A303 Sparkford to Ilchester Dualling Scheme TR010036

6.3 Environmental Statement

Appendix 13.1 Carbon Assessment Report

APFP Regulation 5(2)(a)
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The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

A303 Sparkford to Ilchester Dualling Scheme

Development Consent Order 201[X]

6.3 Environmental Statement
Appendix 13.1 Carbon Assessment Report

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Table of Contents

Executive summary

A carbon assessment has been undertaken for the A303 Sparkford to Ilchester Dualling scheme (hereafter referred to as 'the scheme'). This assessment provides an estimate of the expected Greenhouse Gas (GHG) emissions (known commonly as carbon emissions and measured in tonnes of carbon dioxide equivalent (tCO_2e)) from the construction and operation of the scheme.

This report details the use of the Mott MacDonald Carbon Portal in assessing the GHGs associated with the scheme. The assessment has taken into account the direct and indirect emissions of GHGs as a result of the construction of the scheme. This includes direct emissions from construction plant and machinery, as well as indirect emissions from the embodied carbon content of the materials.

This assessment does not include emissions from vehicles during the operational phase. These are considered within Chapter 13 Climate, Volume 6.1. The quantities of materials have been obtained based on the scheme description contained within Chapter 2 The Scheme of Volume 6.1, with relevant assumptions made where information has not been available.

This carbon assessment shows the largest contributor of carbon emissions to be from highways construction at 5,161tCO_2e and 50.5% of total carbon emissions.

The results from the Mott MacDonald Carbon Portal total carbon emissions were 10,414tCO_2e. The methodology is presented in the report below.

1 Introduction

1.1 Overview of the scheme

Existing route corridor

1.1.1 The A303 forms part of Highways England's Strategic Road Network (SRN) and a strategic link between the south west and the rest of the south, south-east and London. The route comprises multiple road standards, including dual carriageway, single carriageway and single carriageway sections with overtaking lanes. Speed limits also vary between 40 miles per hour and 70 miles per hour, depending on the character of the road and its surroundings.

Existing road

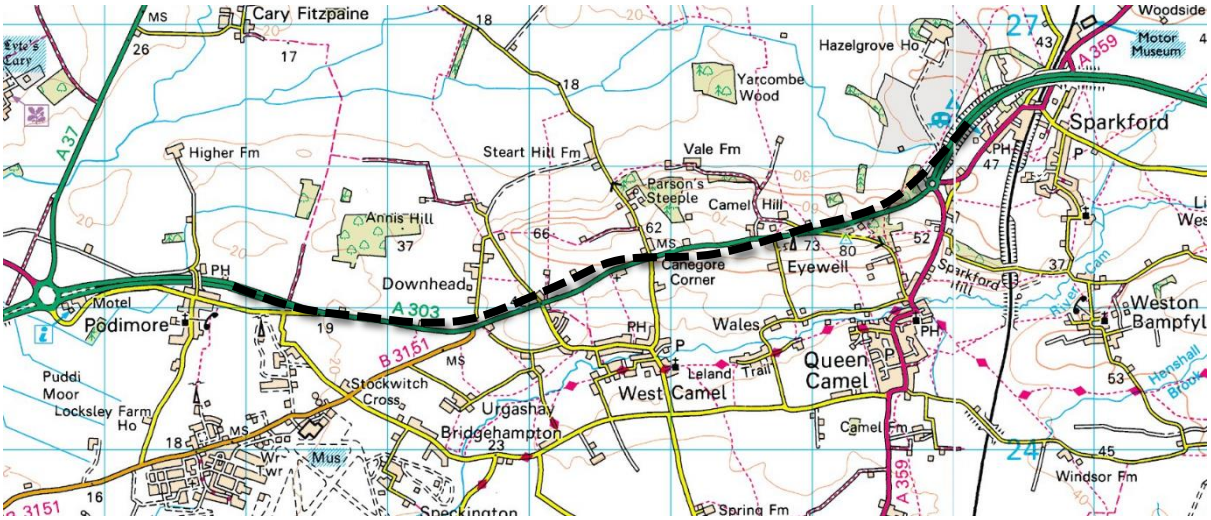
1.1.2 The section of the A303 that is being upgraded as part of this scheme commences at the eastern limits of the existing dual carriageway, the Podimore Bypass. Travelling east, the corridor reaches the junction with the B3151 before bearing north east and rising upwards through Canegore Corner to reach the crest of Camel Hill at Eyewell. This section of the corridor is characterised by a single lane road, with double white lines negating overtaking and subject to a 50 miles per hour speed limit. There are several priority junctions along the route giving access to the settlements of Queen Camel and West Camel to the south and Downhead to the north, as well as several farm accesses and parking laybys.

