

CPCCBC4010

APPLY STRUCTURAL PRINCIPLES TO RESIDENTIAL AND COMMERCIAL CONSTRUCTIONS

THEORY EXAM

Participant name	
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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 consultation with the Assessor.
- You must complete all questions unassisted by the Assessor or other personnel. You 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.

Specify the State or Territory you are responding to when responding to Q1. Q2. & Q3.

State/Territory:

Q1. Identify one current building and construction legislation relevant to the application of structural principles. (*Legislation identified may be national legislation or be specific to your state/territory.*)

Briefly explain how the identified legislation applies to the following:

- Residential construction
- Commercial construction

Answer

Building and construction legislation relevant to the application of structural principles	e.g. The candidate must identify one current building and construction legislation relevant to the application of structural principles. Their response will vary depending on the state/territory they selected in the preliminary task, e.g. if they ticked QLD, their response must be a building and construction legislation in QLD. They may identify national legislation or legislation specific to their state/territory. The model answer below is based on legislation from QLD: Queensland Building and Construction Commission Act 1991.
How does it apply to residential construction?	e.g. Responses will vary, but for a satisfactory performance, the candidate must demonstrate sufficient knowledge of how the legislation they identified applies to residential construction. An example of a satisfactory response is provided below: This legislation explains what is included as residential structure in issues of rectification of building work due to issues in structural integrity.
How does it apply to commercial construction	e.g. Responses will vary, but for a satisfactory performance, the candidate must demonstrate sufficient knowledge of how the legislation they identified applies to commercial construction. An example of a satisfactory response is provided below: This legislation explains what issue in structural integrity can be called consequential damage in the context of any construction work.



Q2. Name one (1) current building and construction regulation applicable to your state/territory. Briefly explain how this regulation is relevant to the application of structural principles.

Answer

The candidate must identify one (1) current building and construction regulations applicable to their state/territory. The candidate must also briefly explain how the regulation they identified is relevant to the application of structural principles.

Example 1: Building Regulation 2006 - The regulation identifies what type of building work is acceptable under the Planning Act for particular non-load bearing devices. It also identifies limits for the acceptable building work.

Example 2: Building Fire Safety Regulation 2008 - specifies that the behaviour of structural materials is one of the things that is considered when assessing the occupancy safety factors of a building, specifically the flammability of the materials used. This means that when constructing a building, flammability is one thing that should be considered when selecting materials for use.

Q3. Identify the following current standards.

Answer

Standard	Description
One current standard relevant to the installation of roof trusses	e.g. AS 4440-2004 – Installation of nailplated timber roof trusses
One current standard relevant to timber framing	e.g. One of: AS 1684.2 N4 Supp 10-2010 – Residential timber-framed construction, Part 2: Non-cyclonic areas N4 Supplement 10: Timber framing span tables – Wind classification N4 – Unseasoned softwood – Stress Grade F5 (Supplement to AS 1684.2 – 2010) AS 1684.3 -2010 – Residential framed construction – Cyclonic areas

Q4. Discuss why builders must refer to the NCC to confirm appropriate application of structural principles relevant to the build.

Answer

Should reflect but is not limited to: NCC is a performance-based code, containing all Performance Requirements for the construction of buildings including the buildings structural resistance and resistance to actions, structural requirements for wind loads, and other provisions for the structural integrity of buildings.



Q5. Provide a brief description for each of the following building classes.

Answer

Building Class	Description
Class 1a building	e.g. A detached house. OR One of a group of two or more attached dwellings, each being a building, separated by a fire-resisting wall, including a row house, terrace house, town house or villa unit
Class 1b building	e.g. A boarding house, guest house, hostel or the like that would ordinarily accommodate not more than 12 people; and have a total area of all floors not more than 300m ² (measured over the enclosing walls of the building or buildings); OR Four or more single dwellings located on one allotment and used for short-term holiday accommodation.
Class 5 building	e.g. An office building used for professional or commercial purposes.
Class 6 building	e.g. A shop or other building used for the sale of goods by retail or the supply of services direct to the public, including a café, restaurant, milk bar; or a dining room, bar area that is not an assembly building, shop or kiosk part of a hotel or motel; or a hairdresser's or barber's shop, public laundry, or undertaker's establishment; or a market or sale room, showroom, or service station.



Q6. Explain why a determination of the climate zone is important when ensuring the structural integrity of the building.

Answer

Should reflect but is not limited to: the intended use of building and climate zones will help to determine NCC requirements, such as those for bushfire, high wind, alpine environment, and earthquake. You must make sure that building products, elements, components, and the whole structure comply and conform to these provisions and requirements. In addition to purposes such as thermal comfort and efficient use of energy, one importance of determining under which climate zone a building project belongs is to anticipate structural loads brought about by climate. These structural loads include, but are not limited to, wind and rain, snow, and thermal loads due to extreme humidity or low temperatures. All these factors need to be accounted for in the structural design to promote the structural integrity of structural components, thus, avoiding structural defects and damages.



