

Strategic Forum for  
Construction & Carbon  
Trust

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**Construction carbon  
15% target by 2012**

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Scoping paper

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## Executive Summary

In June 2008, the UK Government and the Strategic Forum for Construction (SFfC) published the industry-led *Strategy for Sustainable Construction*. The strategy set overarching targets for the industry in England, as well as actions and deliverables that will contribute to the overarching targets. For the Climate Change Mitigation theme, one of the deliverables is: *15% reduction in carbon emissions from construction processes and associated transport compared to 2008 levels*.

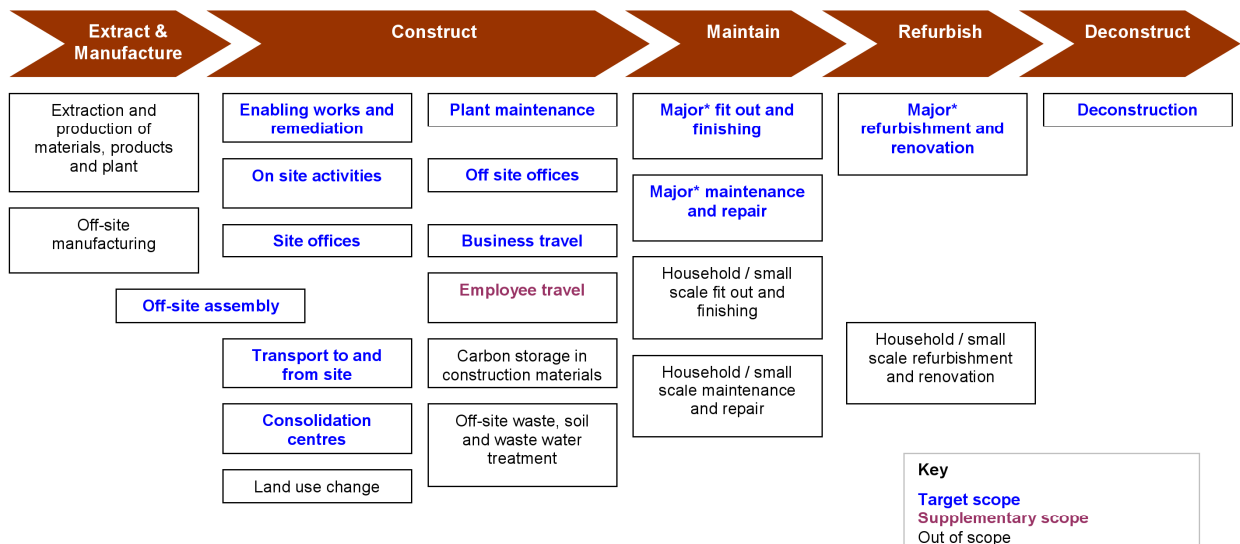
This scoping study is a key step to defining the activities covered by this target, and therefore, the stakeholders that will need to be engaged to implement carbon reduction strategies. It has been reviewed by the SFfC carbon sub-group, a reference panel of stakeholders, to ensure that it reflects the sector’s drivers, objectives, existing systems and initiatives, and available data sets. The study establishes the basis for a baseline assessment and progress monitoring towards the target.

The aim of the target is to promote emissions reductions from construction processes, addressing gaps between voluntary and mandatory carbon management initiatives. This scoping paper proposes that ‘construction processes’ are the transport, enabling works, assembly, installation and disassembly activities necessary to deliver the service of construction. Therefore, the target does not cover the sector’s inputs (from the manufacturing sector), its outputs (to the waste sector) and its saleable product (to asset owners and users).

Three scoping categories have been proposed:

- Target scope – activities that are included within the scope for assessment and emissions reductions.
- Supplementary scope – activities that are relevant and to be included in the scope of the assessment but do not contribute to progress towards the emissions reduction target due to the lack of consistent and accurate data.
- Out of scope – activities that are not directly relevant to the target.

The figure below shows the categorisation of various processes across the timeline of a construction project.



\* Major means the construction work meets the threshold for notification set by the CDM Regulations 2007

If a construction process is relevant to the objectives of the target, it is included in the target or supplementary scope. Processes that are relevant but for which data is incomplete or inconsistent are placed in the supplementary scope. Any reductions in these processes will not count towards the 15% reduction target because of the difficulty in robust measurement.

The target applies to all types of projects in England. Where possible, it accounts for the 100 year global warming potential of the six main anthropogenic greenhouse gases.

Progress towards the target will be reported for each calendar year. It is recommended that the target will be considered **met** if by 2012:

- a) absolute emissions (tonnes CO<sub>2</sub>e/annum) in the target scope are reduced by at least 15% by 2012; **AND**
- b) emissions relative to contractors' output (tonnes CO<sub>2</sub>e/£ million /annum) in the target scope are reduced by at least 15% by 2012.

Based on the output of the study, the next steps will be:

- a protocol for assessing the annual emissions of the construction sector;
- an assessment of emissions during 2008, which is the baseline against which progress towards the reduction target is measured;
- the development of options for reducing carbon in construction processes; and
- an action plan for achieving the target.

# 1 Introduction

## 1.1 Project background

In June 2008, the United Kingdom (UK) Government and the Strategic Forum for Construction (SFfC) jointly published the *Strategy for Sustainable Construction*. The strategy set overarching industry targets for England, as well as actions and deliverables that will contribute to the overarching targets. The Strategy was published before the UK set its first carbon budget in the *Low Carbon Transition Plan* in July 2009. The UK policy context for this work is described in Appendix B.

For the Strategy's climate change mitigation theme, one of the deliverables is: *15% reduction in carbon emissions from construction processes and associated transport compared to 2008 levels*. The SFfC is responsible for delivering this target by 2012.

The strategy notes that one of the first steps is to establish the mechanism for measurement. This is the aim of this project, which will produce the tools and means for regular sector level carbon measurement and reporting, making best use of existing data.

This scoping study is a key step in agreeing the activities covered by this target, and therefore, the stakeholders that will need to be engaged to implement carbon reduction strategies. Based on the output of the study, the next steps will be:

- a protocol for assessing the annual emissions of the construction sector;
- an assessment of emissions during 2008, which is the baseline against which progress towards the reduction target is measured;
- the development of options for reducing carbon in construction processes; and
- an action plan for achieving the target.

## 1.2 Objective of this scoping paper

The objective of this scoping paper is to discuss and recommend the activities to be included within the boundary of the carbon reduction target and how progress towards the target is to be reported. The scope is to be set such that it supports the principles for account and reporting carbon emissions outlined in Table 1. These principles align with the *Greenhouse Gas (GHG) Protocol Scope 3 Accounting & Reporting Standard*, which is currently under development.

**Table 1 Principles for accounting and reporting carbon emissions**

Principle	Description
Relevance	<p>Assessments should ensure the emissions inventory appropriately reflects the emissions of the sector and can inform the decision-making of stakeholders internal and external to the sector.</p> <p>The scope of the assessment should be set to address the objective of the target (to reduce emissions from construction processes), and minimise overlap or 'double counting' of carbon reductions that result from other industry and government initiatives. This is further discussed in Section 2.2.</p>
Completeness	<p>Assessments should account for and report on all emission sources and activities within the chosen inventory boundary. Assessments should disclose and justify any specific exclusions.</p>

Principle	Description
Consistency	Assessments should use consistent data sets to allow for meaningful comparisons of emissions over time. Any changes to the data, inventory boundary, methods, or any other relevant factors in the time series should be transparently documented.  For emissions to be measurable and consistent, it may be necessary to exclude activities where data is unavailable or poor quality. The exclusion is necessary to ensure that changes in reported emissions result from real reductions, rather than changes in data quality or methodology.
Transparency	Assessments should address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.
Accuracy	Assessments should ensure that the quantification of emissions is systematically neither over nor under actual emissions, as far as can be judged, and that uncertainties are reduced as far as practicable. It should achieve sufficient accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information.

### 1.3 Stakeholder involvement

This scoping paper has been reviewed by the SFfC carbon sub-group, which acts as a reference panel of stakeholders to ensure that the scope reflects the sector's drivers, objectives, existing systems and initiatives, and available data sets. At this scoping stage, the carbon sub-group involved the following stakeholders.

#### **Strategic Forum for Construction (SFfC)**

The SFfC brings together the main representative bodies in the construction industry. The Forum is a channel for coordinating the sector's actions to achieve the 2012 carbon reduction target. The action plan resulting from this project will be implemented via SFfC's members, who include trade associations covering major contractors, industry professions, manufacturers and suppliers, and trades.

#### **Carbon Trust**

The Carbon Trust is supporting the SFfC in this project, as part of its mission to accelerate the move to a low carbon economy by providing business and the public sector with expert advice and finance.

#### **Department of Energy and Climate Change (DECC)**

DECC is responsible for all aspects of UK energy policy, and for tackling global climate change on behalf of the UK. It is responsible for setting carbon budgets and has published the *Low Carbon Transition Plan*, which plots out how the UK will meet the cut in emissions to meet the intermediate target of 34% on 1990 levels by 2020.

#### **Department of Business, Innovation and Skills (BIS)**

BIS develops policies for economic growth, higher education, skills and science to innovation, enterprise and business. It has a construction business unit to promote best practice in design and manufacture, investment opportunities. With SFfC, it coordinated the development of the *Strategy for Sustainable Construction*. The BIS Construction Statistics and Economics Unit is responsible for collecting, analysing and publishing statistics for the construction sector.

**Department for Environment, Food and Rural Affairs (Defra)**

The overarching challenge for Defra is to secure a healthy environment for UK's current and future prosperity. Defra's work on sustainable and low carbon consumption and production is particularly relevant to this project. Defra aims to work towards an economy where products and services are designed, produced, used and disposed of in ways that minimise carbon emissions, waste and the use of non-renewable resources.

**Confederation of British Industries (CBI) Construction Council**

The CBI is a lobbying organisation for UK business, working with the UK government, international legislators and policy-makers. It has set up a Construction Council with a climate change sub-group.

**UK Construction Industry Council (CIC)**

The UK Construction Industry Council is the representative forum for the industry's professional bodies, research organisations and specialist trade associations. Its environment group addresses climate change in the built environment.

**Civil Engineering Contractors Association (CECA)**

CECA represents the interests of civil engineering contractors registered in the UK. Its members work on essential infrastructure including transport, communications, energy production and distribution, water and waste water. CECA monitors and addresses major industry issues including sustainable construction.

**Individual companies**

The companies represented in the carbon sub-group were:

- Bovis Lend Lease
- Laing O'Rourke
- Kier Group
- BAM Construct
- JCB
- Vinci Construction
- Balfour Beatty
- Speedy Hire



## 1.4 Structure of this paper

The paper is structured to address the key scoping questions. These are outlined in Table 2, with reference to the relevant sections of this report.

