CPCCBC6014
APPLY STRUCTURAL PRINCIPLES TO THE CONSTRUCTION OF LARGE, HIGH-RISE AND COMPLEX BUILDINGS

THEORY EXAM

Participant name	

FOR THE PARTICIPANT

Instructions

- You will complete written questions as outlined on the following pages. You must attempt all questions and provide enough detail in your responses to demonstrate you know and
- It is anticipated that you should complete this assessment within two (2) hours but additional time may be allowed upon negotiation with the Assessor.
- You must complete all questions unassisted by the Assessor or other personnel but may refer to reference material as needed. All questions must be answered correctly for a 'Satisfactory' assessment outcome to be awarded.
  - An oral examination may be allowed under certain circumstances, whereby your answers will be documented by another party.
  - Any written questions that are incomplete, or not answered satisfactorily will need to be completed again after further training support.
  - If you answer a question incorrectly but modify your response, put your initials next to the written change (or the Assessor must initial a verbal change).

Resources required

Pen

FOR THE ASSESSOR

Instructions

- Where oral examination has occurred, ensure that this is acknowledged in writing (e.g. FT001 and Assessor Comments)
- All questions must be satisfactorily demonstrated by the Participant for a Satisfactory determination (indicated by an Assessor tick to the right of the question).
- Assessors are to complete marking in pen of a different colour to the Participant.
- If the Participant verbally modifies their response, write in the modified response verbatim and put your initials next to the written change.

ASSESSOR COMMENTS
As necessary, outline: • Details on reattempts, alternative arrangements or reasonable adjustments made. • Where a Participant is deemed 'Not Satisfactory', provide recommendations for future training.

Q1. **a) What is the Building Act 1975 relevance in Queensland?**
b) Who is affected by the Building Act 1975?

Answer

a) Should reflect but is not limited to: The Building Act 1975 governs all building work in Queensland, empowering the regulation of certain aspects of buildings and structures. The Building Act dictates that buildings must be constructed in accordance with the Building Code of Australia and, where Queensland-specific provisions are necessary, the Queensland Development Code. It includes the administrative terms necessary to give effect to the laws.

b) The building industry is affected by this legislation, including licensees, building professionals, local councils and the general community.

Q2. **Discuss the basic principles of structural design and how stress or strain occurs.**

Answer

Should reflect but is not limited to: . A building must be designed to provide strength, stability, serviceability and durability and must be able to withstand loads efficiently. This involves structural calculations to work out the effects of all the forces acting on any component in the building and on the building overall. Stress occurs in any material which supports a load. Stress is the way a material transfers the load through its molecules. It's like an internal pressure resisting the external applied loads. Under loading, some deflection and deformation may occur, and if this movement is not allowed for then structural failure may be the result. Strain is the term applied to deformation (or change of shape) of an object when a load is placed on it Therefore, a principle of structures is that they be designed to maintain a state of equilibrium; resisting external loads without moving.

Q3. **Discuss the impact the following forces can impose on a building structure.**

Answer

Force	Impact
Wind	e.g. Wind exerts three types of forces on a structure: Uplift load - Wind flow under a roof pushes upward; wind flow over a roof pulls upward. Shear load – Horizontal wind pressure that could cause racking of walls, making a building tilt. Lateral load – Horizontal pushing and pulling pressure on walls that could make a structure slide off the foundation or overturn
Snow	e.g. Snow load is the downward force on a building's roof by the weight of accumulated snow and ice. The roof or the entire structure can fail if the snow load exceeds the weight the building was designed to shoulder
Groundwater	e.g. Construction must take place below the water table or soil is used to retain water, groundwater affects the project by impacting the function and design of the facility, and the cost of its construction
Earthquake	e.g. The inertia forces can cause shearing of the structure which can concentrate stresses on the weak walls or joints in the structure resulting in failure or perhaps total collapse.

Question continued over page

Answer

Force	Impact
Liquid pressure	e.g. Uplift pressure or liquid pressure, is an upward pressure applied to a structure that has the potential to raise it relative to its surroundings
Rainwater	e.g. Water entering through seepage or leakage damages the internal structure due to corrosion. The corroded steel rod used inside the structure weakens the structural strength of the building. Most of the structure collapses due to corrosion of reinforcement structure as the steel rods cannot be restored once rusted.
Earth pressure actions	e.g. The earth pressure is important because it affects the consolidation behaviour and strength of the soil and because it is considered in the design of geotechnical engineering structures such as retaining walls, basements, tunnels, deep foundations and braced excavations.