Q7. You are involved in preparing for the building of a 16-level apartment building where the carpark is underground, and the ground floor consists of shops and cafés/restaurants/bars. Specify the classifications that you will apply to this building.

Answer

Should reflect: Carpark - Class 7a; Shops/cafes/bars - Class 6; Apartments- Class 2



Q8. Explain why sectional properties are important in structural design.

Answer

Should reflect but is not limited to: structural designers manipulate these section properties in order to calculate and achieve the correct design of members that can effectively resist tensile, compressive, shear, torsional, and bending stresses. Four commonly used section properties in structural design are shape, centroid, second moment of area and radius of gyration



Q9. **Considering sectional properties, what will occur if the structural engineer increases the second moment of area on a beam?**

Answer

Should reflect: To increase the second moment of area, structural designers may increase the depth of the beam, which results in an increase in the beam stiffness as well. This will allow the beam to resist greater magnitude of bending stresses and large deflections.



Q10. **Identify if the following are examples of either:**

- **Dead load**
- **Live loads**
- **Wind load**

Answer

Example of load	Type of load
Reinforced concrete beams	e.g. dead load
Strong winds blowing against a building	e.g. wind load
People walking around	e.g. live load
A soft breeze on a fence	e.g. wind load
A vehicle being parked	e.g. live load
Stone columns	e.g. dead load



Q11. What is the purpose of AS 1684 Residential timber-framed construction?

Answer

Should reflect: This Australian Standard provides the building industry with procedures that can be used to determine building practice, to design or check construction details, and to determine member sizes, and bracing and fixing requirements for timber-framed construction in non-cyclonic areas. It specifies requirements for building practice and the selection, placement and fixing of the various structural elements used in the construction of timber-framed Buildings

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Q12. Self-healing concrete is one emerging material. Using special bacteria, this material has the ability to “heal” itself if it cracks. This is intended to extend the concrete’s lifespan. Describe the assessment methods you would apply before using this material.

Answer

Should reflect using the following assessment methods: Documentary evidence; verification methods; expert judgement and comparison to ‘deemed to satisfy provisions’.

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Q13. Which industry professionals would you consult before the site inspection, to discuss if structural performance meets the General Requirements and Performance Requirements of NCC? Provide two (2).

Answer

1. Should reflect but is not limited to any two (2) of: Builder; engineer; architect;
 2. material supplier
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Q14. Explain the importance of having project plans and specifications approved.

Answer

Should reflect that it is important to have project plans and specifications approved by the appropriate authorities, usually the local council, to ensure that all details and specifications provided are sufficient and comply with local requirements, relevant building codes and standards before the commencement of any construction work. Plans and specifications must be approved prior to commencement of work.



Q15. Describe how you apply structural design and specification documents.

Answer

Should reflect that these documents contain the structural drawings, layouts, requirements, and instructions that must strictly be followed and implemented in the construction phase. These documents consist a part of the larger set of documents called project plans and specifications. Structural design specifications are found in the elevation and section view, the foundation plan, floor framing plan and roof framing plan and will include the material requirements, measurements, connections and steelwork details.



Q16. What information is provided in the engineer's footing design and specifications documents?

Answer

Should reflect that these documents contain the drawings, details, layouts, section views, and specifications related to the foundation of the building project and will include information such as distances between columns and footing and the position of footing in the construction site. Specifications will include installation, material strength, dimensions, reinforcements and design assumptions.



Q17. Discuss cadastral survey plans, what they contain and who is responsible for preparing these.

Answer

Should reflect but is not limited to: another name for registered plans, prepared by a registered cadastral surveyor, these provide the details of the boundaries of a property, as well as its area, showing the property boundary lines, boundary distances, bearings and the actual area of the property.



Q18. What is determined from the contour site plan?

Answer

Should reflect but is not limited to: The contour site plan consists of a map or drawings that represent the physical features of the ground on the site. This assists in understanding the nature of the ground (i.e. ridges, valleys, cliffs) when determining the ground profile for cut and fill calculations and procedures to be undertaken and helps to determine ground slopes which direct the flow and quantity of water. This is important in the planning and construction of appropriate drainage systems.



Q19. Discuss who prepares and geotechnical report and what this report contains.

Answer

Should reflect but is not limited to: Prepared by the Geotechnical engineer, the geotechnical report is used to communicate the site conditions and design and construction recommendations and will contain information relating to level of excavation and slope of grade, degree of compaction, soil bearing capacity, cut and fill procedures and recommended foundation



Q20. The plans and specifications include underpinning design and specifications due to a change in the imposed loading. Why are these included?