**Table 2 Scoping questions and report sections**

Scoping question	Section
What are 'construction processes'?	2
What sub-sectors of construction are within the scope of the target?	3
What types of greenhouse gases are addressed by the target?	4
What is the metric? Is the target absolute or relative?	5
What is the geographic scope of the target?	6
Over what time periods will emissions be reported?	7
What data issues may affect the consistency and accuracy of assessment and therefore limit the scope?	8

Section 9 summarises the recommendations for the scope of the target.

Section 10 outlines the next steps from this scoping paper, including the stakeholders that should be involved in action planning to reduce emissions for 2012.

Appendix A contains a list of abbreviations and acronyms.

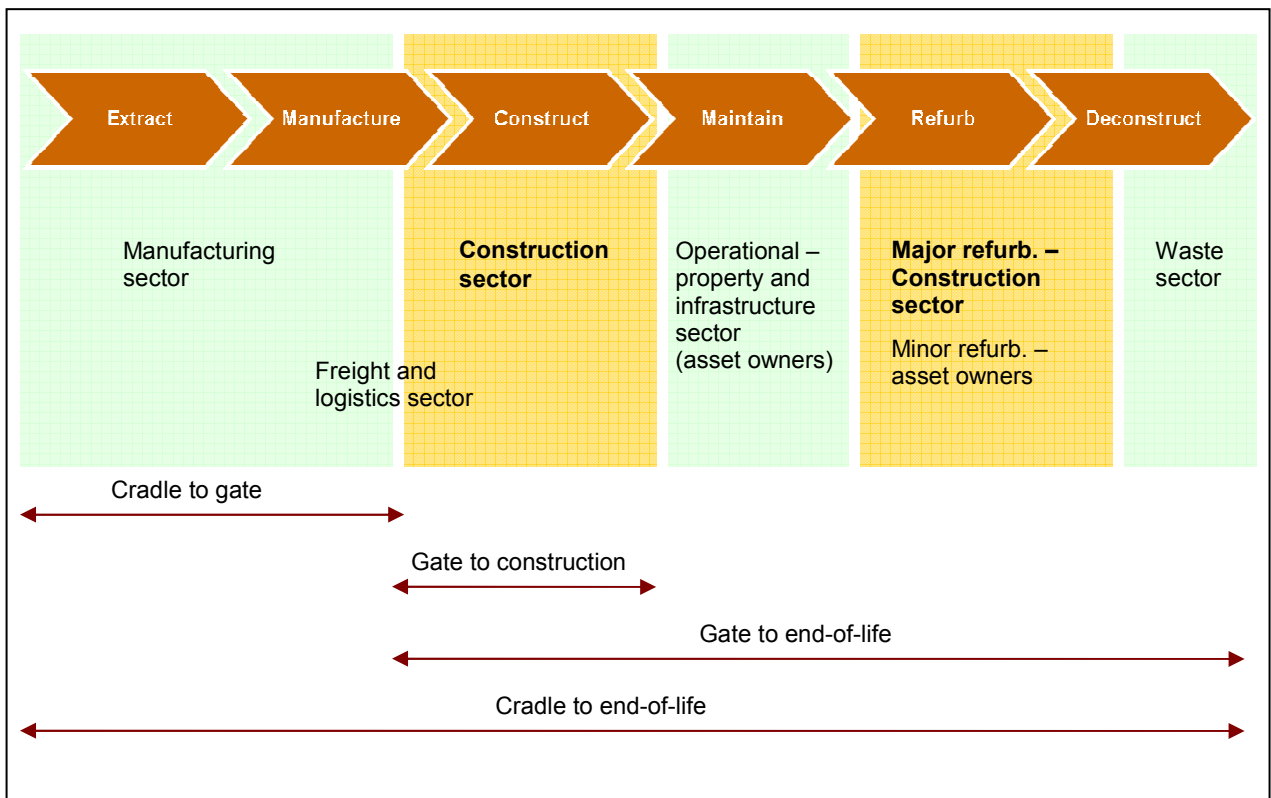
## 2 Defining construction processes

### 2.1 Overview of the construction sector

Construction is a broad sector with interlinked supply chains. The 1998 Egan Report *Rethinking Construction* and 1994 Latham Report *Constructing the team* both recognised that the sector was complex and fragmented. Although the phrase ‘construction sector’ and ‘construction industry’ is in general use, it is not always clearly and consistently defined. Section 2.3 describes the differences between various definitions of the construction industry.

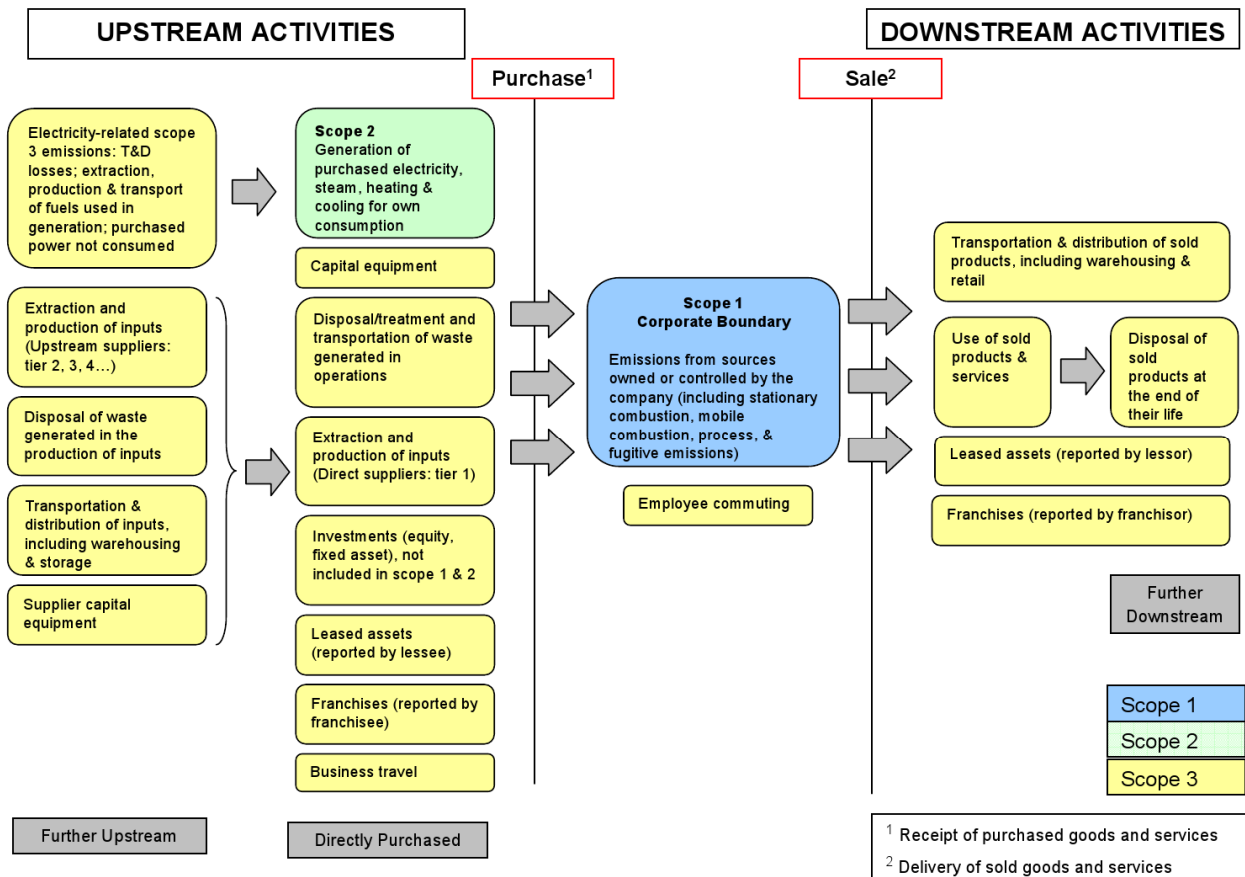
Defining the construction sector is an important first step in understanding the roles and responsibilities of different groups to respond to the 15% carbon reduction target. The objective of the target is to reduce emissions from the service of construction, which is currently not addressed by other mandatory and voluntary initiatives. The construction sector has inputs and outputs to other sectors. These are shown in Figure 1.

Figure 1 Sector ownership during the life cycle of development projects



Sector-based emissions accounting and reporting differs from organisational reporting because there is no clear organisational or supply chain boundary. Although not directly applicable, organisational protocols such as the *Greenhouse Gas (GHG) Protocol for Scope 3* and ISO (International Organization for Standardization) 14064-1 *Greenhouse gases – Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals* can inform the development of a sector-based emissions protocol by considering the sector as an organisational with boundaries to be determined. Figure 2 is from the *GHG Protocol for Scope 3* and illustrates the concepts of scope 1, 2 and 3 across the activities of a corporate supply chain.

Figure 2 GHG Protocol supply chain protocol boundaries for organisations



The definitions of scope 1, 2 and 3 are not readily applied to the construction sector because the sector comprises many organisations engaged in the delivery of construction services. Activities considered scope 3 for one construction organisation may be scope 1 for another. Inevitably, implementing measures to reduce carbon emissions will require a partnering approach between clients, designers, contractors and suppliers. The 1998 Egan Report notes:

*‘Partnering involves two or more organisations working together to improve performance through agreeing mutual objectives, devising a way for resolving any disputes and committing themselves to continuous improvement, measuring progress and sharing the gains.’*

For this reason, it is critical to first define the scope of the target before identifying the organisations that control and influence the construction processes that emit GHGs.

## 2.2 Responsibilities and ownership of carbon reduction measures

There is much activity currently underway to reduce emissions from various aspects of the construction life cycle. The context for the emissions target is provided in Appendix B. Key carbon-related initiatives are summarised in Table 3, which shows that there is limited action on addressing emissions from on site construction processes. This is the gap that the *Strategy for Sustainable Construction* carbon reduction target seeks to address.

