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

ASSESSMENT SUMMARY

The assessment activities for *CPCCBC6014 Apply structural principles to the construction of large, high-rise and complex buildings* cover all aspects of the unit of competency. For Apprentices/Trainees, this includes supervisor completion of the Apprentice/Trainee Record (ATR).

Participants must read all the information given before starting any assessment task. The assessment tasks are intended to be fair, flexible, valid and reliable. If a Participant has any questions or requires alternative arrangements to be made such requests should be directed to their Trainer/Assessor, who should note such arrangements in the 'Assessor Comments' on the affected assessment. If a Participant feels they are not yet ready to be assessed, they should discuss their options with their Trainer/Assessor.

To satisfactorily complete the assessment, the Participant is required to answer all questions correctly and demonstrate their skills to industry standards. If a Participant does not answer all questions or perform all tasks, they will be deemed 'Not Satisfactory' for the task and 'Not Yet Competent' for the unit of competency.

The Trainer/Assessor can provide the Participant with additional information on interpreting the assessment outcomes and guide the Participant's options. If a Participant is still deemed 'Not Satisfactory' they will have the opportunity to undertake a supplementary assessment or appeal the result as per the process in the Student Handbook.

By signing below, the Participant acknowledges:
- They understand the assessment instructions and requirements, and consent to being assessed.
- The work submitted is to be their own work – with the work of/with others needing to be clearly acknowledged and documented.
- They consent to any photo/video recording of their work that occurs during assessment.

Participant name	Ryan Hay
Participant signature	Ryan Hay Digitally signed by Ryan Hay DN: E=rhay@besixwatpac.com, CN=Ryan Hay, OU=BNE, OU=Construction, OU=User Accounts, OU=Watpac Group, DC=watpac, DC=local Date: 2024.04.24 12:44:30+10'00'

Pre-requisite unit(s) to be achieved and authenticated prior to undertaking assessment
☑ Not applicable

Task	**Date completed**	**Assessment Results**	
Theory Exam	Select Date.	☐ Satisfactory	☐ Not Satisfactory
Workbook	Select Date.	☐ Satisfactory	☐ Not Satisfactory
Practical Assessment	Select Date.	☐ Satisfactory	☐ Not Satisfactory
Outcome for CPCCBC6014	Select Date.	☐ **Competent**	☐ **Not Yet Competent**

Evidence requirements checklist (ticked by assessor and evidence supplied to RTO)	
☑ Theory Exam	☑ Document/screenshot showing performance characteristics required of structural elements
☑ Workbook	☑ Document/screenshot showing performance requirements of materials in the building plan
☑ Practical Assessment	
☑ Site and soil assessment	

Assessor name	
Assessor signature	

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

THEORY EXAM

Participant name	Ryan Hay

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 your knowledge.
• 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.
  o An oral examination may be allowed under certain circumstances, whereby your answers will be documented by another party.
  o 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)	The building act is relevant to all building work in queensland
b)	The entire building industry in queensland

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

Answer	
	Structures are design to withstand all forces that may be imposed on it durings its life cycle. A structure is designed to keep the buildings shape when these forces are imposed on it. Stress and strain are the result of forces being imposed on a structure. Stress is the force that is imposed on a structure. Strain is how the structure reacts, bends or deforms as a result of the force.

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

Answer

Force	Impact
Wind	Positive and negative wind loads. Positive is the direct force put onto the side of a building by wind or the latrel load Negative loads are the loads that are created on the side of the building that the wind is blowing away from. For example winds create up lift on the opposite side of the roof due to the fact that different pressures of air are creating a wind up lift.
Snow	Dead load and potentially latrel loads if the snow has built up against a structure
Groundwater	Hydrostatic pressure is the pressure that ground water puts on a structure. The more water the greater the pressure
Earthquake	Earthquakes can cause the structure to shift and move in multiple different ways. Structural and non structural components need to be built in a way that allows movement without failure of critical components.

Question continued over page

Answer

Force	Impact
Liquid pressure	Water pressure behind retaining structures. Sometimes although the earth behind walls are not putting a lot or pressure on the wall the water can be
Rainwater	Hydrastatic pressure as per ground water. Live loads if the load of water is moving through pipes or the like or continuous heavy down pours on the roof and gutters
Earth pressure actions	Lateral pressure, Hydrastatic

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

Answer

Structures are design to withstand all forces that may be imposed on it durings its life cycle.