Answer

Should reflect: Underpinning design and specifications documents are included because the way the structure is used has changed. The documents that contain the processes for underpinning procedures which include the application of modifications or additional structural methods to existing foundation elements to provide strength and stability for the structure. The documents will generally include the amount of enlargement of footing elements, an increase in the depth of existing foundation, introduction of new foundation elements and the application of grout or chemical treatment required.



Q21. Specifications are included for temporary rock anchors to be used for securing a retaining wall. What is the purpose of these?

Answer

Should reflect: These anchors transfer tensile loads, using high strength steel bars or steel strand tendons. They consist of an anchor head, a free length and a bond length. As they create minimal soil disturbance during installation they can be stressed to an exact holding capacity. Temporary anchors, in single-rod or strand anchor configuration, which can be removed fully or partially, are used to secure retaining walls for a maximum of two years. They are quick to install and highly cost-effective. The load-bearing behaviour of each anchor is tested and logged during the acceptance procedure



Q22. Explain how shoring specifications differ to specifications for temporary rock anchors.

Answer

Should reflect but is not limited to: shoring supports the walls of an excavation or the construction of walls following a shoring design, whereas, rock anchor application supports the walls of the soil through soil nailing procedures; where rock anchors are concealed or embedded into the soil.



Q23. Describe what tanking is and methods used.

Answer

Should reflect but is not limited to: Tanking is the process of applying waterproofing or moisture barrier on structural elements (e.g. basement walls, retaining walls) to protect the structure from unwanted and harmful water intrusion. The membrane method involves applying and fixing polyester/PVC sheets directly onto the internal face of the wall. Membranes for waterproofing must comply with the Australian Standard (AS 4654.1 – 2012) for waterproofing materials. Coating is achieved by applying liquids composed of bitumen or asphalt, epoxy resins or cement slurry to the face of the wall (e.g. brushed-on, rolled-on, sprayed-on).



Q24. Briefly explain the expected deflection of the following beams.
In your explanation, identify the point of maximum and minimum deflection.

Answer

Beams	Expected deflection
Cantilever beams Beam length = 10 m Fixed support at 0 m Point load at 5 m Load magnitude = 5N	e.g. Cantilever beams under such stress would only receive the greatest amount of stress and will be stretched on the part opposite to where it is fixed to the wall. Deflection rarely occurs on the part that is fixed to the wall.
Beam with overhang Beam length = 10 m Support #1 = 0m Support #2 = 8m Point load at 4m Load magnitude = 5 N	e.g. Beams with overhang under such stress would have the point of maximum deflection between the supports while little to no deflection will happen on the overhanging part of the beam. .
Beam fixed at both ends Beam length = 10 m Fixed support at 0 m Point load at 5 m Load magnitude = 5 N	e.g. Beams fixed in both ends have no support in the middle but have great resistance to stress at both its ends, due to this, deflection is greatly expected to happen on the middle of the beam, deflection will lessen the more it is closer to the ends of the beam.



Q25. Briefly explain the performance of the following columns when put under compressive loads.

Answer

Beams	Expected deflection
Steel column	e.g. Steel columns tend to buckle or bend under extreme loading but has good compressive strength that's as strong as columns made of masonry.
Masonry column	e.g. Bricks, when used in columns, have high compression strength and has no trouble containing heavy loads due to brick's resilience to compression.
Reactive powder concrete columns	e.g. Reactive powder concrete columns have the highest compressive strength out of all materials, being able to carry almost twice the vertical stress that steel columns can.



Q26. Briefly explain the safety factor in design of the following types of roof trusses.

Answer

Beams	Expected deflection
Timber trusses	e.g. Timber trusses have a low chance of expansion or increase in length due to raised temperature. This provides safety to structures.
Metal trusses	e.g. Metal trusses can be softened and melted with exposure to extremely high temperature. To increase safety factor in design, additional passive fire protection must be used on trusses.



Q27. Describe wind bracing and four (4) types of wind bracing applied.

Answer

Should reflect but is not limited to: A braced frame used in structures in order to be able to resist lateral loads from wind loads. For a satisfactory performance, their response must include all of the following:



- Single diagonals
- Cross-bracing
- K-bracing
- V-bracing

Consider the rafter that the pots are hanging from in the photo below when responding to Q28. Q29. & Q30. Assume that it is a rafter tie also connected to walls on either side.



Q28. Identify the force system that is acting on the rafter. Explain your answer.

Answer

Should reflect: Coplanar and non-concurrent force system. The forces present in the rafter from its connection to the wall and from the hanging pots do not meet at a common point, however they lie in a single plane which is the rafter.