Q4. **Discuss the basic principles of structural design that must be considered in any building design.**

Answer

Should reflect but is not limited to: In any building design, the strength and stability of an overall building and its individual components must be considered. This involves structural calculations to work out the effects of all the forces acting on any component in the building and on the building overall.

One of the main structural principles is that elements such as the roof, floor and walls must remain stationary. For this to happen, there needs to be an equilibrium of forces – when the forces acting on them are equal and opposite. Under loading, some deflection and deformation – in the form of bending and buckling – may occur, and if this movement is not allowed for then structural failure may be the result. Structures must be designed to maintain a state of equilibrium; resisting external loads without moving

Q5. **Discuss compressive and tensile stresses on buildings.**

Answer

Should reflect but is not limited to: Structural members are influenced by forces acting on them. Compressive stress squeezes a member or and tension force is the development of tensile stress which pull the structure members in tension. Tensile stress along with compressive stress causes bending moment. Loads of buildings are designed to transfer through the columns to the ground. All horizontal loads are uniformly distributed and transferred to the beam and all the horizontal load acting on beam transfer vertically to the column. thus vertical load acting on column in downward direction try to resulting compressed in downward direction and vis versa supporting strength of column and their internal force counter with vertical load and acting in upward direction which also try to compress structure member column in upward direction.

Q6. **Discuss the structural significance of building basements in tall buildings.**

Answer

Should reflect: to deal with lateral loads applied to the structure.

e.g. Foundations must be designed to accommodate the bending moment induced by the superstructure. There are significant lateral loads applied to tall buildings, which the foundation system must resist. In such cases, the induced bending moments and shear forces should be accounted for in the design. Lateral loads from the superstructure must be added to the foundation model, especially when the foundations are modelled separately.

Q7. **What is meant by the term the 'aesthetics' of a structural design?**

Answer

Should reflect: the appeal of the building, architectural consideration.

e.g. The aesthetics of a building is one of the principal aspects considered in architecture. The appeal of a building covers the combined effects of a building's shape, size, texture, colour, balance, unity, movement, emphasis, contrast, symmetry, proportion, space, alignment, pattern, decoration, culture and context

Aesthetics is a core design principle that defines a design's pleasing qualities. In visual terms, aesthetics includes factors such as balance, colour, movement, pattern, scale, shape and visual weight. Designers use aesthetics to complement their designs' usability, and so enhance functionality with attractive layouts. May contribute to saleability of the building

Q8. **Explain economic factors and how these affect design.**

Answer

Should reflect: costs must be within limitations of the client – building structures at the minimum cost and within design criteria and codes for safety, strength and stability.

e.g. designer should search for design alternatives that consider strength and serviceability on the one hand and economic feasibility on the other. The designer should select the alternative likely to be the lowest overall cost and apply a value engineering process to find the optimal solution

Q9. **'The function of a structure is to resist forces in equilibrium' - What does this mean?**

Answer

Should reflect: Forces in equilibrium = a stable structure - the basis of design. e.g. The equilibrium of forces throughout a structure at rest represents an important basis for the analysis of those forces. Provided the structure stays at rest as the loads are applied, the structure can be described as being in a state of static equilibrium.

Q10. **Explain why reinforced concrete is commonly used for the construction of high-rise buildings.**

Answer

Should reflect but is not limited to: Steel's high tensile strength is paired with concrete's excellent compressive strength in traditional reinforced concrete to create a structural material that is robust in both compression and tension. Reinforced and pre-stressed concrete are durable. Higher strength concrete can support more weight and has a higher compressive strength. Concrete is workable and can be pumped. Lower in cost than other materials.

Q11. **Why might you need to consult the structural engineer regarding the loads and forces acting on a beam or column?**

Answer

Should reflect: A structural engineer is trained and fully equipped to check the loads acting on the columns and beams, The engineer will calculate the forces and stresses on each and choose the material, size and shape required. Engineer must consider how much load is acting on the beam, the length or span of the beam, clear height available below the beam or any limitations on geometry, deflection limits of the beam, strength of the material, as well as fire rating and resistance.

