

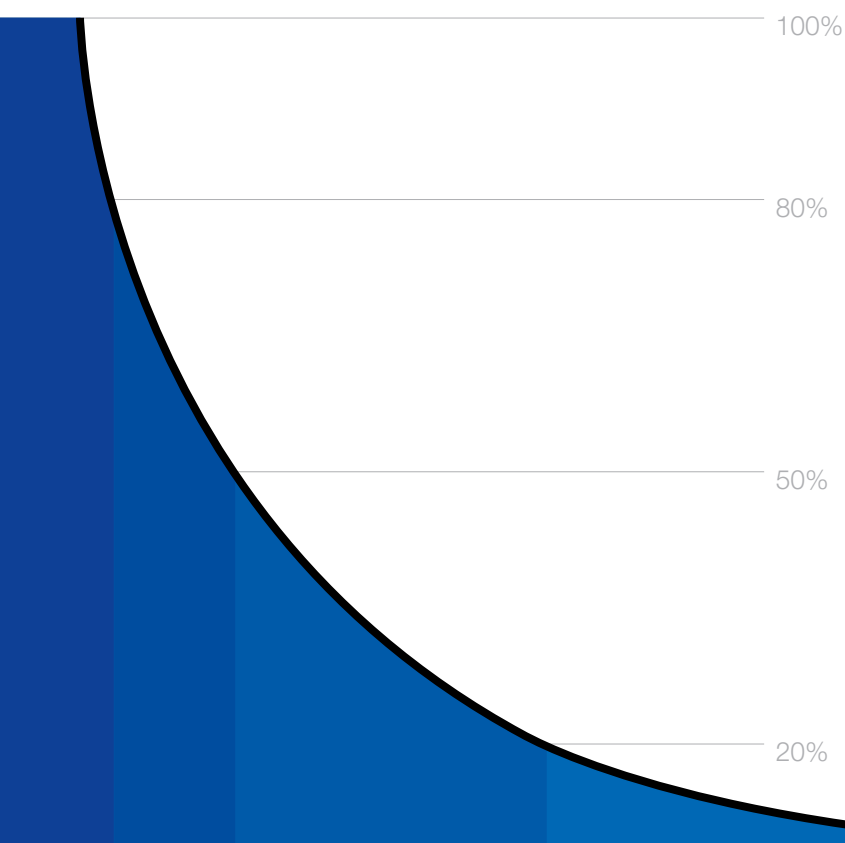
PAS 2080:2016

Carbon Management in Infrastructure



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ISBN 978 0 580 90155 3

ICS 13.020.01

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Publication history

4th May 2016

Carbon management in infrastructure – Be part of it with PAS 2080

Reduce carbon, reduce cost and stay on top of it!



Construction
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The **Green Construction Board**

with the generous support of the following organisations:



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Foreword

This Publicly Available Specification (PAS) was commissioned by the Green Construction Board (GCB). Its development was facilitated by BSI Standards Limited. It is published under licence from The British Standards Institution and came into effect on 4 May 2016.

This PAS was developed from a preliminary draft prepared by a Technical Authoring Team from Mott Macdonald and Arup, who have continued to support the development of the specification as members of the Steering Group.

Particular thanks are extended to the Carbon Trust for their pre-review contribution to the draft PAS and acknowledgement is also given to the following organizations that were involved in the development of this PAS as members of the Steering Group:

- Anglian Water Services Limited
- Arup Group Limited
- Balfour Beatty plc
- BRE Group
- Cambridge University
- CEMEX UK
- Clancy Group
- Construction Products Association
- Costain Group plc
- Department for Business, Innovation and Skills (BIS)
- HM Treasury
- High Speed Two (HS2) Limited
- J.N. Bentley Limited
- London Underground
- Mott McDonald
- MWH Global
- National Grid
- Responsible-Solutions
- SKANSKA UK plc
- Tata Steel
- Transport for London

Comments from other parties were also sought by BSI. The expert contributions from all the organizations and individuals consulted in the development this PAS, are gratefully acknowledged.

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The PAS process enables a specification to be rapidly developed in order to fulfil an immediate need in industry. A PAS may be considered for further development as a British Standard, or constitute part of the UK input into the development of a European or International Standard.

This PAS is not to be regarded as a British Standard. It will be withdrawn upon publication of its content in, or as, a British Standard.

