structural provisions of the Building Code. These skills are necessary to be successful in passing the qualification examination.

Recognizing that some readers will have greater familiarity with either Part 4 or Part 9, approximately equal emphasis will be placed on these parts of the code. The course will also address limitations of Part 9 in the design and construction of buildings, and will identify situations where Part 4 must be used for Part 9 buildings.

References made throughout this course to the abbreviation "OBC" are intended to refer to the 2012 Ontario Building Code, O. Reg. 332/12, as amended to O. Reg. 191/14. The use of the terms "Building Code", or "Code" in this course also refer to the above noted regulation.
(The use of "OBC" in this course should not be confused with "objective-based code".)

Unless otherwise noted, all Code references within this course are intended to refer to Division B.

1.2 EXAMINATION SYLLABUS AND EXAMINATION FORMAT

An examination syllabus published by the Ministry of Municipal Affairs and Housing gives examination candidates the specific topics that will be covered in each examination. The syllabi for "Building Structural" is found on their website:

http://www.obc.mah.gov.on.ca

under the headings: "Qualification & Registration / Examination Syllabi".

Questions on the Ministry's exams are all multiple choice. They have been chosen to address Building Code requirements based on the "**difficulty**", "**importance**" and "**frequency**" of the requirement. The function of the questions is to test the ability of the candidate to find, understand or apply the Code requirements.

1.8 BUILDING STRUCTURES - SCOPE AND APPLICATION OF DIVISION B

Individual requirements within Division B do not apply to every *building*. The rules for the application of each of the 12 Parts of Division B to a particular *building* are found in Subsection 1.1.2. of Division A.

For instance, Sentence 1.1.2.1.(1) informs us that Part 1 applies to every building, and that Parts 7 and 12 apply to every building subject to Article 1.1.2.6. Sentence 1.1.2.2.(1) shows that Parts 3, 4, 5 and 6 apply to all buildings subject to Articles 1.1.2.6. and 1.3.1.2.

Sentence 1.1.2.4.(1) tells us that Part 9 would apply to *buildings* of *residential* and *mercantile occupancies*, of three *storeys* or less in *building height* and having a *building area* not exceeding 600 m². However, Clause 1.1.2.2.(2)(b) indicates that the structural design of a *building* of *residential or mercantile occupancy* would be governed by Part 4 instead of Part 9, if the *building area* exceeded 600 m² or the *building height* exceeded 3 *storeys*.

From the above example, it should become very clear that one does not jump from Part 9 to Part 4, or from Part 4 to Part 9, unless the Code specifically provides direction to that effect.

Another example is the snow loading requirements for certain elements in Part 9 *buildings*. Sentence 9.4.2.2.(3) informs us that the snow loads for special roof trusses spanning more than 6 metres are to be determined using Subsection 4.1.6. Thus, in this instance, the requirements of Part 4 must be applied to a *building* regulated by Part 9 of the Building Code.

However, sometimes Part 9 provisions must be used in the design of *buildings* using Part 4. Consider the requirements of Sentence 4.3.1.3.(1). We are informed that in areas know to be infested with termites, wood used in structures designed under Part 4 shall comply with the requirements of Articles 9.3.2.9., 9.12.1.1. and 9.15.5.1. Thus in this instance, a Part 9 provision is deemed to form part of a Part 4 requirement.

The subject of "designated structures" will be discussed in detail later in this Module.

The Act also gives the following important definitions:

"**construct**" means to do anything in the erection, installation, extension or material alteration or repair of a building and includes the installation of a building unit fabricated or moved from elsewhere and "construction" has a corresponding meaning.

"**demolish**" means to do anything in the removal of a building or any material part thereof and "demolition" has a corresponding meaning.

The requirements of the OBC apply to the construction and to the demolition of buildings.

2.4 BUILDING AREA, HEIGHT AND OCCUPANCY

In applying the Building Code to any particular *building*, it is necessary to start by determining which Parts of the Code are applicable to that specific *building*.

In general, the structural design and construction of all *buildings* and other designated structures must comply with the requirements of Part 4 of the Code. However, in certain circumstances, the design of "houses and small buildings" may be carried out using the provisions of Part 9 of the Code.

The determination of which types of *buildings* may be considered "Part 9 buildings" is based on *building area*, *building height* and type of *occupancy*. Please take a moment to review these definitions in Clause 1.4.1.2.(1)(b) of Division A. Care should be taken not to confuse such terms as *gross area* and *floor area* with *building area*.

Also important in the classification of *buildings* is the type of *occupancy* of the *building*, which pertains to the degree of hazard associated with the *building* usage. Terminology pertaining to *occupancy* is also defined in Clause 1.4.1.2.(1)(b) of Division A.

In reading Article 1.1.2.2., it will become apparent that Part 4 applies to all Part 3 *buildings*.

Exercise #2-2

Read all of Articles 1.1.2.2. and 1.1.2.4. of Division A. Complete the following exercise, and when complete, discuss the answers with your group.

Which of the following *buildings* must be constructed using the provisions of Part 9 of Division B?

1. Two-*storey* single-family residence, having overall maximum horizontal dimensions of 4.0 meters x 12.0 meters?

   ☐ Part 9 ☐ Parts 3, 4, 5 and 6

OBC Reference(s): _____

_____

_____

2. Three-storey single-family residence, with *basement*, having overall maximum horizontal dimensions of 4.0 meters x 12.0 meters?

   ☐ Part 9 ☐ Parts 3, 4, 5 and 6

OBC Reference(s): _____

_____

_____

3. One-storey funeral home and chapel, having overall maximum horizontal dimensions 4.0 meters x 12.0 meters?

   ☐ Part 9 ☐ Parts 3, 4, 5 and 6

OBC Reference(s): _____

_____

_____

STOP

Exercise #2-4

Complete the following exercise, then discuss the answers with your group.

1. In Table 1.3.1.2. of Division B, the "Issuing Agency" CWC refers to the Canadian Wood Council, as indicated by Table 1.3.2.1. What specific Code provision permits the use of CWC's "Engineering Guide for Wood Frame Construction"?

   a) Sentence 4.3.1.1.(1)

   b) Sentence 9.4.1.1.(1)

   c) Sentence 9.23.2.1.(1)

   d) The National Farm Building Code of Canada

OBC Reference(s): _____

_____

2. In applying the Building Code, you have discovered that there is a conflicting requirement between a specific provision in Part 9 of Division B, and the provision of a specific document listed in Table 1.3.1.2. of Division B. What should you do?

   a) Apply the Part 9 provision

   b) Apply the provision of the reference document

   c) Apply the most restrictive provision of a) and b)

   d) Seek interpretation from the *Chief Building Official*

OBC Reference(s): _____

_____

STOP

2.7 CLIMATIC DATA FOR STRUCTURAL DESIGN

Volume 1 Subsection 1.1.2. of Division B, and Supplementary Standard SB-1, which is found in Volume 2, provide climatic and seismic design data necessary for the design of *buildings*.