Q12. **Determine the bending behaviour of a column under axial load.**

Answer

Should reflect but is not limited to: Under axial and concentric loads, columns tend to become shorter in length. The term "length" refers to the height or dimension in the same direction as the loading axis. The columns tend to expand in a direction perpendicular to the loading directions. The shape of the column changes somewhat from cuboid to barrel as a result of this activity. Poisson's ratio is the ratio of the change in height to the change in lateral dimensions. It varies depending on the material.

Until the failure,. long columns buckle laterally at a particular weight value. These long columns lose their rigidity abruptly after buckling. As a result, long columns fail far more frequently than small ones.

In general, the failure mechanism is the primary distinction between long and short columns. The failure of a short column is mostly material. On the other hand, long column failure is a structural failure (more specifically, a stability failure).

Q13. **What is the performance characteristic of columns under eccentric load?**

Answer

Should reflect but is not limited to: When the load applied to a portion of the column is not symmetric with the central axis of the column the load applied is called eccentric load. Increase in the eccentric load increases the axial load and the moment acting on the column. This increases the bending stress on the column

Q14. **Discuss bending moments, shear forces, deflection and torsion of beams and slabs.**

Answer

Beams/Slabs	Response
Beams	e.g. Bending Moment is the torque that keeps a beam together (anywhere along the beam). The applied loads and the support reaction produce vertical shear forces in a beam. While the burden pulls down, the reactions push up. Shear reaches its maximum magnitude near the supports in most circumstances. In beam, the vertical movement of a spot on a loaded beam is known as deflection. Torsion, in addition to bending moment and shear force, is applied to beams in a variety of conditions.
Slabs	e.g. For slab, the design bending moments are zero at discontinuous ends, negative at continuous ends and positive at mid spans. The shear strength of a slab that resists flexural stresses in two orthogonal directions around a column (flat plates, footings, and pile caps) is measured using a prism placed half the slab depth d away from the column sides. Bending or distortion of slabs over time owing to shrinkage and temperature is known as long-term deflection. The state of the cracking and concrete creep can have an impact. Bending moment and shear force are produced by loads operating normal to the plane of bending. Loads distant from the plane of bending, on the other hand, will cause torsional moment as well as bending moment and shear.

Q15. **Discuss how beams are connected to columns. Explain your answer.**

Answer

Should reflect but is not limited to: The standard way of connecting beams to columns is to provide moment transfer through full penetration butt welds between the beam flanges and column flanges (strong axis connections) or continuity plates (weak axis connections), and to provide shear transfer through the beam web connection. Beam-column joint BCJ role in a building is to connect its components together and enable these component to reach their ultimate resistance. BCJ stiffness, strength and ductility are key characteristics needed to guarantee efficient building behaviour under the action of different loads.

Q16. **Describe the slenderness ratio and its effect on columns.**

Answer

Should reflect but is not limited to: The slenderness ratio is the proportion of a column's length to its smallest radius of gyration. It's often used for calculating design loads and sorting columns into short, long, and intermediate categories. The column's slenderness ratio indicates whether or not the column is buckling. The higher the slenderness ratio, the more likely the column may fail due to buckling in the direction.

Q17. **Discuss the characteristics of dead loads and live loads. Include how each is calculated.**

Answer

Load	Characteristics and calculations
Dead load	e.g. The term "dead loads" refers to structural loads that remain constant in magnitude over time. They include structural members such as walls, plasters, ceilings, floors, beams, columns, roofs, and their weight. AS/NZS 1170.1 and AS/NZS 1170.2 provide the basis for determination of appropriate dead, live and wind design loads and load combinations applicable to Class 2 and 3 multi-residential construction. Dead load calculation = volume of member x unit weight of materials.
Live load	e.g. Live/Imposed load: -Live loads can be moved around or are temporarily attached to a structure. They include the loads imposed on a structure by furniture and equipment storage, occupancy (people), and impact. Live loads are variable as they depend on usage and capacity, therefore the AS/NZS 1170 table provides allowances which are based on conservative estimates. Calculate using Area of floor x live load rating of structure

