Greater Cambridge Partnership

CAMBOURNE TO CAMBRIDGE

Technical Report 06 – Greenhouse Gasses

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1 INTRODUCTION AND SUMMARY

1.1.1. This Technical Report outlines the outcome of the assessment of likely significant environmental effects arising from the Cambourne to Cambridge (C2C) Scheme on Climate - Greenhouse Gases (GHG). Impacts from the construction and operational phases of the C2C Scheme have been assessed.

1.1.2. The C2C Scheme will include a 13.6km long mainly dedicated busway connecting Cambourne in the west with Cambridge in the east. A service road and maintenance track, to be used as an active travel path, will run alongside the segregated sections of busway. The C2C Scheme will use hybrid vehicles (and in due course, electric vehicles), providing a service of around 10 buses per hour each way. The Scotland Farm travel hub (a park and ride facility) will be situated along the route, just north of the A428, approximately 5km west of Cambridge. Further details about the Scheme proposal are set out in Chapter 3 of the ES[1].

1.1.3. This Technical Report is intended to be read as part of the wider ES with particular reference to the following topic specific technical reports:

- **Technical Report 2: Air Quality**
- **Technical Report 3: Climate Resilience**
- **Technical Report 5: Ecology**
- **Technical Report 8: Landscape**
- **Technical Report 10: Materials and Waste**
- **Technical Report 12: Traffic and Transport**

1.1.4. This Technical Report:

- Describes the methodology followed for the assessment;
- Identifies the potential impacts as a result of the Proposed Scheme;
- Details the design, mitigation and enhancement measures that have been so far identified, and the effectiveness and certainty with which they are expected to be applied;
- Reports the assessment of the significant environmental effects of the Proposed Scheme; and
- Details the monitoring that should be carried out for the Proposed Scheme.

1.1.5. The Proposed Scheme has the potential to affect GHG as a result of:

- Construction stage e.g. embodied emissions associated with materials, transport of materials to site and waste/arisings from site, and the construction process; and
- Operation stage e.g., operation of lighting and controls, maintenance and replacement of original materials, as well as emissions (or avoided emissions) from end-user vehicles.

[1] Environmental Statement (Document reference: C2C-10-00-Environmental Statement (Volume 1)).

2 BASELINE ENVIRONMENT

2.1.1. This section describes the materials consumed, and waste generated and disposed of, by the current use (the baseline) of the C2C Scheme; this information provides the context in which an assessment of environmental impacts and significant effects can be undertaken.

2.2 EXISTING BASELINE

2.2.1. In the baseline (Do Minimum) scenario, GHG emissions occur constantly and widely as a result of human and natural activity including energy consumption (fuel, power), industrial processes, land use and land use change. The GHG assessment will only consider instances in which the Proposed Scheme results in additional or avoided emissions in comparison to the baseline scenario and its assumed evolution. The baseline conditions therefore focus on those emissions sources subject to change between the baseline scenario and the Proposed Scheme.

2.2.2. Transport emissions from 2020 within South Cambridgeshire, and Nationally are presented in **Table TR06-2-1** for context[2].

Table TR06-2-1 - Transport Emissions for South Cambridgeshire and nationally

Category	South Cambridgeshire ($ktCO_2$)	National ($ktCO_2$)
Road Transport (A roads)	292.5	40,506.3
Road Transport (Motorways)	91.2	20,957.1
Road Transport (Minor roads)	91.7	41,532.9
Diesel Railways	2.9	1,521.8
Transport Other	8.2	2,153.2
Transport Total	**486.5**	**106,671.4**

2.2.3. The 'Do Minimum' (baseline) scenario involves no construction activities and therefore the construction baseline is zero emissions.

2.2.4. The operation and management of the existing assets under the baseline scenario are likely to require a small number of components (for example, light bulbs and signage) as well as some bulk material (cement, concrete, sand and gravel) for minor works and repairs of the highway and ancillary infrastructure. These materials will have embodied emissions associated with them, and the installation of these materials will result in emissions due to the transport of these materials, and plant use.

