unless otherwise stated, MHS shall be

- reinforced concrete grass paved areas,
- set into the verges and
- minimum 8.0m long by 3.5m wide.

7.5.3 MHS on the approaches to Stonehenge Tunnel shall be located at the Tunnel Service Building (TSB) areas with

- a minimum length of twenty (20) metres,
- a paved surface matching the pavement construction of the adjacent the new A303 carriageway,
- safe vehicle parking and access to the TSBs and
- space where Plant, Equipment and personnel can assemble prior to maintenance of Stonehenge Tunnel.

## 7.6 Places of Relative Safety

7.6.1 Type A parking lay-bys[41] shall be provided on each carriageway of the new A303 west of Parsonage Down Land Bridge (Green Bridge 1) (Approx. chainage Ch. 2+600).

7.6.2 The *works* shall be future proofed for the provision of Emergency Areas in accordance with the requirements in section 22 (Future Proofing Requirements) of this document.

7.6.3 Places of Relative Safety shall be provided on both approaches on both carriageways to the Stonehenge Tunnel portals.

7.6.4 Places of Relative Safety provided on the approaches to the Stonehenge Tunnel portals shall provide

- a muster point for the self-evacuation of tunnel users,
- a muster point for TSB users,
- a location for over height vehicles to stop prior to escort off the carriageway and
- a location for Road Users to stop in an emergency.

7.6.5 Where Places of Relative Safety are provided as a location for Road Users to stop in an emergency, Places of Relative Safety shall be provided as an emergency lay-by defined by Figure 6.2N3 of CD 169 'The design of lay-bys, maintenance hardstandings, rest areas, service areas and observation platforms' [27] except as modified as follows

- twenty-five (25) metre minimum design entry taper length and
- forty-five (45) metre minimum design exit taper length.

[41] As defined in CD 169 'The design of lay-bys, maintenance hardstandings, rest areas, service areas and observation platforms' [27].

## 7.7 Conversion of Existing Highway

7.7.1 Where existing highways are being permanently stopped up by the *works*, the existing highway pavement shall either

- be converted to a PRoW and / or PMA in accordance with the requirements of section 8 (Public Rights of Way and Private Means of Access) of this document or
- have the bound surface removed and treated in accordance with the Landscaping Scheme.

## 7.8 Traffic Regulation Orders

7.8.1 Traffic regulation orders, in addition to the Traffic Regulation Measures, required by the *works* shall be prepared.

## 7.9 Traffic Impact During the Works

7.9.1 Traffic management proposals shall be assessed to determine the impact of Providing the Works on the operation of the existing highway network[42].

7.9.2 The traffic management proposals at Longbarrow and Countess Junctions shall be provided for the link flows and turning movements shown in Figure 7-5 (2026 AM Peak Traffic Flow Diagram) to Figure 7-7 (2026 Busy Day Traffic Flow Diagram).

7.9.3 The impact of Providing the Works shall not cause a significant adverse traffic impact at Longbarrow and Countess Junctions[43].

7.9.4 When assessing the impact at Longbarrow (existing and proposed) and Countess Junctions, the area of modelling shall extend to the area outside the junction vicinity to cover impact to all Road Users affected by Providing the Works which includes the

- level of queuing on the approaches to the junctions,
- construction compound and site access / egress and
- Countess service area access / egress (Countess Junction).

7.9.5 The assessment of the impact of Providing the Works on traffic flows on both the existing A303 and local roads shall include

- delays, including queueing and extent of delays and
- journey time changes.

7.9.6 Traffic management proposals shall include measures to minimise rat running through local roads.

7.9.7 A regime for monitoring the impact of Providing the Works on traffic flows[44] shall

- be developed and detailed in the TMP[42] and
- permit real-time monitoring of the impact of the *works* on traffic flows.

[42] Refer to action or commitment MW-TRA2 of the OEMP [5].
[43] Refer to the Journey Time Reliability measure contained in the Scheme 'Performance Manual' [111] which sets out the thresholds for assessing the impact of Providing the Works on journey times.
[44] Refer to action or commitment MW-TRA11 of the OEMP [5].

7.9.8 The regime for monitoring the impact of Providing the Works on traffic flows shall include

- a monitoring programme,
- details of the monitoring system(s),
- the monitoring locations,
- journey time monitoring and
- NMU monitoring including PRoW relocation or temporary closure, accessibility and safety.

7.9.9 Monitoring locations for monitoring the impact of Providing the Works on traffic flows shall

- permit the verification of the assessment predictions,
- be undertaken at a minimum thirty (30) No. locations,
- be determined in consultation with Wiltshire Council (for local road monitoring) and
- be agreed with the *Project Manager.*

7.9.10 Until Completion of *section* 3, journey time changes shall be monitored on the following routes

- on the existing and the new A303 covering east / west movements in both directions between the A338 and A36 junctions,
- on the A360 and A345 covering north / south movements in both directions crossing the existing and the new A303 and
- on the local road network identified as being materially affected by the *works*.

7.9.11 Heavy goods vehicle (HGV) construction traffic monitoring shall permit the tracking and enforcing HGV construction traffic movements along the designated construction traffic routes[45].

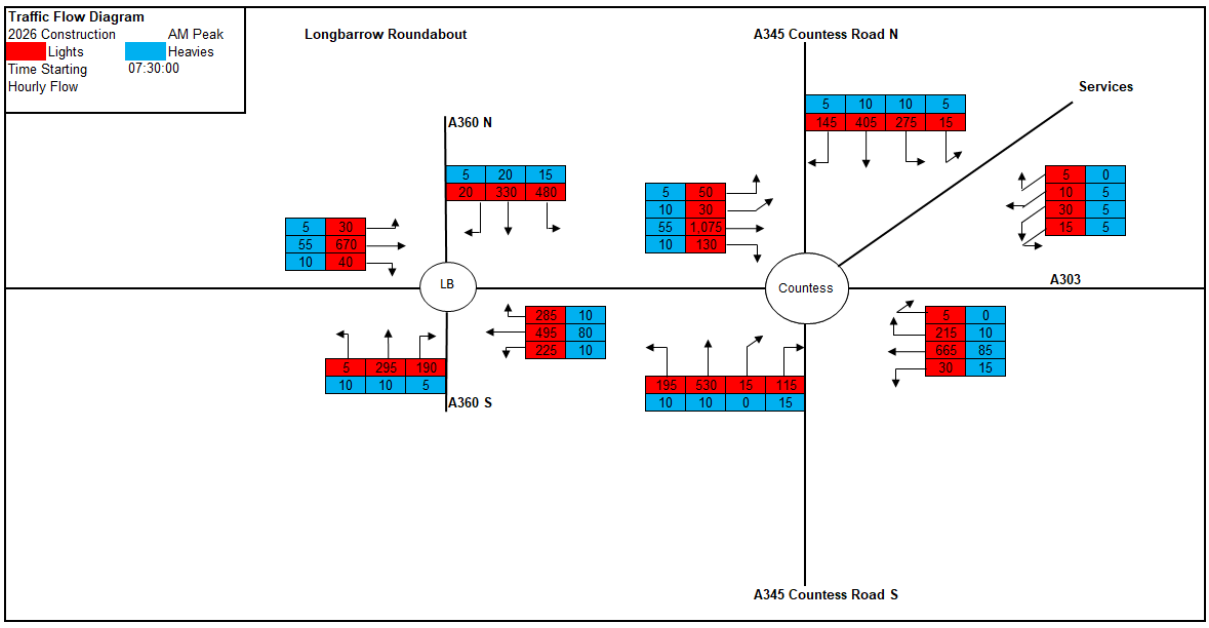



**Figure 7-5 2026 AM Peak Traffic Flow Diagram**

[45] The designated construction traffic routes are given in Specification Appendix 1/19 contained in Volume 3 (Specification Appendices).

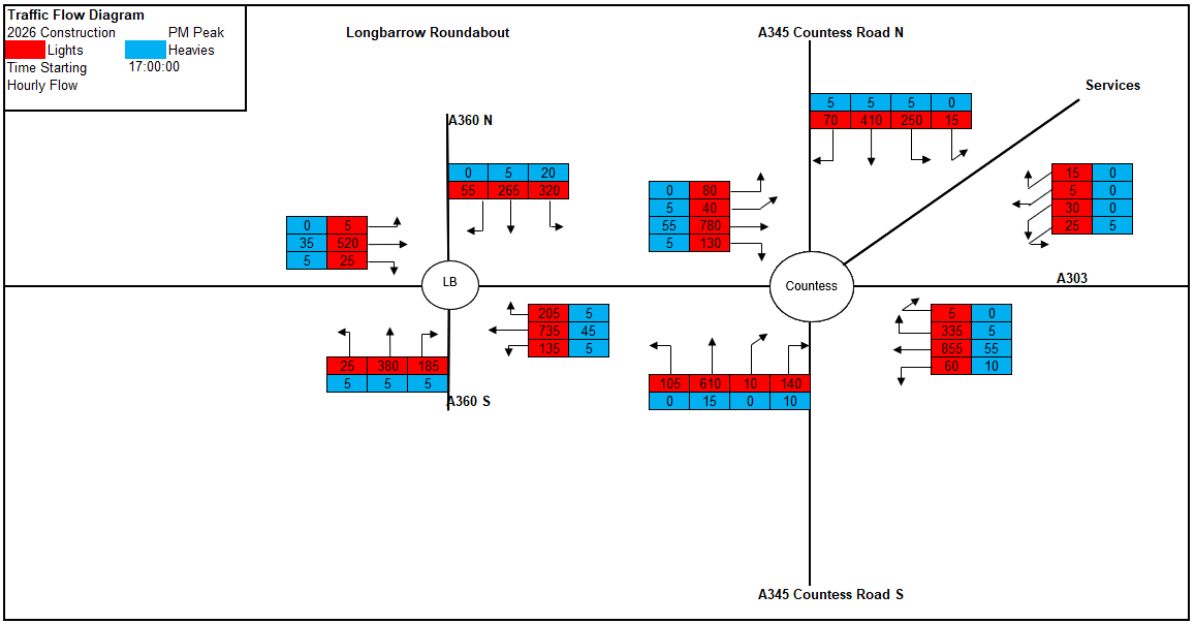



**Figure 7-6 2026 PM Peak Traffic Flow Diagram**

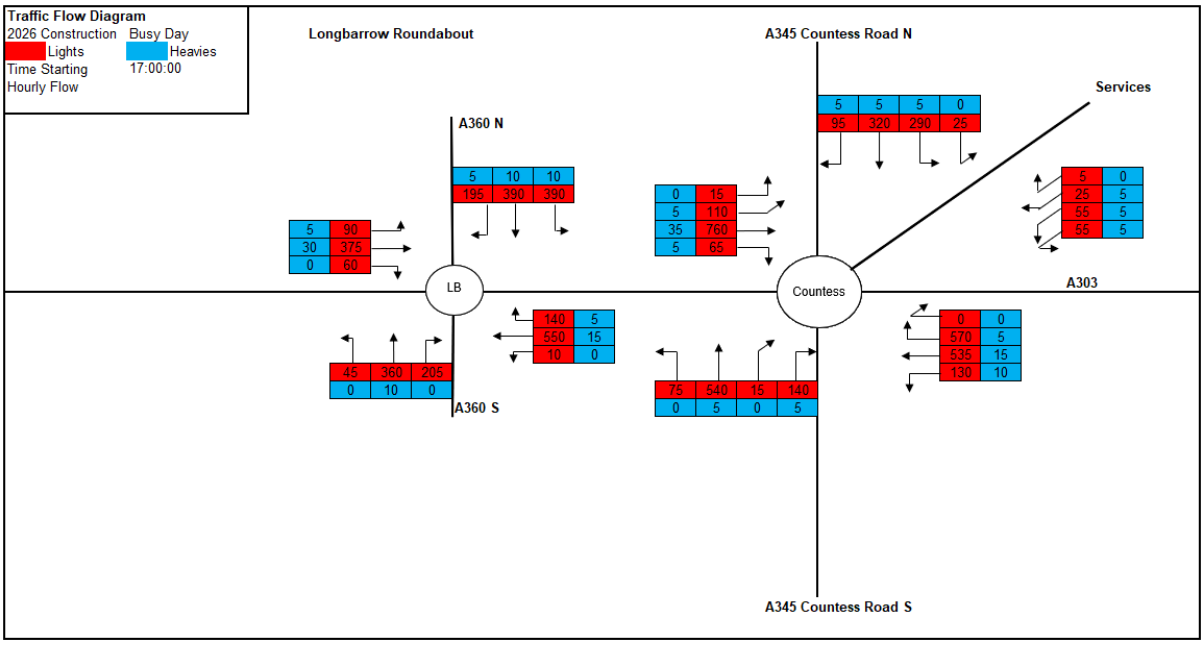



**Figure 7-7 2026 Busy Day Traffic Flow Diagram**

# 8 Public Rights of Way and Private Means of Access

## 8.1 General

8.1.1 Public Rights of Way and private means of access shall be provided based on the linear works and ancillary works described in the Authorised Development.

8.1.2 PRoWs and PMAs shall be provided as shown in the Rights of Way and Access Plans[46].

8.1.3 Permanent stopping up of existing highways, PRoWs and PMAs and the provision of new highways, PRoWs and PMAs shall be as follows[47]

- existing highways and PRoWs stopped up with a substitute provided,
- provision of new highways and PRoWs,
- existing highways and PRoWs stopped up with no substitute provided,
- existing PMAs stopped up with a substitute provided,
- provision of new PMAs and
- existing PMAs stopped up with no substitute provided.

8.1.4 PRoWs shall be in accordance with Table 8-1 (PRoW Requirements).

8.1.5 PRoWs within the WHS shall

- have a coloured and textured surfacing,
- not have raised edgings, surface markings, lighting, litter bins or other such street furniture and
- be drained and free from standing water.

8.1.6 Until Completion of *section* 3A, existing PRoWs shall be maintained to remain clear and accessible, including

- cutting back undergrowth and overhanging vegetation,
- removing weeds, debris and rubbish and
- undertaking regular inspections of the PRoW to confirm the surfacing is not damaged and that they are clear and accessible.

## 8.2 Creation of new PRoWs and PMAs

8.2.1 The existing highway surface of the following locations shall have the bound surface removed and treated in accordance with the Landscaping Scheme except to the extent it is required to create new PRoW and PMA

- the redundant section of the existing A303 within the WHS,
- the redundant section of the existing A360 including Longbarrow Roundabout and
- the redundant section of Stonehenge Road.

8.2.2 Existing PRoWs which are to be upgraded to cycleways shall be in accordance with the requirements of section 10 (Road Pavement and Paved Areas) of this document.

[46] Refer to DCO documents 2.6 Rights of Way and Access Plans [105].
[47] Refer to DCO Schedule 3 (Permanent Stopping Up of Highways and Private Means of Access and Provision of New Highways and Private Means of Access) Article [10]

8.2.3 Where an existing highway is being converted to a PRoW and / or PMA, verges shall be

- created from the remaining width of the carriageway and
- planted in accordance with the Landscaping Scheme.

8.2.4 Except where there is a requirement to retain the following elements, kerbs, drainage, road markings and stud shall be removed from existing highways being converted to PRoW and PMA.

8.2.5 Where an existing highway is being converted to a PMA, verges shall be provided so that vehicles using the PMA can use the verge as an over-run area.

8.2.6 BOATs shall be provided with verges with profiled earthworks to prevent vehicles from parking on the verges.

### Table 8-1 PRoW Requirements

| PRoW | Verge Width | Paved Width |
|---|---|---|
| Byway Open to All Traffic | As existing + remaining width from redundant carriageway. | 4.0m |
| Restricted Byway outside WHS | 3.0m / 1.0m [1]. Any redundant carriageway removed. | 4.0m |
| Restricted Byway created from existing carriageway inside WHS | As existing + remaining width from redundant carriageway. | 3.0m |
| New Restricted Byway inside WHS | 4.0m / 1.0m [1] | 3.0m |
| Bridleway | 4.0m / 1.0m [1] | 3.0m |
| Shared Use Cycle Track | n/a | 3.0m |
| Cycleway | 1.0m / 0.5m [2] | 2.5m |

[1] widest verge on opposite side of paved width from adjacent carriageway if present.

[2] widest verge between paved width and adjacent carriageway if present.

## 8.3 PRoW and PMA Surfacing

8.3.1 The surfaces of PRoWs shall be agreed with

- Wiltshire Council where Wiltshire Council is the adopting local authority and
- the *Project Manager*.

8.3.2 Any new PRoW within the WHS shall be a maximum of three (3) metres in width and have a bound surface.

8.3.3 Within the WHS, the surface of PRoWS and PMAs shall be visually recessive.

8.3.4 The colour tone of materials and finishes used for visually recessive surfacing of PRoWS and PMAs within the WHS shall

- sympathetically integrate into the landscape,
- minimise its visual appearance,
- be based on a thorough understanding of the landscape character, including the WHS Management Plan [8] and
- account for the seasonal colour change, key views, weathering and the difference between close and long-range views.

8.3.5 The location, surface colour, texture and materials of bound surfaces of PRoW within the WHS shall be

- determined in consultation with the SDCG,
- selected based on the results of trial panels or areas and
- agreed with the *Project Manager*.

8.3.6 Proposals for the colour tone of materials and finishes used for of PRoWS and PMAs surfacing within the WHS shall

- be presented to the SDCG,
- demonstrate the design intent for achieving a visually recessive surfacing and
- define the colour tones for the trial panels or areas.

8.3.7 Surfacing trial panels or areas shall be undertaken for a minimum period of three (3) years.

8.3.8 Surfacing trial panels or areas shall be undertaken for a minimum one (1) year prior to the surfacing being provided in the *works*.

8.3.9 Surfacing trial panels or areas shall be provided in locations which experience daily use by vehicles.

8.3.10 Where paved construction is provided for PRoW and PMA, the formation level shall be treated prior to construction to prevent plant growth.

8.3.11 **[Not Used]**.

8.3.12 PRoW and PMA surfacing over Structures shall be provided to prevent

- erosion to underlaying fill and
- damage to drainage layers and structural waterproofing.

8.3.13 PMAs within the WHS and east of Stonehenge Road[48] shall be provided with a surface which can support calcareous grassland to maintain landscape connectivity.

## 8.4 PRoW Affected by Providing the Works

8.4.1 Temporary traffic management measures shall be implemented on PRoW and PMA which are affected by Providing the Works[49].

8.4.2 Where PRoW are affected by Providing the Works, alternative and accessible routes shall be provided which are signposted throughout the diversion and the Site.

[48] PMA reference No. 27 as shown on DCO documents 2.6 Rights of Way and Access Plans.
[49] Refer to action or commitment MW-TRA1 and MW-TRA10 of the OEMP [5].

# 9 Earthworks

## 9.1 General

9.1.1 Earthworks shall be provided in accordance with the guidance and recommendations contained in BS 6031 'Code of Practice for Earthworks' [29].

9.1.2 Surface water and groundwater flows shall be managed where the flows would be detrimental to the stability and integrity of the earthworks.

9.1.3 Except where required for habitat creation, the creation of bare areas of permanently exposed earthworks that could be vulnerable to erosion shall not be provided.

9.1.4 Earthworks involving MCHW Series 600 [30] Class 3 material shall be in accordance with the guidance and recommendations contained in CIRIA publication C574 'Engineering in Chalk' [31].

9.1.5 Materials for landscape integration and habitat creation shall be in accordance with the

- Soils Management Strategy[50] and
- Materials Management Plan[51].

9.1.6 Processed tunnel arisings Should be deposited to the land east of Parsonage Down National Nature Reserve.

9.1.7 Earthworks shall

- be provided based on the illustrative Environmental Masterplan included in the Environmental Statement,
- be provided in accordance with the DAMS[52],
- provide a natural appearance and reflect the surrounding topography and landscape character,
- avoid any sudden or visually apparent change in landform,
- be rounded at changes in grade and direction,
- be blended into the natural contours around the edge of the *works*,
- have the height of the regraded earthworks not exceeding the natural adjacent landform and
- not result in an increased risk of localised flooding.

9.1.8 No new permanent or temporary raised earthworks shall be provided within the WHS except in the following locations

- the dry valley to the North West of Vespasian's Camp and
- at Countess Roundabout Flyover.

9.1.9 The extent (width, length and height) of permanent raised earthworks within the WHS shall be minimised.

9.1.10 Except where otherwise stated, side slopes to earthworks adjacent to the carriageway Should

- provide a natural appearance[53] and
- not exceed a maximum gradient of one (1) in three (3).

[50] Refer action or commitment MW-GEO3 of the OEMP [5].
[51] Refer action or commitment MW-MAT2 of the OEMP [5].
[52] Refer to DCO Schedule 2 (Requirements), Part 1 (Requirements), section 5, Article [4].
[53] Refer action or commitment MW-LAN5 of the OEMP [5].

## 9.2 Environmental Bunds

9.2.1 PRoW and PMA adjacent to the north (between approx. chainage Ch. 0+000 to Ch. 2+850) and south (between approx. chainage Ch. 0+000 to Ch. 2+000) of the new A303 shall be segregated from the new A303 by

- one (1) metre high environmental bunds and
- fencing.

9.2.2 Environmental bunds on Structures shall

- provide visual screening and landscape integration,
- have a height of two (2) metres above the adjacent finished ground level,
- have maximum side slopes of 1 in 2 on the inner face,
- have maximum side slopes of 1 in 2.5 on the outer face, except for 1 in 2 on the outer face on the B3083 Underbridge,
- have a minimum crest width of two (2) metres, except for one (1) metre on the B3083 Underbridge,
- be provided along the full length of the Structure,
- connect into the adjacent Landscaping Scheme and
- be planted with calcareous grassland.

# 10 Road Pavement and Paved Areas

## 10.1 Road Pavement

10.1.1 The road pavement shall be provided for the minimum design traffic given in Table 10-1 (Minimum Design Traffic).

10.1.2 A thin surface course system[54] shall be provided on the new A303 and the associated slip roads.

10.1.3 The noise characteristics for the thin surface course systems on the new A303 and the associated slip roads shall be as follows

- design speed < 70km/hr - Road / Tyre Noise Level 2 and
- design speed ≥ 70km/hr - Road / Tyre Noise Level 3.

10.1.4 The foundation areas to the road pavement on the new A303 and the associated slip roads shall be provided using a restricted foundation design approach[55].

10.1.5 The road pavement on Wiltshire Council's road network shall be in accordance with Wiltshire Council's standard details[56].

### Table 10-1 Minimum Design Traffic

| Section | Minimum Design Traffic (msa) |
|---|---|
| The new A303 | 80 |
| Longbarrow Junction slip roads | 20 |
| Countess Junction slip roads | 10 |
| A360 | 40 |
| A345 | 50 |
| De-trunked A303 between Longbarrow and Winterbourne Stoke | 10 |
| All other roads | 5 |

## 10.2 Footways and Paved Areas

10.2.1 Surfacing for PRoW and PMA shall be in accordance with the requirements of section 8.3 (PRoW and PMA Surfacing) of this document.

10.2.2 Central reserve paved areas shall be provided in the following locations:

- where rigid concrete safety barrier RRS are provided,
- in the Stonehenge Tunnel portal areas and
- at crossovers.

## 10.3 Temporary Haul Routes

10.3.1 Temporary construction haul routes within the WHS shall be within the footprint of the permanent *works*.

[54] As defined in CD 236 'Surface course materials for construction' [112].
[55] Refer to Section 3 'Foundation designs' of CD 225 'Design for new pavement foundations' [119].
[56] Refer to drawings WC-HCD-700-D001 to D003contained in the Data Room [17].

