Construction Waste Measurement Protocol

A guide to measuring and reporting waste from construction activities
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Introduction
Introduction

This document provides guidance on how to measure and report waste arisings and reuse / recycling / recovery from construction, demolition and excavation activities on construction projects. The quantity data produced can also be used calculate scope 3 CO$_2$e emissions from waste as laid out in the ENCORD Construction CO$_2$e Measurement Protocol.

Although this document focuses on EU legislation to help define and categorise waste, the principles of measurement can be used by any construction organisation to establish the quantities of waste produced, and subsequent reuse / recycling / recovery. However it is not intended to supersede any local or national legal reporting guidelines.

The European Waste framework Directive (2008/98/EC) states that:

“The first objective of any waste policy should be to minimise the negative effects of the generation and management of waste on human health and the environment. Waste policy should also aim at reducing the use of resources, and favour the practical application of the waste hierarchy...

…In order to comply with the objectives of this Directive, and move towards a European recycling society with a high level of resource efficiency, Member States shall take the necessary measures designed to achieve the following targets:…

(b) by 2020, the preparing for re-use, recycling and other material recovery, including backfilling operations using waste to substitute other materials, of non-hazardous construction and demolition waste excluding naturally occurring material defined in category 17 05 04 in the list of waste shall be increased to a minimum of 70% by weight”

Many European Governments have policies and agendas that focus on reducing waste production, reducing waste to landfill, and/or reducing incineration with no energy recovery. For example the Strategy for Sustainable Construction (2008)$^1$ in England and the Plan Nacional de Residuos de Construcción y Demolición (Plan of Construction and Demolition Wastes) in Spain. (See Appendix 1 for further details).

The business case for reducing waste production is also compelling, with the cost associated with waste (material, logistics, labour, and disposal costs) accounting for a significant proportion of the contract value. Any reduction in waste production will reap significant benefits for all involved in the construction process including increased resource efficiency and reduced cost.

This document sets out the principles and a clear method for the collection, and if required the reporting, of construction, demolition and excavation (CD&E) waste data, and covers:

1.0 Scope of waste measurement and reporting
2.0 Levels of reporting
3.0 Units of measurement
4.0 Waste destinations and waste diversion rates
5.0 Key Performance Indicators (KPIs)
6.0 Glossary of terms

It is recommended that all construction clients and contractors adopt these principles in order to improve consistency and transparency in the industry.

Any words or phrases highlighted as indicated are explained in more detail in the glossary at the back of the document.

$^1$ www.bis.gov.uk/files/file52843.pdf
1.0 Scope of waste measurement and reporting
1.0 Scope of waste measurement and reporting

The following points outline the scope of waste measurement, and the reporting requirements where applicable. See Appendix 2 for further guidance on defining what waste is to be reported.

1.1 Only materials taken off site as waste are to be measured against the primary and secondary indicators. In most locations this information is available through the use of waste movement records required by European waste legislation.

1.2 Different diversion rates will then be applied to calculate the amount of waste sent to landfill/incineration without energy recovery, depending on the type and condition of the material, and the destination to which it is sent (see Section 4.0 for further detail).

1.3 Organisations should record (as a minimum):
   i) Total tonnes (or bulk m³) of waste arisings for all construction works undertaken
   ii) Total tonnes (or bulk m³) of waste sent to landfill/incineration without energy recovery for all construction works undertaken
   iii) Total construction cost of all construction works undertaken

1.4 It is recommend that 1.3.i) and 1.3.ii) are recorded according to the source activity as follows:
   i) Construction Waste
   ii) Demolition Waste
   iii) Excavation Waste

1.5 All subcontractor wastes that are part of the contract of works should be reported. Companies should also include wastes from associated activities on the site (ie. waste resulting from the site office and temporary site infrastructure).

1.6 It is optional to record the following data, but the data must not be included within the primary or secondary indicators outlined in section 5, as in many cases the quantities will be based on estimates rather than auditable records of waste movements:
   i) Waste materials that are either reused in their original form, or remediated, processed or recycled on the site of production, and subsequently reused on the site of production.
   ii) Waste materials that are processed or recycled on the site of production into a non-waste product, and then sent off site for reuse elsewhere.

1.7 It is optional to report company waste that does not result from a construction site (eg. central office and plant depot waste), and this is to be reported separately as ‘Premises Waste’.

