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CENTRE FOR RESEARCH INTO ENERGY DEMAND SOLUTIONS

DecarboN8

Capital carbon of transportation infrastructure

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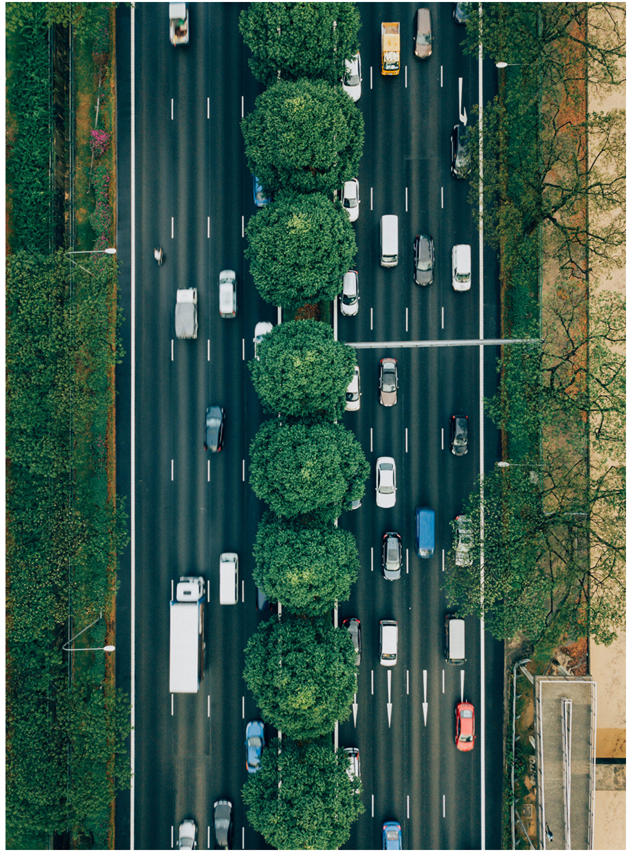
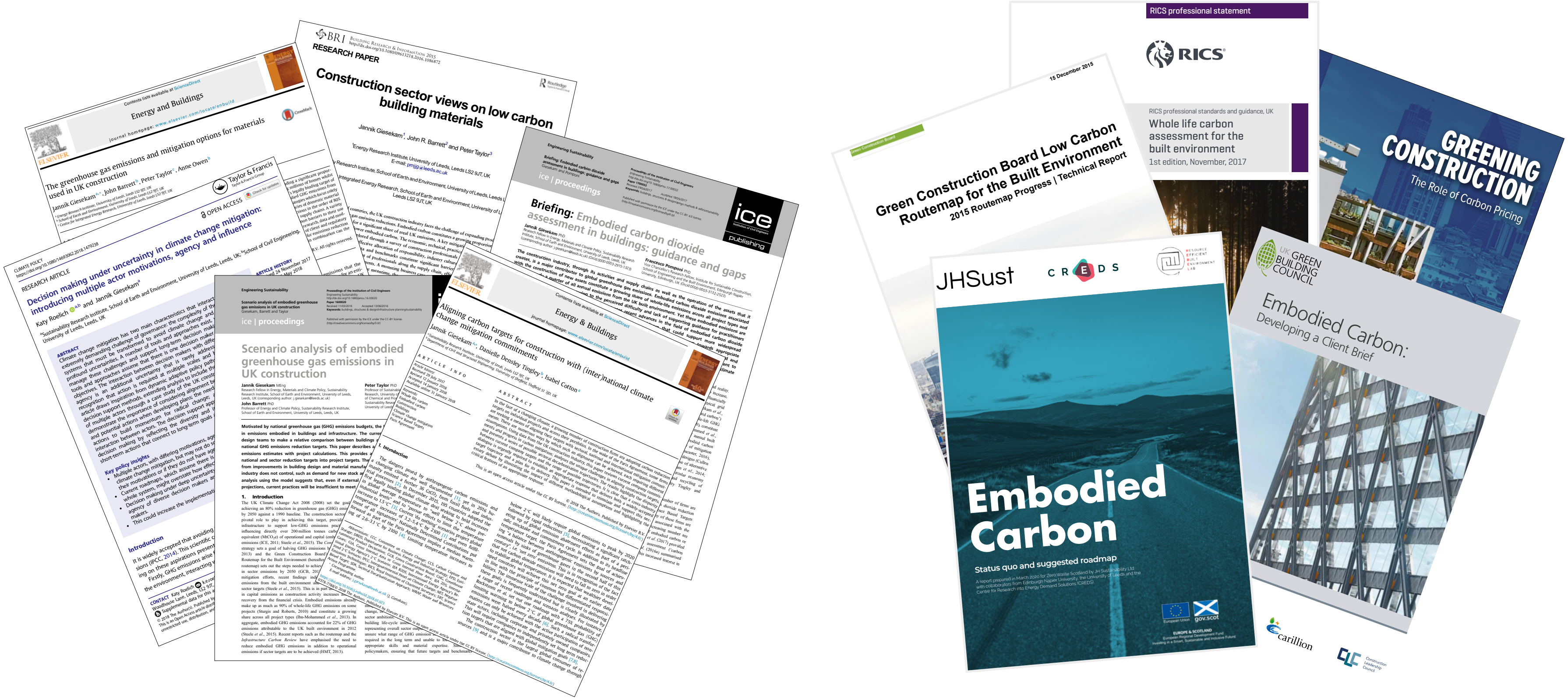
25/11/2020

