Professional qualification of construction contractors

Competency profile

3.1 – Contractor – Concrete structures

Régie du bâtiment Québec

This document was produced with the collaboration of the team of competency assessment advisors (Direction de la qualification) of the Régie du bâtiment du Québec.

In this document, the masculine gender is used without discrimination and solely for the sake of brevity.

Changes to the content may be made at any time.

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Introduction

The person who passes the exam can act as a guarantor for construction work included in subclass 3.1 - Contractor – Concrete structures.

This competency profile is based on the scope of application of the *Building Act*, as well as on Section (21-22-23 or 24) of the *Regulation respecting the professional qualification of contractors and owner-builders*.

Subclass definition

3.1 - Contractor – Concrete structures

This subclass authorizes construction work relating to cast or precast structural concrete.

It also authorizes construction work in subclass 3.2 of Schedule III.

Finally, it authorizes similar or related construction work.

Module 1 – DEFINITIONS AND TYPES OF STRUCTURES

Elements of competency covered in this module:

1. Define concepts and terms related to concrete structures
2. Define concepts relating to concrete properties
3. Define concepts relating to loads
4. Describe the main characteristics of concrete structures and their components

Module 1 – DEFINITIONS AND TYPES OF STRUCTURES

Elements of competency	Skills required
1. Define concepts and terms related to concrete structures	1.1. Define the concepts of “shallow foundation,” “deep foundation” and “load-bearing elements”
	1.2. Define “allowable deflection” (1/240; 1/360; 1/420, etc.)
	1.3. Define terms associated with concrete structures: shrinkage, curing, camber, etc.
2. Define concepts relating to concrete properties	2.1. List the important characteristics of concrete (aggregate, water, strength, dosage, temperature) (9.3.1)
	2.2. Identify factors or practices that can adversely affect concrete quality (freezing, W/C ratio, etc.)
	2.3. Explain the use and effects on concrete properties of various admixtures (calcium, etc.)
3. Define concepts relating to loads	3.1. Define the concepts of “live load,” “dead load” and “bearing surface”
	3.2. List the various loads that can act on a structure (snow, wind, earthquake, etc.)
	3.3. Explain the impact of a “lateral load” on a structure (causes, consequences, etc.)
	3.4. Explain the difference between a “concentrated load” and a “uniformly distributed load”
4. Describe the main characteristics of concrete structures and their components	4.1. Name the elements that make up the various structures and their functions
	4.2. Name the connections that ensure the stability of a structure
	4.3. Name the elements that make up bracing

Elements of competency	Skills required
	4.4. Name the various components that ensure the lateral stability of concrete structures

Module 2 – LEGISLATIVE, NORMATIVE AND REGULATORY FRAMEWORK

Elements of competency covered in this module:

5. Situate concrete structural work in relation to the various codes and standards in force

Module 2 – LEGISLATIVE, NORMATIVE AND REGULATORY FRAMEWORK

Elements of competency	Skills required
5. Situate concrete structural work in relation to the various codes and standards in force	5.1. Identify and define the use of the parts and sections of the *Quebec Construction Code – Chapter I, Building* applicable to concrete structural work
	5.2. Identify the various installation standards applicable to concrete structural work (CSA and others)
	5.3. Define the role of the *Canadian Standards Association* (CSA)
	5.4. Outline the scope of the various codes and standards applicable to concrete structural work (materials, building types, etc.)
	5.5. Describe the links between the various codes and standards specific to concrete structural work and the *Quebec Construction Code – Chapter I, Building* (organizational structure)
	5.6. Explain the roles and responsibilities of the designer and contractor with regard to soil and groundwater investigation

Module 3 – PLANS AND SPECIFICATIONS

Elements of competency covered in this module:

6. Read and interpret drawings and plans of structures (concrete)
7. Read and interpret the divisions of specifications for structures (concrete)