10.3.2 Temporary construction haul routes shall comply with the requirements for temporary haul roads described in the DAMS[57].

10.3.3 Where a temporary construction haul road crosses the Esso oil pipeline, the haul road shall either

- cross at locations where protective measures have already been provided prior to the *starting date* or
- have protective measures provided where it crosses the pipeline.

10.3.4 Protection measures required to be provided to the Esso pipeline shall be

- determined in consultation with Esso and
- agreed with the *Project Manager*.

10.3.5 Where a temporary construction haul road crosses the River Till, a temporary bridge shall be provided in accordance with the requirements contained in section 13.2 (River Till Viaduct) of this document.

[57] Final Detailed Archaeological Mitigation Strategy (DAMS) sections 5.2.35 to 5.2.44.

# 11 Traffic Signs and Signals

## 11.1 General

11.1.1 Traffic Signs shall be provided which

- controls and guides Road Users,
- incorporates NMU requirements,
- promotes road safety,
- are the minimum required for the safe operation of the *works* and
- minimises the over-provision and clutter of signs.

11.1.2 Traffic Signs shall provide a coherent and unambiguous signing and messaging system to Road Users.

11.1.3 A Traffic Sign strategy shall be developed which includes proposals for

- warning signs,
- regulatory signs,
- informatory, directional and tourist signs,
- signs to enforce the traffic regulation measures,
- tunnel signs and signals[58], including for normal operation, maintenance closures and emergency closures,
- the requirements for the use of non-prescribed signs,
- the mounting, positioning and orientation of signs,
- the incorporation, alteration or replacement of existing signs,
- the removal of signs that are obsolete or unnecessary and
- road markings, marker posts and studs.

11.1.4 The Traffic Sign strategy shall study the wider area outside of the Site to

- permit coherent and unambiguous Traffic Signs to be provided and
- identify conflicting and confusing signs which introduce an inconsistency in the proposed Traffic Sign strategy.

11.1.5 The following shall be consulted to determine the requirements for tourism signage

- English Heritage Trust,
- National Trust and
- Wiltshire Council.

11.1.6 If the method of illumination of Traffic Signs can be provided without the requirement for lighting, Traffic Signs shall not be lit.

[58] The warning sign and distance plate described in 2.1 of Regulation 2, Annex I, Schedule (Signing for Tunnels) of the Road Tunnel Safety Regulations [117] cannot be used to indicate the length of a tunnel in Britain. The portal sign to diagrams 892 and 893 in The Traffic Signs and Regulations and General Directions [109] were introduced so that the requirements to indicate the length of a tunnel contained in the Road Tunnel Safety Regulations could be met in Britain.

11.1.7 Where lighting of Traffic Signs is required, lighting of Traffic Signs shall be provided which

- have low energy usage,
- are energy efficient,
- have high reliability,
- are durable,
- have a long lifespan and
- minimises light spill (including glare and upwards or sideways emission of light).

11.1.8 If non-prescribed Traffic Signs are required, the application[59] for their use shall be submitted in accordance with the *Client's* requirements for seeking authorisation.

11.1.9 Traffic Signs shall be

- positioned for minimal impact when viewed from the WHS and
- mounted on low reflectivity posts or settings.

11.1.10 Longbarrow and Countess Junctions shall be signalised.

11.1.11 Traffic signals at Longbarrow Junction shall be provided with shrouds or louvres to

- direct the signals towards the intended Road User and
- minimise light spill.

11.1.12 Pegasus crossings shall be provided at the following NMU crossing points of the Longbarrow Junction southern roundabout

- the realigned A360 and
- the new road classified as the C507.

11.1.13 Traffic Signs between the western portal (Approx. chainage Ch. 7+200m) and the western extent of the WHS shall

- be set lower than the existing ground level on the lower of the adjacent sides of the cutting and
- not be lit.

11.1.14 Signage for new PRoWs and PMAs within the WHS shall be

- low reflectivity,
- in-keeping with the character of the WHS and
- located in such a way as to ensure no adverse impacts on the OUV of the WHS.

11.1.15 Passively safe design of Traffic Signs Should be provided to minimise the requirement for Road Restraint Systems.

11.1.16 Distance marker posts shall

- be located at approximate intervals of two hundred (200) metres on the new A303,
- continue the numbering from the distance marker posts as the eastern tie in to the existing A303,
- tie in to the existing marker post numbering at the western tie in to the existing A303,
- be placed in the eastbound and westbound verges and
- provided to HCD drawing number E1[60] except with green backing colour to numerals.

[59] All non-prescribed sign applications seeking authorisation by the department on behalf of the Secretary of State are made via the Safer Roads Design team's DfT appointed Designated Responsible Officer.
[60] Refer to MCHW Volume 3 – Highway Construction Details (HCD) – E Series [99].

## 11.2 Variable Message Signs and Indicators

### General

11.2.1 The *works* shall be future proofed for the provision of variable message signs and indicators in accordance with the requirements in section 22 (Future Proofing Requirements) of this document.

### Variable Message Signs and Indicators Outside Stonehenge Tunnel

11.2.2 Variable message signs (VMS) shall be provided outside Stonehenge Tunnel to

- display strategic and tactical messages,
- display multi-coloured pictograms,
- inform Road Users of incidents ahead, planned works and contraflows,
- display variable mandatory speed limit (VMSL) messages for compliance and enforcement and
- support the operation and control of Stonehenge Tunnel.

11.2.3 VMS shall be positioned outside Stonehenge Tunnel

- in advance of key junctions,
- in advance of network decision points and
- for optimum visibility by the Road User.

11.2.4 Indicators shall be provided on the approaches to Countess and Longbarrow Junctions to display speed and lane information when

- Stonehenge Tunnel is closed,
- there are lane closures,
- a contraflow is ahead or
- other traffic diversions are in place.

11.2.5 Cantilever mounted MS4s shall be provided on the new A303 at the following locations described in the Authorised Development

- on the eastbound approach to Longbarrow Junction and
- on the westbound approach to Countess Junction.

11.2.6 Traffic Signs shall be provided to

- close individual bores of Stonehenge Tunnel to traffic in a controlled manner and
- prevent traffic entering the new A303 slip roads to Stonehenge Tunnel.

11.2.7 Traffic Signs shall be provided to safely close the carriageway in the event of a closure of Stonehenge Tunnel

- at the entrance of each tunnel bore, including for contraflow and reverse operation,
- at the entry slip roads leading towards the tunnel at Countess and Longbarrow Junctions and
- on the new A303 after the exit slip roads and before the crossing points leading towards the tunnel at Countess and Longbarrow Junctions.

11.2.8 The system used to safely close the carriageway in the event of a closure of Stonehenge Tunnel shall be provided as a single unified system.

11.2.9 Wigwags[61] shall not be provided in the system used to safely close the carriageway in the event of a closure of Stonehenge Tunnel.

11.2.10 If drop arm barriers are provided to safely close the carriageway, stop lines at the location of the drop arm barrier shall be provided.

### Variable Message Signs and Indicators Inside Stonehenge Tunnel

11.2.11 Lane control indicators (LCI) within Stonehenge Tunnel shall be mounted back to back.

11.2.12 Stonehenge Tunnel shall be provided with enhanced message sign (EMS) type VMS

- at the entrance and exit of each tunnel portals and
- back-to-back at regular intervals within the tunnel bores.

11.2.13 Speed limit indicator (SLI) repeaters shall be provided within Stonehenge Tunnel to control the speed of Road Users.

## 11.3 Customer Information Signs

11.3.1 While Providing the Works, portable VMSs shall be provided at strategic locations to display the following information to Road Users

- travel time through the *works*,
- key messages,
- work taking place and
- milestones and progress.

11.3.2 The locations and messages to be displayed on the portable VMSs shall be set out in the Traffic Management Plan[62].

11.3.3 Messages to be displayed on the portable VMSs shall be agreed with the *Project Manager*.

[61] Refer to TSRGD diagram 3014 [109].
[62] Refer to action or commitment MW-TRA2 of the OEMP [5].

# 12 Lighting

## 12.1 General

12.1.1 Except where otherwise stated, external lighting of the *works* within the WHS shall not be provided.

12.1.2 Permanent road lighting of the *works* during normal operation shall not be provided except

- under Longbarrow Land Bridge (Green Bridge 4),
- at Countess Roundabout and
- within Stonehenge Tunnel.

12.1.3 Provision for temporary lighting shall be provided where required for safety at the following locations

- at Crossovers and
- at the TSBs.

12.1.4 Lighting solutions shall be provided which

- have low energy usage,
- are energy efficient,
- have high reliability,
- are durable,
- have a long lifespan and
- minimises light spill (including glare and upwards or sideways emission of light).

12.1.5 Traffic Signs shall be illuminated in accordance with the requirements contained in section 11 (Traffic Signs and Signals) of this document.

12.1.6 Lighting solutions shall minimise light spill by selecting luminaires with an optical distribution type based on the area to be illuminated.

12.1.7 Lighting solutions shall be provided to comply with the following environmental zone lighting classes[63]

- zone E0 within the WHS and
- zone E1 elsewhere.

12.1.8 Lighting solutions shall be provided in accordance with the guidance and recommendations contained in

- CIE 126-1997 'Guidelines for minimizing sky glow' [32],
- ILP GN01 'Guidance Notes for the Reduction of Obtrusive Light' [33] and
- CIE 150-2017 'Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations' [34].

12.1.9 Lighting solutions shall be designed for serviceability with luminaires that meet the European Union's recommendations for circular economy luminaires [35].

12.1.10 Lighting solutions shall be provided to comply with the requirements of Photo-Biological Risk group[64] 0 (no risk) or 1 (low risk).

12.1.11 Lighting solutions shall be provided to comply with the requirements contained Table 12-1 (Lighting Performance Requirements).

[63] As defined in ILP GN01 'Guidance Notes for the Reduction of Obtrusive Light' [33].
[64] As defined in BS EN 62471 'Photobiological safety of lamps and lamp systems' [118].

12.1.12 Lighting solutions shall be controlled using a Central Management System (CMS).

12.1.13 The CMS shall permit the *Client* to

- remotely control the road lighting from the *Client's* south west Regional Operations Centre (ROC),
- control individual lighting columns,
- switch and vary light output and
- identify faults, energy consumption, performance and maintenance requirements.

### Table 12-1 Lighting Performance Requirements

| Parameter | Requirement |
|---|---|
| Power Density Indicator (PDI), $D_P$ [1)] | < 27 W/lux/m$^2$ |
| Annual Energy Consumption Indicator (AECI), $D_E$ [1)] | < 2.3 |
| Rated Lifetime and Lumen Maintenance, $L_{70}$ | 50,000 hours |
| CCT and Colour Consistency | 3,000K – 4,000K |

[1] As defined in BS EN 13201-5 'Road lighting. Energy performance indicators' [36]

## 12.2 Longbarrow Land Bridge (Green Bridge 4) Lighting

12.2.1 Lighting solutions for the new A303 at Longbarrow Land Bridge (Green Bridge 4) shall

- provide daytime lighting,
- not provide night-time lighting,
- provide route guidance to Road Users and
- provide clear visibility during the daytime of stationary vehicles and pedestrians in emergency situations.

12.2.2 Longbarrow Land Bridge (Green Bridge 4) shall not be provided with full daytime lighting[65].

## 12.3 Countess Roundabout Lighting

12.3.1 Existing luminaires at Countess Roundabout shall be replaced.

12.3.2 Existing lighting columns at Countess Roundabout shall be replaced when an assessment to ILP GN6 'Retrofitting LED luminaires on existing columns' [37] concludes that it is required.

12.3.3 Road lighting at Countess Roundabout shall

- not illuminate the new A303 and
- provide NMU lighting.

12.3.4 Road lighting at Countess Roundabout shall be fed from an independently metered electrical supply housed in separate cabinets which can be isolated from other electrical supplies to the *works*.

[65] As defined in Clause 5 of BS 5489-2 'Code of practice for the design of road lighting – Part 2: Lighting of tunnels' [96].

## 12.4 Stonehenge Tunnel Lighting

12.4.1 Stonehenge Tunnel lighting shall be provided which includes

- continuous daytime and night-time lighting of the carriageway,
- standby lighting with testing system and
- evacuation lighting.

12.4.2 Stonehenge Tunnel lighting shall be provided as a Tunnel Class 3[66], except as modified as follows

- longitudinal uniformity, $U_1 \geq 0.7$.

12.4.3 Dynamic emergency exit lighting shall be provided to Stonehenge Tunnel.

12.4.4 The Stonehenge Tunnel lighting control system shall include an automatic standby lighting testing system which allows the testing regimes contained in BS EN 50172 'Emergency escape lighting systems' [38] to be undertaken automatically.

[66] As defined in BS 5489-2 'Code of practice for the design of road lighting – Part 2: Lighting of tunnels' [96].

# 13 New Structures

## 13.1 General

13.1.1 The Structures listed in Table 13-1 (List of New Structures) shall be provided within the Limits of Deviation, as shown on the Engineering Section Drawings (Plan and Profiles)[67] and described in the Authorised Development.

13.1.2 The Structures listed in Table 13-1 (List of New Structures) shall comply with the minimum geometric requirements shown on the relevant drawings contained in Part 2 Volume 4 (Contract Drawings) of the contract.

13.1.3 Structures shall be provided which are not listed in Table 13-1 (List of New Structures) but are otherwise required to comply with the requirements of the Scope.

13.1.4 The following Structures shall be provided with Standard Headroom for a high load route

- Parsonage Down Land Bridge (Green Bridge 1) and
- Winterbourne Stoke Land Bridge (Green Bridge 2).

13.1.5 The following Structures shall be provided with environmental bunds in accordance with the requirements in section 9.2 (Environmental Bunds) of this document

- B3083 Shrewton Road Underbridge,
- Parsonage Down Land Bridge (Green Bridge 1),
- Winterbourne Stoke Land Bridge (Green Bridge 2) and
- Longbarrow Junction Overbridge (Green Bridge 3).

13.1.6 Green bridges shall be provided in accordance with the guidance and recommendations contained in Natural England Commissioned Report NECR181, 'Green Bridges: A Literature Review' [39].

13.1.7 Green bridges with an arch profile shall adopt

- an elliptical, parabolic or circular profile between springings and
- a consistent arch curve across the family of green bridges.

13.1.8 The following Structures shall be provided in accordance with the requirements in section 15 (Stonehenge Tunnel and Tunnel Portal Approach Retaining Structures) of this document

- Stonehenge Tunnel,
- Longbarrow Retaining Wall (North and South),
- Western Tunnel Portal Approach Retaining Wall (North and South) and
- Eastern Tunnel Portal Approach Retaining Wall (North and South).

13.1.9 Where a Structure carries a BOAT or PMA, the Structure shall be designed for traffic load models[68] LM1 and LM2 and pedestrian load model LM4.

13.1.10 Parts of Structures not subject to traffic loads shall be designed for

- pedestrian loading and
- service vehicles defined by the load model in clause 5.6.3 of BS EN 1991-2 'Eurocode 1: Actions on structures – Part 2: Traffic loads on bridges' [40].

[67] Refer to DCO documents 2.7 Engineering Section Drawings (Plan and Profiles) [102].
[68] As defined in BS EN 1991-2 'Eurocode 1: Actions on structures – Part 2: Traffic loads on bridges' [40].

## Table 13-1 List of New Structures

| Structure Name | Type and Description of Structure |
|---|---|
| **Bridge Structures** | |
| River Till Viaduct | Five span, twin-deck viaduct carrying the new A303 over the River Till north of Winterbourne Stoke. |
| B3083 Underbridge (Shrewton Road) | Single span integral portal or box structure accommodating the realigned B3083 under the new A303. |
| Countess Roundabout Flyover (East and West) | Grade separated junction comprising 2 No. integral portal underbridges with linked earthworks carrying the new A303 over the existing A345 Countess Roundabout. |
| **Green Bridges** | |
| Parsonage Down Land Bridge (Green Bridge 1) | Single span, fully integral, arch overbridge providing habitat connectivity and carrying a new Restricted Byway and PMA over the new A303. |
| Winterbourne Stoke Land Bridge (Green Bridge 2) | Single span, fully integral, arch overbridge providing habitat connectivity and carrying the existing, realigned WST06B bridleway over the new A303 and providing a new agricultural vehicular access. |
| Longbarrow Junction (Green Bridge 3) | Single span, fully integral, arch overbridge providing habitat connectivity and carrying the A360 over the new A303. |
| Longbarrow Land Bridge (Green Bridge 4). | Single span, fully integral portal overbridge providing habitat connectivity, physical and visual connectivity between scheduled monuments in the WHS and carrying a new Restricted Byway and agricultural vehicular access over the new A303. |
| **Tunnel Structures** | |
| Stonehenge Tunnel | Western cut and cover tunnel, bored tunnel and eastern cut and cover tunnel. |
| **Retaining Structures** | |
| Countess Roundabout Flyover R/W (South West)<br>Countess Roundabout Flyover R/W (North West)<br>Countess Roundabout Flyover R/W (South Central)<br>Countess Roundabout Flyover R/W (North Central)<br>Countess Roundabout Flyover R/W (South East)<br>Countess Roundabout Flyover R/W (North East) | Retaining structures on the approaches and between the Countess Roundabout Flyover underbridges. |
| River Avon R/W (North West)<br>River Avon R/W (South West)<br>River Avon R/W (North East)<br>River Avon R/W (South East) | Retaining structures for widening of the existing A303 approach embankments. |
| Longbarrow R/W (North)<br>Longbarrow R/W (South) | Retaining structures between Longbarrow Junction and Longbarrow Land Bridge on the approach the western tunnel portal. |
| Western Tunnel Portal Approach R/W (North)<br>Western Tunnel Portal Approach R/W (South) | Retaining structures on the approach to the western tunnel portal between Longbarrow Land Bridge and the western tunnel portal. |
| Eastern Tunnel Portal Approach R/W (North)<br>Eastern Tunnel Portal Approach R/W (South) | Retaining structures on the approach the eastern tunnel portal between Countess Roundabout and the eastern tunnel portal. |
| **Other Structures** | |
| Bat Hibernation Structure – River Till | Bat hibernation structure |

13.1.11 Wiltshire Council shall be consulted on the general external appearance and finishes of the following Structures

- River Till Viaduct,
- B3083 Underbridge (Shrewton Road),
- Parsonage Down Land Bridge (Green Bridge 1),
- Winterbourne Stoke Land Bridge (Green Bridge 2) and
- Longbarrow Junction Overbridge (Green Bridge 3).

13.1.12 The SDCG shall be consulted on the external appearance and finishes of the following Structures

- Longbarrow Land Bridge (Green Bridge 4),
- Western Portal Approach Retaining Walls (North & South),
- Eastern Portal Approach Retaining Walls (North & South),
- Countess Roundabout Flyover Retaining Walls (all) and
- Countess Roundabout Flyover (East and West).

13.1.13 Pipes, ducts, cables or other equipment on Structures shall be hidden.

13.1.14 Structural steelwork for bridges shall be weathering steel with supporting elements detailed to prevent staining.

13.1.15 Portal type gantries shall not be used.

13.1.16 The parapet edge detail shall be developed to be consistent across all overbridges, retaining walls and Stonehenge Tunnel cut and cover portals.

13.1.17 The combined height of the parapet edge beam and restraint system shall be minimised.

13.1.18 If provided, weep holes to retaining Structures within the WHS shall not be visible on the external face.

## 13.2 River Till Viaduct

### General

13.2.1 The River Till Viaduct shall be provided as a Structure which is sympathetic to the surrounding landscape.

13.2.2 The River Till Viaduct shall be designed and constructed as a twin-deck, five (5) span viaduct Structure to carry the new A303 over the River Till, its floodplain and the existing Winterbourne Stoke BOAT (WST04).

13.2.3 The River Till Viaduct shall be positioned so that River Till passes beneath the centre span of each bridge deck.

13.2.4 The carriageway level on the River Till Viaduct shall be a minimum ten (10) metres above the River Till where it crosses the river channel.

13.2.5 The WST04 shall be located beneath the westernmost span of each bridge deck of the River Till Viaduct.

13.2.6 The existing alignment of WST04 shall be maintained.

13.2.7 The WST04 BOAT shall remain open.

13.2.8 Standard Headroom shall be provided between the River Till Viaduct bridge soffit and the WST04 BOAT.

13.2.9 The River Till Viaduct shall adopt a deck edge profile, structural form and overall geometry to minimise the shadow of the structure on the river and its banks below.

13.2.10 The decks of River Till Viaduct shall

- be separated by a seven (7) metre clear distance and
- minimise the shadow of the Structure on the river and its banks below.

13.2.11 Each deck of the River Till Viaduct shall be a minimum two hundred and ten (210) metres in length between the centreline of abutment supports.

13.2.12 A 1.5m high visual screen shall be provided on the southern edge of the westbound River Till viaduct to screen Road Users from Winterbourne Stoke.

### Substructure

13.2.13 The River Till Viaduct bridge deck shall be supported

- on bankseats or buried full height walls at the abutments and
- at intermediate supports.

13.2.13a Bankseats or buried full height walls at the abutments of the River Till Viaduct shall

- be positioned to create open end spans to the viaduct and
- have the exposed faces minimised.

13.2.14 Intermediate supports on the River Till Viaduct shall

- be minimised,
- have the visual impact of the intermediate supports minimised,
- be orientated parallel to the River Till,
- have a maximum width of W/4 up to a minimum height of 2H/3[69],
- have any local flaring at the top of the support limited to a maximum width of W/2,
- have a common geometric appearance across all supports,
- be designed to have minimal obstruction to water flows over the floodplain and
- be excluded from a zone within eight (8) metres of the boundary of the River Till section of the River Avon SAC.

13.2.15 Leaf Piers shall not be provided on the River Till Viaduct.

13.2.16 If crossheads are provided to the River Till Viaduct, crossheads, when viewed from the side elevation of the bridge deck, shall not be visible below the soffit of the bridge deck.

13.2.17 Where bearings are provided, bearings shall be provided so that

- they can be replaced without requiring the removal of any structural material or modification of the structure,
- there is provision for jacking from the substructure to facilitate bearing replacement and
- unrestricted traffic flows on the new A303 can be maintained during bearing replacement.

### Foundations

13.2.18 Piling and pile caps, temporary works including excavations and ground disturbance shall not be positioned within 8m of the boundary of the River Till section of the River Avon SAC.

[69] Where W is the overall width of the bridge deck and H is the total height of the pier (measured from deck soffit to ground level).

13.2.19 The River Till Viaduct foundations shall not be installed using impact piling techniques.

### Technical Approval

13.2.20 The River Till Viaduct shall comply with the technical approval procedures and requirements for a category 3 Structure[70].

### Temporary Works

13.2.21 The River Till temporary bridge shall be provided with a minimum one (1) metre clearance between the bridge soffit and the valley floor.

13.2.22 Supports for the temporary River Till temporary bridge, inclusive of foundations, shall be excluded from a zone within eight (8) metres of the boundary of the River Till section of the River Avon SAC.

13.2.23 The River Till temporary bridge shall be restricted to a maximum width of six (6) metres.

13.2.24 The River Till temporary bridge Should not be in the same location for a period greater than two (2) years.

13.2.25 If the River Till temporary bridge is proposed to be in the same location for a period greater than two (2) years, the condition of the vegetation beneath the temporary bridge shall be assessed in consultation with the Environment Agency and Natural England, and subject to the vegetation assessment the temporary bridge is to be either

- retained in place for the minimum additional time necessary or
- re-positioned.

