

Net zero highways

Data methods statement



July 2021

Introduction

This document outlines the methods used to develop National Highways Net Zero Highways plan¹ ([Link](#)). This covers the three following areas of carbon emissions:



1. **Corporate:** Emissions from our own operations, this covers emissions sources such as office energy requirement, network lighting, and ‘corporate Purchases’, for example office supplies and gritting salt for the network.

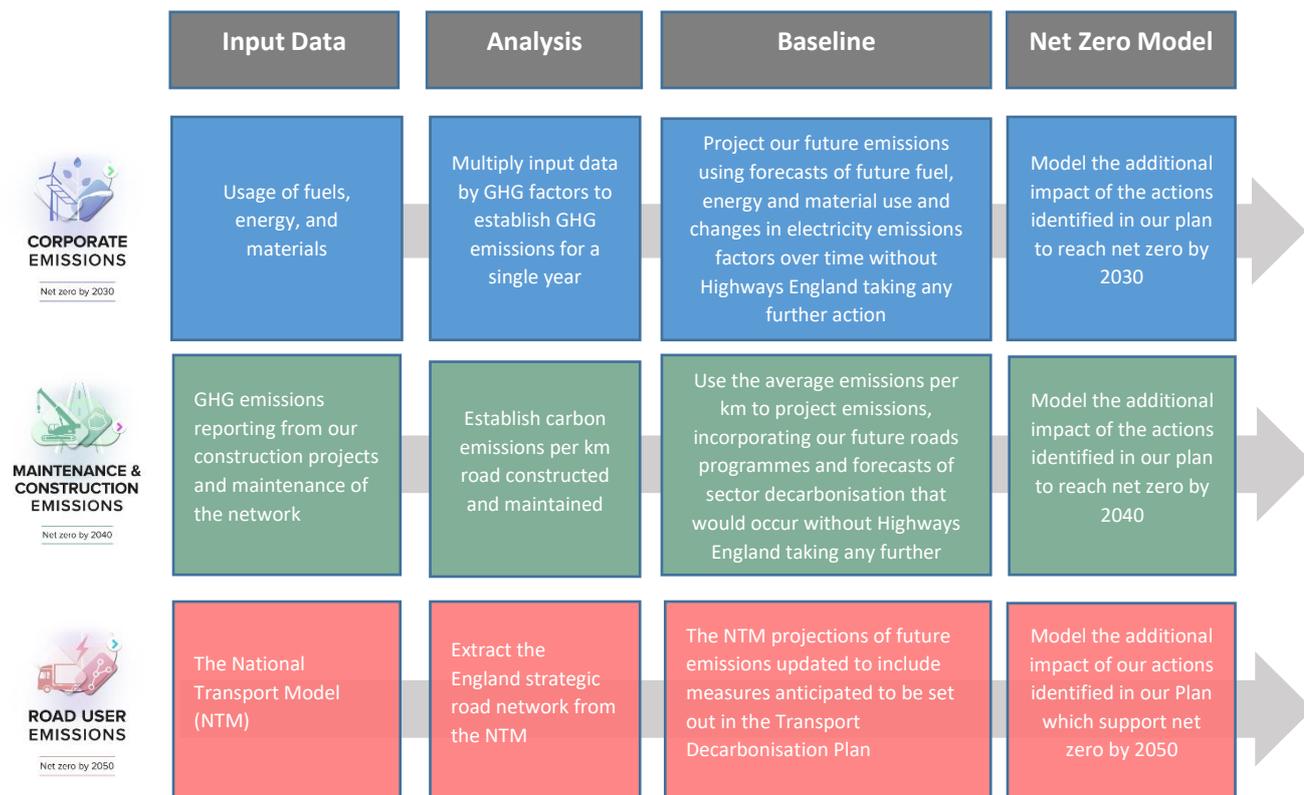


2. **Maintenance and construction:** Emissions from our capital works supply chain. This includes emissions ‘embodied’ in materials, emissions from the transport of materials to and from site, and the use of construction plant, for both new construction and maintenance activities. In addition, this category also includes energy use where the supply chain is managing sections of the network under ‘Design Build Finance Operate’ contracts.



3. **Road User:** Emissions generated by vehicles using the strategic road network. These emissions are not required to be included within Highway’s England Carbon footprint, as they fall outside of the minimum boundary as defined by the GHG protocol corporate standard². However, this has been included as we have some influence over emissions from Road users.