Q18. **Discuss the advantages of using composite floor systems consisting of steel beams, profiled metal decking, and reinforced concrete slabs.**

Answer

Should reflect but is not limited to: Concrete responds excellently in compression and steel behaves the same in tension, these strengths can be used to achieve a highly efficient and lightweight design that can effectively resist both axial and flexural forces. Provides lighter than concrete construction; high strength from a relatively small cross-sectional area; reduced weight of composite, reduces the forces in those elements supporting them, meaning supporting members including foundation costs can be reduced; reduces or eliminates need for concrete forming like propping, stripping, and other temporary works; good resistance to buckling, fire, and corrosion; Cost and time saving.

Q19. **Discuss the characteristics of the following high performance structural elements.**

Answer

Structural element	Characteristics
Castellated beams	e.g. Castellated beams have regular and repeating pattern of hexagonal holes. These provide improved strength due to the increased depth of the section without any additional weight. The high strength to weight ratio is both cost-effective and durable at the same time However one consequence of the increased depth of the section is the development of stability problems during erection
Laminated beams	e.g. Made from thin slices of precisely engineered timbers that are tightly compressed together and fixed in place with an adhesive. This increases the strength and load bearing aspects of the beam, and makes it more versatile and lightweight. Often used in applications where the beam will be exposed to weather, insects, sunlight and high moisture conditions.
Pre-stressed concrete beams	e.g. Prestressed concrete is a system devised to provide sufficient precompression in the concrete beam by tensioned steel wires, cables, or rods that under working conditions the concrete has no tensile stresses or the tensile stresses are so low that no visible cracking occurs. Typically used to permit longer spans and/or minimise the structural depth of beams and slabs.
Trusses	e.g. A truss is a structure that consists of a collection of structural elements connected at joints. The members are predominantly axially loaded. This means they are either in compression, tension or have no force, so-called zero-force members. The main uses of trusses are in covering large spans to provide shelter only, and not resist superimposed floor loads except dust, rain and winds.
Waffle slabs	e.g. A reinforced concrete footing and slab systems constructed in situ, pre-cast or pre-fabricated. Suited to buildings that require less vibrations – this is managed by the two way joist reinforcements that form the grid. Bigger spans can be achieved with less material, being more economical and environmentally friendly; higher load-carrying capacity; Requires expensive formwork

Q20. **Describe the process associated with fabricating and installing tilt-up concrete panels.**

Answer

Should reflect: Prepare the slab for construction of concrete segments such as walls, on-site or off-site. Once the cast panels are in position, they are lifted up and held in position by special supports known as 'props' or 'braces'. One end of a prop attaches to a cast-in ferrule on the vertical concrete panel, while the other end is directly fastened into the slab itself. Once each panel has been erected and fastened together, the building will be stable and ready for completion. each prop needs to be well-attached on the vertical plane, requiring the cast-in ferrule to be perfectly designed and installed properly. The same goes for connection to the slab on the horizontal plane - an anchor that is always post-installed. These anchors have their own regulatory code, ensuring that each building erected using the tilt-up technique is as strong and stable as possible Each panel needs to be made accurately so that, when bolted together, every part lines up perfectly.

Q21. **Discuss considerations that must be made when using masonry in the construction of high-rise buildings.**

Answer

Should reflect properties, characteristics and limitation of masonry.

e.g. Non-combustible material, The thermal mass of a structure can be increased by using bricks. Masonry is typically heavy, and to avoid settling and cracking, it must be erected on a solid foundation, such as reinforced concrete; cost; Long lasting; Masonry must generally be built to the specified dimensions within the tolerances provided by the standards. reference should be made to the National Construction Code (NCC) and relevant Australian standards, including Masonry Structures (AS 3700)

Q22. **Discuss what must be organised as part of the site assessment to ensure the soil in the site can support the construction loads.**

Answer

Should reflect: Soil testing and site classification must be achieved to understand the soil conditions before you start planning your build or designing the foundations. A geotechnical investigation is organised to ensure a qualified professional comes out to examine the composition, properties and condition of the soil. Testing will indicate the type of soil which will help the engineer determine the footing system appropriate for the project. The soil test may also be needed to achieve building approval and/ or permits from the local authority (council)