ENCORD members should aim to identify waste from construction, demolition and excavation activities separately as recommended in 1.4.
For the purpose of reporting construction waste from joint venture (JV) projects, it is recommended best practice that the operational control approach is used.

i) Under this approach, a company would record and report all waste data from the JV projects over which it, or one of its subsidiaries, has operational control. The wastes produced in other JV projects over which the organisation does not have operational control will consequently not be reported.

ii) However, where no one organisation has overall operational control, then the equity share approach should be used.

iii) If an organisation uses the equity share approach or the financial control approach for measuring and reporting its GHG emissions, in order to be consistent, the same approach should be used for recording its waste data.

Organisations can choose the level of detail in which they report; further explanation is provided in Section 2.0 Levels of Reporting.

Organisations should report their waste production in their annual report as a minimum. However it is best practice for these data to be collated and checked on a quarterly basis.

Q1 - Do we need to record materials removed by subcontractors?
If it can be proved not to be a waste under the waste framework directive, then it does not need to be measured. For example if a subcontractor removes excess materials from site for their reuse elsewhere, then they have not discarded them, so they should not be recorded as waste. However if a subcontractor removes empty paint containers from site, or disposes of materials in the principal contractor’s skip, then this would be classed as discarded and therefore classed as waste and would need to be measured and reported.

Q2 - Do we need to record excavated soil that is to be reused on another part of the same site?
No. As the material is being reused in its original form on the site of production this does not need to be measured and reported as waste, but may optionally be recorded as on-site reuse. However if soil is reused on another site this may need to be recorded as waste depending on local interpretation of the regulations. If in doubt record as waste.

Q3 - Do we need to measure recovered materials?
If it can be proved not to be a waste under the waste framework directive, then it does not need to be measured and reported as waste, but may optionally be recorded as recovered materials. An example could be bricks recovered for reuse on the same site which would not be waste, however bricks recovered for reuse off site may need to be recorded as waste depending on local interpretation of the regulations. If in doubt record as waste.
2.0
Levels of reporting
## 2.0 Levels of reporting

### 2.1 Organisations can choose the level of detail at which they wish to report their data, as illustrated in the diagram below. The four levels are: Minimum, Basic, Intermediate, and Detailed.

<table>
<thead>
<tr>
<th>Levels of Data</th>
<th>Minimum Data</th>
<th>Basic Data</th>
<th>Intermediate Data</th>
<th>Detailed Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total C, D &amp; E waste</td>
<td>Total C, D &amp; E to landfill</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hazardous</td>
<td>Hazardous</td>
<td>Non Hazardous</td>
<td>Hazardous (Inert)</td>
<td>EWC code</td>
</tr>
<tr>
<td>Non Hazardous</td>
<td>Non Hazardous</td>
<td>Non Hazardous (Inert)</td>
<td>Non Hazardous (Inert)</td>
<td>EWC code</td>
</tr>
</tbody>
</table>

As a minimum, ENCORD members will need to identify and report at the ‘minimum data’ level, but should aim to report at ‘Basic Data’ level in the future.
2.2 Data entries can also be tagged by project type. These project types are consistent with the ENCORD Construction CO₂e measurement protocol.

<table>
<thead>
<tr>
<th>Tier 1</th>
<th>Tier 2</th>
<th>Tier 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All construction</td>
<td></td>
</tr>
<tr>
<td>Tier 2</td>
<td>All Buildings</td>
<td></td>
</tr>
<tr>
<td>Tier 3</td>
<td>All Civil Engineering</td>
<td></td>
</tr>
<tr>
<td>Tier 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial Offices</td>
<td>Commercial Other</td>
<td>Airports</td>
</tr>
<tr>
<td>Commercial Retail</td>
<td>Education</td>
<td>Bridges &amp; Structures</td>
</tr>
<tr>
<td>Healthcare</td>
<td>Industrial Buildings</td>
<td>Coastal protection</td>
</tr>
<tr>
<td>Public Buildings</td>
<td>Transport</td>
<td>Development site infra</td>
</tr>
<tr>
<td>Residential</td>
<td>Mixed Use</td>
<td>Flood defence</td>
</tr>
<tr>
<td>Leisure</td>
<td>Buildings - Other</td>
<td>Highways</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ports &amp; harbours</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Railways</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tunnels</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Utilities - infrastructure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Landfill &amp; Quarries</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Civil - Other</td>
</tr>
</tbody>
</table>

As a minimum, ENCORD members will need to differentiate at Tier level 2 (All Building and All Civil Engineering).

