A83 Rest and Be Thankful

LTS EIAR VOLUME 4, APPENDIX 16.2 - EFFECTS ON CLIMATE METHODOLOGY

Transport Scotland

A83AAB-AWJ-EAC-LTS_GEN-RP-LE-000286

A16-2.Effects on Climate Methodology

A16-2.1. Assessment Methodology

A16-2.1.1. The methodology for the assessment of the Proposed Scheme aligns with Design Manual for Roads and Bridges (DMRB) LA 114, the IEMA Guide: Assessing Greenhouse Gas Emission and Evaluating their Significance (referred to hereafter as the IEMA 2022 guidance) and Publicly Available Specification (PAS) 2080: Carbon Management in Infrastructure and Buildings.

A16-2.1.2. It is key to note that whilst Effects on Climate is a wide-ranging topic in terms of potential sources, it is simple in terms of its receptors and impacts because:

- there is only one receptor, the atmosphere
- there is only one direct impact, climate change
- all units of CO_2e can be considered to have the same impact no matter where they are emitted.

A16-2.1.3. Therefore, assessment of the effects of the Proposed Scheme on climate (Greenhouse Gas Emissions (GHG)) has been limited to quantification of the magnitude of GHG emissions, from individual sources and in total, and comparison of these to the baseline. Different GHGs have different global warming potentials, and to account for this they have been reported throughout this assessment as their carbon dioxide equivalent (CO_2e) value.

A16-2.1.4. The goal of the assessment was to calculate the emissions anticipated to be generated by the Proposed Scheme to:

- determine the magnitude of the Proposed Scheme's effect on climate, in comparison with the Do-Minimum Scenario
- assess the significance of the effect on climate by considering it in the context of the UK and Scottish carbon reduction targets

- enable identification of emissions hot spots within the Do Something Scenario to inform the identification of appropriate mitigation measures.

A16-2.1.5. Emissions calculations are carried out by multiplying activity data by an emission factor associated with the activity being measured. Activity data is a quantitative measure of an activity that results in emissions during a given period of time, (e.g. kilometres driven, kWh electricity consumed, tonnes waste sent to landfill). An emission factor is a measure of the mass of emissions relative to a unit of activity.

A16-2.1.6. The lifecycle stages and GHG emissions sources included within the assessment are presented in Table A16-2.1, as per DMRB LA 114 Section 3.11.1.

Table A16-2.1: Sources and lifecycle stages for project GHG emissions

Main stage of project lifecycle	Sub-stage of lifecycle	Potential sources of GHG emissions (not exhaustive)	Included within the assessment?
Construction stage	Product stage; including raw material supply, transport and infrastructure	Embodied GHG emissions associated with the required raw materials	Yes
Construction stage	Construction processes stage; including transport of materials to and from works site and construction processes	Activities for organisations conducting construction work.	Yes – Transportation of materials and construction plant usage included.
Construction stage	Staff and contractor travel to site	Transportation GHG emissions from workers travelling to site	No – no data available to estimate workers commuting to site.

Main stage of project lifecycle	Sub-stage of lifecycle	Potential sources of GHG emissions (not exhaustive)	Included within the assessment?
Construction stage	Land Use Change	GHG emissions mobilised from vegetation or soil loss during construction	Yes – Type and area of land subject to change in usage
Operation stage	Use of infrastructure by the end-user (road user)	Vehicles using highways infrastructure	No – scoped out as there are no anticipated changes in speed band, fleet makeup or volume of traffic upon completion of the Proposed Scheme
Operation stage	Operation and maintenance	Energy consumption for infrastructure operation and activities of organisations conducting routine maintenance.	Yes
Operation stage	Land use and forestry	Ongoing land use GHG emissions/sequestration each year	Yes – Type and area of land subject to change in usage

Main stage of project lifecycle	Sub-stage of lifecycle	Potential sources of GHG emissions (not exhaustive)	Included within the assessment?
Decommissioning	Decommissioning activities	Energy consumption for decommissioning activities and emissions from waste processing and disposal	No – no anticipated end-of-life date for the Proposed Scheme.