It is acknowledged that in context of the whole life cycle of a building or infrastructure asset, on-site processes are lesser emissions sources than carbon embodied in materials and products. For example, at building completion of an office building, emissions from site

processes, site offices and associated transport could be around 10-15% (the remainder is from embodied carbon in materials).<sup>1</sup> For a highway, it could be around 25-30%.<sup>2</sup>

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<sup>1</sup> For example, see Lockie S (2009), Low carbon: building a better future, New Civil Engineer, 1 October 2009, available at <http://www.nce.co.uk/home/low-carbon/low-carbon-building-a-better-future/5208913.article>

<sup>2</sup> Pantelidou H, Nicholson D, Hughes L, Jukes A, Wellappili L (2009), *Earthworks emissions in highway projects*, Arup

**Table 3 Major carbon-related initiatives for aspects of the construction life cycle**

	Policy and strategy	Mandatory	Voluntary	Emerging
<b>Construction materials and products</b>	Construction Products Regulations	Climate Change Agreements European Union (EU) Emissions Trading Scheme (ETS) Code for Sustainable Homes	Civil Engineering Environmental Quality Assessment and Award Scheme (CEEQUAL) Building Research Establishment Environmental Assessment Method (BREEAM) BRE Environmental Standard 6001 <i>Framework Standard for Responsible Sourcing of Construction Products</i> BRE Environmental Profiles Certification Scheme BRE Green Guide to Specification International Organization for Standardization (ISO) 14040 series <i>Environmental management – Life cycle assessment</i> ISO 21930 <i>Sustainability in building construction – Environmental declaration of building products</i> Publicly Available Specification 2050 <i>Assessing the life cycle greenhouse gas emissions of goods and services</i> World Business Council for Sustainable Development Cement Sustainability Initiative	European Committee for Standardization / Technical Committee (CEN/TC) 350 Code for Sustainable Buildings European Life Cycle Assessment platform project European Ecolabel Greenhouse Gas (GHG) Protocol Product Standard
<b>Construction logistics</b>	UK Low Carbon Transport	Vehicle efficiency standards (outlined in UK Low Carbon Transition Plan)		
<b>On site plant</b>		Carbon Reduction Commitment (CRC) (large organisations only)	CEEQUAL (optional credit) Code for Sustainable Homes (optional credit)	
<b>Commuting</b>	UK Low Carbon Transport			
<b>On site waste management</b>		Site Waste Management Plan Regulations 2008 Environmental Permitting Regulations 2008 (mobile permitting)		
<b>Waste treatment</b>	UK Low Carbon Transition Plan (waste sector)	Environmental Permitting Regulations 2008	<i>Strategy for Sustainable Construction</i> target of a 50% reduction by 2012 of construction, demolition and excavation (CD&E) waste to landfill compared to 2008.	
<b>Organisational (including office activities and business travel)</b>	UK Low Carbon Transition Plan (business and public sector)	CRC (large organisations only) Climate Change Levy	Carbon Disclosure Project Defra guidance on how to measure and report greenhouse gas emissions Carbon Trust Standard accreditation GHG Protocol Corporate Standard ISO 14064-1 <i>Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals</i>	Global Reporting Initiative for Property and Real Estate European Network of Construction Companies for Research and Development Construction CO <sub>2</sub> Measurement Protocol GHG Protocol Scope 3 (Supply Chain) Standard

### **2.3 Commonly used definitions of the construction industry**

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The scope should, to the extent possible, align with stakeholders' intuitive understanding of what comprises the 'construction sector' and its processes. Using existing definitions of the industry simplifies communication, allows the use of existing data sets, and minimises the risk of incompleteness.

Table 4 summarises the coverage of various definitions of the industry. The documents that contain these definitions differ in their objectives, general approach and level of detail. This is described in Appendix C.

**Table 4 Summary of definitions of the construction industry**

Refer to Appendix C for full author-date details.

**Key**

	Specifically included in construction sector definition		Specifically excluded in definition
	Likely to be included, although wording is not precise		Silent: not specifically included or excluded in definition

Activities	Example processes	1998 Egan Report – ‘construction process’	Site Waste Management Plan Regulations 2008 – ‘construction work’	CDM Regulations 2007 – ‘construction work’	Standard Industrial Classification 2003 – ‘Division 45 construction’	Draft BS EN 15978 (document WG1 CEN TC350) – ‘construction process’	CIRIA – ‘construction business processes’	Kyoto Protocol category 1A2 – ‘manufacturing and construction’
Extraction and production of materials, products and plant	Mining, processing, refining, remediation, wastes							
Off-site manufacturing (OSM), off-site assembly, Modern Methods of Construction (MMC), pre-fabrication	Pre-fabrication of whole modules (e.g. bathrooms), skeletal panels, complete panels/units with wiring, insulation and windows							
Transport from factory gate to site	Road, rail and water transport for materials, products and equipment							
Enabling works and remediation	Clearance, ground improvements, removal of a structure, cleaning							
On site activities	Earthworks, assembly, piling, asphalt laying, mechanical and electrical installation, pumping, lighting, security, temporary works							
Transport from site to facilities for treatment and/or disposal	Transport to waste treatment centres off site							
Off-site waste, soil and waste water treatment	Soil decontamination, recycling, landfill, incineration, composting							
Fit-out (building completion)	Carpets, painting, furniture installation, fittings							
Site offices	Heating, ventilation, cooling, electrical appliances in temporary offices, on site catering							
Consolidation centres	Receiving materials and products, inventory management, building lighting and heating							
Maintenance and repair	Painting, corrosion protection, cleaning, replacements							
Refurbishment and renovation	Extension, conversion, stripping							
Plant maintenance (including leased assets)	Storage, cleaning, repair							
Decommissioning and deconstruction	Demolition, waste management							
Off-site offices	Payroll, insurance, project management, HSE							
Employee commuting	Personal transport from home to site							
Business travel	Paid by business							

## 2.4 Recommendations for activities scope

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### 2.4.1 Approach to scoping recommendations

Each of the activities listed in Table 4 is to be included in one of three categories:

- Target scope – activities that are included within the scope for assessment and emissions reductions.
- Supplementary scope – activities that are relevant and to be included in the scope of the assessment but do not contribute to progress towards the emissions reduction target due to the lack of consistent and accurate data.
- Out of scope – activities that are not directly relevant to the target.

### 2.4.2 Activities in the target scope

#### 2.4.2.1 On site activities

It is clear that the use of electricity (from the grid or generated on site), diesel, gas, heat and other fuels to run plant and ancillary equipment during construction is within the control of the sector. Emissions can occur during enabling works and remediation, new construction, maintenance, refurbishment and renovation, and deconstruction.

Emissions from on-site activities are to be included in the **target scope**, regardless of who owns, operates, or pays to fuel plant and ancillary equipment.

#### 2.4.2.2 Site offices

Site offices and other amenities are powered by electricity from on-site diesel or gas generators or a grid connection. Offices and consolidation centres may also have heat, cooling and gas connections.

It is recommended that emissions from running site offices are included in the **target scope**, as these facilities directly support site work. This inherently assumes that the activities in site offices relate directly to the construction project where they are located.

#### 2.4.2.3 Transport to and from the site

As noted in Section 1.1, the target is defined to include 'associated transport'. This has been interpreted as the transport of construction materials, products and plant to the site, and the transport of materials (such as waste, soil and waste water) off the site. The inclusion of transport as a construction process aligns with the definition of construction processes used by draft standard BS 15978.

There is potentially minor overlap between construction logistics measures and the vehicle efficiency standards that form part of the *UK Low Carbon Transition Plan* and the *UK Low Carbon Transport* strategy. New vans are to meet the carbon standard of 160 g/km, which will save 1.0 megatonnes CO<sub>2</sub>e Budget 1 (2008-2012).

Beyond 2012 (after the 15% target is to be met):

- new cars are to meet the carbon standard of 130 g/km from 2015 onwards;
- 10% of transport fuels are to be renewable by 2020; and
- new heavy goods vehicles are to have low rolling resistance tyres.

Emissions from transport of materials and products to and from the site are to be included in the **target scope**.

#### 2.4.2.4 Consolidation centres

Large construction sites may make use of an on site or near site consolidation centre for receiving materials, products and plant. These centres combine part loads into single shipments to promote efficient vehicle movement to construction sites. Consolidation centres may serve one or more sites.



It is recommended that emissions from running consolidation centres are included in the **target scope**.

#### **2.4.2.5 Off-site manufacturing and assembly**

Off-site manufacturing (OSM) involves the pre-fabrication of whole modules (like bathrooms), skeletal panels, or complete panels/units with wiring, insulation and windows already built in. In a controlled factory environment, there is greater quality control and less chance of weather damage. Components are then assembled on-site. If more builders move towards OSM to take advantage of theoretical cost and environmental savings, then emissions will be shifted from the construction site to the factory.

The assembly of components off site is therefore a construction process that occurs in a factory environment rather than at the building site. Therefore, emissions related to the *assembly* of pre-fabricated components are to be included in the **target scope** to avoid burden shifting from the construction sector to manufacturing. Where possible, emissions related to *manufacturing* components will be excluded, which aligns with Section 2.4.4.1. If detailed energy use data is not available, then it may not be possible to distinguish between assembly processes, manufacturing processes and unrelated office activities, which may be co-located.

The method for distinguishing manufacturing and assembly-related emissions for OSM will be detailed in the methodology paper.

#### **2.4.2.6 Plant maintenance**

Construction plant are essential tools of the trade that need to be manufactured, maintained and disposed. The manufacture and disposal of plant (non-consumables) is out of scope for the same reasons as embodied carbon in materials and products and waste-related emissions are excluded (refer to Section 2.4.4.1).

It is recommended that emissions related to the storage and maintenance of plant are included in the **target scope**, as these directly enable construction processes.

#### **2.4.2.7 Scale of projects (new construction, fit out, refurbishment, renovation, maintenance and repair)**

The construction industry is diverse and depending on definitions, could include major new infrastructure construction, neighbourhood development, office refurbishments, or household/small scale construction activities such as people painting and renovating their homes.

In order to distinguish between major and household/small scale construction activities, the **target scope** applies to construction processes where the project is notifiable to the Health and Safety Executive (HSE) under the CDM 2007 regulations. Notifiable projects are those that:

- last longer than 30 days; or
- involve more than 500 person days of construction work.

Where it is not possible to distinguish between major and household/small scale construction activities, then all projects will be included in the target scope.

#### **2.4.2.8 Off site offices**

Some office activities that directly enable a construction project occur off site, rather than in a site office. These include: project management; health, safety and environmental management systems; some payroll activities; some legal and insurance activities, etc.

These would be covered by the scope of the target. In principle, only emissions from office activities that directly serve construction projects would be included. This would require the exclusion of emissions from other businesses or departments (e.g. facilities management, consultancy and investments) that might share the same office space. In typical carbon footprint calculations the organisational boundary is used, so it is not necessary to do this allocation. However, as our interest is in construction processes, then we would distinguish

between the different businesses or departments within an organisation. Table 3 shows that organisational emissions are covered by existing emissions accounting and reporting programmes.

It should be noted that emerging work from the SFfC Water sub-group considers water use on site only.

It is recommended that emissions from off-site office activities are included in the **target scope**. It is likely that the availability of good quality data will be limiting. During the data review, the significance (relative magnitude) of emissions from corporate offices will be assessed to make reasonable and transparent assumptions to fill any data gaps. For example, if corporate office emissions are less significant than other sources, it may be that all emissions will be included regardless of how the office activity relates to construction processes.

#### **2.4.2.9 Business travel**

Where business travel is undertaken to directly support on-site construction processes, then resulting emissions would be addressed by the target. As with off-site offices, in principle only emissions from business travel directly related to construction projects would be included. It is likely that the availability of good quality data will limit the extent to which emissions can be allocated between those that directly support construction projects.

It is recommended that emissions from business travel are included in the **target scope**. It is likely that the availability of good quality data will be limiting. During the data review, the significance (relative magnitude) of emissions from business travel emissions will be assessed to make reasonable and transparent assumptions to fill any data gaps.

