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GRADE 12

SEPTEMBER 2022

CIVIL TECHNOLOGY: CONSTRUCTION MARKING GUIDELINE

MARKS: 200

This marking guideline consists of 16 pages, including 2 answer sheets.

INSTRUCTIONS FOR THE MARKERS

1. Markers should:

- Familiarise themselves with the question and answer before evaluating the responses of candidates.
- Always interpret the responses of the candidates within the context of the question.
- Consider any relevant and acceptable answer during pre-marking but should strictly adhere to the answers after finalisation of the marking guideline.
- There are two approaches to answering questions, these are (1) to describe and (2) to explain.
- If a candidate is required to explain e.g., a process in 4 steps, only the first 4 responses should be considered.
- If, however a candidate is required to e.g., explain or describe how to transfer heights from one point to another using a transparent pipe level we need to consider that candidates may write a long description not necessarily well organised as an intellectual response may do. In this case the marker needs to evaluate the complete statement to judge if the candidate explained the required outcome satisfactorily and allocate marks on merit. The marker should apply his/her professional judgement with these types of questions.
- Mark what the candidate wrote and do not award marks for answers that the marker thinks the candidate meant with what was written.
- Indicate the tick or cross right at the position where the mark needs to be awarded or where the candidate made the error.
- Accept the letter corresponding with the correct answer as well as the answer written in full in multiple-choice questions.
- Accept incorrect spelling in one-word answers unless the spelling changes the meaning of the answer.

2. For calculations:

- A mark is only awarded if the correct unit is written next to the answer.
- If TWO marks are awarded ONE mark is awarded for the answer and ONE mark for the correct unit.
- Where the candidate made a principle error e.g. added instead of multiplying, no marks will be awarded for the steps. If the answer is correct according to what the candidate did, the mark for the answer can be awarded for the application of skills.
- Where an incorrect answer could be carried over to the next step, the first answer will be deemed incorrect. However, should the incorrect answer be carried over correctly, the marker has to recalculate the values, using the incorrect answer from the first calculation. If correctly used, the candidate should receive the full marks for subsequent calculations.
- Markers should consider when and where a candidate has rounded off in a calculation, as well as the subsequent effect it has on the final answer obtained. The calculation should therefore be awarded marks on merit.
- Alternative methods of calculations must be considered, provided that the correct answer is obtained.

3. When marking drawings:

- The member for which the mark should be awarded should be drawn correctly in the correct position to receive a mark.
- A member incorrectly drawn but wrongfully repeated in another position will be awarded the mark for the repeated incorrect member provided that the marking guideline provide for TWO or more marks for that member (positive marking).
- Marks can only be awarded for a label if the label is correctly indicating the correct member.
- Scale drawings should always be marked using an appropriate mask.

When a candidate drew the wrong drawing e.g.:

- A horizontal section instead of a vertical section, no marks will be allocated to the drawing as the candidate did not respond to the expected outcome.
- An orthographic view instead of sectional view, no marks will be allocated to the drawing as the candidate did not respond to the expected outcome.
- An orthographic view instead of an isometric view, no marks will be allocated to the drawing as the candidate did not respond to the expected outcome.
- If the incorrect drawing was drawn, the candidate can be awarded for only what was asked but mark/s for the correctness of the drawing will not be awarded e.g., if a King Post roof truss was asked in the question, and candidate drew SA-Howe Truss.

QUESTION 1: OHSA, SAFETY MATERIALS, TOOLS, EQUIPMENT AND JOINING (GENERIC)

- 1.1 It is an unplanned/uncontrolled (1) event that occurs because of an unsafe act/unsafe conditions. (1) (2)
- 1.2 Steel alloy pipe (1)
- 1.3 1.3.1 Two (1)
- 1.3.2 38 mm (1)
- 1.3.3 900 mm (1)
- 1.4 Any TWO:
- To ensure that the scaffolding is stable in all directions
 - Must be able to carry the mass of the load
 - Free of any defects
 - Similar answer (Any 2 x 1) (2)
- 1.5 1,8 meters (1)
- 1.6 3 meters (1)
- 1.7 1.7.1 Any ONE:
- Higher person can slip and fall on the lower person
 - Can damage the ladder
 - Makes it more unstable
 - Similar answer (Any 1 x 1) (1)
- 1.7.2 Red or orange flag (1)
- 1.7.3 Any ONE:
- Aluminium
 - Wood
 - Metal
 - Similar answer (Any 1 x 1) (1)
- 1.7.4 Any ONE:
- Defects must be visible (clean)
 - Will prevent slipping accidents (oil / grease)
 - Similar answer (Any 1 x 1) (1)
- 1.8 Any TWO:
- Can be applied with a brush, roller or spray-gun
 - Enhances appearance of surfaces
 - Easy to apply
 - Makes cleaning and maintenance easier
 - Dry quickly
 - Marks/smudges are easily cleaned with water
 - Gives elastic/flexible finish resistant to cracking (Any 2 x 1) (2)

