

# HIGH SPEED RAIL (LONDON - WEST MIDLANDS)

## Supplementary Environmental Statement 4 and Additional Provision 5 Environmental Statement

Volume 5 | Technical appendices

Summary of carbon calculation outputs  
(CL-002-000)

December 2015

SES4 and AP5 ES 3.5.1.1



# HIGH SPEED RAIL (LONDON - WEST MIDLANDS)

Supplementary Environmental Statement 4 and  
Additional Provision 5 Environmental Statement

Volume 5 | Technical appendices

Summary of carbon calculation outputs  
(CL-002-000)

December 2015

SES4 and AP5 ES 3.5.1.1



Department  
for Transport

High Speed Two (HS2) Limited has been tasked by the Department for Transport (DfT) with managing the delivery of a new national high speed rail network. It is a non-departmental public body wholly owned by the DfT.

A report prepared for High Speed Two (HS2) Limited:

**AECOM**

**ARUP**

**ATKINS**

**CAPITA**



**ineco**



**PARSONS  
BRINCKERHOFF**



High Speed Two (HS2) Limited,  
One Canada Square,  
London  
E14 5AB

Details of how to obtain further copies are available from HS2 Ltd.

Telephone: 020 7944 4908

General email enquiries: [HS2enquiries@hs2.org.uk](mailto:HS2enquiries@hs2.org.uk)

Website: [www.gov.uk/hs2](http://www.gov.uk/hs2)

Copyright © High Speed Two (HS2) Limited, 2015, except where otherwise stated.

High Speed Two (HS2) Limited has actively considered the needs of blind and partially sighted people in accessing this document. The text will be made available in full via the HS2 website. The text may be freely downloaded and translated by individuals or organisations for conversion into other accessible formats. If you have other needs in this regard please contact High Speed Two (HS2) Limited.



Printed in Great Britain on paper  
containing at least 75% recycled fibre.

SES4 and AP5 ES Appendix CL-002-000

Environmental topic	Climate	CL
Appendix name	Summary of carbon calculation outputs	002
Community forum area	Route-wide	000



# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
<b>2</b>	<b>Description of the scoping assessment</b>	<b>1</b>
<b>3</b>	<b>Scoping exercise results</b>	<b>2</b>

## List of tables

Table 1:	SES <sub>4</sub> results from the quantitative element of the scoping exercise	3
Table 2:	The SES <sub>4</sub> qualitative aspect of the scoping exercise, along with justification text as to whether the amendment(s) are material, and final scoping results.	5
Table 3:	AP <sub>5</sub> results from the quantitative element of the scoping exercise.	7
Table 4:	The AP <sub>5</sub> qualitative aspect of the scoping exercise, along with justification text as to whether the amendment(s) are material, and final scoping results	9



# 1 Introduction

- 1.1.1 This appendix provides an update to Appendix CL-002-000 from the Supplementary Environmental Statement 2 (SES2) and the Additional Provision 3 Environmental Statement (AP3) as a result of design changes and amendments assessed as part of the Supplementary Environmental Statement 4 (SES4) and the Additional Provision 5 Environmental Statement (AP5 ES). This update should be read in conjunction with both the main ES and the SES2 and AP3 ES Appendix CL-002-000.

# 2 Description of the scoping assessment

- 2.1.1 A process was developed to identify which of the SES4 design changes and AP5 amendments could be material<sup>1</sup> from a greenhouse gas (GHG) emissions perspective in comparison to the updated carbon footprint reported in Part 1 of the Volume 3 SES2 and AP3 ES. The carbon footprint reported in Part 1 of the Volume 3 SES2 and AP3 ES is regarded as the baseline scheme as it materially changed the carbon footprint reported in the main ES. The assessment process comprised the following steps:

1. establish the percentage of construction elements<sup>2</sup>, by type, under the carbon footprint reported in Part 1 of the Volume 3 SES2 and AP3 ES that are altered (i.e. a modification in design, a completely new addition or removal of a construction element) by the SES4 design changes or AP5 amendments. For example, there were 180 bridges reported in Part 1 of the Volume 3 SES2 and AP3 ES of which two are affected by the AP5 revised scheme, thus comprising 1% of the total of bridge-related elements;
2. estimate the potential for the SES4 design changes and AP5 amendments to influence the total construction or operational carbon footprint reported in Part 1 of the Volume 3 SES2 and AP3 ES based on the average contribution of the relevant construction elements. Where amendments and/or design changes are considered to exceed 1% of the construction carbon footprint; they have been identified as potentially material; and
3. review each SES4 design change and AP5 amendment to understand each change from a qualitative perspective. For example, the realignment of construction elements, such as the Birmingham International People Mover (AP5-024-001), result in a small extension to infrastructure but are not however considered to be material to the carbon footprint.