Presentation structure

1. Terminology
2. Scale - national
3. Scale - project
4. Current assessment practice
5. Example problem
6. Scale - future
7. Suggestions



Past experience



More examples at **www.jannikgiesekam.co.uk**

Emissions from an infrastructure asset

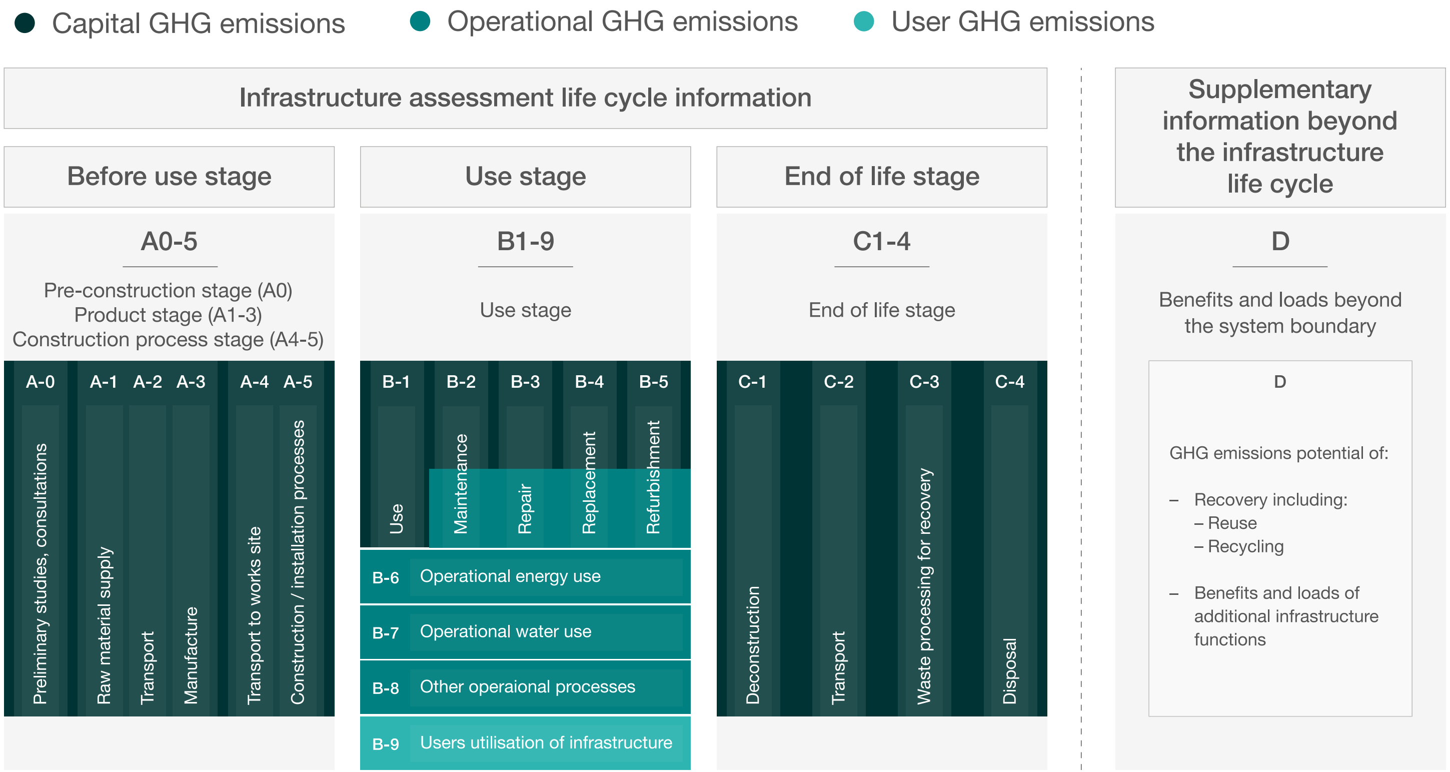


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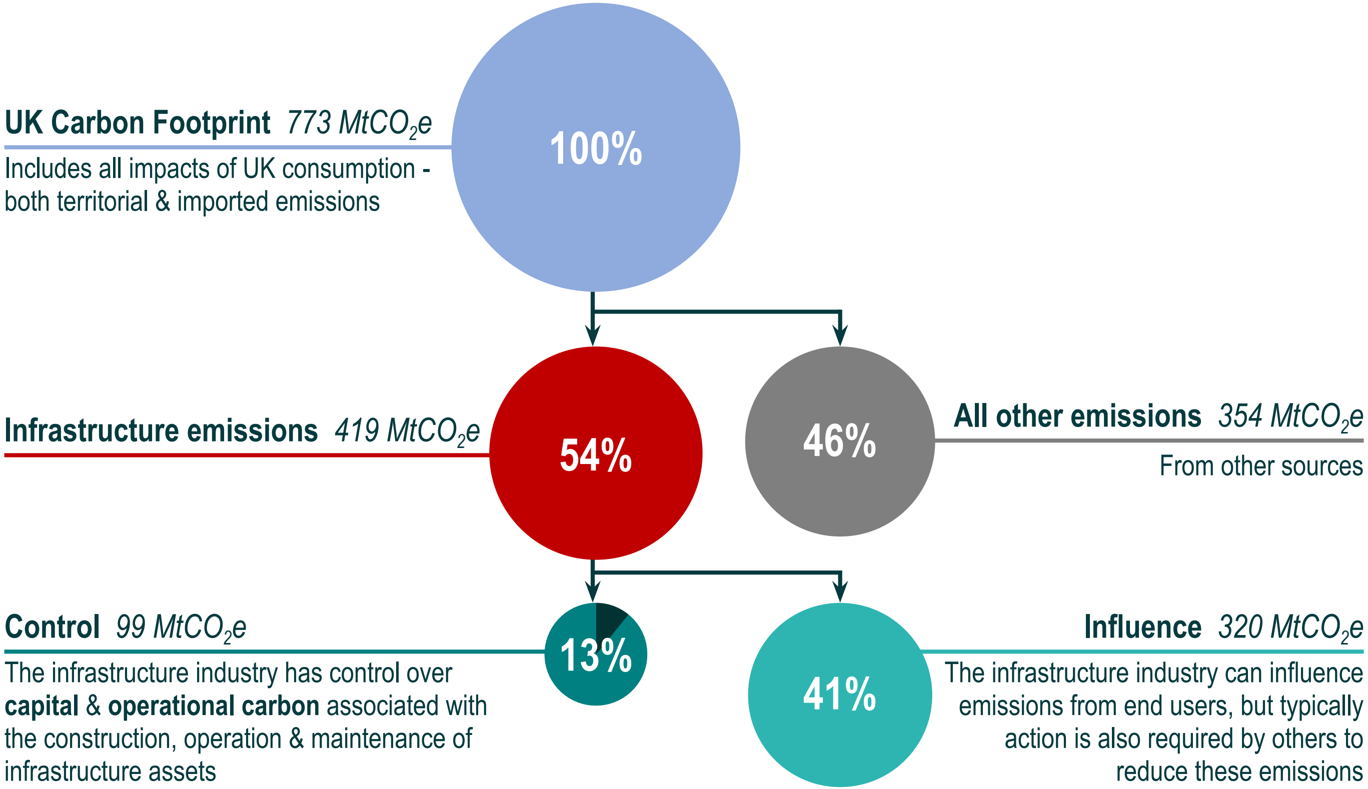
Figure 7 from PAS 2080:2016 Carbon Management in Infrastructure

