

<b>Title</b>	<b>Carbon Calculation &amp; Accounting Standard</b>	
<b>Release Date</b>	27 <sup>th</sup> September 2023	
<b>Version</b>	Rev. 4.5	
<b>Release</b>	Release Candidate 4	
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<b>Restrictions</b>	<b>FHRG Members Only</b>	

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# Carbon Calculation & Accounting Standard (CCAS)

## Carbon Reporting Guidance for Local Highways Authorities

(GHG Scopes 1, 2 & 3)

## Contents Amendment Record

This document has been amended and issued as follows:

Version	Date	Description	Editor(s)	Review
1-0-0	Feb 2022	Release Candidate 3.0A	S. Wilson, A. Perrin	J. Carter
1-1-2	Feb 2022	Release Candidate 3.0b	S. Wilson	J Russel, D Lennox
1-1-4	Feb 2022	Release Candidate 3.0D	S. Wilson	M. Hall, J. Carter
1-2-0	Feb 2022	1 <sup>st</sup> Edition	S. Wilson	M. Hall, D. Lennox
1-2-1	Mar 2022	1 <sup>st</sup> Edition (Scope 1 & 2)	S. Wilson	N/A
2.0.0	Apr 2023	Framework	D. Lash, Victoria Walsh	S. Wilson
2.1.0	Apr 2023	Initial Content	D. Lash, Victoria Walsh	S. Wilson
2.1.4	May 2023	Internal Draft	S. Wilson	D. Lash, Victoria Walsh
2.1.3	May 2023	Artwork	S. Wilson	D. Lash, Victoria Walsh
2.1.5	Jun 2023	Release Candidate 3.4.0	D. Lash, Victoria Walsh	S. Wilson
2.3.0	July 2023	Release Candidate 3.4.1	S. Wilson	K. Farquharson, A. Perrin
2.4.1	Aug 2023	Release Candidate 3.4.2	S. Wilson, A. Perrin	K. Farquharson
2.5.0	Aug 2023	Release Candidate 3.5.0	K. Farquharson	S. Wilson
3.1.1	Aug 2023	Release Candidate 3.6.0	S. Wilson	K. Farquharson, A. Perrin
3.1.2	Aug 2023	Release Candidate 3.6.3	K. Farquharson, A. Perrin	S. Wilson
3.4.0	Sep 2023	Release Candidate 3.6.4	S. Wilson	K. Farquharson, A. Perrin
3.6.0	Sep 2023	Release Candidate 3.6.0	S. Wilson	V. Walsh, D. Lash
4.5.0	Sep 2023	Release Candidate 4	J. Russell	A. Perrin, S. Wilson

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## Acknowledgements

Proving and the FHRG would like to thank the following sector contributors:

- **Victoria Walsh, Devon County Council**
- **Daniel Lash, University of Exeter**
- **Phil Skegg & Mitesh Solanki, Ringway**
- **Jason Russell & Justin Udie, Atkins**
- **David Ogden & Mark Saunders, Colas**
- **James Haluch, Breedon**
- **Emily See, LGTAG**
- **Marie-Claude Hemming & Simon White, CECA**
- **Helen Bailey, Driven (Scope 1 & 2)**
- **Emma Pye, Pye Consulting (Scope 1 & 2)**

A special thank you is also extended to the members of the FHRG CCAS pioneer group, without whose help this document would not have been possible:

- **Owen Jenkins, Oxfordshire County Council (as Research Coordinator)**
- **Jon Evans & Tom Gifford, Lincolnshire County Council**
- **Amanda Richards & Lloyd Allen, Surrey County Council**
- **James Bailey & David Walters, Staffordshire County Council**
- **Neill Bennet & Alice Russell, Derbyshire County Council**
- **Scott Tompkins & Shail Chohan, Warwickshire County Council**

## Terminology

This guidance uses precise language to indicate accounting and reporting requirements, recommendations, and allowable options that organisations may choose to follow.

- **The term “shall” is used throughout this document to indicate what is required for a GHG inventory to be in conformance with this guidance and, by extension, the GHG protocols and associated standards.**
- **The term “should” is used to indicate a recommendation, but not a requirement.**
- **The term “may” is used to indicate an option that is permissible or allowable.**

The term “required” is used in the guidance to refer to requirements and reporting obligations. Where specified, “needs”, “can”, and “cannot”, may be used to provide recommendations on implementing a requirement or to indicate when an action is or is not possible.

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# Introduction & Overview



## Introduction

The Future Highways Research Group (FHRG) has developed this guidance to assist Local Highways Authorities (LHAs) and their supply chain partners in implementing the GHG (greenhouse gas) protocols for measuring and reporting carbon emissions. This guidance follows what the GHG protocol refers to as the *operational control approach* and is intended to identify the emissions from LHAs over which they have control or influence.

To assist LHAs, the following steps have been taken in the production of this guidance:

- **Identify and review existing GHG standards, relevant to LHA services and supply chains.**
- **Define the activities undertaken (or commissioned) by LHAs that are within scope.**
- **Identify what GHG emissions are relevant within these activities.**
- **Re-categorise GHG emissions so they can be most usefully and efficiently applied to the sector.**
- **Describe the data gathering, calculation, and reporting approaches for each category.**

The following sections describe these steps in more detail.

## Purpose & Goals

The primary objective of this document is to provide straightforward, standardised, highways-specific guidance for the collation, calculation and reporting of GHG emissions for highways construction and maintenance activities. This guidance will assist LHAs in establishing their carbon footprint, including how to identify, measure and assess the applicable data. Through the application of practical and repeatable methods, LHAs will be able to calculate their carbon footprints on a consistent and comparable basis. Designing, prioritising, and managing carbon reduction initiatives are out-of-scope for this document.

The stated goals of this guidance include to provide and enable:

- **Comprehensive and consistent standards for carbon accounting for LHAs.**
  - Across GHG scopes 1, 2 & 3.
  - Based on the relevant elements of the GHG protocol, BS EN ISO 14001 (specifically ISO 14064), PAS 2050, PAS 2060 and PAS 2080 standards.
  - Baseline reporting standards for LHAs and their supply chain partners.
- **Repeatable, transparent, and robust processes for undertaking emissions assessments.**
  - Common baseline assumptions and boundaries.
- **Guidance covering both highways construction and highways maintenance.**
  - Guidance for consistent carbon measurement, conversion, and aggregation.
  - Guidance regarding data sources, data calibration and assessing data sources veracity.
- **Proposed in-house processes for reducing the administrative overheads of carbon accounting.**
  - Enable in-house skills and the development of a low-carbon culture.
  - Avoiding the repeating costs of expensive external consultancy.
- **The assessment of strategic carbon reduction options based on accurate carbon baseline assessments.**
  - Including the assessment of new materials, methods, policies, and partners.
  - Early identification of unsubstantiated initiatives / claims (greenwash).

This guidance has been produced for highways sector practitioners and is not intended to provide general information on the overarching protocols, wider standards, or government policies regarding carbon emissions management. Wherever possible, a balance has been sought between addressing the requirements of the GHG standards (to obtain accurate and actionable information) and pragmatic, streamlined processes.

This approach enables LHAs to provide accurate and timely carbon emissions information to their organisations, identifying carbon hotspots with the aim of reducing carbon emissions over time.

This guidance document is open source (IP/AP free), free to access and use, sector owned, and sector curated. This guidance will be updated as the standards and requirements for carbon reporting and management evolve.



A *carbon footprint* is the measure of greenhouse gases (GHGs) released into the atmosphere as a result of the activities of a particular individual, organisation, or community. The calculated carbon footprint of an organisation enables key stakeholders to understand emissions, where they come from, and plan the necessary steps towards reducing them.

## Target Users

This guidance has been prepared for LHAs and their supply chain partners. In addition to general guidance, specific advice is provided for key highways services stakeholders engaging in carbon measurement and reporting. Each step in the guidance will require the oversight and participation of the following stakeholders:

- **The carbon management and reporting team<sup>1</sup>.**
- **The director responsible for highways services.**
- **Asset manager(s).**
- **Works commissioning teams.**
- **Function manager(s).**
- **Supply chain partner(s).**
  - Including supply chain carbon team(s)

It should be noted that all members of the LHA team should be briefed on this guidance, the GHG standards, and the wider implications of carbon measurement and management on services provision.

## Resources & Competence

Each LHA must ensure that competent resources are assigned, and that roles and responsibilities are clearly defined and communicated. This will ensure the necessary data used to calculate the carbon footprint is collected.

Competence requirements are to be determined by each local authority; however, it is recommended that the identified resources undertaking carbon monitoring and management activities are suitably trained and certified.

The main competencies for those involved in carbon analysis and management include:

- **Familiarity with the GHG standards and the carbon reporting requirements.**
- **Carbon accounting systems training and skills<sup>2</sup>.**
- **Comprehensive understanding of the guidance outlined in this document.**
- **Familiarity with the items included in the carbon inventories.**
- **Data and data sources management skills.**
- **Data collection and collation skills (especially the management of large data sets).**

There will be different levels of competency depending on the role, and frequent training is one of the many methods for achieving (and maintaining) competency. Those with responsibility for carbon management and reporting within LHAs should be encouraged to continually improve their knowledge, skills, and expertise.

<sup>1</sup> These may be part of a corporate function within a local authority but have reporting responsibility for highways services.

<sup>2</sup> Authorities typically either adopt a proprietary software tool or will create an in-house Microsoft Excel-based reporting tool.

The following competency requirements are recommended as a minimum for the associated roles:

1. **Data collator:** fully aware of where the data is sourced from; including access to data, meters, and other information as required. Data collators should be fully conversant in the use of data recording tools, the approach adopted for unit conversion and be able to identify data inaccuracies and data gaps, thereby enabling correction at source.
2. **Carbon footprint producer:** fully conversant in the use of the adopted carbon calculation and reporting tools and trained in the production of carbon footprint reports<sup>3</sup>.
3. **Carbon Manager:** trained and ideally certified for carbon management, with comprehensive knowledge of the highways sector and LHA services.

It is recommended that the staff assigned the roles identified above receive formal training on carbon footprint assessments through a relevant local or national qualification (or equivalent) scheme. Training is offered by numerous providers including, but not limited to GHG Protocol and IEMA (Institute of Environmental Management and Assessment).



In many authorities, a **Corporate Carbon Management & Reporting Team (CCMRT)** will be responsible for monitoring and recording the sources and scale of emissions (e.g., emissions arising from premises and sites, vehicles and staff commuting). In these cases, reporting should be undertaken by the CCMRT, ensuring that effort is not wasted, and data is not double counted.

## What Are Greenhouse Gas Emissions?

GHGs are gases that contribute to anthropogenic climate change (i.e., from human activity). These include carbon dioxide (CO<sub>2</sub> or CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs), ozone (O<sub>3</sub>), and hexafluoride (SF<sub>6</sub>). These gases each have a different contributory impact on global warming and climate change for the same fixed mass.



Whilst ISO 14064 states that emissions should be quantified separately for each GHG, there are unlikely to be any significant benefits to the sector for doing so given the additional effort. It is therefore recommended that only the carbon dioxide equivalent (CO<sub>2</sub>e) need be calculated and reported<sup>4</sup>.

GHGs considerations for highways services will include:

- **Sources:** processes that release GHGs into the atmosphere.
- **Sinks:** processes that remove GHGs from the atmosphere.
- **Reservoirs:** components other than the atmosphere that have the capacity to accumulate GHGs.

In most cases, it will only be sources that are relevant.

This guidance aims to establish the GHG emissions associated with highways activities, where these are:

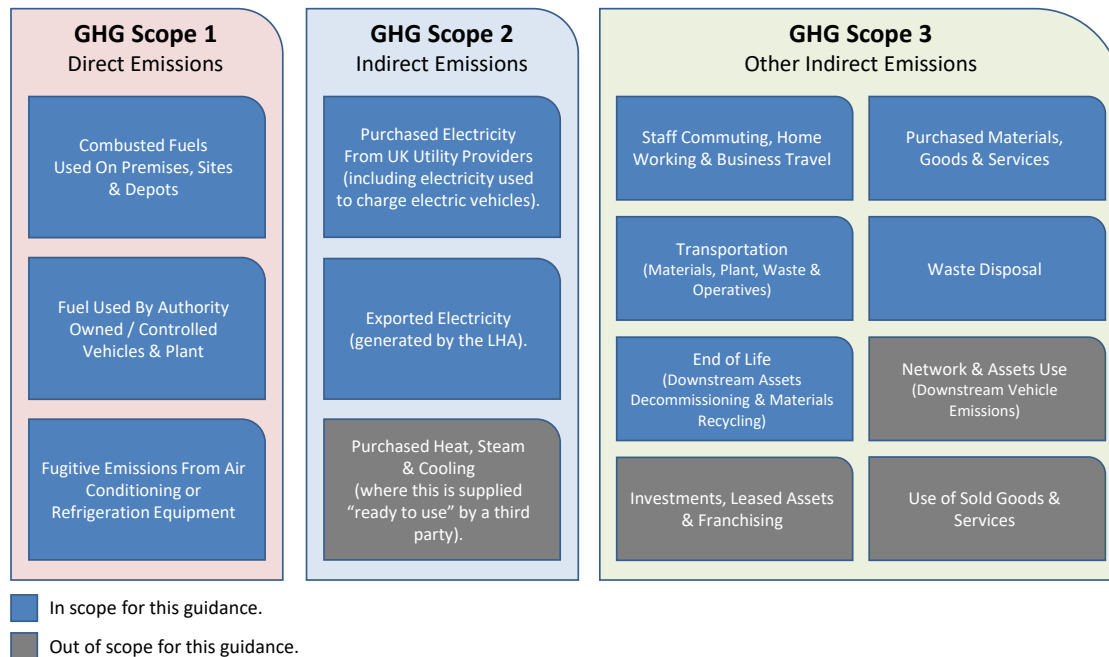
1. **Procured and / or commissioned by the LHA or,**
2. **Directly delivered by the LHA.**

The overall boundary of the calculations should cover all work, based on an *operational control* basis. An organisation has operational control of emissions if it, or its supply chain, has the full authority to introduce and implement its operating policies at the operational level.

<sup>3</sup> Including training and certification by an appropriate and relevant professional body.

<sup>4</sup> This guidance will be reviewed annually with regard to specific GHG reporting. If mandated specific GHG reporting is required, this guidance will be updated accordingly.

**Figure 1: GHG Protocol: Scope Definitions**



Emissions sources within the overall boundary can be separated into *direct* and *indirect* emissions. These are called scope 1, 2, and 3 emissions and can be summarised as follows (and as shown in Figure 1).

- **Scope 1** (direct emissions): Activities owned or controlled by the organisation (in this case the LHA) that release emissions straight into the atmosphere, e.g., combustion in owned boilers or vehicles.
- **Scope 2** (indirect emissions): Emissions released into the atmosphere associated with the consumption of purchased electricity, heat, steam, and cooling by the organisation (in this case the LHA).
- **Scope 3** (other indirect): Emissions that are a consequence of the organisation's actions, which occur at sources which are not in ownership or control of the organisation, e.g., work undertaken by contractors, transport by means other than company vehicles, waste disposal, or purchased materials.

## GHG Standards & References

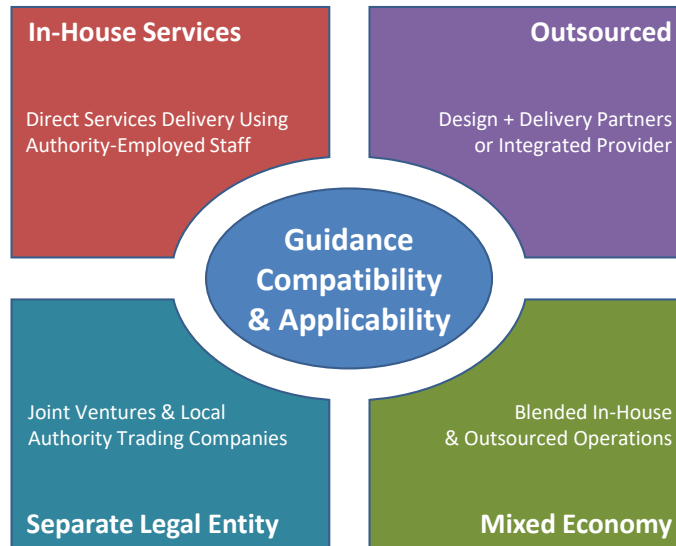
There are two main standards in use that provide methods for quantifying organisational Greenhouse Gas (GHG) emissions. The first of these is BS EN ISO 14064-1 (hereafter referred to as ISO 14064) and the accompanying ISO/TR 14069 which provides specific guidance on applying ISO 14064. The second is the *Greenhouse Gas Protocol* (hereafter referred to as the GHG Protocol) and has accompanying documents which provide more detail on quantifying emissions from supply chains.

In addition, the UK's *Environmental Reporting Guidelines* (ERG) are broadly based on ISO 14064 and the GHG Protocol but are less detailed. Finally, PAS 2060 enables organisations to demonstrate carbon neutrality. Within PAS 2060, ISO 14064, the GHG Protocol and the ERG are listed as the three standards that can be used by organisations to provide methods to quantify GHG emissions. PAS 2080:2023 offers an industry specific standard by specifying the requirements for the management of whole life carbon in buildings and infrastructure. In general, there is significant overlap between ISO 14064 and the GHG Protocol.

## Supported Highways Delivery (Operating) Models

There are many different types of service delivery models within the local roads sector, and these have each been tailored to meet local needs and political priorities. To ensure the widest sector applicability, this guidance has been tested against, and supports, all the delivery models illustrated in Figure 2:

**Figure 2: Supported Highways Services Delivery Models**



The objective is to capture the carbon impact of *all* work that is the responsibility of the LHA; whether undertaken in-house or subcontracted to supply chain partners. This will ensure calculated emissions are comparable between different LHAs, even if the delivery model is different. Although works activities may vary between LHAs, categorisation can generally be consistently applied by utilising the series published in the *Specification for Highway Works (Volume 1)*. A standard schedule of activities (also known in this document as *activity carbon profiles*) is available in Appendix D.

To accommodate differences in delivery methods and highways operations, this guidance recommends an *Inventory-Based Carbon Accounting* approach, with an optional *Activity-Based Carbon Analysis* method to support the targeting, planning, implementation, and monitoring of carbon reduction initiatives. These two approaches are described in the next section.

A further consideration is that all works will have an additional carbon impact through network disturbance (e.g., queuing or diverted traffic). Although this is an important factor when designing traffic management plans, this guidance will focus on the emissions generated by the service and its activities. Once these have been firmly established, it is recommended that the network impact is calculated. This two-step approach will increase the achievability of carbon reporting for LHAs.

# Key Considerations

## Annual GHG Emissions & Life Cycle Assessments (LCA)

A *Life Cycle Assessment (LCA)* measures the environmental impacts associated with the life cycles of products, processes, or services. Full analysis includes up to twenty environmental impact categories, such as carbon, water depletion, eutrophication (harmful algal blooms and de-oxygenated water or 'dead zones'), toxicity and contamination, and more. It is only carbon that is directly relevant to this guidance. For further information, the wider principles and approach are defined in the ISO 14040 and ISO 14044 standards.

There are additional standards for products and services, for example ISO 14067, PAS 2050, and the *Greenhouse Gas Protocol Product Life Cycle Accounting & Reporting Standard*. There are also standards such as ISO 14025 covering the requirements for labelling; for example, Environmental Product Declarations (EPDs). From these, specific standards for the construction and infrastructure sectors have been developed; including, BS EN 15978-1 (for buildings), BS EN 15804 (for construction works and products), and PAS 2080 (for infrastructure).

Common to these is the establishment of a modular approach to calculating the carbon impact at each lifecycle stage (shown in Figure 3). This includes the consideration of carbon emissions across four *modules*:

- Module A. Before use stage.**
- Module B. Use stage.**
- Module C. End of life stage, and,**
- Module D. Beyond infrastructure life cycle.**

The aim of this guidance is to establish the GHG emissions of an LHA for its functions and activities within a reporting year. This will include a range of activities at different lifecycle stages for the assets the LHA is responsible for, e.g., the construction of a new road (module A), the repair of an existing road (module B), etc. The only emissions to be calculated as part of this guidance are those that have occurred within the reporting year and will exclude estimates or projections for activity in future years. A carbon reporting year should align with the financial reporting year (1<sup>st</sup> April to 31<sup>st</sup> March for all LHAs).

Life Cycle Assessments (LCA) are an important process and LHAs are encouraged to implement them to inform their decision making. For example, GHG emissions in the initial year may be lower for a road resurfacing solution that has poor longevity, compared to specifying a more durable solution with higher initial emissions that may result in lower emissions over the service life of the road. The guidance in PAS 2080 should be followed when undertaking these analyses.

It is best practice to undertake a LCA for carbon alongside the LHA's asset management processes during the options analysis and scheme design phases of a programme. This introduces carbon emissions as a key consideration at an early stage of scheme development. To achieve a reduction in emissions, carbon should be given a significant weighting in the scheme design and options prioritisation: balancing cost, political preferences, operational performance, longevity, and deliverability. This includes an equal focus on future maintenance and end-of-life decommissioning. For maintenance works, this approach can be embedded into the culture of the organisation through asset management strategies or plans<sup>5</sup>.

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<sup>5</sup> Including the Highway Asset Management Infrastructure Plan (HIAMP).

**Figure 3: Life Cycle Stages (GHG Emissions Module Assignments & Quantification)**

Life Cycle Stages	Product Stage				Construction Stage		Use Stage						End Of Life				
	A0	A1	A2	A3	A4	A5	Asset Maintenance				Operations		C1	C2	C3	C4	
Modules (EN15978 & PAS2080)	Studies & Consultations	Raw Materials Supply	Transport	Manufacturing	Transport	Construction	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	Demolition	Transport	Waste Processing	Disposal
	Benefits & Loads Beyond The System Boundary																
D																	
Reuse, Recovery & Recycling																	

### Category Scoping & Mapping (Based on ISO 14064-1/GHG Protocols)

Inventory categories for ISO 14064-1 are provided in ISO/TR 14069. These have been reviewed in the context of the highways sector, and their inclusion or exclusion is explained in *Appendix E: Included & Excluded GHG Categories (ISO 14064-1)*.

