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A14
Cambridge to Huntingdon improvement scheme
Development Consent Order Application
Response to the First Written Questions

HE/A14/EX/30

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Report 3: Carbon Emissions

June 2015

The Infrastructure Planning (Examination Procedure) Rules 2010

A14 Cambridge to Huntingdon improvement scheme

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Question 1.3.1

In the context of section 5 of the NN NPS, how does the proposed scheme limit the carbon footprint of the proposal in terms of design and construction and any associated mitigation measures?

Response

1. The scheme limits the carbon footprint of the proposal, in design, construction and operation, through the following considerations:
    - As the scheme has an objective to reduce congestion, within the design constraints the design seeks to reduce journey length, optimise speed, and reduce any impacts due to car idling. These measures would all contribute to reducing operational usage emissions per vehicle;
    - Decisions in relation to outline design were made on the basis of the most efficient engineering design whilst paying due regard to 'fitness for purpose', which contributed to reduced construction and operational emissions;
    - Utilisation of the principle of avoidance and reduction (in both design and construction), lean construction methods, such as the efficient use of plant and minimisation of material use, and SPeAR assessment; and
    - The scheme design, in particular the vertical alignment, was influenced by the minimisation of earthworks quantities. The required borrow pits are located close to the point of use along the route of the scheme to reduce the use of heavy vehicles and associated emissions.
2. Further context and description on these processes is given below.

Carbon footprint of the scheme

3. The construction of the A14 Cambridge to Huntingdon improvement scheme (the scheme) would result in carbon emissions associated with the use of materials and energy during construction. Further, the operation of the scheme will lead to an increase in CO_2 emissions from traffic as the scheme seeks to increase road capacity, while making journeys quicker, safer and less congested, leading to a predicted increase in numbers of vehicles using the road.

4. Table 3.1 below indicates the carbon footprint of the construction phase. Emissions would be primarily due to materials and excavation, and transport and logistics.

Table 3.1 Estimated carbon footprint of scheme construction

CO_2e source	Tonnes CO_2e
Waste	281
Transport and logistics	235,979
Materials and excavation	740,062
Energy (site offices and other fuel use)	5,110
Construction total	**981,432**

5. It is expected that the fully utilised scheme would result in the emission of an additional 68,238 tCO_2 per year from traffic in the 2035 assessment year and that by 2041, when traffic growth is assumed to reach maximum likely levels, there would be an additional 81,827 tCO_2 per year. Energy use, such as lighting and Intelligent Transportation System (ITS) equipment, would account for 135 tCO_2e per year and reducing over the years due to decarbonisation of the electricity grid. **Error! Reference source not found.** below presents the anticipated operational emissions over a 60-year assessment period.

Table 3.2 Estimated carbon footprint of scheme operation

CO_2e source	Tonnes CO_2e
Energy use in scheme	2,350
Operational additional emissions	4,388,445
Operational total	**4,390,795**

6. The increase in carbon emissions generated by the scheme is not so significant that it would have an impact on the ability of the Government to reach its carbon reduction targets.

The design of the scheme - process

7. To date, decision-making during outline design has been informed through regular design meetings that have reviewed the most efficient engineering design whilst paying due regard to 'fitness for purpose'. This has resulted in opportunities for materials reduction, road alignment and traffic management design benefits being reviewed at early design stage, which have simultaneously resulted in associated carbon savings through design efficiencies.

8. The Carbon Assessment for the scheme has utilised the principle of avoidance and reduction (in both design and construction), and the application of lean construction methods, such as the efficient use of plant and minimisation of material use.

9. Recommendations relating to emissions generated by traffic during operation were considered in light of overall scheme objectives, safety and design standards, i.e. where possible the scheme seeks to reduce journey length, optimise speed, and reduce any impacts due to car idling that would otherwise increase emissions per vehicle. The Intelligent Transportation System (ITS) equipment included within the scheme design would regulate flows, reduce congestion and improve traffic reactions to road incidents. The smoother flows and reduced congestion delivered by such systems act to reduce the emissions per vehicle.

10. Formalised decision-making within the project, by designers and contractors, has followed best practice in the carbon management of construction projects, using initial design information, carbon assessment and identifying benchmarks and targets for the carbon impacts of construction activities. The detail of the mechanism for future decision-making has yet to be agreed, due to the current stage of outline design, but it would follow best practice, such as the process set out for construction carbon management indicated in the Carbon Management Framework for Major Infrastructure Projects[1].