[2] Department for Business, Energy & Industrial Strategy (2022) UK local authority and regional carbon dioxide emissions national statistics: 2005 to 2020. Available at: https://www.gov.uk/government/statistics/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics-2005-to-2020 (Accessed: 14 February 2023)

2.3 FUTURE BASELINE

2.3.1. The future baseline scenario involves no construction activities and therefore the construction baseline is zero emissions. The future baseline scenario for the operational phase will be modelled, based on projected traffic data for the existing road network.

2.3.2. Under a future Do-Nothing scenario, two key changes in the baseline carbon impact would be anticipated:

1. a reduction in user emissions as the national fleet decarbonises, and
2. an increase in user emissions as demand for private vehicles increases, with the added impact of congestion.

2.3.3. As the national vehicle fleet decarbonises (following legislation to ban new pure petrol or diesel cars from 2030, and new hybrids only being sold until 2035), this will gradually cause a reduction in user emissions associated with private vehicles as the efficiency of the national fleet improves. While beneficial, this is not likely to outweigh the adverse impact of congestion and increased private vehicle demand.

2.3.4. It is anticipated that private vehicle demand will increase in the absence of alternative sustainable travel solutions (and as a general trend) which would otherwise be provided by the scheme. This increase in demand not only has associated impact of additional tailpipe emissions, but also causes congestion on the network, which in itself causes further emissions – a positive feedback loop with adverse impact. The ban on petrol and diesel vehicle is only for *new* vehicles, so other vehicles on the network will contribute to emissions. Equally, zero-emissions vehicles still contribute to the congestion problem. In summary, demand and congestion cause additional emissions under a future scenario.

2.3.5. The future baseline carbon impact will worse under future scenarios because the adverse carbon impact of congestion and demand will likely outweigh the benefit of fleet decarbonisation.

3 METHODOLOGY SUMMARY

3.1 STUDY AREA

3.1.1. The GHG assessment is not restricted by geographical area but instead includes any increase or decrease in emissions as a result of the Proposed Scheme, wherever that may be. This includes:

- Construction emissions from the Proposed Scheme footprint, but also related to the transport of materials to and from the site and their manufacture (this may be distant from the Scheme location, for example emissions from the manufacture of steel); and
- Operational emissions (increase or reduction) which result from the end-use of the Scheme and any shifts in transport modes/patterns which may occur. Such emissions include those for traffic using the Scheme as well as the surrounding regional road network to gain access. The boundary of the traffic assessment is per Design Freeze 3 (DF3).

3.2 ASSESSMENT METHODOLOGY

GUIDANCE AND STANDARDS

3.2.1. The following guidance documents have been used during the preparation of this Technical Report:

- Design Manual for Roads and Bridges (DMRB) LA 114 Climate[3];
- PAS 2080:2016 Carbon Management in Infrastructure[4];
- Royal Institute of Chartered Surveyors (RICS) Whole life carbon assessment for the built environment (2017)[5];
- Transport Analysis Guidance: Unit A3 Environmental Impact Appraisal[6]; and
- Institute of Environmental Management and Assessment (IEMA) (2022) Assessing Greenhouse Gas Emissions and Evaluating their Significance 2nd Edition[7].

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[3] All UK Overseeing Organisations (2021). Design Manual for Roads and Bridges (DMRB) LA 114 Climate. Available at: https://www.standardsforhighways.co.uk/dmrb/search/d1ec82f3-834b-4d5f-89c6-d7d7d299dce0. (Accessed: 14 February 2023).
[4] BSI, (2016). PAS 2080:2016 Carbon Management in Infrastructure. Available at: https://knowledge.bsigroup.com/products/carbon-management-in-infrastructure/standard. (Accessed: 14 February 2023).
[5] RICS, (2017). Whole life carbon assessment for the built environment. Available at: https://www.rics.org/globalassets/rics-website/media/news/whole-life-carbon-assessment-for-the--built-environment-november-2017.pdf. (Accessed: 14 February 2023).
[6] Department for Transport, (2022). TAG Unit A3 Environment Impact Appraisal Chapters 4 Greenhouse Gases. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1102784/tag-unit-a3-environmental-impact-appraisal.pdf. (Accessed: 14 February 2023).
[7] IEMA, (2022). Assessing Greenhouse Gas Emissions and Evaluating Their Significance. Retrieved from https://www.iema.net/ (Accessed: 14 February 2023).