2.3 Finally, organisations may wish to specify whether the data being reported relates to:

i. New construction

ii. Refurbishment / maintenance

iii. All construction activity
3.0
Units of measurement
3.0 Units of measurement

3.1 Waste should be reported in tonnage wherever possible. Organisations that cannot measure all of their waste by tonnage should apply standardised volume to mass conversion factors. These factors should take into account both the density of the material and the bulking factor (to allow for void space). The high level conversion factors below originate from the UK Environment Agency / Environment Agency Wales[^2], and are also available on the WRAP website[^3]. However, where a more detailed breakdown of the waste is available, or other verifiable country / company specific conversion factors are available, to give a more accurate weight, then these should be used.

Conversion factors exist for different levels of detail (e.g. activity type > waste stream > EWC code). The basic conversion factors used at the highest level (to convert m$^3$ bulk volume to tonnes) are:

- **Construction Waste** (mixed) – 0.87
- **Demolition Waste** (mixed) – 0.87
- **Excavation Waste** – 1.25

Where organisations can only measure and report waste in volume, only primary volume (bulk volume) or mass data, that has not undergone any previous conversion, should be used to calculate the tonnage. Some site waste management planning tools (e.g. BRE’s SMARTWaste) allow entry of data by volume and will convert it to mass and/or apply a compaction factor. If this is the case, the original bulk volume data should be used for the calculation, so as not to apply bulking factors twice.

4.0 Waste destinations and waste diversion rates
4.0 Waste destinations and waste diversion rates

4.1 Waste materials may be sent to a number of off-site destinations. Monitoring the amount of waste going to each destination will allow the calculation of CO₂e emissions from off-site waste disposal, and conversion factors will be developed for the following:

- Beneficial Reuse off site
- Remediation
- Recycling (via Recycling Centre, Material Recycling Facility, Waste Transfer Station)
- Incineration with energy recovery
- Incineration without energy recovery
- Landfill

See the ENCORD CO₂e Protocol for further information on waste CO₂e conversion factors.

4.2 Wherever possible, data on the actual diversion rates achieved by a waste destination (that can be verified by Government Agency or other approved third party verification) should be used when calculating the waste diversion from a construction site. An individual contractor may wish to audit transfer stations and waste management companies used in order to further validate data received. Organisations should specify that this information is required when procuring waste management services.

Where these data is not available, or it would be uneconomical to obtain, then the quantity of waste being recovered via each destination can be calculated using the diversion rates outlined in Table 1 in Appendix 3.

4.3 It is also optional to record materials falling into any of the scenarios below:

- The quantity of material that as a result of on-site treatment, in accordance with European Waste Directive guidelines, is no longer considered to be a waste; becoming a material/product which is then reused on or off site.
- The quantity of material, which originally was destined for landfill, but that has now been possible to incorporate into the works without any further treatment (beneficial reuse on site), for example by adjusting cut and fill levels.

These figures will not affect the KPIs as the material is not recorded as a waste, but recording them will allow an organisation to identify where projects are taking steps to reduce these waste arisings.
5.0
Key Performance Indicators (KPIs)
# Key Performance Indicators (KPIs)

The following KPIs are to be used to enable comparison of waste between sectors and project types:

## 5.1 Primary Indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total waste arisings</td>
<td>Absolute in Tonnes (construction, demolition and excavation)</td>
</tr>
<tr>
<td>Waste recovery</td>
<td>Percentage of all construction, demolition and excavation waste diverted from landfill/incineration without energy recovery (%)</td>
</tr>
</tbody>
</table>

## 5.2 Secondary Indicators (optional)

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Waste arisings (excluding demolition and excavation waste)</td>
<td>Tonnes of waste generated per million of construction cost (t / £/€/$)</td>
</tr>
<tr>
<td>Quantity of waste recovered and reused on the site of production</td>
<td>Tonnes</td>
</tr>
<tr>
<td>Quantity of waste recovered on the site of production, and removed as a non-waste product</td>
<td>Tonnes</td>
</tr>
<tr>
<td>Waste shipped internationally</td>
<td>Percentage of waste transported</td>
</tr>
</tbody>
</table>


6.0
Glossary
6.0 Glossary

6.1 Waste

6.1.1
The definition within Article 3 of the European Waste Framework Directive (2008/98/EC)\(^4\) is used to define waste. This states that:

‘Waste means any substance or object which the holder discards or intends or is required to discard.’

