CSA GROUP™

CSA S413:21
National Standard of Canada

Parking structures

scc ccn

Legal Notice for Standards

Canadian Standards Association (operating as "CSA Group") develops standards through a consensus standards development process approved by the Standards Council of Canada. This process brings together volunteers representing varied viewpoints and interests to achieve consensus and develop a standard. Although CSA Group administers the process and establishes rules to promote fairness in achieving consensus, it does not independently test, evaluate, or verify the content of standards.

Disclaimer and exclusion of liability

This document is provided without any representations, warranties, or conditions of any kind, express or implied, including, without limitation, implied warranties or conditions concerning this document's fitness for a particular purpose or use, its merchantability, or its non-infringement of any third party's intellectual property rights. CSA Group does not warrant the accuracy, completeness, or currency of any of the information published in this document. CSA Group makes no representations or warranties regarding this document's compliance with any applicable statute, rule, or regulation.

IN NO EVENT SHALL CSA GROUP, ITS VOLUNTEERS, MEMBERS, SUBSIDIARIES, OR AFFILIATED COMPANIES, OR THEIR EMPLOYEES, DIRECTORS, OR OFFICERS, BE LIABLE FOR ANY DIRECT, INDIRECT, OR INCIDENTAL DAMAGES, INJURY, LOSS, COSTS, OR EXPENSES, HOWSOEVER CAUSED, INCLUDING BUT NOT LIMITED TO SPECIAL OR CONSEQUENTIAL DAMAGES, LOST REVENUE, BUSINESS INTERRUPTION, LOST OR DAMAGED DATA, OR ANY OTHER COMMERCIAL OR ECONOMIC LOSS, WHETHER BASED IN CONTRACT, TORT (INCLUDING NEGLIGENCE), OR ANY OTHER THEORY OF LIABILITY, ARISING OUT OF OR RESULTING FROM ACCESS TO OR POSSESSION OR USE OF THIS DOCUMENT, EVEN IF CSA GROUP HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, INJURY, LOSS, COSTS, OR EXPENSES.

In publishing and making this document available, CSA Group is not undertaking to render professional or other services for or on behalf of any person or entity or to perform any duty owed by any person or entity to another person or entity. The information in this document is directed to those who have the appropriate degree of experience to use and apply its contents, and CSA Group accepts no responsibility whatsoever arising in any way from any and all use of or reliance on the information contained in this document.

CSA Group is a private not-for-profit company that publishes voluntary standards and related documents. CSA Group has no power, nor does it undertake, to enforce compliance with the contents of the standards or other documents it publishes.

Intellectual property rights and ownership

As between CSA Group and the users of this document (whether it be in printed or electronic form), CSA Group is the owner, or the authorized licensee, of all works contained herein that are protected by copyright, all trade-marks (except as otherwise noted to the contrary), and all inventions and trade secrets that may be contained in this document, whether or not such inventions and trade secrets are protected by patents and applications for patents. Without limitation, the unauthorized use, modification, copying, or disclosure of this document may violate laws that protect CSA Group's and/or others' intellectual property and may give rise to a right in CSA Group and/or others to seek legal redress for such use, modification, copying, or disclosure. To the extent permitted by licence or by law, CSA Group reserves all intellectual property rights in this document.

Patent rights

Attention is drawn to the possibility that some of the elements of this standard may be the subject of patent rights. CSA Group shall not be held responsible for identifying any or all such patent rights. Users of this standard are expressly advised that determination of the validity of any such patent rights is entirely their own responsibility.

Authorized use of this document

This document is being provided by CSA Group for informational and non-commercial use only. The user of this document is authorized to do only the following:

If this document is in electronic form:

- load this document onto a computer for the sole purpose of reviewing it;
- search and browse this document; and
- print this document if it is in PDF format.

Limited copies of this document in printed or paper form may be distributed only to persons who are authorized by CSA Group to have such copies, and only if this Legal Notice appears on each such copy.

In addition, users may not and may not permit others to

- alter this document in any way or remove this Legal Notice from the attached standard;
- sell this document without authorization from CSA Group; or
- make an electronic copy of this document.

If you do not agree with any of the terms and conditions contained in this Legal Notice, you may not load or use this document or make any copies of the contents thereof, and if you do make such copies, you are required to destroy them immediately. Use of this document constitutes your acceptance of the terms and conditions of this Legal Notice.

Standards Update Service

CSA S413:21
October 2021

Title: *Parking structures*

To register for e-mail notification about any updates to this publication
- go to **www.csagroup.org/store/**
- click on **Product Updates**

The **List ID** that you will need to register for updates to this publication is **24392**.

If you require assistance, please e-mail **techsupport@csagroup.org** or call 416-747-2233.

Visit CSA Group's policy on privacy at **www.csagroup.org/legal** to find out how we protect your personal information.