A structure is designed to keep the buildings shape when these forces are imposed on it.

Considerations for the following need to be addressed during design:
Ground conditions including foundation depths
Building heights
Structure type or method
Area wind rating requirements
Temperature zones
Property location

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

Answer

Compressive strength is when loads are forcing components together. Like a slab down onto a column.

Tensile strength is a load which is pulling something apart like a bolt connection from a post to the underside of the slab.

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

Answer Tall buildings will generally use the basement structure to help with the lateral loads of the building.
In multi level carparks, slabs can be used to brace the piles and can also use the pressures of the ground around the piles (passive pressure) to help brace the piles from bending.

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

Answer That the structure has been designed to look good and is in proportion to finishes on the façade and that the method of building it is to run smoothly.

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

Answer

All projects no matter what size have some sort of budget.
Designs should be completed keeping these budgets in mind.
So assume we are talking about a tall commercial building:

Larger projects can use an array of different methods in which they all have financial advantages and disadvantages.

A steel structured floor plate will generally be faster to build than a reinforced concrete slab and requires less workers to achieve it. However there maybe factors in the design whether it be structure, fire rating or general use of the floors.

Precast can be a great solution for projects.
The finish of the panels generally are of much better quality than a FRP wall completed on the job.
Inclement weather does not delay the projects as they are done in a factory.
This is a much faster system than FRP walls for the site however, this option is very expensive in comparison and requires large cranes to be able to achieve it.

There are many factors to be taken into account in the design:

1. Service life
2. Safety in design. Can the building be built safely and is it safe for the user.
3. Budget
4. Quality (this includes the building being fit for purpose)
5. Program

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

Answer

This means that all forces or moments acting on the building are balanced

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

Answer

Durability
Good fire rating properties
Strong
It's a very workable product and can be shaped in many ways.
Allows very little movement.

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

Answer

All designs should be completed by an engineer.
Usually a big factor is the settlement of the building when looking at façade design and internal framing.
These elements need to take into consideration any movement gaps that are required to ensure that the structure does not place pressure on the element.
Light weight walls usually have a head track that allows the studs to move up and down inside the track. This way the wall will not deform or crack.

Façade panels may have elongated holes in the mounting brackets that allow movement so the façade panel does not crack.

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

Answer

An axial load is when the load that the column is carrying, is directed down through the centroid of the column.
Under this load depending on the size and height of the column they will compress and/or bend laterally.
Longer columns will tend to bend more than shorter columns.

☐

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

Answer

The force on the column is pushing the column away as the force on the column is not through the columns centroid so the column may tip sideways

☐

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

Answer

Beams/Slabs	Response
Beams	Bending moments is the torque that keeps a beam together. When a beam has a load forced down onto the beam the beam will bend. So the bottom of the beam will stretch while the top of the beam compresses so both reactions are working against each other creating Torque. Shear forces are when the loads enforced make one reaction work against the other. So while force is applied down onto a beam the support of the beam is stationary or pushing up. Deflection is the amount the beam bends or sags down after shrinkage and a force is applied and is accounted for in the design. Torsion is when the load creates force that makes the beam twist or deform in some way. For example when a beam is on top of a column and the beam sags the end of the beam will need to distort as the bottom of the beam is is stretching and the top of the beam is compressing. On a beam the torsion point is generally over the column or point of support and can go hand in hand with Shear and bending moments.
Slabs	Bending Moments on a slab, the design bending moments are the reactions in the slab from the load enforced on the slab. Usually near the center of the span at the top of the slab this is called positive bending moment and at the bottom of the slab over a column is called negative bending moment. Shear strength on a slab is the slab supporting itself against another force in an opposite direction. Slab to walls, slab to beams, slab to columns etc. Deflection of a slab is how far the slab sags down after the structure has settled and the final loads have been applied. Torsion, much the same as the torsion of the beam is when the reactions of the structure make the slab twist from the point of negative bending moment that is created over a column or the like.

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

Answer

Concrete beams are connected usually via reinforcement.

The reinforcement of the columns is cogged into the slab and the columns are poured first.

After this, the beam is formed and reinforcement is placed into the form and over the column and then poured over.

There are different connection details for different designs but this would cover 95% of concrete structures.