#### **2.4.3 Activities in supplementary scope**

##### **2.4.3.1 Employee commuting**

The commuting of employees to their place of work (construction site or off site office) is an activity over which a business has some influence but not direct control. In principle, it should be included in the scope, as it directly enables construction processes.

Commuting may be a significant source of emissions that could be addressed through a company's influence (e.g. using green travel plans, employing locally and providing travel loans or subsidies). However, early data review indicates that employee commuting data is not consistently or comprehensively collected. As part of action planning, recommendations may be made to reduce commuting emissions, although any resulting reductions in emissions will not count towards achieving the 15% target as they cannot be reliably measured against the 2008 baseline.

It is recommended that employee commuting is included in the **supplementary scope**, except where commuting is paid by a construction organisation. Emissions from travel paid through a business account will be treated like business travel (Section 2.4.2.9).

#### **2.4.4 Exclusions from the scope**

##### **2.4.4.1 Extraction and production of materials, products and plant**

The target addresses construction processes, which has been defined to exclude the manufacturing of materials and products. The rationale for this is:

- there are many emerging initiatives in this field and as some may become mandatory, and this uncertainty is yet to be resolved;
- there is existing voluntary initiatives directly targeting emissions from material and products, and this project is to avoid double counting any resulting savings; and
- given the short timescale for the first target milestone (2012), it is likely the lack of complete and consistent data for embodied carbon will obstruct accurate assessments of carbon reductions.

However, it is recognised that the carbon emitted in the extraction and production of material and products (embodied carbon) is likely to be greater than the emissions from construction processes. Although the manufacturers have primary responsibility for reducing emissions in production processes, the construction sector has an important contribution to make by increasing efficiency of materials specification, use on site and recovery. Reducing the demand for materials and products reduces emissions.

The efficiency of materials use is addressed through the construction sector's work on waste and resource efficiency (see the SFC's parallel project in waste), and this will have the added benefit of reducing carbon emissions. However, those benefits will not be counted towards achieving the 15% target.

It is recommended that emissions from the extraction and production of materials, products and plant are **excluded from the scope**.

#### **2.4.4.2 Water supply**

Water is dealt with in the same way as materials and products. Waste water is dealt with in the same way as waste. As such, the production of water (extraction and treatment) and treatment of waste water is **excluded from scope**. The pumping of water on site is covered by on-site activities (Section 2.4.2.1).

The supply of water to the site by pumping is similar to the transport of material to the site (Section 2.4.2.3). Emissions from pumping water will vary with the project location, especially topography and local water network conditions. Difficulties in data collection mean that, although relevant to the objectives of this project, water supply to the site will be included in the supplementary scope.

#### **2.4.4.3 Off-site waste, soil and waste water treatment**

The transport of waste from the site to the point of treatment is included in the target scope, as is on-site waste treatment, which is in the control of the construction contractor. Off-site waste treatment is excluded from the target as emissions are reported by the waste industry.

As such, the treatment and transport of waste, soil and waste water is treated in the same way as the production and transport materials and products are treated (refer to sections 2.4.2.3 and 2.4.4.1). For example, if contaminated soils are removed from site:

1. the transport off site is included in the target scope;
2. off-site remediation is excluded and treated like a manufacturing process, where the product that leaves the gate is remediated soil; and
3. the transport to bring treated soil back on the site is included in the target scope, and is dealt with like other logistics.

It is recommended that emissions from the treatment of waste, soil and waste water off site are **excluded from the scope**.

#### **2.4.4.4 Carbon storage in construction materials (carbon sequestration)**

Over the life of a built asset, any timber used in the construction contains sequestered carbon (carbon not released to the atmosphere). The sequestration of carbon in timber is an aspect of materials embodied carbon, which has been excluded for the reasons outlined in Section 2.4.4.1.

When materials with sequestered carbon are disposed from a construction site or as part of deconstruction, there is a potential for emissions. If incinerated or composted, the sequestered carbon is released as CO<sub>2</sub> through combustion. If landfilled or anaerobically digested, the material could potentially decompose to methane, which is a potent GHG. This is a case of emissions from waste treatment, which have been excluded for the reasons outlined in Section 2.4.4.3.

It is recommended that storage and release of emissions in construction materials is **excluded from the scope**.

#### **2.4.4.5 Land use changes**

If construction and development removes woodland and grassland, greenhouse gases may be emitted due to changes to soil organic matter, dead organic material (deadwood and litter), and living biomass (both above and below ground).

However, the location of construction work is a planning and design issue, and decisions are made before construction work begins. It is recommended that emissions from land use changes are **excluded from the scope**.

#### **2.4.5 Summary of activities against criteria**

Table 5 shows how activities relate to the principles for accounting and reporting of carbon emissions as outlined in Table 1 have been translated to the target scope. The principles of accuracy and transparency will be addressed in the methodology paper, which will contain a more in depth data review and requirements for documentation and referencing.

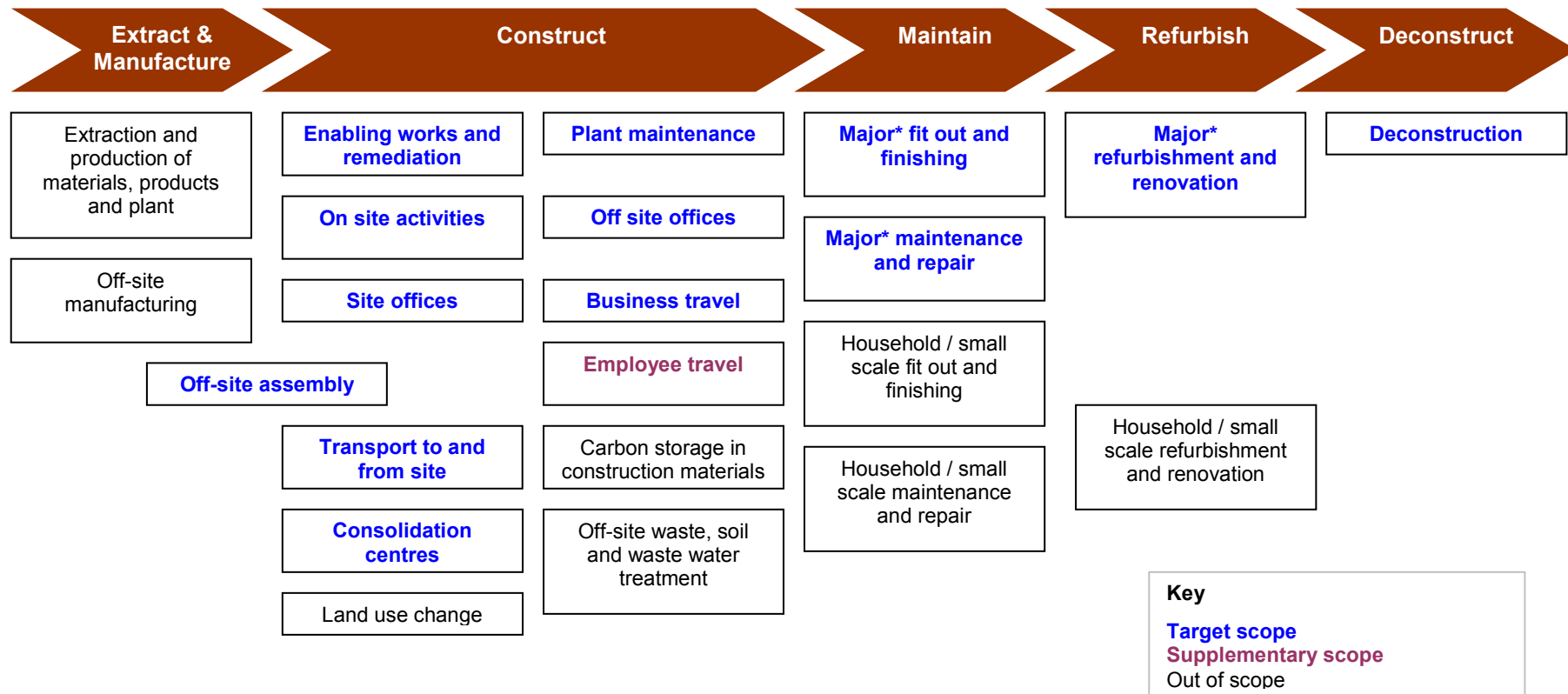
Processes have been included within the target scope where they are relevant to objectives and are significant (in magnitude) for completeness within the boundary. The main reason a relevant activity is in the supplementary scope rather than target scope is the lack of consistent and accurate data. If the forthcoming data review changes this initial assessment of significance and data consistency, then some activities may move between the target scope and the supplementary scope.

**Table 5 Summary of recommendations for activities in scope**

	Relevant to objectives	Complete (significance)	Consistent data available	Scope category
On site activities	Yes	Yes	Yes	Target scope
Site offices	Yes	Yes	Yes	
Transport to and from site	Yes	Yes	Yes	
Consolidation centres	Yes	?	?	
Assembly processes in OSM	Yes	?	?	
Plant maintenance	Yes	?	?	
Project scale (those notifiable under CDM 2007 regulations)	Yes	Yes	?	
Off site offices	Some	Yes	?	
Business travel	Some	?	?	
Employee commuting	Yes	Yes	?	
Extraction and production of materials, products and plant	No	Yes	No	Out of scope
Water supply	No	?	?	
Off site waste, soil and waste water treatment	No	?	No	
Carbon storage in construction materials	No	?	No	
Land use changes	No	?	?	

