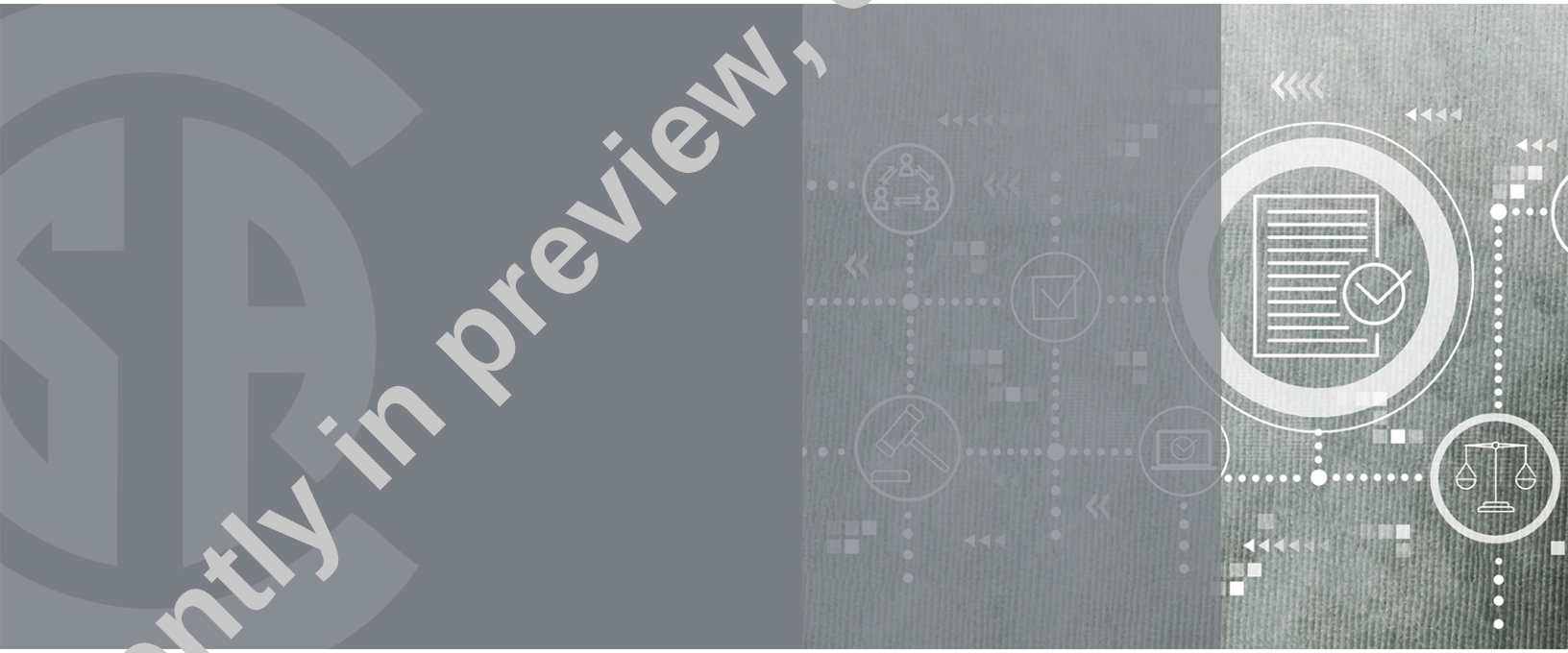
CSA SPE-112:21

CarbonStar®: Technical specification for concrete carbon intensity quantification and verification



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Preface

This is the first edition of CSA SPE-112, *CarbonStar®: Technical specification for concrete carbon intensity quantification and verification*. This Document, written under Standards Council of Canada's *National Technical Specification Guidelines*, has been developed without using the full consensus process.

CSA Group acknowledges that the development of this Technical Specification was made possible, in part, by the financial support of the Standards Council of Canada.

This Technical Specification was prepared and reviewed by the Technical Committee on SPE 112 CarbonStar®.