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

Answer

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	Are the loads on the structure that will generally remain stationary like joinery, plant, internal finishes. This could also be a load that can build up like snow.
Live load	A live load is loads that move like people, movable furniture and includes plant used tyo build the structure like scissor lifts

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

Answer

Fast construction.
Less workers required when comparing to a conventional formwork system where formworker, reinforcement fixers and concretors are required.
Lighter weight
Less concrete required normally meaning also that more ceiling space can be achieved
Very little formwork or propping so works can commence under new slabs relatively quickly and propping can be pulled out earlier than conventional forwork.
Very little materials handling.

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

Answer

Structural element	Characteristics
Castellated beams	Steel beams that can be I-H or U shaped. Lightweight. Achieve long spans Has perforated webbing so services can pass through these.
Laminated beams	Created by adhering multiple layers of timber together. Long spans when compared to other species of timber beams.
Pre-stressed concrete beams	Beams with cables running through them that are tensioned and grouted in. Help reduce quantities of reinforcement due to the cable taking the weight. Helps with reducing the amount of columns that are required to support the beams.
Trusses	Can be timber or steel and are a series of members that are fixed to each other usually creating the shape of triangles. Easy to install and can be lighter weight when compared to single timber or steel members. For roofing the roof rafter and ceiling joist come in one piece greatly reducing labour cost.
Waffle slabs	Slabs that usually have foam or void formers layed on the ground with spaces in between creating beams or ribs to enable greater strength in the slab without going a thicker slab. Also good for sites where the slab is higher than the suurounding ground as there is no need to fill and compact areas to bring the subgrade up to the base of the slab. Also good for reactive soils as the slab to a degree can carry its own weight.

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

Answer

Tilt up panels are created by:

1. Starting by Usually have a flat hard surface like another slab to works off.
2. Place a membrane down to ensure the concrete of the panels don't stick to the substrate.
3. Form up the sides of the panel
4. Place reinforcement inside along with all lifting points and dowel sleeves that are placed in the bottom of the beam.
   All are designed by an engineer
5. Pour concrete inside the form and let it cure for a prescribed time frame.
6. Once approved to lift, a crane can lift the panels into position over the top of the dowel system coming out of the slab or footing.
7. Braces are installed to hold the panel in position once plumbed up.
8. Grout is then injected into the sleeves
9. Panels will remain braced until the remaining structure is installed

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

Answer

What is supporting the masonry. Some structures may have rebates in slabs to carry the brickwork or shelf angles could be intrucued.
Continuous heights of masonry. All types of masonry have maximum continuous heights that they are able to go before a structure support would need to be installed.
Climate of the building location. Some locations may have environments that can affect the life time of the masonry product.

Fire rating. Different types of masonry have different fire ratings and may or may not be able to be used dependant on what the design is.

Slab mass ratings for not only the finished product but for materials point loading during construction. How many pallets per m2.

Construction sequence. Comes down to design as different types of construction require different sequences. For example brick veneer construction requires stud work to be installed so that the brick can tie back to the frame. Stand alone bricks or blocks can potentially could go in any sequence

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

All areas have soil classifications generally which can be accessed from local councils.
For designs generally a Geotechnical engineer and structural engineer is employed to design the building.
Usually core samples would be taken to determine pile/footing depths, make up of the ground along with an evaluation of water content.
In short the Geotech will determine the maximum capacity that could be reached from foundation depths as well as an assumption of pressures imposed on the building and the structural engineer will determine the make up of the building to cope with these findings.
Hydraulic engineers may also be employed to come up with solutions for perimeter and basement drainage.

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

Answer

NCC states that AS4678 contains requirement for retaining walls between 800mm and 15m. This does not cover walls that need substantial design consideration like landslide areas.
And that part 3.1 should be referd to for all retaining structures.

Work for a retaining wall according to the Building regs 2006 is:

(1) Building work for a retaining wall is prescribed if— (a) there is no surcharge loading over the zone of influence for the wall; and (b) the total height of the wall and of the fill or cut retained by the wall is no more than 1m above the wall's natural ground surface; and (c) the wall is no closer than 1.5m to a building or another retaining wall. (2) Despite subsection (1), the building work is not prescribed if it is for a retaining wall that forms part of the fencing for a regulated pool.