Module 3 – PLANS AND SPECIFICATIONS

Elements of competency	Skills required
6. Read and interpret drawings and plans of structures (concrete)	6.1. Locate the various elements of the various structures on a plan
	6.2. Locate concrete structural elements on a plan
	6.3. Explain the meaning of the main symbols used for drawings of concrete structures
	6.4. Locate, read and interpret the main dimensions and annotations of elements of concrete structures
	6.5. Locate, read and interpret cross-sections and details associated with elements of concrete structures
	6.6. Read and interpret general notes and tables associated with elements of concrete structures
	6.7. Prepare the quantity survey[1] (concrete, formwork, etc.)
	6.8. Read and interpret erection diagrams (or standard installation plans) for concrete (formwork, reinforcement, etc.)
	6.9. Read and interpret shop drawings for concrete structures
7. Read and interpret the divisions of specifications for structures (concrete)	7.1. Define the divisions and sections of construction specifications associated with the structural elements of a building
	7.2. Interpret information relating to concrete formwork in specifications
	7.3. Interpret information relating to concrete reinforcements in specifications
	7.4. Interpret information relating to cast-in-place and precast concrete in specifications

[1] Prepare the quantity survey: measure the structure and calculate the quantities of materials required.

Module 4 – STANDARDS AND EXECUTION OF WORK

Elements of competency covered in this module:

8. Plan and organize concrete structural work
9. Manage the execution of foundation work (concrete)
10. Manage the execution of concrete structural work (above ground)
11. Ensure quality control of concrete structural work
12. Ensure health and safety in relation to concrete structural work

Module 4 – STANDARDS AND EXECUTION OF WORK

Elements of competency	Skills required
8. Plan and organize concrete structural work	8.1. Communicate to the general contractor the limits of the work supplied by the concrete structures contractor
	8.2. Determine the stages and logical order of execution of concrete structural work
	8.3. Identify elements to be supplied by other disciplines but installed by the concrete structures contractor
	8.4. Explain the importance of properly coordinating the interface (common boundaries) between the various disciplines on the site
	8.5. Describe the characteristics of concrete structural projects that require plans and specifications
	8.6. Explain the process for modifying concrete structures
	8.7. Explain how climatic conditions can affect concrete structural work
	8.8. Determine the maximum weight of equipment that can be placed on a concrete structure
	8.9. Obtain and forward certificates issued by the steel mill that manufactured the reinforcements
	8.10. Plan concrete production and stagger deliveries to avoid interruptions during a pour
	8.11. Produce and obtain approval for shop and assembly drawings where applicable
	8.12. Explain the conditions that allow machinery to circulate on a slab
9. Manage the execution of foundation work (concrete)	9.1. Check excavation levels
	9.2. Place and secure all marker posts on site for erecting formwork

Elements of competency	Skills required
	9.3. Explain the difference between a foundation wall that is “laterally supported” and one that is not laterally supported in small buildings (9.15.4.2)
	9.4. Explain the limitations of pilaster-type foundations for small buildings (9.15.2.4)
	9.5. Explain how to build different types of foundations depending on the soil (type and water table) and the load (strength required, impact on dimensions and height)
	9.6. Recognize the type of soil and assess its bearing capacity (admissible pressure) (table 9.4.4.1)
	9.7. List the conditions that make it impossible to install footings (redeveloped soils, frost, etc.)
	9.8. Dimension footings and foundation walls for small buildings (9.15)
	9.9. Check excavation slopes, taking into account the nature of the soil
	9.10. Check that excavation slopes are stable and comply with the requirements of the Commission des normes, de l’équité, de la santé et de la sécurité du travail (CNESST)
	9.11. Ensure that the soil beneath the foundations has not been disturbed and has adequate bearing capacity (based on the engineer’s samples)
	9.12. Determine the thickness of foundation walls with a maximum unsupported height of 2.5 m in small buildings (9.15.4.1)
	9.13. State the height of the foundation wall above finished grade for small buildings (9.15.4.3)
	9.14. State the conditions under which a reduction in the thickness of the upper part of the foundation wall is permitted in small buildings (floor joists and exterior masonry cladding) (9.15.4.4)