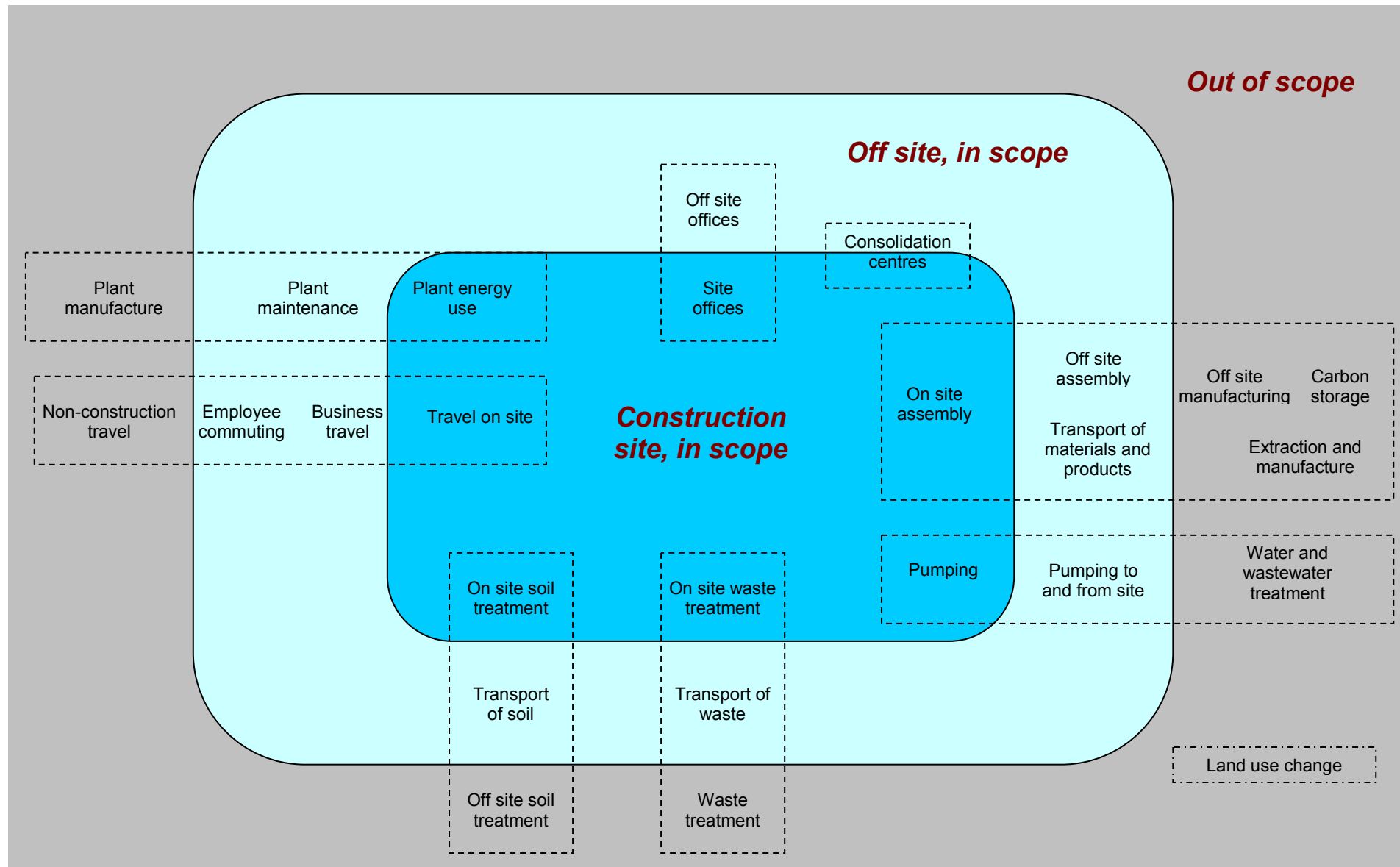
Figure 3 shows these recommendations across a timeline that generally correlates to the life cycle of development projects shown in Figure 1. Figure 4 shows the scope in relation to the physical boundary of the construction site.

**Figure 3 Scope categorisation of processes across the construction project life cycle**



\* Major means the construction work meets the threshold for notification set by the CDM Regulations 2007

**Figure 4 Scope categorisation of processes across the construction project physical boundary**



### 3 Types of construction work

It is recommended that the target cover all types of construction work. The *Construction Statistics Annual* categorises types of work in a number of ways. For example, contractors' output<sup>3</sup> in Great Britain is shown in Figure 5. From this economic data, in the past five years (2004 onwards), it appears that new housing, offices, education, shops, entertainment, health and factories consistently represented around 80% of the construction sector by project value. In methodology development, these project types would be prioritised for data collection. Before 2003, road construction was also significant.

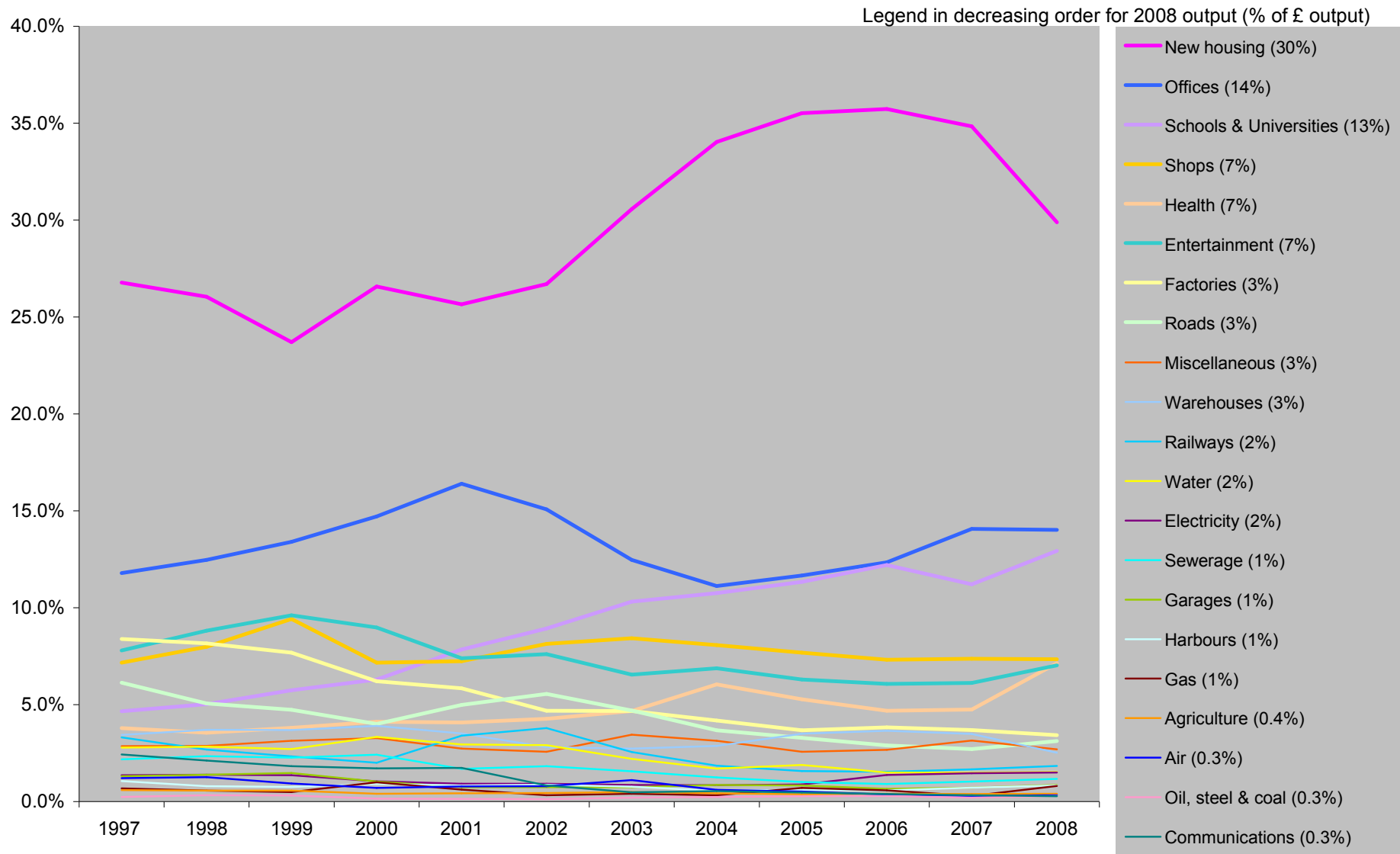
Unfortunately, there is no readily available data on how project values correlate with GHG emissions. New housing may represent 35% of output by value, but because of variations in added value, wages, economies of scale and other factors, new housing construction may not represent 35% of construction process emissions. The detailed data review will also investigate how much these economic values fluctuate between years.

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<sup>3</sup> Contractor's output is defined as the amount chargeable to customers for building and civil engineering work done in the relevant period excluding Value Added Tax. Contractors are asked to include the value of work done on their own initiative on buildings such as dwellings or offices for eventual sale or lease, and of work done by their own operatives on the construction and maintenance of their own premises. The value of goods made by the contractors themselves and used in the work is also included.



**Figure 5 Contractors' output by work type (% of total output)<sup>4</sup>**



<sup>4</sup> Office for National Statistics (2009), *Table 2.8 Contractors' output by type of work*, Construction Statistics Annual 2009 (ISSN=17580838)

## 4 Greenhouse gas emissions and global warming potential

The climate change mitigation target set in the *Strategy for Sustainable Construction* specifies reductions in 'carbon emissions'. 'Carbon emissions' is a term that is often used interchangeably with carbon dioxide emissions and GHG emissions.

The Kyoto Protocol and UK carbon budgets take into account six main anthropogenic greenhouse gases: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF<sub>6</sub>). These gases differ in their ability to trap heat in the atmosphere, so the warming potential (GWP) of each gas compared relative to CO<sub>2</sub>. For example, over 100 years, methane is around 25 times more potent than CO<sub>2</sub>. The emissions of these non-CO<sub>2</sub> greenhouse gases are usually expressed in CO<sub>2</sub> equivalent (tonnes or kilograms CO<sub>2</sub>e). Carbon dioxide has a GWP of exactly 1 since it is the baseline unit to which all other GHGs are compared.

In principle, it is recommended that the target takes into account the six main anthropogenic greenhouse gases and their GWP over 100 years. The unit for reporting emissions would be tonnes or kg CO<sub>2</sub>e. This would align to the emissions reported under the UK carbon budget, the EU ETS, the Kyoto Protocol and Defra guidelines. It should be noted that the CRC refers to CO<sub>2</sub> emissions rather than CO<sub>2</sub>e (GHG) emissions. It is likely that the CRC Regulations will reflect the Defra emissions factors, which have recently changed to CO<sub>2</sub>e, taking into account CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O.

However, for construction processes in the target scope, the difference between CO<sub>2</sub> and CO<sub>2</sub>e is likely to be minor. An initial data review of emissions factors indicated:

- for electricity, emission factors for CO<sub>2</sub>e are less than 1% greater than CO<sub>2</sub>;
- for light goods vehicles using diesel, emission factors for CO<sub>2</sub>e are less than 1% greater than CO<sub>2</sub>; and
- for rigid and articulated heavy goods vehicles, emissions factors for CO<sub>2</sub>e are slightly greater than 1%.

Therefore, in the absence of complete GHG emissions data, CO<sub>2</sub> is an adequate proxy for CO<sub>2</sub>e.

This does not apply for waste treatment processes, as landfilling, composting and incineration produce N<sub>2</sub>O and CH<sub>4</sub>.

## 5 Defining the metric

The *Strategy for Sustainable Construction* does not specify the metric (units) for measuring carbon emissions. The chosen metric will vary with what information stakeholders need in order to inform their decision making (a principle described in Table 1).

Stakeholders are interested in the construction sector's carbon performance for a variety of reasons including: reducing impacts on climate change; incentivising efficiency improvements through technological, design and/or system changes; and decoupling emissions from economic growth. To measure progress towards any of these aims, it is necessary to select and measure quantitative indicators, however stakeholders' different drivers and aims have an impact on how this is done.

Options for metrics therefore are:

- Absolute emissions as total tonnes CO<sub>2</sub>e per annum
- Emissions relative to:
  - finance – tonnes CO<sub>2</sub>e per turnover per annum, gross value added (GVA) or project value (e.g. contractors' output) per annum
  - labour/time – tonnes CO<sub>2</sub>e per hours worked or full time equivalent (FTE) employee per annum
  - physical output – tonnes CO<sub>2</sub>e per constructed gross floor area (GFA), kilometres of road or service population (e.g. passenger numbers)

The advantages and disadvantages of each metric are shown in Table 6.