2020 Infrastructure Carbon Review update



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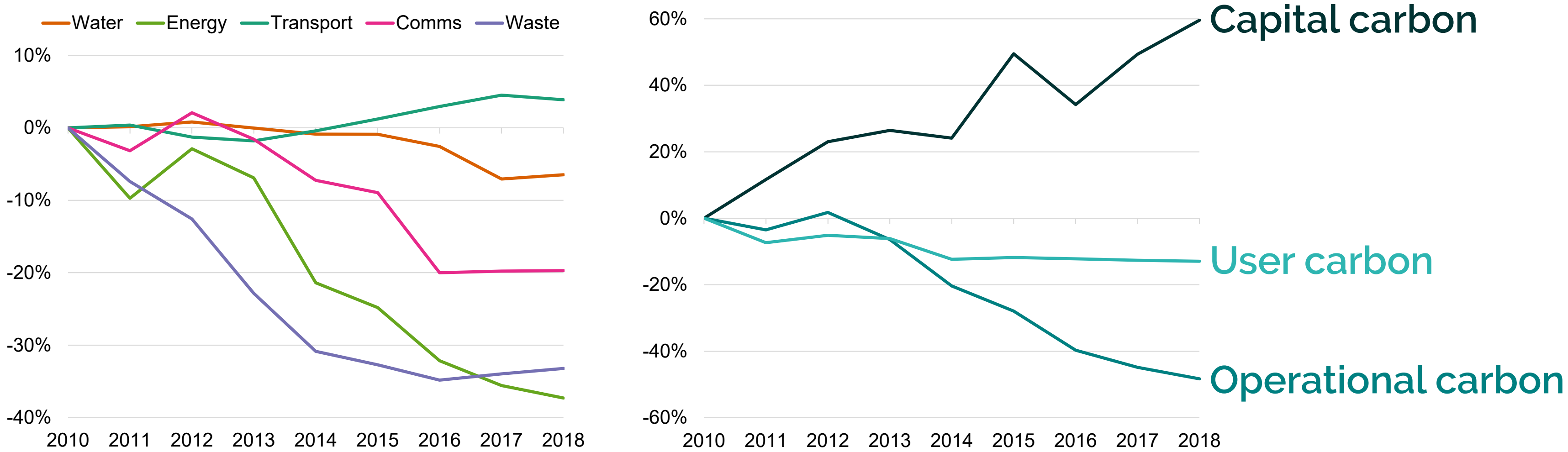
See Unwin Lecture recording for breakdown of results