Overview of data, methods and outputs



¹ Highways England’s [Net Zero Carbon Plan 2030-2040-2050](#)

² GHG Protocol Corporate Standard. [Corporate Standard | Greenhouse Gas Protocol \(ghgprotocol.org\)](#)



Net zero by 2030

Corporate

Scope and data

Our corporate baseline is reported according to the GHG protocol corporate standard² and as we are setting a net zero target this must also follow the SBTi Guidance³, this has been used to determine which Scope 3 emissions sources to include.

The key data used was collected during operations by the estates team. This baseline was supplemented by additional data and estimates to ensure full coverage of our corporate emissions for the SBTi Net Zero scope, as summarised below:

Scope 1

- Estate gas use – kWh metered/billed data for all major buildings;
- Light vehicle mileage;
- Heavy vehicle mileage;
- Company car fuel use – mileage claims; and
- Forestry on our land (sequestration) – estimated 7,000 hectares of forest based on our geographic information system (GIS) data and application of Woodland Carbon Code calculator method to estimate tCO₂/year absorbed.

Scope 2

- SRN network electricity use – kWh mostly estimated data; and
- Estates electricity use – kWh metered/billed data for all major buildings.

Scope 3

- Staff business travel – travel expense claims; and
- Other scope 3 items as per GHG Protocol categories – estimated based on available information and industry benchmarks to gauge materiality. This included Design-Build-Finance-Operate contract (DBFO) operational energy use, motorway service area energy use and gritting salt embodied carbon (excluding capital works undertaken by our supply chain, this is covered under construction and maintenance).

Baseline

To help us understand where we needed to focus our actions a baseline of historic and future GHG emissions was constructed by multiplying the input data by GHG emissions factors. All emissions are reported in carbon dioxide equivalent emissions (CO₂e).

DEFRA GHG Reporting Guidance⁴ was used for historical emissions factors for electricity and other fuels. BEIS long-run marginal forecasts are used for grid electricity emission to account for grid decarbonisation.

³ Science Based Targets initiative [Net-Zero - Science Based Targets](#)

⁴ DEFRA [Guidance on how to measure and report your greenhouse gas emissions - GOV.UK \(www.gov.uk\)](#)

Net zero highways plan: data methods statement

Assumptions

For the corporate baseline year, 2019, some data was unavailable; the following assumptions were made based on industry benchmarks and professional judgement;

Emissions Source	Assumption
F-Gas	1% of office energy
Commuting	30% of office energy
Office and depot supplies	3% of office energy
Office and depot waste	2% of office energy
Upstream leased assets (Data centres)	5% of Network Energy Use
Downstream leased assets (MSA energy use)	20% of Network Energy Use

To forecast from the 2019 baseline required some assumptions as follows;

- Additional natural gas would be required to heat new additions to the estate;
- Additional mileage would be driven by our vehicles as new vehicles are added to the fleet;
- Additional electricity consumption will be required as smart motorways are rolled out as they tend to increase energy use (although smart motorways help to increase capacity on our existing network reducing the need to build new roads);
- DBFO operational electricity usage was included from the contract end date when emissions move from maintenance and construction to corporate; and
- Forestry sequestration estimated based on our GIS data and Woodland Carbon Code, however this was then rounded down to 15,000 tCO₂e to account for uncertainty.

Limitations

- No independent assurance of our baseline figures has yet been undertaken; and
- There is limited metering of our network electricity usage and estimation has been used. This is an area for ongoing validation.
- There is limited information regarding our scope 3 emissions

Action quantification

In addition to the reductions in carbon emissions expected in the baseline, primarily due to the decarbonisation of the electricity grid, our net zero plan includes the implementation of actions to further reduce our emissions. This was modelled to understand the impact of these actions. Full details of this modelling can be found in the Supporting Data Spreadsheet^{Error! Bookmark not defined.}. The key actions modelled in our net zero scenario are:

- Our vehicles – The transition of our own fleet to electric vehicles, and the use of electric vehicles for business travel;
- Building heating – gradual switch away from gas to renewable sources by 2030;
- LED roll out – the switch to LEDs for our lighting;
- On-site renewables – uptake of on-site solar photovoltaics could provide up to 10% of our energy demand by 2030;
- Green energy tariffs/Power Purchase Agreements (PPAs) – credit in net emissions reporting for zero carbon electricity sources; and
- Scope 3 – policies to monitor and reduce emissions in this category by 30% by 2030.

Net zero highways plan: data methods statement

Limitations

- Forestry sequestration is significant and estimates still need to be verified by a third party.
- Further work is needed to map out and robustly quantify the other Scope 3 Corporate Emissions (excluding construction) as initial estimates are uncertain due to data availability.



Maintenance and construction

Scope and Data

Emissions from our construction and maintenance supply chain covers the manufacture, transport and use of materials such as asphalt, cement, concrete and steel on our network.