Use of this document

Presentational conventions

The provisions of this PAS are presented in roman (i.e. upright) type. Its methods are expressed as a set of instructions, a description, or in sentences in which the principal auxiliary verb is “shall”.

The blue bordered boxes in clauses 5 through to 10, each provides a short summary of the intention for its relevant clause but does not include specific requirements.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a PAS cannot confer immunity from legal obligations.

Executive Summary

Working together, infrastructure organizations have the power to use PAS 2080 to transform the benefits that a national economy gains from its infrastructure systems and to provide a sustainable legacy. If all parties involved across the value chain work collaboratively, towards a common goal to reduce carbon, the following outcomes can be achieved:

- Reduced carbon, reduced cost infrastructure;
- More collaborative ways of working will promote innovation, delivering benefit to society and communities served by economic infrastructure;
- Effective carbon management in infrastructure will make an important contribution to tackling climate change and leave a positive legacy for future generations;
- Delivering more sustainable solutions, at lower cost, will enhance the reputation of the infrastructure industry, generating pride for those who work in it and attracting new people and skills;

The challenges set out in PAS 2080 will create a platform for innovation to thrive, leading to more vibrant and rewarding workplaces.

The Infrastructure Carbon Review recognized the opportunity and PAS 2080 will help the infrastructure value chain turn this into reality.

Targeted at leaders and practitioner-level individuals in different value chain organizations (asset owners/managers, designers, constructors and product/material suppliers) responsible for delivering infrastructure, PAS 2080 provides a common framework for all infrastructure sectors and value chain members, on how to manage whole life carbon when delivering infrastructure assets and programmes of work. Use of the PAS will promote reduced carbon, reduced cost infrastructure delivery, more collaborative ways of working and a culture of challenge in the infrastructure value chain through which innovation can be fostered.

- This PAS includes requirements for all value chain members to show the right leadership and to establish effective governance systems for reducing whole life carbon through the use of a carbon management process. The individual value chain requirements in the carbon management process are structured around the following components:
 - setting appropriate carbon reduction targets;
 - determining baselines against which to assess carbon reduction performance;
 - establishing metrics (e.g. Key Performance Indicators) for credible carbon emissions quantification and reporting;
 - selecting carbon emissions quantification methodologies (to include defining boundaries and cut off rules);
 - reporting at appropriate stages in the infrastructure work stages to enable visibility of performance; and
 - continual improvement of carbon management and performance.

All value chain members can claim conformity to PAS 2080 by demonstrating that relevant requirements set out in the different PAS clauses have been met. This will illustrate that the right organizational capability, for working collaboratively under a carbon management process to deliver low carbon assets and programmes of work, is actively in place.

The PAS is supplemented by the "Guidance Document for PAS2080" which provides practical advice on how to implement the different PAS requirements and addresses current good practice through worked examples and case studies.

0 Introduction

0.1 Infrastructure and greenhouse gas emissions

The Infrastructure Carbon Review (ICR)¹ showed that infrastructure is associated with over half of UK Greenhouse Gas (GHG) emissions:

- 30% of which are directly attributed to the construction, operation and maintenance of infrastructure assets (emissions that infrastructure directly controls); and
- 70% of which are attributed to the users of infrastructure (emissions over which infrastructure has influence)

Figure 1 illustrates the importance of infrastructure in relation to the overall challenge of reducing national carbon emissions targets.

Reducing carbon emissions associated with infrastructure is fundamental to addressing the global challenge of climate change.

PAS 2080 is applicable to anyone involved in the delivery of infrastructure, including asset owners/managers, designers, constructors and product/material suppliers.

Complying with the requirements of PAS 2080 will help all value chain members understand and manage carbon associated with the development of infrastructure from its inception to the end of its life and is equally applicable to individual assets or to programmes.

In this regard PAS 2080 is a specification for whole life carbon management and is not a detailed quantification protocol. As such it avoids the duplication of existing quantification protocols.

NOTE 1 The word 'carbon' used in this document is used as shorthand for GHG emissions as defined in Clause 3.18.