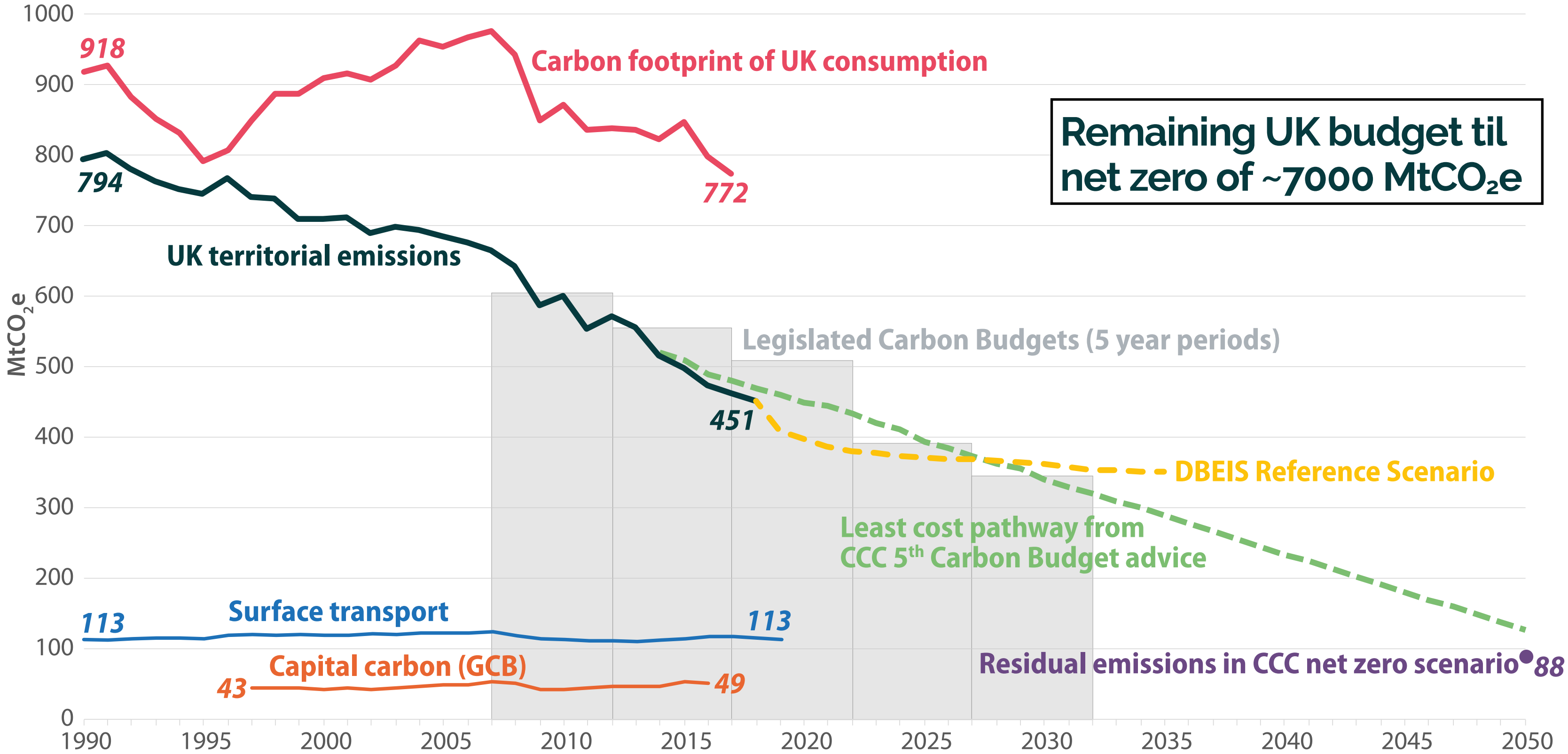
Infrastructure carbon changes from 2010-2018