6. Consider a *building* with an effective width of 60 meters, and a height of 180 meters. According to Sentence 4.1.3.6.(3), would it be necessary to account for the dynamic effects of wind in the structural design of the *building*?

   a) No, since height/width < 3

   b) Yes, since height/width < 4

   c) No, since height > 60 m, but height/width < 4

   d) Yes, since height > 60 m or height/width > 4

OBC Reference(s): _____

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STOP

3.5.2 ULTIMATE LIMIT STATES (ULS) STRENGTH AND STABILITY

In the design of structural members for strength and stability, the philosophy of limit states design is to ensure that the maximum strength of a material exceeds the load that will be imposed upon it, with a reasonable margin of safety against failure. In limit states design, loads and material resistance are treated as probabilities.

In this method, adequacy of strength is addressed by the Code in requiring that " load factors" be used to account for the possibility that actual loads may exceed those anticipated at the time of design. The "factored resistance" (fR) of a member is determined by applying a factor (f) less than one, to the nominal member strength (R), to account for variability of material properties, dimensions and workmanship. To ensure adequacy of strength, the factored loads must be less than the factored resistance. This requirement is stated in Sentence 4.1.3.2.(1).

Stability is the ability of a structure to carry load without collapse or excessive deformation. Stability is affected by the manner in which loads are transmitted to structural members, the properties of the member, and the means by which the structure or member is braced to prevent unintended movement. An example of bracing to ensure stability of structural members is given in Figure 3:2.

3. For the *building* in question 2 above, what is the *partition dead load* that should be used in assessing the overturning resistance of the *building* to wind loads?

   a) 0 kPa

   b) 0.5 kPa

   c) 1.0 kPa

   d) None of the above

OBC Reference(s): _____

_____

_____

4. Consider a cantilever retaining wall in which the weight of *soil* above the footing is relied upon to provide stability against possible overturning. Considering the requirements of Sentence 4.1.4.1.(6), what load factor must be applied to the vertical *dead load* due to *soil* when designing to counteract the effects of overturning?

   a) 0.0, since *soil* weight must be neglected

   b) 0.9 or 1.0, as required by Sentence 4.1.3.2.(5)

   c) 1.25, or as otherwise required by Sentence 4.1.3.2.(8)

   d) 1.40 as required by Tables 4.1.3.2.A. and B.

OBC Reference(s): _____

_____

_____

STOP

3. For a movie theatre, what is the *live load* reduction factor that may be applied to the 2.4 kPa *live load* on a column supporting a tributary area of 100 m²?

   a) 0.00

   b) 0.61

   c) 0.95

   d) No *live load* reduction allowed

OBC Reference(s): _____

_____

_____

4. When applying the *live load* reduction factors of Article 4.1.5.8., which of the following is true?

   a) Reduction factors are not allowed for *assembly occupancies*.

   b) The reduction factors to *live load* may be applied to the loads determined under Article 4.1.5.9.

   c) The structural drawings must show that a reduction factor was used in the design.

   d) The 1.0 kPa minimum *live load* for roofs may be reduced using the equation in Sentence 4.1.5.9.(3)

OBC Reference(s): _____

_____

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STOP

2. What is the value of I_w to be used in determining the wind load for a shopping mall to check the overall deflections of the main lateral force resisting system?

   a) 0.75

   b) 0.80

   c) 1.00

   d) 1.25

OBC Reference(s):_____

_____

_____

STOP

6.4.2 REFERENCE WIND VELOCITY PRESSURE, Q

The basic design wind load in the Code is the velocity pressure of a wind lasting for a few seconds that will be exceeded, on the average, once in 50 years.

Column 15 of Table 1-2 in Supplementary Standard SB-1 provides reference wind pressures, q, for various geographical locations. These values of q are to be used with the equation in Sentence 4.1.7.1.(1):

$$p = I_w \, \mathbf{q} \, C_e \, C_g \, C_p$$

3. In the design of sloped glazing for the effects of wind, what value of C_g should be used for determining wind pressures on the main structural members in the glazing system?

   a) 2.00

   b) 2.25

   c) 2.50

   d) 3.00

OBC Reference(s): _____

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_____

STOP

6.4.5 EXTERNAL PRESSURE COEFFICENT, C_p

The pressure distributions on a *building* can be expressed as non-dimensional pressure coefficients, based on the shape of a *building*. Pressure coefficients used in design are based on experimental testing of models of different types and shapes of buildings in wind tunnels.

When using the static method for wind, the external pressure coefficient, C_p, is applied to a *building* using Sentence 4.1.7.1.(1):

$$p = I_w \, q \, C_e \, C_g \, \mathbf{C_p}$$

The orientation of a building to the wind and the slope of a roof have a significant effect on pressure distribution, particularly on the edges and corners of buildings. A sample distribution of pressure coefficients on a *building* is given in Figure 6:3.

Pressure coefficients for determining static wind loads are found in Commentary I of the "User's Guide – National Building Code 2005 Structural Commentaries (Part 4 of Division B)". The commentary includes pressure coefficients for a wide variety of building shapes.

The values given in Commentary I correspond to the average pressures acting at 90 degrees to a surface. Thus, for sloped surfaces, wind pressures have horizontal and vertical components.

- ***Firewall*** means a type of *fire separation* of *noncombustible construction* that subdivides a *building* or separates adjoining *buildings* to resist the spread of fire and that has a *fire-resistance rating* as prescribed in this Code and has structural stability to remain intact under fire conditions for the required fire-rated time.
- ***Noncombustible*** means that a material meets the acceptance criteria of CAN/ULC4-S114, "Test for Determination of Non-Combustibility in Building Materials".
- ***Combustible*** means that a material fails to meet the acceptance criteria of CAN/ULC4-S114, "Test for Determination of Non-Combustibility in Building Materials."
- ***Noncombustible construction*** means a type of construction in which a degree of fire safety is attained by the use of *noncombustible* materials for structural members and other building assemblies.
- ***Combustible construction*** means a type of construction that does not meet the requirements for *noncombustible construction*.
- ***Fire-resistance rating*** means the time in minutes or hours that a material or assembly of materials will withstand the passage of flame and the transmission of heat when exposed to fire under specified conditions of test and performance criteria, or as determined by extension or interpretation of information derived from that test and performance as prescribed in this Code.

In reading these definitions, it is important to understand a *fire separation* wall is a wall between two spaces that is meant to stop or slow the spread of fire, while a *firewall* is a fire separation that must remain standing after one side of the *building* has collapsed.

In *buildings*, it is common for *firewalls* and *fire-separations* to act as *loadbearing* elements that support floor or roof framing elements, however such walls may also be non-*loadbearing*. If a firewall relies on support from other elements, those elements require the same fire resistance rating as the firewall.

The applicable Code requirements for *buildings* designed using Part 4 are found in OBC 3.1.8.2. and OBC 3.1.10.1. Corresponding requirements for Part 9 buildings are given in Article 9.10.9.8.

The structural provisions for *firewalls* are found in Article 4.1.5.17., which form part of the Subsection that deals with *live loads* due to use and *occupancy*.