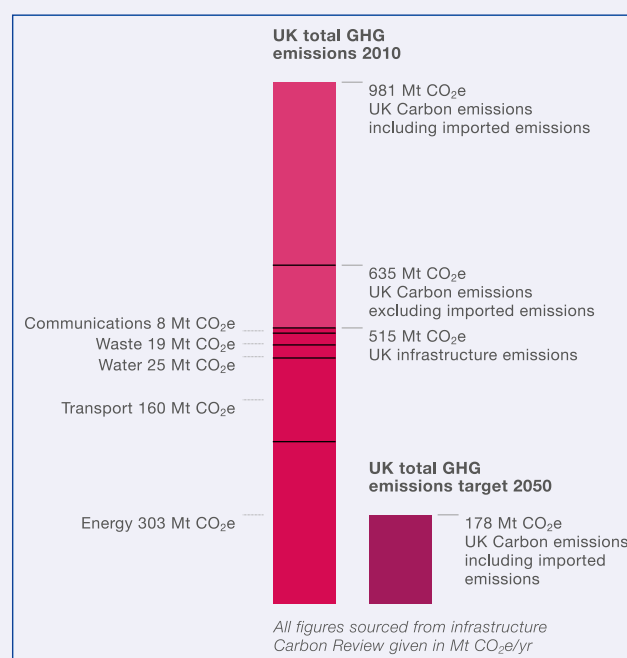
NOTE 2 Figure 1 GHG emissions outside the UK infrastructure sector include: transport related emissions from imported products; emissions from agriculture, land use change and industrial process emissions outside infrastructure. Readers should refer to the Infrastructure Carbon Review Technical Report for details of the GHG emissions attributed to the different infrastructure sectors.

PAS 2080 should be read in conjunction with the "Guidance Document for using PAS 2080"² which is designed to help practitioners implement the requirements of the PAS with the aid of real case studies and worked examples.

0.2 Whole life carbon and cost reduction

PAS 2080 sets out the general principles and components of a carbon management process, to promote carbon and cost reduction in infrastructure delivery on a whole life basis. The individual clauses of the PAS are arranged in accordance with the components illustrated in **Figure 2**.

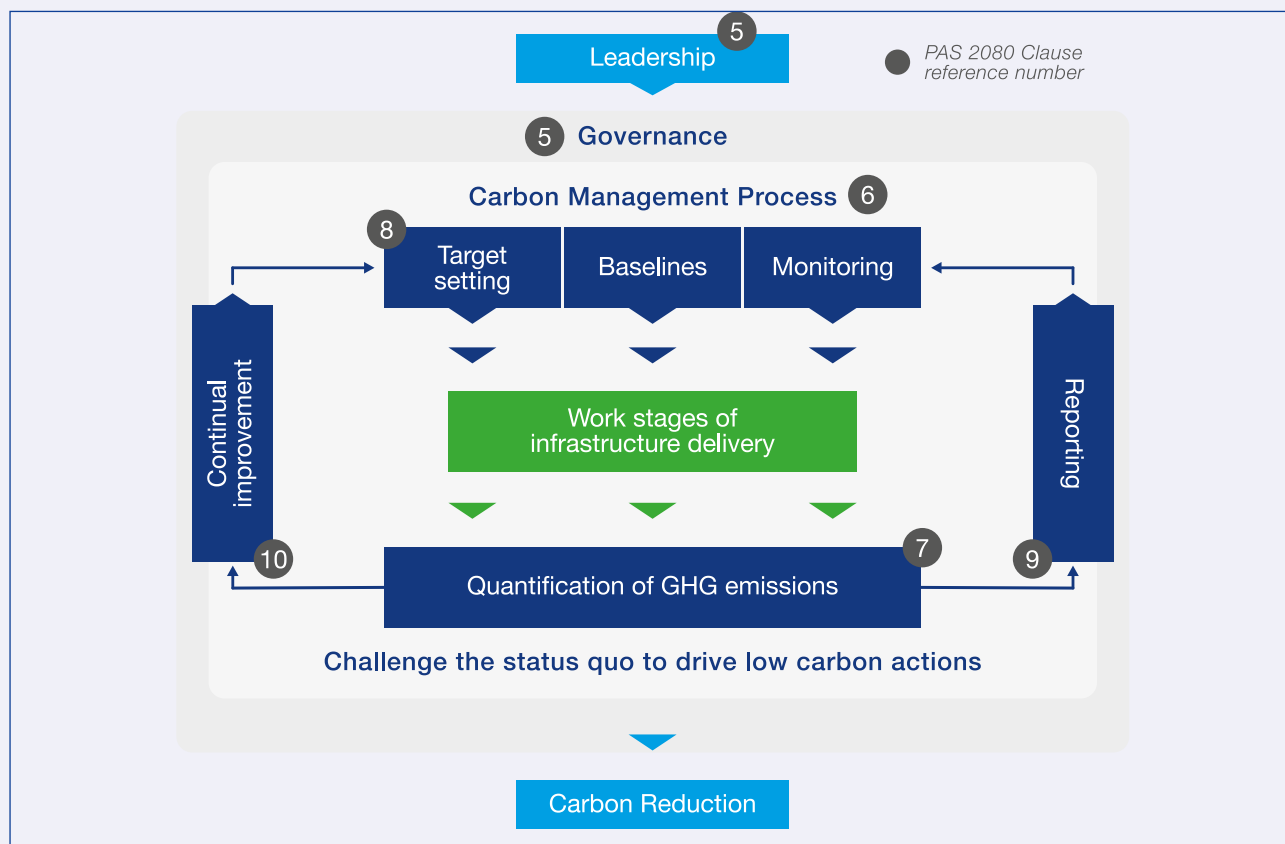
Figure 1 – Infrastructure is responsible for over half of the UK's consumption GHG emissions