1.1.3 From the crest of Camel Hill, the corridor descends to meet the roundabout at the western limit of the dual carriageway Sparkford Bypass (Hazlegrove Roundabout). This section comprises 2 lanes in the westbound direction, 1 lane in the eastbound direction and is also subject to a 50 miles per hour speed limit. Hazlegrove Roundabout forms a junction between the A303 and the A359 which runs south through Queen Camel and north-east through Sparkford. The roundabout also provides access to a service station, and to a school at Hazlegrove House.

1.1.4 The section of the A303 that is to be upgraded is almost 3.5 miles, or approximately 5.6 kilometres long.

1.1.5 The extents of the scheme are illustrated in Figure 1.1 below. Figure 2.1 of Volume 6.2 shows the proposed red line boundary for the scheme.

Figure 1.1: Scheme extents



Source: Mott MacDonald Sweco Joint Venture

Scheme proposals

1.1.6 The proposed scheme is to provide a continuous dual-carriageway linking the Podimore Bypass and the Sparkford Bypass. The scheme would involve the removal of at-grade junctions and direct accesses. The Hazlegrove Junction would be constructed to grade-separated standards and Downhead Junction and Camel Cross Junction would be constructed to compact grade-separated standards, as illustrated on Figure 2.3 General Arrangement Plans, contained in Volume 6.2.

1.1.7 A detailed description of the scheme is provided within Chapter 2 of the Environmental Statement, Volume 6.1.

1.2 Scope of the report

1.2.1 This report forms a technical appendix to Chapter 13 Climate (Volume 6.1) of the Environmental Statement for the A303 Sparkford to Ilchester Dualling scheme (hereafter referred to as 'the scheme').

1.2.2 Quantification of the Greenhouse Gas (GHG) emissions associated with the scheme has been undertaken using the Mott MacDonald Carbon Portal and the Highways England Carbon Tool[1] (version 1.03). It has been completed based on information available at the current stage of development (refer to Chapter 2 The Scheme of Volume 6.1 of the ES) with assumptions and calculations made where necessary.

[1] Highways England (2018) Carbon Tool [online] available at: https://www.gov.uk/government/publications/carbon-tool (last accessed May 2018).

1.2.3 Various activities during construction of the scheme would have GHG emissions associated with them. In addition to construction materials, other sources of GHG emissions include energy consumption on site, waste and transportation.

1.2.4 GHG emissions from construction are classified as direct or indirect. Direct emissions arise from activities such as the use of energy or water in construction. Indirect emissions are those associated with the production of construction materials (including mining and processing of raw materials into construction products), known as the embodied carbon content of materials.

1.2.5 GHG reporting has been presented as mass of carbon dioxide equivalent (CO_2e). This is a comparable measure that allows for the consideration of 6 key GHGs all expressed in terms of their equivalent global warming potential in mass of CO_2. These 6 key GHGs are:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)
- Sulphur hexafluoride (SF6)

2 Methodology

2.1.1 The collected data comprised estimates of material types and quantities that would be used for the construction. This data is used as inputs to the Mott MacDonald Carbon Portal in order to generate an initial estimate of the carbon footprint.