Exercise #8-2

Read Article 4.1.5.17. of Division B. Complete the following exercise, then discuss the answers with your group.

1. What is the minimum lateral load to be used in the design of an interior *firewall*?

   a) 0.5 kPa factored load

   b) Wind loads determined using Article 4.1.7.4.

   c) Earthquake loads determined using Article 4.1.8.18.

   d) a), b) or c), whichever produces the greatest effect

OBC Reference(s):_____

_____

_____

2. What is the minimum *fire-resistance rating* required for a floor system that is relied upon to provide lateral support for a 2-hour *firewall*?

   a) 45 minutes

   b) 1 hour

   c) 2 hours

   d) 3 hours

OBC Reference(s): _____

_____

_____

STOP

8

8.3 DESIGN LOADS AND REQUIREMENTS FOR HANDRAILS

A handrail is a horizontal or sloping rail intended for grasping by the hand for guidance and/or support. Handrails are provided to help support a person requiring something to hold on to as they use steps or a ramp. Handrail requirements are found in both Part 3 and Part 9 of Division B of the Building Code.

Exercise #8-3

Read Article 3.4.6.5. Complete the following exercise, then discuss the answers with your group.

1. For handrails located in *exits,* what is the minimum specified design load to be used for the design of the handrails and their anchorages and supports?
   (Assume that the handrail does not also serve as a *guard.)*

   a) 0.7 kN/m, acting in any direction, along the length of the handrail

   b) 0.9 kN concentrated load, acting in any direction, located such as to produce the maximum effects on any part of the handrail

   c) a) and b) as separate load cases

   d) a) and b) acting together

OBC Reference(s)_____

_____

_____

Exercise #8-6

Read Article 3.7.2.1. This Article refers one to Part 9 for windows for sleeping rooms in any building and every principal room such as living rooms, dining rooms or a combination of them in dwelling units. Sentence 9.7.2.2.(4) requires that the protection of windows and doors against persons falling through them shall conform to Article 9.8.8.1. Sentence 9.8.8.1.(5) requires that openanble windows in buildings of residential occupancy shall be protected by:

a) a guard in accordance with Article 9.8.8.1., or

b) a mechanism capable of controlling the free swinging or sliding of the openable part of the window so as to limit any clear unobstructed opening to a size that will prevent the passage of a sphere having a diameter more than 100 mm.

Complete the following exercise, then discuss the answers with your group.

1. Is the following statement true or false?
"Window *guards* or equivalent alternate means of fall protection are only required in *dwelling units* above the 3rd floor of Group C *major occupancy* apartment *buildings.*"
☐ True ☐ False

OBC Reference(s):_____

_____

_____

2. Is the following statement true or false?
"Window *guards* or equivalent alternate means of fall protection are not required for windows located not more than 1 800 mm above the floor or ground on the other side of the window."
☐ True ☐ False

OBC Reference(s):_____

_____

_____

2. With respect to Code requirements for anchor systems on *buildings*, which of the following statements is false?

   a) Design of anchorage systems shall be in accordance with CAN/CSA Standard Z91, or a method that provides an equivalent level of safety

   b) Anchors are only required if the *building* has windows

   c) Anchorage systems must be corrosion-resistant

   d) Anchors are required where the elevation difference between the roof and ground exceeds 8 m, and where exterior maintenance and window cleaning is carried out

OBC Reference(s):_____

_____

_____

3. To which of the following does the requirements of CSA-S413 apply?

   a) Guards on retaining wall

   b) Roof anchors

   c) Parking garage

   d) Manure storage tank

OBC Reference(s):_____

_____

_____

4. True or false:
   "G*uards* are required on open sides of retaining walls, designated in Sentence 1.3.1.1.(1) of Division A, where the elevatorpublic has access to the top of the wall."
   ☐ True ☐ False

OBC Reference(s):_____

_____

_____

STOP End of Module 8

9.3 MATERIALS USED IN FOUNDATIONS

Subsection 4.2.3. specifies the requirements for the materials used in *foundations*. The provisions of Subsection 4.2.3. are additional to those of Section 4.3., and have specific requirements pertaining to durability.

EXERCISE #9-2

Read Subsection 4.2.3. and complete the following exercise. Then discuss your answers with your group.

1. According to the Building Code, what portions of wood used in *foundations* must be treated with preservatives to prevent deterioration?
   a) Wood located above the lowest anticipated *groundwater* table, exposed to soil
   b) Wood located above the highest anticipated *groundwater* table, exposed to soil or air
   c) Wood located above the lowest anticipated *groundwater* table, exposed to soil or air
   d) All wood *foundations*

OBC Reference(s):_____

_____

_____

2. Which of the following reference standards do <u>not</u> address the material requirements for steel *piles*?
   a) ASTM-A252
   b) CAN/CSA-A23.1-M
   c) ASTM-A1011/A1011M
   d) CSA-G40.21

OBC Reference(s):_____

_____

_____

Other exceptions to the use of Part 9 can be found within Part 9 itself. As the scope of this Module is only the general structural provisions, we will review these general exceptions here only.

Some areas where Part 9 redirects the user to Part 4, are:

- Reinforced concrete design [Sentence 9.3.1.1.(3)]
- Machine stress rated lumber (Article 9.3.2.3.)
- Structural members and connections not specifically prescribed in Part 9, or outside the limitations of Part 9 (Article 9.4.1.1.)
- Design snow loads for special roof trusses with spans greater than 6 metres [Sentence 9.4.2.2.(3)]
- Special condition *foundations* (Subsection 9.4.4.)
- Roof trusses not conforming to the loading and deflection requirements of Sentence 9.23.13.11.(1)
- Design snow loads for special trusses or other structural members with spans larger than 6 m or spacing greater than 610 mm [Sentence 9.4.2.2.(3)]

The need to design specific components to Part 4 of the Building Code does not imply that the remaining portions of the *building* have to be designed to Part 4 as well. However, portions of a *building* required to support the loads of Part 4 must also be designed to comply with Part 4. (Article 9.4.1.1.)

These exceptions and others to Part 9 applicability will be covered in greater detail within individual Modules of this course.

Exercise #10-1

Read Articles 1.1.2.2. to 1.1.2.4. of Division A, including any referenced Articles or Sentences. Complete the following exercise, then discuss the answers with your group.

Where C_b is a basic snow load roof factor. For Part 9 *buildings* the factor is 0.45 for roofs where the width does not exceed 4.3 metres and is 0.55 for all other roofs. In no case shall the specified snow load (S) be less than 1.0 kPa.

There are instances in Part 9 where design is required under the provisions of Part 4. For example, structural members in Part 9 *buildings* with framing exceeding the limitations of Article 9.23.1.1. must be designed in accordance with Part 4. However, in these cases, the snow loads may be determined using the provisions of Part 9 rather than Part 4, provided that the framing geometry complies with the requirements of Sentence 9.4.2.1.(1).