Notes:

1) *Use of the singular does not exclude the plural (and vice versa) when the sense allows.*
2) *Although the intended primary application of this Document is stated in its Scope, it is important to note that it remains the responsibility of the users of the Document to judge its suitability for their particular purpose.*
3) *To submit a proposal for change, please send the following information to inquiries@csagroup.org and include "Proposal for change" in the subject line:*
   a) *designation (number);*
   b) *relevant section, table, and/or figure number;*
   c) *wording of the proposed change; and*
   d) *rationale for the change.*

CSA SPE-112:21
CarbonStar®: Technical specification for concrete carbon intensity quantification and verification

0 Introduction

It is broadly accepted that CO_2 concentration in Earth's atmosphere must be limited to slow climate change. Important steps have been made in recent decades that avoid anthropogenic CO_2 emissions. It is now understood that atmospheric CO_2 concentration will increase to unacceptable levels unless CO_2 is actively captured and sequestered at the rate of many gigatons per year. There is an increasing number of technical solutions to reduce climate impact of concrete, including CO_2 sequestration in concrete.

The built environment provides an opportunity to safely store large quantities of sequestered CO_2. The most common building material, concrete, is a potential vast reservoir for permanently storing Gt quantities of captured anthropogenic CO_2.

The goal of this Technical Specification is to quantify the embodied carbon of concrete. Since the relative proportions of each constituent of concrete is customized in every concrete mix, performance of a traditional life cycle carbon assessment (LCA) for every mix of concrete is rarely performed or available to owners, architects, engineers, or contractors. Hence, developing an environmental product declaration, guided from the product category rules for concrete, is not commonly done until one particular mix design is continuously repeated and there is a justified reason for the undertaking.

While the carbon intensity of the standard individual components of concrete (sand, gravel, cement, admixture, etc.) can be well known, including an LCA for each, there is no universal and accurate methodology for calculating the carbon intensity of novel components of concrete that sequester CO_2. What is needed to quantify and compare concrete mix designs for embodied carbon is a simple system that provides each concrete mixture with a readily calculated embodied carbon value corresponding directly and exactly to the net CO_2 sequestered CO_2 and emitted CO_2 in the custom designed concrete mix. This Technical Specification sets out a methodology for calculating the carbon intensity of CO_2 sequestering materials and utilising that data in a system able to incorporate all the relevant components to give the embodied carbon of a unit of concrete.

1 Scope

1.1 General

This Technical Specification provides minimum requirements and recommendations for the quantification and verification of the carbon intensity in a unit of concrete, including any carbon that is permanently sequestered during the production of the concrete and/or its input materials. Therefore, this number could be either positive or negative.

The quantification calculation results in a CarbonStar® rating expressing:

a) the carbon intensity of concrete in kilograms (pounds) of CO_2 and/or CO_2e per cubic metre (cubic yard), subject to the methodology in this Technical Specification; and
b) where applicable, the net CO_2 sequestered in kilograms (pounds) per cubic metre (cubic yard), or as otherwise required for the purposes of carbon credits, offsets, or tax incentives.

Note: *This Technical Specification provides a methodology for quantifying carbon emissions and sequestration for a declared unit of 1 m³ (yd³) of concrete. When selecting concrete options for a given application, functional criteria, including strength, constructability, performance, and durability, also need to be considered.*

For example, in Canada, CSA A23.1 provides performance and durability requirements for ready-mixed concrete, CSA A23.4 covers these same requirements for precast concrete, and CSA A23.3 covers structural requirements; and for specific types of structures, CSA S6 covers bridge construction and CSA S413 covers parking structures. In the USA, ACI 318 covers structural and durability requirements for buildings, ACI 350.5 covers environmental structures, and ACI 562 covers concrete repairs.

1.2 Terminology

In this Technical Specification, "shall" is used to express a requirement, i.e., a provision that the user is obliged to satisfy in order to comply with the Technical Specification; "should" is used to express a recommendation or that which is advised but not required; and "may" is used to express an option or that which is permissible within the limits of the Technical Specification.

Notes accompanying clauses do not include requirements or alternative requirements; the purpose of a note accompanying a clause is to separate from the text explanatory or informative material.

Notes to tables and figures are considered part of the table or figure and may be written as requirements.

Annexes are designated normative (mandatory) or informative (non-mandatory) to define their application.

2 Reference publications

This Technical Specification refers to the following publications. For dated references, only the edition cited shall apply. For undated references, the latest edition of the referenced document (including any amendments thereto) shall apply.

Note: *See also Annex D.*

CSA Group

A23.1:19/CSA A23.2:19
Concrete materials and methods of concrete construction/Test methods and standard practices for concrete

A23.3:19
Design of concrete structures

A23.4-16
Precast concrete — Materials and construction

S6:19
Canadian Highway Bridge Design Code