The following key data sources have been used:

1. Construction and maintenance supply chain Highways England Carbon Tool⁵ outputs from 2012 to 2020;
2. Major projects bill of quantities from 2013 to 2034; and
3. Major Project Environmental Statements.

Baseline

The principal data source for the baseline is the carbon returns our construction and maintenance supply chain create using the Highways England Carbon Tool. Where the carbon returns were not complete or sufficiently robust, we supplemented this with the GHG emissions data declared within the project's Environmental Statements or calculate GHG emissions using the projects material bill of quantities. The resultant dataset was compiled and summarised by contract type, project type, material type and emissions source. The following section sets out how we used this data to model future performance to create a baseline.

Major Projects baseline forecast

The carbon impact of construction is dependent on what is built, so we needed a measure of the average carbon efficiency of construction to compare performance over time (and between different projects), and to produce forecasts.

In order to establish a measure of carbon efficiency the total carbon impact (tCO₂e) was divided the total major projects length (lane km). This gives a carbon intensity indicating the carbon emissions per lane km (tCO₂e/lane km). See below.

$$\frac{\sum \text{Carbon impact from major projects}}{\sum \text{Lane km from major projects}} = \text{Carbon impact per lane km}$$

This analysis was carried out for each category of major project:

- Widening
- Junctions
- Complex Infrastructure Projects (CIPs)
- Smart Motorway
- Bypass
- All Lane Running (ALR) Retrofit

⁵ Carbon emissions calculation tool: Highways England [Carbon emissions calculation tool: Highways England - GOV.UK \(www.gov.uk\)](https://www.gov.uk)

Net zero highways plan: data methods statement

An overall average for performance was calculated across all project categories. To forecast future emissions a five-year rolling average was used. The CIPs were added discreetly on top of the rolling average as this project type is built on an ad hoc basis due to their size. This also allows for future CIPs to be added to the model as they arise.

Maintenance contracts

There are two primary types of maintenance contract that we have, regional area maintenance and DBFO contracts.

DBFOs and regional maintenance contracts have the same sources of maintenance GHG emissions with the exception of operational energy usage, such as lighting and variable message signs, which is only included for DBFOs. Operational energy usage for all other parts of the SRN outside of DBFOs is included within our corporate scope of GHG emissions. DBFO operational energy use has been estimated based on the average from other areas of the network currently under Highways England's control.

Baseline decarbonisation

A baseline level of decarbonisation is expected to occur without the specific actions set out in the Highways England Net Zero Carbon Plan. This includes the following:

- Decarbonisation by material sectors which have publicly announced a net zero by 2050 pathway. The sectors are:
 - Concrete and cement⁶; and
 - Steel⁷.
- The use of lower temperature asphalt.
- The decarbonisation of transport and plant through the transition to electric power.

Total construction and maintenance emissions baseline

The combined construction and maintenance supply chain emissions baseline was summarised by source of emissions set out below based on the average split across all contract types:

- On site plant;
- DBFO operational energy;
- Material transport;
- Materials:
 - Concrete;
 - Cement;
 - Steel;
 - Asphalt;
 - Aggregates;
 - and other.

⁶ MPA UK Concrete and Cement Industry Roadmap to Beyond Net Zero (2020) available online: https://www.thisisukconcrete.co.uk/TIC/media/root/Perspectives/MPA-UKC-Roadmap-to-Beyond-Net-Zero_October-2020.pdf

⁷ Energy Transitions Commission, Mission Possible: Reaching net-zero carbon emissions from harder-to-abate sectors (2018) available online: https://www.energy-transitions.org/wp-content/uploads/2020/08/ETC-sectoral-focus-Steel_final.pdf

Net zero highways plan: data methods statement

Assumptions

- The total carbon emissions for each project have been applied evenly over the total years of construction.
- The 5-year (2015-2019 inclusive) average carbon footprint for maintenance and the DBFO contract works has been used and remains constant to 2050.
- All DBFO operational electricity will return under the control of Highways England after the contract end years.

Limitations

- Not all suppliers are currently reporting their Highways England Carbon Tool data correctly e.g. mis-reporting, late reporting or not reporting. To address this bill of quantity data and Environmental Statement carbon assessments were used to supplement the data and fill in gaps.
- A location based⁸ approach has been taken to estimating the GHG emissions for the operational electricity use by DBFOs using grid average emission factors. Therefore, this does not take into account DBFOs using green energy tariffs. The future decarbonisation of the grid has been taken into consideration using the UK Government Green Book⁹ greenhouse gas emission factors.