- 1.9 Any TWO:
- Increases the strength of concrete
 - Decreases the permeability of concrete
 - Improves the durability of concrete
 - Reduces cracks
 - Makes concrete more watertight
 - Reduce crimping cracks in the concrete
 - Provides volume stability
 - Concrete can carry more weight without being damaged (Any 2 x 1) (2)
- 1.10 Any TWO:
- Painting
 - Electroplating
 - Powder coating
 - Galvanising (Any 2 x 1) (2)
- [20]**

QUESTION 2: GRAPHICS, JOINING AND EQUIPMENT (GENERIC)

- 2.1 FIGURE 2.1 on ANSWER SHEET A shows the outer lines of a structure that must be built on a site. Draw the site plan on scale 1 : 200 on ANSWER SHEET A so that the structure is in the middle of the site.

The site plan must comply with the following requirements:

- 2.1.1 Plot size is 30 m wide from east to west and 40 m long from south to north (2)
- 2.1.2 Pavement of 2 m and the street of 6 m on the south side (3)
- 2.1.3 Building boundaries are 2 m on the east, north and west sides and 4 m on the south side (4)
- 2.1.4 3 m wide entrance to the site (2)
- 2.1.5 Datum level in the north-west corner of the site (2)

Also draw in the sewer lay-out on the structure and show the following:

- 2.1.6 Water closet and symbol at the abbreviation (1)
- 2.1.7 Sewer pipes (2)
- 2.1.8 Rodding eye with the abbreviation (2)
- 2.1.9 Inspection eye with the abbreviation (2)
- 2.1.10 Manhole with the abbreviation (2)

Indicate the following measurements:

- 2.1.11 Length and width of the site (4)
- 2.1.12 South and west building boundaries (2)

Use the points table on ANSWER SHEET A as reference.

- 2.2 When square shoulder is driven in it resists rotation. (1)
- 2.3 A – Nut (1)
B – Thread (1)
C – Run-out (1)
D – Shank (1) (4 x 1) (4)
- 2.4 Prevents backing off. (1)
- 2.5 Can be tightened with fingers. (1)
- 2.6 2.6.1 1,61 m (1)
- 2.6.2 1,64 ✓ – 1,584 ✓ x 100 = 5,6 m ✓ ✓ (4)

[40]**TOTAL SECTION A: 60**

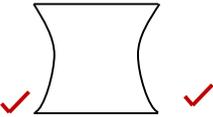
QUESTION 3: ROOFS, STAIRS AND JOINING (SPECIFIC)

- 3.1 Any THREE advantages of the use of roof underlays:
- Acts as a secondary roof
 - A weather shield during construction
 - Waterproof and weatherproof
 - Condensation barrier
 - Dustproof
 - Protects the building / structure
 - Protects thermal insulation material
 - Protects ceiling boards
 - Superior wind uplifting strength prevents lifting of tiles
 - Vapour resistant
 - High tensile resistance
 - Cost effective
 - High heat resistance
- (Any 3 x 1) (3)
- 3.2 Any TWO:
- Sturdy enough to carry the roof covering safely
 - Able to withstand wind and other forces that act on them
 - Provide adequate height in rooms below the roof and ceiling assembly
 - Should not allow the accumulation of rainwater upon the roof surface
 - Neat and solid to enhance the appearance of the buildings
- (Any 2 x 1) (2)
- 3.3 3.3.1 A – Purlins or battens (1)
- B – Rafter (1)
- C – Ridge plate or concrete ridge tile or ridge tile (1)
- D – Nail plate (1)
- E – King post (1)
- 3.3.2 114 mm (1) x 38 mm (1) (2)
- 3.3.3 Join the different parts together. (1)

3.4	3.4.1	10°	(1)
	3.4.2	345 mm	(1)
	3.4.3	5°	(1)
3.5	3.5.1	250 mm	(1)
	3.5.2	3 m	(1)
	3.5.3	42°	(1)
	3.5.4	200 mm	(1)
3.6	3.6.1	Run	(1)
	3.6.2	Nosing	(1)
	3.6.3	Riser	(1)
3.7	Any TWO:		
	•	Stainless steel	
	•	Wood	
	•	Metal	
	•	Concrete	
	•	Glass	
	•	Similar answer	(Any 2 x 1) (2)
3.8	3.8.1	True	(1)
	3.8.2	True	(1)
	3.8.3	False	(1)
3.9	Any TWO:		
	•	Hex-head bolt with washer	
	•	L-bolt	
	•	J-bolt	
	•	Welded headed stud	(2 x 1) (2)