Q29. Describe what would happen to the rafter if the force applied by the hanging pots were too heavy to be held up by the rafter.

Answer

Should reflect: The equilibrant force needed to be applied so that the rafter will remain structurally sound will increase. The rafter will bend in downwards and will be stretched in where it is connected to the wall.



Q30. Identify the force system that would be applied if all the hanging pots are removed from the rafter.

Answer

Should reflect: The rafter will only be under gravity load, and a parallel coplanar force would be present instead.



Q31. Describe the general details contained in the project documents for each structural system stated below.

Answer

Structural system	General details
Floor system	e.g. Project documents for floor systems contain details regarding the materials, components and floor configuration that will ensure structural stability, serviceability and safety against floor dead and live loads.
Wall system	e.g. Project documents for wall systems contain details such as the types of structural wall systems employed for the building project, materials used, and structural wall configuration that are designed to carry the dead and live loads transmitted from floor and roof systems, as well as lateral loads induced by earthquake and wind..
Roof system	e.g. Project documents for roof systems contain details such as the structural design of the members and components that resist wind, snow and rain loads. Additionally, it contains the details of the roof construction to prevent the detachment of the roof due to uplift pressure. .



Q32. What must be covered by the site environmental management plan?

Answer

Should reflect: The environmental management plan should specify environmental management measures such as noise management, waste management, waterway management, site chemicals management as well as how the effectiveness of environmental management measures will be monitored. It should include the methodology, frequency and duration of monitoring activities. It should also include trigger values or conditions under which corrective actions are taken.



Q33. Discuss what type of information is included in the site safety plan.

Answer

Should reflect but is not limited to: site location and scope, site rules, emergency procedures and site emergency responsibilities, emergency plan with contact numbers, Weather contingencies, accident and incident protocols, recording and reporting, Hazard identification procedures, Hazard controls, Hazard safety practices, safety training and communication.



Q34. Discuss the different contracts a builder or building company must organise before beginning a residential or commercial construction project. What are the legal requirements for such contracts?

Answer

Should reflect but is not limited to: Commercial and domestic building work requires a written domestic building contract when over the specified state/territory amount (Qld \$3300) this contract is between the client and the builder. To be valid, there must be an offer, acceptance, intention to create legal relations and consideration (i.e. money for services). This is evidenced by the contract being in writing, signed and dated by each party, as well as compliance with relevant legislation (e.g. QBCC, fair trading). Written contracts are required for any agreement between parties (contractor and subcontractors) for building work priced above the amount for which a licence is required. Subcontractors also need written contracts when contracting sub-sub-contractors. Written training contracts are required when employing apprentices or trainees.



Q35. Identify one (1) potential structural issue for each of the following footing systems.

Answer

Footing system	Potential structural issues
Concrete slab floor	e.g. There may be difficulty in applying concrete slabs on steep sites. Geotechnical requirements existing on steep sites may make concrete slabs structurally unstable unless certain frame constructions are incorporated.
Mass concrete piers	e.g. Because of the size of structures that are considered mass concrete, they generate high internal temperatures which then increase the risk of cracking. Ultimately, this may lead to shorter structure lifespans.



Q36. Describe how the following footing systems perform when bearing structural load.

Answer

Footing system	How they perform when bearing structural loads
Bored pier footing	e.g. Bored pier footings support and transmit structural load down to the firm strata or the pile cap using its bearing and friction resistance.
Column footing	e.g. A column footing, which may be square or rectangular in shape, supports structural load from the columns and disperses the stress equally through a large area to the foundation soil.
Stump footing	e.g. Stump footing is the simplest footing which, like column footings, may be square or rectangular in shape. They support loads from stumps for elevated floors and distributes the loads towards the foundation soil equally through a large area.
Drilled pile foundation	e.g. Drilled pile foundation, which is a cast-in-situ reinforced-concrete foundation, supports and transmits loads from the structure through its bearing and friction resistance.
Driven pile foundation	e.g. Driven pile foundation, which is a pre-fabricated reinforced-concrete foundation, supports and transmits loads to the ground only through its bearing capacity.



Q37. Identify the structural advantages of each of the following footing systems.

Answer

Footing system	Structural advantages
Reinforced piers and beams	e.g. Due to the reinforcement present in reinforced pier and beams, structural weakness of concrete, such as brittleness, is reduced. The rebar also allows for concrete to be more durable and be less likely to crack under heavy loads.
Screw piles	e.g. Loads for structures can be immediately put once screw pile foundations are installed. They are also effective at carrying loads of heavy structures.
Brick bases	e.g. Brick bases are made of non-combustible materials which improves the passive fire protection of the structure. Brick bases are also resistant to large amounts of compressive weight loads.