2.1.2 The Greenhouse Gas (GHG) emissions for the scheme were sub-divided into the different series of works to be undertaken and were assessed by scope and construction material providing the required measurement unit and the item CO_2e value. The quantities of materials were based on the scheme design as described within Chapter 2 The Scheme, Volume 6.1.

2.1.3 The series of works assessed under the Highways: Major Works MMHW4 database of the Mott MacDonald Carbon Portal are:

- Site clearance
- Road restraint systems
- Drainage and service ducts
- Earthworks
- Pavement
- Kerbs, channels and footways
- Road lighting columns
- Structural concrete
- Steelwork for structures
- Fencing
- Road markings
- Traffic signs

2.1.4 The assessment has been defined in terms of lifecycle stages, as detailed in Section 7 of PAS2080:2016[2/3]. The stages which have been included and why for each tool have been listed below in Table 2.1 below.

Table 2.1: Life cycle stages scoped in to the assessment

Life Cycle Stage	Mott MacDonald Carbon Portal
A1-3 Products and materials	Yes
A5 Construction/ installation process	Yes, as the tool uses CESMM4 which has plant included in the emission factors.
B6 Operational energy use	Yes, energy usage from the lighting columns

[2] PAS 2080 sets out a common approach and understanding of whole life carbon management in the provision of economic infrastructure as a result of the commissioned Infrastructure Carbon Review.
[3] BSI (2016) PAS 2080: *Carbon management in infrastructure* [online] available at: https://shop.bsigroup.com/ProductDetail?pid=000000000030323493 (last accessed June 2018)

2.1.5 It is anticipated that the following lifecycle stages will be excluded from the assessment, on the basis that these stages would be minimal / negligible, the data is unavailable, or not applicable to the scheme:

- Preliminary studies and consultations (A0)
- Transport to construction site (A4) - transportation of construction materials to site
- Construction waste transportation and construction waste off-site processing (A5)
- Use (for example direct operational emissions) (B1)
- Maintenance, repair, replacement and refurbishment (B2-5) - replacement cycles
- Operational water use (B7)
- Other operational processes (B8)
- End of life stages (for example deconstruction, transport, waste processing for recovery and disposal) (C1-4)
- Benefits and loads beyond the system boundary (D) - predicted effects on traffic on the surrounding road network.

3 Key Assumptions

3.1.1 The following assumptions and estimation of quantities are of relevance to this assessment:

- The material quantities obtained from the design information were based on the units for the assessed item in the Mott MacDonald Carbon Portal.
- Items without a direct match in the Mott MacDonald Carbon Portal were assessed using similar items.
- The area covered by the scheme was measured using the MX model.
- The road restraint system to be provided in the central reserve is a concrete barrier assumed to have a working width of W2 and containment class of H2 for the full length of the route. Steel barriers have been specified in the MX model with containment class H2/N2 and an assumed working width of W2 as per emerging expressway standards. Lengths of parapets for new bridges within the scheme have been included within the MX model.
- The drainage system has been specified in the Drainage Strategy Report (Appendix 4.7 of Volume 6.3). This included pipework and manholes for the mainline and local roads, concrete and grass channels, and culverts.
- For the cut and fill volumes it has been assumed that 5% of all excavation would be unacceptable with regards to re-use and would therefore require removal. This assumption is based on professional judgement and experience on other schemes of this scale and nature. The total excavation and fill volumes have not been balanced resulting in a volume of 43,000m^3 in surplus materials being required to be removed. All fill material has been assumed as site won.
- Pavement design information was not available during completion of this carbon assessment. Pavement volumes have been assumed utilising the scheme length, a 20 millimetre surface course, 45 millimetre binder source, 150 millimetre dry bound macadam base course, and Type 1 granular fill sub-base.
- The length of lighting columns was taken as the overall average between the 85 columns proposed for the scheme. Energy usage per year has been assumed considering 87W per column and a 12 hour usage per day; this equates to 32,390.1kWh per year. Enabling ducts and chambers were also provided within the specification.

