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CSA S478:19
National Standard of Canada

Durability in buildings

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Preface

This is the second edition of CSA S478, *Durability in buildings*. It supersedes the first edition, published in 1995 under the title *Guideline on Durability in Buildings*. The first edition of CSA S478 was issued as a guidance document. This second edition has been developed as a Standard so that it can be referenced in the *National Building Code of Canada (NBC)*.

This Standard sets forth minimum requirements to assist designers in creating durable buildings. Annexes to the Standard provide a framework within which the design service life of a building or a building element can be determined and specified. Other annexes to the Standard provide general guidance on the environmental and other design factors that have an impact on the durability of a building, a building material, and/or a building component.

The Standard carries forward from its first edition as a guideline an emphasis on the need to consider both initial and long-term costs, maintenance, and replaceability in the selection of materials and components.

This Standard is intended to evolve as more information on environmental loads and the impact on building durability becomes available.

This Standard was prepared by the CSA Technical Committee on Designing for Durability, under the jurisdiction of the Construction and Civil Infrastructure Strategic Steering Committee, and was formally approved by the Technical Committee. This Standard has been developed in compliance with Standards Council of Canada requirements for National Standards of Canada. It has been published as a National Standard of Canada by CSA Group.

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 Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.*
3) *This Standard was developed by consensus, which is defined by* CSA Policy governing standardization — Code of good practice for standardization *as "substantial agreement. Consensus implies much more than a simple majority, but not necessarily unanimity". It is consistent with this definition that a member may be included in the Technical Committee list and yet not be in full agreement with all clauses of this Standard.*
4) *To submit a request for interpretation of this Standard, please send the following information to inquiries@csagroup.org and include "Request for interpretation" in the subject line:*
   a) *define the problem, making reference to the specific clause, and, where appropriate, include an illustrative sketch;*
   b) *provide an explanation of circumstances surrounding the actual field condition; and*
   c) *where possible, phrase the request in such a way that a specific "yes" or "no" answer will address the issue.*

   Committee interpretations are processed in accordance with the CSA Directives and guidelines governing standardization *and are available on the* Current Standards Activities *page at standardsactivities.csa.ca.*
5) *This Standard is subject to review within five years from the date of publication. Suggestions for its improvement will be referred to the appropriate committee. 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) *Standard designation (number);*
   b) *relevant clause, table, and/or figure number;*
   c) *wording of the proposed change; and*
   d) *rationale for the change.*

CSA S478:19
Durability in buildings

0 Introduction

Premature degradation of buildings, resulting in costly repairs and disruptions in use, is increasing in scope and magnitude. The annual costs related to such repairs and disruptions have reached multimillion dollar levels. In addition, the design of buildings requires a new perspective that includes future environmental loads in addition to codified loads, and those environmental and physical loads require that designers, owners, and constructors all assume responsibility for assuring that buildings and building elements will remain durable and serve their intended function for their specified design service lives.

The issue of durability has been addressed in numerous public documents, including the *National Building Code of Canada* (NBC), materials and installation standards published by standards-writing bodies worldwide, and numerous publicly distributed publications and manuals of good practice. Consideration of the issue of durability, however, has often been limited to the effects of premature degradation. This Standard includes additional considerations (e.g., the maintenance procedures that are expected to be necessary) that designers must take into account to address durability and avoid premature degradation throughout the life of a building.

This Standard is based on the impact on buildings and building elements of known action effects and requires that designers consider those effects and the repair or replacement procedures required to maintain durability throughout a specified design service life. Annexes have been provided to supplement, qualify, or expand on various topics covered in the Standard.

This Standard also introduces the issue of climate change and its potential effects on buildings and building elements. It is anticipated that designers will need to factor into their designs the environmental loads and action effects resulting from climate change. Environmental data factoring in climate change were not available when this Standard was developed. As information on environmental loads evolves, so too will this Standard and other information available to designers.

The following concepts are key to this Standard:

a) the achievement of durability requires that service life be considered in the design procedures for buildings and their building elements;
b) beginning with the initial concept for a building, the design process is to take into account the structure environment and agents to which the building elements will be exposed and the action effects arising from environmental action; and
c) decisions taken during the design of a building, and even before the development of design documents, affect all subsequent decisions and resultant performance.

1 Scope

1.1

This Standard provides criteria and requirements for the design of a durable building and its building elements and includes provisions for cost analysis and management and for a quality management

program for the design, construction, operation, maintenance, repair, and renovation of a building and its building elements.

1.2

This Standard applies to the building and to building elements that

a) are required to resist loads from the structure environment and the effects of those loads;
b) are exposed to exterior space or the ground;
c) separate interior space from exterior space or separate interior space from the ground; or
d) separate environmentally dissimilar interior spaces.

1.3

This Standard includes the following:

a) definitions for performance, failure, service life, and other concepts related to the durability of a building or building element;
b) fundamental durability requirements for the design of a new building or the repair or renovation of an existing building and building elements;
c) compliance criteria for the design for durability of a building and building elements, including requirements for design service life and predicted service life;
d) compliance criteria for construction processes that affect durability;
e) compliance criteria for quality management and for an operation, maintenance, and inspection program;
f) for existing buildings, requirements for investigation and assessment of degradation of a building and building elements and for repair and maintenance; and
g) guidance on the use of this Standard to
    i) select a design service life for a building and building elements;
    ii) determine a predicted service life;
    iii) assess structure environments; and
    iv) understand degradation mechanisms.

1.4

This Standard is intended to be used throughout all stages of the building life cycle, as follows:

a) by designers, working from design conception to building handover;
b) by building owners, particularly after building handover;
c) for operation and maintenance, in conjunction with the designer; and
d) for repair and renovation.

Note: *As a minimum, designers should consult with the building owner from design conception to building handover. The nature of the contract between the designer and the owner might affect the assignment of responsibilities for implementing the Standard after building handover. However, the intent is to ensure seamless transition and effective cooperation and communication between the designer and the owner throughout all stages of the building life cycle to ensure durability and reliability.*

1.5

The following are not within the scope of this Standard:

a) durability of mechanical systems, electrical systems, and services in buildings; and
b) durability of building finishes, except those providing a performance control function.

Notes:

1) *Although the Standard does not specifically address mechanical systems, electrical systems, and services, such systems and services should be taken into account in an integrated design for durability of a building and building elements.*

2) *The loads on a building and building elements that result from the operation of mechanical and electrical systems and services should be considered along with the structure environment and structural loads.*

1.6

In this Standard, "shall" is used to express a requirement, i.e., a provision that the user is obliged to satisfy in order to comply with the standard; "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 Standard.

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 (nonmandatory) to define their application.

2 Reference publications and bibliography

2.1 Reference publications

This Standard refers to the following publications, and where such reference is made, it shall be to the edition listed below, including all amendments published thereto.

CSA Group

S413-14
Parking structures

ASTM International (American Society for Testing and Materials)

E3054/E3054M-16
Standard Guide for Characterization and Use of Hygrothermal Models for Moisture Control Design in Building Envelopes

European Committee for Standardization

EN 15026:2007
Hygrothermal performance of building components and building elements — Assessment of moisture transfer by numerical simulation

ISO (International Organization for Standardization)

2394:2015
General principles on reliability for structures

13823:2008
General principles on the design of structures for durability

15686-1:2011
Buildings and constructed assets — Service life planning — Part 1: General principles and framework