It is recommended that the target has both absolute and relative components. Therefore, the target will be considered **met** if:

- a) absolute emissions (tonnes CO<sub>2</sub>e/annum) in the target scope are reduced by at least 15% by 2012; **AND**
- b) emissions relative to contractors' output (tonnes CO<sub>2</sub>e/£ million/annum) in the target scope are reduced by at least 15% by 2012.

**Table 6 Options for metrics and units**

Metric	Advantages	Disadvantages	Precedents for use
Absolute emissions (tonnes CO <sub>2</sub> e/annum)	The reduction in absolute emissions is ultimately what will impact the rate of climate change, therefore there is a need to limit absolute emissions.	Absolute emissions will vary with economic activity. For example, in 2008, there was a downturn in construction due to the UK recession. If 2008 is set as the baseline against which reductions are measured, then as the economy grows, the target is more difficult to meet. Conversely, if the construction sector continues to decline or stagnate, then it may meet the target without changing any construction processes to improve labour or technological efficiency.	Kyoto Protocol UK carbon budget CRC (weighted 75%)
Emissions relative to turnover (tonnes CO <sub>2</sub> e/£ turnover or project value/annum)	This metric reflects economic efficiency and the decoupling of emissions from economic activity. Carbon-efficient growth is one factor rewarded in ranking for the Carbon Reduction Commitment.	As with all relative metrics, there is no inherent limit to manage impacts on climate change. That is, as long as the sector grows economically, the sector can increase carbon emissions. Additionally, the performance will vary with market conditions, such as wages, energy prices, interest rates and inflation, which are not relevant to the physical efficiency of construction processes.	CRC uses percentage change in emissions per unit turnover (weighted 25%) The <i>Construction Statistics Annual</i> uses emissions relative to project value per annum SFfC waste project defines target relative to contractors' output
Emissions relative to gross value added (tonnes CO <sub>2</sub> e/£1000 GVA/annum)	This metric reflects the productivity of the construction sector in terms of carbon emissions. It allows stakeholders to compare sectors or regions in terms of how efficiently they use carbon to deliver goods and services valued by the public.	As with all relative metrics, there is no inherent limit to manage impacts on climate change. That is, as long as the sector grows economically, the sector can increase carbon emissions. Additionally, the performance will vary with market conditions, such as wages, energy prices, interest rates and inflation, which are not relevant to the physical efficiency of construction processes.	Global Reporting Initiative
Emissions relative to physical output (tonnes CO <sub>2</sub> e/GFA/annum or tonnes CO <sub>2</sub> e/km/annum or tonnes CO <sub>2</sub> e/population served/annum)	This metric reflects the physical efficiency of construction processes and incentivises technological and system improvements. Unlike the economic metrics above, it does not vary with market conditions, such as changes in wages, energy prices, interest rates and inflation.	This metric presents problems with measurement and communication. Because the physical output varies between construction sub-sectors (buildings, infrastructure), the effect will be multiple targets for each sub-sector.	Designers are accustomed to measuring carbon emissions per physical output
Emissions relative to employment (tonnes CO <sub>2</sub> e/FTE/annum)	As with the physical output metric, this metric reflects the scale of the sector in terms of labour.	Employment may not be closely tied to carbon emissions and will vary with the mix of construction processes (e.g. MMC versus traditional masonry construction) and the degree of mechanisation.	Emissions per FTE is a commonly used metric for organisational carbon reporting.

## 6 Geographic scope

The *Strategy for Sustainable Construction* is a Strategy for England. The Strategy notes that policy for most aspects of sustainable construction are devolved matters. Therefore, the target covers construction processes that take place in England.

The baseline carbon assessment (2008) will at minimum cover England. Where data is available, the assessment will also cover Wales, Scotland and/or Northern Ireland. The action plan for reducing emissions will focus on achieving reductions in England, although measures and learnings can be readily applied in Wales, Scotland and Northern Ireland, as often the construction organisations working in England are the same as those working in the rest of UK.

## 7 Temporal scope

Emissions will be reported for the calendar year, which aligns to the data reported by the BIS *Construction Statistics Annual*. It is likely that BIS's construction statistics compilation will be a key data source to calculate emissions for the construction sector using a top-down approach. This will be confirmed during methodology development.

In principle, emissions from activities that occur during the calendar year will be reported for that year. This means that although new orders (construction projects) are reported for the year they are made, for projects that span multiple years, it is only the emissions that result from processes in that calendar year that will contribute to the sector's emissions. Where possible, *contractors' output* and *revenue* will be used in preference to *new orders* and *project value* statistics. Minimising the use of *new orders* and *project value* means that the calculation methodology would consistently allocate emissions across years for large projects.

The feasibility of this temporal scope will be assessed as part of the data review for methodology development. It should be noted that other potential data sources and reporting cycles align with the financial year (April to March). For example, the CRC and the Carbon Trust report using the financial year. It is possible that as the project moves into implementing reduction strategies, stakeholders will want to report the sector's emissions in financial year. In that case, the 2008 baseline could be adjusted to a 2008/2009 baseline. For the first baseline assessment, though, the calendar year will be used.

## 8 Limitations due to data availability

As stated in Section 1.2, the target scope will in part be determined by the availability of data that is complete, consistent and updated annually. Table 5 highlights the construction processes where limited data may affect their inclusion in the scope.

A more comprehensive data review is currently underway and the availability of data and ability to make reasonable assumptions will be confirmed as part of methodology development. Appendix D contains a list of data sources that will be reviewed. Data is being sought on:

- the type and scale (in terms of physical output and financial value) of construction projects each year;
- the processes that are used in different project types;
- percentage breakdown of emissions sources from representative organisations and projects (buildings and infrastructure);
- the emissions intensity of specific physical processes; and
- the emissions intensity of the economic value of output through the construction sector.

Depending on data availability, options for calculating emissions include:

- top-down input-output analyses linked to economic value and trade; and
- bottom-up data collection by aggregating reporting data from organisations across the supply chain.

It is likely that the sector-based nature of the carbon assessment would favour top-down analysis. Analysis of large sectors is often suited to an input-output consumption-based approach. Furthermore, sector data sets would be more stable than organisational data sets, as organisational boundaries shift with acquisitions and mergers.

However, there is a trade-off between the two approaches. A top-down analysis is potentially easier to undertake, while a bottom-up analysis (project-specific or organisation-specific) enables more accurate and reliable action planning for emissions reduction.

The methodology paper following this scoping paper will recommend an approach. It is likely to be a hybrid approach that combines top-down sector specifics with generic construction processes defined using actual data from representative projects and organisations.

## 9 Summary of recommendations

This scoping paper proposes that construction processes are those necessary to deliver the service of construction. Therefore, the target does not cover the sector's inputs (from the manufacturing sector), its outputs (to the waste sector) and its saleable product (to asset owners and users).

The paper identifies the need to specifically drive improvements in construction processes because it is a gap amongst existing policy, regulation and voluntary initiatives.

Three scoping categories have been proposed: a target scope, supplementary scope, and the 'excluded from scope' category. If a construction process is relevant to the objectives of the target, it is included in the target or supplementary scope. Processes that are relevant but for which data is incomplete or inconsistent are placed in the supplementary scope. Any reductions in these processes will not count towards the 15% reduction target because of the difficulty in robust measurement.

The target applies to all types of projects in England. Where possible, it accounts for the 100 year GWP of the six main anthropogenic gases.

Progress towards the target will be reported for each calendar year. At the end of 2012, the target would be considered met if there is a 15% reduction in both absolute emissions, and emissions relative to contractors' output (£ million).



## 10 Next steps

Based on the agreed scope, a construction sector protocol for measuring carbon emissions will be developed. The protocol will include a review of available data and relevant existing carbon accounting methods.

The data review and methodology paper will be produced as a basis for discussion with the stakeholder reference group to agree on key methodological issues. Following the methodology review workshop (scheduled for 4 December 2009 or 11 January 2010), comments would be incorporated into a final methodology paper.

Appendix A

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**Abbreviations**

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BIS	Department of Business, Innovation and Skills
BRE	Building Research Establishment
BREEAM	BRE Environmental Assessment Method
CBI	Confederation of British Industries
CCA	Climate Change Agreement
CCL	Climate Change Levy
CDM	Construction (Design & Management)
CECA	Civil Engineering Contractors Association
CEEQUAL	Civil Engineering Environmental Quality Assessment and Award Scheme
CEN/TC	European Committee for Standardization / Technical Committee
CIC	UK Construction Industry Council
CH <sub>4</sub>	methane
CLG	Communities and Local Government
CO <sub>2</sub>	carbon dioxide
CRC	Carbon Reduction Commitment
DECC	Department of Energy and Climate Change
Defra	Department for Environment, Food and Rural Affairs
ETS	Emissions Trading Scheme
EU	European Union
FTE	full time equivalent
GFA	gross floor area
GHG	greenhouse gas
GRI	Global Reporting Initiative
GVA	gross value added
GWP	global warming potential
HFCs	hydrofluorocarbons
HSE	Health and Safety Executive
ISO	International Organization for Standardization
kg	kilogram
MMC	modern methods of construction
N <sub>2</sub> O	nitrous oxide
OGC	Office of Government Commerce
OSM	off-site manufacturing
PFCs	perfluorocarbons
SF <sub>6</sub>	sulfur hexafluoride
SfC	Strategic Forum for Construction
SIC	Standard Industrial Classification
TS	Technical Specification

UK                      United Kingdom  
UKCG                 UK Contractors Group

Appendix B

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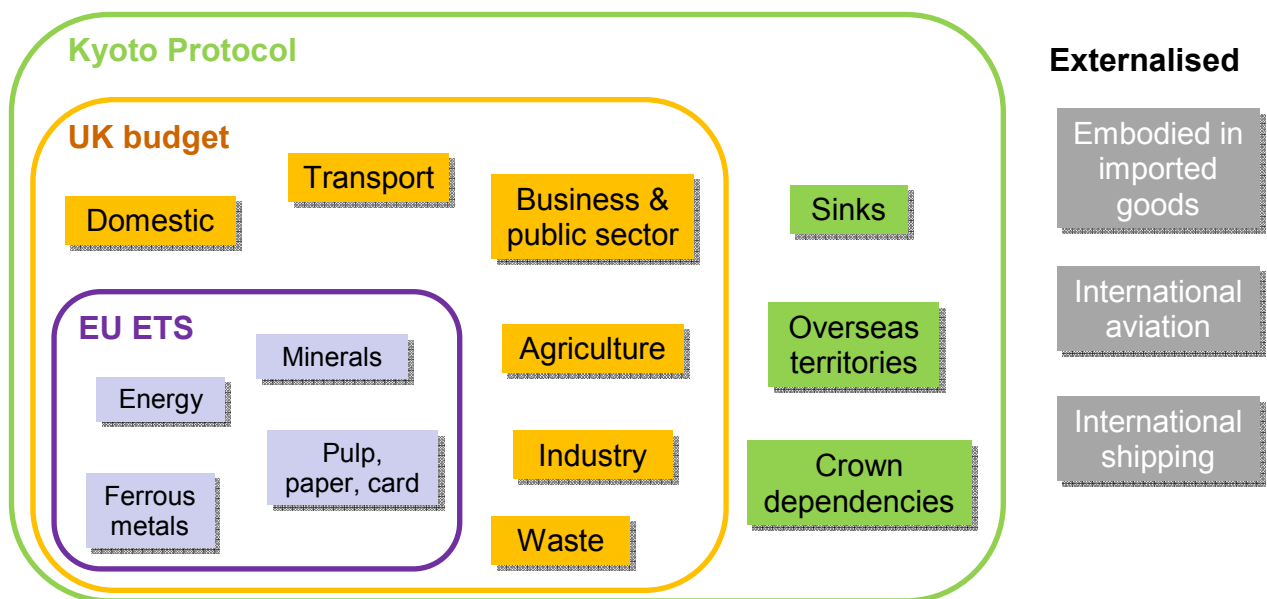
**Links with mandatory  
and voluntary  
programmes**

## B1 Context for the target

The 15% target was set in 2008 and since then there have been major developments in climate change legislation and regulations. This section places the target in the context of these drivers.

