

Section 9.3. Materials, Systems and Equipment

9.3.1. Concrete

9.3.1.1. General

- 1) Except as provided in Sentence (2) and Articles 9.3.1.6. and 9.3.1.7., unreinforced and nominally reinforced concrete shall be designed, mixed, placed, cured and tested in accordance with the requirements for “R” class concrete stated in Section 9 of CSA A23.1, “Concrete Materials and Methods of Concrete Construction.”
- 2) Unreinforced and nominally reinforced site-batched concrete shall be designed, mixed, placed and cured in accordance with Articles 9.3.1.2. to 9.3.1.9.
- 3) Except as provided in Sentence (4), reinforced concrete shall be designed to conform to the requirements of Part 4.
- 4) For flat insulating concrete form walls not exceeding 2 storeys in *building height* and having a maximum floor to floor height of 3 m, in *buildings* of light-frame construction containing only a single *dwelling unit*, the concrete and reinforcing shall comply with Part 4 or
 - a) the concrete shall conform to CSA A23.1, “Concrete Materials and Methods of Concrete Construction,” with a maximum aggregate size of 19 mm, and
 - b) the reinforcing shall
 - i) conform to CSA G30.18, “Carbon Steel Bars for Concrete Reinforcement,”
 - ii) have a minimum specified yield strength of 400 MPa, and
 - iii) be lapped a minimum of 450 mm for 10M bars and 650 mm for 15M bars (See also Articles 9.15.4.5. and 9.20.17.2. to 9.20.17.4.).

9.3.1.2. Cement

- 1) Cement shall meet the requirements of CSA A3001, “Cementitious Materials for Use in Concrete.”

9.3.1.3. Concrete in Contact with Sulphate Soil

- 1) Concrete in contact with sulphate *soil*, which is deleterious to normal cement, shall conform to the requirements in Clause 4.1.1.6 of CSA A23.1, “Concrete Materials and Methods of Concrete Construction.”

9.3.1.4. Aggregates

- 1) Aggregates shall
 - a) consist of sand, gravel, crushed *rock*, crushed air-cooled blast *furnace* slag, expanded shale or expanded clay conforming to CSA A23.1, “Concrete Materials and Methods of Concrete Construction,” and
 - b) be clean, well-graded and free of injurious amounts of organic and other deleterious material.

9.3.1.5. Water

- 1) Water shall be clean and free of injurious amounts of oil, organic matter, sediment or any other deleterious material.

9.3.1.6. Compressive Strength

(See also Article 9.12.4.1., Sentence 9.15.4.2.(1) and Article 9.18.6.1.)

- 1) Except as provided elsewhere in this Part, the compressive strength of unreinforced concrete after 28 days shall be not less than
 - a) 15 MPa for walls, columns, fireplaces and *chimneys*, footings, *foundation* walls, grade beams and piers,
 - b) 20 MPa for floors other than those in garages and carports, and
 - c) for garage and carport floors, and the exterior steps,
 - i) 32 MPa, or
 - ii) 30 MPa where indigenous aggregates do not achieve 32 MPa with a 0.45 water to cementing material ratio.

2) Site-batched concrete used for garage and carport floors and exterior steps shall have air entrainment of 5 to 8%.

9.3.1.7. Concrete Mixes

(See Note A-9.3.1.7.)

1) For pre-mixed concrete and for the site-batched concrete mixes described in Table 9.3.1.7., the maximum ratio of water to cementing materials measured by weight shall not exceed

- a) 0.70 for walls, columns, fireplaces and *chimneys*, footings, *foundation* walls, grade beams and piers,
- b) 0.65 for floors other than those in garages and carports, and
- c) 0.45 for garage and carport floors, and exterior steps.

Table 9.3.1.7.
Site-Batched Concrete Mixes
Forming Part of Sentence 9.3.1.7.(1)

Maximum Size of Coarse Aggregate, mm	Materials, volume					
	Cementing Material		Fine Aggregate (damp average coarse sand)		Coarse Aggregate (gravel or crushed stone)	
	Parts ⁽¹⁾	L	Parts	L	Parts	L
14	1	28	1.75	49	2	56
20	1	28	1.75	49	2.5	70
28	1	28	2	56	3	84
40	1	28	2	56	3.5	98

Notes to Table 9.3.1.7.:

(1) 1 part cementing material = 1 × 40 kg bag

2) The size of aggregate in unreinforced site-batched concrete mixes referred to in Sentence (1) shall not exceed

- a) 1/5 the distance between the sides of vertical forms, or
- b) 1/3 the thickness of flatwork.