Canadian Standards Association (operating as "CSA Group"), under whose auspices this National Standard has been produced, was chartered in 1919 and accredited by the Standards Council of Canada to the National Standards system in 1973. It is a not-for-profit, nonstatutory, voluntary membership association engaged in standards development and certification activities.

CSA Group standards reflect a national consensus of producers and users — including manufacturers, consumers, retailers, unions and professional organizations, and governmental agencies. The standards are used widely by industry and commerce and often adopted by municipal, provincial, and federal governments in their regulations, particularly in the fields of health, safety, building and construction, and the environment.

More than 10 000 members indicate their support for CSA Group's standards development by volunteering their time and skills to Committee work.

CSA Group offers certification and testing services in support of and as an extension to its standards development activities. To ensure the integrity of its certification process, CSA Group regularly and continually audits and inspects products that bear the CSA Group Mark.

In addition to its head office and laboratory complex in Toronto, CSA Group has regional branch offices in major centres across Canada and inspection and testing agencies in fourteen countries. Since 1919, CSA Group has developed the necessary expertise to meet its corporate mission: CSA Group is an independent service organization whose mission is to provide an open and effective forum for activities facilitating the exchange of goods and services through the use of standards, certification and related services to meet national and international needs.

For further information on CSA Group services, write to
CSA Group
178 Rexdale Boulevard
Toronto, Ontario, M9W 1R3
Canada

A National Standard of Canada is a standard developed by a Standards Council of Canada (SCC) accredited Standards Development Organization, in compliance with requirements and guidance set out by SCC. More information on National Standards of Canada can be found at www.scc.ca.

SCC is a Crown corporation within the portfolio of Innovation, Science and Economic Development (ISED) Canada. With the goal of enhancing Canada's economic competitiveness and social well-being, SCC leads and facilitates the development and use of national and international standards. SCC also coordinates Canadian participation in standards development, and identifies strategies to advance Canadian standardization efforts.

Accreditation services are provided by SCC to various customers, including product certifiers, testing laboratories, and standards development organizations. A list of SCC programs and accredited bodies is publicly available at www.scc.ca.

Standards Council of Canada
600-55 Metcalfe Street
Ottawa, Ontario, K1P 6L5
Canada

Cette Norme Nationale du Canada n'est disponible qu'en anglais.

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 to judge its suitability for their particular purpose.

National Standard of Canada

CSA S413:21
Parking structures

Published in October 2021 by CSA Group
A not-for-profit private sector organization
178 Rexdale Boulevard, Toronto, Ontario, Canada M9W 1R3

To purchase standards and related publications, visit our Online Store at www.csagroup.org/store/
or call toll-free 1-800-463-6727 or 416-747-4044.

ICS 91.090
ISBN 978-1-4883-3666-9

Contents

Technical Committee on Parking Structures

D. M. Wint	Read Jones Christoffersen Ltd., Toronto, Ontario, Canada *Category: User Interest*	*Chair*
A. Keri	Concrete Ontario, Mississauga, Ontario, Canada *Category: Producer Interest*	*Vice-Chair*
G. Martin	Tremco Canada, Toronto, Ontario, Canada *Category: Producer Interest*	*Vice-Chair*
A. Attar	National Research Council of Canada, Ottawa, Ontario, Canada	*Non-voting*
B. Ballantyne	Brian Ballantyne Specifications, Oakville, Ontario, Canada *Category: Regulatory Authority/General Interest*	
P. Belanger	Belanger Engineering, Mississauga, Ontario, Canada *Category: User Interest*	
B. Benmokrane	Université de Sherbrooke, Sherbrooke, Quebec, Canada	*Non-voting*
R. Burak	Canadian Precast/Prestressed Concrete Institute, Ottawa, Ontario, Canada	*Non-voting*
S. Chasioti	Cement Association of Canada, Ottawa, Ontario, Canada *Category: Producer Interest*	
P. Cotten	Synergy Partners Consulting LTD, Toronto, Ontario, Canada	*Non-voting*
B. Dhekney	Pickering, Ontario, Canada	*Non-voting*
R. Dozzi	Canadian BBR Inc., Scarborough, Ontario, Canada	*Non-voting*

H. Dutrisac	Department of National Defence / Government of Canada, Ottawa, Ontario, Canada	*Non-voting*
O. Eissa	IES Associates, Windsor, Ontario, Canada *Category: Producer Interest*	
S. Fasullo	Davroc Testing Laboratories Inc., Brampton, Ontario, Canada *Category: User Interest*	
P. Hanratty	BASF Construction Chemicals LLC, Mississauga, Ontario, Canada *Category: Producer Interest*	
C. M. Hansson	University of Waterloo, Waterloo, Ontario, Canada *Category: Regulatory Authority/General Interest*	
M. Hillcoat	Entuitive Corporation, Toronto, Ontario, Canada *Category: User Interest*	
R. D. Hooton	University of Toronto, Toronto, Ontario, Canada *Category: Regulatory Authority/General Interest*	
J. Horst	Sealants and Waterproofing Association, Richmond Hill, Ontario, Canada *Category: Producer Interest*	
J. Kosednar	WSP Canada Inc., Toronto, Ontario, Canada *Category: User Interest*	
A. K. Mehta	The Prestressed Group, Windsor, Ontario, Canada	*Non-voting*
R. E. Munro	Concrete Advice, Toronto, Ontario, Canada *Category: Regulatory Authority/General Interest*	
O.S. Ooi	Realcrete Consultants Inc., Richmond, British Columbia, Canada *Category: User Interest*	