Special attention is given to the design of wood roof trusses under Part 9. If in the rare occasion that the trusses are not designed under Part 4, then the requirements of Sentence 9.23.13.11.(1) apply, in which case the trusses must be capable of supporting a total ceiling load of 0.35 kPa plus 2.67 times the specified live roof load for 24 hours and meet deflection requirements in Table 9.23.13.11. when loaded with the ceiling load plus 1.33 times the specified roof snow load for 1 hour.

Due to the occurrence of large unbalanced snow loads on bowstring, arch or semi-circular roofs trusses, Sentence 9.4.2.2.(3) requires the snow loads for such trusses to be determined in accordance with Part 4, even in Part 9 *buildings.*

Exercise #10-2

Read Articles 9.4.2. and 9.4.3. Complete the following exercise, then discuss your answers with your group.

1. What is the maximum wood floor joist spacing for the specified loads in the Subsection to apply:
   a) 406 mm
   b) 762 mm
   c) 610 mm
   d) 360 mm

OBC Reference(s):_____

11.5 FOOTING DEPTH

Footings may not be placed directly at *grade*. Even in *buildings* without *basements*, footings are placed below grade in order to ensure they bear on sound undisturbed *soil* with sufficient bearing capacity and also protect them from damage due to frost.

The requirement to protect the footings from frost is due to the nature of water expanding when it freezes. Water trapped in the *soil* below the footings that is allowed to freeze expands and can lift the *foundation* causing damage to the *building*. The minimum depth required to adequately protect a footing from frost has been tabulated in Table 9.12.2.2. of the Code for different types of *soil*.

In addition, Sentence 1.2.1.1.(1) of Division C places limitations on the depth of footings constructed within the angle of repose of an adjacent *building*, requiring the design to be conducted by a suitably qualified and experienced person. An illustration of the effect of the allowable angle of repose is given in Figure 11:2.

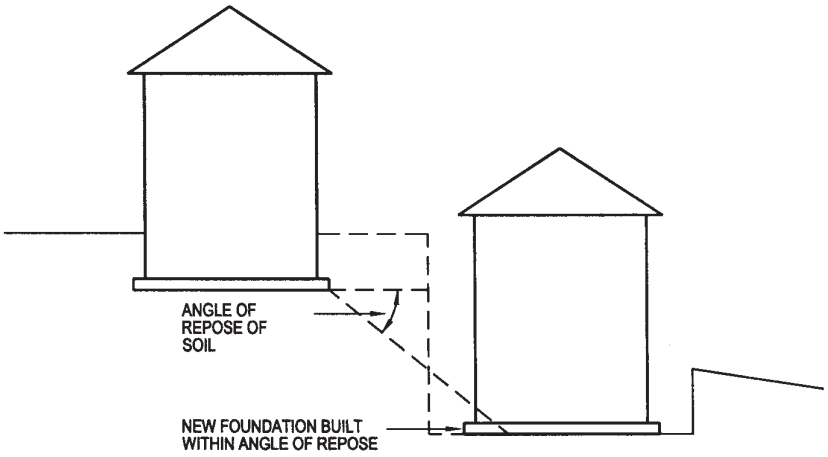

FIGURE 11:2 ANGLE OF REPOSE

Exercise #11-3

Read Subsection 9.12.2. and Sentence 1.2.1.2.(1) of Division C. Answer the following questions, then discuss the answers with the group.

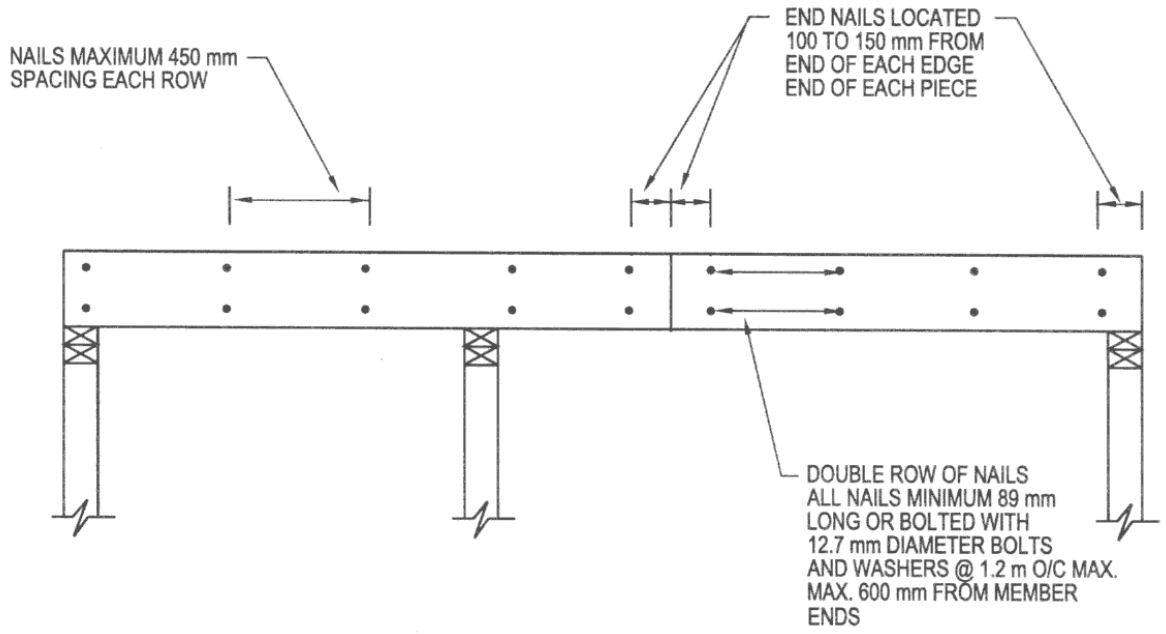

FIGURE 14:10 BUILT UP BEAMS – NAILING – ARTICLE 9.23.8.3.

Span Tables A-1 and A-2 of Part 9 are used for the selection of floor joists. This selection is dependent on the presence of bridging, or as in the case of Table A-2, for special conditions of concrete toppings or ceilings attached.

In addition to the routine spacing of joists and their support, a floor must be designed for a number of special conditions. These special conditions include floor openings, support of *loadbearing* and *nonloadbearing* walls, and the use of cantilevered joists.

Special additional framing members around openings are called 'header' and 'trimmer' joists. Their requirements are found in Articles 9.23.9.5. and 9.23.9.6., respectively. Figure 14:11 summarizes these requirements.