13.2.26 Impact piling techniques shall not be used for the installation of Equipment at the River Till Viaduct location.

## 13.3 B3083 Underbridge (Shrewton Road)

13.3.1 The B3083 Underbridge (Shrewton Road) shall be designed and constructed as an integral single span portal or box Structure to carry the new A303 over the B3083.

13.3.2 The B3083 Underbridge (Shrewton Road) shall be provided with a designated three (3) metre wide (clear width) PMA along the east verge.

13.3.3 The B3083 and the PMA shall be separated with a minimum 1.4m high livestock proof fencing.

## 13.4 Countess Roundabout Flyover (East and West)

13.4.1 2 No. integral portal underbridge Structures and linked earthworks shall be designed and constructed to form the new A303 flyover above the existing Countess Roundabout.

13.4.2 The existing subway at Countess Roundabout shall be made redundant with the Existing Structure retained and infilled, or demolished, in accordance with the requirements in section 14.6 (Subway at Countess Roundabout Flyover) of this document.

13.4.3 The Countess Roundabout underbridges shall be provided with NMU surface routes through the junction.

13.4.4 The surface finish of the retaining walls at Countess Roundabout Flyover (above the earthworks) shall be designed to reduce the reflection of noise.

[70] Category 3 procedures and requirements for technical approval are contained in CG 300 'Technical approval of highway structures' [110].

13.4.5 A minimum 1.8m high noise barrier shall be provided on the northern and southern sides of the underbridges, approach and joining retaining Structures at Countess Roundabout Flyover to at least the extents shown on Figure 9.4 of the Environmental Statement.

13.4.6 If piles are proposed at Countess Roundabout Flyover, piles shall be installed using a non-impact driving technique.

## 13.5 Parsonage Down Land Bridge (Green Bridge 1)

13.5.1 Parsonage Down Land Bridge shall be designed and constructed as a single span, fully integral, arch overbridge Structure carrying a new Restricted Byway and PMA over the new A303.

## 13.6 Winterbourne Stoke Land Bridge (Green Bridge 2)

13.6.1 Winterbourne Stoke Land Bridge shall be designed and constructed as a single span, fully integral, arch overbridge Structure carrying the existing, realigned WST06B BOAT over the new A303.

## 13.7 Longbarrow Junction Overbridge (Green Bridge 3)

13.7.1 The Longbarrow Junction Overbridge shall be designed and constructed as a single span, fully integral, arch overbridge Structure carrying the A360 over the new A303.

## 13.8 Longbarrow Land Bridge (Green Bridge 4)

13.8.1 Longbarrow Land Bridge shall be designed and constructed as a single span, fully integral portal overbridge Structure providing connectivity in the WHS and carrying a new Restricted Byway and PMA over the new A303.

13.8.2 Longbarrow Land Bridge shall be provided

- so as not to constitute a Road Tunnel and
- to not impact the operation of Stonehenge Tunnel.

13.8.3 Longbarrow Land Bridge shall have a minimum width of 148m and a maximum width of 149.9m.

13.8.4 The location of the new Restricted Byway and PMA on Longbarrow Land Bridge shall be assumed to be in any position and orientation within the central one hundred and twenty (120) metre width of the bridge deck.

13.8.5 Fencing shall be located a minimum ten (10) metres from the edges of Longbarrow Land Bridge.

13.8.6 The *works* shall achieve a reduction in the free-field $L_{A10,18h}$ traffic noise level on the approaches to Longbarrow Land Bridge, when comparing the opening year do-minimum and do-something scenarios, which comply with the requirements stated in Table 13-2 (Longbarrow Land Bridge and Stonehenge Tunnel Western Portal Change in Free-Field Traffic Noise Levels).

### Table 13-2 Longbarrow Land Bridge and Stonehenge Tunnel Western Portal Change in Free-Field Traffic Noise Levels

| Location | $L_{A10,18h}$ Traffic Noise Level Change[1] | Distance from linear work centreline[2] |
|---|---|---|
| North of the new A303 | -5dB | 50m |

| | | |
|---|---|---|
| South of the new A303 | -1dB | 75m |

1) At a height of four (4) metres above ground.

2) Measured perpendicular to the linear work centreline 1D [41].

13.8.7 Longbarrow Land Bridge shall be lit in accordance with section 12.2 (Longbarrow Land Bridge (Green Bridge 4) Lighting) of this document.

13.8.8 The finished ground level on top of Longbarrow Land Bridge shall replicate the existing ground levels, subject to the Limits of Deviation.

13.8.9 If piles are proposed at Longbarrow Land Bridge, piles shall be installed using a non-displacement piling method.

## 13.9 Bat Hibernation Structure – River Till

13.9.1 A bat hibernation Structure off-line to the north of the west abutment of the River Till Viaduct shall be provided.

13.9.2 The River Till bat hibernation Structure shall be orientated so that access (including for bats)

- does not face the new A303 and
- is not visible from the Winterbourne Stoke WST04 BOAT and the B3083.

# 14 Existing Structures

## 14.1 General

14.1.1 Existing Structures which shall be modified, demolished or retained as part of the *works* are shown in Table 14-1 (Existing Structures).

14.1.2 Existing Structures listed in Table 14-1 (Existing Structures) which are required to be modified as part of the *works* shall comply with the minimum geometric requirements shown on the relevant drawings contained in Volume 4 (Contract Drawings) of the contract.

## 14.2 Appraisal of Existing Structures

14.2.1 A Structural Review shall be undertaken for all Existing Structures affected by the *works*.

14.2.2 If the Structural Review concludes that an Assessment is required, an Assessment shall be undertaken.

14.2.3 If intrusive or destructive testing is required as part of the Assessment process, a method statement shall be prepared for the proposed *works* for acceptance by

- the *Project Manager* (where the *Client* is the Structure owner) or
- the Structure owner.

14.2.4 If the Assessment concludes that the Existing Structure is a Sub-standard Structure, the following shall be undertaken

- provide any required modification, remediation, strengthening or upgrading *works* to comply with the requirements of the Scope and
- manage the Structure as a Sub-standard Structure.

14.2.5 If Existing Structures prior to the *starting date* are being managed as Sub-standard Structures, the Existing Structures shall continue to be managed as a Sub-standard Structure in accordance with the requirements of the Structure owner[71].

14.2.6 If a Condition Survey is required, the Condition Survey shall

- provide information on the physical condition of all inspectable parts of the Structure,
- comprises a close examination, within touching distance, of all inspectable parts of a Structure,
- review the Structure records,
- assess the present condition of the property, highlighting areas of failure and concern,
- identify the causes of past, or ongoing, deterioration,
- identify issues that need attention to prevent further degradation or failure,
- identify aspects that need further investigation to understand the cause of deterioration and to pre-empt problems in the future,
- present remedial and refurbishment recommendations and
- provide an estimate of the cost of any works that may be required.

[71] Countess (New) Underbridge is currently being managed by Wiltshire Council as a Sub-standard Structure.

14.2.7 The Structure records shall be reviewed as part of the Condition Survey to identify the following

- the characteristics of the structure,
- any hazards,
- the condition at the time of the last inspection,
- any worsening of defects over time and
- any significant maintenance / modifications since the last inspection.

### Table 14-1 Existing Structures[72]

| Existing Structure | Structure Owner | Structure Number | Structure ID | Classification of Works |
|---|---|---|---|---|
| River Avon Bridge | *Client* | A303/109.30 | STR_6202 | Modified |
| Cattle Underpass at north west corner of Vespasian's Camp | *Client* | A303/107.90 | STR_6205 | Converted to bat hibernation structure. Existing structure partially retained and demolished. |
| Subway (Pedestrian Underpass) at Countess Roundabout | *Client* | A303/108.90 | STR_6203 | Subway made redundant. Existing structure backfilled and demolished. |
| Winterbourne Stoke Underbridge | *Client* | A303/101.00 | STR_6206 | Retained and de-trunked. |
| Ratfyn Bridle Bridge | *Client* | A303/109.50 | STR_6200 | Retained. |
| CCTV Mast at Solstice Park | *Client* | A303/110.30 | STR_27830 | Retained. |
| Solstice Park Bridge | *Client* | A303/110.30 | STR_24064 | Retained. |
| Countess RBT CCTV Mast | *Client* | A303/109.00 | STR_39062 | Retained. |
| East of Countess Roundabout Culvert | *Client* | - | - | Retained. |
| East of River Avon Bridge Culvert | *Client* | - | - | Retained. |
| Pumping Station at Countess Roundabout | *Client* | - | - | Retained. |
| Minor Culvert (with headwalls) west of Countess Roundabout | *Client* | - | - | Retained. |
| Minor Culvert (with headwalls) east of Countess Roundabout | *Client* | - | - | Retained. |
| Various Minor Structures - masts, columns and posts | *Client* | - | - | Demolished, retained or modified as required. |
| Various minor drainage Structures | *Client* | - | - | Demolished, retained or modified as required. |
| Countess (New) Underbridge | Wiltshire Council | N/A | 1022 | Retained. |
| Grey (New) Underbridge | Wiltshire Council | N/A | 1070 | Retained. |

## 14.3 Design Requirements for Existing Structures

14.3.1 Materials for new sections of Existing Structures shall be used which are consistent with the materials and finishes of the Existing Structure.

[72] Existing Structure record information can be found within the Data Room [17].

## 14.4 Demolition of Existing Structures

14.4.1 Demolition of Existing Structures shall comply with the guidance and recommendations contained in BS 6187 'Code of Practice for Full and Partial Demolition' [42].

14.4.2 Underground parts of Existing Structures not directly affected by the *works* but rendered redundant shall be

- removed to a level of one (1) metre below finished ground level and
- backfilled and made safe.

## 14.5 River Avon Bridge

14.5.1 The following remedial works shall be undertaken to the River Avon Bridge

- removal of the existing surfacing and waterproofing,
- localised repairs to the bridge deck,
- replacement of the bridge deck waterproofing,
- replacement of the bridge expansion joints,
- re-surfacing of the bridge deck and
- replacement of the bridge parapets, including any localised strengthening required to the stringcourses to accommodate the bridge parapets.

14.5.2 In undertaking the remedial works, the River Avon Bridge shall be modified to accommodate the new highway realignment.

14.5.3 The highway realignment to the River Avon Bridge shall be undertaken so that there is no change to the structural envelope, articulation or overall geometry of the Structure.

14.5.4 Modification of the River Avon Bridge shall not have any adverse impacts to the River Avon SSSI and SAC.

14.5.5 The requirement for, extent and nature of any strengthening of the River Avon Bridge to accommodate the new highway realignment shall be determined.

## 14.6 Subway at Countess Roundabout Flyover

14.6.1 At the subway at Countess Roundabout Flyover, the following shall be undertaken

- retain and fill the sections of the subway which supports the existing slip roads and
- demolish the remainder of the subway.

## 14.7 Bat Hibernation Structure – Vespasian's Camp

14.7.1 The existing cattle underpass at the north-west corner of Vespasian's Camp shall

- be partially demolished along with the redundant section of the existing A303 to accommodate the *works* and
- have the remainder of the Existing Structure converted to a bat hibernation structure.

14.7.2 Vespasian's Camp bat hibernation structure shall have the access (including for bats) provided on the southern elevation of the structure.

## 14.8 Winterbourne Stoke Underbridge

14.8.1 The *works* to Winterbourne Stoke Underbridge required as part of the de-trunking and handover to Wiltshire Council shall be determined.

14.8.2 A Condition Survey of the Winterbourne Stoke Underbridge shall be undertaken[73].

14.8.3 The *works* to Winterbourne Stoke Underbridge shall be provided so that intervention to the Structure is not required for a minimum five (5) years from Completion of *section* 3A to undertake remedial or refurbishment works due to

- defects identified in the Condition Survey and
- deficiencies highlighted in the Assessment (if undertaken).

14.8.4 Works to the Winterbourne Stoke Underbridge shall not have any adverse impacts to the River Till SSSI and River Avon SAC.

14.8.5 Proposals to the Winterbourne Stoke Underbridge shall be prepared defining the remedial and refurbishment *works*, with justification, which are deemed required to comply with the requirements of the Scope.

[73] The Principal Inspection undertaken in February 2019 rated the bridge as in 'generally poor condition' with previously identified defects exhibiting significant deterioration since the last inspection and previous repairs having failed with corroded reinforcement now exposed. Refer to the Principal Inspection report contained in the Data Room [17].

# 15 Stonehenge Tunnel and Tunnel Portal Approach Retaining Structures

## 15.1 General

15.1.1 Stonehenge Tunnel and the tunnel portal approach retaining structures shall be developed within the Limits of Deviation based on the linear work Nos. 1D-1H, as shown in the Engineering Section Drawings (Plan and Profiles)[74] and described in the Authorised Development.

15.1.2 Stonehenge Tunnel shall be provided between at least chainage Ch. 7+200m and Ch. 10+485m.

15.1.3 The bored section of Stonehenge Tunnel shall be

- a minimum length of three (3) kilometres and
- provided between chainage Ch. 7+400 and Ch. 10+400.

15.1.4 Stonehenge Tunnel shall be provided as

- a category A Road Tunnel in accordance with the Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 [43] and
- a category AA Road Tunnel in accordance with CD 352 'Design of Road Tunnels' [44].

15.1.5 Stonehenge Tunnel shall be provided to comply with the requirements for a transport route on the comprehensive trans-European road network.

15.1.6 The *works* shall be provided so that each bore of Stonehenge Tunnel can operate in

- contraflow and
- reverse direction.

15.1.7 Stonehenge Tunnel shall be provided with an over height vehicle detection and warning system.

15.1.8 Surface works within the WHS to provide the bored section of Stonehenge Tunnel (including cross passages and mid tunnel Plant rooms, if provided) shall not be permitted.

15.1.9 A full threat and vulnerability risk assessment of Stonehenge Tunnel shall be undertaken[75] which

- assesses the vulnerability of the tunnel to terrorism and other threats,
- identifies all foreseeable natural, accidental, criminal and terrorist threats and
- defines the requirements to be provided in the *works* to achieve the required level of robustness and reliability to the identified threats.

15.1.10 The Tunnel Design Authority (TDA) report[76] shall be updated to reflect the *works*.

[74] Refer to DCO documents 2.7 Engineering Section Drawings (Plan and Profiles) [102].
[75] Refer to the Centre for the Protection of National Infrastructure (CPNI) [101] – the government authority for protective security advice to the UK national infrastructure.
[76] The PCF Stage 4 TDA report can be found in the Data Room [17].

15.1.11 Stonehenge Tunnel shall be provided in accordance with the guidance and recommendations contained in

- the 'Joint Code of Practice for Risk Management of Tunnel Works in the UK' [45] and
- BS 6164 'Code of Practice for Health and Safety in Tunnelling in the Construction Industry' [46].

15.1.12 A Tunnelling Risk Management Plan shall be prepared which

- complies with the approach to managing risks in the 'Joint Code of Practice for Risk Management of Tunnel Works in the UK' [45] and
- demonstrates how key residual risks of Stonehenge Tunnel construction is to be managed and mitigated.

15.1.13 A Tunnel Materials and Workmanship Specification for Stonehenge Tunnel shall be prepared which

- extends the Manual of Contract Documents for Highway Works (MCHW) [2] to include the tunnel materials and workmanship requirements,
- is based on the project specific Particular Specification as defined in the British Tunnelling Society (BTS) and the Institution of Civil Engineers (ICE) 'Specification for Tunnelling' [47] and
- is extended to include the cut and cover section of the tunnel using the Specification component of the ICE 'Specification for Piling and Embedded Retaining Walls (SPERWall)' [48].

15.1.14 Justification shall be provided where less onerous requirements are proposed in the Tunnel Materials and Workmanship Specification from those contained in

- the BTS-ICE 'Specification for Tunnelling' [47] and
- the ICE 'Specification for Piling and Embedded Retaining Walls (SPERWall)' [48].

## 15.2 Tunnel Structure

15.2.1 The Stonehenge Tunnel cross section shall be determined.

15.2.2 A minimum 1.2m unobstructed width of verge to both sides of the carriageway in the Stonehenge Tunnel shall be provided and designated as an escape route.

15.2.3 A 0.20m wide hard strip edge line provision to both sides of the carriageway in the Stonehenge Tunnel shall be provided.

15.2.4 Except at the locations of cross passages, the hardstrip and verge in Stonehenge Tunnel shall be separated by kerbs which

- are seventy-five (75) millimetres high,
- facilitate the opening of car doors on the nearside,
- are easier to mount for those who are disabled or injured and by vehicles attempting to stop out of the traffic stream and
- guide vehicles away from areas of low headroom.

15.2.5 Dropped kerbs shall be provided between the hardstrip and verge at the locations of cross passages in Stonehenge Tunnel.

15.2.6 The height of the Stonehenge Tunnel portal entrances shall be

- minimised and
- no greater than that required to comply with the headroom requirements of CD 127 [25] and CD 352 [44].

15.2.7 The central wall of the cut and cover section of Stonehenge Tunnel shall be set back from the edge of the tunnel portal by a minimum of five (5) metres.

15.2.8 The Design Situations for Stonehenge Tunnel shall be determined and recorded in the AIP.

15.2.9 A sensitivity analysis shall be undertaken to demonstrate that the design of Stonehenge Tunnel is robust, including justifying assumptions relating to

- the adopted calculation model and method of analysis,
- variations in the assumed geotechnical parameters and ground water levels,
- variations in the assumed structural material parameters and
- the assumed construction sequence and tolerances.

15.2.10 The Stonehenge Tunnel, cross-passages and mid tunnel Plant rooms (if provided), shall be provided to achieve the water resistance and leakage criteria contained in Table 15-1 (Tunnel Water Resistance and Leakage Criteria) at the internal surface of the structural Lining.

15.2.10a The Stonehenge Tunnel, cross-passages and mid tunnel Plant rooms (if provided), shall be provided to achieve the water resistance and leakage criteria contained in Table 15-1 (Tunnel Water Resistance and Leakage Criteria) at the internal surface of the structural Lining or cladding (if provided).

15.2.11 Waterproofing of junctions between segmental tunnel linings and in-situ concrete construction shall be provided with

- hydrophilic strips and
- re-injectable grout systems.

### Table 15-1 Tunnel Water Resistance and Leakage Criteria

| Element | Water Resistance / Leakage Criteria[1)] |
|---|---|
| Tunnel (bored and cut and cover). | Tunnel Class 1 (Absolutely dry), above carriageway level.<br>Tunnel Class 3 (Capillary dampness), below carriageway level. |
| Cross-passages (containing Plant requiring controlled environmental conditions).<br>Mid tunnel Plant rooms (if provided). | Tunnel Class 1 (Absolutely dry). |
| Cross-passages (all other cross-passages). | Tunnel Class 3 (Capillary dampness). |

1 As defined in Clause 508.2 (Leakage criteria and classes of tunnel) of the BTS-ICE 'Specification for Tunnelling' [47].

15.2.12 The leakage criteria for water resistance of Stonehenge Tunnel shall be achieved on average over any one hundred (100) metre length of tunnel.

15.2.13 For any ten (10) metre length of Stonehenge Tunnel the localised leakage rates for water resistance of the tunnel shall not exceed twice (x2) the average leakage rates.

15.2.14 Post-install drip trays shall not be installed in the crown or roof of Stonehenge Tunnel to control water seepage.

15.2.15 Stonehenge Tunnel shall be provided to

- minimise the ingress and drawdown of groundwater,
- minimise the entry of water into the tunnel,
- minimise the impedance of groundwater flow around, above or below the tunnel,
- minimise adverse effects on the groundwater regime,
- not be detrimental to adjacent infrastructure,
- control the volume loss during excavation and
- minimise surface settlement.

15.2.16 The *works* Should be provided to avoid the requirement for dewatering and groundwater abstraction.

15.2.17 If dewatering and groundwater abstraction is determined as required, the extent and duration which dewatering and groundwater abstraction is undertaken shall be minimised.

15.2.18 Dewatering or groundwater abstraction shall not

- be undertaken from existing ground level within the WHS and
- discharge groundwater onto the ground surface of the WHS.

15.2.19 The *works* shall be provided in accordance with the protection measures required by the Groundwater Management Plan[77].

15.2.20 Stonehenge Tunnel shall be provided for

- a minimum uniform twenty (20) kN/m$^2$ characteristic permanent surcharge action applied at ground level and
- traffic load models[78] LM1 and LM2 and the vehicle defined in Figure NA.6 of NA to BS EN 1991-2[79].

15.2.20a Stonehenge Tunnel structural elements shall be designed for accidental actions from vehicular impact for the equivalent static nominal collision forces

- defined in NA to BS EN 1991-1-7 [49] Table NA.1, together with their direction and height of application and
- multiplied by an adjustment factor $F_a$ equal to one (1).

15.2.21 Stonehenge Tunnel shall be provided to allow for a variation in the finished ground level above the tunnel as follows[80]

- restricted zone 1 (full restriction): 0.6m less depth of cover and
- restricted zone 2 (reduced restriction): 1.2m less depth of cover.

15.2.22 The *works* shall achieve a reduction in the free-field $L_{A10,18h}$ traffic noise level on the approaches to Stonehenge Tunnel, when comparing the opening year do-minimum and do-something scenarios, which comply with the requirements stated in Table 13-2 (Longbarrow Land Bridge and Stonehenge Tunnel Western Portal Change in Free-Field Traffic Noise Levels) and Table 15-2 (Stonehenge Tunnel Eastern Portal Change in Free-Field Traffic Noise Levels) for the western and eastern tunnel portal approaches respectively.

15.2.23 Within Stonehenge Tunnel, manhole and inspection chamber covers shall not be located within the carriageway.

[77] Refer action or commitment MW-WAT10 of the OEMP [5].
[78] As defined in BS EN 1991-2 'Eurocode 1: Actions on structures – Part 2: Traffic loads on bridges' [40].
[79] NA to BS EN 1991-2 'UK National Annex to Eurocode 1: Actions on structures - Part 2: Traffic loads on bridges' [95].
[80] Refer to the relevant drawings contained in Volume 4 (Contract Drawings) of the contract.

15.2.24 The unobstructed width of cross passages used for emergency evacuation shall be determined[81].

15.2.25 The unobstructed width and height of cross passages used for emergency evacuation Should be

- at least 2.0 metres wide and
- at least 2.3 metres high.

### Table 15-2 Stonehenge Tunnel Eastern Portal Change in Free-Field Traffic Noise Levels

| Location | $L_{A10,18h}$ Traffic Noise Level Change[1] | Distance from linear work centreline[2] |
|---|---|---|
| North of the new A303 | -1dB | 100m |
| South of the new A303 | -5dB | 50m |

1) At a height of four (4) metres above ground.

2) Measured perpendicular to the linear work centreline 1H [41].

15.2.26 If Stonehenge Tunnel is provided with a suspended road deck structure, all accessible areas within the structure shall

- be classified as a Confined Space and
- have a confined space operational risk classification not exceeding a low-medium risk[82].

15.2.27 Where a suspended road deck structure is provided, the structure shall be provided with

- a dedicated walkway with minimum unobstructed 2.3m headroom and 2.3m width,
- access for maintenance and inspection,
- safe secondary means of escape,
- separate fire compartmentation from the traffic space above,
- a permanent forced ventilation system and
- a dedicated vehicle for maintenance, inspection, and evacuation purposes.

## 15.3 Tunnel Fire Protection

15.3.1 Stonehenge Tunnel shall be provided so that when subject to the Design Fire

- Road Users can safely self-evacuate the tunnel,
- a tenable environment is provided to support the response of the Emergency Services to incidents and emergencies in the tunnel and
- structural damage to the tunnel is limited.