SCOPE OF THE ASSESSMENT

3.2.2. The Scoping Report[8] GHG chapter follows the principles of 'PAS 2080:2016 Carbon Management' in Infrastructure[9] which breaks down a project into a series of lifecycle stages covering construction, operations and end of life for whole life carbon assessments. Using the lifecycle stages, elements were scoped in and out with justification.

3.2.3. The elements scoped out, as shown in **Table TR06-3-1**, are either considered to be relatively minor as GHG emission sources with negligible impact on the overall findings, or are too far into the future to be able to determine with any confidence the likelihood, type or magnitude of activity related emissions resulting from the Proposed Scheme. They have therefore not been considered within this assessment.

Table TR06-3-1 – Proposed Scheme elements scoped out of the assessment at Scoping

Elements scoped out	Phase
Disposal of waste, A5	Construction
Land use, land use change and forestry, A5	Construction
Decommissioning, C1	End of Life
Transport and disposal of materials, C2-4	End of Life

3.2.4. At the time of writing, information for A5, B3, B5 and B8, have become available and therefore been included in the assessment.

3.2.5. Decommissioning (C1) and Transport and disposal of materials (C2-4) are out of scope as it is considered unlikely that the scheme would be removed, and materials disposed at the end of the appraisal period.

ASSESSMENT APPROACH

3.2.6. The assessment approach has considered the likely magnitude of anticipated GHG emissions (or avoided emissions) of the Proposed Scheme in comparison with the baseline scenario.

3.2.7. Where data were available, GHG emissions have been quantified using the methodologies described below, as well as the assumption and limitations in **Section 4**. Where data were unavailable, the impact on GHG emissions was assessed qualitatively using professional judgement and experience on projects of a similar nature and scale.

3.2.8. For reporting, the scoped in lifecycle stages for the Proposed Scheme has been grouped into the following:

[8] Greater Cambridge Partnership (2022). ES Scoping Report.
[9] BSI. (2016) Publicly Available Specifications: 2080 Carbon management in Infrastructure. Retrieved from https://knowledge.bsigroup.com/products/carbon-management-in-infrastructure/standard (Accessed: 14 February 2023).

- Infrastructure Carbon, which is principally from construction, but also from some aspects of operation and later refurbishment;
- User Emissions during operation as a result of changes in traffic; and
- Additional Impacts and Opportunities.

Infrastructure Carbon

3.2.9. Infrastructure Carbon refers to emissions associated with building the infrastructure assets. It comprises capital carbon (emissions associated with construction of the infrastructure asset) and operational emissions (the asset's energy use and maintenance).

3.2.10. To quantify the embodied emissions of construction materials, materials data (for example the type and quantity of materials) were sourced from the Proposed Scheme design team. The quantity of materials was multiplied by appropriate emissions factors sourced from the National Highways Carbon Emissions Calculation[10] tool and the Bath Inventory of Carbon and Energy (ICE) Version 3.0[11].

3.2.11. To estimate the emissions associated with transporting materials during construction, the expected mass of materials was multiplied by transport distance resulting in tonne kilometres. Where actual distances could not be provided by the design team, assumptions based on RICS guidance have been used. The tonne kilometre values were then multiplied by an appropriate emission factor published by the Department for Environment Food and Rural Affairs (Defra)[12].

User Emissions

3.2.12. End-user vehicle emissions were calculated in accordance with DMRB LA 114 Climate (2021). Emissions were quantified using TAG data from the Department of Transport[13,14]. This took into account different vehicle and fuel types, appropriate forecast fuel consumption parameters, and applied appropriate emission factors accordingly. From this, emissions were quantified for each year over the lifetime of the Proposed Scheme (up to 2085).