2. What is the acceptable range of mortar joint thickness for concrete unit masonry or burned clay brick unit masonry?

   a) 10 mm, with no allowable variance

   b) 5 mm to 20 mm

   c) 10 mm to 15 mm

   d) 5 mm to 10 mm

OBC Reference(s):_____

_____

3. Which of the following is an acceptable mortar mix for a *loadbearing* exterior above ground masonry wall?

   a) Mortar type N;
   Mix proportions 1:1:5
   (Portland Cement: Lime: Sand)

   b) Mortar type S;
   Mix proportions 1:2:8
   (Portland Cement: Masonry Cement: Sand)

   c) Mortar type S;
   Mix proportions 2:1:4
   (Portland Cement: Lime: Sand)

   d) Mortar type N;
   Mix proportions 1:3
   (Masonry Cement: Sand)

OBC Reference(s):_____

_____

4. What is the reference standard for the use of reclaimed brick for a masonry veneer wall in Part 9 construction?

   a) CAN/CSA-A82.1M

   b) CAN3-A82.8-M

   c) CAN/CSA-A165.2

   d) None of the above

OBC Reference(s):_____

_____

STOP

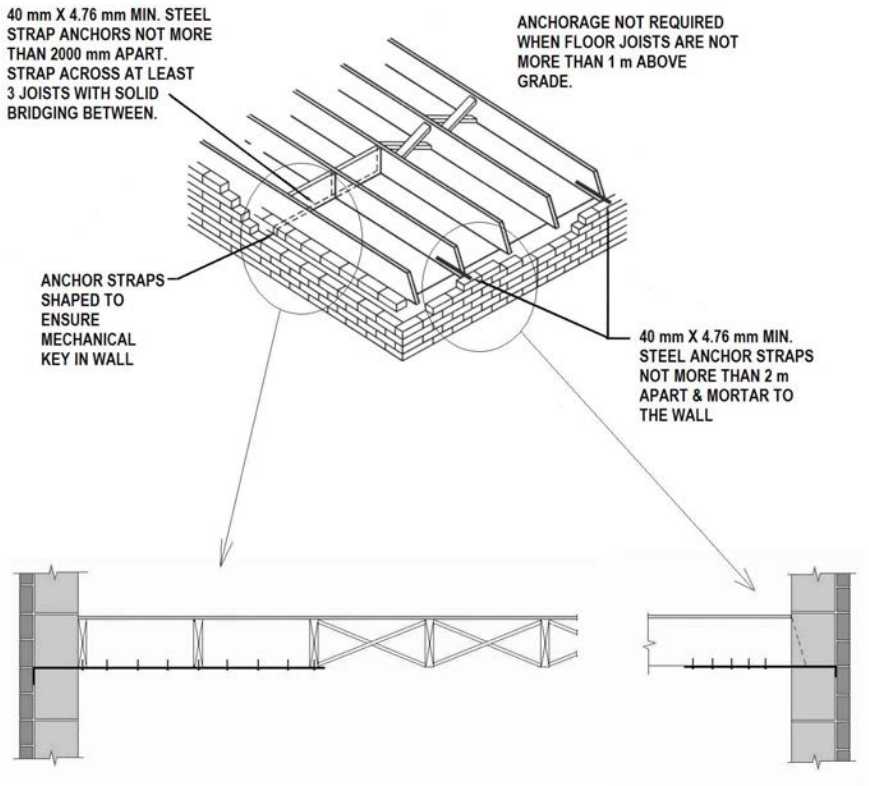

FIGURE 16:7 ANCHORAGE OF FLOOR OR ROOF ASSEMBLIES (ARTICLE 9.20.11.1.)

16.5.3 BONDING AND TYING

Where intersecting walls are to provide lateral support for masonry walls there is also minimum anchorage requirements to satisfy Article 9.20.11.2., which requires, when intersecting masonry walls are to provide lateral support, that 50% of the adjacent masonry units be bonded together. This bond can be done either by toothing the units together or by mechanical ties spaced not more than 800 mm on center vertically. The ties are required to be corrosion resistant, shaped to provide a mechanical keying action, and a minimum thickness of 4.76 mm x 40 mm wide.

Article 9.20.11.3. gives the requirements for a wood-framed wall that provides lateral support to a masonry wall. Figure 16:8 provides a summary of those requirements.

16.9 ABOVE GROUND – FLAT INSULATING CONCRETE WALLS

The minimum wall thickness for an above ground ICF wall is 140 mm as provided in Article 9.20.17.1. Minimum wall reinforcing requirements are provided in Article 9.20.17.2., with reinforcing for openings in Articles 9.20.17.3. and 9.20.17.4.

The requirements for supporting floor joists and roof framing are found in Article 9.20.17.5. and 9.20.17.6.

Exercise #16-7

Read Subsection 9.20.17. and answer the following questions, then discuss your answers with your group.

1. Which of the following is not a requirement for an above ground ICF wall?
   a) Horizontal reinforcement shall be 10M spaced not more than 600 mm o.c.
   b) Horizontal and vertical reinforcement shall be placed in the middle third of the wall thickness.
   c) Wall thickness must remain constant over the entire height of the wall.
   d) Two additional 10M vertical reinforcing bars are to be placed on either side of openings that interrupt vertical reinforcing bars.

OBC Reference(s):_____

_____

_____

18.4 COTTAGES

Section 9.36. applies to buildings of residential occupancy intended to be used as seasonal recreational buildings.

Buildings meeting this description must comply with all the requirements of Part 9 except for the exclusions listed in Article 9.36.2.1. An 'optional' exclusion for foundations is provided in Sentence 9.36.2.2.(1) that states that continuous foundation walls are not required but if they are provided they are required to meet the requirements of Part 9.

Exercise #18-3

Read Section 9.36. and answer the following questions. Then discuss your answers with your group.

1. What is the minimum size of a unreinforced unit masonry column constructed from hollow masonry units?

   a) 140 (d) x 380 (w) x 560 (h)

   b) 190 (d) x 380 (w) x 760 (h)

   c) 240 (d) x 380 (w) x 960 (h)

   d) 290 (d) x 380 (w) x 1 160 (h)

OBC Reference(s):_____

_____

_____

STOP End of Module 18

1. For a one-storey *farm building* of *low human occupancy* with a *building area* of 650 m², where are the Code provisions found?

   a) CCBFC NRCC 38732 National Farm Building Code of Canada

   b) Supplementary Standard SB-11

   c) Either a) or b)

   d) Neither a) nor b)

OBC Reference(s):_____

2. For a two-storey *farm building* of *low human occupancy* with a *building area* of 500 m², where are the Code provisions found?

   a) CCBFC National Farm Building Code of Canada

   b) Supplementary Standard SB-11

   c) Either a) or b)

   d) Neither a) nor b)