15.3.2 The Design Fire to be used for passive structural fire protection shall be represented by

- the Rijkswaterstaat (RWS) time-temperature fire curve (described by Table 15-3 (RijksWaterStaat (RWS) Fire Curve)),
- a peak temperature of one thousand three hundred and fifty (1350°C) degrees centigrade and
- a fire duration of one hundred and twenty (120) minutes.

[81] The unobstructed width of cross passages used for emergency evacuation is dependent on the assumed evacuation strategy, the available safe egress time (ASET) and required safe egress time (RSET).
[82] As defined in the National Occupational Standards (EUSCS01 and EUSCS02).

15.3.3 The resistance of Stonehenge Tunnel to the Design Fire shall be demonstrated by undertaking fire tests in accordance with Efectis Nederland Report Efectis-R0695:2020 'Fire testing procedure for concrete tunnel linings and other tunnel components' [50].

15.3.4 The Design Fire for fire life safety systems shall be determined by a tunnel fire incident risk assessment[83].

15.3.5 If the effectiveness of the fixed firefighting system is not included in the determination of the Design Fire for the fire life safety systems, the Design Fire for the fire life safety systems shall not be less than a minimum peak heat release rate (HRR) one hundred (100) MW with a fast growth characteristic.

15.3.6 Where the effectiveness of the fixed firefighting system is included in the determination of the Design Fire for the fire life safety systems

- the Design Fire for the ventilation system shall not be less than a peak HRR of thirty (30) MW with a fast growth characteristic,
- the Design Fire for the fixed firefighting system shall not be less than a peak HRR of one hundred (100) MW with a fast growth characteristic and
- the effectiveness of the FFFS in suppressing the peak HRR to the proposed value shall be demonstrated[83].

15.3.7 **[Not used]**.

15.3.8 If underground Plant rooms are provided, underground Plant rooms shall be provided with fire protection for a minimum of one hundred and twenty (120) minutes.

15.3.9 The guidance and recommendations contained in PD 7974-6 'Application of fire safety engineering principles to the design of buildings Part 6: Human factors: Life safety strategies - Occupant evacuation, behaviour and condition (Sub-system 6)' [51] shall be used in the determination of the tenability limits for Stonehenge Tunnel.

### Table 15-3 RijksWaterStaat (RWS) Fire Curve

| Time (minutes) | Temperature (°C) |
|---|---|
| 0 | 20 |
| 3 | 890 |
| 5 | 1140 |
| 10 | 1200 |
| 30 | 1300 |
| 60 | 1350 |
| 90 | 1300 |
| 120 | 1200 |
| >120 | 1200 |

## 15.4 Bored Tunnel

15.4.1 Construction of the bored section of Stonehenge Tunnel shall be undertaken using closed face tunnelling techniques.

[83] Refer to Section 8 of CD 352 'Design of Road Tunnels' [44].

15.4.2 The bored section of Stonehenge Tunnel shall be provided in accordance with the guidance and recommendations contained in

- 'Tunnel Lining Design Guide', the British Tunnelling Society and the Institution of Civil Engineers [52] and
- PAS 8810 'Design of Concrete Segmental Tunnel Linings – Code of Practice' [53].

15.4.3 Stonehenge Tunnel shall be provided with a secondary lining to the bored section where it is required for any of the following

- for the management of water ingress,
- to provide the durability over the Design Working Life,
- for fire resistance,
- for structural integrity of the primary lining or
- aesthetics.

15.4.4 No part of the bored tunnel Structure, inclusive of ovalisation and construction tolerances, shall encroach within the Tunnel Profile.

15.4.5 The maximum diametric deformation under any load combination of the bored tunnel Structure, including the additional deformation, shall not exceed one (1%) percent on the outside tunnel diameter.

15.4.6 Tolerances due to the design and construction of the tunnel shall be such that no part of the completed bored tunnel Structure encroaches within the Tunnel Profile due to the deviation of

- any point on the internal profile of the tunnel from its established centre line and
- the tunnel lining (primary and secondary, if provided), including grouting and all building errors.

15.4.7 If fibre reinforced concrete (FRC) is proposed in the *works*, a Departure shall be obtained[84,85].

15.4.8 FRC incorporating structural macro-synthetic (polymer) fibres[86] shall not be used in the *works*.

15.4.9 Micro-synthetic (polymer) fibres may be incorporated into concrete mix designs in the *works* for non-structural requirements.

15.4.10 Longitudinal joints between tunnel lining segments shall be staggered.

15.4.11 Tunnel lining segments shall be provided with caulking grooves on the intrados edges along the circumferential and longitudinal joints.

15.4.12 Precast concrete tunnel lining segments shall be provided so that they remain un-cracked during demoulding, storage, handling and erection.

15.4.13 A tunnel lining segment marking system shall be adopted which

- permits the identification of the individual segment and position in the ring and
- allows for the traceability and quality control of the segment to be established.

[84] The design of FRC is an aspect not covered by Eurocodes (BS EN and the respective UK NA) and a Departure is required in accordance with the requirements of CD 350 [113]. The use of fibres for structural concrete is not covered by MCHW Series 1700 [114] and their use is subject to a Departure.
[85] An outline Departure record has been created within DAS 3.0 for the use of steel fibre reinforced concrete (SFRC). Refer to section 24 (Departures) of this document.
[86] As defined in BS EN 14889-2 'Fibres for concrete - Part 2: Polymer fibres - Definitions, specifications and conformity' [115].

15.4.14 Each tunnel lining segment shall be provided with a barcoding or radio frequency identification (RFID) segment marking system.

15.4.15 Grout holes shall be provided in each tunnel lining segment excluding the key.

15.4.16 Sealing gaskets shall be selected which minimises the potential for damage during ring erection.

15.4.17 The connections between segments shall be selected based on the following

- ease of construction,
- installation time,
- structural performance,
- minimising the quantity required and
- eliminating or reducing health and safety risks.

15.4.18 The requirements for bolted connections between segments shall be minimised.

15.4.19 Bolts above axis level shall be removed where all the following apply

- bolts are no longer required to provide a connection between segments,
- a secondary lining is not provided and
- bolts pose a long-term safety hazard.

15.4.20 Cross-passage openings within the bored section of Stonehenge Tunnel shall use an opening set with provision for the safe removal of temporary infill panels.

## 15.5 Cut and Cover Tunnel and Tunnel Portal Approach Retaining Structures

15.5.1 The alignment of the cut and cover section of Stonehenge Tunnel and the tunnel portal approach retaining structures shall be determined to accommodate the

- highway alignment,
- space for the tunnel services buildings (TSBs) and
- clearances and space for Equipment.

15.5.2 The TSBs shall be provided in accordance with the requirements contain in section 16 (Tunnel Service Buildings) of this document.

15.5.3 Where embedded retaining walls are provided, the *works* shall be provided in accordance with the guidance and recommendations contained in

- BS 8002 'Code of Practice for Earth Retaining Structures' [54] and
- CIRIA publication C760 'Guidance on Embedded Retaining Wall Design' [55].

15.5.4 Spaces and voids within the cut and cover section of Stonehenge Tunnel and the TSB section of the tunnel portal approach retaining structures shall

- be accessible for inspection and maintenance,
- be secured with lockable doors and
- not be a Confined Space.

15.5.5 Except for the TSBs, if embedded retaining walls are required to retain water, embedded retaining walls shall be provided with Grade 1 waterproofing protection[87].

[87] As defined in BS 8102 'Code of practice for protection of below ground structures against water from the ground' [97].

15.5.6 The water resistance acceptance criterion for Grade 1 waterproofing protection to embedded retaining walls shall be in accordance with the ICE 'Specification for Piling and Embedded Retaining Walls (SPERWall)' [48].

15.5.7 The cut and cover section of Stonehenge Tunnel and the tunnel portal approach retaining structures shall be provided to

- mitigate any potential adverse effects of subsurface ground flows and
- prevent uncontrolled groundwater entering the highway drainage system.

15.5.8 The finished ground level on top of the cut and cover section of Stonehenge Tunnel shall replicate the existing ground levels, subject to the Limits of Deviation.

15.5.9 The design and construction of below ground Structures shall mitigate adverse effects on the existing ground water regime to ALARP.

15.5.10 Equipment used for the construction of below ground Structures Should be removed.

15.5.11 Positive drainage measures shall be provided for the interception, collection and discharge of seepage water through the tunnel portal approach retaining structures.

15.5.12 The new A303 within the western WHS shall be in cutting with retaining structures to a minimum cutting depth of seven (7) metres.

15.5.13 The front face of the tunnel portal approach retaining structures shall have a backwards incline from vertical away from the road of no shallower than one (1) horizontal unit to every ten (10) vertical units.

15.5.14 The top approximately 2.5m by depth of each side of the cuttings in the approaches to Stonehenge Tunnel shall be formed of grassed slopes at approximately one (1) in two (2).

15.5.15 Wherever the topography requires a variation in the tunnel portal approach retaining structure height, the vertical profile of the top of wall shall

- not have any steps in the height and
- follow a smooth alignment.

15.5.16 Looking from above, the tops of the tunnel portal approach retaining structures shall be set parallel to the adjacent carriageway alignment of the new A303.

15.5.17 The surface finish of the tunnel portal approach retaining structures shall reduce the reflection of noise.

15.5.18 If a cantilever is provided on the tunnel portal approach retaining structures, the cantilever shall extend no further than the back of the carriageway hardstrip.

## 15.6 Damage Assessment, Instrumentation and Monitoring

### Damage Assessment

15.6.1 Ground movements and vibration, and the risk of damage due to ground movements and vibration shall be minimised.

15.6.2 In addition to the requirements of the OEMP [5], the Ground Movement Monitoring Strategy (GMMS)[88] shall assess the potential ground movement and the risk of damage due to ground movements arising from Providing the Works.

[88] Refer to action or commitment MW-CH8 of the OEMP [5].

15.6.3 The GMMS shall

- describe the methodology and approach to assessing damage,
- propose and justify the volume loss coefficients and trough width parameters used,
- predict the potential ground movement,
- show the predicted ground movement on settlement contour plans,
- establish the extent of the Zone of Influence,
- assess the risk of damage to existing infrastructure, Structures and buildings,
- assess the risk of damage to archaeology and cultural heritage,
- assess the risk of damage to Utilities,
- classify damage using an objective system,
- identify where ground movement predictions result in an unacceptable level of damage (including cosmetic) occurring,
- describe the mitigation and protective measures to be implemented and
- describe the remedial actions to be undertaken where an unacceptable level of damage (including cosmetic) has occurred.

15.6.4 The Zone of Influence shall not extend outside the Site.

15.6.5 The GMMS shall include a sensitivity analysis to

- assess the impact of variations in the assumed volume loss coefficients and trough width parameters,
- assess the impact of variations in the assumed stiffness of the ground parameters and structural materials and
- inform the horizontal extent of the instrumentation and monitoring.

15.6.6 The effects of vibration arising from Providing the Works shall be assessed[89].

15.6.7 Vibration arising from Providing the Works Should not

- affect heritage assets,
- disturb building occupants and
- damage buildings.

15.6.8 For the assessment of damage to Utilities, the affected Statutory Undertaker shall be consulted to determine the

- methodology and approach,
- damage acceptance criteria and
- mitigation and protective measures required when an unacceptable level of damage is predicted.

15.6.9 For the assessment of damage to heritage assets, HMAG shall be consulted to determine the

- methodology and approach,
- damage acceptance criteria and
- mitigation and protective measures required when an unacceptable level of damage is predicted.

[89] Refer to action or commitment MW-NOI5 of the OEMP [5].

## Instrumentation and Monitoring (I&M)

15.6.10 Buildings, Structures, infrastructure, heritage assets and Utilities within the Zone of Influence identified in the GMMS as being affected shall

- have their existing condition surveyed and recorded in a pre-condition survey and
- be instrumented and monitored.

15.6.11 Instrumentation and monitoring shall demonstrate that there are

- no adverse effects on the *works*
- no adverse effects resulting from the *works* and
- no adverse effects resulting from Providing the Works.

15.6.12 Instrumentation and monitoring shall be in accordance with the guidance and recommendations contained in

- BTS Publication 'Monitoring Underground Construction – A Best Practice Guide' [56] and
- ITAtech Activity Group Monitoring report 'ITAtech Guidelines on Monitoring Frequencies in Urban Tunnelling' [57].

15.6.13 I&M plans shall be developed for

- underground Geotechnical Activities and
- assets within the Zone of Influence identified in the GMMS as being affected.

15.6.14 I&M plans shall be developed in accordance with the

- Ground Movement Monitoring Strategy[90],
- Noise and Vibration Management Plan[91] and
- Groundwater Management Plan[92].

15.6.15 Vibration arising from Providing the Works shall be instrumented, monitored and controlled in accordance with Best Practicable Means including the guidance and recommendations contained in

- BS 5228 (all parts) 'Code of practice for noise and vibration control on construction and open sites' [58] [59],
- BS ISO 4866 'Mechanical vibration and shock. Vibration of fixed structures. Guidelines for the measurement of vibrations and evaluation of their effects on structures' [60] and
- BS 7385-2 'Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration' [61].

15.6.16 Vibration monitoring shall be undertaken at the following locations as follows

- at Stonehenge Monument when tunnelling is within two hundred and fifty (250) metres,
- at Stonehenge Cottages when tunnelling is within two hundred and fifty (250) metres and
- at Stonehenge Visitor Centre until the Completion of *section* 3A.

[90] Refer to action or commitment MW-CH8 of the OEMP [5].
[91] Refer to action or commitment MW-NOI3 of the OEMP [5].
[92] Refer to action or commitment MW-WAT10 of the OEMP [5].

15.6.17 I&M plans shall be developed which includes proposals for the

- instrument types,
- instrument locations,
- acceptable limits (trigger levels) of instrument readings,
- frequency of monitoring and
- contingency measures and actions.

15.6.18 Where ground treatment is to be used, the Environment Agency and relevant Others shall be consulted to determine their requirements for monitoring.

15.6.19 Instrumentation and monitoring shall be undertaken until

- the movement rate anywhere within the Zone of Influence is reported as two (2) millimetres per annum or less over a minimum of six (6) months,
- the ground movements anywhere within the Zone of Influence are reported as stable for three (3) months post-construction or
- the *Project Manager* agrees otherwise.

15.6.20 A secure web based I&M system shall be provided for sharing all instrumentation and monitoring data which permits

- trends in behaviour to be monitored,
- results to be compared with defined trigger points,
- the time history to be presented graphically and
- the effectiveness of contingency measures and actions to be assessed.

15.6.21 Instrumentation and monitoring data shall be collected, processed and made available on the web based I&M system in real-time.

15.6.22 All instrumentation and monitoring data transferred or issued shall be in AGS format.

15.6.23 Access to the web based I&M system shall be provided to the *Project Manager* and *Supervisor* to permit the verification of compliance of the requirements of the Scope.

15.6.24 Throughout tunnelling and excavation activities / works, I&M review meetings shall be held in accordance with the Tunnelling Risk Management Plan.

15.6.25 The *Project Manager* and *Supervisor* shall be invited to attend the I&M review meetings.

15.6.26 I&M reports shall be prepared which address the progress of, and issues relating to the tunnelling and excavation activities / *works*, including

- activities carried out since the last report,
- review of surface instrumentation,
- review of sub-surface instrumentation,
- verification of the design assumptions and predicted behaviour,
- compliance with review levels and requirements of the Scope,
- the potential for review levels to be exceeded,
- exceedance of review levels,
- the comparison of actual and predicted ground movements and ground surface settlements,
- the need for corrective actions,
- changes to the design,
- changes to the method or sequence of construction,
- abnormal / unfavourable readings and trends and
- review of materials and workmanship.

15.6.27 The I&M review meetings shall discuss the progress of, and issues relating to the tunnelling and excavation activities / *works* contained in the relevant I&M report.

# 16 Tunnel Service Buildings

## 16.1 General

16.1.1 The tunnel service buildings (TSBs) shall be provided at both the approaches to the western and eastern portals within the Limits of Deviation based on the linear work Nos. 1D-1H, as shown in the Engineering Section Drawings (Plan and Profiles)[93] and described in the Authorised Development.

16.1.2 The TSBs shall be provided to house

- incoming electricity supplies and substations,
- Plant required by the Utility suppliers,
- Plant rooms,
- facilities for locally controlling the tunnel control and management system (TCMS),
- Plant monitoring and control systems,
- tunnel technology systems (traffic control, communications and information systems),
- communications systems,
- control systems,
- uninterruptible power supplies (UPS),
- generator Plant and associated services (if required),
- a Silver Command control room,
- fire systems,
- welfare facilities and
- any other rooms required to comply with the requirements of the Scope.

16.1.3 The TSBs shall be underground with only the front façades visible.

16.1.4 The TSB shall be provided with Grade 3 waterproofing protection[94].

16.1.5 Rooms shall be provided to accommodate the required M&E Systems and Technology Equipment.

16.1.6 Noise emitted from operational fixed Plant located at the TSBs shall not exceed the existing background level by more than zero (0) dB(A) at the nearest residential receptors when assessed in accordance with BS 4142 'Methods for rating and assessing industrial and commercial sound' [62].

16.1.7 The TSB shall be provided to house the Plant and facilities required to enable the inter-connecting of the systems required in

- section 17 (Stonehenge Tunnel Mechanical and Electrical Systems) of this document and
- section 18 (Technology) of this document.

16.1.8 Provision for local control and operations of the TCMS at both TSBs shall be provided.

16.1.9 The TSB fire strategy shall be developed in accordance with the guidance and recommendations contained in BS 9999 'Fire safety in the design, management and use of buildings – Code of practice' [63].

[93] Refer to DCO documents 2.7 Engineering Section Drawings (Plan and Profiles) [102].
[94] As defined in BS 8102 'Code of practice for protection of below ground structures against water from the ground' [97].

16.1.10 In developing the fire strategy, individual rooms shall be treated as individual fire compartments and provided with

- a minimum level of structural fire resistance according to the determined risk profile,
- automatic fire detection and
- automatic fire protection / suppression (where required).

16.1.11 Silver Command control rooms shall be provided in both TSB for use by the Emergency Services to

- support the management of incidents and emergencies,
- view the operational status and condition of Stonehenge Tunnel and the tunnel systems and
- establish contact with the *Client's* south west ROC.

16.1.12 Both TSBs shall be provided with welfare facilities, including a mess room, potable water supply and toilet facilities.

16.1.12a Water supplies for firefighting systems and welfare facilities shall be provided to both TSBs.

16.1.13 Room data sheets shall be prepared which provide a detailed description of the requirements for each room in the TSB, including

- room type and dimensions,
- structural loadings,
- fire resistance and protection measures,
- security provisions,
- finishes,
- mechanical services,
- electrical services,
- fixtures and fittings and
- expected or maximum occupancy.

16.1.14 The design of the TSB shall be developed to

- comply with the Police 'Secured by Design' [64] high level security standards, including the design guide 'Resilient Design Tool for Counter Terrorism' [65] and
- be protected from hostile vehicles.

16.1.15 The TSBs shall be provided such that all routine maintenance of the buildings can be undertaken

- from the new A303 carriageway level and
- without the need to close the new A303.

16.1.16 Each TSB shall be provided with two (2) ultra-fast (≥150kW) electric vehicle (EV) charging points located at the MHS

- for use by the *Client* and
- which are secured to prevent unauthorised use by Others.

16.1.17 Measures shall be implemented so that Plant and Utilities within and around the TSBs can be maintained, removed and replaced with minimal operational impact.

16.1.18 The TSBs shall be provided with clear and safe access to Plant and Utilities installed within and around the curtilage of the TSB.

16.1.19 The environmental conditions within the TSBs shall be controlled to provide for

- the correct functioning of the equipment located within the building in accordance with the manufacturer's guidance and recommendations and
- the comfort of individuals required to operate and maintain the TSBs.

16.1.20 In each TSB, separate dedicated ventilation and air-conditioning systems shall be provided as follows

- fresh air supply and extraction system to all Plant rooms, welfare facilities, and Silver Command control room,
- toilet extraction system,
- battery room extraction system,
- hydrant and deluge pump (FFFS) room ventilation systems and
- dedicated split air-conditioning systems (if required) for each Plant room.

16.1.21 Each TSB shall

- have fire protection for a minimum of one hundred and twenty (120) minutes,
- be separated from Stonehenge Tunnel by construction of the same structural fire resistance standard and
- have individual rooms provided with a means of escape to a Place of Ultimate Safety.

16.1.22 Throughout the TSBs, the following safety and security measures shall be provided

- fire safety systems,
- intruder alarm systems,
- public-address voice alarm systems and
- CCTV surveillance.

16.1.23 CCTV surveillance area coverage of the TSB shall include

- entrance and egress points,
- storage areas,
- parking areas and
- sump and fuel tank areas.

16.1.24 Rooms within the TSBs shall be provided with

- addressable smoke detectors,
- manual call points,
- audible / visual fire and security alarms and
- IP telephones (excluding toilet).

16.1.25 Mobile phone coverage shall be provided throughout the TSBs.

16.1.26 The TSB lighting shall be provided so that it

- uses low energy and efficient lighting solutions,
- can have the internal and external lighting remotely operated,
- does not create a distraction or pose a risk to Road Users on the new A303 and
- does not illuminate the external façade during normal operation.

16.1.27 Normal lighting for the TSBs shall be maintained in the event of a failure of the power supply.

16.1.28 The internal and external TSB finishes shall be provided so that they

- minimise the requirement for cleaning and maintenance,
- are durable under normal use, normal wear and tear, and in all weather conditions,
- can be easily maintained and
- minimise the attenuation of mobile phone signals.

# 17 Stonehenge Tunnel Mechanical and Electrical Systems

## 17.1 General

17.1.1 The M&E Systems shall be provided so that they

- function together as an integrated mechanical and electrical Service,
- can be remotely and locally monitored and controlled,
- normally operate in automatic control mode,
- have a manual override capability,
- integrate with the other M&E Systems and Technology Equipment and
- reduce safety risk to as low as reasonably practicable (ALARP).

17.1.2 Except where required for functional reasons, the M&E Systems shall

- be located at the TSBs and
- not be located within the Stonehenge Tunnel bores.

17.1.3 If the M&E Systems are proposed to be located other than in the TSB, justification shall be provided for not locating the M&E Systems in the TSB.

17.1.4 TSBs to contain the Plant and control systems shall be provided in accordance with the requirements in section 16 (Tunnel Service Buildings) of this document.

17.1.5 The requirement for M&E Systems spares shall be determined.

17.1.6 Spares for M&E Systems shall be determined to achieve the

- Availability requirements and
- Minimum Operating Requirements.

17.1.7 Spares for M&E Systems shall be available so that faults which arise during testing and commissioning can be effectively and quickly rectified.

17.1.8 Technology Equipment shall be in accordance with the requirements in section 18 (Technology) of this document.

## 17.2 Tunnel Ventilation System

17.2.1 The Stonehenge Tunnel ventilation system shall be provided to maintain a safe atmosphere within the tunnel by controlling

- pollutant and particulate (visibility) concentrations to limiting values and
- smoke from the Design Fire.

17.2.2 Allowable pollutant and particulate (visibility) concentration limits shall be determined.

17.2.3 The Stonehenge Tunnel ventilation system shall not use ventilation shafts or louvres.

17.2.4 The Stonehenge Tunnel ventilation system shall be provided against the 95$^{th}$ percentile of wind impinging on the tunnel portal determined from the wind rose data for the preceding ten (10) years prior to the 6th April 2020 measured at Boscombe Down airfield.