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

Answer

Temporary structure	Use
Bracing	All temporary works would have some type of bracing designed into the overall system. For example formwork has bracing between each frame to ensure that each leg cannot move once loaded.
Closed Sheeting	This is a system that is usually placed in the ground to create a temporary retaining wall. Materials used would depend on the system but it could be a steel rectangular box (Shoring) or planks that are driven into the ground so that soil can be retained while works happen. Once works are complete these can be removed and the area backfilled
Formwork props	There are a lot of products on the markets but formworks props are any vertical load bearing item. This could also include single props that are not apart of the propriatryt system but have been introduced to take loads not allowed for. For example it maybe Post Tension cable coils or even formwork packs.

Pressure resistant formwork	This is formwork that is creating a mold for concrete to be poured into and the formwork not only need to carry the live and dead load but also needs to hold the pressure of the wet concrete. For example wall shutters need to be designed to hold the latrel pressure of the concrete wanting to push the shutter out.
Scaffolding sole plates	These are plates that are placed on the ground or on slabs to spread the load of the props. This will vary for didfernt systems but most conventional formwork system will have a hardwood plank under each prop.
Shields	Basicall formwork shutters that are made from a steel framework and usually timber soldiers and a plywood face. These secure to another shutter by using coil ties or conduits through the wall to take Z-ties and they clamp the wall together with a set dimension between the shutters creating a wall.

Question continued over page

Answer

Temporary structure	Use
Shoring collar set	Shoring collars are used on temporary anchors during excavation. The collar, usually an angled piece of plate steel ensures that the diagonal load from the tension of the anchor transfers evenly into the pile or column or whaler.
Soldier set	These are the vertical timbers or steel members that are in the formwork walls or shutters.

Ties	These are cpmponents that are horizontal and ties two sides or formwork together. Usually through coil ties or z ties.

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

Answer

Cold formed steel is manufactured and shaped through dies and do not use heat in the process.
The steel is much lighter gauge and is mainly used as light weight framing members like wall studs, purlin members for walls and roofs as well as curtain walls.

Structural steel is hot rolled to create much thicker and heavier members that are much stronger than CFS.

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

Answer

1. Façade/glass framing
Very good for being corrosion resistant
Light weight
Good finish

2. Handrails
Very good for being corrosion resistant
Light weight
Good finish.

3.	Tile angles Very good for being corrosion resistant Good finish.

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

Answer	Before starting the setout, during design stage there will be minimum setback from boundaries that will need to be adhered to. In some cases it may be able to encroach these boundaries but this would need to be approved by local councils. When setting out, the boundaries of the Lot will need to be established to enable setbacks to be marked. This through multiple pegs and string lines that will go between the boundary points. This allows you to measure off the string. Once setbacks are marked (usually on the longest side of the building) you can measure all setouts off the setbacks. To find 90 deg, the easiest way is to use Pythagoras Thoerom and 3:4:5 it or for bigger areas it can just be multiplied by two 6:8:10 etc. This means on a tringle one side is 3 metres, the other side of triangle is 4 metres and the longest side of the triangle is 5 metres. This will give you a true 90 deg corner.

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

Answer

Depth of footing:
Bearing capacities need to be obtained to enable an estimate of depth of footing.
Sometimes the top of the footing needs to remain exposed so preparation of the ground around the footing may need to be benched or the footing made thicker to remove the issue.
If masonry is coming off the footing then it needs to be determined if the masonry become a retaining wall due to surround ground or if the bottom of brick is at ground level.

Surrounding finished levels:
Sometimes the intent is to hide the footings or the footing needs to allow for surround slabs or path ways to go in without fouling so top of footing needs to be calculated.
If footings are coming down a slope then depending on what they are supporting it may need to be stepped to suit the surrounding ground condition.
Lets assume the footings are for a dwelling with a subfloor, the area under the dwelling should be flat to enable any water that may come underneath to dreain away. There should not be any low points where ponding could occur.

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

Answer

By having detailed drawings showing all service routes.

Plumbing invert levels will need to be designed and planned.
If services do require to go through footings then engineers input would be required.

Most other services have minimum requirements that they need to be below the ground so this should be designed into the plan.
This could be a step down in the footing so that services pass over the top of the footing or routes changed so it does not have to cross a footing.

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

Answer

All work place procedures need to be accessible for all workers involved. Procedures need to state all information about any works that are taking place on site and how they will be controlled.
This would be anything from in Excavation all the way up to roof installation. These are usually generalised for a company to use across multiple sites. Every project should have a site specific risk assessment which would show specific requirements and will state how the risk have been mitigated. Specific procedures for workers and would be covered in SWMS.