OBC Reference(s):_____

3. What is the maximum allowable occupant load for a *farm building* of *low human occupancy*?

   a) 1 person per 39 m² of *floor area*

   b) 1 person per 40 m² of *floor area*

   c) 1 person per 41 m² of *floor area*

   d) None of the above

OBC Reference(s):_____

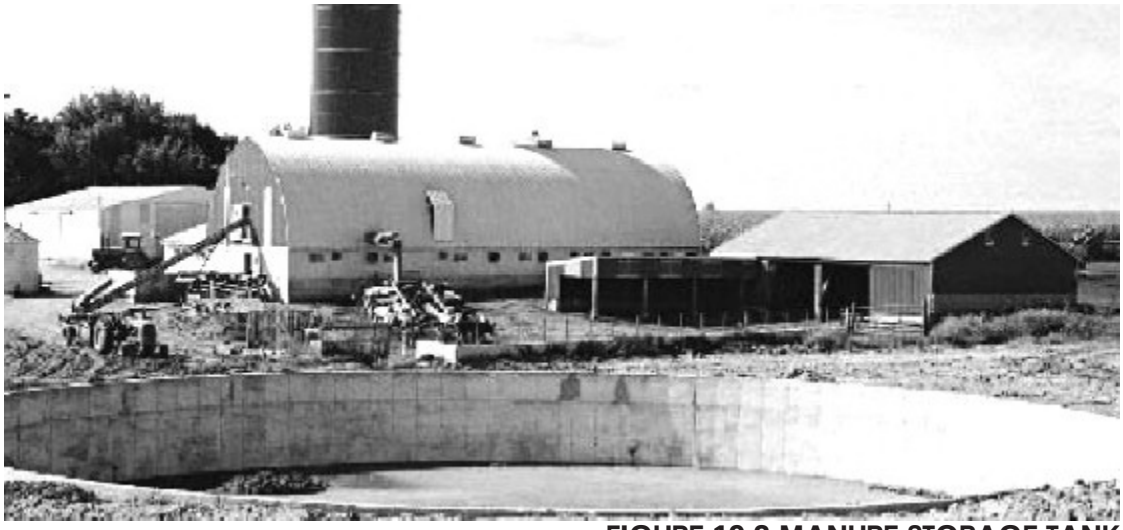

FIGURE 19:2 MANURE STORAGE TANK

Exercise #19-3

Read Subsection 4.4.5. of Division B. Answer the following question, then discuss the answers with your group.

1. Which of the following statements concerning manure storage tanks are <u>false</u>?

   a) Manure storage tanks must be supported on competent *soils* free of organic material, or on compacted granular *fill* above such competent *soil.*

   b) With the exception of the provisions of Article 4.4.5.1., the design provisions for manure tanks are given in the National Farm Code of Canada.

   c) Concrete in manure storage tanks shall have a specified strength of 32 MPa, with a water/cement ratio of 0.45 or more, and made using HS or HSb cement.

   d) It is a Code requirement that manure storage tanks do not leak.

OBC Reference(s): _____

_____

_____

STOP End of Module 19

2. Consider the *building* described in Question 2 of Exercise #20-3. An engineering analysis of the roof has determined that the installation of the ceiling and the mechanical equipment would reduce the *performance level*. What measures must be taken to allow the renovation to proceed?

   a) Nothing – renovation may proceed without compensating construction

   b) The portion of the structure affected must be reinforced to support the new *dead loads*, accounting for the snow loads (including drifts) stated in the Ontario Building Code.

   c) The portion of the structure affected must be reinforced to support the new *dead loads*, accounting for the snow loads (including drifts) stated in the Code in effect at the time of the original *building*'s design.

   d) The entire roof structure must be reinforced to account for the snow loads (including drifts) as stated in the Ontario Building Code.

OBC Reference(s):_____

_____

_____

STOP

20.6 COMPLIANCE ALTERNATIVES

Article 11.5.1.1. permits a *compliance alternative* (CA) to be substituted for a requirement contained in Part 4 of the Code, where the *Chief Building Official* is satisfied that compliance with the requirement is impracticable because:

- (a) of structural or *construction* difficulties, or
- (b) it is detrimental to the preservation of a *heritage building*

A *compliance alternative* for a structural requirement contained in Part 9 may be substituted, without satisfying the *Chief Building Official* that compliance with the requirement is impracticable.

MODULE 2 SCOPE AND GENERAL REQUIREMENTS

Exercise Number	Answer
Exercise 2-1	Question 1 Answers a) Sentence 3.7.4.14.(1) or Subclause 3.8.3.8.(7)(a) b) Sentence 4.3.5.1.(1) c) Sentence 9.15.4.9.(1)
Exercise 2-2	Question 1 **Part 9** Ref: Div. A, Article 1.1.2.4. Question 2 **Part 9** Ref: Div. A, Article 1.1.2.4. Question 3 **Parts 3, 4, 5 and 6** Ref Div. A Subclause 1.1.2.2.(2)(b) and Article 1.4.1.2.
Exercise 2-3	Question 1 **Yes** and **No**, Per Clause 1.3.1.1.(1)(h) Question 2 **Yes** and **Yes,** Per Div. A, Clause 1.3.1.1.(1)(a) and Div. A, Clause 1.1.2.2.(2)(c), Question 3 **No** and **No**, Per Div. A, Clause 1.3.1.1.(1)(d) Question 4 **NO** and **No**, per Div. A Clause 1.3.1.1.(1)(e), Div. A, Clause 1.1.2.2.(2)(g), Clause 1.1.2.2.(5), Div. B, Sentence 3.15.3.1.(1).
Exercise 2-4	Question 1 **Answer is b)**, See column 4 of Table 1.3.1.2. in Division B Question 2 **Answer is a)**, In accordance with Div. A, Sentence 1.5.1.2.(1), the Code provisions govern

MODULE 6 WIND LOADS

Exercise Number	Answer
Exercise 6-1	Question 1 **Answer = b)**, as per OBC 4.1.7.2.(1) Question 2 **Answer = a)**, as per Sentence 4.1.7.2.(3) Question 3 **Answer = b)**
Exercise 6-2	Question 1 **Answer = b)**, from Table 4.1.2.1 Question 2 **Answer = a)**, from Table 4.1.7.1
Exercise 6-3	Question 1 **Answer = c)**, as per Table 1-2 of SB-1 Question 2 **Answer = c)**, as per Table 1-2 of SB-1
Exercise 6-4	Question 1 **Answer = b)**, as per Clause 4.1.7.1.(5) Question 2 **Answer = d)**, as per Sentence 4.1.7.2.(1) Question 3 **Answer = c)**, as per Clause 4.1.7.1.(5)(b)
Exercise 6-5	Question 1 **Answer = b)**, as per Clause 4.1.7.1.(6)(c) Question 2 **Answer = c)**, as per Clause 4.1.7.1.(6)(b) Question 3 **Answer = a)**, as per Clause 4.1.7.1.(6)(a)
Exercise 6-6	Question 1 **Answer = b)**, as per Sentence 4.1.7.1.(1) Question 2 **Answer = a)** Question 3 **Answer = d)**, as per Article 4.1.7.1.(2)

MODULE 8 OTHER STRUCTURAL LOADS AND SPECIAL STRUCTURES

Exercise Number	Answer
Exercise 8-1	Question 1 **True** (Ref. Div. A. Article 1.4.1.2) Question 2 **Yes** (Ref. Sentence 3.1.10.1.(1)) Question 3 **Answer = b)**, as per Sentence 3.1.10.1.(3) Question 4 Support by wood beam would not be acceptable, since supports must be non-combustible construction, as required by Sentence 3.1.10.1.(3)
Exercise 8-2	Question 1 **Answer = d)**, as per Sentence 4.1.5.17.(1) Question 2 **Answer = c)**, as per Sentence 4.1.5.17.(2)
Exercise 8-3	Question 1 **Answer = c)**, as per Sentence 3.4.6.5.(12) Question 2 **Answer = d)**, as per Sentence OBC 3.4.6.5.(3)
Exercise 8-4	Question 1 **Answer = c)** Question 2 **Answer = d)** Question 3 **Answer = b)** Question 4 **Answer = a)**
Exercise 8-5	Question 1 **Answer = c)**, as per Article 3.7.4.14.