Action quantification

In addition to the reductions in carbon emissions expected in the baseline, we will be implementing additional measures that are in the net zero plan to reduce construction and maintenance emissions. A forecast was modelled to demonstrate the impact of these actions. Full details of this modelling can be found in the Supporting Data Spreadsheet^{Error! Bookmark not defined.}. The key actions modelled in our net zero scenario are:

- Requirement for net zero plant on our sites by 2030;
- Requirement for net zero HGVs on our sites by 2040;
- Increase capacity on our network due to smart motorways to meet forecast demand (14% additional capacity 2025-2040 + 2.9% additional capacity during RIS2)¹⁰;
- Increase capacity on our network due to digital roads (1% by 2030, 8% by 2040 and 17% by 2050 of increased capacity)¹⁰; and
- Carbon efficiencies (2.5% from 2020 to 2040 and 10% from 2020 to 2030)¹¹.

⁸ A location-based method reflects the average emissions intensity of grids on which energy consumption occurs (using mostly grid-average emission factor data). GHG Protocol, Scope 2 Guidance (2015): accessed online at: https://ghgprotocol.org/sites/default/files/Scope2_ExecSum_Final.pdf

⁹ Department for Business, Energy & Industrial Strategy, IAG spreadsheet toolkit for valuing changes in greenhouse gas emissions (2019): accessed online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/873679/toolkit-for-valuing-changes-greenhouse-gas-emissions.xlsm

¹⁰ Smart motorway and Digital Roads contribution to Net Zero outcomes (February 2021) WSP Report

¹¹ A 2.5% carbon efficiency rate has been applied pre sector decarbonisation as the savings from building nothing and building less are primarily covered by the savings from smart motorways and digital roads. A 10% carbon efficiency rate has been applied post sector decarbonisation as the build smart and build efficiently construction measures will be taking place as a result of the PAS 2080 framework and ways of working being implemented across the Highways England supply chain. The potential carbon saving percentage was developed using the estimate percentage saving Anglian Water have achieved since implementing and working to PAS 2080 across their alliance.

Net zero highways plan: data methods statement

Assumptions

- All materials, plant and HGVs decarbonise following the CCC 6th Carbon Budget Manufacturing and Construction trajectories.
- HGVs are fully decarbonised by 2040 due to Highways England policy commitment.

Limitations

- The CCC 6th Carbon Budget Manufacturing and Construction decarbonisation trajectories were used and therefore projections include additional carbon saving impacts from the manufacturing sector.
- The projections do not disaggregate plant and transport from materials which may differ in their decarbonisation trajectories, but have been assumed will broadly align.

C&M range summary

To produce the final figures that were used in Our 2030 / 2040 / 2050 net zero plan, we took the final reduction trajectory that was quantified by combining the baseline and the actions quantification. Using this we calculated the percentage reduction compared to 2020 for 2025, 2030, and 2035. To account for the uncertainty associated with this trajectory, we applied a 10% range to these figures based on professional judgement.



ROAD USER EMISSIONS

Net zero by 2050

Road Users

Policy background

The DfT's plan to accelerate the decarbonisation of transport, the Transport Decarbonisation Plan (TDP), sets out in detail what government, business and society will need to do to deliver the significant emissions reduction needed across all modes of transport, putting us on a pathway to achieving carbon budgets and net zero emissions by 2050.

Therefore, many of the actions that will deliver the ambition for net zero road user emissions by 2050 are being pursued by the DfT and are out of our direct control, but that does not mean we cannot play our part. Our priorities are to help roll out solutions to decarbonise HGVs, and support the uptake of electric cars and vans. We will also continue our work integrating the SRN with other transport modes, whilst working to improve the efficiency of the network.

Scope and data

For the purposes of the Highways England Net Zero Plan road user GHG emissions are the carbon dioxide emissions (CO₂) released at the tailpipe from vehicles travelling on the SRN.

The data for road user emissions on the SRN is taken from the National Transport Model (NTM) used to model the impact of the Transport Decarbonisation Plan (TDP).

The NTM is a DfT model which produces forecasts of road traffic growth, vehicle tailpipe emissions, congestion and journey times. The National Transport Model (NTM) provides a systematic means of comparing the national consequences of alternative transport policies against a range of background scenarios which take into account the major factors affecting future patterns of travel.

The NTM data provides the vehicle km travelled and the carbon emissions (tonnes of CO₂) split by fleet (car, light goods vehicles, rigid heavy goods vehicles, articulated heavy goods vehicles and public service vehicles).

Baseline

We required a baseline to of the GHG emissions from vehicles using our network to understand the proportion of emissions from different types of vehicles and how emissions are projected to change over time. The baseline is a projection of road user emissions which takes into account the measures understood to be in the TDP to decarbonise transport and road user emissions by 2050.