### Proposed Sector Categories

Table 1 illustrates the proposed mapping of the standard ISO 14064-1 categories to highways sector categories. The original ISO 14064-1 categories include a range of activities and stakeholders, some of which have limited relevance to the local roads sector. To aid understanding, this guidance has mapped the standard classifications to highway-specific terms, readily recognised by sector practitioners.



**Table 1: Mapping Sector & ISO 14064-1 Categories**

Reference Number	Highways Sector Category  ISO 14069 Category (Subset)	Premises & Sites		Vehicles & Plant		Staff & Contractors		Purchased Products, Services, Transport & Waste					
		Office & Depot Based Activities	Vehicle Use	In-Use Energy of Plant	Transport of Plant & Equipment	Business Travel During Work	Commuting	Home Working	Materials & Products	Purchased Services	Transport of Materials	Transport of Waste	Waste Disposal
1	D/E from stationary combustion.	✓											
2	D/E from mobile combustion.		✓	✓		✓							
3	I/E from imported electricity consumed.	✓	✓	✓		✓			✓				
4	Other energy-related activities†.	✓		✓	✓	✓	✓		✓	✓	✓		
5	Purchased products.								✓				
6	Waste generated from organisational activities.										✓	✓	
7	Upstream transport and distribution.		✓		✓					✓			
8	Business travel.					✓							
9	Upstream leased assets.	✓	✓	✓		✓							
10	Downstream leased assets.	✓	✓	✓									
11	Employee commuting and home working.					✓	✓						

D/E: Direct Emissions I/E: Indirect Emissions

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†Not included in direct emissions or indirect emissions.

## Calculating GHG Emissions: The General Formula

As the actual amount of GHG being emitted (or absorbed or stored) is, in almost all cases, not directly measurable, calculating quantities of GHG is undertaken by multiplying use (or activity) data by an emission factor. The activity data may vary and depends on the category and availability of data. It can include, for example, masses, volumes, units of energy, etc. The following sections discuss general calculation principles, with detail for each category provided later in the guidance.

### Data Collection

The quality of data will depend on what is available. Where possible, directly measured data should be used in calculations, however, it is recognised that occasionally estimates and assumptions may be necessary. These should be documented and examined to assess their accuracy and completeness.

### Using Emission Factors

The choice of emission factor will also depend on availability. For emissions associated with materials and products, the most reliable source will be from EPDs (Environmental Product Declarations). Whilst these are currently available as an exception rather than a rule, the situation is improving. An EPD will state GHG emissions for a functional unit of a product (e.g., per item) on a life cycle basis, and so it is important to only include the modules that align with the categories for the sector<sup>6</sup>. If EPDs are not available, then more generic sources for emission factors are available, including but not limited to the National Highways Embodied Carbon Library, Ecoinvent, and the ICE database.

All other categories use activity data that is related to either energy / fuel use, or transport. The most appropriate emission factors to use are the *Government’s GHG Conversion Factors for Company*

<sup>6</sup>For example, only emissions from Modules A-1 to A-3 should be included in ‘Materials Product Stage’ sub-section of ‘Materials and Products’, whilst any transport from the factory gate to site (which would be Module A-4 in the EPD) should be included in the ‘Transport of Materials’ sub-section.

*Reporting*, which are available for a given calendar year and are updated annually. Where GHGs are being calculated over a financial reporting year (1<sup>st</sup> April to 31<sup>st</sup> March), the choice of the emission factor calendar year should be the one that the majority of the financial reporting year corresponds to.

For activities where energy is being directly consumed (i.e. in buildings or vehicles) the appropriate emission factor should be applied for the specified unit of measure (e.g., kWh of electricity, litres of diesel, etc.). In addition, the equivalent well-to-tank (WTT) emission factor should be used to account for upstream Scope 3 emissions<sup>7</sup>.

For simplicity, it may be easier to add the direct emission factor to the WTT emission factor and apply just the combined emission factor to the activity data. This is especially true where the energy use is from a LHA's supply chain as all resulting emissions will be Scope 3. Where the activity is in a building or vehicle owned by the LHA then there may still be a benefit to reporting these separately (i.e., as Scopes 1 or 2 for the direct energy use, and Scope 3 for the WTT).

### Underreporting & Double Counting

As data is collected, calculated, and reported in multiple places, care should be taken that the calculations are accurate and avoid either underreporting or double counting. This means ensuring that boundaries between categories are fully understood, for example the emissions from transport are allocated to only the relevant category (and only once).

Where the organisation (Local Authority) is producing its overall GHG inventory, there are risks that emissions being calculated within this guidance are already included in reports prepared by the other authority functions (e.g. Fleet Services). It is essential that any double counting of carbon emissions within the service boundary are excluded from any aggregation of service emissions within authority-level reports.

### General Approach to Reporting Outputs

This guidance aims to standardise how the GHG emissions from an annual programme of work for LHAs can be established. The reporting responsibility ultimately rests with the LHA, although contractors and their wider supply chains should aim to cooperate with the LHA's requirements by timely provision of information as described in the next sections. Total GHG emissions should be reported annually for the year as tCO<sub>2</sub>e<sup>8</sup>.

GHG emissions should also be calculated and reported for each of the alternative sector-based categories and subcategories. Reporting may also be broken down by activity type. The guiding principle is to maintain as much granularity as possible for the results to have the most potential to identify emissions hotspots and actions to reduce them.

In addition, the GHG emissions can also be allocated as either of Scope 1, 2 or 3 from the perspective of the LHA as shown in Table 2. This can be done for any calculated emission within a category, for example within the 'Business Travel During Work' section, emissions from fuel use in a vehicle owned by the LHA can be allocated to Scope 1 (and Scope 3 for the WTT emissions), whilst fuel used in a vehicle owned by a contractor can be allocated to Scope 3 (for both the direct combustion and WTT emissions).

<sup>7</sup>Well-to-Tank emission factors are upstream (or indirect emissions) comprising an average of all the GHG emissions released into the atmosphere from the production, processing, and delivery of a fuel or energy supply.

<sup>8</sup> Tonnes, Carbon Dioxide Equivalent.

**Table 2: Typical Allocations of GHG Emissions (Scopes 1, 2 or 3)**

Categories & Subcategories		Scope 1	Scope 2	Scope 3
Premises & Sites	Office & Depot Based Activities	✓	✓	✓
Vehicles & Plant	Vehicle Use	✓	✓	✓
	In-Use Energy of Plant	✓		✓
	Transport of Plant & Equipment	✓	✓	✓
Staff & Contractors	Business Travel During Work	✓	✓	✓
	Commuting			✓
	Home Working			✓
Purchased Products, Services, Transport & Waste	Purchased Materials & Products			✓
	Purchased Services			✓
	Transport of Materials	✓	✓	✓
	Transport of Waste	✓		✓
	Waste Disposal	✓		✓

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These same calculated emissions have the potential to be of use to other stakeholders involved in the delivery of services, as shown in Table 3:

**Table 3: Identifying GHG Emissions Sources for Sector Stakeholders**

Categories & Subcategories		Local Authority	Supply Chain	Wider Supply Chains	Staff Emissions
Premises & Sites	Office & Depot Based Activities	✓	✓		
Vehicles & Plant	Vehicle Use	✓	✓	✓	✓
	In-Use Energy of Plant	✓	✓	✓	
	Transport of Plant & Equipment	✓	✓	✓	
Staff & Contractors	Business Travel During Work	✓	✓	✓	✓
	Commuting		✓		✓
	Home Working		✓		✓
Purchased Products, Services, Transport & Waste	Purchased Materials & Products	✓	✓	✓	
	Purchased Services	✓	✓	✓	
	Transport of Materials	✓	✓	✓	
	Transport of Waste	✓	✓	✓	
	Waste Disposal	✓	✓	✓	

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### Ratio Indicators & Benchmarking

When looking to compare performance and benchmark authority data, it is important to consider intensity ratios. Intensity ratios are used to obtain context in relation to the overall picture, enabling:

- **The comparison of data across LHAs.**
- **The evaluation of performance over time.**

In general, the ratios used should be selected to help improve understanding and clarify interpretation of performance for stakeholders. This guidance proposes two baseline ratio indicators for LHAs:

1. 
$$\frac{\text{Total Emissions (kgCO}_2\text{e)}}{\text{Length of LHA Network}} = \text{kgCO}_2\text{e per mile (or kilometre)}$$

And

2. 
$$\frac{\text{Total Emissions (kgCO}_2\text{e)}}{\text{Highways Budget (£)}} = \text{kgCO}_2\text{e per £ spent on highways services}$$

When benchmarking, these ratios require like-for-like comparisons regarding boundaries (i.e., the activities within the boundary and which activities are assigned to scopes 1, 2 and 3). As this is likely to vary significantly between LHAs, these ratios are best used to monitor internal performance.

# Carbon Accounting & Analysis Methods

The UK local roads sector comprises a diverse range of LHAs, operating models, supply chain partners, and carbon analysis capabilities. To accommodate this complexity and diversity, this guidance recommends an **Inventory-Based Carbon Accounting** approach, supported by an optional **Activity-Based Carbon Analysis**.

**1. The inventory-based carbon accounting method.**

This method calculates carbon emissions based on inventories of all the significant emissions sources. These sources comprise both directly owned / controlled resources and emissions from supply chain partners.

**2. The activity-based carbon analysis method.**

This method calculates carbon emissions based on highways activities commissioned and completed during the reporting year. This method may be applied for all activities within the service, or to specific activities requiring greater scrutiny and redesign.



**In most authorities, a CCMRT will be responsible for preparing carbon footprint reports.**

**The CCMRT should be able to provide the highways service leadership team with directives and guidance when selecting and implementing a carbon accounting method.**

## Inventory-Based Carbon Accounting

The *inventory-based method* requires the creation of categorised inventories of all emissions sources; each calculated and aggregated to provide the total CO<sub>2</sub>e emissions for the service. Carbon inventories will typically include:

- 1. All LHA owned or controlled premises or sites used to deliver the service.**
  - a. Either wholly or partially occupied / used.
- 2. All owned, hired, leased or contractor-provided vehicles and plant.**
- 3. All directly employed or contracted / subcontracted staff.**
- 4. All purchased products and services.**
  - a. Including construction and maintenance materials and treatments, third-party services, water, transport, and waste services.

Each inventory will require a detailed schedule of emissions sources and measured emissions for the reporting year. Carbon data is obtained from corporate functions, supply chain partners, staff records, vehicle fuel and maintenance records, and purchase orders and invoices.

Aggregating the total carbon emissions for these four inventories for the reporting year will provide the service-level carbon footprint. The inventory-based approach provides a straightforward, comprehensive method for carbon reporting, but lacks granular analysis for identifying carbon hotspots at an activity level.

## Activity-Based Carbon Analysis

Activity-based carbon analysis evaluates the carbon emissions resulting from specific activities undertaken by the service. Activities are classified as either repeating (for reactive, cyclical, and minor works) or one-off (for major schemes and capital works). In each case, resources are assigned to activities from the standard inventories described above. These resources will typically include:

- 1. The staff assigned to the activity, used to calculate the emissions arising from:**
  - a. Home working,
  - b. Commuting,
  - c. Business-related travel while at work (i.e., “grey miles” reclaimed on expenses).
- 2. The products and services used.**
  - a. Including types and quantities.
- 3. The transport of materials, plant, and waste.**

#### 4. Waste processing and waste disposal.

### Repeating Activities

Units of work form the basic unit of analysis for a repeating activity. Examples include a shift (per gang, per day doing reactive maintenance), per 500m<sup>2</sup> (for surfacing and surface dressing), per cut (for grass cutting). A share of the inventory items (e.g., staff time, vehicles and plant usage, materials, and residual waste) is then allocated against each unit of work for each activity.

### One-Off Activities (Projects)

A similar process is adopted for one-off schemes, where the basic unit of work becomes the entire project. The share of the inventory items is then allocated based on resources assignments derived from scheme designs, bills of materials and project specific purchases of services.

**Table 4: Highways Emissions Sources Categories**

Method	Category Group	Category Description(s)
Carbon Accounting: Inventory Based Reporting	Premises & Sites (Offices & Depots)	Emissions from combusted fuels.
		Emissions from purchased electricity.
		Fugative emissions from air conditioners and refrigeration units.
	Vehicles & Plant	Vehicle use (including supply chain and pool vehicles).
		In-use energy of plant.
	Staff & Operatives	Travel during work (business travel using personal vehicles, i.e. "grey fleet miles").
		Staff commuting to an assigned place of work.
		Home working.
	Purchased Goods & Services (Materials, Services, Transport, Water & Waste)	Purchased goods and materials (direct and supply chain).
		Purchased services (e.g. design and consultancy services).
		Purchased transport services (materials and waste).
		Purchased waste processing and disposal.
	Carbon Analysis: Activity Based Reporting	Recurring Activity Carbon Profiles (Reactive, Cyclical & Planned Minor Works)
Transport of staff, materials and waste (activity specific).		
In-use energy of plant.		
Residual waste.		
In-use energy for electrical assets and streetlighting (activity / asset class specific).		
One-Off Activity Carbon Profiles (Major Schemes & Capital Works)		Products and services use (scheme specific).
		Transport of staff, materials and waste (scheme specific).
		In-use energy of plant (scheme specific).
		Residual waste.
		In-use energy for electrical assets and streetlighting (scheme specific).

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The activity-based approach increases the granularity of reporting, enabling the identification of carbon hotspots at an activity level.

## Selecting a Method

The selected method of analysis will depend on the objectives of the authority. A summary of typical objectives and apposite methods is illustrated in Figure 4:

**Figure 4: Selecting an Analysis & Reporting Method**

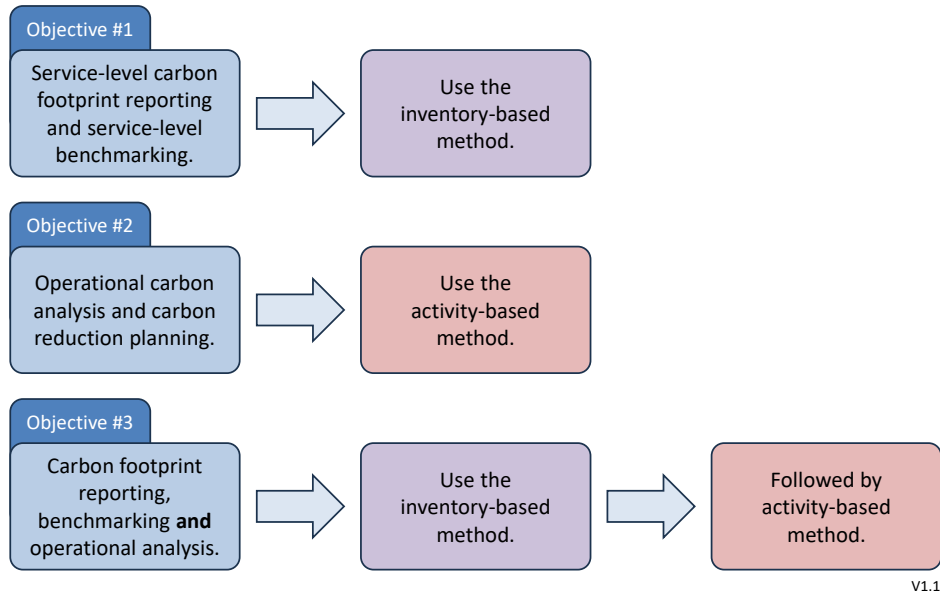


Table 5 highlights the key characteristics of each approach, together with the applicable implementation steps in each case.

**Table 5: Method Characteristics & Applicable Steps**

Method Characteristics	Carbon Analysis & Reporting Options		
	Inventory-Based Reporting	Activity-Based Analysis	Combined Reporting
<b>Suitability</b>	Carbon Footprint Reporting & Benchmarking	Carbon Analysis & Reduction Initiatives Planning	All (Carbon Reporting, Benchmarking & Analysis)
<b>Service Accuracy &amp; Completeness</b>	High	Medium	High
<b>Reporting Granularity</b>	Medium	High	High
<b>Complexity &amp; Effort (Baseline Year)</b>	●●●○○	●●●●○	●●●●●
<b>Complexity &amp; Effort (Subsequent Years)</b>	●●●○○	●●●○○	●●●●○
<b>Applicable CCAS Steps</b>			
<b>Step 0: Baseline Year</b>	✓	✓	✓
<b>Step 1: Carbon Reporting Boundary</b>	✓	✓	✓
<b>Step 2: Premises &amp; Sites</b>	✓	✓	✓
<b>Step 3: Staff &amp; Contractors</b>	✓		✓
<b>Step 4: Vehicles &amp; Plant</b>	✓		✓
<b>Step 5: Purchased Products &amp; Services</b>	✓		✓
<b>Step 6: Carbon Footprint Reporting</b>		✓	✓
<b>Step 7: Carbon Offsets</b>			
<b>Step 8 &amp; 9: Activity-Level Carbon Profiles</b>		✓	✓
<b>Step 10, 11 &amp; 12: Service-Level Carbon Reductions</b>	✓	✓	✓

● High, ◎ Potentially High, ○ Low

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The selected method of carbon analysis and reporting will be informed by the following considerations and constraints:

- 1. The carbon reporting and analysis objectives of the service.**
- 2. The carbon reporting policies of the LHA.**
- 3. Inventory analysis previously completed by the CCMRT.**
- 4. The availability and accuracy of data.**
- 5. The internal resources available.**
- 6. The need to benchmark activity profiles with other authorities.**
- 7. The willingness and ability of supply chain partners to provide the necessary data.**
- 8. The level of analysis required for planning carbon reduction initiatives.**

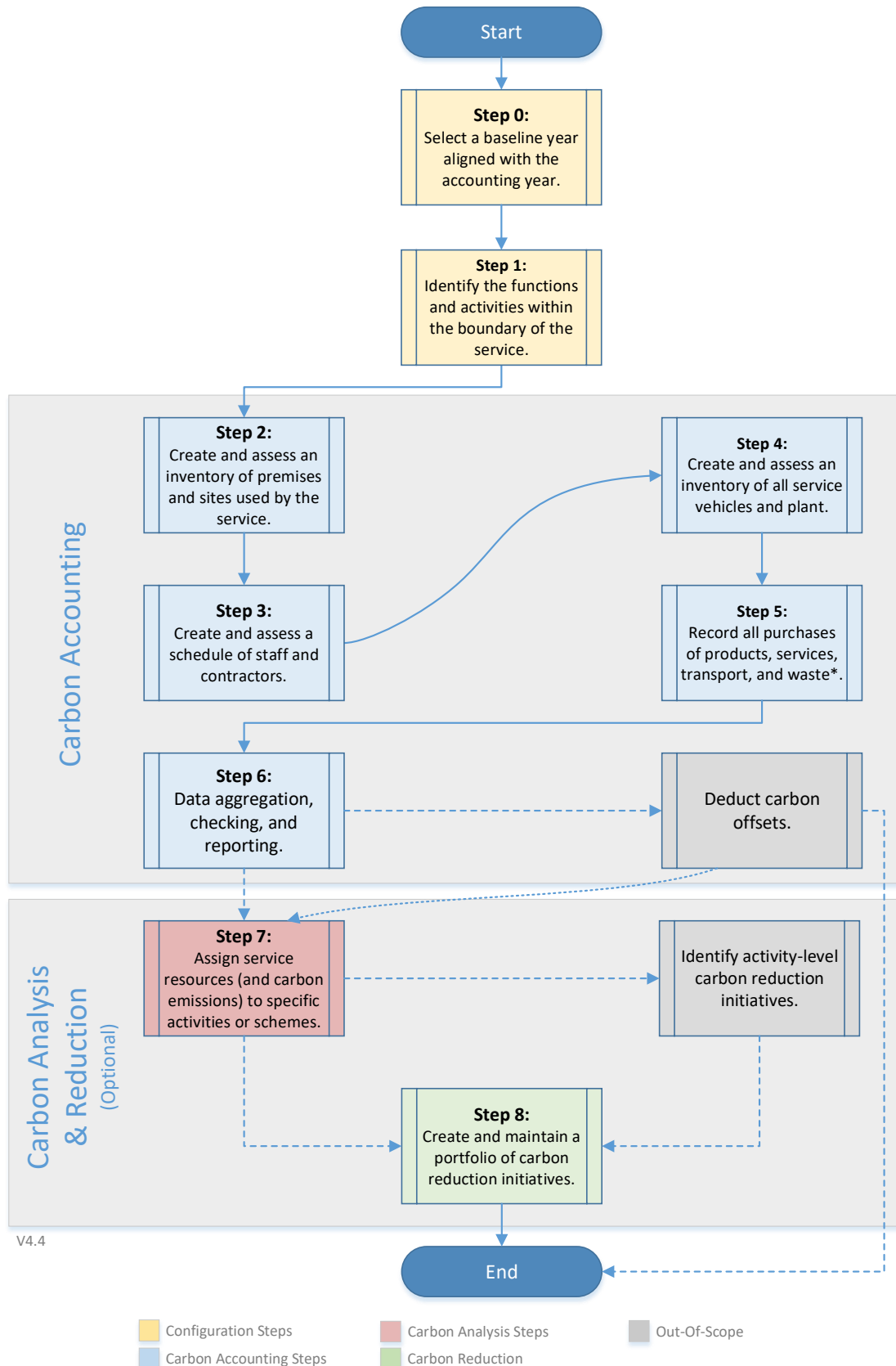
A readiness assessment, exploring these considerations and constraints, will enable the service to identify any issues and barriers and prepare the service for the assessment steps.