However the following exclusions apply:

a. Uncontaminated soil and other naturally occurring material excavated in the course of construction activities where it is certain that the material will be used for the purposes of construction in its natural state on the site from which it was excavated.\(^5\)

b. Waste waters (such as trade effluent disposed of via tankers, foul sewers, surface water drains, water courses, etc.\(^6\))

6.1.2
In addition, where waste material produced in the course of construction activities is going to be reused on the site of production, either following on-site processing or in its original state, this guidance does not require this material to be reported as waste. See Appendix 2 for further details.

6.2 Construction, demolition and excavation (CD&E) waste

6.2.1
Demolition waste – Unwanted material arising from the demolition or strip out of an existing structure.

6.2.2
Excavation waste – Unwanted material resulting from excavation activities such as a reduced level dig and site preparation and levelling, and the excavation of foundations, basements, tunnels, and service trenches, typically consisting of soils and stones.

6.2.3
Construction waste – Any other unwanted material produced at the construction site, which is not classified as Demolition or Excavation waste.

6.3 Construction cost

Cost in the context of a construction project is the price in the accepted tender or, if there is no tender, the cost of labour, plant and materials, overheads and profit for the construction phase. For a contractor this could be their turnover.

6.4 Construction works

For the purpose of reporting construction waste data, the definition of a construction project is taken from the UK Site Waste Management Plans Regulations (2008):

‘Construction work’ means the carrying out of any building, civil engineering or engineering construction work and includes:

a. The construction, alteration, conversion, fitting out, commissioning, renovation, repair, upkeep, redecoration or other maintenance (including cleaning which involves the use of water or an abrasive at high pressure or the use of corrosive or toxic substances), de-commissioning, demolition or dismantling of a structure;

b. The preparation for an intended structure, including site clearance, exploration, investigation (but not site survey) and excavation, and the clearance or preparation of the site or structure for use or occupation at its conclusion;

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\(^5\) Article 2, paragraph 1c of Waste Framework Directive 2008/98/EC

\(^6\) Article 2, paragraph 2a of Waste Framework Directive 2008/98/EC
c. The assembly on site of prefabricated elements to form a structure or the disassembly on site of prefabricated elements which, immediately before such disassembly, formed a structure;

d. The removal of a structure or of any product or waste resulting from demolition or dismantling of a structure or from disassembly of prefabricated elements which immediately before such disassembly formed such a structure; and

e. The installation, commissioning, maintenance, repair or removal of mechanical, electrical, gas, compressed air, hydraulic, telecommunications, computer or similar services which are normally fixed within or to a structure, but does not include the exploration for or extraction of mineral resources or preparatory activities carried out at a place where such exploration or extraction is carried out.

6.5 Container

Any waste receptacle designed to hold waste material prior to and during removal from site. This would include roll-on roll-off containers, skips, compactors, bins, bags, etc.

6.6 Waste destinations

- **Beneficial Re-use** – the beneficial re-use of materials in their current form (either on-site or off-site) which are subject to exemptions from the permit requirements as detailed in Article 24 of the European Waste Framework Directive (2008/98/EC).
- **Remediation** – the removal of pollution or contaminants from environmental media such that the material can be put to beneficial re-use.
- **Recycling** – the reprocessing of wastes, either into the same material (closed-loop) or a different material (open-loop).

- **Incineration with Energy recovery** – the process of recovering the embodied energy of a material through incineration.
- **Incineration without energy recovery** – the incineration of waste without recovering the embodied energy.
- **Landfill** – The disposal of waste in the ground.

6.7 Diversion rates

This is the percentage of any waste arising that is not sent to landfill or for incineration without energy recovery (with the exception of material going to landfill for beneficial re-use as described in Section 4.0).

The Diversion Rates outlined in Appendix 3 will be reviewed every two years, and where revised information is available (from either inside or outside Europe), they will be updated.

6.8 Project

‘Project’ means a project that includes or is intended to include construction work and includes all planning, design, management or other work involved in a project until the end of the construction phase.

6.9 EWC Code

European Waste Catalogue code, latterly known as the List of Waste code. Used to identify individual waste streams.
Appendices
Appendix 1

Examples of European Government policies and objectives

UK
The Strategy for Sustainable Construction (2008) in England has a specific target for the construction sector, defined as:

“By 2012, a 50% reduction in construction, demolition and excavation waste to landfill compared to 2008”.