---

<sup>1</sup> 'Material' in this context refers to changes in the design and construction of the HS2 scheme that are considered to be large enough to materially alter (increase or decrease) the scheme's total construction GHG emissions.

<sup>2</sup> Construction elements refers to elements that make up the HS2 scheme such as bridges, viaducts, roads, tunnels, track, stations etc.

2.1.2 Using the three-stage process listed in paragraph 2.1.1 it was determined whether an amendment or design change was either:

- non-material: represents a situation where the presumed GHG emissions impact of the design change or amendment is considered negligible and updating the carbon footprint for this element is not necessary (i.e. it is not necessary to update the carbon footprint as reported in Part 1 of the Volume 3 SES<sub>2</sub> and AP<sub>3</sub> as a result of the amendment and/or design change); or
- potentially material: represents a situation where, for a single construction element (i.e. a bridge) or a combination of similar construction elements (i.e. a group of bridges), the GHG emissions impact of the SES<sub>4</sub> design changes or AP<sub>5</sub> amendments are considered potentially material and that updating the carbon footprint of this construction element is necessary.

### 3 Scoping exercise results

3.1.1 Table 1 and Table 2 present the SES<sub>4</sub> scoping exercise results. None of SES<sub>4</sub> design changes were considered to have a material impact in comparison to the carbon footprint reported in Part 1 of the Volume 3 SES<sub>2</sub> and AP<sub>3</sub> ES, and therefore do not require any further analysis.

3.1.2 Table 3 and Table 4 present the AP<sub>5</sub> scoping exercise results. The scoping exercise concluded that none of the AP<sub>5</sub> amendments would have a material impact on the carbon footprint reported in Part 1 of the Volume 3 SES<sub>2</sub> and AP<sub>3</sub> ES, and therefore do not require any further analysis.

Table 1: SES4 results from the quantitative element of the scoping exercise

Construction element types	Part 1 of the Volume 3 SES2 and AP3 ES - number of construction elements <sup>3</sup>	Part 1 of the Volume 3 SES2 and AP3 ES - carbon contribution (%) by construction element type	Number of SES4-related changes, by construction element	SES4- related changes as a proportion (%) of Part 1 of the Volume 3 SES2 and AP3 ES construction elements type	Estimated carbon emissions (tCO2e) per Part 1 of the Volume 3 SES2 and AP3 ES construction element type	Estimated carbon emissions (tCO2e) of SES4-related changes	SES4-related changes in carbon emissions as a % of total construction emissions
Earthworks	-	9.2%	-	-	-	-	-
Demolition	109	0.2%	-	-	-	-	-
Construction waste	184	0.2%	-	-	-	-	-
Land use, land-use change and forestry (LULUCF) <sup>4</sup>	-	1.6%	-	see footnote	see footnote	see footnote	see footnote
Bridges	180	2.6%	-	-	-	-	-
Viaducts	59	8.7%	-	-	-	-	-
Roads	118	1.7%	-	-	-	-	-
Retaining walls	17	1.6%	-	-	-	-	-
Cuttings	31	1.8%	-	-	-	-	-
Embankments	41	0.1%	-	-	-	-	-
Tunnels and dive-under <sup>5</sup>	35	19.0%	-	see footnote	see footnote	2,300	0.04%
Tunnel boring machine (TBM)	-	4.0%	-	-	-	-	-

<sup>3</sup> The number of construction elements listed here represent those described in the main ES plus the changes identified as material during the Part 1 of the Volume 3 SES2 and AP3 ES scoping exercise.

<sup>4</sup> Carbon emissions associated with land use, land-use change and forestry (LULUCF) is estimated for the purposes of this scoping assessment on the basis of land area rather than number of construction elements.

<sup>5</sup> Tunnel and dive-under construction emissions were estimated per metre of construction, assuming a direct correlation between tunnel length and construction emissions, rather than per tunnel as lengths varied significantly.