11. It is anticipated that subsequent project stages would take the opportunity to further formalise the process of decision-making and carbon management through the development of scheme detailed design.

[1] https://www.forumforthefuture.org/sites/default/files/images/Forum/Projects/Carbon-Management/EC21-Carbon-Framework-FINAL.pdf

Design of the scheme – mitigation in design and construction methodology

12. A number of measures to support carbon reductions have been built into the development of the outline design. Some examples of opportunities taken through design development to date to implement savings identified through the decision-making process include:

- SPeAR assessment[2] was applied to review options during the design of six key bridge crossings along the route of the scheme. Carbon is one of the considerations, and further assessment shows savings achieved on each of the six crossings, as a result of the application of the SPeAR process.
- Whilst there has been an increase in the use of concrete and steel, redesign of the Great Ouse crossing has resulted in a carbon saving of 900 tCO_2e through a significant reduction in required earthworks.
- Six borrow pits would be used to supplement fill requirements. These are located close to the point of use along the route of the scheme to reduce usage of heavy vehicles and associated emissions. In addition haul routes have been identified within the scheme boundaries, which avoid using the existing local road network and thereby avoid contributing to the existing congestion problems.
- Imported materials would be sourced with consideration for recycled content, appropriately graded secondary aggregates and transportation requirements.

13. End user emissions are broadly influenced through a variety of design aspects. One of the main ways through which carbon emissions can be reduced is through reductions in congestion and this is the primary objective of the scheme. Several aspects of the design have been considered to achieve this during the design including alignment, junction design and access road design. Further design consideration was given to lighting, signage and pavement design, with the design goals being to minimise material and energy use during construction and use.

[2] http://www.arup.com/Projects/SPeAR.aspx

14. The horizontal and vertical alignment of the main route and the local access roads together with the choice of cross-section were important in ensuring that the road can deal with predicted traffic levels. Due to the high level of predicted traffic, of which a large percentage would be HGVs, the decision was taken to provide a full dual three-lane cross-section rather than a reduced cross-section. When compared to a narrow cross-section this would increase flow capacity and hence reduce congestion and associated emissions. In addition, three lanes in each direction would increase journey time reliability, improve resilience of the road and hence reduce the effect of traffic incidents, congestion and carbon emissions.

15. Vertical alignment considerations also play a role in reducing carbon emissions. Avoiding long steep gradients reduces associated emissions, particularly related to the high proportion of HGVs that would be using the road. In addition steep gradients would also have a negative effect on congestion during peak flow conditions.

16. Further to these operational reductions, optimising the vertical alignment also minimises earthworks quantities. Where possible the level of the alignment was kept as close to existing ground level as far as possible, subject to the constraints of flood levels and drainage issues. In this respect the vertical alignment was designed to avoid the requirement for pumped drainage solutions, which would have had an associated carbon emission impact. The drainage solution employs ditches and swales that reduce the requirement for positive drainage methods such as kerbs, gullies and pipe networks and in some instances these will also yield usable earthworks materials, reducing the requirement for on-site earthworks transport.

17. Another key factor in reducing congestion has been to eliminate minor accesses and junctions, frontage accesses and laybys on the main line as these tend to reduce traffic capacity or cause speed variations and therefore lead to congestion. In addition, they have a negative impact on safe operation of the road and in some instances lead to an increase in traffic accidents and hence congestion.

18. Junction design has a significant effect on congestion. All junctions on the scheme have been optimised to provide an adequate level of traffic capacity to accommodate predicted traffic levels. In some cases latent traffic capacity has been provided, such as at Bar Hill, in order to minimise future construction.

19. Adding to the design considerations that would result in reduced emissions, one of the objectives of scheme was to place the “right traffic” on the “right roads”. This involved separating long distance strategic traffic from local traffic. To this end the local access roads provided within the scheme would enable local traffic to avoid the main A14 altogether, thereby improving the congestion resilience. In addition, by utilising existing local roads and infrastructure a reduction in construction material can be realised. The scheme design is to retain the eastbound carriageway of the A14 between Swavesey and Bar Hill for use as the local access road, which will reduce new road construction and the carbon footprint of the scheme.

20. Other design objectives included the use of low energy technology lighting systems such as LED in order to reduce operational costs and emissions, the installation of clear signage and ITS in order to improve traffic flow and reduce unnecessary misdirection, which will aid in reducing operational emissions.

Further mitigation

21. Additional mitigation to be explored, dependent on the development of the detailed design, could include sequestration through screening planting and use of lower carbon aggregate of suitable quality.