Method

The baseline is taken directly from the NTM data provided by the DfT with professional judgement used to factor in the anticipated measures outlined in the TDP. The data provided by the DfT is an SRN (England) specific extract of the NTM.

Assumptions

- The baseline assumes an increase in vehicle km travelled on the SRN over time. This includes an approximately 40% increase in car vehicle km travelled on the SRN between 2020 and 2050.

Net zero highways plan: data methods statement

- The baseline assumes an increase in vehicles that are zero emission at the tailpipe over time. For cars this will primarily be battery electric vehicles (BEVs) and for heavier duty vehicles this could include BEVs, electric road enabled vehicles or hydrogen powered vehicles.
- The proportion of zero emission vehicles is based on professional judgement of the anticipated impact of key policies such as the ban on new diesel or petrol cars and vans from 2030, and a future ban on diesel or petrol HGVs, which has been assumed to be in 2040 for the purposes of analysis.
- A rapid uptake of BEV cars and vans over the next decade has been assumed, with 80% zero emission by 2035.
- A rapid uptake of zero emission HGVs has been assumed to take place from 2035 onwards with 75% zero emission by 2045.
- It has been assumed that almost all vehicles on the network in 2050 will be zero emission at the tailpipe.
- The NTM is aligned with the data and assumptions in the DfT TAG Databook and OBR latest GDP forecast¹².
- In line with the TAG Databook, the NTM assumes progressively lower carbon associated with electricity through to 2050 but that there are residual emissions from electricity generation, therefore there are still small residual carbon emissions from vehicles that are zero emission at the tailpipe.

Action quantification

Whilst government policy is expected to drive the transition to a net zero vehicle fleet on the road network, there are actions we can take to support the transition or increase the rate of transition. To help prioritise which actions we should focus our efforts on, the potential carbon emission reduction was estimated for key actions. Some actions we have included in our net zero plan were not included in this analysis because the potential impact of some actions could not be disaggregated from existing government policy and initiatives.

Research was undertaken to determine the likely emissions reductions achievable by potential actions. The emissions reduction assumptions were applied to the NTM data to estimate in each year between 2021 and 2050 what the emissions reduction would be.

Assumptions

A number of assumptions were made in order to apply emissions reductions to the NTM data. The assumed impact on each action or group of actions of reducing emissions as well as the reference sources these assumptions are based on is set out in Table 6.1.

Table 1: Assumptions and reference sources for each action considered

Action / Action Group	Impact Assumptions	Reference
70 mph speed Limit compliance by cars and LGVs	2% emissions reduction across cars and LGVs	CCC Report ^{Error! Bookmark not defined.} and European Environment Agency ¹³
60 mph speed Limit compliance by cars and LGVs	7% emissions reduction across cars and LGVs	CCC Report ^{Error! Bookmark not defined.} and European Environment Agency ¹³

¹² DfT TAG Databook. <https://www.gov.uk/government/publications/tag-data-book>

¹³ European Environment Agency 2020. Available online: [Do lower speed limits on motorways reduce fuel consumption and pollutant emissions? — European Environment Agency \(europa.eu\)](https://www.eea.europa.eu/en/press-releases/2020/04/04)

Net zero highways plan: data methods statement

Economical and efficient driving by cars and LGVs	8% emissions reduction across 20% of cars and LGVs	
Economical and efficient driving by rigid HGVs	13% emissions reduction, 50% take up	Energy Saving Trust ¹⁴ , CCC Report ^{Error! Bookmark not defined.} and Professional judgement
Economical and efficient driving by articulated HGVs	22% emissions reduction, 50% take up	Energy Saving Trust, CCC Report and Professional judgement
Improved logistics by rigid HGVs	10% emissions reduction	Energy Saving Trust, CCC Report and Professional judgement
Improved logistics by articulated HGVs	11% emissions reduction	Energy Saving Trust, CCC Report and Professional judgement
Demand reduction through modal shift	1% emissions reduction across cars and HGVs	CCC Report and Professional judgement
Smoother road surface	Assume 2% emissions reduction on 5% of km travelled across the network	Fuelsave Project ¹⁵ and Professional judgement

Limitations

- Whilst reference sources were found for the potential emissions saving from potential actions, the extent of uptake and impact across the SRN has been largely based on professional judgement.

¹⁴ Energy Saving Trust. Available online: <https://energysavingtrust.org.uk/service/subsidised-ecodriving-training/>

¹⁵ Ramboll Fuelsave Project. Available online: <https://ramboll.com/digital-mobility-lab/modelling/fuelsave>