Construction element types	Part 1 of the Volume 3 SES2 and AP3 ES - number of construction elements <sup>3</sup>	Part 1 of the Volume 3 SES2 and AP3 ES - carbon contribution (%) by construction element type	Number of SES4-related changes, by construction element	SES4- related changes as a proportion (%) of Part 1 of the Volume 3 SES2 and AP3 ES construction elements type	Estimated carbon emissions (tCO2e) per Part 1 of the Volume 3 SES2 and AP3 ES construction element type	Estimated carbon emissions (tCO2e) of SES4-related changes	SES4-related changes in carbon emissions as a % of total construction emissions
Stations/ interchanges	2	10.8%	-	-	-	-	-
Depots	2	0.1%	-	-	-	-	-
People mover	1	0.1%	-	-	-	-	-
Track	1	17.4%	-	-	-	-	-
Rolling stock (life span 35 years)	-	3.6%	-	-	-	-	-
Other (pylon demolition)	119	17.4%	-	-	-	-	-
Mitigation <sup>6</sup>	-	0.0%	-	see footnote	see footnote	see footnote	see footnote

<sup>6</sup> Noise mitigation measures along the route are not considered to be material along the length of the route in terms of carbon emissions.

Table 2: The SES4 qualitative aspect of the scoping exercise, along with justification text as to whether the amendment(s) are material, and final scoping results.

Construction element types	Justification text	Scoping result
Earthworks	-	-
Demolition	-	-
Construction waste	-	-
LULUCF	-	-
Bridges	-	-
Viaducts	-	-
Roads	-	-
Retaining walls	-	-
Cuttings	-	-
Embankments	-	-
Tunnels and dive-under	One of the noise mitigation measures being proposed at Wendover (SES4-010-001) is the extension of the Wendover green tunnel by 100m. The total tunnel length for the Part 1 of the Volume 3 SES2 and AP3 ES is 53,903m. The extension of the Wendover green tunnel represents a 0.18% increase in total tunnel/portal length. Assuming a direct correlation between tunnel length and construction emissions, this design change would result in an addition of approximately 2,300 tCO <sub>2</sub> e, equivalent to a 0.04% increase in the scheme's overall construction GHG emissions	Non-material impact
TBM	-	-
Stations/ interchanges	-	-
Depots	-	-
People mover	-	-
Track	-	-

Construction element types	Justification text	Scoping result
Rolling stock (life span 35 years)	-	-
Other	The noise mitigation measures proposed at Wendover (SES4-010-001) will result in the demolition of an electricity pylon and construction of a new pylon 60m south of the original location. The works leading to a change in pylon location are not considered material.	Non-material impact
Mitigation	It is proposed to increase the size of noise barriers at Wendover (SES4-010-001) and Chetwode (SES4-013-001). These enhanced mitigation works are not considered material.	Non-material impact

Table 3: AP5 results from the quantitative element of the scoping exercise.

Construction element types	Part 1 of the Volume 3 SES2 and AP3 ES - number of construction elements <sup>7</sup>	Part 1 of the Volume 3 SES2 and AP3 ES - carbon contribution (%) by construction element type	Number of AP5-related changes, by construction element	AP5- related changes as a proportion (%) of Part 1 of the Volume 3 SES2 and AP3 ES construction elements type	Estimated carbon emissions (tCO2e) per SES2 construction element type	Estimated carbon emissions (tCO2e) of AP5 - related changes	AP5-related changes in carbon emissions as a % of total construction emissions
Earthworks	-	9.2%	-	-	-	-	-
Demolition	109	0.2%	-	-	-	-	-
Construction waste	184	0.2%	-	-	-	-	-
LULUCF <sup>8</sup>	-	1.6%	10	see footnote	see footnote	see footnote	see footnote
Bridges <sup>9</sup>	180	2.6%	2	see footnote	see footnote	see footnote	see footnote
Viaducts	59	8.7%	-	-	-	-	-
Roads	118	1.7%	-	-	-	-	-
Retaining walls	17	1.6%	-	-	-	-	-
Cuttings	31	1.8%	-	-	-	-	-
Embankments	41	0.1%	-	-	-	-	-
Tunnels & dive-under	35	19.0%	-	-	-	-	-
TBM	-	4.0%	-	-	-	-	-
Stations/ interchanges	2	10.8%	-	-	-	-	-
Depots	2	0.1%	-	-	-	-	-

<sup>7</sup> The number of construction elements listed here represent those described in the main ES plus the changes identified as material during the Part 1 of the Volume 3 SES2 and AP3 ES scoping exercise.