Q38. Why must foundation movement be considered when designing and constructing on-ground concrete slab floors?

Answer

Should reflect: Movements can be significant enough to damage slab and other structural elements that it supports. The on-ground concrete slab must be specifically designed and constructed to make sure that it is capable of opposing different stresses.



Q39. Identify the structural advantages of the following floor systems.

Answer

Floor system	Structural advantages
Suspended concrete floors	e.g. Because they are not in direct contact with the ground, suspended concrete floors are much less likely to be affected by damp. They also demonstrate a good load-span capability, allowing for heavy loads to be carried with ease.
Timber floor frames	e.g. When timber burns, its outer layer acts as an insulator against heat, protecting the centre of the timber against damage. This allows the floor frame to last longer in a fire and helps prevent the floor from collapsing.
Steel floor frames	e.g. Steel frames do not age or worsen over time. They are also resistant to extreme weather conditions and require relatively little maintenance.
Aluminium raised floors	e.g. Aluminium raised access floors are lightweight, corrosion resistant, and can carry loads of around 1000–2000 pounds.
Solid hardwood fitted floors	e.g. Solid hardwood fitted floors are able to stand up to active loads such as heavy movement and foot traffic.
Engineered wood fitted floors	e.g. Engineered wood is very stable and resistant to change in temperature and moisture. Engineered wood would keep its stability even under heavy active loads.



Q40. Identify two (2) actions during the installation of I-joists that may negatively affect their structural integrity. Explain your response.

Answer

1. Should reflect and explain 2 actions. E.g. Cutting, notching, or drilling flanges - When I-joists are modified, their efficacy for transferring floor loads to the joist supports and for carrying very high loads cannot be guaranteed.
2. e.g. Carrying the joists in a flat position - I-joists are very weak when carried in a flat position. The entire weight of the joist will pull it down with great stress on the middle and deflection may happen, which would weaken the joist's load bearing capability.

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Q41. What are the structural disadvantages of using platform floors?

Answer

Should reflect but is not limited to: Because platform floors are typically put in place before walls and roof frames, they are exposed to the elements and may experience some level of deterioration. They also provide avenues for sound to travel through into other rooms.

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Q42. Why are compressed sheets commonly used in the flooring of wet areas?

Answer

Should reflect but is not limited to: If taken care of properly, compressed sheets are highly resistant to moisture damage and rotting. This improves the lifespan of the flooring and reduces the need to replace it.

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Q43. What is one (1) benefit of using vinyl sheet flooring in areas with high foot traffic?

Answer

Should reflect but is not limited to: Vinyl sheet flooring is highly durable and can withstand high foot traffic for years if properly installed and maintained.

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Q44. Describe one (1) structural advantage of using tongue and groove boards for flooring.

Answer

Should reflect but is not limited to: Gaps due to wood swelling and shrinkage in changing humidity levels are less likely to appear in tongue and groove boards used for flooring. This is because of the tight seams between the boards that make up the flooring.

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Q45. Discuss the structural capability of autoclaved aerated concrete (AAC) flooring panels.

Answer

Should reflect but is not limited to: AAC panels are lightweight making them versatile compared to standard concrete. It offers excellent sound and thermal insulation and is strong and fire resistant. AAC panels can provide loadbearing support in houses up to two storeys high.

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Q46. What are the structural limitations of using lightweight AAC as part of a composite loadbearing wall?

Answer

Should reflect but is not limited to: Compared to other concrete products, lightweight AAC is weaker and needs to be reinforced so that it can carry loads without cracking. A protective finish also needs to be applied to AAC products in general to prevent them from deteriorating.



Q47. Discuss one (1) structural factor that must be considered when integrating tilt-up slab panels into composite walls. Explain your answer.

Answer

Should reflect but is not limited to: Tilt-up slabs to be used for wall panels must be designed not only for the loadings that the final structure is expected to bear, but also for the lifting and handling it will experience during the construction process.



Q48. Identify the structural advantages of using the following products in composite walls.

Answer

Products	Structural advantages in composite walls
Glue-laminated lumber	e.g. Glue-laminated lumber has greater tensile and compression strength than steel and concrete, respectively. This makes it durable and able to carry heavy active and dead loads.
Mass concrete piers	e.g. The veneer layers are organised so that the grain of each goes in the same direction. This increases the strength of the product, enabling it to support heavier loads compared to regular timber.



Q49. What makes a cavity brick masonry wall a good choice for areas that often experience rain?

Answer

Should reflect but is not limited to: Cavity brickwork prevents moisture from penetrating into the building because moisture condenses in the cavity between the leaves of the wall.