Exercise Number	Answer
Exercise 8-6	Question 1 **False**, Per Sentence 9.8.8.1.(6) Question 2 **True**, as per Sentence 9.8.8.1.(6) Question 3 **True**, as per OBC 9.8.8.1.(6)
Exercise 8-7	Question 1 **Answer = d)**, as per Sentence 4.1.5.14.(5) Question 2 a) 0.75 kN/m horiz per Clause 4.1.5.14.(1)(c) b) 1.5 kN/m vertical per Sentence 4.1.5.14.(4) c) 1.0 kN per Clause 4.1.5.14.(1)(c) d) 0.5 kN per Sentence 4.1.5.14.(2) Question 3 **Answer = d)**, as per Article 4.1.5.16. Question 4 **Answer = d)**, as per Articles 4.1.5.14. and 4.1.5.15.
Exercise 8-8	Question 1 **Answer = b)** Question 2 **Answer = a)** Question 3 **Answer = c)**, as per OBC 4.1.5.11.(5) Question 4 **Answer = c)** as per Article 4.1.5.12.
Exercise 8-9	Question 1 **Answer = c)**, as per Sentence 4.4.1.1.(1) Question 2 **Answer = b)**, as per Sentence 4.4.4.1.(1) Question 3 **Answer = c)**, as per Sentence 4.4.2.1.(1) Question 4 **Answer = TRUE**, as per Sentence 4.4.3.1.(1)

Exercise Number	Answer
Exercise 11-2	Question 1 Answer: Referencing Figure 11:1, the lower soil stratum is more than twice the footing width below the founding level therefore a bearing value of 150 kPa would be used.(per Article 9.4.4.2) Question 2 Loose sand 50 NO Compact silt 100 YES Soft clay 40 NO Firm clay 75 YES Loose gravel 50 NO Sensitive Clay N/a NO Question 3 **Answer = c)**, as per Article 9.4.4.3. and Sentence 9.15.3.4.(3)
Exercise 11-3	Question 1 **Answer = b)** Minimum depth required. Building is of masonry construction. Table 9.12.2.2. and Subclause 9.12.2.2.(6)(a)(i) Question 2 Difference of elevation = 3.2 – 2.4 = 0.8 m, Therefore, required horizontal separation = twice the rise = 1.6 m. (Ref. Per Article 1.2.1.2.(1) Div. C)
Exercise 11-4	Question 1 **a)** **Answer = iv**, as per Table 9.15.3.4 and Article 9.15.3.6.(1) **b)** **Answer = iv**, as per Table 9.15.3.4. and 9.15.3.4.(2) **c)** **Answer = ii**, as per Table 9.15.3.4. and 9.15.3.5.(1)(c) Question 2 Per Table 9.15.3.4, area = 0.75 m²

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Exercise Number	Answer
Exercise 13-2 (continued)	Question 3 **Answer = b)**, as per Article 9.23.4.1. Question 4 **Answer = c)**, as per Sentence 9.23.4.4.(2)
Exercise 13-3	Question 1 **Answer = c)**, Per Table A-4 Question 2 **Answer = a)**, as per Table A-6 Part 9 Question 3 **Answer = b)**, as per Table A-6 Part 9 Question 4 **Answer = a)**, as per Table A-3 of Part 9 Question 5 **a)** **Answer is ii)**, as per Article 9.23.13.10. **b)** **answer is iii)**, from Table A-4 Question 6 **Answer = d)**, as per Table A-12 of Part 9
Exercise 13-4	Question 1 **Answer = d)**, as per Article 9.23.15.6. Question 2 **Answer = b)**, as per Article 9.23.15.6. and 9.23.15.7., and Table 9.23.15.7.A.
Exercise 13-5	Question 1 **Answer = a)**, as per Sentence 9.23.3.4.(1) and Table 9.23.3.4.

MODULE 14 FLOOR CONSTRUCTION- PART 9 BUILDINGS

Exercise Number	Answer
Exercise 14-1	Question 1 **Answer = c)**, as per Sentence 9.23.9.4.(2) Question 2 **Answer = d)**, as per Sentence 9.23.6.1.(3) Question 3 **Answer = d)**, as per Sentence 9.23.8.3.(1) and Sentence 9.23.8.3.(7)
Exercise 14-2	Question 1 Per Article 9.23.4.1.: a) 3.54 m per Table A-1 b) 3.72 m per Table A-1 c) 3.87 m per Table A-2 d) 3.64 m per Table A-2 Question 2 **Answer = d)**, as per Table A-8 Part 9, also reference Note 4 of Table A-8 Question 3 **Answer = d)**, as per Table A-11 Part 9, also reference Note 4 of Table A-11 Question 4 **Answer = a)**, as per Table A-1 Question 5 **Answer = d)**, as per Sentence 9.23.9.5.(2) Question 6 The Header joist (L = 2 400 mm) needs to be doubled and the Trimmer joist needs to be determined by calculations. (Ref. Articles 9.23.9.5. and 9.23.9.6.)
Exercise 14-3	Question 1 **Answer = d)**, as per Sentence 9.23.14.2.(2)

MODULE 15 WALL CONSTRUCTION

Exercise Number	Answer
Exercise 15-1	Question 1 **Answer = c)**, as per Table 9.23.10.1. Question 2 **Answer = c)**, as per Table 9.23.10.1. Question 3 i) Walls have interior finish conforming to Section 9.29. ii) Walls are clad with panel-type sheathing iii) Walls are clad with lumber applied diagonally iv) Walls are sheathed with plywood, OSB, waferboard, gypsum or fiberboard. Ref. Sentence 9.23.10.2.(2)
Exercise 15-2	Question 1 **Answer = b)**, as per Sentence 9.23.10.6.(1) Question 2 **Answer = c)**, Sentence 9.23.10.6.(1) and Sentence 9.23.12.2.(1) Question 3 **Answer = b)** as per Table A-15 Question 4 **Answer = d)** as per Table A-13 Question 5 **Answer = c)** The effect of the snow load is irrelevant. a) is not acceptable. From Note (6) to Table A-15 the allowable span of 1.27 m can be increased by 10% to 1.397 m < 1.42 m. b) is not acceptable. From Note (6) to Table A-14 the allowable span of 1.19 m can be increased by 10% to 1.31 m < 1.42 m. c) is acceptable. From Note (6) to Table A-13 the allowable span of 1.30 m can be increased by 10% to 1.43 m > 1.42 m. d) is not acceptable, since Table A-16 is for exterior walls supporting roof and ceiling load only.

Exercise Number	Answer
Exercise 15-3	Question 1 **Answer = d)**, Per Sentence 9.23.11.3.(3) Question 2 **Answer = a)**, as per Sentence 9.23.11.1.(2)
Exercise 15-4	Question 1 **Answer = d)**, as per Sentence 9.23.16.3.(1) and Table 9.23.16.2.A.
Exercise 15-5	Question 1 **Answer = c)**, as per Table 9.24.2.1.