# Carbon Analysis & Reporting Route Map

Carbon Accounting & Carbon Analysis

Figure 4 illustrates the steps involved in determining an LHA carbon footprint for scope 1, 2 and 3 emissions using an *inventory-based accounting* approach, with the option to undertake more detailed analysis using an *activity-based* approach.

**Figure 5: Carbon Assessment Guidance: Process Route**



\*Purchased waste treatments and disposals.

# Step 0: Selecting a Baseline Year

## Establishing Carbon Accounting Practices

## Overview

Selecting a baseline year with accurate and complete data is essential for producing a carbon footprint. Without an assessment of baseline emissions, it is impossible to reliably judge the success of any carbon reduction initiatives through performance monitoring.

## Purpose & Goals

The purpose of this step is to:

1. **Select the baseline year.**
  - a. Set the reporting starting date to align with the financial reporting year.
2. **Check to ensure that comprehensive carbon data for the service is available for that year.**
3. **Agree the baseline year with internal and external stakeholders.**
  - a. Within the authority (typically, the CCMRT).
  - b. Within supply chain partners (typically, the contract management team).

## Preparation

To complete this step, you will need:

- **Your LHA's carbon management and reporting policy.**
  - Identifying the baseline reporting year, if specified.
- **Carbon data for the selected baseline year.**
  - See checklist below.

## Process Step Lead & Process Delivery Team

This step will require the engagement of the following local authority and highways service stakeholders:

- **Director responsible for Highways Services or the Highways Services Commissioner.**
- **The CCMRT.**
- **Highways assets manager(s).**
- **Supply chain partner(s).**

In many cases, this step will be managed by and / or coordinated with the CCMRT within the authority. If completed within the service, the Director with responsibility for Highways Services / Highways Services Commissioner should assign a process leader.

## Process

The process for determining the baseline year includes the following steps:

1. **Has a baseline year for carbon reporting been identified by the authority?**
  - a. If yes, move to item 4 in this list.
2. **Identify a proposed baseline year.**
  - a. The proposed year should be a year where inventory, activity and emissions data are available.
  - b. Agree this year with the CCMRT.
3. **Align the carbon reporting year with the financial reporting year.**
  - a. Annual spend on services typically correlates with changes in the carbon footprint, so an alignment of the financial reporting year and the carbon reporting year will aid in identifying carbon footprint changes related to spend on highways services.
4. **Check the data availability for the selected baseline year.**
  - a. See Table 6.
5. **Move to Step 1 (Establishing a boundary and the carbon sources inventories).**

Once a baseline year is identified, subsequent years must be calculated using methods and measures consistent with those used to calculate the baseline year. This will enable meaningful year-on-year comparisons and progress reporting.

**Table 6: Process & Data Readiness Assessment**

Required Data Items (Reporting Year)		✓
<b>Carbon Accounting</b>		
<b>Step 1</b>	<b>Functions &amp; Activities (within the carbon reporting boundary)</b>	
	Schedule of highways functions and activities.	<input type="checkbox"/>
	Schedule of supply chain partners for outsourced activities.	<input type="checkbox"/>
<b>Step 2</b>	<b>Owned / Controlled Premises &amp; Sites (for each site)</b>	
	Gas meter readings.	<input type="checkbox"/>
	Electricity meter readings.	<input type="checkbox"/>
	Service records for air conditioning units and / or refrigeration units.	<input type="checkbox"/>
	Records for fuels used from on-site fuel storage tanks (typically depots).	<input type="checkbox"/>
	Water meter readings for each site.	<input type="checkbox"/>
<b>Step 3</b>	<b>Directly Employed / Contracted Staff &amp; Operatives (for each staff member)</b>	
	Typical number of home working days.	<input type="checkbox"/>
	Typical number of commuting days and commute distances.	<input type="checkbox"/>
	Commuting transport mode and fuel type (i.e., walk, cycle, car, taxi, train).	<input type="checkbox"/>
	The fuel type for commuting, where applicable (i.e., diesel, petrol, electric, hybrid).	<input type="checkbox"/>
	The annual business miles using a privately owned vehicle (reclaimed as expenses).	<input type="checkbox"/>
<b>Step 4</b>	<b>Owned / Controlled Vehicles &amp; Plant (for each asset item)</b>	
	Vehicle or plant type (i.e., plant, car, van / LGV, rigid HGV, articulated HGV).	<input type="checkbox"/>
	Engine size and fuel type (combusted fuels only, i.e., diesel, petrol, LPG, CNG)	<input type="checkbox"/>
	Annual fuel consumption or mileage for each vehicle (fuel usage is preferred).	<input type="checkbox"/>
<b>Step 5</b>	<b>Directly Purchased Goods &amp; Services (for repeating activities or one-off schemes)</b>	
	Invoices or orders for products and materials.	<input type="checkbox"/>
	Invoices or orders for materials or waste transportation.	<input type="checkbox"/>
	Invoices or orders for purchased services (e.g., design, consultancy, etc).	<input type="checkbox"/>
	Invoices or orders for purchased waste processing and disposal.	<input type="checkbox"/>
	Invoices or statements for purchased water and related services.	<input type="checkbox"/>
<b>Carbon Analysis (Optional)</b>		
<b>Step 9</b>	<b>Assign Carbon to Repeating &amp; One-Off Activities</b>	
	Assign the emissions share of premises and sites to each activity or scheme.	<input type="checkbox"/>
	Assign the number of staff assigned to each activity or scheme.	<input type="checkbox"/>
	Assign the use of vehicles and plant to each activity or scheme.	<input type="checkbox"/>
	Assign purchased products and services to each activity or scheme.	<input type="checkbox"/>
<b>Step 12</b>	<b>Designing Out Carbon: Major Schemes &amp; Capital Works</b>	
	Schedule of planned or commissioned programmes and projects*.	<input type="checkbox"/>
	A schedule of low carbon options for each scheme.	<input type="checkbox"/>

\*Including bills of materials and costs.

On completion of Step 0, if it is determined that an alternative year can provide more accurate data, the baseline year can be reviewed and amended, if agreed by key stakeholders.

## Baseline Year Changes

Future amendments to the baseline year may be necessary in the following circumstances:

1. **If a calculation error is discovered, or several cumulative errors, that are collectively significant.**
2. **There is a change in calculation methodology or in the accuracy of recording emission levels.**
3. **There are significant changes in the LHA services delivery / operating model.**
  - Impacting the carbon inventories.
  - Changes in the boundary (i.e., services devolution<sup>9</sup> or unitary services aggregation).

Changes to the baseline must be disclosed by the local authority. A change in baseline can have a significant impact on the targets set and carbon reduction strategies.

## Significance Threshold

A significance threshold sets the granularity of the data to be used when measuring emissions. A policy will need to be established to ensure like-for-like comparisons over time and to avoid cumulative errors manifesting in reports (i.e., rounding spikes).

The LHA should therefore set a significance threshold policy to be applied when:

- **Using assumptions to address data gaps.**
- **Rounding vehicle mileage or fuel usage.**
- **Accounting for unused fuel in gas cylinders and vehicle fuel tanks.**
- **Rounding electricity to the nearest kWh.**
- **Rounding gas usage to the nearest m<sup>3</sup>.**

The GHG guidance makes no specific recommendations as to what constitutes “significant”. It is, therefore, up to the local authority to set the significance threshold for monitoring and reporting.



**In most authorities, a CCMRT will be responsible for setting the baseline year and the significance threshold for carbon reporting. For consistency, accuracy, and completeness, it is important to coordinate highways carbon profiling with the CCMRT.**

## Completion Checklist

Check that Step 0 has been completed using this checklist:

- A baseline year has been identified and agreed with the CCMRT and supply chain partners.**
- The rationale and assumptions for the baseline year have been documented.**
- The significance threshold has been agreed for the baseline and subsequent years.**
- The carbon reporting year has been aligned with the financial reporting year.**

# Step 1: Carbon Reporting Boundary

## Highways Functions & Activities



## Overview

LHAs are responsible for the construction and maintenance of highways assets within their jurisdiction. These assets typically include:

- **Carriageways.**
- **Footways.**
- **Electrical assets and streetlights.**
- **Bridges, structures, and geotechnical assets.**
- **Signs and lines.**
- **Gullies and drainage systems.**
- **Public rights of way.**
- **Green estate.**

To support these assets, highways services typically comprise:

- **Office and depot-based functions and activities.**
  - Design and consultancy services.
  - Asset policy setting, planning and management.
  - Budget setting, allocation and value for money assurance.
  - Services planning and operations management.
  - Facilities, fleet and materials management.
  - Contract and contractor management (where functions or activities are outsourced).
  - Customer services and enquiries management.
- **Repeating, network-based activities** (reactive, cyclical and planned minor works).
  - Surveys and inspections.
  - Planned maintenance.
  - Minor works.
  - Cyclic maintenance.
  - Winter maintenance.
  - Reactive maintenance and incident response teams.
  - In-situ and ex-situ materials recycling and waste management.
- **One-off, network-based, major schemes and capital works** (programmes and projects).
  - Scheme(s) design.
  - Programme management (including works scheduling and materials management).
  - Construction and supervision.
  - Asset commissioning.

Collectively, these functions and activities form the **service boundary for carbon reporting**.

Using the categories above, services can be divided into two classes:

### 1. **Overhead carbon emissions (as predictable business-as-usual emissions).**

These are baseline emissions from:

- Owned or controlled **premises and sites**.
- Directly employed or contracted **staff and operatives**.
- Owned or controlled **vehicles and plant**.

These are typically known and predictable carbon emissions sources for a given year.

### 2. **Activity related, network-based, carbon emissions (as “variable” emissions from maintenance and construction activities).**

These include emissions from network-based activities, determined annually relative to the service budget, the condition of network assets, emergent statutory obligations, and the political priorities of the local authority.

For the purposes of carbon reporting, overhead and activity related emissions can be seen as analogous to the financial accounting terms “fixed” and “variable” costs. To facilitate simplified reporting, this guidance segregates these two classes.

## Preparation

The purpose of this step is to:

1. **Identify all highways functions and activities.**
  - a. See **Error! Reference source not found.** for a standard list of highways activities.
2. **Identify activities inside the carbon footprint boundary.**
  - a. Activities not conducted by, nor commissioned by the highways service, are outside the boundary.
  - b. All other activities are within the boundary.
3. **Identify the responsible party for each function and activity.**
  - a. In-house activities typically generate scope 1, 2 and 3 emissions.
  - b. Outsourced and devolved<sup>10</sup> activities typically generate scope 3 emissions.
4. **Identify the responsible reporting party for each activity and delivery partner.**
  - a. The corporate team (internal),
  - b. The highways team (internal) or,
  - c. Supply chain partner(s) (external).

## Process Step Leader & Process Delivery Team

This step will typically require the engagement of the following local authority and supply chain stakeholders:

- **Director with responsibility for Highways Services or the Highways Services Commissioner.**
- **CCMRT.**
- **Heads of highways functions.**
- **Supply chain partner(s).**
  - Client / relationship manager(s).

This step should be led by the Director with responsibility for Highways Services or Highways Services Commissioner, supported by the CCMRT.



**In most authorities, a CCMRT will be responsible for preparing carbon footprint reports.**

**The CCMRT should be able to provide the highways service leadership team with service-specific carbon footprint reports based on the data collated and calculated centrally.**

## Process

Use the following process to create a schedule of functions and activities to include within the carbon reporting boundary:

1. **Create a schedule of LHA functions and activities.**
  - a. A standard schedule of typical highways activities is provided in Appendix D.
2. **Ensure that any excluded functions and activities are accounted for elsewhere within the authority.**
  - a. This is usually reviewed and verified with the CCMRT.
3. **Identify whether the activity is undertaken in-house or outsourced.**
  - a. Scope 1, 2 and 3 emissions.

---

with regard to specific GHG reporting. If ma

4. **Identify those functions and activities where a detailed activity based analysis will (may) be undertaken.**
5. **Identify the scopes of emissions resulting from each activity.**
  - a. GHG scope 1, 2, and or 3.
6. **Record the *responsible party* for carbon reporting for each activity selected for more detailed analysis.**

Typically, activities that are carried out in-house by the LHA will produce **scope 1 and 2** emissions. Any products or services purchased to support directly delivered services will result in **scope 3** emissions. All activities which are outsourced or devolved (i.e., completed by a third-party or supply chain partner) will produce **scope 3** emissions.

## Supply Chain Carbon Reporting

The LHA and its directly contracted providers will need to agree the level and format of emissions data to be collected and collated across the supply chain. This guidance describes the level of granularity necessary to support detailed analysis, benchmarking and carbon reduction planning across supply chains. However, it is recognised that many supply chain partners will be at a low state of readiness for carbon reporting and may not be able to accurately capture and report their carbon emissions.

A pragmatic approach is required that encourages supply chain partners to provide accurate estimates, progressing over time to more detailed analysis. Effective vehicle and plant tracking devices, systems that support carbon reporting and open book accounting should help improve the quality of carbon reporting without introducing unnecessary bureaucracy.

## Completion Checklist

Check that Step 1 has been completed using this checklist:

- All highways functions and activities have been identified and documented.**
- Activities within the carbon boundary have been clearly identified.**
- The responsible party for reporting carbon for each function / activity to be assessed in more detail has been identified and agreed.**

## Step 2: Premises & Sites

LHA Owned or Controlled Sites

## Overview

The LHA will need to make an inventory of all premises and sites used to deliver the service. This will include all directly owned and / or controlled premises and sites, such as depots, used to deliver the service. It will also include any sites leased or owned by primary provider(s) where there are significant resources dedicated to the LHA.

Where the supply chain uses non-dedicated sites for products or services delivery, site emissions should be excluded. In many cases these emissions are included in the carbon footprint of purchased products and services (see *Step 5: Purchased Products and Services*).

## Purpose & Goals

The purpose of this step is to:

1. **Identify all owned or directly controlled premises and sites.**
  - a. These are typically sites where the local authority pays for provided utilities (i.e., gas, water and / or electricity).
  - b. Identify the internal responsible reporting party.
2. **Assess all the emissions sources at each site.**
3. **For shared sites, identify and agree the share of emissions from highways services.**
4. **Calculate the total emissions from each site.**
  - a. Typically categorised as scope 1 and 2 emissions unless the site is owned by a contractor.

## Process Step Leader & Process Delivery Team

This step will typically require the engagement of the following local authority and supply chain stakeholders:

- **Director with responsibility for Highways Services or the Highways Services Commissioner.**
- **CCMRT.**
- **Facilities management team.**
- **Representatives of supply chain partner(s)**

This step should be led by the Director with responsibility for Highways Services or Highways Services Commissioner, supported by the CCMRT.



**In most cases, local authorities will have complex electricity sourcing arrangements and agreements, which may include:**

- **Power Purchase Agreements (PPA),**
- **Renewable Energy Certificates (RECs),**
- **Utility-Specific Emission Factors,**
- **Energy Export Agreements.**

**In these cases, scope 2 reporting should be undertaken by the CCMRT. This team can provide a carbon footprint for the highways service based on the data collated and calculated centrally.**

## Preparation

To complete this step, you will need:

- **The locations and uses of the premises and site(s) owned or controlled by the LHA.**
  - Owned, leased, or rented by the LHA, or
  - Sites operated by contracts, but dedicated services in support of the LHA.
- **A schedule of fuel / energy sources at each site.**

- Including services from utility providers (mains gas and electricity).
- Including on-site fuel tanks and bottled gaseous fuels.
- **A schedule of air conditioning and / or refrigeration units at each site.**
  - Where applicable.
- **Any mains water provision at each site.**
  - Where applicable.
- **Where sites are shared with partners and / or other authority services, the assigned share of:**
  - Energy / fuel use (%).
  - Fugitive emissions from air conditioning and refrigeration systems (%).
  - Water use (%) (where applicable).



If the measurement and calculation of the carbon footprint is the responsibility of a different function or team within the local authority, this guidance should be discussed with that team.

## Process

Use the following process to create the schedule of premises and sites and calculate the carbon emissions for the reporting year:

1. **Identify all owned / controlled premises and sites used by the LHA.**
2. **Where applicable, document the emissions share for shared sites.**
  - a. Agree with the other site occupants the protocols for emissions share calculations.
3. **Collate and calculate the total emissions for each site for the reporting year.**
  - a. Add the totals for combusted fuels to the scope 1 emissions for each site (including metered fuels from site fuel tanks and bottled gas stocks).
  - b. Add the totals for purchased electricity to the scope 2 emissions for each site.
  - c. Add the totals for fugitive emissions from air conditioning and refrigeration equipment to the scope 1 emissions for each site.
4. **Aggregate the carbon totals for all sites and add them to the carbon footprint for the service.**

## Inventory Guidance

The inventory of premises (or sites) should include all premises / site(s) where fuel is combusted and / or stored, where there is a mains electricity supply, or where there is a water supply. These will typically include:

- **Offices.**
- **Depots.**
  - Including materials storage and processing.
- **Ex-situ materials recycling sites.**
- **Garages and vehicle storage sites.**
  - Including refuelling stations.
- **Staff rest areas, overnight accommodation facilities<sup>11</sup>, welfare offices and marshalling yards.**
- **Plant and equipment maintenance and storage facilities.**

The inventory should include any site with:

- **Boilers for heating buildings.**
- **Electric heating, electric lighting and / or electrically powered appliances.**
  - Utilising electricity purchased from a utility provider.
- **Gas fires or furnaces.**
- **Combusted fuels used as a heat source for processes.**
- **Gas-fired Combined Heat and Power (CHP) plants.**

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<sup>11</sup>dated specific GHG reporting is required, t

- **Air conditioning, humidity controllers and / or air filtration systems<sup>12</sup>.**
  - These may produce fugitive emissions, see Step 3.
- **On-site PV solar or wind turbines used to generate and export electricity or solar heating.**
  - This is required to calculate carbon offsetting.
- **A metered mains water supply.**

The inventory of premises / sites should include the following details for each location:

- **Site reference name or site number.**
  - Alternatively, the street address of the premises / site.
- **The responsible person(s) or agent(s) for that site.**
- **Specify owned, leased, rented or controlled.**
  - Where utility bills (including gas, water, and electricity) are the responsibility of the authority or where the site is controlled by through a contract with a service provider.
- **Fuel / energy type(s).**
  - Specify any applicable; gas, oil, coal and / or electricity.
  - Specify on-site solar heating, photovoltaic (solar) panels and / or wind turbines.
- **On-site fuel storage.**
  - If the site includes fuel storage<sup>13</sup>, specify type, capacity, and location.
- **Metered mains water supply.**
- **Measurement method for each fuel type.**
  - Meter readings (preferred).
  - Invoices and statements (used for verification).
  - Invoicing / meter reading cycle details, i.e., monthly, quarterly or annually.
- **Location of meters, reference numbers and items metered.**
  - Including water meters, where applicable.
- **Measurement adjustments.**
  - Record in the inventory if a meter has been replaced, as readings may not tally if the replacement was zeroed<sup>14</sup>.
- **Air conditioner(s) and refrigeration unit(s) (where applicable).**
  - Number and location of air conditioning / air processing units.
  - Name(s) of the maintenance / service agent(s).
- **Energy generation facilities, where applicable.**
  - Including solar PV, solar heating, and / or wind turbines (with or without an energy export agreement).
- **Carbon capture and storage facilities, where applicable.**
- **Emissions share (where the site is shared), where applicable.**
  - Specifying an agreed standard formula / ratio used to apportion emissions to the relevant parties.

### On-Site Fuel Storage (Liquid Fuel Tanks & Bottled Gaseous Fuels)

It is important to report the use of stored liquid and bottled fuels on each site (where applicable). Fuel use for the reporting year can be obtained from supplier receipts or fuel tank meter readings. Where the precise usage is not known (i.e., tank levels were not recorded at the start of the reporting year), estimates should be made, and assumptions documented.

For delivered fuels (e.g., heating oil, LPG, coal), where the emissions are calculated for the total delivery rather than “as used”, this will cause a spike in the monthly data. Over time the usage data will smooth to provide a clear usage pattern.

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his guidance will be updated accordingly.

<sup>12</sup> Including the Highway Asset Management Infrastructure Plan (HIAMP).

<sup>13</sup>For example, only emissions from Modules A-1 to A-3 should be included in ‘Materials Product Stage’ sub-section of ‘Materials and Products’



**If fuel from on-site fuel stores is recorded for individual vehicles and plant, it is important that this is not double counted.**

**Agree a consistent policy for accounting for on-site fuel measurement and accounting and ensure that this applied across all sites and all reporting years.**

### Cross-Checking Invoices & Statements

Using the inventory of premises and sites for data checking will ensure that all emissions sources are considered and accounted for. It is important that all emissions sources are included in the reported carbon footprint.

By cross-checking fuel use for each site on the inventory against statements, receipts and invoices, it will be easier to identify discrepancies and billing errors. Where errors are found, the higher value(s) for fuel use must be recorded on the carbon footprint while any investigations are undertaken. A correction can be recorded against subsequent carbon footprint reports, detailing the issue and the adjusted emissions values.

### Shared Facilities & Co-located Staff

Some LHA facilities<sup>15</sup> may be shared with other local authority services teams. In these cases, fuel, electricity, and water use (resulting in emissions) will need to be allocated based on a formula or ratio agreed both corporately and with each party sharing the facility. This formula can be recorded in the inventory of premises / sites for each shared location. In most cases, it will be the responsibility of the CCMRT to ensure the data is collated and that emissions are properly apportioned.

Where LHA staff are co-located with external organisations, it is important to ensure that data gaps and double counting are avoided when calculating the carbon footprint. An approach consistent with one for shared facilities should be adopted, ensuring the boundaries between scope 1, 2 and 3 are clearly defined and documented. Where premises are leased or rented, these agreements will require the cooperation and participation of the landlord(s).

### Refrigeration & Air Conditioning: Fugitive Emissions

GHG emissions resulting from leaks from Air Conditioning (AC) and refrigeration units either owned or controlled by the local authority will need to be added to the carbon footprint. These leaks are described as fugitive emissions. The schedule of premises should identify sites with AC or refrigeration units.