¹ 2013 by HM Treasury, BIS and the Green Construction Board

² Published by the Green Construction Board, see www.greenconstructionboard.org.

Figure 2 – Process map summarising the key components of the PAS 2080 carbon management process and their respective clause numbers in this document



NOTE to Figure 2: Clauses 1 to 4 are excluded from Figure 2 as they do not set out any requirements which directly relate to the carbon management process.

Achieving carbon reductions in infrastructure depends on robust leadership and governance and the integration of the key carbon management process components (i.e. baseline and target setting, monitoring, quantification, reporting and continuous improvement) into existing infrastructure delivery processes. Developing and implementing a carbon management process within infrastructure delivery processes will help join up the value chain, create a strong innovation culture, challenge the current status quo and thereby maximise reductions in both carbon and cost.

0.3 The aim of PAS 2080

The aim for PAS 2080 is that it should set out a carbon management process for use in infrastructure delivery that can be undertaken collaboratively, applied by all parties across the value chain and against which compliance can be either:

- monitored and self-validated by the applying entity; or
- assessed and validated uniformly by other parties or by independent certification bodies accredited to undertake certification services against PAS 2080, with the primary objective of reducing carbon emissions from infrastructure in a manner that also reduces cost.

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1 Scope

This PAS specifies requirements for the management of whole life carbon in infrastructure – defined as the transport, energy, water, waste and communications, sectors – both in the provision of new infrastructure assets and programmes of work and the refurbishment of existing infrastructure.

The scope of the PAS is summarised in **Table 1**.³

Table 1 – The scope of PAS 2080

PAS 2080 is about:	PAS 2080 is not about:
Carbon management (as part of wider climate change mitigation).	Wider environmental or sustainability issues ³ .
Consistency in the use of data, reporting, quantification, benchmarking, target setting, continuous improvement, leadership, inclusion in BIM, etc.	Prescriptive approaches to quantifying GHG emissions, including the use of specific data or methods.
Management of capital and operational carbon under direct control of the value chain, and user carbon over which the value chain has influence.	Management of user carbon which relies on government policy or action, or where other parties are better placed to manage.
Promoting whole life cost reductions through whole life carbon reduction	Whole life cost management

Because of the evidence included in the Infrastructure Carbon Review that reduced carbon infrastructure is related to reduced cost, PAS 2080 has been developed to:

