

Specification Guide for Low Carbon Concrete on Council Projects



This guide supports councils in adopting low carbon concrete by outlining specification pathways, recommended wording, technical considerations and drawing updates for project delivery.

Introduction

Intent of the guide

This guide has been developed to support councils in updating technical specifications and drawings to enable the integration of low carbon concrete (LCC) requirements. The recommendations are outlined to ensure that all nominated requirements are capable of delivering the following:

- **Durability performance**
- **Structural performance** - including early-age strength and shrinkage
- **Constructability** - including pumpability, placement, and finishing
- **Sustainability** across various concrete construction applications throughout the state

The recommendations outlined in this document can apply to a council's standard technical specification or to project specific specifications.

Content Overview

The guide includes:

1. [Minimum specification requirements](#) – outlines the minimum wording that is recommend to adopt LCC on your project
2. [Additional wording suggested for inclusions within specifications](#), including:
 - [Suggested guidance notes for inclusion in specifications](#)
 - [Scope modifications to reflect LCC considerations](#)
 - [Reference documents and definitions to support specification updates](#)
 - [Requirements for SCMs \(fly ash and GGBFS\)](#)
 - [Constructability considerations for SCMs](#)

- [Target setting for maximum cementitious content and embodied carbon](#)

3. [Proposed changes to drawings](#)

Notes for user:

- The requirements or suggested texts are provided in **colour** boxes.
- Wording that is **underlined** should be updated in your documents with the appropriate specification table numbering or specification reference.
- Wording that is shaded in grey are guidance notes that should be removed from your specification or directions that should be filled in within your specification.
- The wording may be adjusted as necessary to align with the specification format and terminology.

Minimum specification requirements

Specification Pathways

Two implementation options are proposed. The aim of outlining two different options is to accommodate for the different levels of capability in carbon reporting across in the supply chain and between metropolitan and regional areas.

Pathway 1 (Preferred): Carbon targets

Incorporate carbon targets and identify the corresponding bands within the CCAA low carbon concrete rating system. This approach supports long term sustainability aspirations by directly addressing embodied carbon and providing the flexibility for the suppliers to optimise mix designs and carbon reductions in their supply chains thus promoting innovation.

Pathway 2 (Alternative): Cement replacement requirements

Specifies maximum cementitious content and cement replacement targets. This is nominated as an alternative approach to carbon requirements. Reduction in cement is proposed through the incorporation of supplementary cementitious materials (SCMs), such as fly ash and blast furnace slag.

This alternative option is intended for councils and their supply chains that are less familiar with carbon accounting and carbon targets, providing a simpler entry point before progressing to Pathway 1.

Pathway 1 (Preferred): Carbon targets

f adopting the [carbon targets pathway](#) the following wording is recommended.

1.1 Concrete shall meet the embodied carbon targets outlined in Table X. Environmental Product Declarations (EPDs) or product carbon footprints (PCFs) are preferred to demonstrate compliance.

Table X

Compressive strength grade (MPa)	Specified maximum CCAA rating band	Embodied carbon targets – recommended upper limit (kgCO ₂ e/m ³)
20	D	205
25	D	225
32	D	255
40	D	305

NOTE: For a project specific specification where the concrete grade is known you may simplify the requirement as outlined below

1.1 **(project specific)** Concrete with strength grade [INSERT strength] shall meet the embodied carbon target of [INSERT target based on table and understanding of local supply chain] kgCO₂e/m³.

The above specified values can be updated and are intended to be flexible, allowing for deviations from the standard where justified by project scale, site-specific conditions, or other project-specific exemptions. See the [Target Setting](#) section for further information on how the numbers are proposed and how it may adapt over the next 5 years.

Pathway 2 (Alternative): Cement replacement requirements

If adopting [cement replacement pathway](#) the following wording is recommended.

Concrete shall achieve low carbon outcomes by complying with requirements 2.1 and 2.2

2.1 Minimum of 40% SCM replacement by weight (on average) for all concrete being used on the project (including temporary concrete and both structural and non-structural concrete)*

2.2 Maximum amount of cementitious materials per concrete grade as per table below, with the objective to restrict excessive amount of cementitious materials to be added to the concrete mix.

Compressive Strength Grade (MPa)	Maximum cementitious content (kg/m³)**
20	280
25	310
32	360
40	440

** This percentage can be adjusted based on the project type and council location. It may need to be reduced for regional projects and is subject to local supply chain capability.*

*** The amount of cementitious materials includes cement and supplementary cementitious materials.*

Additional wording suggested for inclusions within specifications

The below identifies additional requirements that should be considered for inclusion within a council specification.