The process steps outlined below are repeated for each item with air conditioning / refrigeration units:

1. **Collate AC / refrigeration unit servicing records for each site.**
2. **If an AC or refrigeration unit has been serviced, identify if the unit required a coolant top-up.**
  - a. Record the amount and type of coolant replaced (i.e., 5kg of R410A).
3. **Multiply the quantity used by the relevant emission factor for the specified coolant.**
  - a. Convert the data using the current government conversion tables.
4. **Add the converted total to scope 1 emissions of the site for the reporting year.**
5. **If the site is shared with other services, use the agreed formula / ratio to apportion the total emissions to the relevant parties.**
6. **Repeat for all AC / refrigeration service records.**

### Carbon Considerations & Calculation Guidance

The following points should be considered when calculating the emissions for premises and sites:

- **All sites (or parts of sites) occupied by LHA staff (whether the building is owned or leased) should be included in the inventory.**

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<sup>15</sup>, whilst any transport from the factory gate to site (which would be Module A-4



- **Where possible, all sites dedicated to the service and used by the LHA or supply chain partners should be included in the inventory.**
- **For each building, obtain energy consumption data for gas, oil, LPG, electricity using the following hierarchy (best to worst):**
  - Actual meter readings (kWh) where available.
  - Billing data, which should be converted to consumption (kWh) based on the unit rates of energy.
  - Estimates based on a previous year's actual data.
  - Benchmark data (e.g. from CIBSE TM46, for example) comparing the energy consumed by similar building types (kWh/m<sup>2</sup>) multiplied by the area of the building.
- **Where a building is only partially utilised by the LHA (i.e., where LHA staff occupy part of a larger building) and the energy data is not sub-metered to measure only the applicable space, then the energy use should be apportioned by multiplying the building energy use by the fraction of relevant space.**
  - In the case of hot desk environments (with variable occupation), a calculation based on the average share of headcount can be applied for the reporting year.
- **Where a building generates renewable energy, any metered energy that is exported can be calculated separately and used to offset emissions.**
- **The *Greenhouse Gas Reporting: Conversion Factors, 2023*<sup>16</sup> available from the *Department for Energy Security and Net Zero* (previously the *Department for Business, Energy & Industrial Strategy*) provides a comprehensive schedule of emission factors for site-related emissions and carbon offsets.**
- **Calculations should include both the emission factor for direct combustion of a fuel (or generation in the case of electricity) as well as the emission factors for any upstream WTT emissions.**
  - In the case of electricity, this will include factors for transmission and distribution (T&D) as well as WTT emissions applied to both generation and T&D (four emission factors in total).
  - For simplicity, these emission factors can be added together so that only one calculation is needed for each fuel to establish GHG emissions.
- **GHG emissions for each building should be calculated by multiplying the energy use from each fuel (in kWh) by the relevant emission factor (in kgCO<sub>2</sub>e/kWh).**
  - The result can be divided by 1000 to get emissions in tCO<sub>2</sub>e
- **Care should be taken when aggregating data at an organisation level.**
  - For example, if a LA is producing its annual GHG inventory and obtains the outputs of these calculations from the highways service, if the LA has already separately calculated emissions from its facilities portfolio, then the emissions calculated here should not be added to the organisational footprint as this would be double counting.
- **For all fuels and electricity, upstream WTT emissions should be included.**
- **Some utility provider statements (gas and electric) may be estimated, and this may distort emissions data when adjusted after a meter reading.**
- **If the emissions for streetlighting and / or other electrical assets (i.e., pumps, traffic signals, sign illuminations) are assigned to a specific site (e.g., County Hall), this data may significantly distort the analysis.**
  - This guidance recommends creating separate activities and carbon profiles for street lighting and electrical assets, enabling greater reporting granularity.

If the agreed basis for calculation is to assign the use of stored fuels (fuel tanks or bottled fuels) to a site, then these fuels should be included in the site calculations.



**In all calculations, it is critical that all carbon sources and emissions are included and not double-counted. Ensure the data sources, emission factors, and bases for calculation are properly documented, and that the agreed protocols are followed.**

in the EPD) should be included in the 'Transport of Materials' sub-section.

<sup>16</sup>Well-to-Tank emis

## Calculation Example

A highways service team based in “Building X”. This has a floor area of 2,500 m<sup>2</sup>. They occupy 1,000 m<sup>2</sup> of the building. In 2022 (the reporting year) the building used 250,000 kWh of electricity and 300,000 kWh of gas.

The fraction of the building applicable to the LHA is  $1000 / 2500 = 0.4$  (or 40%). Therefore, the applicable energy use is 100,000 kWh electricity and 120,000 kWh gas.

The Government’s GHG Conversion Factors for Company Reporting for 2022 state the following emission factors:

- **Natural gas combusted on site 0.18254 kgCO<sub>2e</sub>/kWh and WTT emissions of 0.0311 kgCO<sub>2e</sub>/kWh. The total of these is therefore 0.21364 kgCO<sub>2e</sub>/kWh.**
- **Grid electricity generation results in 0.19338 kgCO<sub>2e</sub>/kWh with a further 0.01769 kgCO<sub>2e</sub>/kWh from T&D, 0.04625 kgCO<sub>2e</sub>/kWh from WTT on generation and 0.00423 kgCO<sub>2e</sub>/kWh from WTT on T&D. The total of these is therefore 0.26155 kgCO<sub>2e</sub>/kWh.**

Emissions from gas consumption are therefore  $(120,000 \times 0.21364) / 1000 = 25.6$  tCO<sub>2e</sub>. Emissions from electricity consumption are therefore  $(100,000 \times 0.26155) / 1000 = 26.2$  tCO<sub>2e</sub>. The total share of emissions for the highways service from the building is therefore 51.8 tCO<sub>2e</sub>.

When the LA reports its annual GHG emissions this may already include calculations for Building X. Therefore, when obtaining detailed calculations from its highways service, the 51.8 tCO<sub>2e</sub> should not be included as the total emissions from the building will already have been accounted for.

This approach should be taken for all applicable premises.

## Completion Checklist

Check that Step 2 has been completed using this checklist:

- All premises and sites used to provide the service have been identified and documented.**
  - The responsible party for reporting carbon for each site is identified.
- All emissions sources for each site have been identified.**
- Emissions calculations have been completed for each source, for each site.**
- The totals for each site have been added to the LHA carbon footprint for the reporting year.**

## **Step 3: Staff & Contractors**

**LHA Directly Employed or Contracted Staff (Scope 3)  
Supply Chain Directly Employed or Contracted Staff (Scope 3)**

## Overview

The LHA is responsible for reporting emissions associated with directly employed staff and contractors. These emissions arise from commuting, home working, and business-related travel and should be assessed, calculated and reported for each staff member.

Ideally, supply chain partners should also provide emission data relating to staff and contractors dedicated to the LHA contract. Where people are deployed on an ad-hoc basis, these resources should be recorded in the *Purchased Products & Services Inventory* (see *Step 5: Products and Services*)

## Purpose & Goals

The purpose of this step is to:

1. **Identify all staff and contractors dedicated<sup>17</sup> to the highways service.**
  - a. Create an inventory (or schedule) of staff and contractors.
2. **Calculate the total emissions for staff and contractors for the reporting year:**
  - a. Emissions resulting from commuting.
  - b. Emissions resulting from working from home.
  - c. Emissions resulting from business travel using a private vehicle (where applicable).
3. **Calculate the total emissions for staff and contractors and include these in the reporting year carbon footprint statement.**
  - a. Typically, these emissions are categorised as scope 3 emissions.

## Preparation

To complete this step, you will need:

- **A schedule of all staff and contractors.**
  - Directly employed or contracted by the LHA.
  - Where possible, directly employed or contracted within the supply chain delivering the highways service.
- **Carbon emissions details for each staff member for the reporting year:**
  - The number of working days.
  - The number of commuting days.
  - Commuting distances.
  - Commuting modes.
  - The number of business miles using their own vehicle (where applicable).
- **The carbon emission data from each supply chain partner for staff and contractors deployed in delivering the highways service.**

## Process Step Leader & Process Delivery Team

This step will typically require the engagement of the following local authority and supply chain stakeholders:

- **Director with responsibility for Highways Services or the Highways Services Commissioner.**
- **Corporate human resources team.**
- **CCMRT.**
- **Heads of highways functions.**
- **Primary supply chain partner representatives.**

This step should be led by the Director with responsibility for Highways Services or Highways Services Commissioner, supported by the CCMRT.

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<sup>17</sup> Emission factors are upstream (or indirect emissions) comprising an average of all the GHG emissions relea

## Process

Use the following process to create an inventory (schedule) of staff and contractors and calculate the carbon emissions for the reporting year:

1. **Create an inventory of all directly employed or contracted staff for the reporting year.**
  - a. Add the carbon profiles for each staff member, as described below.
  - b. Ensure that only staff employed during the reporting year are included.
2. **Collate and calculate the total emissions for each item in the inventory for the reporting year.**
  - a. Apply the appropriate carbon emissions factor using the *Department for Energy Security and Net Zero* conversion factors.
  - b. Add the totals to the scope 3 emissions for each staff member.
3. **Aggregate the emissions totals for all directly employed or contracted staff and add them to the carbon footprint for the service.**
4. **Supply chain partners should provide a schedule of staff dedicated to the LHA and a summary of carbon emissions.**
  - a. If a supply chain partner is unable to provide this information or contractor staff are dynamically assigned and shared over a range of clients, then these emissions can be recorded in the Purchased Products & Services Inventory (see *Step 5: Purchased Products and Services*).
  - b. If a supply chain partner provides pre-calculated carbon emission data, all assumptions and supporting evidence should be documented. If the accuracy and completeness of the data cannot be fully verified, this should be recorded.

## Inventory Guidance (Schedule of Staff & Contractors)

The inventory of staff should include:

1. **All staff assigned to the service, both full-time and part-time employees, working for the LHA / Supply Chain.**
  - a. Exclude all staff who sit outside the agreed boundary (see Step 1).
2. **All named, dedicated, contractors employed by the LHA or supply chain partners.**
  - a. Contractors and temporary agency workers.
3. **Any unpaid workers or volunteers working on behalf of the LHA or supply chain partners.**

Details for each staff member in the inventory should include:

- **Staff / contractor member name or unique identifier.**
  - It is important to seek advice regarding GDPR<sup>18</sup> when using staff names.
- **Primary role(s).**
  - Assigned functions and activities.
- **Total working days in the reporting year.**
  - This should equate to [Total Commuting Days] + [Total Home Working Days].
- **Total commuting distance.**
  - The roundtrip distance in miles or kilometres to designated office or depot.
- **Total home working hours per day.**
  - Used to calculate emissions from home working.
- **Commuting mode (for staff working from offices or depots).**
  - Car or van.
  - Motorbike.
  - Bus or coach.
  - Train.
  - Taxi.
  - Cycle.
  - Walk.
  - Car share.
  - Mixed mode.

- **Fuel type (where applicable).**
  - Electricity.
  - Petrol.
  - Diesel.
  - Hybrid.
  - LPG.
- **Vehicle size (using BEIS size classifications).**
  - Car / van (by size)
    - Small,
    - Medium, or,
    - Large.
  - Car (by market segment)
    - Mini,
    - Supermini,
    - Lower medium,
    - Upper medium,
    - Executive,
    - Luxury,
    - Sports,
    - Dual purpose 4X4, or,
    - MPV.
  - Motorbike (by size)
    - Small,
    - Medium, or,
    - Large.
  - Where the vehicle size is unknown, use the emission factor for an “average” vehicle.
- **Annual miles using a private vehicle on LHA business (i.e., “grey fleet” miles).**
  - Where this differs from the vehicle used for commuting, the inventory should specify the vehicle used for business miles.

## Carbon Considerations & Calculation Guidance

The following points should be considered when calculating the emissions for staff and contractors:

1. **Where possible, all directly employed or contracted staff by the LHA or supply chain deployed to deliver the highways service should be included in the inventory.**
2. **The *Greenhouse Gas Reporting: Conversion Factors, 2023*<sup>19</sup> available from the *Department for Energy Security and Net Zero* (previously the *Department for Business, Energy & Industrial Strategy*) provides a comprehensive schedule of emission factors for passenger vehicle emissions and per-hour home working.**
  - a. Where possible, use the appropriate carbon factor for the *vehicle market segment* and / or *vehicle size*, rather than the “average” for the fuel type.
3. **Calculations should include Well-To-Tank (WTT) emission factors and, in the case of electrically powered vehicles, emission factors for Transmission & Distribution (T&D) and T&D emissions on the WTT emissions.**
  - a. For simplicity, these emission factors can be added together so that only one calculation is needed for each fuel to establish GHG emissions.
4. **By default, home working calculations should include both “office equipment” and “home heating” emissions factors.**
  - a. Or the combined factor.
5. **Total business miles for each staff member can be acquired from the claimed expenses of each individual.**
  - a. Where mileage has not been reclaimed an estimate can be used.

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inventory of a fuel or energy supply.

<sup>19</sup> Tonnes, Carbon Dioxide Equivalent.  
conversion-factors-2023.



## Keep it simple.

There are many varied and combined methods for staff commuting:

1. **Car sharing.**
  - a. With different pick-up and drop-off points on a non-repeating route.
2. **Mixed commuting and business miles.**
  - a. Collecting materials or dropping off colleagues at other offices or depots.
3. **Mixed mode travel.**
  - a. Cycle to railway station, train, then taxi.
4. **Commuting from different home addresses.**
  - a. With different commute distances.

Whilst accuracy is important, the dataset must also be manageable and actionable. Where complex or highly variable work patterns apply, use “primary transport mode” or worst-case emissions factors and document this within the inventory.

The general rule for carbon accounting is that it is better to overestimate than understate.

### Calculation Example (Commuting)

An LHA has 80 full-time employees (FTEs), where an FTE contract is for 220 days per year. A staff commuting survey is sent out and is returned by 45 people. It is assumed that the commuting habits of the remaining 35 staff are the same as those who responded. From the survey, aggregated results were available. It was established that 70% of respondents commute as single drivers, 10% carshare, 8% take the train, and 12% walk or cycle. On average, respondents commuted 3 out of 5 days a week and the average commute distance was 12 miles.

From this, the total annual distance commuted is  $[80 \text{ staff}] \times [220 \text{ days per working year}] \times ([3 \text{ working days}] / [5 \text{ total working days per week}] \times 12) \times [2 \text{ to include the return journey}] = 253,440 \text{ miles} = 407,872 \text{ km}$ .

The Government’s GHG Conversion Factors for Company Reporting for 2022 were used to obtain the emission factors (tailpipe and WTT) for each mode. For liftsharing it was assumed that car occupancy was two people and therefore emissions are half those of a single driver journey. Walking or cycling assumed zero emissions. For car commuting it was assumed travel in an “Average Car with Unknown Fuel” which has tailpipe emissions of 0.17 kgCO<sub>2</sub>e/km and WTT emissions of 0.04 kgCO<sub>2</sub>e/km (total therefore 0.21 kgCO<sub>2</sub>e/km). For train commuting emissions are 0.035 kgCO<sub>2</sub>e/ passenger.km and WTT emissions of 0.009 kgCO<sub>2</sub>e/ passenger.km (total therefore 0.044 kgCO<sub>2</sub>e/passenger.km).

Emissions from each mode were therefore:

- **Car (single):**  $407,872 \times ((70\% \times 0.21) / 1,000) = 59.96 \text{ tCO}_2\text{e}$
- **Car (carshare):**  $407,872 \times ((10\% \times 0.21) / 2) / 1,000) = 4.28 \text{ tCO}_2\text{e}$
- **Train:**  $407,872 \times ((8\% \times 0.044) / 1,000) = 1.4 \text{ tCO}_2\text{e}$
- **Walk/Cycle:**  $407,872 \times (12\% \times 0) / 1,000 = 0 \text{ tCO}_2\text{e}$

Total commuting emissions were therefore 65.6 tCO<sub>2</sub>e.

### Calculation Example (Home Working)

An LHA has 80 full-time employees (FTEs), where an FTE contract is for 220 days per year. A staff commuting survey is sent out and is returned by 45 people. On average, respondents worked from home for 2 out of 5 days a week. Each home working day is typically 7.5 hours long.

The Government's GHG Conversion Factors for Company Reporting for 2022 was used to obtain the emission factor for home working (Homeworking: Office Equipment + Heating). Emissions were therefore calculated as:

- **40% of days are home working days.**
- **There were 220 working days in the reporting year, of which 88 were home working days.**
- **80 staff worked from home for 7,040 days or 52,800 hours (based on a 7.5 hour working day).**

The total emissions for home working:  $(0.33378 \times 52,800) / 1,000 = 17.6235 \text{ tCO}_2\text{e}$ .

### Calculation Example (Business Miles)

An LHA has 80 full-time employees (FTEs), where 20 FTEs use their personal vehicles for business purposes. They reclaim their out-of-pocket expenses by recording the mileage and recharging their employer. The current expenses claim form does not include the vehicle type or engine size, only the fuel type.

The Government's GHG Conversion Factors for Company Reporting for 2022 was used to obtain the emission factor for home working (Homeworking: Office Equipment + Heating). Emissions were therefore calculated as:

- **16,600 business miles in an average petrol car.**
  - Where the emission factor is 0.27436 kgCO<sub>2</sub>e/mile.
  - Total petrol emissions:  $(0.27436 \times 16,600) / 1,000 = 4.554 \text{ tCO}_2\text{e}$ .
- **71,500 business miles in an average diesel car.**
  - Where the emission factor is 0.27436 kgCO<sub>2</sub>e/mile.
  - Total petrol emissions:  $(0.27492 \times 71,500) / 1,000 = 19.656 \text{ tCO}_2\text{e}$ .
- **68,000 business miles in an average plug-in petrol hybrid car.**
  - Where the emission factor is 0.11007 kgCO<sub>2</sub>e/mile.
  - Total petrol emissions:  $(0.11007 \times 68,000) / 1,000 = 7.484 \text{ tCO}_2\text{e}$ .

The total emissions for business travel:  $(4.554 + 19.656 + 7.484) = 31.694 \text{ tCO}_2\text{e}$ .

### Completion Checklist

Check that Step 3 has been completed using this checklist:

- All named, dedicated staff (both LHA and supply chain) deployed to deliver the highways service have been identified and added to an inventory.**
- The responsible party for reporting carbon for each type is identified.**
- Emissions calculations have been completed for each person on the inventory.**
- The totals are added to the LHA carbon footprint for the reporting year.**



## **Step 4: Vehicles & Plant**

**LHA Owned, Leased or Hired Vehicles & Plant (Scope 1 & 2)**  
**Supply Chain Owned, Leased or Hired Vehicles & Plant (Scope 3)**

## Overview

The emissions arising from the use of vehicles and plant contributes significantly to the carbon footprint of an LHA. It is important to create an inventory of all LHA or supply chain owned / controlled vehicles and plant dedicated to the LHA. The inventory should include engine sizes, fuel types (or electricity) and fuel use (or distances travelled using odometer readings). This inventory will then be used to calculate the total emissions for the owned / controlled fleet.

Temporarily rented or shared vehicles and plant should not be included in the inventory. In these cases, the carbon emissions should be recorded and calculated in the *Purchased Products & Services Inventory* (see *Step 5: Purchased Products & Services*).

## Purpose & Goals

The purpose of this step is to:

1. **Identify all vehicles and plant deployed wholly or primarily to deliver the service.**
2. **Identify the fuel types and fuel use for each item for the reporting year.**
3. **Calculate the total emissions from each inventory item.**

## Process Step Lead & Process Delivery Team

This step will typically require the engagement of the following LHA and supply chain stakeholders:

- **Director with responsibility for Highways Services or the Highways Services Commissioner.**
- **Fleet and plant management team.**
- **CCMRT.**
- **Heads of highways functions**
- **Supply chain representatives**

This step should be led by the Director with responsibility for the Highways Services or Highways Services Commissioner, supported by the CCMRT.

## Preparation

To complete this step, you will need:

- **An inventory of all owned or controlled vehicles and plant.**
  - Owned or leased by the LHA.
- **An inventory of all supply chain vehicles and plant used wholly or primarily to deliver LHA highways services.**
- **A schedule of fuel / energy types for each item.**
- **The annual fuel use for vehicles and plant, or mileage for vehicles.**
  - Actual fuel use from fuel receipts is the recommended method.

## Process

Use the following process to create an inventory of vehicles and plant and calculate the carbon emissions for the reporting year:

1. **Create an inventory of all vehicles and plant (LHA & Supply Chain) used wholly or primarily to deliver the highways service.**
  - a. In each case, identify the vehicle or plant type, fuel type, and fuel usage (recommended) or mileage for the reporting year.
  - b. Exclude fuel usage where fuel is drawn from site-based fuel tanks or site-based bottled gas where fuel this is recorded within the *Premises & Sites Inventory*.
  - c. Where fuel usage data is not available, or the asset is shared, record the mileage attributable to the service.

2. **Collate and calculate the total emissions for each item in the inventory for the reporting year.**
  - a. Apply the appropriate carbon emissions factor using the *Department for Energy Security and Net Zero* conversion factors.
  - b. Add the totals for combusted fuels to the scope 1 emissions for each site.
  - c. Add the totals for purchased electricity to the scope 2 emissions for each site.
3. **Aggregate the emissions totals for all vehicles and plant and add them to the carbon footprint for the service.**
4. **Ensure that all other supply chain vehicle and plant emission data (such as transportation) is captured as purchased goods and services.**
5. **If a supply chain partner provides pre-calculated carbon emission data rather than an inventory of vehicles and plant, all assumptions and supporting evidence should be documented. It should be recorded if the accuracy and completeness of the data cannot be fully verified.**

## Inventory Guidance

The inventory of fuel and electrically powered vehicles and plant should include:

1. **Fuel-powered vehicles (i.e. items powered by diesel, petrol, biofuels, LPG and / or CNG).**
2. **Hybrid vehicles (including plug-in and self-charging hybrid vehicles).**
3. **Fully Electric Vehicles (EVs).**
4. **Fuel-powered plant.**
  - a. Where the fuel source is not included in the *Premises & Sites Inventory* (i.e., fuel tanks and LPG stores).
5. **Shared / pool vehicles.**
  - a. These should only be included if not included within the inventory of another service within the LHA.