Additional Impacts and Opportunities

3.2.13. For the assessment of land use change, the assessment compared the habitats that are subject to change between the baseline and Proposed Scheme scenario. In order to estimate the carbon storage and the change over time from the different habitats, the habitat type and the hectares of individual habitats were considered along with appropriate values for carbon storage and flux using best practice taken from the scientific literature.

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[10] National Highways. Carbon emissions calculation tool [online]. Available at: https://nationalhighways.co.uk/suppliers/design-standards-and-specifications/carbon-emissions-calculation-tool/ . (Accessed: 14 February 2023).
[11] The Inventory of Carbon and Energy (ICE), (2019). ICE Database (2019) v3.0. [online] Available at: https://circularecology.com/embodied-carbon-footprint-database.html (Accessed: 14 February 2023).
[12] Defra, (2021). Greenhouse gas reporting: conversion factors 2022. [online] Available at: https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2022 (Accessed: 14 February 2023).
[13] Department for Transport, (2022). Guidance: Tag Data book. [online] Available at: https://www.gov.uk/government/publications/tag-data-book (Accessed: 03/11/2022).
[14] Department for Transport, (2022). Road Statistics. [online] Available at: https://www.gov.uk/government/collections/road-traffic-statistics (Accessed: 03/11/2022).

3.2.14. A habitat carbon calculator was used to assess the net carbon flux and carbon stock of the habitats. The calculator uses the following literature sources:

- Natural England, (2021), Carbon Storage and Sequestration by Habitat (2nd) (Natural England, 2021); and
- Woodland Carbon Code, (2021), Woodland Carbon Code Calculator (V4 (Woodland Carbon Code, 2021)).

3.2.15. For most habitat types, there is a wide range of estimates of the carbon storage and flux per unit area in the literature. Following a review of available estimates combined with expert knowledge and professional judgement, the most appropriate values were identified. This approach was aligned with Natural England Carbon Storage and Sequestration by Habitat (2021), which uses the median value in calculations.

SIGNIFICANCE CRITERIA

3.2.16. The significance of GHG emissions is assigned with reference to the magnitude of emissions, their context in relation to the UK's net zero trajectory, guidance from IEMA's *Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance*, and the use of professional judgement.

3.2.17. As climate change impacts are global in nature, it is not possible to link a specific project with a specific environmental effect. Recently published guidance from IEMA sets out five distinct levels of significance based on the GHG emissions relative contribution towards achieving a science-based 1.5ºC aligned transition towards net zero by 2050. As such, significance of GHG emissions have been put into context through comparison with the respective UK carbon budgets (

3.2.18. **Table TR06-3-22**) to assess their compatibility with the UK's net zero trajectory. The budgets are expressed in millions of tonnes of carbon dioxide equivalents ($MtCO_2e$).

Table TR06-3-22 - National carbon budgets set by the Government ($MtCO_2e$)[1]

Carbon budget period	UK carbon budget
Fourth: 2023-2027	1,950 $MtCO_2e$
Fifth: 2028-2032	1,725 $MtCO_2e$
Sixth: 2033-2037	965 $MtCO_2e$

3.2.19. The following terms have been used to define the significance of the effects identified as set out in IEMA guidance:

- **Major adverse (significant)**: the GHG impacts are not mitigated or are only compliant with do-minimum standards set through regulation, and do not provide further reductions required by existing local and national policy and does not make a meaningful contribution to the UK's trajectory towards net zero;
- **Moderate adverse (significant)**: the GHG impacts are partially mitigated and may partially meet the applicable existing and emerging policy requirements but would not fully contribute to decarbonisation in line with local and national policy goals, falling short of fully contributing to the UK's trajectory towards net zero;

- **Minor adverse (not significant)**: the GHG impacts are fully consistent with applicable existing and emerging policy requirements and good practice design standards, fully in line with measures necessary to achieve the UK's trajectory towards net zero;
- **Negligible (not significant)**: the GHG impacts are reduced through measures that go well beyond existing and emerging policy and design standards for projects of this type, such that radical decarbonisation or net zero is achieved well before 2050; and
- **Beneficial (significant)**: the net GHG impacts are below zero and it causes a reduction in atmospheric GHG concentration, whether directly or indirectly, compared to the without-project baseline, substantially exceeding net zero requirements with a positive climate impact.