Calculating construction emissions

A16-2.1.7. Construction emissions calculations have been carried out by multiplying activity data by an emission factor associated with the activity being measured. Activity data is a quantitative measure of an activity that results in emissions during a given period of time, (e.g. kilometres driven, kWh electricity consumed, tonnes of waste sent to landfill). An emission factor is a measure of the mass of emissions relative to a unit of activity.

A16-2.1.8. Proposed Scheme emissions have been quantified by calculation, using project data and material quantities from the Stage 3 design for the Proposed Scheme and relevant carbon conversion factors. To account for uncertainty in the design and therefore uncertainty in the quantities of materials used during construction, a quantities uncertainty factor of 7% has been applied to all materials used in construction. This factor is based on guidance provided in the Royal Institute of Chartered Surveyors whole life carbon assessment for the built environment.

A16-2.1.9. At this stage of design there is limited information on the breakdown of plant and machinery that would be required to construct the Proposed Scheme. National Highways state that 17% of their construction emissions come from the construction plant and compounds required during construction (National Highways Net Zero Plan). Therefore, it has been assumed that GHG

emissions from construction processes equal 17% of the total GHG emissions from construction materials and waste and their associated transport.

A16-2.1.10. Transport Scotland's Roads Project Carbon Tool v1.4 (hereafter referred to as the 'Carbon Tool') has been used to calculate the construction phase emissions. The Carbon Tool uses material emission factors from the Inventory of Carbon and Energy (ICE) version 3 as well as energy, waste and transport emission factors from the UK Government emission conversion factors for GHG company reporting 2020 to calculate the emissions from construction.

Calculating operational emissions

A16-2.1.11. During the operation of the Proposed Scheme, electricity will be required to power lighting and signage along the route. The total annual energy requirement for the Proposed Scheme has been identified from the Stage 3 design and multiplied by the predicted yearly electricity emissions factors (Green Book: valuation of energy use and greenhouse gas emissions for appraisal) for 60 years from the Opening Year of the Proposed Scheme (0.143kgCO_2e/kWh for 2023).

A16-2.1.12. The Proposed Scheme will require maintenance due to standard wear and tear from operational use (road-users) as well as possible damage from road traffic collisions and external events (e.g. flooding). Whilst it is not possible to identify when the latter occurs, a regular maintenance programme will take place to manage the former. Information from the Stage 3 design has been used to identify the anticipated replacement and maintenance of Stage 3 design over a 60-year period to calculate the anticipated emissions from maintenance of the Proposed Scheme. Emissions from design elements that will require partial or full replacement have been calculated via the same method used to calculate those elements during the construction phase.

Calculating land-use, land-use change and forestry (LULUCF) emissions and removals

A16-2.1.13. LULUCF plays an important role in the balance and transfer of carbon through global carbon cycles. Carbon is stored in and exchanged between the

atmosphere and biosphere, which includes plants and soils. When humans alter land-use, they impact the carbon stocks held within the biosphere and the exchange of carbon with the atmosphere. These changes can have adverse climate change impacts, but also provide key mitigation opportunities by removing carbon from the atmosphere and storing it in terrestrial biospheres.

A16-2.1.14. The construction and operation of the Proposed Scheme have the potential to:

- change and disturb land-uses, leading to the release of carbon dioxide (CO_2) into the atmosphere from vegetation and soils
- create and enhance carbon stocks in vegetation and soils, encouraging increased removal of greenhouse gases from the atmosphere.

A16-2.1.15. Baseline calculations have been calculated by establishing annual sequestration or emission rates per hectare of each habitat present on site, sourced from literature. These rates have then be multiplied by the total area for each habitat, derived from the Phase 1 habitat survey, which provided the area of land-use type which will be lost or disturbed by construction work for each option and variation. The results provided the annual sequestration or emission rate of each habitat, assuming it remains the same in future. The totals for each habitat type have then been summed to give the total emissions, and multiplied by 60, to produce the total for the operational appraisal period.