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Q50. Discuss disadvantages of using single-leaf masonry walls.

Answer

Should reflect but is not limited to: Because there is only one component involved in the structure of the wall, the single-leaf masonry wall is responsible for withstanding loads, keeping moisture out of the building, and regulating temperature. The combination of all these forces could reduce the lifespan of the wall and increase the need for constant maintenance and repairs.

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Q51. What behavioural properties make AAC a good choice for masonry walls?

Answer

Should reflect but is not limited to: Compared to regular concrete, AAC conducts less temperature and lasts longer when exposed to fire. Because of its internal structure, it also does not transmit sound as readily as other building materials.

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Q52. Discuss structural disadvantages of using timber weatherboards as wall cladding.

Answer

Should reflect but is not limited to: Timber weatherboards have poor temperature regulation as well as poor insulation. Durability is also inconsistent and will depend on both the species of tree that the timber is taken from and the maintenance performed.

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Q53. Discuss how wall coatings differ from regular paint.

Answer

Should reflect but is not limited to: Wall coatings are much more durable and weather resistant compared to regular paint and applying them to external walls is one way to lengthen the lifespan of the structure. It is also better than regular paint at keeping out moisture.

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Q54. What structural factors must you consider when using compressed wood panelling as cladding?

Answer

Should reflect but is not limited to: The species of wood used in the creation of compressed wood panelling has an effect on its durability. When using compressed wood as cladding, it is important to examine its grade to determine its level of water resistance, fire resistance, and insulation.

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Q55. Identify the structural advantages of the following products used in wall cladding.

Answer

Products	Structural advantages in wall cladding
Corrugated metal sheeting	e.g. Corrugated metal sheets are highly durable and can stand against high-wind, hurricanes, and other environmental loads that it may face. It is also waterproof and resistant to fire.
Fibre cement cladding	e.g. Fibre cement cladding can withstand loads from harsh winds and heavy rain. It is also resistant to fire, infestations from insects and mould, and rot.
Tilt-up concrete panels	e.g. They have good load-bearing capabilities, specifically for gravity loads and lateral loads. They are also good at sound insulation and resisting fire.
Fired bricks	e.g. Due to being fired in ovens, fired clay bricks have high compressive strength and excellent weathering qualities.
Unfired bricks	e.g. Unfired bricks' strength may vary depending on the material that was used, but it generally has good compressive strength and has resistance to wind loads due to its ability to absorb more moisture from the air than fired bricks.
AAC bricks	e.g. AAC bricks are lightweight, and they reduce excess dead loads on the foundation and supporting structures. When used, it makes structures safer from accidents brought by earthquakes.



Q56. Discuss one (1) structural advantage and one (1) structural disadvantage when using timber prefabricated roof trusses.

Answer

Should reflect but is not limited to: Prefabricated roof trusses made of timber perform better than those made of steel when exposed to fire because the centre of the timber trusses remain protected by the burnt outside. This improves the chances of the roof remaining stable after a fire. They are weaker than steel prefabricated roof trusses when it comes to carrying high wind loads. They are also more prone to warping, especially if they are exposed to moisture.



Q57. Provide one (1) structural advantage and one (1) structural disadvantage when using steel prefabricated roof trusses.

Answer

Should reflect but is not limited to: Steel prefabricated roof trusses can withstand heavy wind and have a higher strength-to-weight ratio. This means that it can span greater lengths without buckling from its own weight. Steel prefabricated roof trusses perform poorly in terms of insulation when compared to timber prefabricated roof trusses. They allow more heat to escape and are also worse at sound insulation.



Q58. Name five (5) structural components of a hand cut timber roof.

Answer

1. Should reflect but is not limited to: Ridge board;
 2. Battens,
 3. Rafters,
 4. Purlins,
 5. Joist.
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Q59. Discuss uses and disadvantages of the following roof types.

Answer

Roof types	Uses and disadvantages
Box gable roof	e.g. The design of box gable roofs makes it easier to allow water loads to shed, reducing the load experienced by the structural walls that carry it. Problematic in high wind and hurricane areas due to its susceptibility to collapsing if no proper support is provided.
Dual pitch roof	e.g. A dual pitched roof's design allows for insulation to move efficiently and lessens the possibility of materials to be subjected to extreme temperatures. This allows for flexibility in the materials that can be used. Dual pitch roofs place a huge amount of load on the foundations of the buildings which would require a design with a greater depth of footing.
Dutch gable and Dutch hip roof	e.g. A Dutch gable and Dutch hip roof function very well against rain and high wind environments. Dutch hip roof takes a lot of size which may require support from walls that has a high loadbearing capacity.
Hip and valley roof	e.g. Hip and valley roofs have a self-bracing capability that enables them to eliminate possibilities of being lifted by strong winds. Hip and valley roofs have a greater risk of experiencing leaks, especially at the seams that make up the valley.
Skillion roof	e.g. Rainwater will slide off in skillion roofs which lessens the possible load carried by the roof and walls. Skillion roofs have a high possibility of sustaining damage from hurricane force and wind loads.