Suggested guidance notes

It is suggested to include the following guidance text at the beginning of the specification or concrete section to highlight the significance of adopting LCC and its alignment with the council's goals.

To enhance sustainability practices in council concrete works, materials should be sourced locally where feasible. In alignment with this goal, efforts should be made to maximise the use of concrete with supplementary cementitious materials (SCMs) to the greatest extent permitted within this Specification. Portland cement clinker is a major contributor to embodied carbon in concrete, and its reduction is key to achieving lower carbon footprints in construction projects.

Scope modifications

The following text can be added to expand the scope of the specification, clarifying the role and application of LCC in project planning and delivery. Recommend including only concrete element types relevant to the developed specification (e.g. if the specification is for pavements, remove elements such as buildings and bridges).

These specification requirements can be used in concrete elements including both unreinforced and reinforced concrete such as building elements, bridge elements, paving for bicycle paths/shared paths, footpaths, medians, and driveways, drainage structures, footings and plinths for sign support structures, lighting columns and traffic signals, kerbs and channels (gutters), and safety barriers.

Updates to reference documents section in specification

If the specification includes a list of standards and reference documents, it is suggested to include the following reference documents in the specification.

Australian Standards

AS 3582.1	<i>Supplementary cementitious materials: Part 1: Fly ash</i>
AS 3582.2	<i>Supplementary cementitious materials: Part 2: Slag – Ground granulated blast-furnace</i>
AS 3582.4	<i>Supplementary cementitious materials: Part 4: Pozzolans – Manufactured</i>
AS 3583.3	<i>Methods of test for supplementary cementitious materials for use with Portland cement: Determination of loss on ignition</i>
AS 3583.4	<i>Methods of test for supplementary cementitious materials for use with Portland cement: Method 4: Determination of autoclave expansion</i>
AS 3583.6	<i>Methods of test for supplementary cementitious materials: Method 6: Determination of relative water requirement and strength index</i>
AS 3583.13	<i>Methods of test for supplementary cementitious materials for use with Portland cement: Method 13: Determination of chloride ion content</i>

TfNSW Standards

TfNSW QA Specification 3211	<i>Cementitious Materials, Binders and Fillers</i>
TfNSW QA Specification B80	<i>Concrete Work for Bridges</i>
TfNSW QA Specification R53	<i>Concrete for General Works</i>

Updated to definitions

If the specification includes a definitions section it is suggested to include the following definitions to introduce the audience on the terms used in the specification update.

Cementitious materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, ground granulated blast furnace slag (GGBFS), silica fume, and other pozzolans; subject to compliance with requirements.

Supplementary cementitious materials (SCMs): Naturally occurring materials or industrial byproducts complying with AS 3582 used as a partial replacement of general purpose (GP) cement, usually comprising fly ash and ground granulated blast furnace slag (GGBFS). Silica fume or metakaolin are also classified as SCMs.

Fly ash: A byproduct of pulverized coal combustion in black coal-fired power plants.

Ground granulated blast furnace slag (GGBFS): A byproduct of ironmaking in a blast furnace within the steel industry.

Binary blend: General purpose (GP) cement in combination with one of any supplementary cementitious materials (i.e. fly ash, GGBFS, or silica fume).

Ternary (tertiary or triple) blend: General purpose (GP) cement in combination with any two supplementary cementitious materials (i.e. any two of fly ash, GGBFS or silica fume).

Requirements for Supplementary Cementitious Materials

It is suggested to include the following requirements under the section on material selection.

To reduce the embodied carbon in concrete, the use of supplementary cementitious materials (SCMs) to replace Portland cement shall be adopted for all concrete.

Blended cements may comprise a mix of general or special purpose cement, and one or more of the following: fly ash, ground granulated blast furnace slag (GGBFS).

Fly ash shall conform to AS/NZS 3582.1.

Ground granulated blast furnace slag (GGBFS) shall conform to AS 3582.2.

Updates to the constructability considerations

It is suggested to include the following requirements under the section for consistency of the mix as a guide. Typically, councils specify a slump of 75-100mm for concrete for general works and 10-15mm for extruded concrete. If these slump requirements are used for concrete with higher levels of supplementary cementitious material, then the mix will be 'sticky' making the mix less workable. A common error is to then add water to the mix on site. This is not recommended as it impacts the concrete strength. Hence, the slump ranges below are intended as guidance only.