4 ASSUMPTIONS AND EMBEDDED MITIGATION

4.1.1. The following assumptions and limitations apply to this topic:

4.2 ASSUMPTIONS

- Embodied emissions have been calculated based on bill of quantities data sourced from the design team. The volumes of bulk construction materials required by the Proposed Scheme may alter as the design progresses, however, this would not be expected to materially alter the assessment findings;
- Where specific distances were not available, the transportation of materials to site (i.e., the source of materials) has been taken from RICS (2017) assumptions for transportation scenarios;
- A two-way transport distance has been assumed for materials to site and waste leaving site;

4.3 LIMITATIONS

- Where specific material data were not available, an appropriate emissions factor has been selected based on professional judgement;
- When calculating the traffic emissions from the affected traffic route, there will be some uncertainty regarding forecast traffic modelling data as this is based on predicted future use;
- This assessment is based on DF3;
- Due to the absence of a maintenance schedule and design life information of specific scheme elements, maintenance of the assets has been quantified using the best available data. Notably, maintenance has been quantified based on typical highway requirements as such maintenance for the scheme is expected to be lower than quantified;
- The opening year for the Proposed Scheme has been modelled from the year 2023; and
- In line with standard practice, the design life of the Proposed Scheme is assumed to be 60 years, though in reality, it is likely to extend beyond this.

4.4 ESSENTIAL MITIGATION MEASURES

4.4.1. At the current stage of design, the Proposed Scheme has a preferred fixed alignment, limiting carbon reduction opportunities through adoption of alternative route. Despite this, the design was optimised, and the decision was taken to realign approximately 2km of the route from off-road to using the existing highways facilities, therefore saving all the carbon emissions associated.

4.4.2. The magnitude of GHG emissions from embedded carbon can be further minimised by the following, though this would forgo potential carbon savings from the operation of new public transport infrastructure:

- Design optimisation to reflect the carbon reduction hierarchy (detailed below and found in clause 6.1.4 of PAS 2080[4]):
  - Build nothing: evaluate the basic need for an asset and/or programme of works and explore alternative approaches to achieve outcomes.
  - Build less: evaluate the potential for re-using and/or refurbishing existing assets to reduce the extent of new construction required.
  - Build clever: consider the use of low carbon solutions (including technologies materials and products) to minimise resource consumption during the construction, operation and user's use stages.

- Build efficiently: use techniques (e.g., construction, operational) that reduce resource consumption during the construction and operation phases of an asset or programme of work.

- Optimising the landscaping and public realm design (including selection of number and species of tree planting);
- Compliance with the Code of Construction Practice[15] (CoCP) to ensure that adverse effects to people and the environment are kept as low as practicable during on site works;
- Being in line with the waste hierarchy, where possible, site arising have been designated for reuse (approximately 80% earthworks cut as fill) reducing emission associated with transport and disposal of this waste material;
- Maximising the local sourcing of materials and local waste management facilities to reduce transport time between facilities and construction site, reducing GHG emissions;
- The principal contractor, during detailed design, to consider further carbon savings during any value engineering exercise;
- Develop cut and fill balance, and refine/optimise the earthworks design; and
- Specifying the use material options with greater longevity, to reduce frequency of replacements and therefore reducing the need and frequency of maintenance.

4.5 POTENTIAL MITIGATION MEASURES

4.5.1. The following design measures should be explored to further avoid, prevent or reduce the potential for significant environmental effects:

- Actively seek partners for the construction stage with low-carbon construction technical expertise and practice, and values that align to GCPs commitments.
- Include carbon impacts as part of the criteria for selecting a principal contractor, including sustainable construction practices such as use of sustainable materials (e.g. recycled aggregates) and methods (low-temperature asphalt, on-site re-use of materials etc);
- Develop a Construction Traffic Management Plan that minimises traffic, congestion and rerouting;
- Seek to use zero emission construction and freight vehicles (or seek relevant partners), and try and source infrastructure carbon materials as locally as possible to minimise the carbon associated with freight;
- Substitute construction materials for lower-carbon alternatives (where safe and of sufficient integrity for engineering) should be considered, eventually supported with eco- and carbon labels or verified Environmental Product Declarations (EPD); and
- The Construction Contractor should have training policies and management protocols in place to avoid idling of engines, spills of fuels (for example, when refuelling) and safe/environmentally sensitive driving techniques to maximise fuel saving.