Do not include static, electrically powered plant or equipment. These items typically include:

1. **Electrically powered tools, plant and equipment.**
2. **Rechargeable hand-held tools.**
3. **Tools that use compressed air from an electrically powered compressor.**

The excluded items will be assessed using meter readings for premises and sites and reported as scope 2 emissions.

Details for each item inventory item should include:

- **Vehicle or plant type.**
  - Electric or fuel-powered vehicle, plant or equipment<sup>20</sup>.
- **Registration number, serial number, VIN<sup>21</sup> number or asset number.**
- **Class** (Used for future analysis and to align with government classifications for vehicle and plant classes<sup>22</sup>).
  - Car.
  - Van or Light Goods Vehicle.
  - Rigid HGV.
  - Articulated HGV.
  - Self-propelled plant (e.g. rollers, grass cutters and hedge trimmers).
- **Fuel / energy type.**
  - Diesel or red diesel.
  - Petrol (gasoline).
  - Biodiesel (including HVO and GTL).
  - Biopetrol.
  - Ethanol, butanol, or methanol.
  - Fuel oil or heating oil.

<sup>20</sup> E.g., HGVs, vans, cars, gritters, gully emptiers and pavers, hand-held petrol-powered plant.

<sup>21</sup> VIN: Vehicle Identification Number

<sup>22</sup> <https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2023>.

- Liquefied Petroleum Gas (LPG), Compressed Natural Gas (CNG), propane or butane.
- Hydrogen (white, grey, blue, or green).
- Solid fossil fuels (including coal and coke).
- EVs using electricity purchased from a utility provider or a public EV charging station.
- **Fuel source.**
  - Garage or fuel retailer.
  - Fuels distributor (on-site delivery to vehicle, or on-site fuel tank / gas cylinder store).
  - Jerrycan for fuel from a fuel retailer (for portable plant items).
  - Electric charging station (on-site and / or public).
- **Fuel use recording method.**
  - Fuel cards, detailing quantity of fuel purchased, the vehicle registration and mileage (preferred).
  - Invoices and receipts from a fuel provider / retailer, detailing the quantity purchased.
  - Filling docketts (from fuel storage tanks).
  - EV charging station receipts (reported as scope 2).
  - Job codes and works orders (optional).
- **Vehicle and plant ownership.**
  - Owned, leased, or rented.
- **Shared vehicles with other authority users (where applicable)<sup>23</sup>.**
  - Identify shared vehicles with other (non-highways) authority users.
  - Agree a standard formula / ratio to be used to apportion emissions to the relevant users.
- **Location (optional).**
  - Storage location for vehicles and mobile plant.

## Carbon Considerations & Calculation Guidance

The following points should be considered when calculating the emissions for vehicles and plant:

- **All owned / controlled vehicles and plant used by the LHA should be included in the inventory.**
- **The *Greenhouse Gas Reporting: Conversion Factors, 2023*<sup>24</sup> available from the *Department for Energy Security and Net Zero* (previously the *Department for Business, Energy & Industrial Strategy*) provides a comprehensive schedule of emission factors for vehicle and plant related emissions.**
  - Where possible, use fuel usage rather than mileage in calculations.
- **Calculations should include WTT emission factors and, in the case of electrically powered vehicles, emission factors for transmission and distribution (T&D) and T&D emissions on the WTT emissions.**
  - For simplicity, these emission factors can be added together so that only one calculation is needed for each fuel to establish GHG emissions.
- **If vehicles or plant refuel using site-based fuel tanks or bottled gas, ensure the emissions from fuel use are not double-counted.**
  - If site fuel tanks and gas bottles form part of the site inventory, do not include them in the emissions calculations for vehicles and plant, as these emissions will form part of the site carbon footprint (see *Premises & Sites*).

## Calculation Example

The LHA owns a fleet of 12 gritters in 2022 (the reporting year). Half of the fleet used 4,600 litres of biodiesel (hydrogenated vegetable oil, or HVO), the remainder of the fleet used 6,000 litres of standard biodiesel fuel blend from a fuel retailer.

The Government's GHG Conversion Factors for Company Reporting for 2022 state the following emission factors:

<sup>23</sup> E.g., pool cars and buses (not public transport).

<sup>24</sup> <https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2023>.

- HVO fuel has an emission factor of 0.03558 kgCO<sub>2e</sub>/litre and WTT emissions of 0.35178 kgCO<sub>2e</sub>/litre. The total of these is therefore 0.38736 kgCO<sub>2e</sub>/litre.
- A standard biodiesel fuel blend from a retailer has an emission factor of 2.55784 kgCO<sub>2e</sub>/litre and WTT emissions of 0.60986 kgCO<sub>2e</sub>/litre. The total of these is therefore 3.1677 kgCO<sub>2e</sub>/litre.

Emissions from HVO fuel use are therefore  $(4,600 \times 0.38736) / 1000 = 1.78$  tCO<sub>2e</sub>. Emissions from the standard biodiesel blend are  $(6,000 \times 3.1677) / 1000 = 19.006$  tCO<sub>2e</sub>. The total emissions for the LHA from gritter fleet is therefore 20.786 tCO<sub>2e</sub>.

## Completion Checklist

Check that Step 4 has been completed using this checklist:

- All vehicles and plant have been identified and added to an inventory.**
  - The responsible party for reporting carbon for each type has been identified.
- Emissions calculations have been completed for each item on the inventory.**
  - Where fuel for that item is purchased directly, and not drawn from a site-based fuel storage tank.
- The totals have been added to the LHA carbon footprint for the reporting year.**

## **Step 5: Purchased Products & Services**

**Purchased Products, Materials & Services (Scope 3)**  
**Purchased Materials & Waste Transportation (Scope 3)**  
**Waste Treatment & Disposal (Scope 3)**

## Overview

The *Purchased Products & Services Inventory* is used to record the emissions arising from all products and services purchased by the LHA, where these are not included in the inventories completed in Steps 2 to 4.

Purchased products and services typically comprise the following categories:

- **Purchased materials and treatments.**
- **Purchased transportation.**
  - Using third party vehicles not included in the *Vehicles & Plant* inventory.
  - Typically used to deliver materials, move plant and transport waste.
- **Purchased waste treatments and disposals.**
- **Purchased services.**
  - Using resources not included in Steps 2 to 4.

In many cases, rather than directly purchasing products, transportation and waste disposal, an LHA will outsource functions and activities to a service provider. These outsourced services may utilise people, products, transportation, and waste disposal not otherwise recorded in the service inventories (Steps 2 to 4). In these cases, they should be recorded in the *Purchased Products & Services Inventory*.

## Purpose & Goals

The purpose of this step is to:

1. **Identify all suppliers and subcontractors used by the service in the reporting year.**
2. **Identify all purchased products (materials and treatments) used to deliver highways services.**
3. **Identify all purchased services used to deliver the highways service.**
  - a. Where these are not included in Steps 2 to 4.
4. **Identify any internal or external waste treatments and / or waste disposals.**
5. **Calculate the total emissions from each category.**
  - a. Internally processed waste is typically categorised as scope 1.
  - b. Purchased products, ad-hoc services and waste services are typically categorised as scope 3.
  - c. Purchased transportation (as a service) is categorised as scope 3.
  - d. Purchased ancillary or ad-hoc services are classified as scope 3 emissions (as an apportioned share of the scope 1, 2 and 3 emissions of the service provider).

## Process Step Lead & Process Delivery Team

This step will typically require the engagement of the following LHA and supply chain stakeholders:

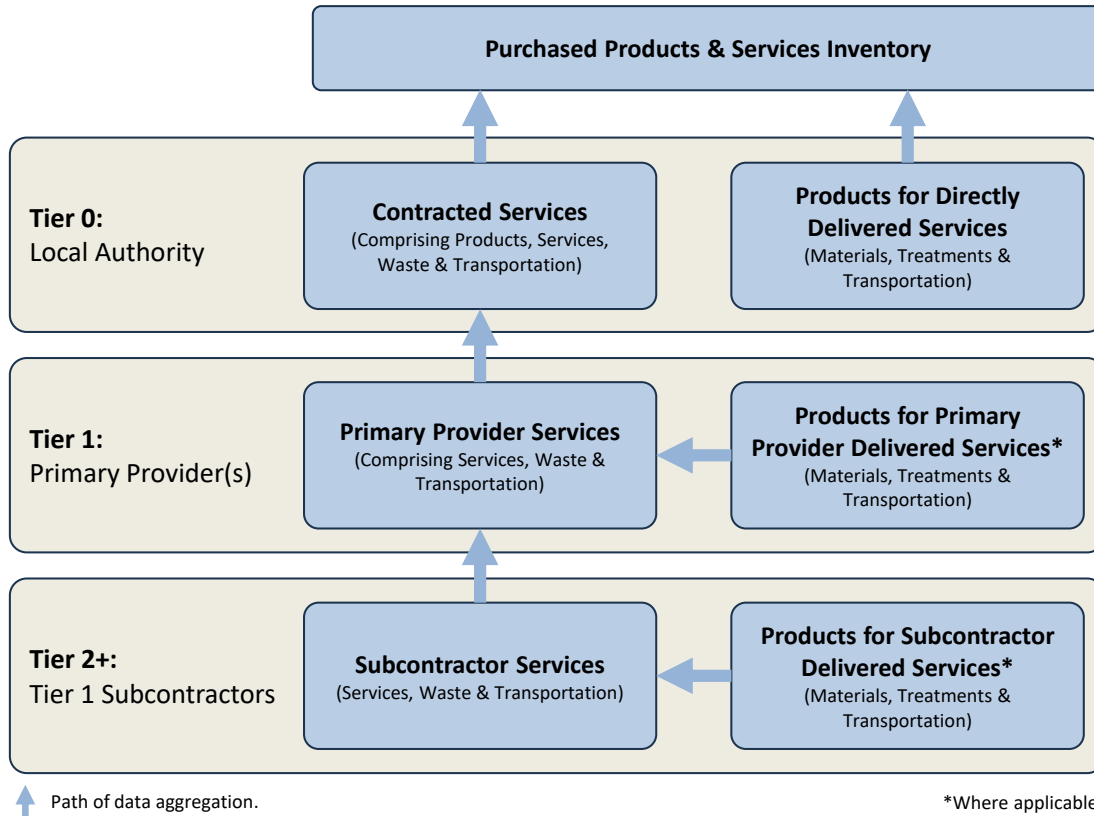
- **Director with responsibility for Highways Services or the Highways Services Commissioner.**
- **Corporate procurement and contracts management team.**
- **Corporate finance team.**
- **Corporate waste management team.**
- **CCMRT.**
- **Heads of highways functions.**
- **Primary (tier 1) provider(s).**
  - Responsible for their (tier 2) subcontractors.

This step should be led by the Director with responsibility for Highways Services or Highways Services Commissioner, supported by the CCMRT.

## Preparation

When reporting carbon for purchased products and services, three tiers of carbon data will be required from service stakeholders:

**Figure 6: Tiered Supply Chain Carbon: Reporting Responsibilities**



When reporting carbon emissions, each tier is accountable to its respective parent tier. The LHA is responsible for maintaining the *Purchased Products & Services Inventory*.

### Tier 0 (Authority) Preparation

To complete this step, the following is required:

- **A schedule of all products and services directly purchased by the LHA during the reporting year.**
  - This data is usually available from the finance team or from supplier invoices.
- **Mapping of the supply chain (with supply chain partners) and agreement and documentation of the responsibilities for carbon emission reporting.**
  - Confirming the primary contractor responsibilities for gathering inventory data from their subcontractors (where applicable).
- **Agreement on the format and level of detail for carbon emissions data provided by the supply chain.**
  - Ideally, the emissions data provided should detail specific activities and usages (in addition to carbon emissions).
- **Identification and investigation of any potential data gaps.**
  - A process for data gap closing should be agreed with the appropriate partners.



## Tier 1 (Primary) Partner(s) Preparation

Primary providers / partners will need:

- **A schedule of all products and subcontracted services purchased to service the contract during the reporting year.**
  - This data is usually available from the contract management team, the finance team or from supplier invoices.
- **To agree the responsibility and data requirements for carbon emission reporting within their supply chain.**
  - To agree the format and level of detail of carbon emission data provided by their subcontractor supply chain.
- **To identify and investigate any potential data gaps.**
  - A process for data gap closing should be agreed with the appropriate partners.

## Subcontractor(s) Preparation

Subcontractors of the primary providers / partners will need:

- **A schedule of all resources used to service the subcontract during the reporting year.**
  - Including human resources, fuels, energy, materials, and waste disposals.



**It is important to recognise that subcontractors may be at varying levels of readiness in their ability to provide the data necessary for carbon calculations. In cases of low readiness, a subcontractor will need to provide a minimum breakdown of resources used (i.e., people, materials, transport and waste), from which an accurate carbon assessment can be calculated.**

**When supply chain readiness is low, a plan should be developed to improve the quality of data to meet the minimum reporting standard.**

## Process

The reporting responsibilities for purchased products and services will vary based on the service role. These responsibilities and the necessary data sources are illustrated in Figure 7.

**Figure 7: Carbon Reporting Responsibilities (Purchased Products & Services)**

Inventory Of Purchased Products & Services	LHA Carbon Reporting Responsibilities	Direct Purchases By LHA			
		Emissions Sources	Purchased Products & Materials	Purchased Waste Disposal	Purchased Services
			Data Sources	Purchase Orders & Invoices	Landfill Gate Invoices (Waste Type(s), Tonnes)
			Purchased Transport (Fuel / Energy Usage)	Incineration Invoices (Waste Type(s), Tonnes)	
	Primary Provider Carbon Reporting Responsibilities	LHA-Related / Apportioned Purchases By Primary Provider(s)*			
		Emissions Sources	Purchased Products & Materials	Purchased Waste Disposal	Purchased Services
			Data Sources	Purchase Orders & Invoices	Landfill Gate Invoices (Waste Type(s), Tonnes)
			Purchased Transport (Fuel / Energy Usage)	Incineration Invoices (Waste Type(s), Tonnes)	
		LHA-Related / Apportioned Purchases By Subcontractor(s) of Primary Provider*			
		Emissions Sources	Purchased Products & Materials	Purchased Waste Disposal	Purchased Services
Data Sources			Purchase Orders & Invoices	Landfill Gate Invoices (Waste Type(s), Tonnes)	Service Provider Energy & Fuel Statements
		Purchased Transport (Fuel Type, Fuel Use / Miles)	Incineration Invoices (Waste Type(s), Tonnes)		
		Or	Or	Or	
		Bills of Materials (Material Type / Quantity)	Aggregated Disposal Fees (Waste Type, Tonnes)	Total Resource Days (Number of People * Days)	
	Products & Services Carbon Statements (Requires Validity Assessment & Evidence)				

\*Where applicable.

v1.3

### Tier 0 (LHA) Process

Use the following process to identify and collate the data necessary to calculate the carbon emissions for the reporting year arising from directly purchased products and services:

1. **Create a map of supply chain providers and an inventory of all purchased products and services for the reporting year.**
  - a. This map should clearly identify the carbon reporting responsibilities of each party.

- b. The data required from each subcontracted provider is the responsibility of the primary provider(s).
2. **For directly purchased products and materials, collate and calculate the total emissions for each item for the reporting year.**
  - a. Apply the appropriate carbon emissions factors using the *Department for Energy Security and Net Zero* conversion factors, or the *National Highways Carbon Library Factors (Highways Construction Materials)*. Alternatively, the *Inventory of Carbon and Energy (ICE)* database can be used<sup>25</sup>.
  - b. Ensure that only materials that are used in the reporting year are included in the carbon footprint.
  - c. Add the totals for products and materials to the scope 3 emissions of the LHA.
  - d. Assign the appropriate lifecycle stage (EN15978 Module) for each purchase.
3. **For directly contracted services, the contracted provider is responsible for providing data for products and services purchased on behalf of the LHA within the reporting year<sup>26</sup>.**
  - a. Contracted services should include carbon emissions for design and consultancy, transportation, digital services and waste management.
  - b. Where primary provider(s) submit carbon emissions data, rather than an inventory of resources and usage, all assumptions and supporting evidence should be documented. It should be recorded if the accuracy and completeness of the data cannot be fully verified.
4. **Collate the data from the primary provider(s) and their subcontractors and add it to the *Purchased Products & Services Inventory*.**
5. **Aggregate the emissions totals for the directly and indirectly purchased products and services and add them to the carbon footprint for the highways service for the reporting year.**

### Process for Primary Provider(s)

Use the following process to identify and collate the data necessary to calculate the carbon emissions for the reporting year arising from products and services purchased on behalf of the LHA:

1. **For products and materials purchased directly by the primary provider on behalf of the LHA, collate and calculate the total emissions for each item for the reporting year.**
  - a. Apply the appropriate carbon emissions factors using the *Department for Energy Security and Net Zero* conversion factors, or the *National Highways Carbon Library Factors (Highways Construction Materials)*. Alternatively, the *Inventory of Carbon and Energy (ICE)* database can be used.
  - b. Add the totals for products and materials as scope 3 emissions to the *Purchased Products & Services Inventory*.
2. **For waste, specify:**
  - a. The total kgCO<sub>2</sub>e of waste treatments and disposal, or,
  - b. The total quantity of waste recycled, and waste sent to incineration and / or landfill.
3. **For staff not included in the *Staff & Contractors Inventory*, specify either:**
  - a. The total kgCO<sub>2</sub>e for staff / subcontracted staff, or,
  - b. The number of human resource days assigned to the contract / subcontract<sup>27</sup>.
4. **For transportation using vehicles not included in the *Vehicles & Plant Inventory*, specify either:**
  - a. The total kgCO<sub>2</sub>e, or,
  - b. The total number of litres used for each fuel type, or,
  - c. The total number of miles driven, the fuel type, and the engine size.
5. **For plant not included in the *Vehicles & Plant Inventory*, specify either:**
  - a. The total kgCO<sub>2</sub>e, or,
  - b. The total number of litres used for each fuel type.
6. **For subcontracted services, the primary provider is responsible for providing data for all products and services purchased on behalf of the LHA.**
  - a. These include design and consultancy and digital services.

<sup>25</sup> The National Highways Carbon Library is an evolution of the ICE database.

<sup>26</sup> This includes any subcontracted services.

<sup>27</sup> These can be multiplied by the average kgCO<sub>2</sub>e per staff member in the Staff & Contractors inventory.

- b. If a subcontractor provides carbon emissions data, rather than an inventory of products and materials, all assumptions and supporting evidence should be documented. It should be recorded if the accuracy and completeness of the data cannot be fully verified.
7. **Assign the appropriate lifecycle stage (EN15978 Module) for each purchase.**
8. **All purchased products and services, whether directly or indirectly sourced by the primary provider(s), should be added to the *Purchased Products & Services* inventory of the LHA.**

### Process for Subcontractors of the Primary Provider(s)

The following process should be implemented by the primary provider(s) to collect and collate the carbon emissions from subcontractors for the reporting year:

1. **For each subcontracted service, identify the products, materials and treatments purchased by the subcontractor and specify:**
  - a. The material / treatment type or product name,
  - b. The total kgCO<sub>2</sub>e for the material or treatment, or,
  - c. The quantity (weight or volume) and the carbon density (where applicable).
2. **For waste, specify:**
  - a. The total kgCO<sub>2</sub>e of waste treatments and disposal, or,
  - b. The total quantity of waste recycled, and waste sent to incineration and / or landfill.
3. **For staff not included in the *Staff & Contractors Inventory*, specify either:**
  - a. The total kgCO<sub>2</sub>e for subcontracted staff, or,
  - b. The number of human resource days assigned to the subcontract<sup>28</sup>.
4. **For transportation using vehicles not included in the *Vehicles & Plant Inventory*, specify either:**
  - a. The total kgCO<sub>2</sub>e, or,
  - b. The total number of kWh or litres used for each fuel type, or,
  - c. The total number of miles driven, the fuel type, and the engine size.
5. **For plant not included in the *Vehicles & Plant Inventory*, specify either:**
  - a. The total kgCO<sub>2</sub>e, or,
  - b. The total number of litres used for each fuel type.
6. **For subcontracted services (tier 3+), specify:**
  - a. The kgCO<sub>2</sub>e for subcontracted services.
7. **All subcontracted products and services should be added to the inventory of the primary provider.**

The protocols for calculating the carbon emissions for subcontractors should be agreed with the LHA prior to implementation.

### Inventory Guidance

The inventory of *Purchased Products & Services* includes all purchased items not included in inventories described in Steps 2 to 4. The responsible reporting parties and the recommended data sources are outlined in Figure 7.

### Purchased Products

The inventory of products, materials, and treatments for the reporting year should include:

1. **All items with a significant carbon profile. These items include:**
  - a. Concrete and cement,
  - b. Asphalt (and asphalt mixes),
  - c. Bitumen,
  - d. Steel products,
  - e. Aluminium products,
  - f. Plastic products, and,
  - g. Fuels and energy.
2. **Quantity.**

<sup>28</sup> These can be multiplied by the average kgCO<sub>2</sub>e per staff member in the Staff & Contractors inventory.

3. **Unit of measure.**
4. **Weight (usually aligned with the quantity).**
5. **Date of purchase.**
  - a. Only products purchased in the reporting year should be added to the carbon footprint.
6. **Date of use (where known).**

### Purchased Transportation as a Service

Where products require transportation, either to a depot or direct to site, and transportation does not utilise a vehicle in the *Vehicles & Plant Inventory*, this should be recorded as a purchased transportation service.