Q23. **What are the requirements relating to retaining walls over 1m in height according to the NCC and the Building Regulations 2006 (Qld)?**

Answer

Should reflect: The NCC states within AS 4678 Earth-retaining structures that any retaining wall in excess of 800 mm in height to be constructed with materials that will give it a minimum life of 60 years. Schedule 1 of the Building Regulations outlines that any retaining wall measuring in excess of 1 m must be subject to a Building Application being lodged for consent to construct the wall and approval being given by a licensed Building Certifier and also requiring a Final Inspection Certificate to be issued at the conclusion of the walls construction.

Q24. **Discuss the use of the following temporary structures and components in the construction of large and complex buildings.**

Answer

Temporary structure	Use
Bracing	e.g. temporary restraint/bracing provides stability against unintended movement or loading during component installation.
Closed Sheeting	e.g. Closed sheeting is where vertical timber or metal members are used to fully cover and support a trench wall and which are in turn supported by other members.
Formwork props	e.g. Propping is a system of structural components used to support loads while being built. The forces generated by these loads must be fully resolved, with props or columns providing the necessary support for the work in progress, such as beams, formwork, and so on
Pressure resistant formwork	e.g. Pressure resistance formwork is used to create a temporary mould into which concrete is poured and formed. Pressure resistance formwork is fabricated from steel, glass fibre reinforced plastics and other materials.
Scaffolding sole plates	e.g. A timber, concrete, or metal bearer used to distribute the load from a standard or base plate to the ground
Shields	e.g. A method of shoring. In excavation and trenching works, steel and aluminium trench shield equally shares critical contribution in improving safety, quality, and productivity at construction sites.

Question continued over page

Answer

Temporary structure	Use
Shoring collar set	e.g. Similar to shore brackets, friction collars mount onto columns to support forms without the need for vertical shores. The two sides of the collar bolt tightly together around the column like a clamp. Friction collar systems are used with prefabricated columns or columns in which anchors are not intended to be left within them. Thanks to its design, it can support high loads transferred by the slab system, working in friction with the column.
Soldier set	e.g. designed to provide support to the walls of a trench and also to work around services like electricity, water or drainage when working in a trench.
Ties	e.g. The form tie is an accessory used in formwork, to hold the concrete wall forms firmly against the lateral pressure of freshly placed plastic concrete. By maintaining equal space between forms to achieve uniform thickness of walls. A form tie contains two parts namely internal tension member and external holding device. Removal of ties after complete hardening of concrete depends upon type of tie used.

Q25. **Explain the differences between structural steel and cold-formed steel.**

Answer

Should reflect: Structural steel is used for large, high-rise and complex towers and buildings. Cold-formed steel is generally used for lighter load-bearing structural elements (framing and joists) in residential and commercial buildings. Molten iron is made into structural steel beams with a profile of a cross section to give it extra rigidity. Cold-formed steel is also made with iron, but it is instead made into thin strips and cooled. The cold steel is then formed into the desired thickness and a protective coating is applied. Where structural steel is heavy and bulky, cold-formed steel is lighter to handle and has the higher strength to weight ration.

Q26. **Discuss three (3) uses of aluminium in the construction industry and why it is used.**

Answer

1. Should reflect but is not limited to: A suitable roofing material. Resistant to corrosion. It's lightweight in comparison to other materials and has a good strength-to-weight ratio. Light and thin storing little heat and quick to cool once it stops receiving direct sunlight.
2. Pure aluminium flat sheet is not combustible and is suitable for cladding and skirting and is available in many colours
3. Most commonly used material for window and door frames as these can be powder coated to any colour and the very high strength-to-weight ratio means that there's less aluminium needed to withstand large amounts of glazing and wind deflection compared to other materials.

Q27. **Explain what is involved when coordinating the set-out of the building.**

Answer

Should reflect but is not limited to: Locating boundary pegs and marking the boundary, identifying building position and relationship to boundary according to the plans, determining setbacks. Position profiles for excavation and footings - set out the positions of the steel columns or posts

Assess structural performance of the footings specified in the building plan.