[15] Code of Construction Practice (Document reference: C2C-26-00-Code of Construction Practice).

5 ASSESSMENT OF IMPACTS AND EVALUATION OF EFFECTS

5.1.1. This section details the assessment of predicted impacts and effects for the Proposed Scheme. The total estimated GHG emissions arising from each life-cycle stage of the asset are considered, as set out in Section 3.2, and have been quantified using the Highways England Carbon Tool.

5.2 Infrastructure Carbon

5.2.1. The results of each stage are as followed as presented in **Table TR06-5-1**:

Table TR06-5-1 - Estimated Emissions for each life-cycle stage

Life-Cycle Stages	GHG Emissions (tCO_2e)*	Percentage of Emissions*
Product Stage (manufacture and transport of raw materials to suppliers) (A1-3)	11,630	40%
Transport of Materials to Site (A4)	9,760	34%
Plant and Equipment Use during Construction (A5)	1,850	6%
Maintenance, Repair, Replacement, Refurbishment (B2-5)	5,890	20%
Total	**29,130**	**100%**

*All figures rounded.

5.2.2. This illustrates that the primary source of carbon is associated with the production of materials stage (A1-A3), **11,630** tCO_2e, followed by the transport to Site (A4) with a total of **9,760** tCO_2e.

5.2.3. As detailed above, the total GHG emissions arising from the elements set out above are estimated to be **29,130** tCO_2e.

5.3 User Emissions

5.3.1. Provision of priority public transport (bus) infrastructure is predicted to initiate a modal-shift to bus. This is forecast to reduce private vehicle kilometres travelled on the road network by 1.25 million kilometres a year, or more than 75 million kilometres over the 60-year appraisal period, with an associated reduction in carbon emissions of **4,500** tCO_2e. Carbon savings are likely to be higher when assessed in-combination with other planned infrastructure, policies and interventions that further encourage behavioural change and improve perceptions of sustainable travel choices.

5.3.2. Making Connections – a proposed road user charge in the centre of Cambridge, the raised funds of which are to be invested in sustainable transport within Cambridge – is anticipated to reduce private vehicle demand and associated emissions. This will unlock additional user emissions savings associated with Cambourne to Cambridge as more people choose sustainable and shared modes rather than private vehicles.

5.3.3. The scheme is therefore also predicted to result in a shift to active modes, resulting in a reduction of 61,000 vehicle kilometres annually, equivalent to a carbon reduction of approximately **600** tCO_2e

(based on Active Mode Appraisal Toolkit analysis). These vehicle kilometre reductions have been applied (using TAG-compliant criteria) through the full 60-year appraisal period, rather than the 15-year appraisal period for active travel schemes, to align with the road scheme's appraisal period.

5.3.4. This active travel path adds to the growing rural walking and cycling network as it integrates with new routes, such as the planned Comberton Greenway and Madingley Road scheme, and existing routes. This in-combination effect is likely to further increase carbon savings associated with modal shift, which in turn may be enhanced with the future supportive policy and infrastructure measures. This means, the carbon savings attributed to modal shift are likely to be higher over time than has been quantified here.

5.3.5. Provision of the busway and park and ride facility is anticipated to reduce delays across the network, thereby improving traffic efficiency, reducing stop-start traffic, and reducing fuel consumption of vehicle trips across the network. A comprehensive **Transport Assessment**[16] report with a more detailed explanation has been prepared for C2C. Link-by-link modelling provides analysis on the local transport system that will result from the Scheme, by reviewing the changes in traffic flows, speeds, and journey time savings. The modelling results show an estimated reduction in emissions of **30,960** tCO_2e within the study area over the 60-year appraisal period.