Generally good progress with 23% reduction in total infrastructure carbon 2010-2018 & 44% reduction under 'control' of infrastructure industry

But **transport & capital carbon increased**



National scale - capital carbon compared to targets



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Territorial emissions & carbon footprint from 2020 official statistics to 2018 and 2017 respectively. Others from CCC (2019) Net Zero. The UK's contribution to stopping global warming & 2020 Annual Progress Report to Parliament; DBEIS Energy & emissions projections 16/05/19 & 2017 Green Construction Board Low Carbon Routemap update

Project scale - capital carbon

10 kt | 100 kt | 1 Mt | 10 Mt

M54-M6 Link Road

81,890 tCO2e

1.6 miles new road
2 new junctions
& some realignment

A14 extension

981,432 tCO2e

23 miles of upgrades
7 miles widening
new bypass
& local modifications

HS2

13.3 MtCO2e

Heathrow 3rd runway

3.6 MtCO2e

Current assessment practice

Already routinely evaluated | Increasingly commonplace | Rarely evaluated

	Materials, products & components	Assets & projects	Asset portfolios	Investment plans, pipelines & scenarios
CapCarb				
OpCarb				
UseCarb				
Recent trends	Rapidly expanding range of Environmental Product Declarations *(>8000)*; new and recently updated databases *(e.g. ICE v3)*; suppliers increasingly able to provide information on request	Carbon assessment increasingly embedded into regulations *(e.g. 2014/52/EU)*; organisational requirements and standards *(e.g. Network Rail Environmental and Social Minimum Requirements)*	Carbon management commonplace; many organisations with carbon KPIs *(e.g. Highways England supply chain emissions)*; some benchmarking (though often only for OpCarb & UseCarb)	Increasingly detailed and integrated system models evaluating futures but CapCarb largely absent from models and rarely assessed for investment pipelines

Current research project

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Creating open source resource to facilitate estimation of capital carbon of future projects and pipelines. Will include links to guidance & tools, amalgamating data from:

Materials, products & components:

EPD (Environmental Product Declaration) directories

Carbon factor databases (e.g. ICE database)

Bespoke tools

Assets & projects:

Independent LCA studies

Environmental Statements produced as part of EIA

Information from stakeholder databases

A9/A96 Inshes to Smithton
DMRB Stage 3 Environmental Impact Assessment Report
Appendix A17.2: Carbon Assessment

JACOBS

- treatment of wastes;
- transportation of waste and material;
- operational electricity consumption; and
- emissions associated with maintenance activities.

2.12 Footway quantities are not included in the pavement/sub base materials in Table 1, but are modelled and the impacts included in the results below. Footway construction depth is assumed to be 220mm, comprising Type 1 unbound mixture sub-base 150mm thick, dense macadam binder course with 20mm aggregate 50mm thick, close graded macadam surface course with 6mm aggregate 20mm thick = 5,245m^3 (including 10% worst-case scenario contingency).

3 Results

3.1 Transport Scotland's Projects Carbon Tool was used to estimate the carbon emissions associated with the proposed scheme. The results are set out in Table 2, Table 3 and Table 4. The calculations are based on a worst-case scenario, including a 10% contingency to cover unknown items.

3.2 Table 2 shows the total carbon emissions anticipated from the proposed scheme throughout its lifetime, during construction and maintenance. It should be noted that that due to rounding of data outputs there are slight discrepancies between the totals presented in Tables 3 and 4, when compared to Table 2. It is confirmed that the information provided in these tables is correct as an output of the Carbon Tool.

Table 2: Proposed Scheme Emissions Summary (Worst Case Scenario Including 10% Contingency)

Carbon source	tCO_2e
Construction: Materials embodied	15,050
Maintenance: Materials embodied	13,975

3.3 Table 3 and Table 4 provide more detailed information on the carbon emissions for each of the 3 stages by splitting the figures into individual project elements and the carbon emissions for construction materials by type. All volumes shown are based on the worst-case scenario figures that include a 10% contingency.