MODULE 16 ABOVE GROUND MASONRY AND ICF WALLS- PART 9 BUILDINGS

Exercise Number	Answer
Exercise 16-1	Question 1 **Answer = b)**, as per Table 9.20.2.7. Question 2 **Answer = b)**, as per Article 9.20.4.1. and 9.20.4.2. Question 3 **Answer = b)**, as per Table 9.20.3.2.A. and Table 9.20.3.2.B. Question 4 **Answer = d)**, as per Article 9.20.2.2.
Exercise 16-2	Question 1 **Answer = c)**, as per Sentence 9.20.6.1.(1) Question 2 **Answer = b)**, as per Sentence 9.20.6.5.(1) Question 3 **Answer = b)**, as per Sentence 9.20.10.1.(3) Question 4 a) 600 mm Min, as per Clause 9.20.7.3.(1)(b) b) 500 mm Max as per Sentence 9.20.7.1.(1) c) 4 x w – B/2 – D/2, For the values of B and D in this example C = 260 mm Min. (Ref. Clause 9.20.7.3.(1)(a)) d) 500 mm Max as per Sentence 9.20.7.1.(1)

Exercise Number	Answer
Exercise 16-3	Question 1 - Not less than 57 mm solid masonry bridging full wall thickness. - Wood plate not less than 38 mm thick, bearing on a minimum of 50 mm on each wythe. Ref. Clauses 9.20.8.2.(3)(a) and (b) Question 2 **Answer = d)**, as per Clause 9.20.9.4.(6)(b) Question 3 **Answer = b)**, as per Clause 9.20.9.5.(1)(a)
Exercise 16-4	Question 1 **Answer = c)**, as per Table 9.20.5.2.A. Question 2 **Answer = c)**, as per Table 9.20.5.2.B.
Exercise 16-5	Question 1 - 12 mm for 75 mm brick - 25 mm for 90 mm brick Ref. Sentence 9.20.12.3.(1)
Exercise 16-6	Question 1 **Answer = d)**, as per Sentence 9.20.1.2.(2) Question 2 **Answer = a)**, as per Table 1.2 SB-1
Exercise 16-7	Question 1 **Answer = d)**, as per Sentence 9.20.17.2.(3) Question 2 **Answer = d)**, as per Sentences 9.20.17.4.(3) and (4) and Table A-17

Exercise Number	Answer
Exercise 16-8	Question 1 - No horizontal outside dimension less then 40 mm - Chimney does not extend more than 3.6 m above roof or masonry wall of which it forms a part. Ref. Sentence 9.21.4.5.(2) Question 2 **Answer: 100 mm** **No.** Reinforced concrete is to be designed under Part 4 of the Code. Ref. Sentence 9.22.5.2.(1)

MODULE 17 OTHER STRUCTURAL COMPONENTS- PART 9 BUILDINGS

Exercise Number	Answer
Exercise 17-1	Question 1 **Answer = d)**, as per Sentence 9.17.3.4.(1) and Clause 9.17.1.1.(1)(c) Question 2 **Answer = d)**, as per Sentence 9.17.3.1(1) Question 3 **Answer = c)**, as per Sentence 9.17.5.2.(1) Question 4 - Bolted together with a minimum 9.52 mm Dia. Bolts spaced at 450 mm on centre - Nailed together with minimum 76 mm nails spaced not more than 300 mm on centre - Glue laminated and in conformance with Section 4.3. Ref. Sentence 9.17.4.2.(2) and (3) Question 5 **Answer = c)**, as per Article 9.17.4.3

Exercise Number	Answer
Exercise 17-2	Question 1 The Supplementary Standard only provides for wood guards. This guard is steel and therefore needs to be designed in accordance with Part 4. Ref. Sentence 9.8.8.2.(1) and (5) and Supplementary Standard SB 7 Question 2 **Answer = b)** is false - the uniform load stated in Clause 9.8.7.7.(1)(b) is not mandatory for single dwelling units Question 3 **Answer = b)**, as per Table 2.2.1.of SB-7
Exercise 17-3	Question 1 **Answer = a)**, as per Clause 9.8.9.1.(1)(a)
Exercise 17-4	Question 1 **Answer = b)**, as per Sentence 9.23.5.2.(1) Question 2 **Answer = c)**, as per Sentence 9.23.5.2.(1) Question 3 **Answer = c)**, as per Article 9.23.5.1. and Table A-1 Question 4 **Answer = b)**, as per Sentence 9.23.5.3.(1)

MODULE 18 SPECIAL BUILDING TYPES- PART 9

Exercise Number	Answer
Exercise 18-1	Question 1 **Answer = b)**, Sentence 9.37.2.3.(1) Question 2 Must be treated with wood preservative to prevent decay. Ref. Sentence 9.37.1.2.(1) Question 3 **Answer = d)**, as per Sentence 9.37.3.2.(1)
Exercise 18-2	Question 1 **Answer = None**, as per Sentences 9.38.3.3.(1) and 9.38.1.1.(1) Question 2 Per Sentence 9.38.3.3.(1), anchorage shall be in conformance with the manufacturer's installation instructions Question 3 **Answer = b)**, as per Article 9.38.3.3.
Exercise 18-3	Question 1 **Answer = c)**, as per Reference 9.36.2.2.(2)(a)

MODULE 19 FARM BUILDINGS

Exercise Number	Answer
Exercise 19-1	Question 1 **Answer = a)**, as per Div. A, Article 1.3.1.2.(4) Question 2 **Answer = c)**, as per Div. A, Sentence 1.3.1.2.(4) Question 3 **Answer = b)**, as per Div. A, Article 1.4.1.2. Question 4 Answer = From Q3, need 40 m^2 of floor area per person, therefore minimum required floor area is 40*16 = 640 m^2

Exercise Number	Answer
Exercise 19-2	Question 1 **Answer = c)**, as per Table 1.3.3.N Question 2 **Answer = c)**, as per Article 1.1.2. of SB-11 Question 3 **Answer = b)**, as per Table 1.3.2.H Question 4 **Answer = d)**, as per Table 1.3.2.J Question 5 **Answer = a)**, per Article 9.23.1.1. (Part 4 design always an option Clause 9.4.1.1.(1)(c)
Exercise 19-3	Question 1 **Answer = c)**

MODULE 20 RENOVATIONS – PART 11

Exercise Number	Answer
Exercise 20-1	Question 1 **Answer = c)**, as per Division A, Sentence 1.1.2.6.(1) Question 2 **Answer = c)**, as per Division A, Sentence 1.1.2.6.(2)
Exercise 20-2	Question 1 **Answer = a)** Question 2 The performance level of the building after the material alteration or repair shall be at least equal to the performance level prior to the material alteration or repair. Ref. Sentence 11.3.1.1.(1)
Exercise 20-3	Question 1 **Answer = a)** Question 2 **Answer = a)**, as per Clause 11.4.2.1.(1) (c) Question 3 **Answer = c)**