Records for transportation should include:

1. **The order / job reference for the associated product(s), plant transport, or waste disposal.**
  - a. Where applicable.
2. **Transportation mode (where known, or document assumptions).**
  - a. Courier services (using a car, moped or motorbike).
  - b. Van or LGV (up to 3.5 tonnes).
  - c. Rigid HGV, up to 33 tonnes.
  - d. Articulated HGV, up to 33 tonnes.
3. **Fuel type for transport mode.**
  - a. Where unknown use diesel as the fuel type.
4. **Load weight and distance (national and local deliveries).**
  - a. Where the load weight is known, the weight should be specified in tonnes and calculated as kgCO<sub>2</sub>e per *tonnes.km* for the inbound delivery.
  - b. Where the load weight is estimated for HGVs, specify 0%, 50% or 100% laden.
  - c. For outbound journeys (with no load), specify 0% laden<sup>29</sup>.

Alternatively, purchased transportation can be specified in kgCO<sub>2</sub>e:

1. **The order / job reference for the associated product(s), plant transport, or waste disposal.**
  - a. Where applicable.
2. **Total kgCO<sub>2</sub>e for transportation.**
  - a. With supporting evidence.

### Internationally Sourced Products (Optional Calculation)

If a material is sourced internationally, and the point of origin is identifiable, the carbon emissions for this journey should be included in the calculation. Where the point of origin can only be identified as a country, rather than a port, Table 7 provides typical shipping distances from major international seaports. Use the standard BEIS conversion factors for the material type (liquid, gaseous or product) for sea freight per *tonne.km*<sup>30</sup>.

**Table 7: Typical International Shipping Distances**

Journey (To Port of London)	Nautical Miles	Miles	Kilometres
Europe (Port of Rotterdam, Netherlands)	253	291	469
Canada (Port of Montreal)	3,251	3,741	6,021
USA (Port of Houston)	6,057	6,970	11,218
India (Jawaharlal Nehru Port)	7,040	8,101	13,038
Malaysia (Endau Port)	9,333	10,740	17,285
China (Shanghai Port)	11,865	13,654	21,974

Where the transport modes, fuel types and distances are known from the in-country source, these should also be included in the calculations using UK conversion factors (for consistency).

<sup>29</sup> This is reversed for waste disposal.

<sup>30</sup> The 2023 BEIS average emissions factor is "Delivery vehs & freight, sea tanker, Products tanker, Average, tonne.km". Include the additional WTT emissions for each tonne.km.

## Purchased Waste Processing & Disposal as a Service & LHA Disposal

Where waste disposal is purchased as a service, the weight and type of waste should be recorded. Typically, waste disposal services comprise waste to incinerator and / or waste to landfill. Where waste is disposed of in LHA-owned incinerators and or landfill sites, this should be included in the tier 0 (LHA) *Purchased Products & Service* inventory.

Waste which is recycled and / or reused should only be recorded where there are emissions arising from either transportation (specifically ex-situ recycling) or energy is used in waste processing to create a reusable product.

The inventory should include:

1. **Waste source (job / activity reference).**
2. **Service provider name.**
3. **Waste type.**
  - a. Non-hazardous, green / garden (for vegetation),
  - b. Non-hazardous, household / construction (for mixed waste),
  - c. Hazardous, highways waste (for asphalt waste containing >0.1% coal tar), or,
  - d. Hazardous, other.
4. **Quantity (in tonnes).**
5. **Disposal method.**
  - a. Landfill,
  - b. Incineration, or,
  - c. Recycled / reused.
6. **Disposal site.**
  - a. LHA owned site, or,
  - b. Purchased disposal under commercial conditions.
7. **Energy used in reprocessing (in kWh).**
  - a. Excluding any transportation included elsewhere.

Alternatively, purchased waste treatments and disposals can be specified in kgCO<sub>2</sub>e:

1. **Waste source (job / activity reference).**
  - a. Where applicable.
2. **Total kgCO<sub>2</sub>e for waste treatments and disposal.**
  - a. With supporting evidence.

Internally treated waste should be assessed and added to the scope 1 carbon footprint. Outsourced waste treatments and disposals should be added to the scope 3 carbon footprint.

## Purchased Design and Consultancy as a Service

Where design and / or consultancy is provided by a third party, and the resources utilised are not included in steps 2 to 4, these services should be added to the *Purchased Products & Services Inventory*. Typically, these will include ad-hoc services, procured outside of the main contract(s).

Design and consultancy service providers should calculate the emissions for each instance of service provided and these should be added to the inventory as:

1. **Order or job reference.**
2. **Service provider name.**
3. **kgCO<sub>2</sub>e for service provision.**
  - a. Apportioned to the job.

Alternatively, a formula for remote, office-based workers can be applied based on the *Chartered Institution of Building Services Engineers* (CIBSE) carbon benchmarks for office working. An illustrative example of calculating carbon emissions for contracted services is provided in **Calculation Example (Services)**, below.

## Purchased Temporary / Agency Resources (People) as a Service

Where temporary / agency resources (people) are not included in the *Staff & Contractors Inventory*, these services should be added to the *Purchased Products & Services Inventory*. The carbon emissions for these resources should include:

1. **Order or job reference.**
2. **Service provider name.**
3. **Resource name or identifier.**
4. **Total days purchased.**
  - a. Where applicable, apportioned to the reporting year.

The total days purchased can be multiplied by the average emissions for all staff in the *Staff & Contractors Inventory*.

Alternatively, purchased temporary staff and agency workers can be specified in kgCO<sub>2</sub>e:

1. **Order or job reference.**
2. **Service provider name.**
3. **Resource name or identifier.**
4. **Total kgCO<sub>2</sub>e for the assignment.**
  - a. Where applicable, apportioned to the reporting year.
  - b. With supporting evidence.

## Purchased Information Technology as a Service

Digital technologies and software services will require carbon statements from service providers. In many cases, these services will produce significant carbon emissions from the electricity used to power high-performance servers and digital communications infrastructure. In most cases, this will include equipment cooling using air conditioners.

The inventory should include:

1. **Order, job reference or technology platform name.**
2. **Service provider name.**
3. **Service description.**
4. **kgCO<sub>2</sub>e for service provision (electricity).**
  - a. Apportioned to the service and the reporting year.

It is important to ensure that purchased digital services included within the service boundary (*Functions & Activities*) are not double counted by the corporate IT/IS/digital team within the LHA.

## Carbon Considerations & Calculation Guidance

The following points should be considered when calculating the emissions for purchased goods and services:

- **Ensure all products and services purchased by the highways service are included in the inventory.**
  - Where these have not been included in the inventories completed in Steps 2 to 4.
- **The following emissions factor databases are available for conversion:**
  - The *Greenhouse Gas Reporting: Conversion Factors, 2023* are available from the *Department for Energy Security and Net Zero* (previously the *Department for Business, Energy & Industrial Strategy*),
  - The *National Highways Carbon Library* (Highways Construction Materials), or,
  - The *Carbon and Energy* (ICE) database.

- Environmental Product Declarations (EPDs) provide an essential resource when calculating emissions for named, certified products. EPD certificates are available from materials and services providers and EPD International AB<sup>31</sup>.
- **All transport required for delivery (both inbound and outbound) should be included in the inventory.**
  - Unless the vehicle used is directly owned by the LHA or supply chain and has been included in the vehicles and plant inventory (Section 4).
- **All purchased waste processing and disposal should be classified and included in the inventory.**
  - Typically classified as construction waste, green waste, or hazardous waste.
- **All purchased services (typically, digital services and consultancy / support services) should be classified and included in the inventory.**
- **Recycled materials can be added using the appropriate conversion factors from the government conversion tables.**

### Calculation Example (Products, Materials, Waste & Transportation)

Figure 5 illustrates a simple inventory of all product purchases. The inventory includes direct purchases of:

- **Asphalt,**
- **Bitumen emulsion,**
- **Concrete, and,**
- **Waste disposal.**

**Figure 8: Sample Inventory: Purchased Products, Materials, Transport & Waste**

Items In Reporting Year	Data Source	Quantity	No. Of Deliveries	Unit Of Measure	Carbon Factor	Total kgCO2e
<b>Total "Asphalt 5% Binder Content" Purchases</b>						
Asphalt 5% Binder Content (100mm depth)	NH	84		tonnes	54.22774	4,555.13
Transport, HGV Rigid, 50% Laden, Inbound (Inc WTT)†	BEIS	315	3	km	1.03710	1,960.12
<b>Total "Bitumen Emulsion" Purchases</b>						
Bitumen Emulsion, Avg	NH	215		kg	0.32629	70.15
Transport, HGV Rigid, 50% Laden, Avg, Inbound (Inc WTT)†	BEIS	42	1	km	1.03710	87.12
<b>Total "Concrete GEN 3 With CEM 1" Purchases</b>						
Concrete GEN 3 With CEM 1	NH	60		m <sup>3</sup>	248.75413	14,925.25
Transport, HGV Artic, 50% Laden, Avg, Inbound (Inc WTT)†	BEIS	54	9	km	1.03710	1,008.06
<b>Total Waste Disposal Purchases</b>						
Asphalt, Landfill, Waste, Avg	BEIS	56		tonnes	1.23401	69.10
Transport, HGV Rigid, 50% Laden, Avg, Inbound (Inc WTT)†	BEIS	62	2	km	1.03710	257.20
<b>Total kgCO2e (Reporting Year)</b>						<b>22,932.13</b>

†Assumes overall 50% laden to account for the inbound (100% laden) and return (0% laden) journeys. Each HGV full load is 33 tonnes.

The Government's GHG Conversion Factors for Company Reporting for 2022 state the following emission factors:

- **Asphalt:**
  - Asphalt 5% binder content has a carbon factor of 54.22 kgCO<sub>2</sub>e per tonne. As 84 tonnes have been purchased, the total for asphalt is  $(54.22 * (84/1000)) = 4.555$  tCO<sub>2</sub>e.
  - Transport of asphalt utilises a rigid HGV using diesel fuel and assumes a 33-tonne load. An overall 50% load is assumed, based on a full 33 tonnes delivery load and an unladen return. The *per km* carbon factor (including the WTT emissions) was applied as  $([126 \text{ km roundtrip distance to the supplier}] * [3 \text{ deliveries}]) * [\text{carbon factor of } 1.03710 \text{ per km}] = 1,960$  kgCO<sub>2</sub>e.
- **Bitumen Emulsion:**

<sup>31</sup> <https://environdec.com/library>.



- The same method is applied for bitumen emulsion, substituting the emissions factor for the material.
- **Concrete:**
  - The same method is applied for concrete, substituting the emissions factors for the material and the use of an articulated HGV.
- **Waste Disposal:**
  - The same method is applied for waste disposal, substituting the emissions factor for waste disposal (waste to landfill).

This approach should be applied to all items in the inventory.

### Calculation Example (Remote, Office-Based Design & Consultancy Services)

Where ancillary services are purchased by the LHA and no carbon statement is available from the provider, a carbon estimate for services can be estimated using the *Chartered Institution of Building Services Engineers* (CIBSE) carbon and other benchmarks:

1. **An average of 0.91 tCO<sub>2</sub>e per annum per square metre of office space.**
2. **An average of 12m<sup>2</sup> per employee (outside of London).**
  - a. 8m<sup>2</sup> per employee (inside greater London).
  - b. 10m<sup>2</sup> per employee (average).

Assuming a contract for six staff for six months (remote office working):

1. **(0.091 tCO<sub>2</sub>e \* 10m<sup>2</sup>)<sup>32</sup> = 0.91 tCO<sub>2</sub>e per employee, per annum.**
2. **(0.5 years [the length of the contract]) \* (6 contractors) = 3 contractor years.**
3. **(3 contractor years \* 0.91 tCO<sub>2</sub>e) = 2.73 tCO<sub>2</sub>e**

### Completion Checklist

Check that Step 5 has been completed using this checklist:

- All direct, ancillary and ah-hoc purchases of products, waste treatments and disposal, and transport have been included on an inventory.**
- All direct purchases of services have been included on the inventory.**
  - Either people or technology related.
- Supply chain product and services purchases have been included on the inventory.**
  - Alternatively, carbon statements for each agreed category of product or material have been provided by the supply chain partner with supporting evidence as to the basis of calculation and any assumptions made.
- Emissions calculations have been completed for each item on the inventory.**
- The totals have been added to the LHA carbon footprint for the reporting year.**

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<sup>32</sup> As the national average.

## Step 6: Data Collation & Reporting

## Overview

The combined carbon emissions from the inventories (prepared in Steps 2 to 5) represent the carbon footprint of the in-boundary functions and activities (identified in Step 1). Calculation of the carbon footprint for the reporting year requires the collation, checking and aggregation of the data within these inventories. The format of the report should remain consistent with the GHG protocols and those established by the CCMRT.

## Purpose & Goals

The purpose of this step is to:

1. **Check that the significance threshold and any assumptions used in reporting are agreed and documented.**
  - a. See Step 0.
2. **Collate and check that all in-scope highways functions and activities are included within the carbon reporting boundary.**
  - a. See Step 1.
3. **Collate and check the data within the inventories.**
  - a. See Steps 2 to 5.
4. **Verify the data is accurate and complete with the support of the supply chain partners.**
5. **Prepare and publish the carbon footprint report for the highways service.**

## Process Step Lead & Process Delivery Team

This step will typically require the engagement of the following LHA and supply chain stakeholders:

- **Director with responsibility for Highways Services or the Highways Services Commissioner.**
- **CCMRT.**
- **Heads of highways functions.**
- **Primary provider(s).**
  - Responsible for their subcontractors.

This step should be led by the Director with responsibility for Highways Services or Highways Services Commissioner, supported by the CCMRT.

## Preparation

Completion of Step 6 will require:

1. **The terms of reference and the agreed reporting year (Step 0).**
  - a. Including any assumptions and the agreed threshold of significance.
2. **The identified / agreed functions and activities within the reporting boundary (Step 1)**
3. **The completed inventories from Steps 2 to 5.**
  - a. Premises and sites.
  - b. Staff and contractors.
  - c. Vehicles and plant.
  - d. Purchased products and services.

## Process

The report preparation process includes the following stages:

1. **Collate the documents and inventories created in Steps 0 to 5.**
2. **Ensure that all the steps have been completed.**
  - a. **Steps 0 and 1 are documented.**
  - b. **The inventories prepared in Steps 2 to 5 are completed.**
3. **Check for accuracy and completeness (with supply chain partners).**
  - a. Checking and verifying the premises and sites inventory.
  - b. Checking and verifying the staff and contractors inventory.

- c. Checking and verifying the vehicles and plant inventory.
- d. Checking and verifying the purchased products and services inventory.
- 4. Check the correct / agreed carbon conversion factors have been applied in each case.**
- 5. Prepare the carbon footprint report.**
  - a. Collate the documentation from Steps 0 and 1.
  - b. Aggregate the emissions data from Steps 2 to 5.
  - c. For guidance, use the report headings below.
- 6. Issue the report to key stakeholders.**
  - a. The CCMRT.
  - b. The service leadership team.
  - c. Supply chain partners.
- 7. Proceed to the optional steps:**
  - a. Analyse activity-level carbon emissions.
  - b. Assess carbon reduction options.

## Data Quality Assurance

Data quality is recognised by the GHG Protocol as vital, and no methodology can compensate for poor quality data. It is therefore important that the datasets are accurate and complete.

The LHA is required to carry out an annual review, following the calculation of the carbon footprint, to ensure that:

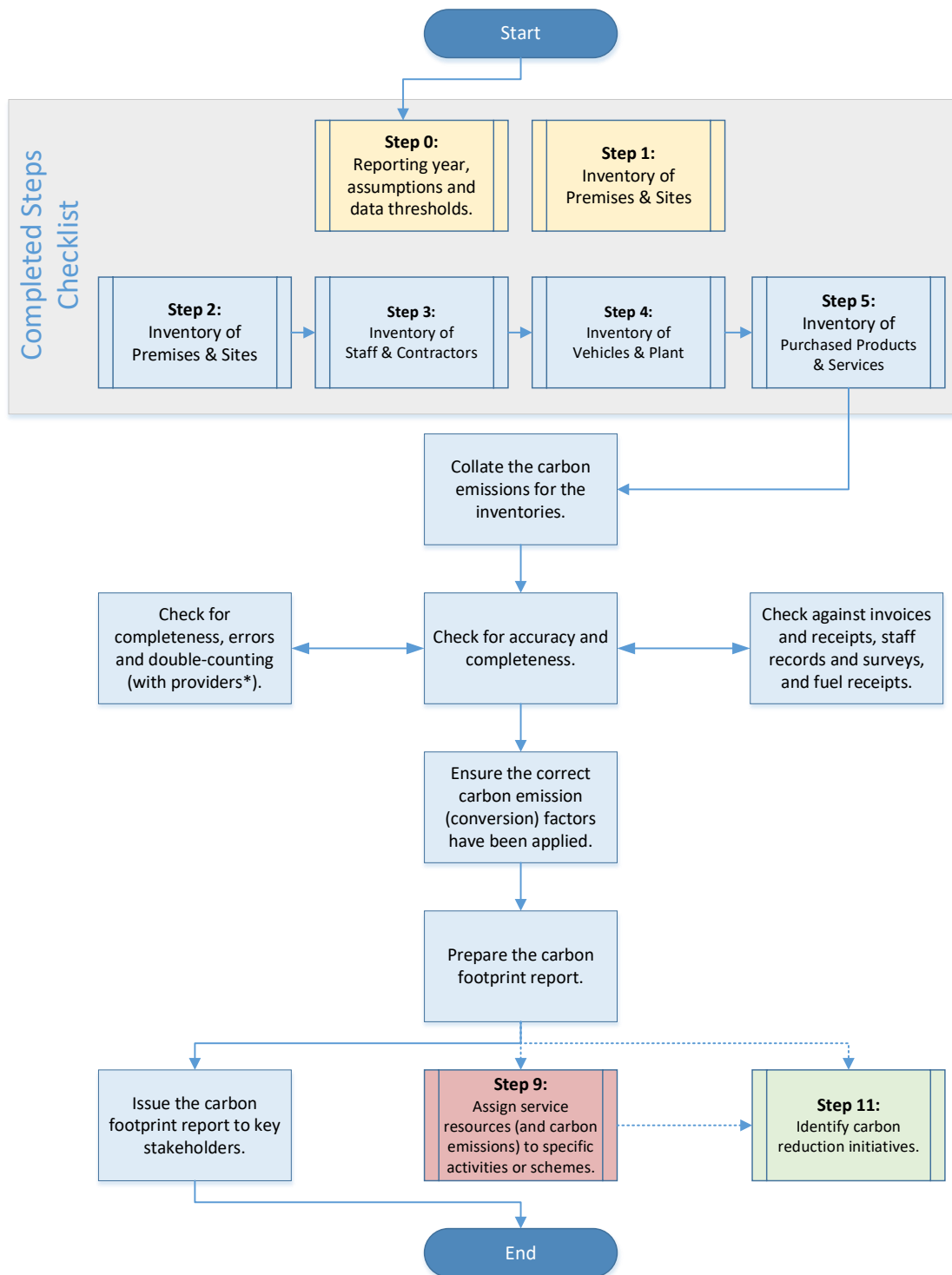
- 1. The baseline year's data has been accurately calculated.**
  - a. As a foundation for all future years.
- 2. The defined processes for emissions data collection, validation and conversion are followed.**
- 3. The data is accurate and complete.**
  - a. All monitoring and measurement equipment is working, used as specified and properly maintained.

It is recommended that the LHA perform both cyclical and random (spot) checks on datasets, calculation methods, measurement instruments and processes adherence. These will typically include:

- 1. Ensure all processes including carbon measurement are executed as specified.**
- 2. Check meters and invoices for reporting errors.**
  - o Especially where reported usage levels change unexpectedly.
- 3. Check for omissions / errors in the carbon inventories.**
- 4. Check a sample of input data for transcription errors.**
- 5. Check that assumptions for activity data and emission factors are documented.**
  - o Ensure any related files are referenced and archived.
- 6. Check a representative sample of the calculations by hand or electronically for errors.**
- 7. Check for equation / formula errors within spreadsheets or proprietary software tools.**
- 8. Check for data aggregation / double counting errors.**
  - o Particularly if used in the wider local authority figures.
- 9. Confirm version control is applied for electronic files with multiple users.**

The process is summarised in Figure 9.