In terms of mandatory legislation and regulation, the construction sector is not specifically addressed. Instead, there are implications for the construction industry in a number of programmes that aim to move the UK towards a low carbon economy. The figure below shows the relationship between key legislative frameworks relevant to the UK. Reductions in emissions from construction processes would contribute to reduction targets for 'industry', construction logistics would contribute to 'transport', and from office activities to 'business and public sector'.

Relationship between the Kyoto Protocol, UK carbon budget, and EU Emissions Trading Scheme



## B2 Legal and other requirements

### B2.1 Climate Change Act 2008

In terms of legislation, the UK construction sector is covered by the Climate Change Act 2008. The Act makes it the duty of the Secretary of State to ensure that the net UK carbon account for all six Kyoto greenhouse gases for the year 2050 is at least 80% lower than the 1990 baseline. This effectively makes the UK the first country to put carbon emissions reduction targets into law. This duty has led to the mandatory initiatives described below.

### B2.2 UK Low Carbon Transition Plan

On 15 July 2009, the Government published the *UK Low Carbon Transition Plan*, which plots how the UK will meet the cut in emissions to meet the intermediate target of 34% on 1990 levels by 2020. The Plan sets the platform for the UK's position at the Conference of Parties 15 in Copenhagen in December 2009, where the successor to the Kyoto Protocol will be negotiated.

Within the Transition Plan, there are no reductions required from construction processes in any of the budget periods (2008-2012, 2013-2017 and 2018-2022). Construction does not fall under any of the categories within the carbon budget, which are:

- EU ETS;
- transport;
- households;
- business and public sector;
- renewables;
- waste; and
- agriculture.

The Committee on Climate Change (CCC) is an independent body established by the Climate Change Act 2008 to report to Parliament on the progress made in reducing greenhouse gas emissions. As there are no carbon budgetary implications for the 15% target, it appears that the outcomes of this project do not need to be reported to the CCC.

### **B2.3 Low Carbon Industrial Strategy**

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The *Low Carbon Industrial Strategy* was published alongside the Transition Plan to position the UK to capitalise on the global demand for low carbon goods and services. The Industrial Strategy addresses construction in a limited way, focusing on the construction of energy infrastructure. Therefore, there are no reporting or alignment obligations for this project with the Industrial Strategy.

### **B2.4 EU Emissions Trading Scheme**

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The EU Emissions Trading Scheme (ETS) was established by an EU Directive as a mechanism for meeting its Kyoto Protocol emissions reduction target. It is currently in its second period, which will expire in December 2012. It currently covers approximately 40% of EU CO<sub>2</sub> from:

- energy activities (combustion installations with a rated thermal input exceeding 20 MW, mineral oil refineries, coke ovens);
- production and processing of ferrous metals;
- mineral industry (cement clinker, glass and ceramic bricks); and
- pulp, paper and board activities.

Construction processes are not affected by the EU ETS except through the purchase of energy from installations covered by the scheme.

### **B2.5 Climate Change Levy and Climate Change Agreements**

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The Climate Change Levy (CCL) was introduced in April 2001 as additional tax for business and public organisations that use electricity, natural gas as supplied by a gas utility, petroleum, liquefied petroleum gas, coal and lignite, and coke.

Energy intensive sectors that sign a Climate Change Agreement (CCA) pay a reduced levy if they are able to meet targets for energy efficiency and greenhouse gas emissions. Construction processes are not covered by CCAs.

### **B2.6 Carbon Reduction Commitment**

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The Climate Change Act 2008 has enabled the implementation of the Carbon Reduction Commitment (CRC) Energy Efficiency Scheme. The CRC is a form of emissions trading scheme that caps GHG emissions produced by large commercial and public sector

organisations. The scheme will be compulsory for any public or private organisation using more than 6,000 MWh of half-hourly metered electricity (which equates to around £500,000 in electricity bills). It is designed to reduce emissions not already covered by Climate Change Agreements and the EU ETS.

The CRC will affect large construction companies and their suppliers. Emissions from buildings and site offices will be monitored from April 2010, with the first sale of allowances to occur from April 2011. CRC data is a potential data source to inform the update of emissions from the construction sector, although it will not capture changes from smaller companies.

## **B2.7 Code for Sustainable Homes**

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The Code for Sustainable Homes is a mandatory scheme that measures the sustainability of a new home against nine categories of sustainable design, rating the 'whole home' as a complete package. It uses a one to six star rating system to communicate the overall sustainability performance of a new home.

Management credit 3 deals with 'construction site impacts'. In order to gain credits, at two or more of the following items are to be addressed.

- Monitor, report and set targets for CO<sub>2</sub> production or energy use arising from site activities
- Monitor and report CO<sub>2</sub> or energy use arising from commercial transport to and from site
- Monitor, report and set targets for water consumption from site activities
- Adopt best practice policies in respect of air (dust) pollution arising from site activities
- Adopt best practice policies in respect of water (ground and surface) pollution occurring on the site
- 80% of site timber is reclaimed, re-used or responsibly sourced.

For methodology development, it may be possible to review applications for Code ratings and to use any data available on construction GHGs to represent typical domestic construction projects.



## B3 Voluntary initiatives

### B3.1 BRE Environmental Assessment Method (BREEAM)

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BREEAM (BRE Environmental Assessment Method) is a voluntary environmental assessment method for buildings. As with the Code for Sustainable Homes (Section B2.7), BREEAM awards credits for managing construction site impacts. In order to gain credits, at two or more of the following items are to be addressed.

- Monitor, report and set targets for CO<sub>2</sub> or energy arising from site activities
- Monitor, report and set targets for CO<sub>2</sub> or energy arising from transport to and from site
- Monitor, report and set targets for water consumption arising from site activities
- Implement best practice policies in respect of air (dust) pollution arising from the site
- Implement best practice policies in respect of water (ground and surface) pollution occurring on the site
- Main contractor has an environmental materials policy, used for sourcing of construction materials to be utilised on site
- Main contractor operates an Environmental Management System.

For methodology development, it may be possible to review applications for BREEAM ratings and to use any data available on construction GHGs to represent typical non-domestic construction projects.

### B3.2 Civil Engineering Environmental Quality Assessment and Award Scheme (CEEQUAL)

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CEEQUAL was developed with support from organisations including CIRIA and Crane Environmental. It is an assessment and awards scheme for improving sustainability in civil engineering and public realm projects. Awards are made to projects in which the clients, designers and contractors go beyond the legal and environmental minima to achieve distinctive standards of performance.

CEEQUAL uses a points-based scheme with criteria and questions regarding carbon. For construction processes, the relevant questions are:

- Is there evidence that the project has considered the energy consumption of the project during construction?
- Is there evidence that the contractor has considered the carbon emissions of the project during construction?
- Is there evidence that the design has incorporated appropriate measures to reduce energy consumption during construction where feasible?
- Is there evidence that the contractor has considered appropriate measures to reduce energy consumption and/or carbon emissions during construction and have these been incorporated through an energy management plan, or energy management section of a Site Environmental Management Plan, or Integrated Project Plan?
- Has the procurement, maintenance and use of construction plant been influenced by consideration of their energy efficiency, energy type or carbon emissions?
- Has energy from renewable and/or low- or zero-carbon resources been used during construction?
- Is there evidence that construction plant and ancillary equipment has been maintained to maximise fuel efficiency and minimise carbon emissions?

- Is there evidence that energy use has been monitored and controlled on site as and where possible?

CEEQUAL guidance lists evidence considered acceptable for demonstrating that the above questions have been addressed. These include specifications, plant documentation and target setting. For methodology development, it may be possible to review applications for CEEQUAL awards and to use any data available on construction process GHGs to represent infrastructure construction projects.

### **B3.3 Greenhouse Gas Protocol (GHG Protocol)**

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The World Resources Institute and World Business Council for Sustainable Development have produced the GHG Protocol, an accounting methodology for governments and businesses to understand, quantify, and manage greenhouse gas emissions.

The Corporate Standard is commonly referenced by reporting guidelines, including the Global Reporting Initiative, Carbon Disclosure Project and Defra GHG reporting guidelines. Other GHG Protocol standards include a Project Protocol, the Product Protocol (under development) and Supply Chain Protocol (under development).

### **B3.4 Global Reporting Initiative (GRI)**

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The GRI is a network-based organisation that has pioneered the development of the world's most widely used sustainability reporting framework. It sets out the principles and indicators that organisations can use to measure and report their economic, environmental, and social performance.

Specific GRI carbon indicators include:

- Total direct and indirect greenhouse gas emissions by weight
- Other relevant indirect greenhouse gas emissions by weight
- Initiatives to reduce greenhouse gas emissions and reductions achieved.

To calculate carbon emissions, GRI guidance refers to the GHG Protocol.

GRI is exploring opportunities to develop sector specific reporting guidelines for the Construction and Real Estate Industry.

For methodology development, it may be possible to review the reports and databases of companies that have submitted GRI reports in order to understand the relative significance of construction and office activities.

### **B3.5 Carbon Disclosure Project (CDP)**

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The CDP is an independent not-for-profit organisation which holds the largest database of corporate climate change information in the world. A number of construction-related companies have already reported, although scope and boundaries are not clearly stated. To calculate carbon emissions, CDP guidance refers to the GHG Protocol.

Organisations who have publicly reported are visible including the source of data for representative organisations. The construction organisations listed on the CDP include:

- Balfour Beatty
- Skanska
- Bouygues
- Carillion
- Keller
- Kier Group
- Morgan Sindall
- Vinci

- Interserve

For methodology development, it may be possible to review the reports and databases of companies that have disclosed their organisational emission via the CDP in order to understand the relative significance of construction and office activities.