B. R. Salazar	Euclid Admixture Canada Inc., Toronto, Ontario, Canada	*Non-voting*
D. B. Simms	Armtec | PRE-CON INC., Belleville, Ontario, Canada *Category: Producer Interest*	
R. Sqapi	Stephenson Engineering Ltd., Toronto, Ontario, Canada *Category: User Interest*	
S. Starkman	Calgary Parking Authortiy, Calgary, Alberta, Canada *Category: Regulatory Authority/General Interest*	
A. J. Steen	Toronto, Ontario, Canada *Category: Regulatory Authority/General Interest*	
M. Thomas	University of New Brunswick Dept of Civil Engineering, Fredericton, New Brunswick, Canada *Category: Regulatory Authority/General Interest*	
K. Crew	CSA Group, Toronto, Ontario, Canada	*Project Manager*

Preface

This is the fifth edition of CSA S413, *Parking structures*. It supersedes the previous editions published in 2014, 2007, 1994, and 1987.

This Standard differs from the previous edition as follows:

a) added clarification in Scope regarding considerations for structures or portions of structures which are designed for the storage and/or repair of vehicles;
b) requirements for fibre-reinforced polymer reinforcement have been added;
c) updates to requirements for surface preparation, installation, testing, and performance of protection systems;
d) updated requirements for placement and design of expansion joints near columns, spandrels, walls, and other vertical elements;
e) revisions to clarify concrete types for perimeter basement walls;
f) revision to requirements and suggested details for parking structure drains;
g) added requirements for cast-in services placed in proximity to parking structure drains;
h) revision to requirements for core testing;
i) added requirements for protection of reinforcement at precast joint ends and expansion joints;
j) clarification for water supply for periodic washdowns;
k) clarifications for concrete requirements to harmonize with CSA A23.1;
l) added requirements for crack treatment;
m) added requirements for footing protection from chloride contamination;
n) revisions to requirements for concrete moisture testing and calcium chloride testing;
o) added requirement for consideration of alternate access/egress pathways in parking structures in cases of repair;
p) revisions to requirements for tooled or soft cut joints;
q) recommended minimum work procedures have been moved from Annex D into the main body of the Standard;
r) Annexes A, D, and H have been revised; and
s) all references, including those for the annexes, have been updated where applicable.

This Standard has been adopted by the Canadian Commission on Building and Fire Codes as the reference standard for parking structures in Section 4 of the *National Building Code of Canada*.

This Standard was prepared by the Technical Committee on Parking Structures, under the jurisdiction of the Strategic Steering Committee on Structures (Design), and has been 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 S413:21
Parking structures

0 Introduction

0.1

This Standard specifies the minimum design, construction, and maintenance requirements necessary for the structural durability of new parking structures, storage garages, parts of buildings subject to vehicular traffic or used for parking, and pedestrian areas adjoining to or contained within parking structures.

The provisions of this Standard are intended to address both ultimate and serviceability limit states, and more specifically, to

a) protect against the deterioration of concrete and metal elements caused by de-icing chemicals alone or by de-icing chemicals in combination with the effects of freeze-thaw cycling;
b) protect against damage to vehicles caused by leakage through floors; and
c) control the flow of water and avoid ponding.

The structural design methods, loadings, and limit states referenced and specified in this Standard are those set forth in the *National Building Code of Canada (NBCC)*.

0.2

The requirements of this Standard are applicable to all parking structures susceptible to corrosion, whether the corrosion is caused by atmospheric conditions or de-icing chemicals. In geographic areas where de-icing chemicals are not used and are not expected to be used in the foreseeable future, some of the corrosion protection provisions in this Standard do not apply.

0.3

Acceptable protection systems are specified in Table 1. The provision of multiple protection systems is a fundamental principle of this Standard. The appropriate choices should be made by the designer and specified in the drawings and related documents. Some parking structures, or portions of parking structures, require more than the minimum protection required by this Standard because of factors such as environmental conditions, the extent of utilization of salt by the municipality, the number of daily vehicle in-and-out trips, the difficulty of access for repairs, or the desire to minimize maintenance.

For types of construction or construction details not covered by this Standard, the same principles of protection required by this Standard apply.

0.4

To obtain the intended durability, parking structures designed and constructed in conformance with this Standard need to be regularly maintained by the owner in accordance with a comprehensive regularly scheduled inspection and maintenance program. Maintenance information is provided in Annex E and Table E.1.