17.2.5 The Stonehenge Tunnel ventilation system shall

- demonstrate how the ventilation system achieves pollution control to the required limits at all positions within the tunnel and under all predicted traffic scenarios,
- demonstrate for all locations within the tunnel the required ventilation system response to control smoke both during and following the evacuation phase,
- define the ventilating operating modes for all required tunnel operational scenarios[95] and testing regimes,
- describe the levels of redundancy provided and provide justification for the chosen solution,
- describe the pollution monitoring measures proposed and the switching limits to be adopted,
- demonstrate how the ventilation system operates in conjunction with the FFFS and
- define the ventilation system operational modes.

## 17.3 Tunnel Lighting

17.3.1 Stonehenge Tunnel lighting (carriageway) shall be in accordance with the requirements in section 12.4 (Stonehenge Tunnel Lighting) of this document.

## 17.4 Tunnel Drainage System

17.4.1 The Stonehenge Tunnel drainage system shall be in accordance with the requirements in section 6.6 (Stonehenge Tunnel Drainage System) of this document.

## 17.5 Tunnel Fire Engineering

17.5.1 A suite of active and passive fire protection measures shall be provided to Stonehenge Tunnel, including

- structural fire protection,
- fire detection system,
- emergency doors and cross-passages,
- fire mains and hydrants,
- emergency panels,
- ventilation system and
- fixed firefighting system.

17.5.2 Structural fire protection to Stonehenge Tunnel shall be provided in accordance with the requirements in section 15.3 (Tunnel Fire Protection) of this document.

17.5.3 An automatic fire detection system within Stonehenge Tunnel, cross passages, Plant rooms and TSBs shall be provided.

17.5.4 A fixed firefighting system (FFFS) shall be provided in each Stonehenge Tunnel bore which

- activates, following manual confirmation, upon detection of a fire,
- limits the peak HRR to the Design Fire,
- is divided into nominal twenty-five (25) metre length independently operable zones and
- has the sectional and control valves located outside of the main tunnel bores.

[95] Refer to section 19 (Minimum Operating Requirements) for the Stonehenge Tunnel operating scenarios.

17.5.5 Emergency panels (EP) shall be provided at

- intervals up to fifty (50) metres along the nearside carriageway,
- intervals up to seventy-five (75) metres along the offside carriageway,
- the locations of cross-passages and
- the Places of Relative Safety at each of Stonehenge Tunnel portal entrances.

17.5.5a Fire hydrants shall be provided at all EPs along the offside carriageway.

17.5.6 The Stonehenge Tunnel fire main[96] shall be provided

- as a wet main,
- as a ring main with multiple cross-connections located at cross-passages,
- to be supplied from independent water sources at each end of the tunnel,
- with section isolating valves at each cross-connection,
- with pumps where the water pressure could drop below the minimum operating pressure requirements,
- with fire hydrants in the central reserve within ten (10) metres of each tunnel portal and
- with water consumption meters, including remote pressure and flow monitoring of each the supply main.

17.5.7 Dry cross connections shall be provided

- at the location of all cross-passages and
- with double connectors on the inlets and outlets.

17.5.8 The requirement for the provision of break tanks shall be determined.

17.5.9 If break tanks are required, break tanks shall be provided

- with pipework and valves to allow the circulation of water in the break tanks and for the testing of the fire pumps,
- which are located within the TSB,
- with individual isolating valves,
- with redundancy so that any individual tank can be taken out of use and
- which are protected from freezing.

## 17.6 Tunnel Electrical Power Supply and Distribution

17.6.1 The Stonehenge Tunnel electrical distribution system shall be connected to two independent incoming high voltage (HV) electrical power supplies.

17.6.1a The two independent incoming high voltage (HV) electrical power supplies shall be procured from the Distribution Network Operator (DNO)[97,98].

17.6.1b The route of the incoming HV electrical power supplies from the DNO's network to the metering points shall be determined.

17.6.1c The incoming HV electrical power supplies shall be provided to comply with the DNO's requirements[99] for connections to the DNO's network.

[96] The flow rates of the incoming water supply to the western and eastern portal are 7.0l/s and 5.5l/s respectively.
[97] The *Client* has secured a ten (10) MVA reservation only HV supply for the western permanent connection from Salisbury Bulk Supply Point utilising one of the thirty-three (33) kV cables installed for the temporary connection to the Longbarrow construction compound. Refer to quotation EMT853 contained in the data room [17].
[98] The *Client* has secured a ten (10) MVA reservation only HV supply for the eastern permanent connection at eleven (11) kV from Ratfyn Primary Substation. Refer to quotation EMG341 contained in the data room [17].
[99] Requirements for SSEN requirements for connections to their network can be found here https://www.ssen.co.uk/Forms/SignIn/?ReturnUrl=CompetitionInConnectionsSecureDocuments

17.6.2 The Stonehenge Tunnel electrical distribution system shall be provided so that all tunnel systems can remain fully operational with a failure of either incoming HV electrical power supply.

17.6.3 The Stonehenge Tunnel electrical distribution system shall be provided so that any individual incoming main or interconnecting circuit breaker can be isolated without affecting the safe operation of the tunnel.

17.6.4 Each high voltage system within Stonehenge Tunnel shall

- be an independent ring circuit, with segregated sections,
- be routed through separate tunnel bores,
- allow an individual bore to be isolated and
- be available at the TSBs and mid tunnel Plant rooms (if provided).

17.6.4a The incoming HV electrical supplies to Stonehenge Tunnel shall be metered at eleven (11) kV.

17.6.4b The Stonehenge Tunnel electrical distribution system shall be provided with an interlocking scheme to prevent a network parallel occurring within the tunnel[100].

17.6.4c The TSBs shall be provided with individual rooms for the following electrical power supply and distribution Plant

- 11kV switch gear and communications for the DNO and metering circuit breakers (1 No. room)
- metering cabinets containing the metering equipment (1 No. room) and
- 33kV to 11kV 10MVA transformer[101] (1 No. room) (west TSB only).

17.6.4d The DNO shall be provided with exclusive access to the following rooms in the TSB

- 33kV to 11kV 10MVA transformer room (west TSB) and
- 11kV switch gear and communications room (east and west TSB)

17.6.4e The *Client* shall be provided with exclusive access to the room and metering cabinets containing the metering equipment.

17.6.5 Stand by power shall be provided so that Stonehenge Tunnel can operate in the event of a simultaneous failure of both incoming HV electrical power supplies until one of the following apply

- the tunnel and approaches to the tunnel can be safely closed,
- the failed incoming HV electrical power supplies can be restored or
- additional transportable generating Equipment can be connected to the tunnel electrical distribution system.

[100] An Interlocking scheme is required as the east and west HV electrical supplies are being provided from separate National Grid substations.
[101] For typical transformer details refer to drawing TX/A1/430.8361 '*General Arrangement 7.5/15MVA 33/11.5kV 3PH 50Hz ONAN/ONAF Transformer*' contained in the Data Room [17].

17.6.6 UPS shall be provided to maintain the electrical power supplies to the following essential Stonehenge Tunnel systems for a minimum two (2) hour duration

- tunnel closure system,
- tunnel control and management system,
- CCTV surveillance systems,
- emergency lighting of the tunnel, cross passage and TSB,
- Traffic Signs,
- normal TSB lighting,
- fire detection and alarm systems,
- public address and voice alarm systems,
- radio rebroadcast systems,
- emergency telephone system and
- communications system.

17.6.7 **[Not Used]**.

17.6.8 The Stonehenge Tunnel UPS for emergency lighting shall be separate from all other UPS.

17.6.9 Connections for transportable power generating Equipment shall be provided at each TSB.

17.6.10 If provided, standby power generating Plant shall be located outside of the Stonehenge Tunnel.

## 17.7 Inspection, Testing and Commissioning

17.7.1 Inspection, testing and commissioning of the M&E Systems shall be undertaken in accordance with the requirements in section 21 (Inspection, Testing and Commissioning) of this document.

# 18 Technology

## 18.1 General

18.1.1 Technology Equipment shall be provided so that the *Client* can

- manage the *works* as part of the Strategic Road Network (SRN),
- remotely monitor, control and operate Stonehenge Tunnel,
- close Stonehenge Tunnel in the event of an emergency,
- permit local control and operations of Stonehenge Tunnel,
- permit the Emergency Services to manage incidents and emergencies and
- implement future improvements of the new A303 in accordance with the requirements contained in section 22 (Future Proofing Requirements) of this document.

18.1.2 Technology Equipment shall be provided to deliver the Availability requirements on the new A303.

18.1.3 Technology Equipment shall comply with the *Client's* Architecture Services Principles [66].

18.1.4 Technology Equipment shall be provided so that

- there is resilience,
- the systems can self-recover,
- Software (including firmware) can be upgraded remotely,
- faults can be diagnosed remotely,
- it can be reset remotely,
- Services for essential systems have physical segregation and
- the systems are protected from cyber-attack.

18.1.5 Technology Equipment shall be provided based on the conceptual model shown in Figure 18-1 (Technology Equipment Conceptual Model).

18.1.6 Technology Equipment shall

- have an open architecture,
- have unused configuration and management functions removed or disabled,
- use open standards,
- use secure protocols and
- not use legacy protocols.

18.1.7 The Services defined in Table 18-1 (*Services*) shall be provided.

18.1.8 Modules and Devices shall be provided to deliver the Services.

18.1.9 Technology Equipment shall be provided so that it functions as a fully integrated system, including with the *Client's* Technology Equipment.

18.1.10 A fully integrated Tunnel Control and Management System (TCMS) shall be provided to deliver the Services in accordance with the requirement of section 20 (Tunnel Control and Management System) of this document.

18.1.11 The UK Government Technology Code of Practice [67] shall be complied with.

## Table 18-1 Services

| Service | Scope of Service / Definition | Typical Devices |
|---|---|---|
| Integrated M&E | Remote and local monitoring and control of the M&E Systems. | Plant including fans, lights, pumps, electrical distribution (HV and LV), fire fighting infrastructure. |
| Incident Detection (Inc. Stopped Vehicle Detection (SVD)) | Alerting operators of any incident that could impact upon the network. | ERT, detectors, CCTV, M&E Systems, SVD. |
| Queue Detection | Queue detection Service across all running lanes. | Detectors, CCTV. |
| Speed Control (Inc. Speed Compliance) | Speed control and enforcement including the implementation of variable mandatory speed limits (VMSL). | Traffic Signs (Inc. signals and indicators), detectors, CCTV. |
| Lane Control | Lane control across all running lanes within Stonehenge Tunnel and its approaches. | Traffic Signs (Inc. signals and indicators), detectors, CCTV |
| Diversionary Routing | Diversionary routing between the *boundaries of the site*. | Traffic Signs (Inc. signals and indicators), detectors, CCTV. |
| Weather Monitoring | Weather monitoring between the *boundaries of the site*. | Devices that can measure fog, visibility, air temperature, road surface temperature, precipitation, relative humidity, air quality, daylight and wind speed. |
| Smoke and Fire Detection | Alerting operators of smoke or fire detection | Heat and smoke detection Devices. |
| Traffic Monitoring & Management | Ability to monitor traffic conditions and behaviours in and around Stonehenge Tunnel (this shall include count, speed, headway, and over height vehicles). | Detectors, CCTV. |
| Incident Management | Ability to identify, respond, advise and take the actions required to deliver the core operating functions. | ERT, CCTV, Traffic Signs (Inc. signals and indicators), wayfinding signage, public address voice alarm system, door, barriers, detectors. |
| In-Tunnel Communications | Service to provide the means of communicating with Emergency Services, maintainers and Road Users to deliver the core operating functions. | ERT, public address voice alarm system, Emergency Service communications, leaky feed and NRTS. |
| Asset Performance Monitoring and Fault Management | Monitor and report on the status of all Services, Modules and Devices, allowing any faults or alarms against pre-determined thresholds to be triggered and alerted to users.<br>Monitor the Minimum Operating Requirements and alert the user when the Services, Modules and Devices are at risk of falling below or have fallen below this value.<br>Provide a fault management tool for tracking and resolution of any faults. | Devices. |
| Configuration Management | Recording, maintain all configuration items (TCMS, Modules and Devices) their attributes and relationship. | TCMS, Modules and Devices. |

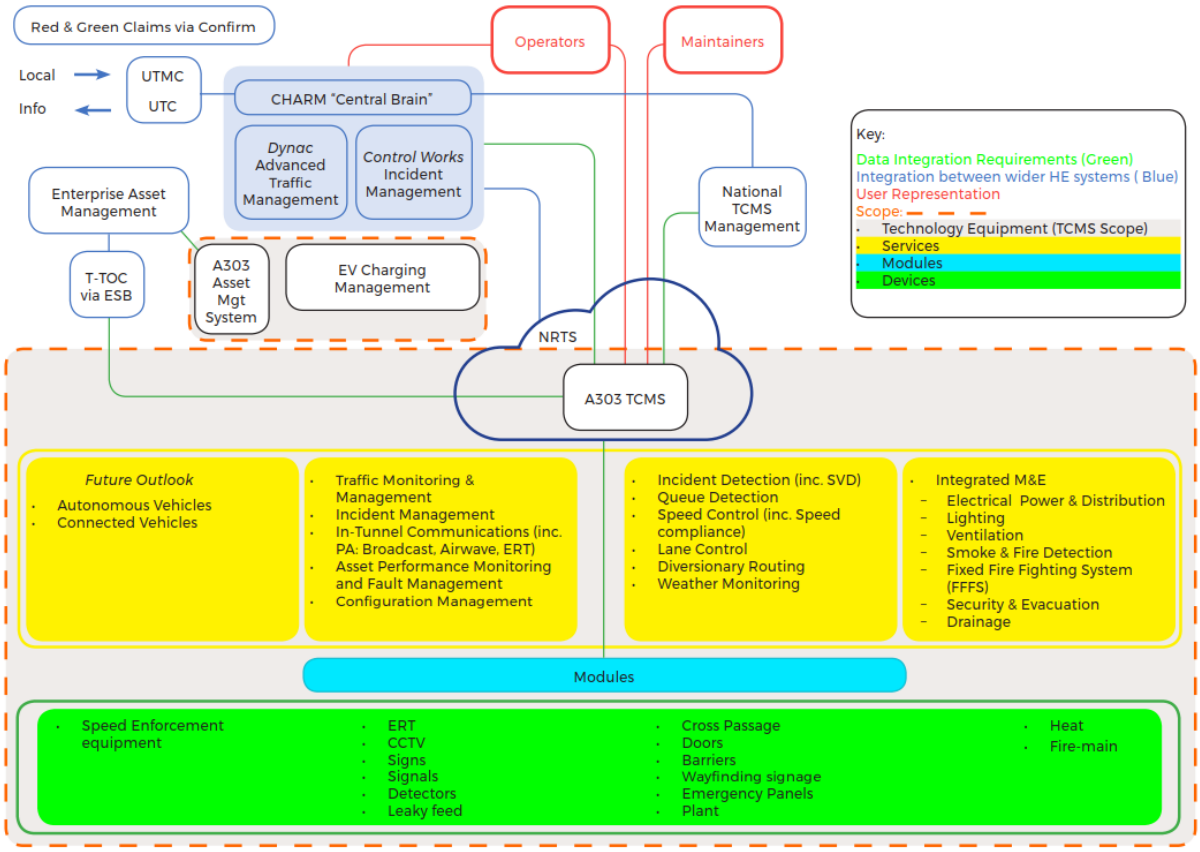



**Figure 18-1 Technology Equipment Conceptual Model**

18.1.12 Unless required for operation or maintenance, Technology Equipment (including the TCMS, Services, Modules and Devices) shall have all of the following disabled[102]

- Software components, ports and protocols,
- USB ports, CD / DVD drives and other removable media devices and
- IPv6.

18.1.13 Where removable media devices, including portable computers, are temporarily connected, it shall be demonstrated how security is to be managed to comply with the security requirements.

18.1.14 Virtual private networks (VPNs) shall be

- used to protect communication of untrusted networks and
- configured in line with National Cyber Security Centre guidance [68].

18.1.15 Where cloud-based technologies are used, cloud-based technologies shall be provided in accordance with the NCSC guidance 'Cloud Security Guidance' [69] and 'Implementing the Cloud Security Principles' [70].

18.1.16 Where wireless technologies are used, wireless technologies shall

- be provided with security controls according to its application and type of wireless capability and
- not introduce adverse availability or resilience.

[102] Refer to Center for Internet Security (CIS) benchmarks [108] and the National Cyber Security Centre (NCSC) guidelines [68] for system hardening.

18.1.17 Structures to support Technology Equipment shall be provided in accordance with the requirements of section 13 (New Structures) of this document.

18.1.18 Cabling infrastructure to Technology Equipment shall be provided

- as a fully ducted network between chainages Ch. 0+800 and Ch. 14+200 to both carriageways of the new A303 outside of Stonehenge Tunnel,
- as a network comprising ducting and cable trays within Stonehenge Tunnel,
- with cross carriageway ducts as dictated by the *works* but not exceeding five hundred (500) metres spacing and
- with the internal diameter of the longitudinal and cross carriageway ducts not smaller than one hundred (100) millimetres.

18.1.19 Technology Equipment Should be located to

- minimise the number of required MHS,
- be grouped together,
- facilitate maintenance access,
- eliminate the need for traffic management during inspection, maintenance and operation activities and
- minimise the requirement for stepped access and retaining structures.

18.1.20 Remote fault diagnostics of Technology Equipment shall allow diagnostics down to an individual Device and sub-Device level.

18.1.21 The *Client's* developments in Technology Equipment Should be incorporated into the *works*.

18.1.22 Where there is a requirement to incorporate the *Client's* developments in Technology Equipment into the *works*, the following shall occur

- the Client's Information Technology (IT) and Safety, Engineering and Standards (SES) groups shall be consulted to determine the Technology Equipment development to be incorporated into the *works* and
- agree the proposed Technology Equipment development to be incorporated into the *works* with the *Project Manager*.

18.1.23 The *Client's* agreement process for Technology Equipment shall be complied with[103].

## 18.2 National Roads Telecommunications Service (NRTS)

18.2.1 Connectivity between individual Modules and between Modules and the TCMS shall use the National Roads Transmission Service (NRTS) transmission infrastructure.

18.2.2 All connections to the NRTS transmission infrastructure shall comply with the *Client's* Code of Connection (CoCo) contained in MCH 1514 'Code of Connection - Application process for Agency Project Sponsors, Suppliers and Maintainers' [71].

18.2.3 The *Client's* Telecommunications Service Provider (TSP) shall be permitted to provide the telecommunications services (physical and logical services) to the *works* using the NRTS transmission infrastructure.

18.2.4 The interface with the *Client's* TSP's network and the *works* at the Service Delivery Point (SDP) shall be coordinated.

18.2.5 The *Client's* TSP shall be permitted to provide, install, terminate and test the NRTS transmission infrastructure up to the SDP.

[103] Refer to Traffic Systems and Signing (TSS) Plans Registry [94].

18.2.6 The *Client's* TSP shall be permitted to provide connections between the *works* and the existing NRTS transmission infrastructure using independent transmission stations located at the eastern and western *boundaries of the site*.

18.2.7 Cables beyond the SDP that connect to the *works*, including any cables that interconnect these systems that are beyond the SDP and are within cabinets, shall be deemed to be part of the *works*.

18.2.8 The *Client's* TSP shall be liaised with so that the *Client's* TSP's requirements are included in the *works*.

18.2.9 All requests for access to the Site and *works* by the *Client's* TSP for providing, testing and commissioning of the NRTS transmission infrastructure shall be permitted.

18.2.10 The type and location for all Devices and Modules shall be determined so that the *Client's* TSP can

- identify the Service Delivery Points,
- determine the bandwidth requirements and
- confirm the NRTS service categories.

18.2.11 The location of SDPs shall be coordinated to minimise the distance between

- SDPs and Devices and
- SDPs and Modules.

18.2.12 Technology Devices and Modules connecting to SDPs shall be configured to the IP addresses provided by the *Client's* TSP.

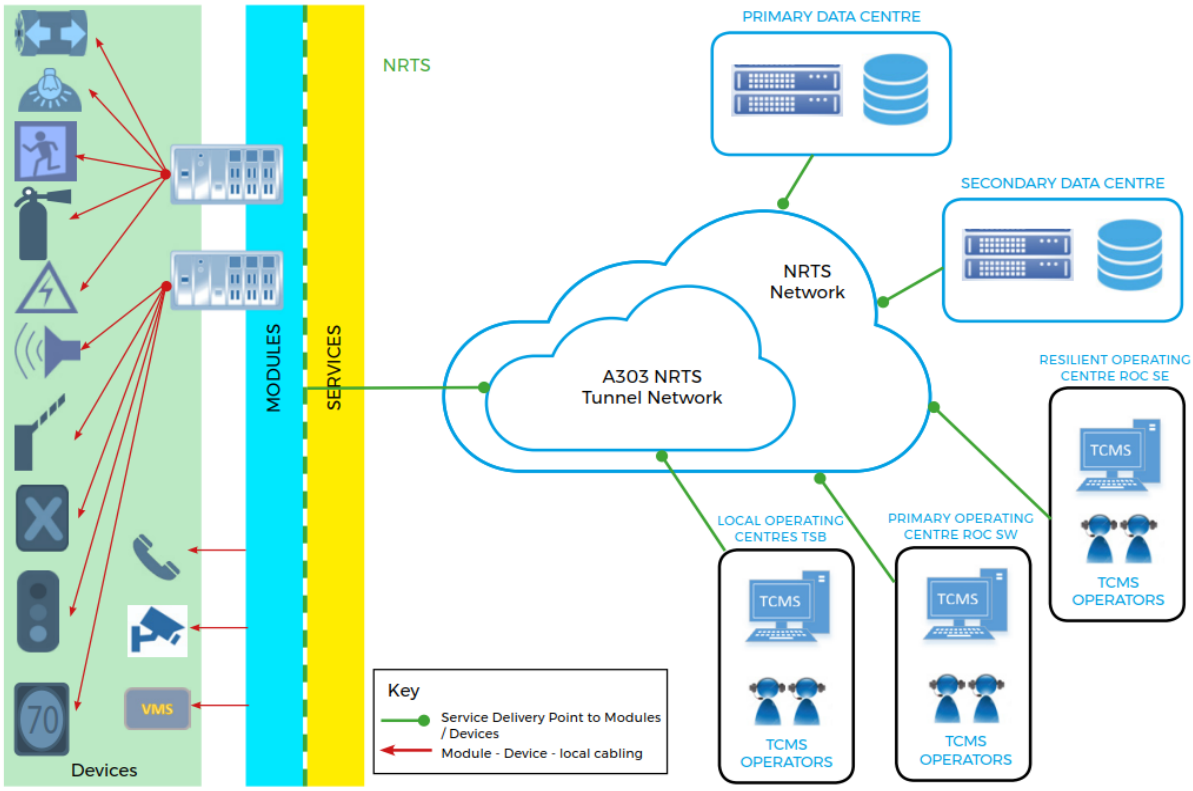



**Figure 18-2 Service Delivery Point Interface Principles**

## 18.3 Technology Equipment Procurement

18.3.1 All Technology Equipment shall be provided.

18.3.2 Technology Equipment shall be provided to function in all reasonably foreseeable environmental and operating conditions.