Q28. **What different items should you assess in the building plan before laying footings? Explain your answer.**

Answer

Should reflect: the structural performance of the footings to ensure construction activities comply with codes and industry construction structural principles. To confirm materials against engineer specifications the structural performance of the footings specified. damp coursing and the provision of termite barriers

Q29. **How do you ensure allowances have been made for plumbing, electrical conduits and other services to be installed?**

Answer

Should reflect: Ensure work adheres to plans and standards relevant to services installation

Q30. **Outline workplace policies and procedures that should be held in the site office.**

Answer

Should reflect but is not limited to: Site safety plan and all relevant procedures such as SWMS, Emergency and evacuation procedures. Access, PPE

Quality policies and procedures including quality documents relating to the schedule, milestones, reporting and recording

CPCCBC6014
APPLY STRUCTURAL PRINCIPLES TO THE CONSTRUCTION OF LARGE, HIGH-RISE AND COMPLEX BUILDINGS

WORKBOOK

Participant name	

FOR THE PARTICIPANT

Instructions

- You will complete written activities as outlined on the following pages. You must attempt all questions and provide enough detail in your responses to demonstrate your knowledge.
- The timeframe for these tasks will be established by your Assessor or Training Provider and additional time may be allowed upon negotiation with the Assessor.
- You must complete all questions unassisted by the Assessor or other personnel but may refer to reference material as needed. All questions must be answered correctly for a 'Satisfactory' assessment outcome to be awarded.
  - An oral examination may be allowed under certain circumstances, whereby your answers will be documented by another party.
  - Any written questions that are incomplete, or not answered satisfactorily will need to be completed again after further training support.
  - If you answer a question incorrectly but modify your response, put your initials next to the written change (or the Assessor must initial a verbal change).

Resources required

Pen

FOR THE ASSESSOR

Instructions

- Where oral examination has occurred, ensure that this is acknowledged in writing (e.g. FT001 and Assessor Comments)
- All questions must be satisfactorily demonstrated by the Participant for a Satisfactory determination (indicated by an Assessor tick to the right of the question).
- Assessors are to complete marking in pen of a different colour to the Participant.
- If the Participant verbally modifies their response, write in the modified response verbatim and put your initials next to the written change.

ASSESSOR COMMENTS

As necessary, outline:

- Details on reattempts, alternative arrangements or reasonable adjustments made.
- Where a Participant is deemed 'Not Satisfactory', provide recommendations for future training.

NOTE

At times, you will be provided with a specific business context to which you must respond, otherwise it is anticipated that you will use a workplace of your choosing (your own, or hypothetical) to provide the context to the task.

At all times, the responses in your assessment must reference **Australian** (Queensland or Federal) documentation, including legislation, regulations, codes of practice, standards and guidance publications.

The following activities require access to the internet.

ACTIVITY 1

Access the Queensland Building and Construction Commission and clearly describe its purpose and its relationship to the National Construction Code (NCC).

Should reflect but is not limited to: The QBCC is a statutory body established under the Queensland Building and Construction Commission Act 1991 (QBCC Act) to regulate the building industry.

The QBCC legislation sets out the legal framework for the administration of the National Construction Code (NCC) in Queensland. The NCC sets out the performance and general requirements for construction of a house, building or plumbing and drainage installation. The relevant laws and codes allow for the Commissioner, QBC Board and the Adjudication Registrar to develop policies to guide the delivery of the QBCC's services and regulatory functions.

Satisfactory Outcome ☐

ACTIVITY 2

Access the National Construction Code (NCC) Housing Provisions - Structural provisions and discuss what the following points explain.

a) 2.2.2 Resistance to actions

b) Construction in cyclonic areas

a) Resistance to actions

Describes that a building must be designed to resist the most critical effect resulting from different combinations of actions and must be designed to meet the requirements of AS/NZS 1170.1 in conjunction with AS/NZS 1170.0 which is applicable to the structural design of whole buildings or structures and their elements. The loads that are to be assumed while designing a structure are usually specified in the 'loading codes' specified in AS/NZS 1170. The Standard covers the following actions:

(a) Permanent action (dead load).
(b) Imposed action (live load).
(c) Wind.
(d) Snow.
(e) Earthquake.
(f) Liquid pressure.
(g) Ground water.
(h) Rainwater ponding.
(i) Earth pressure.

b) Construction in cyclonic areas

NCC requires that the structure has sufficient strength to transfer wind forces to the ground with an adequate safety margin to prevent collapse, the building being lifted or slid off its foundations and suggests it is necessary to have:

- an anchorage system, where the roof is connected by the walls to the footings by a chain of connections; and
- a bracing system to prevent horizontal collapse due to wind forces; and
- continuity of the system where each structural element is interlocked to its adjoining structural element throughout the building.