Elements of competency	Skills required
	9.15. Ensure that footing formwork is in place, taking into account setbacks
	9.16. Explain how to locate and install crack control joints in small building foundations (9.15.4.6)
	9.17. Determine the concrete cover required for reinforcing bars in footings and foundation walls in contact with the ground
	9.18. Monitor concrete placement (mix, pour height, fall height, etc.)
	9.19. Name the usual minimum times for stripping footings and foundation walls
	9.20. Make sure the concrete has cured in the open air (do not backfill too quickly to avoid cracking)
	9.21. Precisely position anchor bolts and other elements embedded in concrete
	9.22. Ensure that backfill material is suitable and correctly placed (with a positive slope)
10. Manage the execution of concrete structural work (above ground)	10.1. Calculate the required camber (based on a criterion previously established by the designers of the reinforced concrete structure)
	10.2. Identify elements that require formwork to be cambered beforehand
	10.3. Identify the maximum allowable deflection expressed in terms of a clear span (9.4.3)
	10.4. Explain the rules applicable to the drilling of concrete structural elements
	10.5. Explain the importance of foundation anchors
	10.6. Ensure formwork is level, including cambering if required

Elements of competency	Skills required
	10.7. Ensure proper use of equipment (crane, pump) for lifting, placing formwork, reinforcement, etc. (capacity, etc.)
	10.8. Identify the properties of reinforcing steel that is commonly used and readily available
	10.9. Name commonly used reinforcement diameters
	10.10. Identify where reinforcement is needed in concrete (layout zone, tension, shear) for different reinforced concrete elements (footings, walls, slabs, flat slabs, beams, etc.)
	10.11. Explain the function (and usual lengths required) of reinforcement overlaps for reinforced concrete elements
	10.12. List methods for jointing reinforcing bars
	10.13. Check or have checked the installation of reinforcement before casting (manufacturing tolerances, installation details, concentration of reinforcement in column strips, two-way slabs, etc.)
	10.14. Check or have checked formwork set-up before casting (stretching, bracing, strength, safety, etc.)
	10.15. Obtain professional authorization before pouring, if required (work with plans and specifications)
	10.16. Ensure that all elements to be incorporated into the concrete from other disciplines are supplied, validated and correctly positioned
	10.17. Monitor concrete placement (pour height, fall height, vibration, etc.)
	10.18. Ensure compliance with curing time and procedure (concrete not overloaded, protected from shocks, vibrations, weather)
	10.19. Explain methods for concreting in cold and hot weather

Elements of competency	Skills required
	10.20. Explain concrete drying and curing conditions
	10.21. Name the usual minimum times for formwork removal of various concrete elements (beams, walls, beam sides, slabs, etc.)
	10.22. Explain how to locate and arrange crack control joints in concrete slabs
	10.23. Check backfill for proper compaction before pouring a slab
11. Ensure quality control of concrete structural work	11.1. Determine the minimum quality of concrete to be used for various structural components of small buildings (embankments, foundation walls, stoops, stairs, barn floors, etc.) (9.3)
	11.2. Explain how to control the quality of concrete delivered to the site (air meter, slump cone, etc.)
	11.3. Check the quality of the concrete delivered to the site (mix description, mixing time, transport time, etc.)
	11.4. Explain the importance of controlling entrained air content in concrete structures
	11.5. List ways to ensure quality control of structural work
	11.6. List the tests and trials to be carried out on materials used in structural work
	11.7. Identify those responsible for the various stages of quality control of structural work
	11.8. Ensure the quality of materials (upon receipt, but also according to optimal storage conditions)
	11.9. Solve problems in the execution of structural work (solutions, schedule adjustments, etc.)
12. Ensure health and safety in relation to	12.1. Ensure that the formwork complies with safety regulations
	12.2. Explain the purpose of a shoring plan

Elements of competency	Skills required
concrete structural work	12.3. Ensure that formwork shoring plans are produced in accordance with the loads applied to the structure *(Safety Code for the Construction Industry* [R.S.Q. c. S-2.1, r.6, section VI])
	12.4. List fall-arresting devices and require their use by workers, where applicable
	12.5. Ensure safe handling of lifting equipment