5.4 Land use changes

5.4.1. Vegetation loss required for the construction of the Proposed Scheme will result in the release of an estimated 10,145 tCO_2e of sequestered carbon. While landscaping proposals will introduce planting that equates to approximately 1,600 new trees, the carbon sequestration these new trees would provide over the course of the 60-year project is lower than the sequestration delivered in the Do Nothing scenario. This is because the newly planted trees in the Do Something scenario would be less mature than the existing trees, and therefore unable to sequester as much carbon.

5.4.2. As a result, the land use change in the Proposed Scheme would lead to a decrease in sequestration (i.e., an increase in carbon emissions) of **1,910** tCO_2e over the project lifespan, as shown in **Table TR06-5-2**.

Table TR06-5-2 - Carbon sequestration across project lifespan

Scenario	Total tCO_2e sequestered for 60-year lifespan*
Do Nothing	11,310
Do Something	9,400
Change (Do Something – Do Nothing)	-1,910

*All figures rounded.

[16] Transport Assessment (Document reference: C2C-25-00-Transport Assessment)

5.5 PREDICTED EFFECTS

5.5.1. The assessment shows that the user emissions benefit will outweigh adverse capital carbon and other impacts. As such, in the core modelled scenario, the net-carbon saving is estimated to equate to **4,640** tCO_2e over the 60-year appraisal period.

Table TR06-5-3 – Summary of Predicted Carbon Impact

Activity Construction Period + 60-Year Appraisal Period	Collective Impact (tCO2e) Construction Period + 60-Year Appraisal Period
User Emissions Modal shift to bus: -4,500 tCO2e Modal shift to walking & cycling: -600 tCO2e Impact on general traffic: -30,960 tCO2e	-36,060
Capital Carbon Producing the necessary materials: +11,630 tCO2e Transport to Works/Site: +9,760 tCO2e Construction: +1,850 tCO2e Maintenance: +5,890 tCO2e	+29,130
Additional Impacts Vegetation planting & loss: +1,910 tCO2e	+1,910
Total	-5,020

5.5.2. Modal shift to sustainable modes is expected to present carbon savings of **4,500** tCO_2e for bus and **600** tCO_2e for walking and cycling over the Scheme's lifetime. Modal-shift is a priority set out in the DfT's transport decarbonisation plan and is a necessary measure in achieving local and national net zero goals. Modelling indicates carbon savings will be achieved through efficiencies in traffic flows, with a total of **30,960** tCO_2e over the Scheme's lifetime.

5.5.3. Based on the results presented above the magnitude of GHG emissions for the Proposed Scheme are **moderate adverse (significant)** for infrastructure carbon. However the Proposed Scheme will result in a **beneficial (significant)** from user emissions.

5.6 ASSESSMENT AGAINST UK CARBON BUDGETS AND LOCAL AUTHORITY TARGETS

5.6.1. The impacts of GHGs relate to their contribution to global warming and climate change. These impacts are global and cumulative in nature, with every tonne of GHGs contributing to impacts on natural and human systems. GHG emissions result in the same global effects wherever and whenever they occur. For the Proposed Scheme, this includes comparing the GHG emissions against the carbon budgets.

5.6.2. GHG emissions arising from the Proposed Scheme are presented in **Table TR06-5-4**, showing the timescale of the impact arising from the Proposed Scheme in terms of the UK National Carbon Budgets and Greater Cambridge Partnership Net Zero Target.

Table TR06-5-4 – Timescales of quantified impact of the Proposed Scheme GHG emissions

Milestone	Proposed Scheme GHG emissions (tCO_2e)	Timescale of Quantified Impact
4th Carbon Budget	31,754	2023-2027
5th Carbon Budget	-5,708	2028-2032
6th Carbon Budget	-3,966	2033-2037
Greater Cambridge Partnership Net Zero Target	16,566	2023-2045
National 2050 Net Zero Target	13,171	2023-2050

5.6.3. GHG emissions arising from the Proposed Scheme are expected to account for approximately 0.0016% of the 4th Carbon Budget and contribute positively by 0.0003% to the 5th and 0.0004% to the 6th Carbon Budgets.