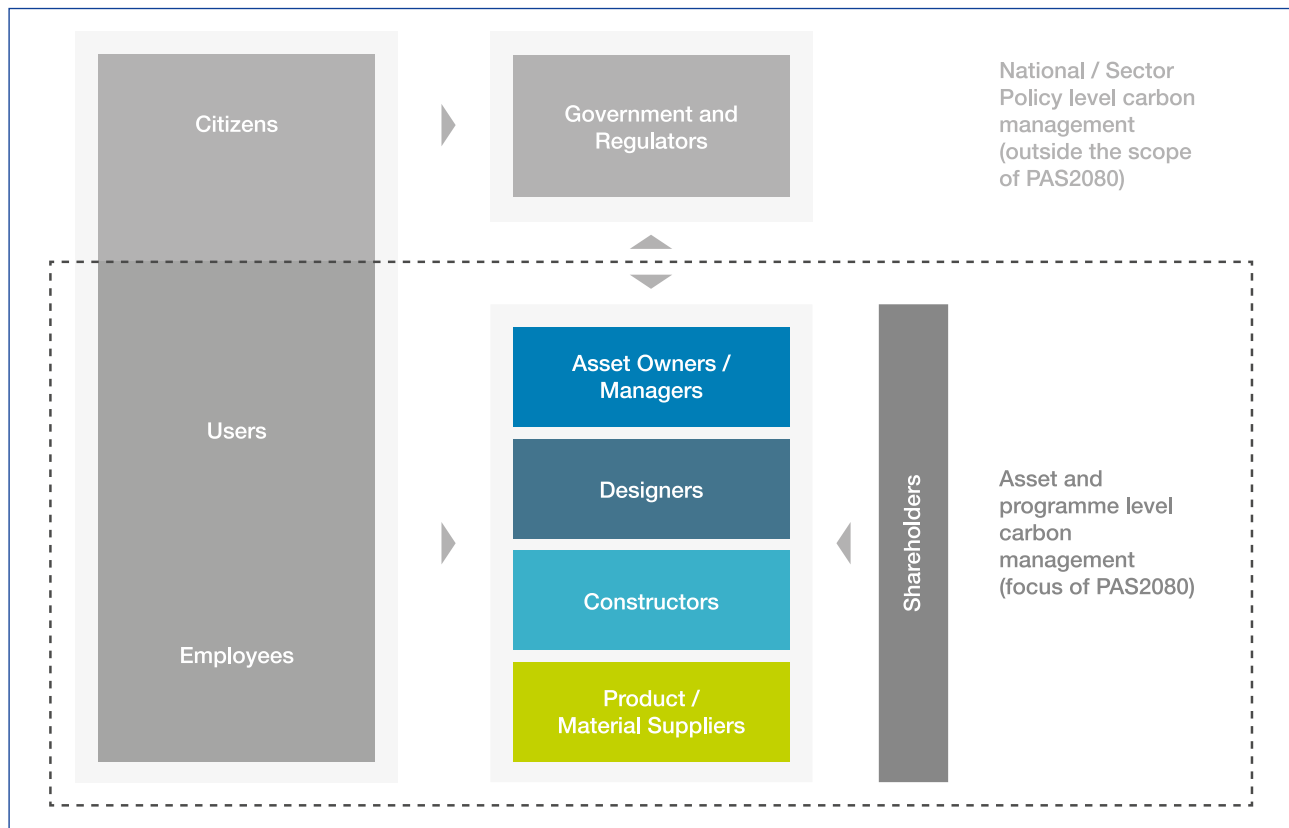
- Provide a specification for infrastructure carbon management which is compatible with international and sectoral norms, relevant existing standards and guidance, with the view of reducing whole life carbon in infrastructure delivery and;
- Bringing consistency to the practice of carbon management;
- Encouraging wider uptake and action on carbon management;
- Helping the infrastructure value chain to become more efficient – to reduce carbon and cost in infrastructure delivery;
- Improving the accuracy, transparency, consistency, relevance and completeness of carbon management and GHG emissions quantification;
- Improving the knowledge and understanding of carbon management by infrastructure practitioners throughout the value chain; and
- Supporting evidence-based decision making and identification of opportunities for carbon reduction.

Although asset owners/managers have the primary responsibility for delivering and managing infrastructure assets, all value chain members share responsibility for the management of the associated carbon emissions. Asset owners/managers can only realise the intended reductions within a fully integrated value chain involving designers, constructors and product/material suppliers.

To reflect this the PAS is applicable to all value chain members involved in the delivery of infrastructure, including asset owners/managers, designers, constructors and product/material suppliers. There are national and sectoral policies covering infrastructure carbon management, however these are mainly the responsibility of Governments and Regulators and are not in the PAS scope. **Figure 3** illustrates the value chain members involved in infrastructure management for whom this PAS is applicable.

³⁾ While this standard is not about environmental or sustainability issues generally, it is important that such issues are taken into full account both in the provision of new infrastructure assets and programmes of work and the refurbishment of existing infrastructure assets.

Figure 3 – Infrastructure value chain members responsible for carbon management.
The focus of PAS 2080 is on value chain members responsible for asset and programme level carbon management



To help each value chain member to contribute effectively, the responsibilities set out in each clause of this PAS are arranged under the following headings:

- Requirements for all value chain members;
- Asset owner/manager requirements;
- Designer requirements;
- Constructor requirements; and
- Product/material supplier requirements.