Satisfactory Outcome ☐

ACTIVITY 3
Access the NCC via the internet to locate the requirements applicable to a building development in the Brisbane area, containing 6 sole-occupancy units, two (2) on each level, each being a separate dwelling. This building includes one (1) basement level designated for car parking. The proposed building structure requires reinforced concrete floors and columns. Document your findings or where in the NCC the information can be located.

Building Description

Classification
Class 2 residential units Class 7a Car park

Rise in Storeys
The building has a rise of three (3) storeys.

Number of Storeys
The development will contain four (4) storeys.

Type of construction
Type A construction throughout

Climate Zone and description
Zone 2 - Warm humid summer, mild winter

Fire resistance and stability

Locate fire resistance information
Detailed in Table 3 of NCC Specification C1.1 for Type A construction. Where lightweight fire rated construction is proposed for walls, the system must comply with Specification C1.8 of NCC and the manufactures tested specification.

Compartmentation and fire separation
e.g. Each sole occupancy unit within the building must be separated by construction achieving an FRL of not less than 90/90/90 for load bearing or -/60/60 for non-load bearing. The car parking areas must be separated from the residential portion of the building by construction having an FRL not less than 120/120/120. The stair and lift shafts must be constructed with an FRL not less than 120/120/120 to the parking levels, and 90/90/90 to residential levels.

Fire hazard properties of materials, assemblies, fixtures and linings
e.g. Must comply with Specification C1.10 of the NCC.

Material requirements

Reinforced concrete requirements relative to Australian Standards
e.g. NCC Part 3.2.3.1 Concrete must be manufactured to comply with AS 3600 Materials used for reinforcing steel must comply with AS 2870
Glazing requirements specifically for windows, sliding doors with frames and balconies.
e.g. NCC Part 3.6 - Glazing Design and construction in accordance with AS 2047 glass is of a type recognised by AS 1288; and safety glazing is legibly marked in accordance with AS 1288; and glazing used in barriers complies with AS 1288 building is located in an area with a design wind speed of not more than N3

Satisfactory Outcome ☐

ACTIVITY 4

Research the Euler–Bernoulli beam theory and respond to the questions below.

a) What is the Euler-Bernoulli beam theory?
b) Provide a Euler-Bernoulli equation.
c) What is the Euler-Bernoulli theory (EBT) generally used for?

a) What is the Euler–Bernoulli beam theory?

e.g. simplification of the linear theory of elasticity which provides a means of calculating the load-carrying and deflection characteristics of beams how beams behave under axial forces and bending.
e.g. a model of how beams behave under axial forces and bending. This assumption is generally relatively valid for bending beams unless the beam experiences significant shear or torsional stresses relative to the bending (axial) stresses. Shear stresses in beams may become large relative to the bending stresses in cases where a beam is very deep and short in length.

b) Provide a Euler–Bernoulli equation

$$\frac{M}{EI} = \frac{\mathrm{d}^2 y}{\mathrm{d}x^2}$$

Should reflect one of:

$$\frac{\mathrm{d}M}{\mathrm{d}x} = \frac{\mathrm{d}^3 y}{\mathrm{d}x^3}$$

$$\frac{\mathrm{d}^4 y}{\mathrm{d}x^4} = \frac{q}{EI}$$

M = Bending Moment; E = Modulus of Elasticity; I = Second Moment Inertia
d = deflection of the beam (y) with respect to the position along the beam (x)

c) What is the Euler-Bernoulli beam theory (EBT) generally used for?

The analysis of the distribution of stresses and displacements in the beam element with a small thickness.