9.3.1.8. Admixtures

1) Admixtures shall conform to ASTM C 260, “Air-Entraining Admixtures for Concrete,” or ASTM C 494/C 494M, “Chemical Admixtures for Concrete,” as applicable.

9.3.1.9. Cold Weather Requirements

- 1) When the air temperature is below 5°C, concrete shall be
 - a) kept at a temperature of not less than 10°C or more than 25°C while being mixed and placed, and
 - b) maintained at a temperature of not less than 10°C for 72 h after placing.
- 2) No frozen material or ice shall be used in concrete described in Sentence (1).

9.3.2. Lumber and Wood Products

9.3.2.1. Grade Marking

1) Lumber for joists, rafters, trusses and beams and for the uses listed in Table 9.3.2.1. shall be identified by a grade stamp to indicate its grade as determined by NLGA 2014, “Standard Grading Rules for Canadian Lumber.” (See Note A-9.3.2.1.(1).)

Table 9.3.2.1.
Minimum Lumber Grades for Specific End Uses
 Forming Part of Sentence 9.3.2.1.(1)

Use	Boards ⁽¹⁾			Framing
	Paragraph in the NLGA Grading Rules under which boards are graded			
	All Species		Eastern White Pine & Red Pine	All Species
	Para 113	Para 114	Para 118	
Stud wall framing (<i>loadbearing</i> members)	–	–	–	Stud, Standard, No. 2
Stud wall framing (non- <i>loadbearing</i> members)	–	–	–	Stud, Utility, No. 3
Plank frame construction (<i>loadbearing</i> members)	No. 3 Common	–	No. 3 Common	No. 2
Plank frame construction (non- <i>loadbearing</i> members)	No. 5 Common	–	No. 5 Common	Economy, No. 3
Posts and beams less than 114 mm in thickness	–	–	–	Standard, No. 2
Posts and beams not less than 114 mm in thickness	–	–	–	Standard
Roof sheathing	No. 3 Common	Standard	No. 4 Common	–
Subflooring	No. 3 Common	Standard	No. 3 Common	–
Wall sheathing when required as a nailing base	No. 4 Common	Utility	No. 4 Common	–
Wall sheathing not required as a nailing base	No. 5 Common	Economy	No. 5 Common	–

Notes to Table 9.3.2.1.:

(1) See Note A-Table 9.3.2.1.

9.3.2.2. Lumber Grades

1) Except for joists, rafters, trusses and beams, visually graded lumber shall conform to the grades in Table 9.3.2.1. (See Article 9.23.4.2. for joists, rafters and beams and Article 9.23.14.11. for trusses.)

9.3.2.3. Machine Stress Rated Lumber

1) Machine stress rated lumber shall conform to the requirements of Subsection 4.3.1.

9.3.2.4. OSB, Waferboard and Plywood Marking

1) OSB, waferboard and plywood used for roof sheathing, wall sheathing and subflooring shall be legibly identified on the face of the material indicating

- the manufacturer of the material,
- the standard to which it is produced, and
- that the material is of an exterior type.

9.3.2.5. Moisture Content

1) Moisture content of lumber shall be not more than 19% at the time of installation.

9.3.2.6. Lumber Dimensions

1) Lumber dimensions referred to in this Part are actual dimensions determined in conformance with CSA O141, “Softwood Lumber.”

9.3.2.7. Panel Thickness Tolerances

1) The thicknesses specified in this Part for plywood, hardboard, particleboard, OSB and waferboard shall be subject to the tolerances permitted in the standards referenced for these products unless specifically indicated herein.

9.3.2.8. Undersized Lumber

1) Joist, rafter, lintel and beam members up to 5% less than the actual Canadian standard sizes are permitted to be used provided the allowable spans for the grade and species of lumber under consideration are reduced 5% from those shown in the Span Tables for full size members. (See Note A-9.3.2.8.(1).)