Table 3: Summary by Project Elements (Worst-case scenario including a 10% contingency)

Project elements	Materials embodied (tCO_2e)	Maintenance (materials embodied) (tCO_2e)
Drainage	60	615
Earthworks	8,290	0
Fencing	120	470
Road Pavement	3,085	12,230
Safety Barriers	125	490
Signs	35	165
Structures (civils & buildings)	3,345	0

Example excerpt from carbon assessment within A9/A96 Inshes to Smithton EIA

For more detail on assessment start with

Highways

DMRB LA114

Highways England Carbon Tool for monthly/quarterly supplier submissions

Rail

Network Rail capital carbon guidance note

RSSB Rail Carbon Tool

Network Rail Environmental Strategy

Example problem - significance criteria

From DMRB LA114:

3.19	Where a project stage extends over multiple carbon budget periods, the projects GHG emissions shall be reported against each carbon budget for each project stage.
3.20	The assessment of projects on climate shall only report significant effects where increases in GHG emissions will have a material impact on the ability of Government to meet its carbon reduction targets.
NOTE 1	*National policy states that "It is very unlikely that the impact of a road project will, in isolation, affect the ability of Government to meet its carbon reduction plan targets".*
NOTE 2	*In the context of NOTE 1, it is considered unlikely that projects will in isolation conclude significant effects on climate.*

Every individual project deemed insignificant

e.g. A14 DCO determines emissions are *“negligible”* on this basis:

1.3.5 If all of these construction related emissions were emitted in the 3rd Carbon Budget period (2018-2022) it would amount to 0.025% of the budget for that period, or 0.12% of the UK’s allowable annual emissions.

What about collectively?

In the absence of official estimates, others will step in, with negative consequences. e.g.

The carbon impact of the national roads programme

Lynn Sloman and Lisa Hopkinson

With contributions from Phil Goodwin, Jillian Anable, Sally Cairns and Ian Taylor

July 2020

transport for quality of life

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Science & Environment

Road planners accused of rigging carbon emissions rules

By Roger Harrabin
BBC environment analyst

23 August

Climate change

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Report available here

Ballpark estimate for future transport infrastructure

Estimated Capital Carbon = Anticipated Capital Spend x Carbon Intensity

Anticipated Capital Spend

£120bn for transport (£640bn for all infrastructure) to 2027/28

Then ~£26-31 bn/yr to 2050 in line with National Infrastructure Commission

Carbon Intensity

Typically stated in gCO2e/£ CAPEX (or tCO2e/£m)

100-900 is typical range depending upon project type from literature reviews & project data

Top down construction sector average of 325 for most recent year

Good contractor (Skanska) 215 in 2018 - down from 351 in 2010; aiming for 130 by 2030

Ballpark estimate for future transport infrastructure

Estimated Capital Carbon = **Anticipated Capital Spend** x **Carbon Intensity**

Brackets are range

Per year

8 MtCO2e *(1.7-27.9)* = **25** *(17-31)* x **325** *(100-900)*

Total to 2050

252 MtCO2e *(72-750)* = **775** *(718-833)* x **325** *(100-900)*

More detailed estimate in preparation

Based on IPA National Infrastructure & Construction Pipeline

Based on 9% actual data; 66% estimated data; 25% no data

Draft report stage

See Highways UK event for further discussion

Net Zero Infrastructure Coalition
including

SKANSKA

MOTT MACDONALD

Pinsent Masons

CARBON TRUST

UNIVERSITY OF LEEDS

Leeds City Council

UKCRIC

nationalgrid

Transport for London

Suggestions

Start by implementing routine programme/portfolio level assessment of capital carbon

Integrate capital carbon into system models

Avoid potential challenges through transparent data and decision making

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Thank you

Please get in touch with any queries

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