Q60. What parts of the building make up the gable end?

Answer

Should reflect but is not limited to: The gable is made up of the gable (the portion of a building, usually triangular, directly underneath the pitched roof) and the wall beneath it.



Q61. Discuss north light roofing.

Answer

Should reflect but is not limited to: North light is a series of dual pitch roofs with one roof section set at a steeper slope than the other. This is also known as sawtooth truss since the series of north light roofs resembles such. This type of roof system is widely used in industrial buildings and allows natural light inside the buildings by employing glass in the steeper slope. A disadvantage that comes with the use of north light is possible overheating in the building in cases where planning and implementation of processes are not done properly.



Q62. Discuss the benefits and disadvantages of using concrete, clay or metal tiles for roof cladding.

Answer

Should reflect but is not limited to: Concrete tiles are dense; strong and able to carry weather and wind loads, however the strength comes from their weight which would require great load bearing capacity from the walls and foundations. Clay tiles are fire resistant and are also very durable against many weather conditions, these are however brittle and prone to cracks. Metal tiles are lighter and can keep their shape under high winds but they are weaker in terms of its load bearing capacity and may dent when a heavy load is applied.



Q63. Discuss the structural advantages associated with the following types of roof cladding.

Answer

Roof cladding	Structural advantages
Shakes	e.g. Shakes are generally thicker than shingles and follow the grain of the wood, making them more durable in comparison to shingles.
Shingles	e.g. Because shingles are more uniform in shape, they can lay flat on top of each other, preventing moisture from getting in between the shingles.
Short run sheeting	e.g. Short-run sheeting has greater density on parts that overlap with each other, which allows them to have support against wind loads.
Long run sheeting	e.g. Long-run sheeting requires less overlapping to cover large areas. This reduces the likelihood of moisture being trapped in these overlapping areas and in turn reduces the risk of leaks or corrosion, depending on the material used for the sheeting.
Metal sheeting	e.g. Metal sheeting is relatively lightweight and more durable compared to other roof cladding options. Metal sheeting also doesn't absorb moisture.



CPCCBC4010

APPLY STRUCTURAL PRINCIPLES TO RESIDENTIAL AND COMMERCIAL CONSTRUCTIONS

WORKBOOK

Participant name	
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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. Additional time may be allowed upon negotiation with the Assessor.
- You must complete all questions unless instructed otherwise by the Assessor. You 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.

ACTIVITY 1

Access the NCC via the internet to locate the requirements applicable to the proposed building development plans at PALLARA, QUEENSLAND (*Handout 1 and Handout 2*) and complete the information below:

Building Description

Classification
Class 1a building
Climate zone and description
Climate zone 2 - warm humid summer, mild winter
Type of construction
Type A construction throughout
Wind Classification
N'2'
Site soil classification
'P' Class

Site Preparation

Termite management
e.g. Not provided Area is considered a high termite hazard area (CSIRO Termite Hazard map), thus requiring a termite management system. Termite management system. 3.4 (Housing Provisions)
Site preparation
e.g. P Class soil caused by tree effect. Removal of all organic material and soft soil followed by cut and compaction is required on plans. Slab and footings preparation to be according to AS 2870. To meet NCC H1D3

Fire resistance and stability

Fire resistance information
Type C Fire-Resisting Construction Meets performance requirements of H3 Fire safety
Fire hazard properties of materials, assemblies, fixtures and linings
e.g. Meets requirements of NCC H3D2 Smoke detector to AS 3786 meets NCC requirements

Material requirements

Reinforced concrete requirements relative to Australian Standards
e.g. Waffle slab meets NCC H2D3 Concrete must be manufactured to comply with AS 3600 Materials used for reinforcing steel must comply with AS 2870
Structural timber and framing
e.g. meets NCC – must be according to AS 1684 Residential timber framed construction
Provision for services
e.g. See typical pipe through waffle rib plan – Drawing No. SO4
Glazing requirements specifically for windows, sliding doors with frames
e.g. meets NCC H1D8 - 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 2

Revisit the proposed building development plans at PALLARA QUEENSLAND (*Handout 1 and Handout 2*) and complete the information below using the plans and specifications:

Identify Earthworks to be completed

e.g. remove loose fill and organic matter and roll site to achieve a firm stable surface. Cut and fill to desired level. Place Class 3 graded quarry material over the building fill area. Compact fill in 150mm layers at OMC. Roll with an excavator in orthogonal directions repeatedly and extend 1000mm past the waffle edge. Additional site scrape at alfresco area to accommodate waffle pod step down.