[30]

QUESTION 4: MATERIAL, EQUIPMENT AND TOOLS, EXCAVATIONS (SPECIFIC)

- 4.1 4.1.1 D (light metal) (1)
- 4.1.2 E (basic sealant) (1)
- 4.1.3 A (heavy metal) (1)
- 4.1.4 H (alternative for glass) (1)
- 4.1.5 C (tested in a laboratory) (1)
- 4.1.6 G (packaging material) (1)
- 4.2 Boom pump (1) and the line pipe concrete pump (1). (2)
- 4.3 30 MPa (1)
- 4.4 Any ONE:
- Very expensive
 - Delivery and pouring delays may affect the quality of concrete
 - Can be noisy if mixed in a residential area. (1)
- 4.5 Any FOUR:
- Slump test cone or mould
 - Base plate
 - Tamping rod
 - Ruler
 - Spirit level
 - Tape measure (4 x 1) (4)
- 4.6 Any TWO:
- Determine the maximum compressive strength of cured concrete with load
 - Ensure concrete complies with requirements of project specifications
 - Indicate compressive strength in MPa, thus the its ability to resist loads (2 x 1) (2)
- 4.7 3 Cubes (1)
- 4.8  (2)
- 4.9 Ferrous (1) and non-ferrous metals (1) (2)

- 4.10 Any TWO:
- Tile cladding
 - Brick slip cladding
 - Stone cladding
 - Timber cladding
 - Metal sheet cladding (2 x 1) (2)
- 4.11 4.11.1 Light soil compaction (1)
- 4.11.2 Any TWO:
- Maintain – lubricate and adjust to manufacturer’s instructions
 - Clean after use and store in a safe, dry place
 - Repair / replace damaged electrical cords
 - Service regularly
 - Remove loose dirt and soil after use
 - Ensure that all parts are firmly attached (2 x 1) (2)
- 4.12 4.12A Concrete mixer (1)
- 4.12B Rammer (1)
- 4.13 Any TWO:
- Geographic location of the site
 - The slope of the ground
 - Position of trees and vegetation
 - Position of rocks
 - Underground or surface water
 - The soil type
 - Other buildings in the vicinity (2 x 1) (2)
- 4.14 Any FOUR:
- Heavy rains
 - Poor soil strata, structure or composition
 - Sides not dug at the correct angle
 - Improper use of formwork or shoring to support walls
 - Vibration by machinery or heavy vehicles nearby
 - Water seeping into the excavated area
 - Contact with underground service
 - Access to and exit from the excavation
 - Soil slides due to cracks or loose soil (4 x 1) (4)
- 4.15 4.15.1 True (1)
- 4.15.2 False (1)
- 4.15.3 False (1)
- 4.16 Any THREE:
- Strip foundation or wide strip foundation
 - Stepped foundation
 - Raft foundation
 - Block foundation (3 x 1) (3)

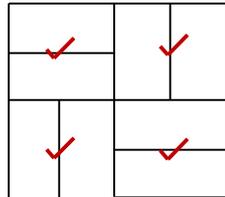
[40]

QUESTION 5: BRICKWORK, GRAPHICS, PLASTER AND SCREED (SPECIFIC)

- 5.1 5.1.1 Stretcher bond (1)
- 5.1.2 Half brick wall (1)
- 5.1.3 110 mm (1)
- 5.2 See ANSWER SHEET B. (5)
- 5.3 5.3.1 270 mm (1)
- 5.3.2 110 mm (1)
- 5.3.3 3 meter (1)
- 5.3.4 Wall ties. (1)
- 5.3.5 Drain any water out of the wall. (1)
- 5.4 Any THREE:
- Prevent rainwater from penetrating the interior wall surface
 - Provide good thermal insulation
 - Provide good sound insulation
 - Cheaper materials can be used for internal walls
 - Reduces / prevent expensive exterior finishes (plastering) (3 x 1) (1)
- 5.5 A – Double triangular pattern (1)
- B – Butterfly pattern (1)
- 5.6 5.6.1 F (prepared layer beneath paving and bedding sand) (1)
- 5.6.2 C (best edge restraint for paving) (1)
- 5.6.3 A (natural soil on which the paving will be laid) (1)
- 5.6.4 D (final layer upon which paving is laid) (1)
- 5.7 Any TWO:
- Little maintenance is required
 - Low life-cycle cost
 - Resistant to point loads
 - Resistant to material fatigue and reflecting traffic patterns
 - Resistant to edge movement
 - User-friendly installation material is used
 - No weeds will be able to grow in between the joints
 - No off-gassing installation products used, that will give off dangerous environmental gasses
 - Insects will not be able to ruin the appearance of the paved structure (2 x 1) (2)

