

Technical Datasheet 8.4 (P2)

Embodied CO₂ of factory-made cements and combinations

Introduction

The embodied CO₂ (ECO₂) for cements and combinations as commonly available in the UK and as listed in the British Standard for 'Concrete — Complementary British Standard to BS EN 206-1' BS 8500: 2006 are shown in Table 1. These figures are rounded up to two significant figures. This datasheet is based on data contained in Datasheet 8.3[P1], 'Embodied CO₂ of UK cement, additions and cementitious material'.

Table 1. Embodied CO₂ of factory made cements and combinations

Cement ^a (Factory made cement)	Combination ^b (CEM I and addition combined at concrete plant)	Secondary Main Constituent (smc) or Addition Low – High Content (%)	Embodied CO ₂ ^c smc content Low – High, (kg CO ₂ /tonne)
CEM I Portland Cement			930
CEM II/A-LL or L Portland Limestone Cement	CIIA-LL or L	6 - 20 (limestone)	880 – 750
CEM II/A-V Portland fly-ash cement	CIIA-V	6 - 20 (fly ash)	870 – 750
CEM II/B-V Portland fly-ash cement	CIIB-V	21 - 35 (fly ash)	730 – 610
CEM II/B-S Portland slag cement	CIIB-S	21 - 35 (ggbs)	740 – 620
CEM III/A Blastfurnace cement	CIIIA	36 - 65 (ggbs)	610 – 360
CEM III/B Blastfurnace cement	CIIBB	66 - 80 (ggbs)	340 – 230
CEM IV/B-V Pozzolanic (siliceous fly ash) cement	CIVB-V	36 - 55 (fly ash)	590 – 420

- a** For CEM I, 1% mac and 5% gypsum is assumed. For CEM II, CEM III and CEM IV at the highest proportion of the smc it is assumed that no mac is incorporated and at the lowest proportion of smc it is assumed that mac is added at 1% with the appropriate proportions of limestone, fly ash and ggbs
- b** For *combinations* the ECO₂ figure for CEM I is used together with the figures for limestone, fly ash and ggbs in the appropriate proportions
- c** ECO₂ figures for CEM II, CEM III and CEM IV and their equivalent combinations are based on the range of smc proportion, where the range is from the minimum to maximum proportion of smc or addition. ECO₂ can be interpolated for proportions of smc or addition between the minimum and maximum, noting that the minimum ECO₂ is associated with the highest proportion of smc or addition



Interpolation of embodied CO₂ in Table 1

As stated in the footnotes to the table, values may be interpolated. For example:

CEM II/A-LL declared by the manufacturer at 15% limestone is: 800 kg CO₂/tonne

NOTE: That is the difference between the high and low ECO₂ figures for CEM II/A-LL (880 - 750 = 130) is divided by the high and low difference in proportions (20 - 6 = 14) giving $130 \div 14 = 9.29$ per 1%.

15% limestone is 5% lower than 20% so the ECO₂ value is higher: $750 + (5 \times 9.29) = 796.5$, or 800 kg CO₂/tonne to the nearest two significant figures

Similarly:

CEM II/B-V or **CIIB-V** declared by the cement manufacturer or concrete producer at 30% fly ash is: 660 kg CO₂/tonne.

CEM III/A declared by the cement manufacturer at 40% ggbs is: 580 kg CO₂/tonne

CIIIA declared by the concrete producer at 50% ggbs is: 490 kg CO₂/tonne

CIIB at 70% ggbs is: 320 kg CO₂/tonne

Which cementitious associations have contributed data to this Fact Sheet?

This information has been supplied by the following associations and their members:

BCA	British Cement Association, www.cementindustry.co.uk
CSMA	Cementitious Slag Makers Association, www.ukcsma.co.uk
UKQAA	UK Quality Ash Association, www.ukqaa.org.uk

NOTE 1. This Datasheet is available on the above websites

NOTE 2. The information in this Datasheet, together with general sustainability information, is also available on www.sustainableconcrete.org.uk

Where can I find out more?

For product-specific information, contact:

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In general usage the term 'fly ash' is used for pulverized coal ash but it can also cover ash from burning other materials. Such 'fly ash' may have significantly differing properties and might not offer the same advantages as ash from burning pulverized coal. UKQAA datasheets only refer to PFA / fly ash produced from the burning of predominantly coal in power stations.

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