5.6.4. By utilising the mitigation measures for the Proposed Scheme design, as well as during construction and operation, as per **Section 4.5**, the GHG emissions from the Proposed Scheme can be reduced and subsequently the impact on the climate.

5.6.5. A visual representation of the cumulative change in carbon emission of this Proposed Scheme, including when the scheme is anticipated to achieve net zero (in 2079), can be found overleaf in **Plate TR06 5-1.**

Plate TR06 5-1 - Cumulative Change in Carbon Emission

Standard User Emissions Scenario	**1.** Carbon emissions due to construction activities and tree removal.	**2.** The scheme is anticipated to achieve Net Zero emissions by 2078.	**3.** Net carbon saving of -5,020 tCO2e over 60-year appraisal period + construction.	**4.** Modal shift: -5,100 tCO2e. To walking and cycling yields -600 tCO2e carbon benefit. To bus yields -4,500 tCO2e carbon benefit.	**5.** Behaviour change which encourages use of active modes and public transport as a result of wider societal or policy change, and paired with in-combination benefits will unlock additional user emissions carbon savings.	
Optimistic User Emissions Scenario - Without Making Connections	**6.** Carbon emissions due to construction activities and tree removal.	**7.** The scheme is anticipated to achieve Net Zero emissions by 2044.	**8.** Net carbon saving of -47,040 tCO2e over 60-year appraisal period + construction.	**9.** Modal shift: -47,120 tCO2e. To walking and cycling yields -850 tCO2e carbon benefit. To bus yields -46,270 tCO2e carbon benefit.	**10.** Behaviour change which encourages use of active modes and public transport as a result of wider societal or policy change, and paired with in-combination benefits will unlock additional user emissions carbon savings.	
Optimistic User Emissions Scenario - With Making Connections	**11.** Carbon emissions due to construction activities and tree removal.	**12.** The scheme is anticipated to achieve Net Zero emissions by 2039.	**13.** Net impact of -64,470 tCO2e over 60-year appraisal period + construction.	**14.** Modal shift: +64,550 tCO2e. To walking and cycling yields -850 tCO2e carbon benefit. To bus yields -63,700 tCO2e. carbon benefit. when Making Connections is accounted for.	**15.** Behaviour change which encourages use of active modes and public transport as a result of wider societal or policy change, and paired with in-combination benefits will unlock additional user emissions carbon savings.	
Applies to all scenarios	**16.** Estimated +23,240 tCO2e increase in emissions in 2023 and 2024 from infrastructure carbon during the construction phase.	**17.** Use of low-carbon construction materials and practices has the potential to reduce infrastructure carbon.	**18.** Maintenance impact of +5,890 tCO2e over the appraisal period is primarily caused by asphalt at 40 years for resurfacing. This impact will also reduce (improve) as low carbon construction methods and materials become available.	**19.** Deconstruction scoped out as it is anticipated that asset(s) will not be decommissioned after 60 years.	**20.** Tree planting and loss is expected to have a net impact of approximately +1,910 tCO2e over the 60 year appraisal period: caused initially by the removal of trees and associated release of carbon, with new tree planting sequestering some of that impact over time.	**21.** Changes in general traffic flows (derived from link-by-link data) present a large proportion of carbon savings, equating to -30,960 tCO2e.

6 SUMMARY OF LIKELY SIGNIFICANT EFFECTS

6.1.1. The assessment of the GHG emissions arising from the Infrastructure Carbon element have been assessed to likely have a **Potentially Moderate Adverse (Potentially significant)** effect.

6.1.2. The assessment of the GHG emissions arising from the User Emissions element have been assessed to likely have a **Potentially Beneficial (Potentially significant)** effect.

6.1.3. Emissions could be minimised through design optimisation to reflect the carbon reduction hierarchy as well as other measures detailed in **Section 4.5**.

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