A16-2.1.16. The same data has been used to derive the emissions for the operational assessment as a result of the lost sequestration over the 60-year period. It should be noted that this is a conservative approach, as it assumes that land-uses would continue to sequester carbon in their current state. In reality, once a land-use is established (this takes different lengths of time depending on the land-use and management methods), it is likely to be neutral in terms of its emissions / removals, i.e., the two will balance each other out in any given year. A conservative approach of including projected sequestration for existing land-uses has been undertaken to prevent an under-estimation of the impact of any of the route options.

A16-2.1.17. Carbon emissions lost during construction as a result of the removal of habitats have been calculated by estimating the change in carbon stocks held within the different land-use types within the study area for the Proposed Scheme, using the information derived from the Phase 1 habitat survey. These areas have been multiplied by typical carbon stocks per ha for that land-use type to give a total carbon stock loss (in tonnes of carbon). This loss in carbon was converted into emissions of CO_2 (multiplying tC by (44/12) to give tCO_2).

A16-2.1.18. A 'value-transfer' approach has been undertaken to ascribing carbon stock data, whereby data from existing studies into similar land-use types were applied to the study area. Based on the habitats present, the data sources used include the following:

- Natural England (2021) Carbon storage and sequestration by habitat: a review of the evidence (second edition), Natural England Research Report NERR094.

A16-2.1.19. Carbon from the excavation and loss of peat during construction has been calculated separately from the loss of habitats. An Outline Peat Management (Volume 4, Appendix 12.6) has been produced which calculated that 46,100 m^3 of peat will be excavated during construction. This equates to approximately 825 tonnes of carbon. This carbon was converted into emissions of CO_2 (multiplying tC by (44/12) to give tCO_2).

Assessment of significance

A16-2.1.20. The emissions calculated for the Do Something scenario of the Proposed Scheme have been compared against the Do Minimum scenario baseline for the assessment years. The difference between these emissions can be considered to be the impact of the Proposed Scheme.

A16-2.1.21. The method of assessment of whether the calculated GHG emissions from the Proposed Scheme will have a significant effect on climate has been determined in accordance with IEMA's 2022 guidance. There is no legal limit for GHG emissions for any one development. The guidance suggests that the

level of significance should be related to how a project contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050, or 2045 for Scotland, as stated in section 6.2 of the guidance: "*The crux of significance…is not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050 (or other date as defined in targets for devolved administrations).*"

A16-2.1.22. The IEMA 2022 guidance document notes that practitioners need to consider whether project GHG emissions are aligned to achieving net zero by 2050 (2045 for Scotland), using the science-based 1.5°C trajectory. Where this is not the case, then the effects are judged to be moderate adverse or major adverse, and thus can be classed as a significant effect. Projects that are compatible with the trajectory can have their effects classed as minor adverse, or where the project achieves GHG emission mitigation that goes beyond the trajectory, negligible. In both cases, the effects are not considered to be significant. Projects that result in GHG emissions being avoided or removed from the atmosphere can be considered to have a significant beneficial effect. The IEMA 2022 guidance notes that the UK 2050 target for net zero and interim carbon budgets are considered by the UK Climate Change Committee to be compatible with the required trajectory.

A16-2.1.23. The percentage contribution of the Proposed Scheme to the national emission reduction target has been determined in accordance with IEMA 2022 guidance on significance. Although the IEMA guidance suggests that, for context, it would be good practice to consider a project's GHG emissions in relation to sector-based targets. There are currently no sector budgets for roads or any other sector provided by the UK Climate Change Committee, the body responsible for developing the UK and devolved administrations' carbon budgets. Therefore, sector-based targets are not considered in this assessment.

A16-2.1.24. For this assessment, the Interim emission reduction targets for Scotland have been used. Additionally, as noted in DMRB LA114 Scotland National Application Annex, a comparison of the Proposed Scheme should be undertaken to the transportation sector's emissions envelope from the Scottish Government Climate Change Plan 2018-2032. Both of these are summarised in Volume 4, Appendix A16.1 Effects on Climate Legislation, Policy and Guidance.

A16-2.1.25. It is noted that the Interim emission reduction targets for Scotland have been scrapped by the Scottish Government. However, in the absence of new targets, the Interim emission reduction targets have been used for this assessment.