In order to successfully claim compliance with the requirements of this PAS, each value chain member is required to declare the role(s) they undertake (from the above list). They can then demonstrate conformity with the clauses under the “requirements for all value chain members” heading and those under other headings pertaining to their role(s).

NOTE All value chain members will be able to claim conformity with PAS 2080 as: PAS 2080 Asset Owner/Manager; PAS 2080 Designer; PAS 2080 Constructor; and PAS 2080 Product/Material Supplier (refer to Clause 12).

To achieve compliance, value chain members must be able to demonstrate relevant organizational capability appropriate to the point(s) of infrastructure delivery at which they are involved.

To maximise carbon and cost reduction, it is recognised that the asset owner/manager has primary responsibility for integrating the work of all value chain members under a common carbon management process that is specifically developed for delivering assets and programmes of work.

The PAS is targeted at both leaders and practitioner-level individuals who are responsible for the day-to-day aspects of infrastructure delivery and carbon management. Practitioner roles range from strategic planning, procurement, design to construction and operations.

NOTE Further details on the specific practitioner-level roles in each value chain organization that are intended to implement PAS2080 are included in the "Guidance Document for PAS2080".

This PAS includes requirements for developing a carbon management process built around the following components:

- 1) Quantification of GHG emissions;
- 2) Target setting, baseline setting and monitoring;
- 3) Reporting; and
- 4) Continual improvement.

Annex C includes reference to a range of external documents from which value chain members seeking to comply with PAS2080 will be able to select approaches and methodologies to assist them.

2 Normative references

Normative references identify documents external to the specification from which they are cross referenced, the applications of which are requirements of that specification. Users of PAS 2080 might therefore expect to find several documents normatively referenced here.

However, in view of the breadth of target subjects existing in the infrastructure sector, the approach taken in PAS 2080 deliberately avoids normative reference to such external documents so as to provide asset owners/managers with the flexibility to select the external methodologies most appropriate for their particular sphere of activity. Consequently, the PAS does specify requirements for transparency and disclosure and the provision of evidence that the selections made are justified.

3 Terms and definitions

For the purposes of this PAS, the following terms and definitions apply.

3.1 activity data

data based on a unit quantity of input or output of the studied system or a process within it

NOTE Activity data may be a physical quantity such as mass (kg), a unit of cost (£) or a unit of energy (kWh), etc.

3.2 asset

physical entity forming part of infrastructure that has potential or actual value to an organization and its stakeholders

[adapted from BS ISO 55000: 2014]

3.3 asset owner/manager

organization that manages and is responsible for providing, operating and maintaining infrastructure assets

NOTE Typically the asset owner/manager is the asset owner, but on occasion an asset owner/manager might also be the organization charged with operating infrastructure, a project sponsor, a service provider, the entity undertaking project works, or the organization charged with providing services from infrastructure.-

3.4 baseline

scenario for what carbon emissions would have been in the absence of planned measures aiming to reduce emissions

[adapted from Greenhouse Gas Protocol: 2009]

3.5 carbon management

assessment, removal and reduction of GHG emissions during the delivery of new, or the management of existing, infrastructure assets and programmes

3.6 carbon reduction

process of minimising GHG emissions in the development of new infrastructure assets and programmes of work or the refurbishment of existing assets

NOTE the outcome of 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.

3.7 carbon dioxide equivalent (CO₂e)

unit for comparing the radiative forcing of a greenhouse gas to carbon dioxide

[BS ISO 14064-1: 2006; PAS 2050: 2011]

NOTE The carbon dioxide equivalent is calculated using the mass of a given GHG multiplied by its global warming potential (see 3.16).

3.8 capital carbon

GHG emissions associated with the creation, refurbishment and end of life treatment of an asset

NOTE The term capital carbon is being adopted in the infrastructure sector as it accords with the concept of capital cost. The related term 'embodied carbon' will continue to be used at a product or material level whereas capital carbon will have greater relevance at an asset level.

3.9 constructor

entity that undertakes work to construct, build, maintain or disassemble an infrastructure asset

NOTE A constructor may be a product/material supplier.

3.10 control

where asset owner/managers have the ability to manage, through direct requirement of infrastructure design and operational approach, specific objectives for capital and operational carbon emissions

3.11 designer

entity that creates, prepares or specifies the design of an asset that is to be constructed or maintained

NOTE A designer may be an asset owner/manager, consultant, constructor, or product/material supplier.