Identify slab type

e.g. Waffle pod

Identify Framing tie down schedule Bottom plate to slab

e.g. 75 masonry nails (hand driven at slab edge) screw or bolt at 1.2m max CRS.

Specify framing tie down bottom plates to floor frame

e.g. 2/75 x 3.05ø nails (up to 38 stud) OR 2/90 x 3.05ø nails (38 – 50 stud) 600 max CRS.

Specify wall frame bracing material

e.g. Nominal 30 x 0.8mm Galv. Strap (or equivalent) All wall ties must be galvanised.

Identify compression strength of a brick unit

e.g. Unconfined compressive strength - Minimum 15 MPa

Identify structure of roof system
e.g. Pre-fabricated roof truss according to manufacturer design and specification
Identify roof cladding
e.g. concrete roof tiles
Identify wall cladding and sarking
e.g. Weatherboard cladding at selected locations, dampcourse, cavity flashing and weepholes in brickwork every 4 th perpend.
Identify installation requirements of windows and doors
e.g. Internal door heights to be 2040mm Privacy locks to bathroom, ensuite and WC Corinthian 820mm wide front door with Window light above door Aluminium framed windows and sliding doors with glazing as marked
Identify membrane to be used around pipes traveling through slab.
e.g. 0.2mm thick polyethylene to be taped around pipes and lapped a minimum of 200mm

**Satisfactory
Outcome**



ACTIVITY 3

A man living in a bungalow in southern New South Wales notices that small splits and cracks are forming in his house's timber roof trusses. He remembers that his area recently experienced heavy snowfall and calls a contractor for help in fixing the cracks.

During their conversation, the contractor tells him that the trusses were not built to withstand heavy snow loads and that a team will come and fix the trusses.

Given the information above, write a report in the space below, to the man, as the contractor, responding to the following points:

- The structural defects of the roof trusses.
- What contributed to the structural defects of the trusses identified.
- The implications of the structural defect identified.
- Structural principles that were not applied.
- How the structural defects you identified were caused by failure to apply the relevant structural principle you identified.
- The extent of work that needs to be done to rectify the structural defects you identified.

Should reflect but is not limited to a satisfactory response to each point.

e.g. Dear 'man'

Following on from our meeting to assess your roof recently, we agree that the roof trusses have small splits and cracks.

Considering the design of the house, and the location, The trusses were not designed to withstand heavy snow loads and this design should not have been used in this location.

Unfortunately, if no action is undertaken, the roof may cave in if another instance of heavy snow load or high wind is applied to it. as the trusses are one of the primary load bearing elements of a building and loads that they could potentially be exposed to should be considered during their design.

The trusses started to split due to bearing a load that exceeded its load bearing capacity. This was due to the trusses being built without considering the possibility of heavy snowfall. The trusses must be built with sturdier timber and should consider calculations for possible environmental loads in the future.

☐

CPCBC4010

APPLY STRUCTURAL PRINCIPLES TO RESIDENTIAL AND COMMERCIAL CONSTRUCTIONS

PRACTICAL ASSESSMENT

Participant name	
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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 assisted 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 achieved.
 - For an 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
1.1A. 1.1B. 1.1C. 1.1C. 1.1D. 1.1E. 1.2C. 1.2D. 1.3C. 1.3D. 1.5A. 1.5B. 1.5C. 1.6A. 1.6B.	Specify (✓) where building classifications, criteria requirements and performance solutions were documented: ☐ Workplace Quality document ☐ Quality Assurance Template ☐ Other (please specify): ☐ Document attached as evidence
1.1F.	Specify (✓) who was consulted regarding structural integrity: ☐ Project management ☐ Relevant tradesperson ☐ Builder ☐ Supplier ☐ Other (please specify):
1.1H.	Specify new and emerging building technologies assessed for compliance. e.g. select new building technology assessed
1.2B.	Specify how cut and fill, excavation and compaction were confirmed as compliant with geotechnical report: e.g. In accordance with soil type and requirements specified
1.3B.	Specify where footing type and tie-down details located. e.g. specifications (page number)
1.3E.	Specify team supervised and floor system installed. e.g. insert team and system

ASSESSOR COMMENTS: PRACTICAL TASK 1	
1.4C.	Specify structural and non-structural wall systems installation supervised to ensure compliance. e.g. external masonry wall and internal framework for plasterboard walls
1.5D.	Specify how quality finishes were assured for roof systems. e.g. monitor work for compliance with SOPs and specifications
1.6C.	Specify supervision and checks made: e.g. monitoring and checks for tolerance