Figure 9: Data Collation & Report Preparation Process



## Template Report Structure

The following report structure is recommended for the inventory-based method described in this guidance:

- 1. Management Summary (■)**
- 2. Reporting Year (■)**
  - a. Assumptions & Reporting Exclusions
  - b. Data Challenges & Reporting Limitations
  - c. Applied Conversion Factors (Data Sources)
  - d. Thresholds of Significance
- 3. Carbon Reporting Boundary (■)**
  - a. LHA Functions & Activities
  - b. Map of Responsible Parties (Carbon Reporting)
- 4. Premises & Sites: Carbon Statement (■)**
  - a. Combusted Fuels (Utility Provider)
    - i. *Fuels (gas, bottled gas, and heating oil).*
  - b. Electricity (Utility Provider)
    - i. *Site electricity.*
    - ii. *Electricity (for electric vehicles).*
    - iii. *Electricity for highways services (street lighting and electrical assets).*
  - c. Water (Utility Provider)
  - d. Fugitive Emissions
    - i. *Static and site-portable air conditioner top-ups.*
  - e. Carbon Totals (By Scope, Reporting Year)
  - f. Observations & Comments
    - i. *Leadership Team, CCMRT, Supply Chain*
- 5. Staff & Contractors: Carbon Statement (■)**
  - a. Commuting
    - i. *Transport Modes*
    - ii. *Fuel / Energy Types*
    - iii. *Distances*
    - iv. *Carbon Impact of Staff & Contractor Commuting Policies*
  - b. Home Working
    - i. *Carbon Impact of Home Working Policies*
  - c. Business Travel (Grey Fleet)
    - i. *Carbon Impact of Grey Fleet Policies*
  - d. Carbon Totals (By Scope, Reporting Year)
  - e. Observations & Comments
    - i. *Leadership Team, CCMRT, Supply Chain*
- 6. Vehicles & Plant: Carbon Statement (■)**
  - a. Fuel / Energy Consumption
    - i. *Emissions by Vehicle / Plant Types*
    - ii. *Emissions by Highways Function*
  - b. Carbon Totals (By Scope, Reporting Year)
  - c. Observations & Comments
    - i. *Leadership Team, CCMRT, Supply Chain*
- 7. Purchased Products & Services: Carbon Statement (■)**
  - a. Products, Materials & Treatments
    - i. *Purchased Directly*
    - ii. *Purchased Indirectly*
  - b. Services (Provided by Third Parties)
  - c. Waste
    - i. *Treatments & Recyclates*
    - ii. *Incineration*
    - iii. *Landfill*
  - d. Transportation as a Service (Using Third Party Vehicles)
  - e. Carbon Totals (By Scope, Reporting Year)
    - i. *Total Emissions for Repeating Activities*



## **Step 7: Carbon Profiles (Optional)**

**Repeating Activities: Cyclical, Reactive & Minor Works (Scopes 1, 2 & 3)**

**One-Off Activities: Major Schemes & Capital Works (Scopes 1, 2 & 3)**



## Overview

A recommended method for conducting activity-based analysis is the development of *carbon profiles* for high-carbon activities. These activities fall into two types:

1. **Repeating, business-as-usual activities.**
  - a. Including cyclical, reactive, and planned minor works.
2. **One-off activities.**
  - a. Including major schemes and capital works.

This section provides specific guidance for the creation of *carbon profiles* and the analysis of *repeating* and *one-off* activities.

## Carbon Profiles for Repeating Activities

The examples in the section above apply most specifically to repeating activities:

1. **Cyclical activities** (e.g., grass cutting, gully emptying, winter maintenance).
2. **Reactive maintenance** (e.g., pothole repairs, blocked drainage systems, inspections).
3. **Planned minor works** (e.g., surface patching, lining, grips and easement repairs).

Repeating activities, whilst diverse, are business-as-usual processes within the LHA. This enables each LHA to set annual budgets for the anticipated scale of work and assign activities to long-term supply chain partners. Most LHAs have robust performance reporting for repeating activities, combined with comprehensive operational knowledge across established and consistent supply chains. These known properties will enable carbon profiles to accurately reflect delivered works.

## Life Cycle Assessments for Repeating Activities

Each carbon profile should identify the scale of emissions for each Life Cycle Stage with which it aligns (PAS 2080 and EN 15978).

The typical life cycle stages relevant for repeating activities are highlighted in Figure 10.

## Carbon Profiles for One-Off Activities

One-off major schemes and capital works are single-instance carbon profiles. The creation of these profiles will follow the process described in *Creating & Managing Carbon Profiles*, above. However, carbon profiles for major schemes are likely to be significantly more complex, with potentially less well qualified and quantified data.

When working with one-off carbon profiles, there are a range of data sources that can be used for carbon profile creation and verification:

1. **Bills of materials.**
2. **Programme plans and work schedules.**
3. **Supply chain operative timesheets.**
4. **Invoices for fuel and electricity.**
5. **Landfill gate fees for waste disposal.**
6. **Transport manifests.**

In many cases, contracted partners (especially design partners) will be able to provide comprehensive carbon statements for one-off programmes. Where these are available, it is possible to check these statements against the emissions category and invoices to ensure that all necessary data is captured and recorded.

## Multi-Year Programmes

Where programmes span multiple years, it is important to identify phases that will be completed in the reporting year. Only emissions for the reporting year should be recorded on the carbon footprint statement.

## Life Cycle Assessments for One-Off Programmes

One-off programmes will typically align with different Life Cycles Assessments modules based on the phase of the project:

1. **Options analysis and case development.**
2. **Feasibility studies, investigations and site surveys.**
3. **Design.**
4. **Ground clearance and preparation.**
  - a. Including existing infrastructure decommissioning and materials recovery.
5. **Construction.**
6. **Commissioning.**
7. **Operations.**

To ensure PAS 2080 and EN 15978 compliance, it is important to identify the carbon emissions at each phase of the project. An option would be to create individual carbon profiles for each programme phase and life cycle stage.

The typical life cycle stages for one-off programmes are highlighted in Figure 10.

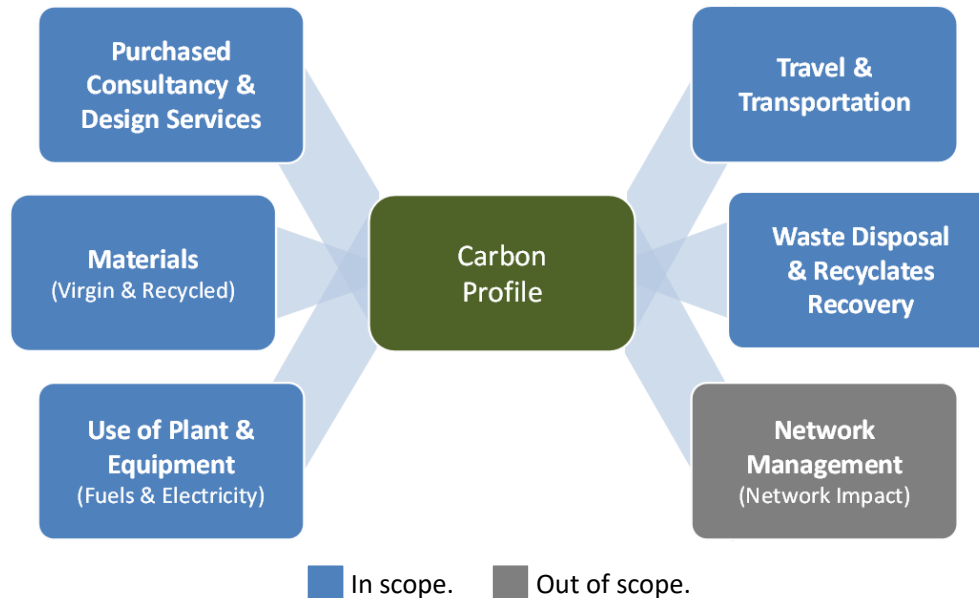
**Figure 10: Steps 6 & 7: Lifecycle Stage Assessment Alignment**

Life Cycle Stages	One-Off Activities (Major Schemes & Capital Works)																
	Product Stage				Construction Stage		Repeating Activities							End Of Life			
	A0	A1	A2	A3	A4	A5	Use Stage					Operations		C1	C2	C3	C4
Modules (EN15978 & PAS2080)	Studies & Consultations	Raw Materials Supply	Transport	Manufacturing	Transport	Construction	B1	B2	B3	B4	B5	B6	B7				
							Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	Demolition	Transport	Waste Processing	Disposal

## Creating & Managing Carbon Profiles

Carbon profiles are self-contained carbon statements for *units of work* for specific highways activities. Carbon profiles provide an efficient, modular, and granular framework for carbon analysis and reporting. Carbon profiles are activity specific (and often supply chain partner specific).

**Figure 11: Carbon Profile Components: Emissions Sources**



### Carbon Profile Creation Options

Carbon profiles for activities can be created “top-down” or “bottom-up”. Top-down carbon profiles are created by assigning resources from each of the inventories prepared in Steps 2 to 5. Profiles created bottom-up require operational analysis of each activity to identify the resources used.

For repeating activities, both top-down and bottom-up analyses assesses the costs and carbon emissions for a *unit of work*. These units can be of any scale, but will typically reflect the budgeting and works planning processes of the LHA:

- Per shift (or day),
- Per 500 m<sup>2</sup>,
- Per 100 m<sup>3</sup>,
- Per kilometre,
- Per instance,
- Per gang, per month,

Units of work usually align with specific activities and budget codes, for example:

- Inspections (Pavement)..... Per Shift
- Inspections (Trees & Vegetation) ..... Per Shift
- Grass cutting ..... Per Cut
- Reactive Maintenance (Pothole Repair) ..... Per Shift
- Reactive Maintenance (Street Lighting) ..... Per Shift
- Resurfacing ..... Per 500 m<sup>2</sup>
- Reconstruction..... Per 500 m<sup>2</sup>
- Winter Maintenance (Winter Treatments)..... Per km
- Gully Emptying ..... Per Shift
- Resurfacing (Carriageway) ..... Per 1,000 m<sup>2</sup>
- Resurfacing (Footway) ..... Per 1,000 m<sup>2</sup>
- Overlay Patching ..... Per 500 m<sup>2</sup>

- Slurry Seal ..... Per 500 m<sup>2</sup>
- Dragon Patching..... Per 500 m<sup>2</sup>
- Hand Lining ..... Per Shift
- Emergency Incident Response..... Per Instance
- Grips & Easements .....Per 500 m
- Kerbing .....Per 500 m
- Water Tabling & Siding..... Per km
- Reactive Maintenance (Tree Safety Works)..... Per Shift

For one-off activities (major schemes and capital programmes), the *unit of work* will typically be the *reporting year* and will include all the scheme emissions for the reporting period.

Each carbon profile provides a comprehensive analysis of the carbon emissions for each *unit of work*. Figure 11 shows an example for “Pothole Repair” using anonymised data from Devon County Council:

**Figure 12: Carbon Profile Example: Pothole Filling (Devon County Council)**

Profile Name	Category	Item Description	Quantity Or Value	Unit Of Measure	Data Source	Carbon Factor	Carbon Factor Units	Exclude From Activity Total	kgCO <sub>2</sub> e Per Shift	
<b>Pothole Repair</b>	Materials	<b>Asphalt</b>	1 tonnes		NH	54.227741	kgCO <sub>2</sub> e/tonne	No	54.22774149	
Profile Unit	Per Shift	Materials	<b>Bitumen Emulsion</b>	3.33 kg		NH	0.221666	kgCO <sub>2</sub> e/kg	No	0.73886667
Quantity Per Unit	20	Transport	<b>All Materials Transport</b>	278.95 km		BEIS	0.10112	kgCO <sub>2</sub> e/tonne.km	No	28.20772332
Longevity	3 Years	Plant	<b>Mini Compactor</b>	3.6 litres		BEIS	2.76468	kgCO <sub>2</sub> e/litre	No	9.952848
Provider	B&C Ltd	Travel	<b>3.5t Pickup</b>	120 km		BEIS	0.31972	kgCO <sub>2</sub> e/km	Yes	38.3664
		Transport	<b>Waste Transport</b>	1.29 tonne.km		BEIS	0.10112	kgCO <sub>2</sub> e/tonne.km	No	0.130189492
		Waste	<b>Materials Recycling</b>	0.04 tonnes		BEIS	0	kgCO <sub>2</sub> e/tonne	No	0
<b>Total kgCO<sub>2</sub>e Per Shift</b>									<b>131.62</b>	
Cost Per Shift In Reporting Year									£ 860	
Number Of Gangs									12	
Shifts Per Gang In Reporting Year									241	
<b>Reporting Year Totals</b>										
<b>Total Shifts</b>									<b>2892</b>	
<b>Total Cost</b>									<b>£ 2,487,120</b>	
<b>Total tCO<sub>2</sub>e</b>									<b>380.66</b>	

In this example, the *unit of work* (Profile Unit) is “Per Shift”, or “one gang, for one day”. This typically includes 20 pothole repairs. Each carbon category is considered by the LHA and the responsible delivery partner (in this case “TMR Ltd”). It is important to consider each emissions category to ensure all emissions have been included. The standard GHG emissions categories include:

**Table 8: GHG Emissions Categories (Highlighting Key Considerations)**

Category	Description
Combusted Fuels	Gas, liquid, and solid fuels.
Fugitive Emissions	From refrigeration and air conditioning.
Heating & Cooling	Supplied by external providers.
Electricity	Purchased electricity from external providers.
Services	Purchased services (supplier scope 1 and 2 emissions).
Materials	Construction and maintenance materials.
Plant	Plant and equipment using combusted fuels.
Travel	Business travel and commuting.
Transportation	Materials, plant, and waste transportation.
Waste	Waste treatments and disposal.
Traffic Flow Impact	Traffic impact (delays and detours).
Sold Goods & Services	Goods and services sold to third parties.
Investments	Emissions from investments.
Leases & Franchises	Emissions from leases and franchises.
End of Life	Materials recycling and reuse.
Other	Unclassified scope 3 emission type.

For each included *category* on the carbon profile, the following details are required:

1. **An Item Description of each emission source.**
2. **A Quantity or Value specifying the amount used of the item for the unit of work.**
  - a. In this example, the quantity is “Per Shift”.
3. **The Unit Of Measure for the stated quantity.**
4. **The Data Source used to lookup the selected carbon factor. Data sources can include:**
  - a. The Department for Energy Security and Net Zero (previously the Department for Business, Energy & Industrial Strategy) carbon conversion factors,
  - b. The National Highways Carbon Library (Highways Construction Materials),
  - c. The Carbon and Energy (ICE) database, or,
  - d. Environmental Product Declarations (EPDs) (noting the certificate number).
5. **The appropriate Carbon Factor from the selected Data Source.**
  - a. Ensuring the Carbon Factor Units align with the Unit of Measure for each item.

The total kgCO<sub>2</sub>e emissions for each item is calculated by multiplying *Carbon Factor* by the *Quantity or Value*.

### Collaborative Carbon Profile Development & Maintenance

Carbon profiles should be developed with the supply partner(s) responsible for delivering each activity. Supply chain partners will be able to provide the specific details required:

1. **Materials choices, quantities or volumes, and specifications.**
  - a. Including the specific carbon details for EPD certificated products.
2. **Transportation and travel details.**
  - a. Ranges, batching and transport modes.
  - b. Operational vehicle types, fuel types, engine sizes, and fuel consumption.
3. **Plant details.**
  - a. Plant used, fuel types, and fuel consumption.
4. **Number of assigned staff and operatives.**
  - a. Number of staff assigned for each unit of work.
  - b. Travel distances per shift (commuting and work-related travel).
  - c. Personal vehicle types, fuel types, engine sizes, and fuel consumption.
5. **Waste and recycling details.**
  - a. The waste produced by each unit of work.
  - b. The types and volumes of any recyclates.

### Carbon Profile Calibration

Carbon profiles should be calibrated by comparing “actuals” with the details in each profile. For repeating activities, for example, by comparing the total purchases of materials with the aggregated totals in each carbon profile. Alternatively, using the total cost of an activity to assess the volume of units of work completed by a supply chain partner. This approach has additional benefits, as it can be used to assess operational performance and efficiency.

Periodic calibration should be undertaken for each carbon profile to ensure the details are properly maintained and reflect the actual work delivered (and emissions produced). This will provide a comprehensive carbon audit trail enabling confident analysis and carbon reduction planning.

### Purpose & Goals

The purpose of this step is to:

1. **Create carbon profiles for each selected activity.**
2. **Calculate the total emissions from each selected activity for the reporting period.**
3. **Calculate the total emissions for a specified unit of work for activity-level carbon benchmarking.**

## Process Step Lead & Process Delivery Team

This step will typically require the engagement of the following LHA and supply chain stakeholders:

- **Director with responsibility for Highways Services or the Highways Services Commissioner.**
- **Contract(s) management team.**
- **Supply chain partner(s) services delivery leaders.**
- **CCMRT.**
- **Heads of highways functions.**

This step should be led by the Director with responsibility for Highways Services or Highways Services Commissioner, supported by the CCMRT.

## Preparation

To complete this step, you will need:

- **The schedule of all highways functions and activities created in Step 1.**
  - Identify activities requiring more detailed analysis and / or benchmarking.
- **For each selected activity:**
  - Set the baseline *unit of work* (e.g., shift, 500m<sup>2</sup>, km) for each selected activity.
  - Identify the annual budget for each selected activity.
  - The number of units of work completed in the reporting year.

**For “top-down” resources assignment you will need:**

- **Completed services inventories (Steps 2 to 5).**
  - Where the resources will be allocated to carbon profiles “top-down”.

**For “bottom-up” resources analysis you will need:**

- **Resources usage data for each selected activity.**
  - Where the resources usage will be calculated “bottom-up”.

## Process (Top-Down Resources Assignment)

Use the following process to create “top-down” carbon profiles for the selected highways activities:

- 1. From the service inventories, for each selected activity (typically activities undertaken on the network), create a carbon profile.**
  - a. Identify and allocate items (or percentages of items) from each inventory to the selected activity.
- 2. Verify the categories included on each carbon profile with the assigned provider(s).**
  - a. Ensuring to adjust for seasonality, variable materials, budget fluctuations, and resources availability.
- 3. Calculate the *unit of work* carbon emissions and costs for the selected activity.**
  - a. Divide the assigned carbon emissions and the annual activity budget by the number of units of work completed in the reporting year.

## Process (Bottom-Up Resources Analysis)

Use the following process to create “top-down” carbon profiles for the selected highways activities:

- 1. Investigate and document the resources used for each *unit of work* for each selected activity.**
- 2. Verify the categories included on each carbon profile with the assigned provider(s).**
  - a. Ensuring to adjust for seasonality, variable materials, budget fluctuations, and resources availability.
- 3. Calculate the *estimated* carbon emissions and costs for the selected activity.**
  - a. Multiply the estimated unit of work carbon emissions and costs by the number of units of work completed in the reporting year.

## Completion Checklist

Check that Step 7 has been completed using this checklist:

- Carbon profiles for high-priority (high carbon) repeating activities have been created.**
  - Resources have been assigned either top-down (using the inventories) or bottom-up through an analysis of resources allocated to each unit of work.
  - These have been verified with the relevant supply chain partners.
- Carbon profiles for significant (high carbon) one-off activities have been created.**
  - Resources have been assigned either top-down (using the inventories) or bottom-up through an analysis of resources allocated to each unit of work.
  - These have been verified with the relevant supply chain partners (both design and delivery).
- Emissions calculations have been completed for each carbon profile.**

# Step 8: Carbon Reduction

## Carbon Initiatives Portfolio Management



## Overview

Carbon reduction initiatives can be identified from a number of options across Scope 1, 2 and 3 emissions, including but not limited to:

- Initiatives to reduce energy consumption at offices and depots
- Reducing energy consumption of street lighting
- Use of low energy materials
- Improved planning to reduce staff and supplier mileage
- Adoption of a low carbon asset management strategy

Developing a portfolio of these initiatives, and assessing the carbon reduction benefit of each, will enable the Local Highway Authority to assess whether it is on track to meet its carbon reduction targets. Some of these carbon reduction initiatives might be activities that can be implemented by the Local Highway Authority in isolation, depending on the extent to which services have been outsourced.

However, it is likely that realising all potential carbon reduction benefits will require the Local Highway Authority and its supply chain to work together collaboratively to create, agree, and implement a carbon reduction action plan, comprising a timetable of specific activities. ‘Constructing the Gold Standard’ (Professor David Mosey, Centre of Construction Law, Kings College London, 2021), the Cabinet Office commissioned independent review of public sector frameworks, provides recommendations and guidance on how such action plans can be developed, either through existing contractual arrangements, or when procuring new framework contracts.”

## Carbon Reduction Options Assessment Scorecard

To enable the prioritisation of carbon reductions, scorecards can be used to provide a quantitative and qualitative assessment of each option. Scorecards provide a consistent, repeatable, and transparent approach to options analysis and a comprehensive audit trail for stakeholders.

A typical scorecard would assess factors in two dimensions: *attractiveness* and *achievability*:

### Option Attractiveness Analysis

#### 1. Strategic Alignment & Contribution

- a. With the local authority strategic goals.
- b. With the current service strategic goals.
- c. With national and local strategies and targets, and political priorities.
- d. With industrial strategies and capabilities.
- e. With citizen demands and expectations.

#### 2. Weighted Benefits & Dis-Benefits Analysis

- a. Including (as standard HM Treasury benefits classes):
  - i. *Future carbon reductions,*
  - ii. *Cashable financial benefits (operational),*
  - iii. *Revenue generating benefits,*
  - iv. *Services performance benefits (VfM),*
  - v. *Assets performance benefits,*
  - vi. *Social benefits,*
  - vii. *National and local economy benefits,*
  - viii. *Other ecology, biodiversity, and environmental benefits<sup>33</sup>.*
  - ix. *Knowledge and learning benefits.*
  - x. *Reputational benefits.*
- b. Benefits measurement and calibration (for each specified benefit).
  - i. *Scale, scope, longevity, measurement method(s), and confidence.*

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<sup>33</sup> Including air quality.

3. **Wider Sector Benefits**
  - a. Wider LHA applications and scaled benefits.
  - b. Provider applications and scaled benefits.
  - c. Adjacent sector applications scaled benefits.
4. **Constraints Analysis**
  - a. Costs, timescales, and resources requirements.
  - b. Resources management and reporting.
  - c. Grants and / or additional funding.
5. **Scalability & Flexibility**
  - a. Opportunities for reducing costs, consolidating activities, expanding the scope and scale of option based on early findings.
6. **Consistency & Coherence**
  - a. With the other LHA programmes.
  - b. With LHA policies and political priorities.
  - c. With market trends and technology developments.
7. **Providers & Partners**
  - a. Willingness and availability.
  - b. Technical readiness.
8. **Stakeholder Support & Sponsorship**
  - a. Political stakeholders (national and local)
  - b. Communities, citizens, and asset(s) users.
  - c. Businesses.