4 Results

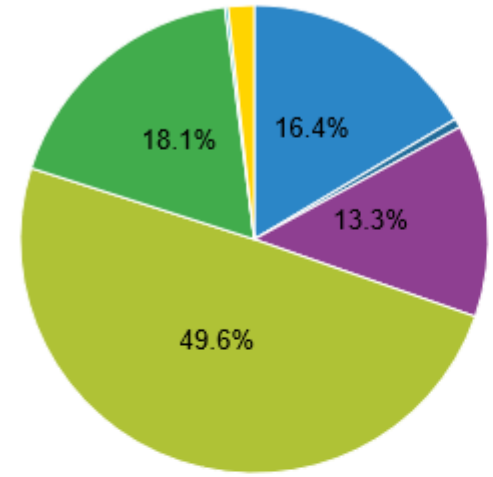
Mott MacDonald Carbon Tool

4.1.1 Based on the provided and estimated quantities, the following findings as detailed in Figures 4.2 and 4.3 have been obtained from the carbon calculations performed with the Carbon Portal:

- The total carbon emissions are calculated to be 10,414tCO_2e;
- The greatest source of carbon emissions are calculated to be from the highways construction, estimated to be at 5,161tCO_2e and 49.6% of the total GHG emissions;
- A substantial amount of GHG emissions are associated with drainage and structural constructions, with 16.4% and 18.1% of the total carbon emissions respectively;
- The greatest source of GHG emissions by material are calculated to be concrete and aggregates. These show carbon emissions of 3,910tCO_2e and 3,314tCO_2e and 43% and 37% of total carbon emissions respectively.
- Operational energy (lifecycle stage B6) calculated from lighting column usage is calculated to contribute 4.2 tCO_2e per year.

Figure 4.2: Carbon Portal output of CO_2e emission by series of work

Total 10,414,165.3 $kgCO_2e$

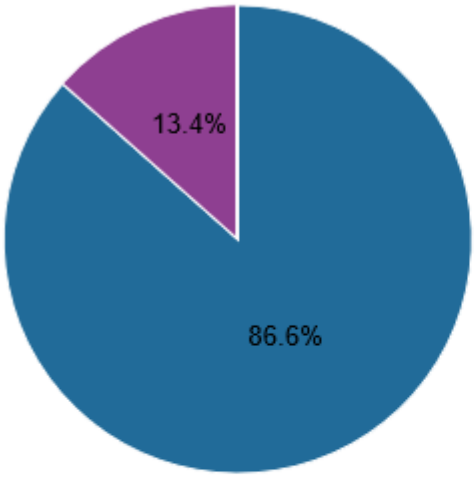


Drainage	1710676.8 $kgCO_2e$	16.4%
Lighting	65050.2 $kgCO_2e$	0.6%
Earthworks	1385531.6 $kgCO_2e$	13.3%
Highways	5161253.7 $kgCO_2e$	49.6%
Structures	1882002.9 $kgCO_2e$	18.1%
Site clearance	24354.7 $kgCO_2e$	0.2%
Misc.	185295.5 $kgCO_2e$	1.8%

Source: Mott MacDonald Carbon Portal

Figure 4.3: Carbon Portal Output of CO_2e emission by scope

Total 10,414,165.3 $kgCO_2e$



Not specified	0.0 $kgCO_2e$	0.0%
Construction Materials	9013949.0 $kgCO_2e$	86.6%
Construction Plant	1395989.3 $kgCO_2e$	13.4%
Construction Transport	0.0 $kgCO_2e$	0.0%
Operational Energy	4227.0 $kgCO_2e$	0.0%

Source: Mott MacDonald Carbon Portal

5 Conclusion

5.1.1 Overall the carbon emissions for the scheme estimated at 10,414tCO_2e using the Mott MacDonald Carbon Portal.

5.1.2 Both methods have highlighted that the highway and structures are the largest contributor.

5.1.3 Having undertaken the Carbon Portal at each of the stages of design has enabled for hotspots in the deigns to be identified and targeted, enabling carbon to be reduced or minimised where possible.