Workplace policies should include:

1. Workplace harassment and bullying
2. Building code compliance and freedom of association
3. Young and inexperienced workers policy
4. ABAlcohol and drugs policy
5. Consultation and Communication
6. WHS or HSEQ policy
7. Rehabilitation and return to work policy

Other requirements that should be posted:

- First aid contacts for the project
- Site contacts
- Evacuation routes
- General site plan

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

WORKBOOK

Participant name	Ryan Hay

FOR THE PARTICIPANT
Instructions

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Resources required
Pen

FOR THE ASSESSOR
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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).

ABCC regulates all construction work in queensland.
The ABCC use the NCC as a basis to be able to administer the industry legally.

Satisfactory Outcome ☐

ACTIVITY 2

Access the National Construction Code (NCC) Volume Two Amendment 1 – Part 3.0 Structural provisions and discuss what the following points explain.

a) 3.0.2 Resistance to actions
b) Construction in cyclonic areas

a) Resistance to actions

In short its stating that the design of building must be designed with greater integrity than the worst case scenario.
So in regards to load, in my experience buildings are designed with anywhere between 10% and 25% excess max load as a safety factor.
This would include live loads, dead loads, wind and snow etc.
3.0.4 **Determination of structural resistance of materials forms and forms of construction** detail the requirements that must be used to determine the reisitance of materials.

b) Construction in cyclonic areas

To ensure that structures have sufficient strength to withstand forces imposed by cyclones with anchorage, bracing and a system designed so that the structure is interlocked.

Figure 3.01 wind regions show what all areas are rated. Queensland coast line is Region C and B.

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 Building classifications Page 62 Vol 1 Class 2 could not cover the carpark due to it being multistorey building. 7a for the carpark. Page 65 . Vol 1

Rise in Storeys
3 Is the sum of the greatest number of storeys above ground level . Page 101 Volume 1
Number of Storeys
3 Page 101 Volume 1
Type of construction
Table C2D2 page 108 volume 1: Type A
Climate Zone and description
Zone 2 ABCB climate zone map Or page 169 volume 2

Fire resistance and stability

Locate fire resistance information

Table C2D2 page 108 volume 1: Type A
C2D33 storey building as the basement is not counted.
C2D4 (1) In a building of multiple classifications, the Type of construction required for the building is the most fire-resisting Type resulting from the application of Table C2D2 on the basis that the classification applying to the top storey applies to all storeys.

Compartmentation and fire separation

Specification 5 Fire resisting construction
S5C3 Fire protection for a support of another part [2019: Spec C1.1: 2.2] (1) Where a part of a building required to have an FRL depends upon direct vertical or lateral support from another part to maintain its FRL, that supporting part, subject to (2), must— (a) have an FRL not less than that required by other provisions of this Specification; and (b) if located within the same fire compartment as the part it supports have an FRL in respect of structural adequacy the greater of that required— (i) for the supporting part itself; and (ii) for the part it supports; and (c) be non-combustible— (i) if required by other provisions of this Specification; or (ii) if the part it supports is required to be non-combustible

Table S5C11g
Floors 90/90/90
Roofs 90/60/30
Columns 90/--/--

S5C15 Type A fire-resisting construction — roof: Concession [2019: Spec C1.1: 3.5] A roof need not comply with Table S5C11g if its covering is non-combustible and the building— (a) has a sprinkler system (other than a FPAA101D or FPAA101H system) complying with Specification 17 installed throughout; or Building element FRL (in minutes): Structural adequacy / Integrity / Insulation Class 2, 3 or 4 part Class 5, 7a or 9 Class 6 Class 7b or 8 Other loadbearing internal walls, internal beams, trusses and columns 90/–/– 120/–/– 180/–/– 240/–/– Floors 90/90/90 120/120/120 180/180/180 240/240/240 Roofs 90/60/30 120/60/30 180/60/30 240/90/60 S5C11 (1 May 2023) Fire resistance NCC 2022 Volume One - Building Code of Australia Page 138 (b) has a rise in storeys of 3 or less; or (c) is of Class 2 or 3; or (d) has an effective height of not more than 25 m and the ceiling immediately below the roof has a resistance to the incipient spread of fire to the roof space of not less than 60 minutes.