Satisfactory Outcome ☐

CPCCBC6014
APPLY STRUCTURAL PRINCIPLES TO THE CONSTRUCTION OF LARGE, HIGH-RISE AND COMPLEX BUILDINGS

PRACTICAL ASSESSMENT

Participant name	

FOR THE PARTICIPANT

Instructions

- The tasks outlined on the following pages will require performance in normal workplace activities, as a result of a structured activity set by an Observer in the workplace or a simulated activity set by your Assessor/Observer.
- The timeframe for these tasks will be established by your Assessor/Observer in consideration of location conditions and industry requirements.
- You must complete all tasks unassisted by the Assessor or other personnel, unless the steps note this assistance.
- You must attempt all tasks (and itemised steps) for a 'Satisfactory' assessment outcome to be awarded.
    - For any observation conducted that is incomplete, or without satisfactory performance, the observation will need to be completed again after further training support.

FOR THE ASSESSOR/OBSERVER

Instructions

- The following observation record should be used to judge and record your observations of the Participant as they complete the task(s) set. You must record your observations of the Participant's performance.
    - For each occasion, indicate the task performed and whether it was a simulation or workplace-based task.
        - Any simulated assessment must ensure the Participant still performs under workplace conditions which reflect industry standards.
    - In the comments, provide clear detail regarding the task that the Participant was required to do (e.g. PPE used, materials handled, attachments connected, plant types).
- All steps must be satisfactorily demonstrated by the Participant for a 'Satisfactory' determination (indicated by an Assessor tick to the right of each itemised step, or an Observer tick to the right of each itemised step, and confirmation by an Assessor in the Assessor Comments).
    - Where you have determined that one or more task steps have not been satisfactorily demonstrated, provide the Participant with additional support and outline details of such assistance in the Assessor/Observer Comments. Allow the Participant two (2) further opportunities to demonstrate the task again to allow an opportunity for a 'Satisfactory' assessment outcome to be achieved.
    - If after three (3) attempts the Assessor determines that the Participant cannot demonstrate the required steps, a 'Not Satisfactory' outcome is to be determined.

TASK OUTCOME					
Task	Date	Task Type (Tick)	Location	Task outcome (Tick)	
				Satisfactory	Not Satisfactory
Task 1		☐ Workplace ☐ Simulation		☐	☐

ASSESSOR COMMENTS: GENERAL
As necessary, outline: • Details on reattempts, alternative arrangements or reasonable adjustments made. • Where a Participant is deemed 'Not Satisfactory', provide recommendations for future training.

ASSESSOR COMMENTS: PRACTICAL TASK 1

☐ Individual student (as named on cover page)

☐ Multiple students [☐ All from Attendance Report, ☐ Specific students involved – identify students]

Task	Provide detail
1.2B.	Specify retaining walls applied to planning process: e.g. retaining wall with piling for basement area
1.2C.	Specify temporary structural elements added to planning process: e.g. shoring
1.2D. 1.5A. 1.5B.	Specify digital tools/devices used to communicate and collaborate with professionals, suppliers, HR and others: e.g. PC to write emails; telephone to confirm availability and organise materials and equipment
1.2E.	Specify equipment used to access and extract information: e.g. PC to access websites, standards, workplace policies and procedures
1.3A.	Specify set-out coordinated: e.g. measure and set out from boundary markers for excavation for footings using plans
1.3B. 1.3C.	Specify footing laid: e.g. footings for high-rise building and basement car parking area according to engineer specifications
1.3D.	Specify damp coursing and termite barriers installed: e.g. according to specifications

ASSESSOR COMMENTS: PRACTICAL TASK 1	
1.4A. 1.4B. 1.4C. 1.5B.	Specify how processes and construction elements were checked for compliance with manufacturer specifications and relevant Australian Standards and codes. e.g. materials checked on delivery and confirmation of stamp/label signed; processes monitored for best practice. Consult with professionals
1.5D. 1.5E. 1.5F. 1.5G. 1.5H. 1.5I. 1.5K.	Specify how the effect of force and movement were assessed against structural material properties and design. e.g. confirmed requirements for building class and site assessment, confirm suitability of materials
1.5L.	Specify faults identified and action undertaken: e.g. insert issues and rectification undertaken