9.3.2.9. Termite and Decay Protection

1) In localities where termites are known to occur,

- a) clearance between structural wood elements and the finished ground level directly below them shall be not less than 450 mm and, except as provided in Sentence (2), all sides of the supporting elements shall be visible to permit inspection, or
- b) structural wood elements, supported by elements in contact with the ground or exposed over bare soil, shall be pressure-treated with a chemical that is toxic to termites.

(See Note A-9.3.2.9.(1).)

2) In localities where termites are known to occur and *foundations* are insulated or otherwise finished in a manner that could conceal a termite infestation,

- a) a metal or plastic barrier shall be installed through the insulation and any other separation or finish materials above finished ground level to control the passage of termites behind or through the insulation, separation or finish materials, and
- b) all sides of the finished supporting assembly shall be visible to permit inspection.

3) Structural wood elements shall be pressure-treated with a preservative to resist decay,

- a) where the vertical clearance between structural wood elements and the finished ground level is less than 150 mm (See also Articles 9.23.2.2. and 9.23.2.3.), or
- b) where
 - i) the wood elements are not protected from exposure to precipitation,
 - ii) the configuration is conducive to moisture accumulation, and
 - iii) the moisture index is greater than 1.00.

(See Note A-9.3.2.9.(3).)

4) Structural wood elements used in retaining walls and cribbing shall be pressure-treated with a preservative to resist decay, where

- a) the retaining wall or cribbing supports ground that is critical to the stability of *building foundations*, or
- b) the retaining wall or cribbing is greater than 1.2 m in height.

(See Note A-9.3.2.9.(4).)

5) Where wood is required by this Article to be treated to resist termites or decay, such treatment shall be in accordance with Table 2, Use Categories for Specific Products, Uses, and Exposures, of CAN/CSA-O80.1, "Specification of Treated Wood," as follows:

- a) Use Category 1 (UC1), where the wood member is used in
 - i) interior *construction*,
 - ii) above-ground applications, and
 - iii) applications where the wood member remains dry,
- b) Use Category 2 (UC2), where the wood member is used in
 - i) interior *construction*,
 - ii) above-ground applications, and
 - iii) applications where the wood member may be subjected to occasional sources of moisture,

- c) Use Category 3.2 (UC3.2), where the wood member is used in
 - i) exterior *construction*,
 - ii) above-ground applications, and
 - iii) applications where the wood member is uncoated or is used in a configuration conducive to moisture accumulation,
 - d) Use Category 4.1 (UC4.1), where
 - i) the wood member is in contact with the ground,
 - ii) the wood member is in contact with fresh water, or
 - iii) the vertical clearance between the wood element and the finished ground level is less than 150 mm and the wood elements are not separated from permeable supporting materials by a moisture barrier, or
 - e) Use Category 4.2 (UC4.2), where the wood member is used in critical structural components, including permanent wood *foundations*.
- 6)** Where wood is protected in accordance with UC1 or UC2 using an inorganic boron preservative, the wood shall be
- a) protected from direct exposure to water during and after the completion of *construction*, and
 - b) separated from permeable supporting materials by a moisture barrier that is resistant to all expected mechanisms of deterioration in the service environment if the vertical clearance to the ground is less than 150 mm.
- 7)** Wood that is required by this Article to be treated to resist termites or decay shall be identified by a mark to indicate the type of preservative used and conformance to the relevant required Use Category.

9.3.3. Metal

9.3.3.1. Sheet Metal Thickness

- 1)** Minimum thicknesses for sheet metal material that are stated in this Part refer to the actual minimum base metal thicknesses measured at any point of the material and, in the case of galvanized steel described in Sentence 9.3.3.2.(1), include the thickness of the galvanizing coating unless otherwise indicated.

9.3.3.2. Galvanized Sheet Steel

- 1)** Where sheet steel is required to be galvanized, it shall be metallic-coated with zinc or an alloy of 55% aluminum-zinc meeting the requirements of
- a) ASTM A 653/A 653M, “Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process,” or
 - b) ASTM A 792/A 792M, “Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.”
- 2)** Where galvanized sheet steel is intended for use in locations exposed to the weather or as a flashing material, it shall have a zinc coating not less than the G90 [Z275] coating designation or an aluminum-zinc alloy coating not less than the AZM150 coating designation, as referred to in Sentence (1).