S5C17 Type A fire-resisting construction — internal columns and walls: Concession [2019: Spec C1.1:3.7] For a building with an effective height of not more than 25 m and having a roof without an FRL in accordance with S5C15, in the storey immediately below that roof, internal columns other than those referred to in S5C11(1)(d) and internal walls other than fire walls and shaft walls may have— (a) in a Class 2 or 3 building: FRL 60/60/60; or
So in summary:
Assumed there are sprinklers in the building
Slabs are concrete and are FRL 90/90/90
Columns are 90/--/-- except the top floor for columns supporting the roof. They can be FRL 60/60/60 due to the concession S5C17.

Internal dividing walls to the two occupancies can be either be load bearing or non-load bearing and must be 90/90/90
Basement level must be a separate compartment to the rest of the building.

Fire hazard properties of materials, assemblies, fixtures and linings

Volume one Section C Fire resistance

Specification C1.10. Page 112
C2C11 Fire hazard properties states that class 2 buildings must comply with specification 7

Table S7C2: Fire hazard property requirements

Lining, material or assembly	Requirement
Floor linings and floor coverings	S7C3
Wall linings and ceiling linings	S7C4
Air-handling ductwork	S7C5
Lift cars	S7C6
In fire control rooms subject to Specification 6 and fire isolated *exits*	S7C7
In Class 9b buildings used as a theatre, public hall or the like — fixed seating in the audience area or auditorium; and a proscenium curtain *required* by Specification 32	S7C7
Escalators, moving walkways and non-*required* non-*fire-isolated stairways* or pedestrian ramps subject to Specification 14	S7C7
Sarking-type material	S7C7
Attachments to internal floors, walls and ceilings	S7C7
Other materials including insulation	S7C7

C2D10 page 110. Non-combustible building elements details that Type A construction must have a number of Non-Combustible building elements

Material requirements

Reinforced concrete requirements relative to Australian Standards

Concrete must conform to AS3600
Post installed fastenings and cast in's AS 5216
B1D4 (b) Concrete page 93 volume 1
Part 3.2.3 Concrete and reinforcing NCC 2019 A1

Volume 2
Specification 1 Fire resistance of building elements
S1C2 Rating
A building element meets the requirements of this Specification if—
(ii) AS 3600 if it is a concrete structure;

FRL's deemed to be achieved by walls Table S1C2b
Page 63 and 64

NCC 2019 ammendment 1 part 3.2 state particulars about concrete and reinforcment conformity.

Glazing requirements specifically for windows, sliding doors with frames and balconies.

C3D77 vertical separation of openings in external walls page 119 Volume 1

Again assuming that the building has a sprinkler system so In short the need for designing compliant separation or spandrels or the like are greatly reduced :

(2) The requirements of (1) do not apply to—
(c) a building which has a sprinkler system (other than a FPAA101D or FPAA101H system) complying with Specification 17 installed throughout; or
(d) openings within the same stairway; or (e) openings in external walls where the floor separating the storeys does not require an FRL with respect to integrity and insulation.
(3) For the purposes of C3D7, window or other opening means that part of the external wall of a building that does not have an FRL of 60/60/60 or greater

Glazing: For the purposes of— (a) Section J of Volume One, except for a sole-occupancy unit of a Class 2 building or a Class 4 part of a building—
(i) a transparent or translucent element and its supporting frame located in the envelope; and
(ii) includes a window other than a roof light; or
(b) Section J of NCC Volume One, for a sole-occupancy unit of a Class 2 building or a Class 4 part of a building

Definitions NCC 2022 Volume Two - Building Code of Australia Page 179
(i) a translucent element and its supporting frame located in the external fabric of the building; and
(ii) includes a window other than a roof light; or (c) Part H6 of NCC Volume Two and Section 13 of the

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?

. It was discovered by Jacob Bernoulli and Leonhard Euler and Daniel Bernoulli put together the useful theory.
It is a simplification of the theory of elasticity which provides a means of calculating the load carrying and deflection characteristics of beams.

b) Provide a Euler–Bernoulli equation

$$EI\frac{\mathrm{d}^4 w}{\mathrm{d}x^4} = q(x).$$

The equation describing the deflection of a uniform, static beam.

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

This Descibes the relationship between deflection and the applied load.