18.3.3 A Technology Equipment procurement strategy shall be prepared detailing

- the proposed approach for the procurement of Technology Equipment,
- whether the Technology Equipment is sourced directly or through the *Client*,
- the lead-in times for procurement of the Technology Equipment,
- Technology Equipment with long lead-in times,
- a delivery programme, in compliance with the identified lead-in times, of the Technology Equipment requirements and proposed date for uplift and
- the location and description of the Technology Equipment store.

18.3.4 Technology Equipment Should be procured which

- have low whole life costs,
- have low energy usage,
- are energy efficient,
- use commercial off-the-shelf (COTS) solutions and
- have high mean time between failures (MTBF).

18.3.5 Technology Equipment Should be procured through the *Client's* existing bulk purchase agreements as *Client* Issued Equipment (CIE).

18.3.6 Technology Equipment shall be procured

- as CIE from the *Client's* national distribution centre (NDC) via the *Client's* stock management system (SMS),
- as CIE directly through the *Client's* IT Commercial Framework[104] and
- from other sources if the NDC or IT Commercial Framework does not stock the required Technology Equipment.

18.3.7 If stock at the NDC is depleted, CIE shall be procured directly through the IT Commercial Framework.

18.3.8 Technology Equipment shall be procured so that it

- is fully interoperable with CIE and
- complies with the Client's product acceptance process contained in TR 1100 'Product Acceptance Process and General Requirements for Motorway Products, Materials, Equipment and Systems' [72].

18.3.9 Specifications for all Technology Equipment not procured as CIE shall be provided.

18.3.10 If Technology Equipment available through the IT Commercial Framework does not permit compliance with the requirements of the Scope, Technology Equipment may be directly procured.

18.3.11 Technology Equipment not procured through the IT Commercial Framework shall be subject to the acceptance of the *Project Manager*.

18.3.12 Technology Equipment not procured through the IT Commercial Framework shall have a minimum seven (7) year supplier warranty (back-to-base, parts and labour).

[104] The *Client's* current IT Commercial Framework is the Traffic Management Technology Framework (TMTF) which is due to be replaced late 2020 by the Software Package and Information Systems Framework.

18.3.13 Technology Equipment Should be procured in accordance with Table 18-2 (Client Technology Equipment Bulk Purchase Arrangements).

### Table 18-2 Client Technology Equipment Bulk Purchase Arrangements

| Item | Procurement Route |
|---|---|
| VMS and indicators (including RSC, ALM, leads and spares) | IT Commercial Framework |
| Emergency roadside telephones | National distribution centre |
| MIDAS IP outstation | National distribution centre |
| Power cables (excluding specialist tunnel cables) | National distribution centre |
| Communications cables | National distribution centre |
| 600 cabinets, 609 cabinets, post 75s and plinths | National distribution centre |
| CCTV (PTZ and fixed) | IT Commercial Framework |
| Secure speed enforcement feeder pillar cabinets | IT Commercial Framework |

## 18.4 *Client* Issued Equipment (CIE)

18.4.1 CIE shall be procured through the *Client's* technology purchasing and logistics (TPL) team.

18.4.2 A schedule (delivery programme) of CIE shall be populated and maintained to

- manage the planning, ordering, dispatch and installation of CIE,
- readily determine the status of each item of CIE (including by the *Client*) and
- be updated monthly while CIE procurement is taking place.

18.4.3 Procurement of CIE shall use the demand forecasting and inventory system of the *Client's* people, finance and procurement system for the order and control process and to store associated records.

18.4.4 For all CIE, the following shall be provided

- a schedule of all Technology Equipment with chainage and equipment reference names,
- Ordnance Survey ten (10) figure grid reference coordinates, details and dimensions of all Technology Equipment and its cross-sectional position,
- dimensions of maintenance hard standings and
- details to allow the *works* to be overlaid on the *Client's* operational installation geographical mapping.

18.4.5 Cabinets supplied by the *Client* as part of CIE shall be provided with the following

- internal fittings (including the heaters),
- switchgear (Technology Equipment cabinets only) and
- plinths and skirts.

18.4.6 CIE shall be procured using the current version of MPI-76-082019 'Procurement of Roadside Technology' [73] unless otherwise notified by the *Project Manager*.

18.4.7 The TPL team shall be liaised with to confirm the availability and allocation of CIE.

18.4.8 CIE shall be received in accordance with the accepted delivery programme contained in the Technology Equipment procurement strategy.

18.4.9 CIE shall be

- delivered direct for large items or
- uplifted and transported from the *Client's* CIE store.

18.4.10 The supply of CIE shall be subject to the *Client's* minimum delivery order requirements.

18.4.11 If CIE is required to be disassembled for transportation, the *Client* shall not be responsible for

- reassembly,
- protection from damage during disassembly, transportation and reassembly,
- operational testing of the reassembled equipment and
- rectification of any damage incurred during disassembly, transportation and reassembly.

18.4.12 Equipment and Staff shall be provided to unload, and if required to load, CIE from the delivery / collection vehicles.

18.4.13 CIE shall be unloaded and stored in a safe, secure and heated environment to avoid potential damage prior to installation.

18.4.14 CIE waiting to be installed shall be stored within a cabinet in an environment that is equivalent to that of its final location.

18.4.15 Damaged, faulty or non-operational CIE shall be notified to the *Project Manager*.

18.4.16 Damaged, faulty or non-operational CIE which cannot be repaired to comply with the requirements of the Scope shall be replaced.

18.4.17 Damaged, faulty or non-operational CIE which is not attributable to the *Client* shall be repaired.

18.4.18 Within twenty (20) Working Days of the *Project Manager* being notified of damaged, faulty or non-operational CIE attributable to the *Client*, the CIE shall be

- repaired by the *Client* at the Technology Equipment store or
- collected and replaced by the *Client*.

18.4.19 Access to the Technology Equipment store shall be granted so that the *Client* can undertake repairs to CIE.

18.4.20 On completion of Technology Equipment commissioning, faulty CIE shall be returned to the *Client*.

18.4.21 Serviceable CIE which has not been incorporated into the *works* shall either be

- returned to the *Client* prior to Completion of *section* 3 or
- retained for spares.

## 18.5 Technology Equipment – General

18.5.1 The requirement for Technology Equipment spares shall be determined.

18.5.2 Spares for Technology Equipment shall be determined to achieve the

- Availability requirements and
- Minimum Operating Requirements.

18.5.3 Spares for Technology Equipment shall be available so that faults which arise during testing and commissioning can be effectively and quickly rectified.

18.5.4 Replacement parts for faulty Technology Equipment not procured as CIE shall be determined and provided.

18.5.5 Configuration settings for Technology Equipment shall be held in non-volatile memory.

18.5.6 Devices that require continuous power Should not be left unpowered.

18.5.7 Devices that require continuous power shall be provided with a temporary power supply which remains in place until the Device is installed.

18.5.8 Devices that require continuous power shall be connected to a power supply within four (4) hours of delivery.

18.5.9 Devices that require continuous power shall not be installed unless there is a permanent power supply which they can be connected to.

18.5.10 Prior to the delivery of VMS and indicators provided as CIE, confirmation shall be obtained from the *Project Manager* that the *Client* has

- undertaken a one hundred (100) hour soak test using a predefined test script and
- provided the evidence to demonstrate that the test has been completed successfully.

18.5.11 For VMS and indicators which are to be installed within Stonehenge Tunnel, including associated cabling and roadside controllers, a further one hundred (100) hour soak test shall be undertaken prior to installation.

18.5.12 For VMS and indicators provided as CIE, the following shall be undertaken

- supply to the *Client* any configuration requirements, including any modifications or Software (including firmware) upgrades required for incorporation into the *works*,
- obtain from the *Client* following configuration a schedule identifying the device serial numbers, Software revisions, and configuration of the device and
- confirm to the *Client* that the correct configuration requirements have been implemented.

18.5.13 Prior to the procurement of non-standard electronic display equipment, the information required in TR2607 ‘Performance Specification for Electronic Motorway Display Equipment’ [74] shall be submitted to the *Project Manager*.

18.5.14 The requirements for working at height on Technology Equipment shall be minimised.

## 18.6 Electrical Power Supply and Distribution

18.6.1 An electrical power supply and distribution network shall be provided to

- Stonehenge Tunnel and the highway Technology Equipment,
- Stonehenge Tunnel and the highway M&E Systems,
- the TSBs and
- Stonehenge Tunnel and the highway road lighting and Traffic Signs.

18.6.2 The electrical power supply and distribution network shall be provided to the

- Traffic Signs in accordance with the requirements in section 11 (Traffic Signs and Signals) of this document,
- lighting in accordance with the requirements in section 12 (Lighting) of this document and
- M&E Systems in accordance with the requirements in section 17 (Stonehenge Tunnel Mechanical and Electrical Systems) of this document.

18.6.3 The requirement for meters at all new electrical power supply connection locations to be provided with remote reading capability shall be determined in consultation with the DNO.

18.6.4 If Technology Equipment requires continuous power, a continuous power supply shall be provided from the time of installation.

18.6.5 The electrical power supply and distribution network shall be provided with the additional capacity required for the Future Infrastructure Requirements.

## 18.7 Incident Detection and Management

18.7.1 The Incident Detection Service shall

- be automated (automatic incident detection (AID) system),
- have a minimum incident detection accuracy of eighty-five (85) percent,
- have a false detection rate less than fifteen (15) percent of all detected incidents,
- classify the detected incident, including determining the confidence value of the detection[105] and
- alert the TCMS user (visual and audible) of the detected incident, including the automatically assigned incident classification and confidence value.

18.7.2 The Incident Detection Service shall be capable of detecting stopped vehicles outside Stonehenge Tunnel on the new A303 carriageway between Longbarrow and Countess Junctions.

18.7.3 The maximum end-to-end time from an incident occurring between Longbarrow and Countess Junctions, to the TCMS user being alerted, including the incident classification and confidence, shall not exceed ten (10) seconds.

18.7.4 For incidents detected by the Incident Detection Service, the Incident Management Service shall

- alert Road Users on the affected carriageway by displaying a pre-set message on the VMS provided outside and within Stonehenge Tunnel,
- implement a speed reduction on the affected carriageway,
- obtain manual confirmation by the TCMS user of the detected incident and
- if no manual confirmation is received from the TCMS user after three (3) minutes of the detected incident being alerted to the TCMS user, automatically respond and take predetermined actions based on the incident classification and confidence value.

18.7.5 Predetermined Incident Management Service actions, including lane control, speed reduction and Traffic Sign messages, shall be defined for each incident classification.

18.7.6 If the detection accuracy of the Incident Detection Service is less than ninety-five (95) percent, the Incident Management Service shall not automatically implement the predetermined actions.

[105] The minimum classification of incident detection events is listed in Clause 9.89 of CD 352 [44].

## 18.8 Closed-Circuit Television (CCTV) Surveillance

18.8.1 CCTV surveillance of the *works* shall be provided.

18.8.2 CCTV surveillance shall provide coverage of the following locations

- the new A303 carriageway between chainages Ch. 0+800 and Ch. 14+200 outside of the Stonehenge Tunnel,
- junctions and their approaches / exits,
- approaches / exits to Stonehenge Tunnel,
- outside of each portal,
- the TSBs and
- inside Stonehenge Tunnel, including cross-passages.

18.8.3 CCTV surveillance shall be provided

- with the minimum number of cameras to comply with the requirements of the Scope,
- with cameras which are optimally positioned for visibility,
- which are ONVIF compliant,
- with control and real-time video and feed to the *Client's* ROC,
- with pan, tilt and zoom (PTZ) capability (except in the Stonehenge Tunnel cross-passages),
- with fixed cameras in the Stonehenge Tunnel cross-passages,
- with overlaps in the field of view of adjacent CCTV surveillance areas,
- with low light CCTV functionality and
- which supports a minimum of twenty-four (24) simultaneous cameras streams to the *Client's* south west ROC.

18.8.4 The CCTV surveillance shall be provided with overlaps in the coverage of adjacent CCTV surveillance areas in the following locations

- inside Stonehenge Tunnel,
- outside of the Stonehenge Tunnel portals and
- on the approaches / exits of Stonehenge Tunnel.

18.8.5 Comprehensive CCTV surveillance coverage outside Stonehenge Tunnel of the new A303 carriageway between Longbarrow and Countess Junctions shall be provided.

18.8.6 Where comprehensive CCTV surveillance coverage is required outside Stonehenge Tunnel, the coverage shall be provided so that

- blind spots due to structures and bends do not exceed 5% of the camera operational coverage and
- a target object, 1.75m in height represents no less than 5% of screen height everywhere within the area of coverage.

18.8.7 CCTV surveillance cameras shall be provided on independent Structures at the MS4 VMS locations.

18.8.8 Except for a CCTV surveillance camera already being used by a TCMS user, the CCTV surveillance system within Stonehenge Tunnel shall automatically focus to

- an Incident Detection Service detected incident,
- an emergency roadside telephone (ERT) being picked up,
- a cross passage door opening and
- an EP door opening.

18.8.9 The position and extent of coverage for each CCTV surveillance camera shall be defined.

18.8.10 CCTV surveillance cameras outside Stonehenge Tunnel shall be provided with co-located infra-red illuminators.

18.8.11 Footage from CCTV surveillance cameras shall be recorded.

18.8.12 Storage for footage recorded from CCTV surveillance cameras shall be provided and located in the TSBs.

18.8.13 The CCTV surveillance system shall have the capability of providing

- text banners for every camera,
- pre-sets for each PTZ camera, including home position and
- non-dwell zones, blanking zones and blocking zones to restrict the view of certain PTZ cameras as required.

## 18.9 Communications and Information

18.9.1 Emergency Roadside Telephones (ERTs) shall be provided at the following locations

- within Type A parking lay-bys[106],
- on both approaches on both carriageways to the Stonehenge Tunnel and
- within Stonehenge Tunnel.

18.9.2 Maintenance telephones shall be provided for communication to the *Client's* south west ROC

- at each cabinet, or group of cabinets,
- in each TSB Plant room,
- in each Stonehenge Tunnel cross-passage and
- in each Stonehenge Tunnel mid tunnel Plant room (if provided).

18.9.3 The public-address voice alarm system shall be integrated for use with any emergency messages broadcast via radio break-in systems in the Stonehenge Tunnel.

18.9.4 Public service radio rebroadcast shall be provided within Stonehenge Tunnel.

18.9.5 The public service radio rebroadcast provision within the tunnel shall broadcast the digital audio broadcasting (DAB) frequency spectrum.

18.9.6 The following wireless communications infrastructure shall be provided support the future delivery of Connected and Autonomous Vehicle (CAV) and Connected and Automated Mobility (CAM) Services.

- narrowband, short-range, low latency communications to support CAV Services and
- mobile cellular communications to support a broad range of CAM Services.

18.9.7 Narrowband, short-range, low latency communications infrastructure shall be provided

- throughout both bores of Stonehenge Tunnel,
- based on the ITSG5 (802.11p) and / or emerging 5G V2X ETSI/3GPP standard,
- using antennae at one hundred (100) metre spacing and
- which connect to the NRTS transmission infrastructure.

18.9.8 The narrowband, short-range, low latency communications infrastructure standard shall be agreed with the *Project Manager*.

[106] As defined in CD 169 'The design of lay-bys, maintenance hardstandings, rest areas, service areas and observation platforms' [27].

18.9.9 5G and future generations mobile cellular communications infrastructure for all UK licensed mobile network operators[107] shall be provided throughout both bores of Stonehenge Tunnel.

## 18.10 Speed Enforcement

18.10.1 A speed enforcement system shall be provided on the new A303 (including entrance and exit slips) between Longbarrow and Countess Junctions.

18.10.2 The speed enforcement system shall be provided

- which has Home Office Type Approval (HOTA),
- which is operational in low light and adverse weather conditions and
- with coverage as a single enforcement zone.

18.10.3 The speed enforcement system type, and the number of dummy sites and locations which are to replace live sites between the primary entry and final exit camera sites shall be

- determined in consultation with the *Client's* national enforcement coordinator and
- agreed with the *Project Manager*.

18.10.4 The remote back office location of the evidence recovery control unit (ERCU) and offence viewing and decision system (OVDS) used for processing offenses shall be

- determined in consultation with the *Client's* national enforcement coordinator and the enforcement authority and
- agreed with the *Project Manager*.

18.10.5 Speed limit repeater indicators which can send signals (in the form of a data log file) from the end signal to the *Client's* ROC to confirm that signals have successfully or unsuccessfully performed a switch of speed limit shall be provided as part of the enforcement verification required by the enforcement authority for prosecution.

18.10.6 The specialist speed enforcement system Subcontractor shall

- supervise the installation, testing and commissioning of the speed enforcement system and
- confirm that the offset requirements are met in accordance with Home Office Type Approval (HOTA).

18.10.7 An evidential trial shall be undertaken in conjunction with the enforcement authority and the specialist speed enforcement system Subcontractor.

18.10.8 The enforcement authority to be used to witness the evidential trial shall be agreed with the *Project Manager*.

## 18.11 Site Data

18.11.1 Site Data shall be prepared.

18.11.2 Configuration requirements for making changes to Site Data shall be

- determined in consultation with the *Client* and
- agreed with the *Project Manager*.

18.11.3 Adverse impacts to the *Client's* existing systems and services in the *Client's* south west ROC arising from the development of Site Data shall be minimised.

[107] The UK currently has four licensed mobile network operators: EE, O2, Three and Vodafone.

18.11.4 Site Data shall be changed as required to maintain safe operation of Technology Equipment outside of the Site during the *works*.

18.11.5 Site Data shall be changed as required to allow for the loss or reduction of Technology Equipment within the Site.

18.11.6 Site Data changes shall be implemented with the inclusion of new operational assets.

18.11.7 Site Data shall describe

- how data will be defined and uploaded onto the TCMS,
- proposed TCMS modifications,
- required amendments for the introduction of the Technology Equipment required for the implementation of the Future Infrastructure Requirements,
- changes to the operation of the *Client's* south west ROC and
- operator interface mark-ups.

18.11.8 The timing of Site Data Loads (SDLs) shall be coordinated with the *Client* to minimise disruption to the *Client's* existing operations.

18.11.9 Site Data shall be tested prior to each SDL.

18.11.10 SDLs shall be undertaken in accordance with the Technology Commissioning Plan.

18.11.11 Confirmation from the *Client* shall be sought following SDLs that none of the existing systems and services in the *Client's* south west ROC have been adversely impacted by the SDL and the Site Data has been successfully uploaded.

## 18.12 IT Service Management

18.12.1 An ITIL four (4) aligned IT service management system [75] shall be provided.

18.12.2 The IT service management system shall be

- a single point of contact for managing all Technology Equipment queries and
- accessible via phone and e-mail.

18.12.3 An IT service management toolset shall be developed to deliver the IT service management activities.

18.12.4 Access to the IT service management toolset shall be provided to the *Client*.

18.12.5 The IT service management toolset shall be compatible with and integrate to the *Client's* IT service management toolset (ServiceNow) via an Application Programming Interface (API).

## 18.13 Inspection, Testing and Commissioning

18.13.1 Inspection, testing and commissioning of the Technology Equipment shall be undertaken in accordance with the requirements in section 21 (Inspection, Testing and Commissioning) of this document.

# 19 Minimum Operating Requirements

## 19.1 General

19.1.1 Minimum Operating Requirements (MORs) for Stonehenge Tunnel shall be defined.

19.1.2 MORs shall define

- the systems[108] which maintain the safe operation of Stonehenge Tunnel,
- the minimum combinations of conditions, availability of systems and procedures for the safe continued operation of Stonehenge Tunnel,
- when a suspension or restriction in the operation of Stonehenge Tunnel (individual lane, bore or tunnel) is required and
- the actions to be undertaken in the event of a failure of a system.

19.1.3 MOR shall be defined for the following Stonehenge Tunnel operating scenarios

- tunnel fully open,
- tunnel fully closed,
- closure of an individual tunnel bore,
- closure of an individual lane within a tunnel bore and
- an individual tunnel bore operating in contraflow.

19.1.4 MOR shall be defined in consultation with the Tunnel Manager and Safety Officer.

19.1.5 For each system maintaining the safe operation of Stonehenge Tunnel the following shall be defined

- the provision / description of the system,
- whether the system provides mitigation for other systems and
- the potential fault events which could occur with the system.

19.1.6 For each system fault event the following shall be defined to restore the system to full functionality for the safe operation of Stonehenge Tunnel

- the potential deficiency[109] in the system,
- the failure likelihood,
- the effects of the failure,
- the mitigation that is to be applied,
- the actions to be undertaken and
- the category of fault.

19.1.7 For each fault event the category of fault shall be assigned according to the definition in Table 19-1 (Fault Category).

19.1.8 Where mitigation of a fault event includes a temporary measure to keep Stonehenge Tunnel at or above MOR for a short period of time, permanent measures shall also be defined which restores the system to full functionality.

19.1.9 Where fault events cannot be resolved or repaired quickly, interim mitigation measures shall be implemented so that Stonehenge Tunnel can be operated safely while a response to correct the deficiency is implemented.

19.1.10 Response time to fault events shall be defined.

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[108] Tunnel systems can comprise any individual Device, Module and Service, including the TCMS, or combination thereof.
[109] System deficiencies could range from minor faults through to complete loss of functionality.

19.1.11 The response time to fault events shall be measured

- from the first notification of a fault from the TCMS and
- concurrently.

19.1.12 For each fault category the response time to fault events at different times of the day for the following shall be defined

- the immediate time for fault diagnosis,
- the time to recover the system as completely as possible and
- the time to complete the permanent repair.

19.1.13 The time to complete the permanent repair for each fault category shall be subdivided (e.g. A1, A2) to identify whether the permanent repair

- can be undertaken at the next scheduled Stonehenge Tunnel closure and
- is required to be undertaken sooner than the next scheduled Stonehenge Tunnel closure.

### Table 19-1 Fault Category

| Fault Category | Definition |
|---|---|
| A | Stonehenge Tunnel cannot be operated safely (breach of MOR). Major faults / system deficiencies or complete loss of functionality of the system. |
| B | Stonehenge Tunnel can be operated safely (above but approaching MOR). Faults / system deficiencies resulting in limited or no redundancy in the system. Further faults would result in MOR being breached. |
| C | Stonehenge Tunnel can be operated safely (above MOR). Small number of minor faults / system deficiencies which do not affect the redundancy of the system or safe operation of the tunnel. |

# 20 Tunnel Control and Management System

## 20.1 General

20.1.1 The TCMS shall enable the full control, monitoring, recording, reporting and service implementation of the Services.

20.1.2 The TCMS shall be provided to enable a services-led and outcomes-based provision.

20.1.3 The TCMS shall be provided to be operated from the following locations

- the *Client's* south west ROC at Aztec West (primary operating centre),
- the *Client's* south east ROC at Godstone (resilient operating centre) and
- the TSBs (local operating centres).

20.1.4 The TCMS shall provide secure web-based access which permits the following Services to be monitored

- Integrated M&E and
- Asset Performance Monitoring and Fault Management.

20.1.5 The TCMS shall be provided so that an individual user can deliver the Services through a single human machine interface (HMI).

20.1.6 The locations where the TCMS is to be operated from shall be provided with the minimum Technology Equipment shown in Table 20-1 (TCMS Operating Centre Technology Equipment).

20.1.7 The requirements of the video wall provided in the south west ROC as part of the TCMS operational capability shall be

- determined based on the TCMS operational requirements,
- determined in consultation with the *Client* and
- agreed with the *Project Manager*.