3.12 infrastructure

transport, energy, water, waste and communications sectors, as defined in the UK National Infrastructure Plan 2014

3.13 emissions factor

amount of greenhouse gases emitted, expressed as CO₂e and relative to a unit of activity

[PAS 2050: 2011; ISO 55000: 2013; ISO 14064: 2012; ISO 14033: 2013]

3.14 direct influence

where asset owners/managers have the ability to use enablers to encourage users to make low carbon decisions

3.15 functional unit

quantified performance of a product or system for use as a reference unit

[BS EN ISO 14044: 2006, 3.20]

NOTE The functional unit takes into account a function, a quantity, a duration, and a quality of the infrastructure asset or programme of work being assessed. Refer to Clause 7.1.2 and the Guidance Document for PAS2080 for further explanation and examples of functional units.

3.16 global warming potential (GWP)

factor describing the radiative forcing impact of one mass-based unit of a given greenhouse gas relative to an equivalent unit of CO₂ over a given period of time

[BS ISO 14064-1: 2006]

3.17 greenhouse gases (GHGs)

gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds

NOTE 1 Throughout PAS 2080 the term 'carbon' is often used (e.g. Capital Carbon, User Carbon, Operational Carbon). This is applied as short-hand for GHGs as defined by the UNFCC Kyoto Protocol six main greenhouse gases.

NOTE 2 The UNFCC Kyoto Protocol six main greenhouse gases include carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆).

[BS ISO 14064-1: 2006]

3.18 greenhouse gas (GHG) emissions

total mass of GHGs released to the atmosphere over a specific period of time

[BS ISO 14064-1: 2006]

3.19 organization

company, corporation, firm, enterprise, authority or institution, or part or combination thereof, public or private, that has its own function and administration

[adapted from ISO 14064-1: 2012]

3.20 operational carbon

GHG emissions associated with the operation of infrastructure required to enable it to operate and deliver its service

NOTE This is primarily defined as stages B6, B7 and B8, but on occasion might also include modules B2, B3, B4 and B5 depending on organisational setting. Refer to **Figure 7**

3.21 practitioner

individual responsible for different aspects of infrastructure delivery and carbon management including, strategic planning, procurement, programme manager, operator, designer/technical advisor, construction manager, material/product developer, environment or sustainability manager, etc.

NOTE Each value chain member will have different practitioner roles. For more details on practitioner roles, refer to the "Guidance Document for PAS 2080".

3.22 programme

defined set of works related to the construction, maintenance or operation of an infrastructure asset or assets

3.23 product/material supplier

organization which extracts, manufactures or produces materials or products for incorporation into works to construct, build or maintain an asset

3.24 sector

collection of organizations involved in the delivery and operation of infrastructure assets for the purpose of providing an infrastructure service (e.g. energy, water, telecommunications)

3.25 system boundary

set of criteria specifying the life cycle, spatial and temporal extent of a GHG quantification or management system

[adapted from BS EN ISO 14040: 2006, 3.32]

3.26 specific data

data representative of a product, product group or construction service provided by one supplier

[from BS EN ISO 15804: 2012]

3.27 target

the desired quantity of carbon emissions (defined as an absolute value, or as a reduction amount against a baseline value) that an asset or programme of works is to achieve during infrastructure delivery

NOTE *A target should be specific and appropriate to an asset or programme of works, it must be measurable, and it must be time bound.*

3.28 user carbon

GHG emissions associated with Users' utilisation of infrastructure and the service it provides during operation

NOTE 1 *This is equivalent to the operation work stage, as show in Figure 4.*

NOTE 2 *Although user carbon is not directly controlled by infrastructure asset owners/managers, they may have a direct influence on user carbon emissions.*

NOTE 3 *Annex A lists the User GHG emissions in each infrastructure sector.*

3.29 value chain

organizations and stakeholders involved in creating and managing infrastructure assets. These include asset owners/managers, designers, constructors and product/material suppliers

NOTE *Government and users of infrastructure can also influence infrastructure asset management however they are not the primary focus of PAS2080 (refer to Figure 3)*

3.30 whole life cycle carbon emissions

sum of GHG emissions from all stages of the life cycle of a product or asset and within the specified system boundaries of the product or asset

NOTE *This includes all GHG emissions and removals associated with the processes within the boundary of the life cycle of infrastructure assets. To avoid undue repetition, reference to removals is not commonly included in the text, but it is intended that assessment should include removals wherever they occur.*

[adapted from PAS 2050: 2011]