Satisfactory Outcome ☐

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

PRACTICAL ASSESSMENT

Participant name	Ryan Hay

FOR THE PARTICIPANT

Instructions

- The tasks outlined on the following pages will require performance of 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	Select Date.	☑ 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: Boxing out of lift pit construction
1.2C.	Specify temporary structural elements added to planning process: Formwork
1.2D. 1.5A. 1.5B.	Specify digital tools/devices used to communicate and collaborate with professionals, suppliers, HR and others: Architectural drawing, structural design, setout CAD drawings. Computer
1.2E.	Specify equipment used to access and extract information: Computer
1.3A.	Specify set-out coordinated: Setout of lift pits and piles
1.3B. 1.3C.	Specify footing laid: Lift pit base and piles
1.3D.	Specify damp coursing and termite barriers installed: N/A. Due to no timber in the building termite treatment is not required

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. All design is completed by relevant design consultants and approved by private certifiers. In some cases a pier review will take place to check design. Processes for the contruction work is discussed within the site teams and eventually with the relevant subcontractor.
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. All completed by structural engineers. This would be in line with local area requirements along with assumptions of load imposed on the building
1.5L.	Specify faults identified and action undertaken: None as yet. Only faults with construction processes were changed to suit program

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

Practical Task 1

Description of task:
The participant must demonstrate the skill and ability to take responsibility for ensuring the structural integrity of materials and building and construction work for a large, high-rise, or complex building project so that site safety and quality control measures are maintained including:

- Apply structural principles to the planning of a construction project.
    - Determine structural principles applicable to the construction of the large, high-rise or complex structure.
    - Document the performance characteristics required of structural elements of the project.
    - Document performance of materials in the building plan as part of the schedule and requirements.
- Coordinate and manage the site assessment and job set-up.
    - Organise site and soil assessment.
    - Confirm and schedule the instalment of retaining walls to meet legislated requirements.
    - Determine and schedule the requirements for temporary structural elements.
    - Use digital tools and devices to communicate and collaborate effectively with others.
    - Use equipment and programs to access, extract information and develop relevant documentation.
- Coordinate and manage construction of footing systems.
    - Coordinate the set-out of the building in accordance with documented building plans, following the full assessment of the site.
    - Assess structural performance of the footings specified in the building plan for compliance with relevant codes and accepted industry construction structural principles.
    - Lay footings, as specified in the building plan, and check for compliance with standards and accepted industry construction principles.
    - Plan, implement and check damp coursing and the provision of termite barriers and other relevant techniques in accordance with codes, standards and industry practice.
- Coordinate and manage structural elements of the construction process.
    - Identify and analyse technical construction principles and performance characteristics of construction materials in the planning of project.
    - Determine, schedule and check processes for construction of all structural elements for compliance with manufacturer specifications and relevant Australian Standards and codes.
    - Confirm building plans and relevant standards and schedule appropriate allowances for plumbing, electrical conduits and other services to be installed.
- Analyse and plan for structural integrity of buildings.
    - Consult and coordinate professional input to evaluate structural integrity of large and complex buildings.
    - Consult effectively with professionals, using relevant industry terminology and concepts.
    - Assess structural requirements and loads of the building design.
    - Analyse the effects of force and movements on structural elements.
    - Analyse properties and behaviours of structural materials.
    - Analyse section properties of structural elements using standard industry formulas and performance comparisons.
    - Evaluate performance characteristics of columns using standard industry techniques.
    - Assess methods used for stress distribution in connections between structural elements.
    - Assess impact of various loads on the building structure.
    - Consider design impact of high-performance structural elements.
    - Select, position and size all structural members that form fixed or temporary building structures.
    - Identify typical faults and problems and the action required to rectify such faults.

Practical Task 1

These tasks may be simulated or real. The Participant is to gather evidence of how they have completed each component of the Practical Task, which is to be submitted with this Practical Assessment sheet. The Observer is to provide detailed comments on the tasks completed by the Participant (on the Observer Comments, overleaf). The Assessor is to verify the Observer's comments, noting their findings in the Assessor Comments (on the back of the Practical Assessment cover page) and provide the assessment outcome.

Resources required:
Access to: relevant current government building and construction and WHS legislation; The NCC, and other relevant industry and Australian codes and standards; environmental requirements and sustainability principles; Manufacturer's materials and product ``s and installation instructions for building materials in the project specifications; Project plans, design brief, working drawings and specifications.