### **B3.6 Defra guidance on how to measure and report greenhouse gas emissions**

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Defra guidance on reporting GHG emissions aims explains how to measure emissions and set targets to reduce them. It is a voluntary standard for business and for public and voluntary sector organisations.

Defra's guidance is based on the GHG Protocol, and aligns with other national and international voluntary measuring and reporting schemes such as ISO 14064-1 and the Carbon Trust Standard.

### **B3.7 European Network of Construction Companies for Research and Development (ENCORD) Construction CO<sub>2</sub> Measurement Protocol**

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ENCORD members and partner construction organisations are currently developing a measurement protocol to detail the method to be used when measuring the GHG emissions of an organisation within the construction sector.

The protocol follows the methodology of the Greenhouse Gas Protocol (GHG Protocol) March 2004 revision. It addresses the main sources of emissions over which a construction company may have some influence and the method of measuring these emissions. Guidance will be provided on reporting methods at a company and project level, with a view that companies will report their emissions publicly.

Appendix C

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**Definitions of the  
construction industry**

### ***Rethinking Construction, The Report Of The Construction Task Force, 1998 (the 'Egan Report')***

*Rethinking Construction* was published in 1998 and aimed to advise the Deputy Prime Minister from the clients' perspective on the opportunities to improve efficiency and quality of delivery of UK construction. It built on the landmark 1994 report, *Building the team* (the 'Latham Report').

The Egan Report examined in particular the issues around improving the quality and efficiency of housebuilding.

### **The Construction (Design & Management) Regulations 2007 (CDM 2007)**

CDM 2007 came into force on 6 April 2007 and applies to construction work in Great Britain. It is designed to help improve health and safety in industry and plan for and manage risks on site. Requirements are specified for all construction projects, with additional requirements where projects are notifiable to the Health and Safety Executive (HSE). Notifiable projects are those that:

- last longer than 30 days; or
- involve more than 500 person days of construction work.

### **Division 45 of the Revised 2003 Standard Industrial Classification (SIC) of Economic Activities**

The SIC is used by the Office of National Statistics to classify business establishments and other statistical units by the type of economic activity in which they are engaged. The classification provides a framework for the collection, tabulation, presentation and analysis of data and its use promotes uniformity.

Division 45 (Construction) includes general construction and special trade construction for buildings and civil engineering, building installation and building completion. It includes new work, repair, additions and alterations, the erection of pre-fabricated buildings or structures on the site and also constructions of a temporary nature.

The BIS-published *Construction Statistics Annual* is based on Division 45 of the SIC. It is likely that in Government publications (such as the UK Low Carbon Industrial Strategy), where the construction sector is not explicitly defined, the document implicitly refers to the definition in Division 45 of the Revised 2003 SIC, unchanged from the 1992 SIC. The sub-divisions of Division 45 are:

#### 45.1 Site preparation

45.11 Demolition and wrecking of buildings; earth moving

45.12 Test drilling and boring

#### 45.2 Building of complete constructions or parts thereof; civil engineering

45.21 General construction of buildings and civil engineering works

45.21/1 Construction of commercial buildings

45.21/2 Construction of domestic buildings

45.21/3 Construction of civil engineering constructions

45.22 Erection of roof covering and frames

45.23 Construction of motorways, roads, railways, airfields and sports facilities

45.24 Construction of water projects

- 45.25 Other construction work involving special trades
- 45.3 Building installation
  - 45.31 Installation of electrical wiring and fittings
  - 45.32 Insulation work activities
  - 45.33 Plumbing
  - 45.34 Other building installation
- 45.4 Building completion
  - 45.41 Plastering
  - 45.42 Joinery installation
  - 45.43 Floor or wall covering
  - 45.44 Painting and glazing
  - 45.45 Other building completion
- 45.5 Renting of construction or demolition equipment with operator
  - 45.50 Renting of construction or demolition equipment with operator

### **BS EN 15978 Sustainability of construction works – for the assessment of environmental performance of buildings – calculation method**

The purpose of BS EN 15978 (working draft document TC 350 WI 01) is to provide calculation rules for the assessment of the environmental performance of new and existing buildings. It is part of a suite of European standards, technical specifications and reports for the assessment of the environmental performance of the building.

The assessment methodology is based on a life cycle approach. It proposes a definition of construction processes as:

(module A4) Transport of:

- materials and products from the factory gate to the building site;
- construction equipment from the supplier to the site; and
- materials from site (including waste and materials for re-use/recycling).

(module A5) Construction – installation processes including:

- ground works and landscaping;
- transport of materials, products, waste and equipment within the site;
- construction process;
- product installation, including ancillary products;
- temporary works; and
- waste management.

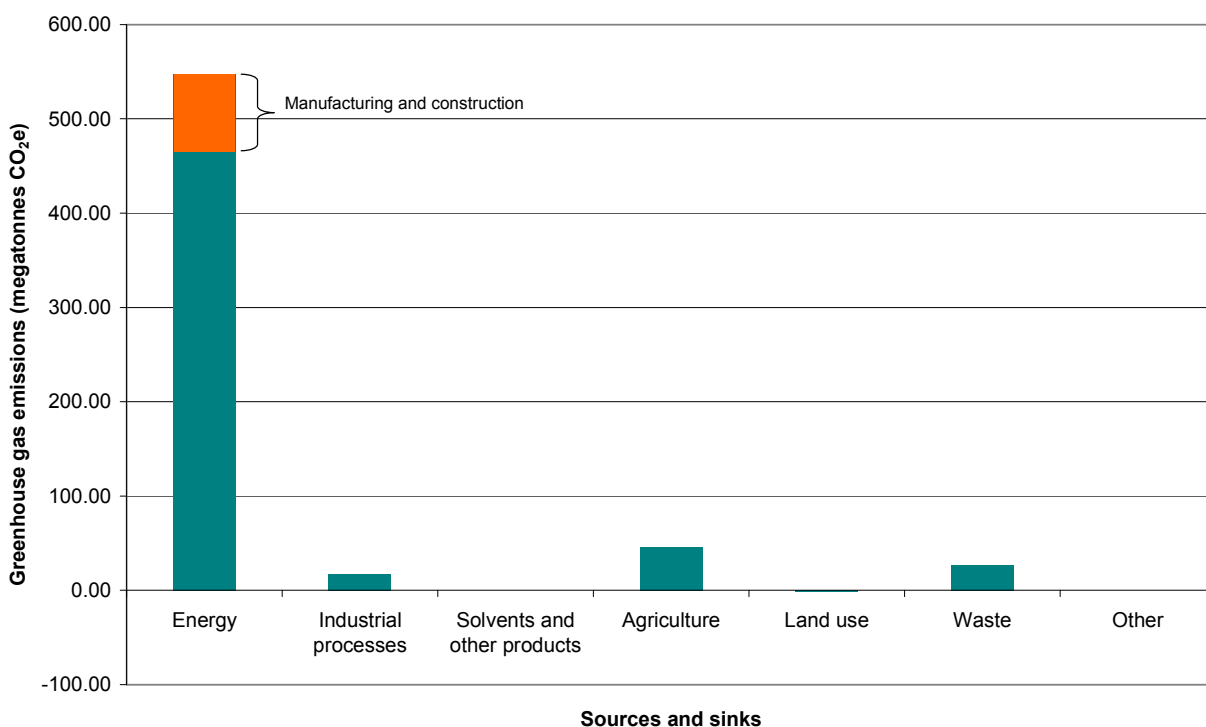
The draft standard specifically excludes the transport of people to and from the site.

The draft BS EN 15978 therefore proposes a 'gate to construction' scope for construction processes.

**United Nations Framework Convention on Climate Change (UNFCCC) Inventory Reporting Guidelines, Category 1A2 Manufacturing Industries and Construction**

The UK’s national greenhouse gas inventory is compiled each year in accordance with the UNFCCC Inventory Reporting Guidelines (FCCC/CP/2002/8). Source Category 1A2 in the inventory is for ‘manufacturing industries and construction’, which covers autogenerators, fuel combustion, cement clinker cement clinker manufacture, lime manufacture, and iron and steel processes. In 2007, category 1A2 CO2 emissions were reported at around 80 megatonnes. It is not possible to separate construction carbon information from manufacturing information. The figure below shows the breakdown of emissions sources and removals in 2007, as reported to the IPCC.

**UK national emissions and removals 2007**



**Construction Industry Research and Information Association (CIRIA)**

CIRIA is an independent member based not-for-profit association that delivers business improvement services and research activities for the construction industry. It provides guidance for construction processes relevant to the business areas of:

- building maintenance;
- building refurbishment;
- buildings and house building;
- construction of new roads and railways;
- construction work at harbours and docks;
- construction work on airports;
- dam, reservoir, water and wastewater treatment plant construction;
- demolition;

- design;
- pipe and tunnel installation;
- rail maintenance works;
- road maintenance works;
- site investigations; and
- working with or around water



Appendix D

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**Data sources to be reviewed**

**Existing data sources**

Arup – Carbon and Cost Calculator

BRE – BREEAM applications that seek credit for the management of carbon from construction sites

California Department of Transportation (2009), *Construction Manual*, State of California Distribution Unit

Carbon Trust – Anonymised organisational carbon data

CBI Construction Council members, with support of UK Construction Group Environment forum – carbon accounts from individual organisations received in response to survey

CIRIA – CEEQUAL applications that seek credit for Section 7 credits for energy and carbon

Consortium on Green Design and Manufacturing (2003), *Pavement LCA Tool for Environmental and Economic Effects*, University of California, Berkley

Defra (2009), *Guidance on how to measure and report your greenhouse gas emissions*

Environment Agency and Jacobs (2007) – Environment Agency Carbon Calculator

Environment Agency – waste transfer notes

HM Revenue & Customs – Climate Change Levy data

Hutchins (2010, *UK Building Costs Blackbook 2010: The Capital Cost and Embodied CO<sub>2</sub>*, Guide Volume Two: Major Works, Franklin+Andrews

ISA UK Research & Consulting – Bottomline3 software with input-output databases

Lockie S (2009), *Low carbon: building a better future*, New Civil Engineer, 1 October 2009

Office for National Statistics (ONS) (2009), *Construction Statistics Annual* (ISSN=17580838)

Pan W., Gibb A., and Dainty A., (2005), *Offsite Modern Methods of Construction in Housebuilding: perspectives and practices of leading UK Housebuilders*, Loughborough University, Loughborough

Pantelidou H, Nicholson D, Hughes L, Jukes A, Wellappili L (2009), *Earthworks emissions in highway projects*, Arup

PE International & EcoInvent – GaBi 4.0 life cycle assessment software and databases

WRAP (2007), *Current Practices and Future Potential in Modern Methods of Construction*, Waste and Resources Action Plan

Others – Estimation software and methods used by individual contractors

**Future data sets**

Carbon Reduction Commitment (April 2010 onwards), baseline and annual emissions reporting by construction companies