In conjunction with the United Kingdom Contractors Group (UKCG) and Civil Engineering Contractors Association (CECA), the delivery body for UK waste strategies, the Waste & Resources Action Programme (WRAP), have established the following Key Performance Indicators (KPIs) in order to benchmark the performance of the UK construction industry against waste to landfill targets:

- Waste arisings: tonnes of waste generated per £100k of construction output (t/£100k)
- Waste to landfill: tonnes of waste disposed of to landfill per £100k of construction output (t/£100k)
- Waste diversion rate: percentage of waste diverted from landfill (%)

Spain
The Spanish Plan of Construction and Demolition Wastes (Plan Nacional de Residuos de Construcción y Demolición) which spans from 2008 to 2015 has set the following targets:

- 35% of C&D waste recycled
- 20% of C&D waste subjected to other reuse or recovery operations
- 55% of C&D waste diverted from landfill

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7 www.bis.gov.uk/files/file52843.pdf
8 www.wrap.org.uk/construction
Appendix 2

Defining what is and is not to be reported as waste

This guidance does not require all material defined as waste by the European Waste Framework Directive 2008/98/EC (European WFD) to be reported as waste. However there may be specific requirements to record this material in individual countries.

The following flow chart will help you decide on what is and is not to be reported.

- **Is the material defined as a non-waste under the European WFD?**
  - **Yes**: Not required to be reported as waste
  - **No**: Is the waste material going to be reused on the site of production, either following on-site processing or in its original state?
    - **Yes**: Not required to be reported as waste
    - **No**: Is required to be reported as waste.

- **Is the waste material unwanted material arising from activities at permanent office locations?**
  - **Yes**: Optional to report as Premises Waste
  - **No**: Is the waste material unwanted material arising from the demolition or strip out of an existing structure?
    - **Yes**: Report as Demolition Waste
    - **No**: Is the waste material unwanted material resulting from excavation activities such as those described under 6.2.2?
      - **Yes**: Report as Excavation Waste
      - **No**: Report as Construction Waste
Appendix 3

Waste diversion rates
These diversion rates should only be used where actual data is not available, or it would be uneconomical to obtain.

Table 1 – Waste destinations and associated default diversion rates for waste sent off site.

<table>
<thead>
<tr>
<th>Destination</th>
<th>Diversion rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed waste sent off site for recycling or energy recovery</td>
<td>50%</td>
</tr>
<tr>
<td>Waste deposited in mixed containers on site and sent to a dedicated Recycling Centre, Materials Recovery Facility or Waste Transfer Station for recycling, or incineration at an energy recovery facility.</td>
<td></td>
</tr>
<tr>
<td>Segregated waste sent off site for recycling or energy recovery</td>
<td>80%</td>
</tr>
<tr>
<td>Wastes that are placed into segregated containers on site and sent to a dedicated Recycling Centre, Materials Recovery Facility or Waste Transfer Station for recycling, or incineration at an energy recovery facility.</td>
<td></td>
</tr>
<tr>
<td>Waste Framework Directive Exemptions for beneficial reuse</td>
<td>100%</td>
</tr>
<tr>
<td>Segregated C,D&amp;E sent to a site operating under an exemption for reuse or recycling.</td>
<td></td>
</tr>
<tr>
<td>• Waste consisting of soil and stones (17 05 04) and brick, concrete, tiles and ceramics (17 01 01, 17 01 02, 17 01 03, and 17 01 07), going for use in construction or for the improvement of land under exemptions is classified as beneficial reuse.</td>
<td></td>
</tr>
<tr>
<td>• Other segregated waste, consisting of items such as Timber (17 02 01), Gypsum (17 08 02), Paper (20 01 01), and Packaging (15 01 01, 15 01 02, 15 01 06), going for recycling under an exemption.</td>
<td></td>
</tr>
<tr>
<td>Landfill (inert materials for beneficial reuse)</td>
<td>50%</td>
</tr>
<tr>
<td>A proportion of inert soil and stones (17 05 04) sent to landfill will go to beneficial reuse (eg. landfill engineering and restoration).</td>
<td></td>
</tr>
<tr>
<td>Landfill/Incineration without energy recovery</td>
<td>0%</td>
</tr>
<tr>
<td>Waste sent to landfill, other than those in ‘Landfill (inert materials for beneficial reuse)’, or for incineration without any form of energy recovery.</td>
<td></td>
</tr>
</tbody>
</table>

10 This figure comes from the CLG Survey of Arisings and Use of Alternatives to Primary Aggregates in England (2005), and will be updated when new data become available.
11 This figure comes from WRAP project report CON900-001 CDEW arisings use and disposal for England 2008 which shows that 57% of inert CDEW entering landfills was beneficially reused and therefore exempt from landfill tax.