Observer details	
Name of observer:	Micheal Brady
Role of observer (Confirm suitability to sign)	Project manager
Email address of observer	Mbrady @besixwatpac.com
Signature of observer:	Michael Brady Digitally signed by Michael Brady DN: E=mbrady@besixwatpac.com, CN=Michael Brady, OU=BNE, OU=Construction, OU=User Accounts, OU=Watpac Group, DC=watpac, DC=local Location: Mackay Reason: I am approving this document Contact Info: mbrady@besixwatpac.com Date: 2024.04.24 15:10:55+10'00'
Date:	Select Date.

When completing the task, did the Participant:		**Tick if satisfactorily completed. Provide comments if left unticked.**
1 Apply structural principles to the planning of a construction project		
1.1A.	Determine structural principles applicable to the construction of the large, high-rise or complex structure	☑
1.1B.	Document the performance characteristics required of structural elements of the project. *(attach copy or screenshot)*	☑
1.1C.	Document performance of materials in the building plan as part of the schedule and requirements. *(attach copy or screenshot)*	☑
2 Coordinate and manage the site assessment and job set-up.		
1.2A.	Organise site and soil assessment.*(attach copy)*	☑
1.2B.	Confirm and schedule the instalment of retaining walls to meet legislated requirements.	☑
1.2C.	Determine and schedule the requirements for temporary structural elements.	☑
1.2D.	Use digital tools and devices to communicate and collaborate effectively with others	☑
1.2E.	Use equipment and programs to access, extract information and develop relevant documentation	☑
3 Coordinate and manage construction of footing systems.		
1.3A.	Coordinate the set-out of the building in accordance with documented building plans, following the full assessment of the site.	☑
1.3B.	Assess structural performance of the footings specified in the building plan for compliance with relevant codes and accepted industry construction structural principles.	☑
1.3C.	Lay footings, as specified in the building plan, and check for compliance with standards and accepted industry construction principles.	☑
1.3D.	Plan, implement and check damp coursing and the provision of termite barriers and other relevant techniques in accordance with codes, standards and industry practice.	☑

When completing the task, did the Participant:		Tick if satisfactorily completed. Provide comments if left unticked.
4 Coordinate and manage structural elements of the construction process		
1.4A.	Identify and analyse technical construction principles and performance characteristics of construction materials in the planning of project.	☑
1.4B.	Determine, schedule and check processes for construction of all structural elements for compliance with manufacturer specifications and relevant Australian Standards and codes.	☑
1.4C.	Confirm building plans and relevant standards and schedule appropriate allowances for plumbing, electrical conduits and other services to be installed.	☑
5. Analyse and plan for structural integrity of buildings		
1.5A.	Consult and coordinate professional input to evaluate structural integrity of large and complex buildings	☑
1.5B.	Consult effectively with industry professionals, and use relevant industry terminology and concepts	☑
1.5C.	Assess structural requirements and loads of the building design.	☑
1.5D.	Analyse the effects of force and movements on structural elements.	☑
1.5E.	Analyse properties and behaviours of structural materials.	☑
1.5F.	Analyse section properties of structural elements using standard industry formulas and performance comparisons.	☑
1.5G.	Evaluate performance characteristics of columns using standard industry techniques.	☑
1.5H.	Assess methods used for stress distribution in connections between structural elements.	☑
1.5I.	Assess impact of various loads on the building structure.	☑
1.5J.	Consider design impact of high-performance structural elements.	☑
1.5K.	Select, position and size all structural members that form fixed or temporary building structures	☑
1.5L.	Identify typical faults and problems and the action required to rectify such faults.	☑

Observer comments:

Ryan has is well versed in structure and how structures act during and after construction. He has completed Low, middle and high rise structures during his career.

He explained the structure was designed as a concrete structure with concrete columns/walls, 350mm post tensioned slabs and a structural steel roof.

He explained that movement joints were designed in the structure to allow for ground movement and earthquakes.
It is also designed to with stand wind loads of cyclones.

He completes site construction programs and uses Aconex, Revisto among company portals.

He is working with the construction team working through construction methodologies for piling and ground slab construction.
He explained how termite treatment is completed on buildings with the risk of damage of termites and that the hospital does not require termite treatment.

He is currently working with engineers for discussions around buildability and requirements of structural members.

He explained that slabs are designed to take live and dead loads and that during construction we would need to get structural engineers input as to how slabs can be loaded during construction to avoid point loading.

He showed understanding of the need to take services requirements into account when in the design stage.