20.1.8 The local TCMS hardware Should be located within the TSBs.

20.1.9 A TCMS sandbox[110] testing environment shall be provided.

20.1.10 A TCMS Service Level Agreement (SLA) shall be provided until the Maintenance Completion Date which defines the required maintenance support to

- provide a continued secure and compliant TCMS provision meeting the *Clients'* Code of Connection (CoCo),
- provide security updates to the TCMS,
- provide a maintenance and support service to log, investigate and resolve functional and performance incidents identified with the TCMS,
- reconfigure the provisioned Services as Modules and Devices are added or replaced,
- correct faults in the TCMS and
- improve the performance of TCMS.

[110] A sandbox is a type of Software testing environment that enables the isolated execution of Software or programs for independent evaluation, monitoring or testing.

### Table 20-1 TCMS Operating Centre Technology Equipment

| Location | Minimum Technology Equipment |
|---|---|
| South west ROC | Five (5) No. individual operator desks with three (3) screens per terminal.<br>Video wall (CCTV, TCMS alarms, integrated M&E health, asset performance and faults). |
| South east ROC | Two (2) No. individual operator desk with three (3) screens per terminal. |
| TSB (each building) | Two (2) No. individual operator desk with three (3) screens per terminal.<br>Video wall (CCTV, TCMS alarms, integrated M&E health, asset performance and faults). |

## 20.2 Concept and Principles

20.2.1 The TCMS shall enable the *Client* to deliver the following core operating functions

- monitor and manage the Services, Modules and Devices,
- normal operation (including the passage of dangerous goods vehicles),
- implement diversion routes,
- manage prohibited users, livestock and wildlife,
- accommodate the safe movement of abnormal loads,
- prevent over-height vehicles from entering Stonehenge Tunnel,
- facilitate the management of large-scale public events,
- monitor and manage the environmental conditions in Stonehenge Tunnel,
- monitor and manage the effects of weather conditions,
- monitor Stonehenge Tunnel and the tunnel approach road traffic conditions,
- manage speed of traffic,
- detect stopped vehicles within Stonehenge Tunnel and on the approaches to the tunnel,
- manage lane availability in Stonehenge Tunnel and on the approaches to the tunnel,
- support safe maintenance and emergency service access,
- communicate with Road Users,
- implement a contraflow during maintenance in the non-affected bore,
- safely manage incidents and clear vehicles from the network,
- prevent traffic from entering an individual bore of Stonehenge Tunnel in the event of an incident,
- quickly close an individual bore or complete closure of Stonehenge Tunnel and
- give advance warning to Road Users of an incident and bore / closure of Stonehenge Tunnel.

20.2.2 Modules and Devices shall expose their main functions as services.

20.2.3 Services, Modules and Devices shall expose their data as services.

20.2.4 A model shall be provided defining how other applications can reuse the TCMS functions and data services.

20.2.5 The TCMS provisioned Services shall

- consist of discrete pieces of Software providing application functionality to other TCMS Modules and applications through well-defined services,
- be accurately described so they can be re-used by the *Client* and Others and
- be published using the OpenAPI Specification.

20.2.6 The TCMS shall configure and implement the Minimum Operating Requirements.

20.2.7 The TCMS shall trigger alerts (visual and audible) when

- the MOR are breached (fault category A[111]) and
- the number of failures or a condition is being approached which would result in the MOR being breached (fault category B[111]).

20.2.8 Detailed configuration documentation shall be provided and maintained for the TCMS, the provisioned Services, and connected Modules and Devices which records the following

- installed application,
- version numbers,
- last patch date,
- control-specific configuration,
- interface specifications and
- network diagrams.

20.2.9 A TCMS Solutions Document shall be prepared which describes

- the architecture of the TCMS,
- how the TCMS functional and non-functional requirements are to be implemented,
- the security measures to be implemented in the TCMS,
- how the *Client's* procedures and policies are to be complied with,
- how the *Clients* Architecture Services Principles [76] are to be complied with,
- how the UK Government Technology Code of Practice [67] is to be complied with and
- how the UK Government, Cabinet Office and NCSC requirements, guidance and recommendations for protection are to be complied with [68, 77, 78].

20.2.10 The TCMS Solutions Document shall describe the following aspects of the TCMS architecture

- how Availability is to be achieved,
- how the core operating functions are to be implemented,
- the standards and protocols to be used,
- how the system is to integrate with the *Client's* National TCMS,
- how the system is to integrate with the *Client's* systems T-TOC, Dynac and ControlWorks,
- how resilience is to be provided and how the system is to self-recover,
- the identification of any single points of failure in the Services, Modules or Devices,
- the proposed user interface,
- how upgrades can be executed remotely,
- the measures to be taken in the event of a failure,
- how faults are to be diagnosed remotely,
- how Technology Equipment is to be reset remotely,
- the Recovery Point Objectives and Recovery Time Objectives,
- where system hardware and data storage are to be located and
- the proposed non-production environment.

[111] Refer to the fault category definition in Table 19-1 (Fault Category)

20.2.11 The TCMS Solutions Document shall describe the following aspects of the TCMS security

- the approach to security risk management,
- the proposals for protection, including network security controls, zones, boundary controls and malware and malicious activity,
- how users are authenticated and managed,
- how user profiles are to be configured,
- how user roles and responsibilities are to be defined,
- how system configuration and hardening are to be implemented,
- how security testing for weaknesses is to be undertaken, including scope of test,
- how Security Incidents are to be managed and monitored,
- the proposed maintenance SLA,
- the approach to producing secure coding,
- how vulnerabilities and patches to the system are to be undertaken, in the form of a Technical Vulnerability and Patch Management Plan and
- how the requirements of the Scope are to be cascaded to, and how security audits are to be undertaken of sub-contractors.

## 20.3 TCMS Integration

20.3.1 The TCMS shall integrate with the following *Client's* enterprise capabilities

- Advanced Traffic Management (Dynac),
- Incident Management (ControlWorks) and
- Tools for the Technology Operations Capability (T-TOC) (ServiceNow).

20.3.2 The TCMS shall integrate with the *Client's* Technology Equipment using the *Client's* enterprise services bus (ESB)[112,113].

20.3.3 The Advanced Traffic Management (Dynac) and Technology Operations Capability (TOC) enterprise capabilities shall be integrated using the ESB device or service adapters.

20.3.4 The Incident Management (ControlWorks) enterprise capability shall be integrated using an ESB direct connection.

20.3.5 The TCMS shall integrate with the *Client's* National TCMS[114,115].

20.3.6 The TCMS shall not integrate directly with the following *Client* systems

- electric vehicles (EV) Charging Management and
- Asset Management.

20.3.7 Data integration shall be provided for all Services, Modules and Devices which are required to be

- contained within the TCMS and
- extended to the wider *Client's* technology systems.

[112] The ESB is the *Client's* principal technology integration method providing a loosely coupled integration landscape; which deals with all the incoming and outgoing network traffic and provides protocol translation mechanisms.
[113] ESB is based upon the RedHat JBoss Fuse product, architecture and technology providing an internal instance for all Technology Equipment at the roadside, plus, an external instance for all external systems.
[114] The National TCMS is the centralised integrated TCMS, operating several tunnels directly under the *Client's* contractual authority and from a single Regional Operations Centre (ROC) location.
[115] Refer to the *Client's* National TCMS interface specification contained in the Data Room [17].

20.3.8 Technology Equipment data interchange shall be compatible with one of the following formats

- DATEX II[116] or
- NTCIP[117].

20.3.9 Services to be integrated with the wider *Client's* technology systems shall be in accordance with Table 20-2 (TCMS Services Integration).

### Table 20-2 TCMS Services Integration

| Services | Dynac and ControlWorks | T-TOC | National TCMS |
|---|---|---|---|
| Integrated M&E | | ✓ | ✓ |
| Incident Detection | | | ✓ |
| Queue Detection | ✓ | | ✓ |
| Speed Control | ✓ | | ✓ |
| Lane Control | ✓ | | ✓ |
| Diversionary Routing | ✓ | | ✓ |
| Weather Monitoring | | | ✓ |
| Smoke and Fire Detection | | | ✓ |
| Traffic Monitoring and Management | ✓ | | ✓ |
| Incident Management | ✓ | | ✓ |
| In-Tunnel Communications | | | ✓ |
| Asset Performance Monitoring and Fault Management | | ✓ | ✓ |
| Configuration Management | | ✓ | ✓ |

## 20.4 Safe State

20.4.1 If a failure in the TCMS / TCMS communication interface occurs which results in operational control of Stonehenge Tunnel ceasing, the tunnel shall be automatically

- placed into a default 'safe state' and
- closed in a controlled manner.

20.4.2 Following Stonehenge Tunnel being placed into a 'safe state', the tunnel shall remain closed until

- the TCMS becomes operational and the TCMS communications interface is active and
- a manual command is issued to re-open the tunnel through the TCMS.

[116] DATEX II is the electronic language used in Europe for the exchange of traffic information and traffic data [106].
[117] NTCIP is a family of standards that provides both the rules for communicating and the vocabulary necessary to allow electronic traffic control equipment from different manufacturers to operate with each other as a system [107].

## 20.5 Resilience and Security

20.5.1 The TCMS shall be provided in accordance with the requirements, guidance and recommendations contained in

- IEC 62443 (All Parts) 'Industrial Communication Networks' [79],
- BS EN ISO / IEC 27001 'Information Technology - Security Techniques - Information Security Management Systems – Requirements' [80] and
- BS EN 61508-1 'Functional Safety of Electrical / Electronic / Programmable Electronic Safety-Related Systems. General requirements' [81].

20.5.2 The TCMS shall be protected in accordance with the requirements, guidance and recommendations

- produced by the UK Government's National Cyber Security Centre [68],
- of the UK Government's Cyber Essentials Scheme [77] and
- contained in the Cabinet Office's Minimum Cyber Security Standard [78].

20.5.3 The TCMS architecture shall show the network security controls implemented and demonstrate how the system has been grouped into zones based on common security requirements, as described BS IEC 62443 [79].

20.5.4 TCMS zones with differing trust levels shall be logically or physically segregated from all other zones using boundary controls[118].

20.5.5 Firewalls used as boundary controls in the TCMS shall

- be deployed at all network perimeters and internal network boundaries,
- provide segregation of the security zone in which they are installed and
- have the basis of firewall rules set to "deny all" with exceptions explicitly identified.

20.5.6 The TCMS shall implement secure coding to minimise the most critical security risks to web applications identified in the OWASP Top Ten [82].

20.5.7 The TCMS shall implement an approach to secure coding using any of the following techniques and measures

- internal code reviews,
- use of automated tools to conduct security checks,
- use of a version control system,
- a segregated and secure development and testing environment and
- evidence of input sanitisation, including buffer overflow prevention[119].

20.5.8 The TCMS and configuration computer shall be protected from unauthorised modification or use through the implementation of physical and technical security features, including the following

- encryption,
- access control,
- event and communication logging,
- monitoring and
- alarming.

[118] Boundary controls can comprise a combination of firewalls, data diodes, and demilitarised zones (DMZs).
[119] For web-based systems this would include the prevention of command injection, SQL injection and cross-Site Scripting.

20.5.9 The TCMS shall be tested for security weaknesses through a security test conducted

- prior to Completion of *section* 3 and
- annually after Completion of *section* 3 until the Maintenance Completion Date.

20.5.10 The scope of the TCMS security test shall be

- determined through consultation with the *Client* and
- recorded in the TCMS Solutions Document.

20.5.11 The un-abridged version of the TCMS security test report and its recommendations shall be provided to the *Project Manager*.

20.5.12 A Remedial Action Plan shall be prepared which proposes how vulnerabilities identified in the TCMS following security testing shall be mitigated.

20.5.13 A Technical Vulnerability and Patch Management Plan shall be provided for the TCMS, the provisioned Services, and connected Modules and Devices which includes

- the methods to guarantee the integrity and compatibility of the systems with patches before their deployment,
- a schedule against which automated vulnerability scans are to be run on the system,
- an approach and associated capability to remediate newly reported zero-day vulnerabilities,
- procedures for patching the system after commissioning,
- a schedule against which patches are to be applied to the system,
- mitigation strategies for situations where there is a recommendation against applying a released patch,
- identification of the party responsible for the installation and update of patches and
- procedures for minimising operational disruption as a result of patching.

20.5.14 Prior to any Software (including firmware) update process on the TCMS, the provisioned Services, and connected Modules and Devices the following shall be complied with

- file integrity checks verify that the update file has not been altered,
- authenticity checks verify that the update file has originated from the correct and expected source and
- the update file version has been validated to demonstrate it is compatible and intended for the target Device.

20.5.15 Validation shall be carried out to all updates on the TCMS, the provisioned Services, and connected Modules and Devices to demonstrated that the updates has been successfully installed and the system is functioning as expected.

20.5.16 If validation of an update on the TCMS, the provisioned Services, and connected Modules and Devices fails, the system shall be rolled back to a known good state.

20.5.17 All TCMS updates and patches shall be tested in the TCMS sandbox prior to deployment on the live TCMS.

20.5.18 Disruption to the TCMS provisioned Services or a failure of the TCMS Should not result in data loss.

20.5.19 The TCMS data shall be backed up

- a minimum once (1) per day,
- to achieve the Recovery Point Objective and
- prior to a change and immediately after any successful change to the TCMS (including upgrades or patches).

20.5.20 The TCMS shall be provided so that system operation can be quickly and efficiently restored following a failure of the TCMS to achieve the Recovery Time Objective.

20.5.21 The TCMS shall be provided with the capability for the detection and prevention of malware and other malicious activity[120].

## 20.6 User Interface

20.6.1 The TCMS user interface shall

- place the user in control,
- reduce the user's memory load,
- be graphically attractive in how the information is presented,
- be simple to use,
- have a short response time,
- be clear to understand and
- be consistent across all interface screens.

20.6.2 The TCMS user interface shall achieve a Level AA conformance to the Web Content Accessibility Guidelines (WCAG) 2.1 [83].

20.6.3 The TCMS user interface shall progress to meet Level AAA conformance to WCAG 2.1.

20.6.4 The TCMS screen layout shall provide an efficient and intuitive environment which supports the user in completing the required tasks.

20.6.5 The TCMS user interface shall

- be consistent in the design of controls, warnings, indicators and layout of presentational elements,
- implement quick entry input means,
- draw the natural focus of the user to the place where action or attention is required,
- use colour in the presentation of information,
- minimise delays in the user performing tasks,
- minimise the execution of erroneous input by the user and
- not force the user into executing unnecessary or undesired actions.

20.6.6 Minimising the execution of erroneous input in the TCMS by the user shall be achieved through implementing the following

- data validation,
- on screen tips and
- context dependent help.

20.6.7 Minimising delays in the user performing tasks in the TCMS shall be achieved through implementing the following

- presenting information to be readily identifiable as to its relevance,
- grouping related functions,
- simplifying the process by having an automated stepped or prompt process,
- using auto-complete,
- pre-filling of screens as users progress through standard workflows and
- maintaining consistency.

[120] Methods for the detection and prevention of malware and other malicious activity can include inbound and outbound traffic filtering, host- and network-based intrusion detection and/or prevention, anti-malware Software and application whitelisting Software.

## 20.7 User Profiles and Access Rights

20.7.1 The TCMS shall provide user profiles with defined access rights.

20.7.2 TCMS user profiles shall be provided as follows

- maintainer,
- operator,
- manager and
- administrator.

20.7.3 TCMS user profiles shall be configured based on the TCMS operational functions.

20.7.4 The TCMS shall manage user credentials so that

- default passwords are changed upon first use,
- the need for shared accounts is avoided,
- stored and in-transit credentials are secured using strong cryptographic techniques,
- concurrent logins of the same account are rejected,
- applications do not store login information between sessions,
- auto-fill functionality during login is prevented and
- anonymous logins are disabled.

20.7.5 The TCMS shall be provided with a user profile password management system that allows for the configuration and setting of

- password length,
- frequency of password change,
- password complexity,
- number of login attempts,
- inactive session logout time,
- screen lock by application and
- denial of repeated or recycled use of the same password.

20.7.6 The configuration requirements for the TCMS user profiles shall be

- determined in consultation with the *Client* and
- agreed with the *Project Manager*.

20.7.7 The TCMS shall support a minimum twenty (20) concurrent users.

20.7.8 Multi-Factor Authentication (MFA) shall be used to authenticate all remote and privileged[121] TCMS users.

20.7.9 The TCMS shall provide full conflict resolution and prioritisation between multiple users.

20.7.10 User profile access rights shall be configured to the principle of least privileged[122] (POLP).

20.7.11 Role-based access controls shall be implemented in the TCMS.

20.7.12 The TCMS shall minimise the number of occurrences a user has to authenticate their credentials.

20.7.13 All TCMS users shall have completed the Baseline Personnel Security Standard [84] (BPSS) pre-employment controls.

[121] A privileged TCMS users means an administrator or other user role that can configure and change the system and can change privileges within the system.
[122] POLP means giving a user account or process only those privileges which are essential to perform its intended function.

## 20.8 Asset Performance Monitoring and Fault Management

20.8.1 The Asset Performance Monitoring and Fault Management Service shall monitor and manage the following

- TCMS system and provisioned Service faults,
- TCMS connected Module and Device faults and
- TCMS system and provisioned Service performance.

20.8.2 The Asset Performance Monitoring and Fault Management Service shall monitor the data connections to provide real-time information and health checks on the connections between the

- TCMS provisioned Services and the connected Modules and Devices and
- the *Client's* south west ROC and the *works*.

20.8.3 The Asset Performance Monitoring and Fault Management Service shall be provided with a fault management tool which permits the TCMS user to

- view, edit, action and acknowledge fault events,
- monitor the progress and track the rectification of fault events and
- clear or close fault events.

20.8.4 For each fault event the following shall be recorded[123]

- affected Services, Modules or Devices, including Module or Device ID,
- fault occurrence time and date,
- fault status, i.e. "open", "closed", "intermittent",
- fault category (as defined by MOR),
- fault response time (as defined by MOR),
- fault rectification time and date,
- fault repair undertaken and
- other fault repair comments and fault observations.

20.8.5 For fault category A and B fault events[124] the Asset Performance Monitoring and Fault Management Service shall

- notify the TCMS user of the fault event[125],
- obtain manual confirmation by the TCMS user of the fault category and
- accept the default fault category after a predetermined time if no manual confirmation is received from the TCMS user.

20.8.6 The TCMS shall permit fault events to be searched and filtered on the following

- fault status,
- fault category,
- unique fault number,
- Service, Module or Device and
- Module or Device ID.

[123] The fault category and response times are defined in section 19 (Minimum Operating Requirements) of this document.
[124] Refer to the fault category definition in Table 19-1 (Fault Category)
[125] Notification of a fault event can be in the form of a pop-up window or the system's notification service such as a system tray.

20.8.7 The following fault event information shall be provided in real time (including status changes) to the *Client's* T-TOC

- fault status,
- fault category,
- unique fault number and
- Module or Device ID.

20.8.8 Key performance indicators (KPIs) shall be defined within the TCMS to measure the performance, availability and reliability of the

- Stonehenge Tunnel (including Availability),
- TCMS,
- TCMS provisioned Services and
- connected Modules and Devices.

20.8.9 TCMS KPIs shall permit interrogation and analysis through

- a dashboard within the TCMS and
- user configurable reports.

20.8.10 TCMS KPI reports shall be generated in the following formats

- structured query language (SQL) [85],
- comma-separated values (CSV) and
- open document format (ODF) v1.2 [86] for word processing and spreadsheets.

20.8.11 TCMS KPIs shall permit the interrogation and analysis of the following

- overall TCMS availability including uptime,
- provisioned Services availability,
- TCMS, provisioned Services and connected Modules and Devices performance,
- fault events and
- response to and resolution of fault events.

## 20.9 Event Reporting and Security Incident Management

20.9.1 The TCMS shall maintain an activity log of changes to the TCMS and the TCMS provisioned Services (including automatic responses to predefined MOR rules and mitigation) with a brief description of changes made, including usernames and timestamps.

20.9.2 the TCMS shall have a centralised Authentication, Authorisation, and Accounting (AAA) management capability[126] which shall

- time stamp events using an authoritative time source and
- protect audit logs from corruption and tampering.

20.9.3 The TCMS shall maintain a time stamped log on the login status and activity of all TCMS users.

[126] Authentication, Authorisation, and Accounting (AAA) is a term for a framework for intelligently controlling access to computer resources, enforcing policies and auditing usage.

20.9.4 The TCMS shall retain historic data within the system capturing the following information

- system activity,
- audit logs,
- Service change of state,
- event faults and
- user actions.

20.9.5 TCMS historic data shall be

- retained within the system for a minimum of two (2) years,
- archived for a minimum of six (6) years and
- able to be exported and downloaded in SQL, CSV and ODF (for word processing and spreadsheets) formats.

20.9.6 System event logging shall be enabled on the TCMS to monitor the activity of the TCMS, provisioned Services and connected Modules and Devices.

20.9.7 The TCMS shall be provided with controls to detect, prevent and report on attacks on the system including denial of service attacks[127].

20.9.8 The TCMS shall be provided with a security monitoring system which

- filters system event logs and alerts users of Security Incidents,
- detects known threats by comparing system event logs against Indicators of Compromise (from threat intelligence sources),
- has procedures defined for responding to threats and Security Incidents,
- permits users to view the logs and produce reports of all detected Security Incidents and
- is refined and improved throughout the term of the TCMS SLA.

20.9.9 All TCMS Security Incidents which are defined as Major Security Incidents shall be reported to the *Project Manager* as soon as reasonably practicable, but not exceeding forty-eight (48) hours, of becoming aware of any Security Incident.

20.9.10 Any TCMS Major Security Incident shall be subject to root cause analysis with a report produced documenting the cause of the Security Incident along with proposed remedial actions which could prevent a recurrence of the Security Incident.

[127] Denial of service attacks can originate from both internal sources (e.g. malfunctioning or misconfigured devices consuming resources) and external sources (originating from connected networks or devices).

# 21 Inspection, Testing and Commissioning

## 21.1 General

21.1.1 Inspection, testing and commissioning of the M&E Systems and Technology Equipment shall be undertaken to demonstrate compliance with the requirements of the Scope.

21.1.2 Inspection and test plans, and commissioning plans shall be prepared which demonstrate how the *works* are to be inspected, tested and commissioned.

21.1.3 A structured and systematic approach to inspection, testing and commissioning shall be undertaken with plans developed for

- testing and inspection prior to delivery,
- testing, inspection and commissioning of individual components and systems,
- demonstrating system performance and
- integration testing of multiple systems, Stonehenge Tunnel and the complete *works*.

21.1.4 Inspection, testing and commissioning activities may be undertaken in stages to enable progressive assurance of the *works* to be undertaken.

21.1.5 Faults identified during testing and commissioning shall be rectified with re-testing and commissioning of the

- replacement part(s) and
- whole system, if required.

## 21.2 Inspection and Testing

21.2.1 Inspection and test plans shall be prepared for

- system build testing,
- post assembly testing,
- pre-factory acceptance tests (pre-FAT),
- factory acceptance tests (FAT),
- factory integration testing,
- site acceptance tests (SAT) and
- site integration testing.

21.2.2 Inspection and test plans shall

- identify the mandatory tests and inspections required by the relevant standards,
- demonstrate compliance with the requirements of the Scope,
- permit verification of assumptions made during the design,
- identify where a nominated third party is to carry out an inspection / test,
- identify where inspections or tests are to be witnessed,
- identify hold points,
- define the scope of the inspection and test,
- define the acceptance criteria,
- identify any testing accreditation requirements,
- define the actions for dealing with nonconformities and corrections,
- define the release / rejection procedures and
- contain the template / proforma for recording the results of the inspection and test.

