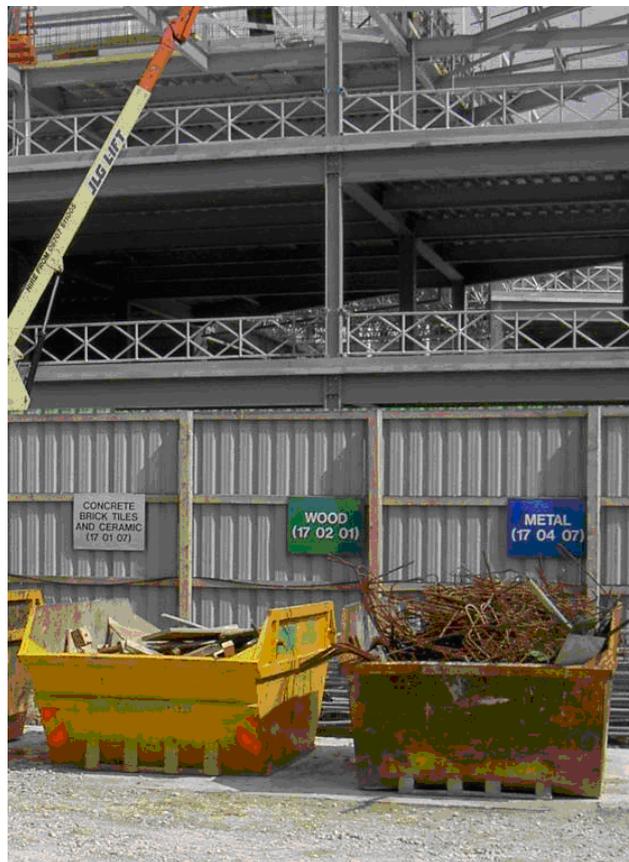


Archetype resource benchmarks for construction projects: Evidence base report



The main objective of this project is to produce a relevant, consistent, robust and accepted dataset of generic resource benchmarks for different types of construction project and built assets. This document comprises the Evidence Base Report for the development of the dataset.

WRAP's vision is a world without waste,
where resources are used sustainably.

We work with businesses, individual and
communities to help them reap the
benefits of reducing waste, developing
sustainable products and using resources
in an efficient way.

Find out more at www.wrap.org.uk

Written by: URS Infrastructure and Environment Ltd

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Executive summary

Background: The Built Environment Programme

The aim of WRAP's Built Environment Programme is to embed resource efficiency in the manufacture and supply of construction products, and the design and construction of new buildings, infrastructure and refurbishment projects. It is advocating five key resource efficiency metrics to the construction industry for quantifying resource efficiency performance. These metrics are:

- waste produced;
- recycled content of materials used;
- embodied carbon in materials and construction activities;
- fossil fuel consumed; and
- fresh water used.

WRAP has also proposed the following two metrics as potential additional measures of resource efficiency:

- total materials used; and
- primary materials used.

Objective of the project

To effectively enable improvements in resource efficiency in construction, it is essential to measure performance and have a benchmark from which relative performance can be determined and targets for improvement can be realised.

The main objective of this project was to produce a relevant, consistent, robust and accepted dataset of generic resource benchmarks for different types of construction project and built assets. The main purpose is two-fold:

- to enable the construction supply chain, including investors, construction clients, contractors and designers, to benchmark the resource efficiency performance of their projects; and
- to provide the basis on which WRAP can measure, monitor and evaluate its influence on the resource efficiency of individual construction projects and the wider construction sector.

The project sought to establish benchmarks that encompass a number of factors including:

- A representative range of construction types and built assets
- New build and refurbishment projects
- Various sizes of company and project across seven metrics
- The key stages in project lifecycle including cradle to as built

Combining all of these factors would result in an overly complicated and large dataset, potentially 840 benchmarks. Therefore, the project has aimed to establish benchmarks for the majority of project types described at the Tier 2 level and where sufficient data is available for projects types at the Tier 3 level as illustrated below.

Project type categorisation				
Tier 1	Tier 2	Tier 3	Cross cutting	
Buildings	Houses	2-bed	New build and refurbishment	Size
		3-bed		
		4-bed		
	Other buildings	Office		
		Retail		
		Health		
		Education		
		Residential		
		Industrial		
		Infrastructure		
Linear infrastructure	Airports			
	Railways			
	Tunnels			
	Other infrastructure	Utilities - streetworks		
		Utilities - infrastructure		
		Ports and harbours		
		Bridges and structures		
		Development site infrastructure		
		Flood defence		
		Coastal protection		

Methodology

The approach used to undertake work for the project is outlined in the bullets below:

- Information gathering and a literature review to collate and review published information from standards and guidance, industry agreements, corporate sustainability reporting, and sources of resource efficiency metric data and benchmarks.
- Stakeholder consultation to understand current approaches to measuring resource use, any benchmarks being used and sources of data. The stakeholders contacted included representatives from the construction industry and supply chain (contractors, clients, designers), industry bodies and specialist organisations, and through other WRAP work such as the project to develop a database of projects detailing embodied carbon impacts (delivered by ARUP) and the Business Cases for improving resource efficiency (delivered by Sweett Group).
- Scoping study to identify where data existed and where there could be gaps.
- Data was sourced from the following areas: Industry datasets; Organisational data; Project data; Case studies; Existing industry benchmarks and targets; Existing corporate benchmarks and targets; Existing project benchmarks and targets
- Review of data to determine appropriateness for inclusion. The data was then collated and analysed to determine typical benchmarks and an evidence base report drafted to document the development of benchmarks for each of the five resource efficiency metrics. The benchmarks calculated were compared to existing publicly available benchmarks in order to determine if they were comparable and therefore appropriate.