Except for extruded concrete, slump shall be in the range of 80-120 mm for concrete with blended cement with less than 50% SCM replacement.

Except for extruded concrete, slump shall be in the range of 120-220 mm for concrete with blended cement with more than 50% SCM replacement.

Slump shall be in the range of 15-25 mm for extruded concrete with blended cement.

It is proposed to add the following requirement under a new section titled "Addition of Water" to discourage the practice of adding water on-site to avoid it affecting the concrete performance, particularly when a lower slump mix containing SCMs has been ordered.

In most projects, delivery dockets specify the maximum allowable water addition approved by the supplier for each batched mix. This provision allows adjustment of slump to achieve suitable workability after transport from the batching plant to the site, provided the specified maximum water-cement ratio is not exceeded.

The addition of water to a batch is to be carried out as approved by the supplier as per AS 1379 Clause 4.2.3.

Target setting

The specified carbon targets have been nominated based on a review of industry benchmarks and best practice. The targets are developed for councils participating in the LOCCA program and outline the global warming potential (GWP) for life cycle states A1-A3.

Embodied carbon limits were calculated using the [Embodied Carbon Databook \(ECD\)](#) for generic concrete mix designs at each strength grade. Upper and lower embodied carbon ranges were developed based on 40% SCM replacement using slag and fly ash respectively. The results were then benchmarked against the current published industry baselines including Transport for NSW (TfNSW) benchmarks, Sydney Water specification limits, available Environmental Product Declarations (EPDs) in NSW, and the City of Newcastle concrete trial data. The [CCAA band](#) is outlined alongside the upper limit.

The adopted carbon targets are intended to be used as recommended upper limits. This approach reflects the availability of fly ash within the Hunter region, the feasibility of adoption by both large and smaller suppliers, and the aim of minimal or no additional cost. The targets are intended to drive embodied carbon reductions while maintaining flexibility for local supply chains and project-specific requirements.

It is recommended that these requirements be incorporated within the concrete specification to establish clear embodied carbon performance targets, aligning with the principles of the [Australian Concrete Benchmark & Classification](#). Design engineers should seek to achieve the lowest practical embodied carbon outcome while ensuring compliance with structural, durability, and constructability requirements.

To support achievement of these targets, the following actions are recommended:

1. **Understand supply chain** - Map out suppliers and their capabilities for LCC mixes in your council area together with the availability of SCMs.
2. **Engage with suppliers early** - Collaborate during design stages to confirm feasibility of achieving these targets. Request EPDs or verified PCFs for proposed mixes, where available.

Proposed changes to drawings

It is recommended that drawings are updated to make requirements clear to contractors and site personnel.

Drawings are proposed to be updated to include the minimum SCM replacement presented in Pathway 2 (Alternative): Cement replacement requirements for each concrete grade. This is to support understanding among personnel referencing these standards and make the information more accessible and easier to understand for engineers and contractors on site.

The following are recommended to be included as a general note on each drawing sheet. Note that the following minimum replacement levels are provided as example guidance only and should be reviewed and assessed for suitability on a project-specific basis.

Concrete class and covers for individual elements shall be as per the following:

Element	Concrete Grade	Required cover (mm)	Minimum SCM replacement (%)
Footpath	N25	30	50
Bored piles	N50	45	70
Precast drainage pits	N32	40	30
XXX			

Concrete shall meet structural requirements and aim to minimise embodied carbon in line with project goals. Refer to specification no. XX.

Concrete shall have a 40% SCM replacement of GP cement by weight.

Disclaimer

The information contained in this publication is based on knowledge and understanding at the time of writing (September 2026) and may not be accurate, current or complete. This document has been prepared as part of the Low Carbon Concrete Accelerator (LOCCA) program and in consultation with participating local councils. As it is currently being piloted in the Hunter region, the content is subject to review and amendment. The document is provided exclusively for participants in the LOCCA pilot program and must not be relied upon by any third party. No part of this document may be reproduced, extracted, or distributed except in its complete form. The State of New South Wales (including the Department of Climate Change, Energy, the Environment and Water and NSW Treasury), the author and the publisher take no responsibility, and will accept no liability, for the accuracy, currency, reliability or correctness of any information included in the document (including material provided by third parties). Readers should make their own inquiries and rely on their own advice when making decisions related to material contained in this publication.

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