<sup>8</sup> Carbon emissions associated with land use, land-use change and forestry (LULUCF) is estimated for the purposes of this scoping assessment on the basis of land area rather than number of construction elements.

<sup>9</sup> No new bridge is being proposed. One is an upgrade from a brideway to an accommodation bridge, whilst the second change is an extension to an existing footbridge, both are considered to be non-material.

Construction element types	Part 1 of the Volume 3 SES2 and AP3 ES - number of construction elements <sup>7</sup>	Part 1 of the Volume 3 SES2 and AP3 ES - carbon contribution (%) by construction element type	Number of AP5-related changes, by construction element	AP5- related changes as a proportion (%) of Part 1 of the Volume 3 SES2 and AP3 ES construction elements type	Estimated carbon emissions (tCO2e) per SES2 construction element type	Estimated carbon emissions (tCO2e) of AP5 - related changes	AP5-related changes in carbon emissions as a % of total construction emissions
People mover	1	0.1%	-	-	-	-	-
Track	1	17.4%	-	-	-	-	-
Rolling stock (life span 35 years)	-	3.6%	-	-	-	-	-
Other <sup>10</sup>	119	17.4%	2	see footnote	see footnote	see footnote	see footnote
Mitigation (tree planting)	-	0.0%	-	-	-	-	-

<sup>10</sup> These two 'other' changes relate to the realignment of a bridleway and the Birmingham International People Mover, both are considered to be non-material as no new construction is being proposed.

Table 4: The AP5 qualitative aspect of the scoping exercise, along with justification text as to whether the amendment(s) are material, and final scoping results

Construction element types	Justification text	Scoping result
Earthworks	-	-
Demolition	-	-
Construction waste	-	-
LULUCF	There are 10 instances where additional land rights are required, of which 7 relate to utility companies requiring land for winching purposes or cable connections. The land use requirement in this case is temporary with no actual change to the land use type, and thus no impact in terms of GHG emissions. Additional land is also needed at the following sites: at the pharmaceutical research facility (AP5-006-001) to relocate the car park, and for the re-alignment of the Birmingham People Mover (AP5-024-001). Total land use related emissions account for 1.6% of the total construction GHG emissions described in Part 1 of the Volume 3 SES2 and AP3 ES.	Non-material impact
Bridges	There are two bridge related changes being proposed. One is an upgrade of a bridleway bridge to an accommodation bridge at the Bucks Head Farm (AP5-021-002). This is a slight extension in size to the original bridleway bridge so that it can accommodate vehicles, thus the change in GHG emissions is considered minor. The second change is an extension to a footbridge at Birmingham International Station (AP5-024-001). Again this is a slight increase in size of the existing structure, rather than a new structural element. There are 180 bridge elements along the entire scheme accounting for 2.6% of total construction emissions.	Non-material impact
Viaducts	-	-
Roads	-	-
Retaining walls	-	-
Cuttings	-	-
Embankments	-	-
Tunnels and dive-under	-	-
TBM	-	-
Stations/ interchanges	-	-
Depots	-	-
People mover	-	-

Construction element types	Justification text	Scoping result
Track	-	-
Rolling stock (life span 35 years)	-	-
Other	<p>There are 2 'other' elements. The first relates to a bridleway (DEN/3 Ricks 002, AP5-007-002) where an alternative alignment is being proposed resulting in no new construction. The second change relates to the Birmingham International People Mover (AP5-024-001) where a realignment is being proposed, and the relocation of the Birmingham International stop. No new construction is being proposed. The People Mover construction emissions were estimated at a little over 6,000 tCO<sub>2</sub>e under Part 1 of the Volume 3 SES<sub>2</sub> and AP<sub>3</sub> ES. Construction emissions are estimated as 12,000 tCO<sub>2</sub>e, which is a 0.19% increase in construction emissions over those described for the Part 1 of the Volume 3 SES<sub>2</sub> and AP<sub>3</sub> ES.</p>	Non-material impact
Mitigation (tree planting)	-	-

**High Speed Two (HS2) Limited**

One Canada Square  
London E14 5AB

**T** 020 7944 4908

**E** [hs2enquiries@hs2.org.uk](mailto:hs2enquiries@hs2.org.uk)

A11