Summary of findings

Waste produced

Data available on waste produced in construction projects is considered to be the most comprehensive of all the resource benchmarks. A number of industry and company datasets were available to develop the waste benchmarks. The data from the BRE SmartWaste WRAP project provided the main data source.

The benchmarks for Tier 0 combined 'buildings and infrastructure' for 'new build and refurbishment' projects showed the 75th percentile for waste produced as 39.3m³ per £100,000 construction value and the 50th percentile (median) as 16.3m³ per £100,000 construction value.

The 75th percentile benchmark for Buildings and Infrastructure 'refurbishment' at Tier 0 was 25.5m³ per £100,000 construction value while the 50th percentile is 16.7m² per £100,000 construction value. For 'new build' the 75th percentile for Buildings and Infrastructure is 51.7m³ per £100,000 construction value and the 50th percentile (median average) is 16.6m³ per £100,000 construction value.

Tier 3 benchmarks are generally in line with the Building Research Establishment Environmental Assessment Method (BREEAM) performance indicators. The range of values for the 50th percentile in 'new build', 'other buildings' were 9.7 to 20.6m³ per 100m² or 5.4 to 17.8 tonnes per 100m², with the 25th percentile in the range 4.4 to 12.5m³ per 100m² or 2.9 to 12.8 tonnes per 100m².

Recycled content of materials used

Data available on recycled content in construction projects is considered to be reasonably comprehensive.

WRAP previously published indicative standard and good practice performance in recycled content as a percentage by value on construction projects. These include for commercial retail buildings 11-32% (standard practice) and 21-44% (good practice), Detached/terraced house 6-26% (standard practice) and 16-31% (good practice) and road reconstruction 8-16% (standard practice) and 27-29% (good practice). The benchmarks for recycled content calculated for this project are within the range of those reported by WRAP.

Embodied carbon in materials and construction activities

It is becoming widely recognised that the balance between operational and embodied carbon emissions needs to be considered in order to understand the true carbon impact of new and refurbished buildings however data available on embodied carbon of construction is currently limited.

Fossil fuel consumed

Data for fossil fuel consumption in construction projects is of varying availability and quality, and on-site consumption is more readily available than use in transportation. With the introduction of mandatory carbon reporting many construction companies will be required to collate fossil fuel consumption data in order to report their carbon emissions.

Fresh water used

Measuring water used on construction sites is not yet standard practice and this is reflected in the amount and quality of data currently available. However, water is moving up the agenda due to increasing pressure on water resources in certain areas of the UK.

Total materials used

Data available on total quantity of materials used in construction is limited. Material use is often addressed through other metrics and approaches, such as reducing waste. No existing industry benchmarks or targets were identified for this metric. The definition of total materials applied in the development of this benchmark is the total quantity of construction materials (virgin, reused and recycled) purchased/used for the completion of a given construction project. Under this definition the quantity of waste arising and any materials reused on site has not been removed from the total. Due to the nature of primary data available, benchmarks could only be developed for 'all materials' and 'aggregates only'.

Primary materials used

Data available on the 'quantity of primary materials used' in construction projects is also limited. Primary material and total material use is often addressed through other metrics and approaches such as increasing recycled content and reducing waste. No existing industry benchmarks or targets were identified for this metric. The definition of the term 'quantity of primary materials used in different sources is uncertain. The definition of Primary materials applied in the development of this benchmark is the total quantity of construction materials purchased/used for any construction project minus any materials that are defined as being from recycled or reused sources. Under this definition the quantity of waste arising has not been removed.

Conclusion

It is believed that this is the first time that a project to collate benchmarks across a wide range of resource efficiency metrics in construction projects has been carried out. In the course of undertaking this study it was possible to acquire an insight into the current practices and limitations around the collection of resource efficiency data. Of the five key metrics analysed, waste data would appear to be the most comprehensive largely due to the requirements for data collection and monitoring through Site Waste Management Plans. For the remaining metrics the recording of resource efficiency data seems to be fragmented and inconsistent across different sections of the industry and different project types. As a result, where data does exist, benchmarks within the same resource category i.e. waste, water etc. but with different metrics i.e. per project value or floor area, are often not consistent or collated in the same way.

For the future it is recommended that there is more collaboration within the construction industry to increase the robustness and consistency of the benchmarks in turn enabling companies to measure and benchmark the resource efficiency performance of their projects and set targets for on-going performance improvements. Ultimately, as the benchmarks are increasingly improved and implemented this will help to drive improvements in resource efficiency across the sector.