## Achievability & Sustainability

1. **Complexity Assessment (Inherent Risk)**
  - a. Scale, novelty, diversity, interdependencies, and volatility.
  - b. Cost of risk (anticipated and emergent).
2. **Affordability**
  - a. Design, development, and delivery costs relative to the programme benefits.
  - b. Future costs of ownership.
  - c. Future costs of decommissioning.
3. **Resources Competence & Capacity**
  - a. Internal and our partners.
4. **Stakeholders' Clarity & Perception**
  - a. Project and programme levels.
  - b. Partners, public, members, other agencies.
5. **Governance & Accountability**
  - b. Governance structure.
  - c. Programme structure and programme coordination.
  - a. Evaluation and monitoring framework.
  - b. Reporting methods, tools, and timeline.
6. **Alternatives Appraisals**
  - a. Alternatives case assessment framework.
    - i. Assessment of "planned" case.
    - ii. Assessment of "do nothing" case.
    - iii. Assessment of "do minimum" case.
    - iv. Assessment of "incremental change" case.
  - b. Design of the optimum / blended approach.

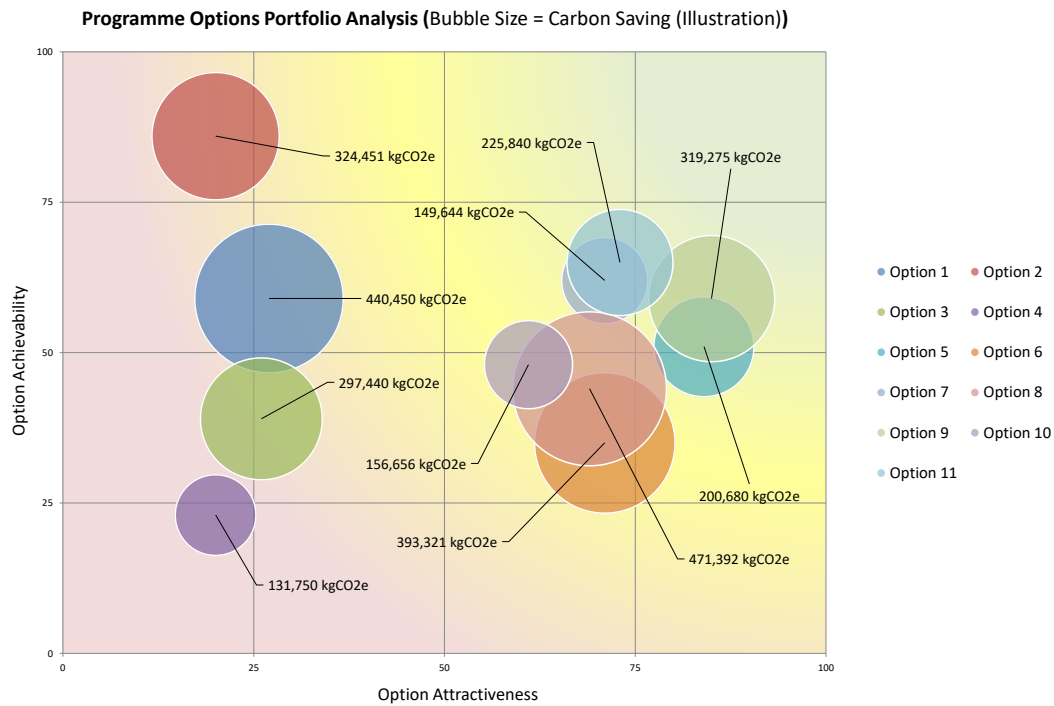
Each scorecard factor will typically include the following weighting and scoring columns:

- **Factor weighting.**
  - Ranging from *not considered* (0) to *very important* (100).
- **Factor score.**
  - Ranging from *poor* (0) to *excellent* (100).
- **Score confidence.**
  - Ranging from *low* (0) to *high* (100).

- **Opportunity to improve.**
  - Ranging from *none* (0) to *significant* (100).
- **A value.**
  - A quantity and unit of measure.

These scorecards will include options charting and reporting, as illustrated in Figure 13.

**Figure 13: Options Portfolio Chart (Example)**



An Excel workbook for options assessment is available from the FHRG.

# Appendices

- Appendix A: References
- Appendix B: Terms & Definitions
- Appendix C: Abbreviations
- Appendix D: Standard Highways Functions & Activities
- Appendix E: Included & Excluded GHG Categories (ISO 14064-1)

## Appendix A: References

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## Appendix B: Terms and Definitions

This document contains the following terms and definitions:

**Baseline year:** a baseline year is a reference point in time against which emission reductions in the future are measured.

**Boundary:** an individual or household; an organisation, event, or product; a city, region, or country.

**Carbon dioxide equivalent (CO<sub>2</sub>e):** the universal unit of measurement used to indicate the global warming potential of greenhouse gases expressed in terms of the 100-year global warming potential of one metric tonne of carbon dioxide. (Note: The carbon dioxide equivalent is calculated using the mass of a given greenhouse gas multiplied by its global warming potential) (PAS 2060).

**Carbon footprint:** absolute sum of all emissions and removals of greenhouse gases caused directly and indirectly by a subject either over a defined period or in relation to a specified unit of product or instance of service and calculated in accordance with a recognised methodology (PAS 2060).

**Carbon reduction:** process of minimising GHG emissions in the development of new infrastructure assets and programmes of work or the refurbishment of existing assets. The outcome of a carbon reduction process would be a quantified reduction in existing sources of GHG emissions, or the avoidance of GHG emissions associated with new or existing infrastructure (PAS 2080).

**Control:** The ability of a company to direct the policies of another organisation and / or operation. More specifically, it is defined as either operational control (the organisation or one of its subsidiaries has the full authority to introduce and implement its operating policies at the operation) or financial control (the organisation has the ability to direct the financial and operating policies of the operation with a view to gaining economic benefits from its activities).

**Controlled sources:** sources of emissions which are under the control of the reporting company.

**Direct emissions:** Emissions from sources that are owned or controlled by the reporting company.

**Fugitive emissions:** Emissions of gases due to leaks or other unintended irregular releases.

**Greenhouse gases (GHGs):** gases listed in the Kyoto Protocol: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF<sub>6</sub>) and nitrogen trifluoride (NF<sub>3</sub>). Note: The range of included gases will be updated should the list of GHGs identified by UNFCCC/Kyoto Protocol, be modified in the future (PAS 2060).

**GHG emissions:** release to air and discharges to water and land that result in GHGs entering the atmosphere (PAS 2050).

**Indirect emissions:** Emissions that are a consequence of the operations of the reporting company, but occur at sources owned or controlled by another company. This includes scope 2 and scope 3.

**Mobile combustion:** combustion of fuels in transportation devices such as automobiles, trucks, buses, trains, airplanes, boats, ships, barges, vessels, etc.

**Owned sources:** sources of emissions which are owned by the reporting company.

**Power Purchase Agreement (PPA):** A contract between a renewable energy generator (e.g., a wind farm) and an energy buyer or 'end-user'.

**Projects:** Mobile primary and secondary/outsourced activities i.e., drainage, pavements, service activity.

**Process emissions:** Emissions from chemical transformation of raw material and fugitive emissions.

**Renewable tariffs:** Renewable options are backed by REGOs (Renewable Energy Guarantees of Origins) and/or GoOs (Guarantee of Origin). The REGO scheme is administered by Ofgem and is used to provide transparency to consumers about the proportion of electricity that suppliers source from renewable generation in the UK.

**Scope 1 emissions:** greenhouse gas emissions from sources that are owned or controlled by the entity (described as direct emissions) (PAS 2060).

**Scope 2 emissions:** greenhouse gas emissions from the generation of energy utilised in direct connection to the activities of a particular entity/subject but occurring at sources owned or controlled by another entity i.e., indirect emissions (PAS 2060).

**Scope 3 emissions:** greenhouse gas emissions that are a consequence of the activities of an entity/subject but occur at sources owned or controlled by another entity (i.e., indirect) and which are not classified as scope 2 emissions (PAS 2060).

**Stationary combustion:** combustion of fuels in stationary equipment such as boilers, furnaces, burners, turbines, heaters, incinerators, engines, flares, etc.

**Top Management:** person or group of people who directs and controls an organisation at the highest level.

**Value chain members:** organisations and stakeholders involved in creating and managing infrastructure assets. These include asset owners/managers, designers, constructors, and product/material suppliers.

**Verification:** The act or process of verifying, often undertaken by an independent person/organisation.

**Whole service:** includes in house (primary activities) scope 1 and 2 emissions plus scope 1 and 2 emissions associated with secondary/outsourced activities (third party provider).



## Appendix C: Abbreviations

<b>ADEPT</b>	Association of Directors of Environment, Economy, Planning and Transport
<b>asPECT</b>	Asphalt Pavement Embodied Carbon Tool
<b>CH<sub>4</sub></b>	Methane
<b>CO<sub>2</sub></b>	Carbon Dioxide
<b>CO<sub>2</sub>e</b>	Carbon Dioxide Equivalent
<b>COP</b>	Conference of Parties
<b>DECC</b>	Department of Energy & Climate Change
<b>IEMA</b>	Institute of Environmental Management and Assessment
<b>EV</b>	Electric Vehicles
<b>FHRG</b>	Future Highways Research Group
<b>FTE</b>	Full Time Employee
<b>GoOs</b>	Guarantee of Origin
<b>GHG</b>	Greenhouse Gas
<b>GWP</b>	Global Warming Potential
<b>HGV</b>	Heavy Goods Vehicles
<b>HFC s</b>	Hydrofluorocarbons
<b>IEMA</b>	Institute of Environmental Management and Assessment
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>ISO</b>	International Organization for Standardization
<b>km</b>	Kilometre
<b>KPI</b>	Key Performance Indicator
<b>kWh</b>	Kilowatt-hour
<b>LEC</b>	Levy Exemption Certificate
<b>LGA</b>	Local Government Association
<b>LHA</b>	Local Highways Authority
<b>LPG</b>	Liquid petroleum gas
<b>MWh</b>	Megawatt-hour
<b>N<sub>2</sub>O</b>	Nitrous Oxide
<b>NF<sub>3</sub></b>	Nitrogen trifluoride
<b>PFCs</b>	Perfluorocarbons
<b>PPA</b>	Power Purchase Agreement
<b>RACI</b>	Responsible, Accountable, Consulted, and Informed
<b>REC</b>	Renewable Energy Certificates
<b>REGO</b>	Renewable Energy Guarantees of Origin
<b>ROC</b>	Renewables Obligation Certificate
<b>SF<sub>6</sub></b>	Sulphur Hexafluoride
<b>T</b>	Metric tonne
<b>VIN</b>	Vehicle Identification Number
<b>VPE</b>	Vehicles, Plant & Equipment

## Appendix D: Standard Highways Functions & Activities

	Emissions Scopes			Activity Locus		Responsible Parties (Carbon Reporting)
	In-House		Supply Chain	Conducted In Offices Or Depots	Conducted On The Network	
	Scope 1	Scope 2	Scope 3			
<b>LHA Functions &amp; Activities</b>						
<b>Services Planning &amp; Management</b>						
Asset Policy & Asset Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✗	
Budget Setting, Allocation & Audit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✗	
Procurements & Contracts Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✗	
Political & Executive Engagement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✗	
Community Engagement & Communications	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✗	
<b>Safety, Risk &amp; Care Inspections</b>						
Condition Assessments	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✗	✓	
Safety & Risk Inspections	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✗	✓	
Care Inspections (Cyclical)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✗	✓	
<b>Programme Management Office</b>						
Technical & Design Services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✗	
Programme Management & Quality Assurance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✗	
<b>Planned Maintenance (Minor Schemes)</b>						
Preventative Maintenance Delivery	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✗	✓	
Minor Schemes Construction & Supervision	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✗	✓	
Planned Schemes Quality Assurance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✗	✓	
<b>Major Schemes &amp; Capital Programmes</b>						
Major Schemes Construction & Supervision	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✗	✓	
Major Schemes Quality Assurance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✗	✓	
<b>Reactive Maintenance</b>						
Works Scheduling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✗	
Reactive Maintenance Teams	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✗	✓	
<b>Network Management</b>						
Permitting & Streetworks Coordination	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✓	
Reinstatements & Works Quality Assurance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✓	
Highways Data Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✗	
<b>Signals &amp; Traffic Control</b>						
Traffic Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✗	
Temporary Traffic Regulation Orders	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✗	
Civil Parking Enforcement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✗	✓	
<b>Cyclical Maintenance (Excluding Drainage)</b>						
Weed Treatments	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✗	✓	
Grass Cutting, Verge & Hedge Maintenance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✗	✓	
Tree Cutting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✗	✓	
Streetscene Improvements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✗	✓	
<b>Drainage &amp; Flood Risk Management</b>						



Flood Risk Authority (Planning & Management)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✘	
Condition Inspections & Risk Assessments	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✘	✓	
Gully Cleansing & Repairs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✘	✓	
<b>Materials Handling &amp; Storage</b>						
Winter Treatments	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✘	
Construction Materials Management & Storage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✘	
Waste & Recycled Materials Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✘	
<b>Fleet, Plant &amp; Equipment</b>						
Fleet Management & Fleet Maintenance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✘	
Plant & Equipment Management & Maintenance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✘	
<b>Network Resilience</b>						
Winter Maintenance Services & Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✓	
Adverse Weather Services & Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✓	
<b>Signs &amp; Lines (Non-Electrical Assets)</b>						
Signs Cleaning, Repair & Replacement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✘	✓	
Lines & Markings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✘	✓	
<b>Electrical Assets &amp; Intelligent Transport Systems</b>						
Street Lighting (Planning & Energy Management)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✘	
Signals & Electrical Assets Maintenance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✓	
Intelligent Transport Systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✘	
<b>Structures Maintenance</b>						
Vehicle & Pedestrian Restraints	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✓	
Bridges, Footbridges & Gantries	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✓	
Geotechnical Assets & Retaining Walls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✓	
<b>Footways &amp; Public Rights of Way</b>						
Condition Assessments	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✘	✓	
Footways & PROW Maintenance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✘	✓	
<b>Traffic &amp; Safety</b>						
Road Safety Advisory Services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✘	
Road Safety Partnerships Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✘	
School Crossing Patrols	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✘	✓	
<b>Sustainable Development</b>						
Road Adoptions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✘	
Highways Development Control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✘	
Materials Recycling / Reuse	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✘	
Waste Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✘	
Ecology & Biodiversity Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✘	
<b>Laboratory Services</b>						
Site Investigations & Surveys	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✘	✓	
Reinstatement QA Assessments	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✘	✓	
Materials Testing & Standards Setting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✘	

Commercial Services						
Developer Services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✘	
Consultancy Services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	✘	
Construction Services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	<del>✘</del>	
Shared Services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	<del>✘</del>	

## Appendix E: Included & Excluded GHG Categories (ISO 14064-1)

No	Category EN 14064-1	Include / Exclude	Notes on Inclusion or Exclusion
<b>Scope 1</b>			
1	Direct emissions from stationary combustion	Include	Combustion of fuels, likely in this case to be for space heating of buildings occupied by the LHA. The function of these buildings is likely to be for staff involved in management, administration and design, depending on the organisational structure. In some cases, staff may occupy only a portion(s) of buildings.
2	Direct emissions from mobile combustion	Include	Combustion of fuels from mobile sources which includes vehicles and plant/equipment owned by the LHA.
3	Direct process related emissions	Exclude	Examples include waste treatment, livestock, fertiliser use etc., these are not directly relevant to the sector.
4	Direct fugitive emissions	Include	Fugitive GHG emissions include leaks from equipment and storage and transport systems, and leaks from reservoirs and injection wells. This is likely to be very small if at all present in most instances (e.g., in cooled office buildings). Refrigerated delivery vehicles are not relevant in this sector, and leakage from cooling systems in personal vehicles is likely to be minimal and hard to measure.
5	Direct emissions and removals from Land Use, Land Use Change and Forestry (LULUCF)	Exclude	Examples include soils, forests, grasslands, and lakes. This is not likely to be relevant in most instances, other than potentially where there is a significant change in land use, and so is excluded from general sector guidance.
<b>Scope 2</b>			
6	Indirect emissions from imported electricity consumed	Include	Emissions resulting from the generation of imported electricity. As with item 1, this is likely to be from buildings occupied by the LHA. It can also include electricity used by mobile sources (vehicles and plant/equipment) where the source is owned by the reporting organisation.
7	Indirect emissions from consumed energy imported through a physical network	Exclude	Emissions resulting from the generation of imported steam, heating, cooling, compressed air. This is not relevant for any onsite based construction work, and for permanent premises (e.g. offices) is very unlikely to be relevant, and so is excluded. If there are specific instances for LHAs where a building is part of a district heating network then this exclusion should be overridden.
<b>Scope 3</b>			
8	Energy-related activities not included in direct emissions and energy indirect emissions	Include	This category is for the inclusion of emissions associated with the extraction, production, and transport (leaks included) of fuels that are consumed by the LHA (upstream emissions linked to categories 1 and 2) and the extraction, production, and transport (leaks included) of fuels in the generation of electricity, steam, heating cooling and compressed air imported by the reporting organisation (upstream emissions linked to categories 6 and 7). These emissions are often referred to as Well to Tank (WTT). The standards also state that these emissions are also relevant for other Scope 3 categories (for example where fuel is being directly combusted in vehicles). In practice, this category uplifts emissions from all categories where energy/fuel is being used.

9	Purchased products	Include	This category includes extraction and production of inputs (i.e., purchased or acquired goods, services, materials) outsourced activities, including contract manufacturing, data centres, outsourced services, etc. associated with direct (tier 1) suppliers and includes the disposal/treatment of waste generated in the production of inputs (i.e. purchased or acquired goods, services, materials or fuels). In practice for the sector, this is taken to be all the materials and finished products required for the delivery of the road construction and maintenance service.
10	Capital equipment	Exclude	This could potentially include manufacturing/construction of capital equipment owned or controlled by the reporting organisation. In the case of the LA this could include vehicles or plant items, or even buildings. When considering work programmes by a LHA, this could also be extended to the vehicles and plant of the supply chain. This information is likely to be very difficult to obtain, as it would rely on knowledge of the materials product emissions of the equipment and the proportion of the expected lifetime used on a job. This is made harder by the very specialist and wide-ranging list of equipment used in the sector. A quick high-level estimate for a road resurfacing job estimated that emissions from this category were around 3% of the job total for plant items, whilst a similar calculation for material delivery in an HGV indicated that materials product stage emissions were about 4% of the emissions resulting from combusting diesel in the vehicle engine, and that in general the delivery of materials on a job is a comparatively minor element. Therefore, this category has been excluded, though there may be some value in creating standard emission factors for materials product stage carbon for typical plant and vehicles e.g., kgCO <sub>2</sub> e/hour or kgCO <sub>2</sub> e/tonne.km.
11	Waste generated from organisational activities	Include	This category includes the disposal/treatment and onward transport of waste generated in operations.
12	Upstream transport and distribution	Include	This category includes the transport and distribution of inputs (i.e., purchased or acquired goods, services, materials or fuels), including intermediate (inter-facility) transport and distribution, warehousing and storage, associated with direct suppliers. In practice for the sector this is taken to be from the source of extraction to site for bulk materials (e.g. aggregate), and from the point of manufacture ("factory gate") to site for finished goods (e.g. streetlamps). Emissions from warehousing and storage are excluded here as it would not be practicable to meaningfully calculate and is expected to be very small.
13	Business travel	Include	This category includes business travel undertaken by employees. It has been expanded here to include any travel in any vehicle not owned by the reporting organisation (e.g., grey fleet, hire cars, other modes) for business purposes by any employees of the organisation, or those directly involved in delivering projects in the supply chain.
14	Upstream leased assets	Include	This section includes the manufacturing/construction and operation of leased assets not included in Scope 1 or 2 categories. As discussed, emissions from Capital Goods emissions have been excluded here, so this category includes the use of fuel or electricity in assets leased by the organisation and expanded here to include assets operated by the supply chain, e.g. the buildings they occupy, and the plant and equipment they operate.
15	Investments	Exclude	GHG emissions associated with investments, including fixed asset investments and equity investments not included in organisational boundaries. If these are included by a reporting organisation, they are likely to be done so for the organisation as a whole and so this section was excluded from the sector guidance.

16	Client and visitor transport	Exclude	This category is present in ISO 14064-1 but not explicitly in the GHG Protocol. It is not likely to be relevant to this sector and so is excluded from the guidance. Emissions from relevant transport activities are captured in other categories.
17	Downstream transport and distribution	Exclude	Transport and distribution of sold products, including warehousing and retail. This is not relevant for the sector and so has been excluded.
18	Usage of the product	Exclude	This section includes the use of the product. In this case, the product is the road/road network. The use of the road by vehicles (i.e., traffic) is excluded from this guidance. New roads are required to account for this using the WebTAG methodology. This usage of roads also includes potential maintenance. The nature of this maintenance will require the use of materials, transport, equipment, and people, as are already included across the other categories discussed. Therefore, this section has been taken to be excluded, though 'maintenance' of the road network is already captured. Projections of future emissions from maintenance can be considered and calculated as part of life cycle assessment to inform decision-making. Forecast emissions from maintenance should not be reported in the current footprint year.
19	End of life of the product	Exclude	Disposal of products at the end of life. In this case, the product is the road. Roads do not typically have ends of life unlike other assets (e.g., buildings, vehicles). As such this is taken to be excluded. The waste generated during any construction or demolition works is taken to be already captured in category 11 (waste generated from organisational activities). As with category 18 (usage of product), the forecast end of life emissions associated with any demolition can be calculated to inform decision making but should not be reported in the current footprint year.
20	Downstream franchises	Exclude	Emissions from all franchisees (to be reported by the franchisor). This is taken as not being relevant to the sector, although the activities of any party involved in the delivery of the programme of works should be captured across the other included sections.
21	Downstream leased assets	Include	This section includes downstream emissions from assets leased by the reporting organisation, for example energy used by buildings or vehicles/equipment leased to the supply chain for delivery of the work programme.
22	Employee commuting	Include	This section covers employees commuting to and from work, as well as emissions from homes associated with any employee homeworking. This section has been expanded to include the commuting and homeworking of any staff directly involved in the delivery of the work programme for the reporting organisation.
23	Other indirect emissions not included in the other 22 categories	Exclude	There are no additional categories, and so this section has been excluded.