21.2.3 The *Supervisor*, *Client* and relevant Others shall be consulted to determine their requirements for inspection and testing, including

- witnessing of tests and
- hold points.

21.2.4 A schedule and programme for inspecting and testing the works shall be prepared.

21.2.5 Inspection and testing shall be undertaken in accordance with the inspection and testing plans, schedule and programme.

21.2.6 The *Project Manager* and *Supervisor* Should be notified a minimum ten (10) Working Days prior to any test or inspection taking place.

## 21.3 Technology Commissioning Plan

21.3.1 A Technology Commissioning Plan shall be prepared which includes the following

- commissioning programme and timescales,
- summary of the commissioning standards,
- key deliverables,
- key roles and commissioning responsibilities (RACI),
- summary of relevant Others,
- descriptions of the pre-commissioning and commissioning activities and stages,
- interdependencies between the commissioning of individual M&E Systems and items of Technology Equipment,
- operational confidence and integration testing,
- operational regime testing,
- decommissioning and removal of redundant M&E Systems and Technology Equipment,
- the Consent to Implement (CTI) process for Technology Equipment,
- the handover process for M&E Systems and Technology Equipment to the *Client* and
- operational and maintenance implications and
- any other M&E Systems and Technology Equipment testing and commissioning requirements for demonstrating compliance with the Scope.

21.3.2 The Technology Commissioning Plan shall include the *Supervisor's*, *Client's,* manufacturer's and relevant Others requirements for commissioning of M&E Systems and Technology Equipment.

21.3.3 Elements of the Technology Commissioning Plan that relate to Technology Equipment shall be prepared in accordance with the testing and commissioning philosophy and requirements of

- MCH 1980 'Process for Commissioning and Handover of Technology Schemes' [87] and
- GG 182 'Major Scheme Enabling Handover into Operations and Maintenance' [88].

21.3.4 The handover process for M&E Systems and Technology Equipment to the *Client* shall demonstrate that

- formal, robust governance is in place to control the transition into operation and maintenance of the assets,
- all key activities and associated approvals are defined and agreed prior to any element becoming operational,
- the *works* complies with the requirements of the Scope and
- the *works* can be handed over into operation and maintenance.

21.3.5 For Technology Equipment handover, the Consent to Implement (CTI) process shall be implemented in accordance with the requirements of GG 182 [88].

21.3.6 Testing and commissioning shall not be undertaken until the Technology Commissioning Plan has been accepted by the *Project Manager*.

## 21.4 Testing and Commissioning

### General

21.4.1 Throughout testing and commissioning, measures shall be implemented so that no danger is posed to other ongoing site activities or to others within the vicinity of the testing or commissioning activity.

21.4.2 During local and remote testing and commissioning, Road Users shall not be subjected to dangerous, misleading or inappropriate conditions / instructions.

21.4.3 Signage shall be deployed to inform Road Users

- that testing and commissioning is being undertaken and
- of the status (functionality) of the item undergoing testing and commissioning.

21.4.4 Where M&E Systems and Technology Equipment are provided for the use of Others, tests Should be witnessed by the relevant Others.

21.4.5 The completion of all FAT and SAT stages shall be witnessed.

21.4.6 The following remotely undertaken tests shall be attended

- all FAT at the *Client's* 3rd party provider and manufacturers' premises and
- all SAT at the *Client's* south west ROC.

21.4.7 Where testing and commissioning activities require remote operation of Stonehenge Tunnel M&E Systems and Technology Equipment, testing and commissioning shall be coordinated with the *Client* through the *Project Manager*.

21.4.8 A staged approach to testing and commissioning of M&E Systems and Technology Equipment shall be undertaken as outlined in Table 21-1 (Site Acceptance Tests (SAT)).

21.4.9 The *Client's* Software Maintenance Contractor's (SMC) shall not commence FAT of the Site Data until the *Project Manager* has been notified by the *Client's* Site Data Action Group (SDAG) that the commencement of FAT is authorised.

21.4.10 SAT of M&E Systems and Technology Equipment shall be completed in accordance with the manufacturer's requirements to

- confirm functionality,
- check, address and configure Software and
- verify information contained in the configuration plug.

21.4.11 Where testing and commissioning activities involve an interface with NRTS, testing and commissioning shall be coordinated with the *Client's* TSP.

21.4.12 Testing and commissioning of the average speed enforcement system to obtain Home Office Type Approval (HOTA) shall be undertaken and coordinated (as required).

## Testing and Commissioning – SAT 1 (Construction)

21.4.13 Prior to the commencement of SAT 1, M&E Systems and Technology Equipment required to undergo SAT 1 shall

- have the supporting infrastructure completed,
- be installed in its final configuration, using the permanent fixing systems,
- be powered by the permanent power supplies,
- have passed all FAT and
- have passed all installation inspections.

### Table 21-1 Site Acceptance Tests (SAT)

| SAT | Stage | Activity (Testing and Commissioning) | |
|---|---|---|---|
| | | M&E Systems | Technology Equipment |
| SAT 1 | Construction (Device functionality tests) | Local commissioning of Devices, including individual groups of Devices.<br>Factory and on-site testing of Devices. | Local commissioning, including individual groups of technology Devices.<br>Factory and on-site testing of Devices.<br>(NRTS installation and circuit provisioning ongoing in parallel at this stage). |
| SAT 2 | Asset Readiness (System performance tests) | Demonstration of individual system performance using local or manual control of the system. | Single or groups of Devices from the line communications controller (LCC) (or equivalent).<br>NRTS longitudinal cable network and circuits.<br>System site integration. |
| SAT 3 | Operational Regime Testing (Integration testing) | Demonstration of integrated M&E Systems and Technology Equipment<br>"End to end" testing of the whole system and tunnel asset:<br>• Using the TCMS from the TSB<br>• Using the TCMS from the Client's ROCs<br>• Testing the integration of the National TCMS and<br>• Complete testing of all the TCMS Services.<br>On-site integrating testing including:<br>• In station and associated site data,<br>• Complete NRTS circuits,<br>• Modules,<br>• Devices and<br>• Outstations and controllers.<br>Resolution of all operational critical issues. | |

## Testing and Commissioning – SAT 2 (Asset Readiness)

21.4.14 Prior to the commencement of SAT 2 for any individual M&E System or single or groups of Technology Equipment Devices, the following activities shall have been completed

- all SAT 1 activities for the system or device to be tested, including any supporting system or device,
- installation and commissioning of any local and longitudinal communications network between individual system components and
- confirmation that the NRTS transmission infrastructure has passed testing and is functional.

## Testing and Commissioning – SAT 3 (Operational Regime Testing)

21.4.15 The following Technology Equipment commissioning prerequisites shall be complied with before commissioning of Technology Equipment is undertaken

- SAT 1 and SAT 2 have been completed,
- the TCMS has had all vulnerabilities mitigated in accordance with the Remedial Action Plan,
- testing of NRTS transmission infrastructure has been completed by the *Client's* TPS and confirmed as functional,
- the NRTS circuits to the Modules and Devices have been activated,
- the required SDLs have been installed and the implementation has been confirmed as successful,
- all required changes, including new operator interface desks and control terminals, have been completed in the *Client's* south west ROC and
- the *Client's* south west ROC has reached operational readiness.

21.4.16 Technology Equipment commissioning shall not commence until the *Project Manager* has notified the *Contractor* that the Technology Equipment commissioning prerequisites have been complied with.

21.4.17 Operational regime testing of Stonehenge Tunnel shall include the following scenarios

- tunnel operation and contra-flow (signalling, queue protection and AID) to demonstrate the functionality of individual systems,
- normal tunnel operation with queue protection applied,
- closure of an individual lane,
- closure of a bore and the application of contraflow operation,
- closure of the tunnel and implementation of the diversionary route,
- operation during failure or isolation of individual components and systems and
- a full "black start" test in which the tunnel shall be started from a condition of having no electrical supply.

21.4.18 For each Stonehenge Tunnel operational regime testing scenario, the following shall be demonstrated

- that the tunnel asset can be placed into any operational mode from the operator interface of the TCMS at the TSB,
- that the tunnel cannot be placed into an unsafe operational mode,
- that individual M&E Systems, components or Technology Equipment can be taken out of operational use without impacting the tunnel,
- that automatic control of any M&E System or Technology Equipment can be overridden by manual intervention at the user interface of the TCMS at the TSB,
- that manual operation of M&E Systems and Technology Equipment (where required) is available,
- that the operational status and condition of all M&E Systems, components and Technology Equipment can be viewed from the operator interface of the TCMS at the TSB,
- that there is a reported change of status on the operator interface of the TCMS at the TSB when the tunnel operating mode is altered and when Device or Module is taken out of service,
- that alarms are displayed on the operator interface of the TCMS at the TSB,
- that systems can be reset remotely from the operator interface of the TCMS at the TSB and
- that the same functionality of the TCMS at the TSB is available using the TCMS located in the *Client's* ROCs.

## 21.5 Acceptance into Operation and Maintenance

21.5.1 The requirements contained in MCH 1349 'Technology Maintenance Instruction Operational and Maintenance Requirements for Technology Systems and Equipment' [89] and MCH 1399 'NMCS Maintenance Instruction Notification of a Change in Equipment Quantities for Maintenance' [90] shall be complied with prior to Completion of *section* 3.

21.5.1a Stonehenge Tunnel shall not be accepted into operation and maintenance until all testing and commissioning requirements have been complied with.

21.5.2 Prior to Completion of *section* 3, materials, training and handover to permit the *Client* to assume independent operational control of the *works* shall be provided and coordinated.

21.5.3 Materials and training on the operational control of the *works* shall be provided to personnel from

- the *Client*,
- the *Client's* representatives,
- those maintaining the M&E Systems and Technology Equipment,
- Emergency Services and
- the *Client's* TSP.

21.5.4 The following materials shall be provided

- user, reference and training manuals,
- original equipment manufacturer (OEM) user manuals,
- maintenance manuals and
- any additional documentation required to permit the *Client* to assume operational control of the *works*.

21.5.5 The following operational and training manuals for each component of the M&E Systems and Technology Equipment as well as an integrated manual shall be provided with procedures covering

- normal operating procedures,
- procedures and agreed mitigation to be applied when the MOR is breached or approaching a level where the MOR would be breached,
- response to emergency situations and alarms,
- incident detection system alarms,
- Plant alarms and failures and
- maintenance and renewal.

21.5.6 The following shall be determined from consultation with the *Client* and relevant Others

- the familiarisation requirements and
- the nominated personnel required to undertake training.

21.5.7 Training shall be tailored for the following groups

- management, supervisors and operators,
- installation, testing and commissioning personnel,
- maintenance personnel,
- Emergency Services personnel and
- other Stakeholder personnel.

21.5.8 Safe and effective training shall be provided to cover procedures and safe implementation of the following activities

- normal operation,
- maintenance,
- routine inspection,
- fault diagnosis and assessment and
- emergency operation.

21.5.9 Training shall be provided

- utilising a mixture of classroom and site-based components,
- at locations reflecting the nature of the training being delivered,
- which is convenient and accessible for those being trained and
- to maximise 'hands on' experience, which is identical, as far as is reasonably practicable, to that of the installed system.

21.5.10 Prior to, and throughout, the commissioning works, training shall be provided to personnel and operators.

21.5.11 A training programme shall be prepared for the *works* which identifies the

- elements of the M&E Systems and Technology Equipment that require training,
- proposed contents of the training,
- stage of the commission the training is to be undertaken,
- list of nominated personnel to attend training,
- intended purpose and outcomes of the training,
- time periods required and
- proposed location for the training.

21.5.12 Prior to Completion of *section* 3, accompanied orientation site visits shall be arranged and provided for personnel who are to be responsible for the operation, maintenance and incident response to

- become familiarised with the *works*,
- be shown the access arrangements and
- understand the safe maintenance and operation of the *works*.

21.5.13 Prior to Completion of *section* 3, a live emergency exercise shall be planned and undertaken in conjunction with the Emergency Services and relevant Others to confirm all emergency systems and Plant can be operated according to the defined emergency operation procedures.

# 22 Future Proofing Requirements

## 22.1 General

22.1.1 The *Client* may look to undertake future improvements to the new A303 to achieve an upgraded all-purpose trunk road complying with the requirements of GD 300 'Requirements for new and upgraded all-purpose trunk roads (Expressway)' [91].

22.1.2 The *works* shall be provided to facilitate future improvements of the new A303 to an upgraded all-purpose trunk road ("Future Infrastructure Requirements") by

- space-proofing Structures and highway infrastructure,
- space-proofing for Emergency Areas,
- provision of additional Technology Equipment and
- provision of additional capacity in the cabling infrastructure and the electrical power distribution network.

## 22.2 Road Restraint Systems

22.2.1 The *works* shall be space-proofed to enable future installation of RRS as protection to the additional provisions required to comply with the Future Infrastructure Requirements.

22.2.2 The space-proofing to enable the future installation of RRS shall assume a minimum working width class W4.

## 22.3 Emergency Areas

22.3.1 The works shall be space-proofed to enable future provision of Emergency Areas outside of Stonehenge Tunnel along the new A303.

22.3.2 The space-proofing to enable future provision of Emergency Areas shall assume they will be located at intervals not exceeding 1.6km.

## 22.4 Variable Message Signs and Indicators

22.4.1 The works shall provide the ducting (comms and power supply) to support the future provision of MS4 VMS at proposed future Emergency Area locations.

22.4.2 Ducting shall be positioned to not prevent the future provision of Emergency Areas and co-located MS4 VMS.

22.4.3 The *works* shall be provided such that two (2) VMSL zones within Stonehenge Tunnel can be established to enable speed limits to be changed.

## 22.5 Technology Equipment

22.5.1 The cabling infrastructure shall incorporate the provision for the upgrading and additional installation of telecommunications and power cabling to support the future Technology Equipment required for the implementation of the Future Infrastructure Requirements.

22.5.2 Technology Equipment cabinets shall be provided with spare unit capacity for future Technology Equipment required for the implementation of the Future Infrastructure Requirements.

22.5.3 The Technology Equipment design shall make provision for the future addition of

- traffic monitoring and vehicle detection systems,
- dynamic control of traffic during incidents and periods of congestion, including the use of VMSL,
- comprehensive CCTV surveillance for the new A303 between the *boundaries of the site*,
- CCTV surveillance of the Emergency Areas and
- EV charging points.

22.5.4 Technology Equipment shall be provided to support the *Client* with the delivery of

- electric fleet and maintenance vehicles,
- Connected and Autonomous Vehicle (CAV)[128] Services and
- Connected and Automated Mobility (CAM)[129] Services.

22.5.5 The requirements for CAV and CAM Services and additional EV charging points shall be

- determined in consultation with the *Client* and
- agreed with the *Project Manager*.

[128] CAV Services relate to the exchange of information and data with vehicles to complement other traffic management measures used to operate the strategic road network, e.g. In-vehicle message signs for warning of hazards and collection of data from vehicles e.g. vehicle type, speed etc.
[129] CAM Services relate to the exchange of information and data with vehicles to support wider mobility services such as availability of parking in a nearby town, distance to next EV charging point, and various infotainment services.

# 23 Utility Supplies

## 23.1 Electrical Supply

23.1.1 The Longbarrow construction compound electricity supply shall connect to the temporary electricity supply substation in the compound which is provided by SSE[130].

23.1.2 All Equipment (switchboards, distribution boards, breakers, cables etc.) to the Longbarrow construction compound from the busbar within the eleven (11) kV cable termination box[131] on the incoming SSE electrical supply substation shall be provided.

23.1.3 An eleven (11) kV switch house shall be provided adjacent to the SSE substation compound from which the electrical supply to the Longbarrow construction compound is to be distributed.

23.1.4 The connection between the SSE substation and the adjacent eleven (11) kV switch house in the Longbarrow construction compound shall be provided

- to SSE standards and
- under the supervision of an SSE authorised person.

23.1.5 All electrical supply cables to the Longbarrow construction compound shall be provided for maximum load conditions under an N-1 operating scenario.

23.1.6 The SSE substation in the Longbarrow construction compound shall be provided with

- an emergency power off (EPO) to trip the SSE substation eleven (11) kV metering circuit breakers (CB) and
- metering cabinets containing metering equipment.

23.1.7 Metering cabinets to the SSE substation in the Longbarrow construction compound Should be located within twenty (20) metres of the SSE substation[132].

23.1.8 The temporary SSE substation in the Longbarrow construction compound shall be decommissioned and removed.

## 23.2 Water Supply

23.2.1 The Longbarrow construction compound water supply shall connect to the incoming water supply to the compound provided by Wessex Water[133] prior to the *starting date*.

23.2.2 All Equipment (pipework, storage and M&E) to the Longbarrow construction compound downstream of the non-return valves on the incoming water supply shall be provided.

23.2.3 The incoming water supply from the connection to the water main at the B3083 shall be maintained until the water supply is adopted by Wessex Water on completion of *section* 3A.

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[130] Scottish & Southern Electric (SSE) are installing two (2) No. 11kV metering circuit breakers to provide a 30MVA supply to the Longbarrow construction compound.
[131] The SSE switchgear is configured to accept three (3) x 630mm$^2$ AL XLPE cables per phase.
[132] SSE have indicated that it is desirable to be within 20 meters of the substation to reduce the burden on the metering current transformers (CT).
[133] Wessex Water are terminating the incoming water supply to the Longbarrow construction compound at a chamber containing double non-return valves. The incoming water supply can provide water at a minimum flow rate of 5l/s. Prior to the non-return valve, additional chambers containing mechanical flow control and a flow meter will be provided. All chambers are approximately 1.2m x 0.9m and 1.5m deep. Typical details of water supply and storage tank provision are shown on drawing BO671-1300 (refer to the Data Room [17]).

23.2.4 Water storage shall be provided in the Longbarrow construction compound which has

- the capacity to maintain the water supply for 12 hours in the event of a disruption to the incoming water supply and
- a Type AA air gap [92].

23.2.5 Pumps provided to distribute the water supply around the Longbarrow construction compound shall maintain a net positive suction head during operation.

23.2.6 All water supply *works* and Equipment shall

- comply with Wessex Water's policy[134] for connections to their network and
- be provided to Wessex Water for review[135] prior to connection to their network.

[134] Refer to Wessex Water's 'Keeping your drinking water safe' Water Supply (Water Fittings) Regulations 1999 enforcement policy (refer to the Data Room [17]).
[135] In accordance with the Water Supply (Water Fittings) Regulations, 1999, Wessex Water's Water Regulation team review designs to satisfy themselves that the proposed system can connect to their network.

# 24 Departures

## 24.1 General

24.1.1 Departure applications required to provide the Authorised Development shall be submitted and approved in accordance with the *Client's* procedures[136,137].

24.1.2 The Departures shown in Table 24-1 (Fundamental Departures Summary) shall be obtained to Provide the Works[138].

24.1.3 The Departures shown in Table 24-2 (Non-Fundamental Departure Summary) may be required to be obtained to Provide the Works.

24.1.4 Departures on local roads (i.e. A360, existing A303 to Winterbourne Stoke and B3083) shown in Table 24-3 (Local Roads Departure Summary) may be required to be obtained from Wiltshire Council to Provide the Works.

### Table 24-1 Fundamental Departures Summary

| Departure ID / DAS Ref | Departure Title | DAS Criticality Scale |
|---|---|---|
| 100078 | A303 Mainline Eastbound, Countess, Combination K & SSD Relaxations | 5 |
| 100525 | A303 Mainline Eastbound, Countess, Vertical Curvature Departure | 5 |
| 100528 | A303 Mainline Eastbound, Countess, SSD Departure | 5 |
| 100529 | A303 Mainline Eastbound, Countess, SSD Departure | 5 |
| 100530 | A303 Mainline Eastbound, Countess, Horizontal Curvature Departure | 5 |
| 100574 | A303 Mainline Westbound, Countess, Combination K & SSD Relaxations | 5 |
| 100601 | A303 Mainline Eastbound, Countess Junction Merge, Weaving Length Departure | 5 |
| 100603 | A303 Mainline Westbound, Countess Junction, SSD Departure | 5 |
| 100604 | A303 Mainline Westbound, Countess Junction, SSD Departure | 5 |
| 100605 | A303 Mainline Westbound, Countess Junction Diverge, SSD Departure | 5 |
| 100606 | A303 Mainline Westbound, Countess, Horizontal Curvature Departure | 5 |
| 100607 | A303 Mainline Westbound, Countess Junction Westbound Diverge, Weaving Length Departure | 5 |
| 100608 | Countess Junction Westbound Diverge, SSD Departure | 5 |
| 100609 | Countess Junction Slip Roads, Cross Sections | 5 |
| 100850 | Cross Passages at 150m | 3 |
| 101959 | Stonehenge Tunnel: Use of Steel Fibres for the Reinforcement of Concrete – Materials | 4 |

[136] The *Client's* procedure for managing applications for Departures is given in the Departures Manual. DAS 3.0 is the database of Departures operated by the *Client*.
[137] Outline Departure records have been created within DAS 3.0 containing enough information to allow the *Client's* technical specialist to understand the scope, context and drivers for the Departure.
[138] Provisional agreement has been obtained for all fundamental Departures (i.e. those Departures with a DAS criticality category of 3 to 5).

| Departure ID / DAS Ref | Departure Title | DAS Criticality Scale |
|---|---|---|
| 101950 | Stonehenge Tunnel: Use of Steel Fibres for the Reinforcement of Concrete – Design | 4 |
| 102510 | Reduction in ventilation system design fire to account for the impact of FFFS | 3 |
| 102584 | Use of fibres for fire protection of concrete | 4 |

## Table 24-2 Non-Fundamental Departure Summary

| Departure ID / DAS Ref | Departure Title | DAS Criticality Scale |
|---|---|---|
| 101001 | A303 Mainline Eastbound, Lay-by Visibility Departure | 2 |
| 101002 | A303 Mainline Westbound, Junction Separation Departure | 2 |
| 101003 | A303 Mainline Westbound, lay-by situated between ADS and junction | 2 |
| 101005 | A303 Mainline westbound, Lay-by Visibility | 2 |
| 101006 | A303 Mainline Eastbound, Weaving Length between lay-by and junction | 2 |
| 101009 | A303 Mainline Eastbound, Weaving Length between Lay-by and Countess Diverge | 2 |
| 101010 | A303 Mainline Eastbound, Lay-by situated between ADS and Diverge | 2 |
| 101011 | A303 Mainline Westbound, Weaving Length between Lay-by and Countess Merge | 2 |

## Table 24-3 Local Roads Departure Summary

| Departure ID / DAS Ref | Departure Title | DAS Criticality Scale |
|---|---|---|
| 101012 | A360 North Link northbound, Combination of SSD and K relaxations | 0 |
| 101026 | A360 North Link southbound, K relaxation on approach to junction | 0 |
| 101027 | A360 South Link southbound, combination of relaxations to horizontal curve and SSD | 0 |
| 101035 | A360 South Link southbound, SSD relaxation on approach to junction | 0 |
| 101036 | Link to existing A303 westbound, SSD relaxation on approach to junction | 0 |
| 101037 | B3083 southbound, crest K relaxation on approach to junction | 0 |
| 101038 | B3083 Southbound, SSD relaxation on approach to junction | 0 |
| 101039 | B3083 Northbound and Southbound, combination of SSD and Crest K relaxations | 0 |
| 101040 | B3083 Northbound and Southbound, 3 step relaxation to SSD | 0 |
| 101041 | B3083 non-standard cross section | 0 |

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