- 5.8 Any TWO:
- Concrete haunch too thin to support itself and cracks or crumbles under pressure
 - Too little weight to retain the structure and keep paving in place
 - Bond between haunch and edge units is weak and will easily crumble
 - Sub-base is not contained and will be washed out by groundwater
- (2 x 1) (2)

- 5.9 Draw a neat sketch with EIGHT (8) bricks of the basket-weave paving:



(4)

- 5.10 5.10.1 Semi-circular gauged arch (1)

- 5.10.2 A – Intrados (1)

- B – Extrados (1)

- C – Span width (1)

- 5.11 Sand (1) and cement (1). (2)

- 5.12 Any TWO:
- Smooth finish
 - Splatter finish
 - Wavy finish
 - Bagging finish
- (2 x 1) (2)

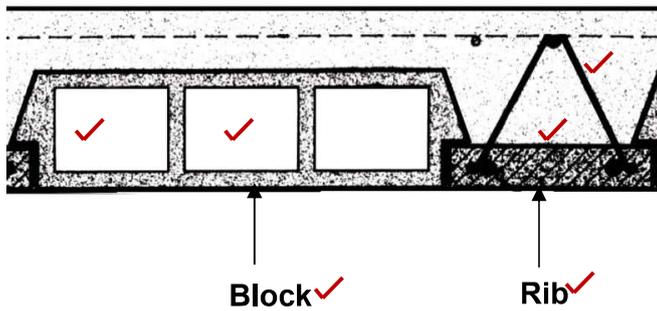
- 5.13 Any TWO:
- Dry screed
 - Monolithic screed
 - Bonded screed
- (2 x 1) (2)

[40]

**QUESTION 6: FORMWORK, REINFORCEMENT, FOUNDATIONS,
CONCRETE FLOORS AND QUANTITIES (SPECIFIC)**

- 6.1 The concrete is mixed on the site. (1)
- 6.2 Any THREE
- Made accurately according to the dimensions indicated
 - Sturdy enough to bear the mass of wet concrete without collapsing
 - Able to bear the mass of workers and equipment
 - Must be able to withstand the pressure of stamping and vibration of concrete
 - Must be strong enough to provide sufficient support, without too much deflection, until the concrete has set
 - Formwork should be easy to repair on site
 - Secured with wire nails, where some should protrude for easy extracting
 - Secured with bolts from 13 mm to 19 mm in diameter
 - Should be sealed properly so that the concrete does not leak and form honeycombs or fins
 - Should be free of dirt (sawdust or releasing agents) etc.
 - Must be quick and simple to erect, mechanically or by hand
 - Ensure the correct cover depth for reinforcing, to prevent structural failure
 - Fit plywood onto laggings if a smooth finish is required
 - Remove when the concrete has cured and is able to support load on its own
 - Should be easy to remove without damaging the formwork or concrete
 - Close-fitting along seams and joints
 - Must be made from recyclable components (3 x 1) (3)
- 6.3 6.3.1 A – Soffit / Shutter board (1)
- B – Strut / Prop (1)
- C – Bearer / Head tree (1)
- D – Brace / Strut (1)
- 6.3.2 Beam (1)
- 6.4 6.4.1 High-tensile steel (1)
- 6.4.2 12 mm (1)
- 6.4.3 200 mm (1)

6.5



(6)

6.6 Any ONE:

- To protect steel against corrosion
- To ensure adequate bonding between the steel and concrete
- To ensure adequate protection of steel in event of a fire

(1)

6.7 Any ONE:

- Crosswise method
- Hair knot method
- Crown method

(1)

6.8 Foundation strips for a store-room is 5 500 x 3 250 (outside measurements).
The foundation is 700 mm wide and 250 mm thick.

6.8.1 Calculate the centre-line of the foundation:

$$\begin{array}{r}
 2 / 5\,500 = 11\,000 \checkmark \\
 2 / 3\,250 = \underline{6\,500} \checkmark \\
 17\,500 \checkmark \\
 \text{Minus corners:} \quad \underline{2\,800} \checkmark \\
 \quad 14\,700 \checkmark \quad \text{of } 14,7 \text{ m} \quad (5)
 \end{array}$$

6.8.2 Calculate the volume of concrete required.

Volume = length x width x thickness

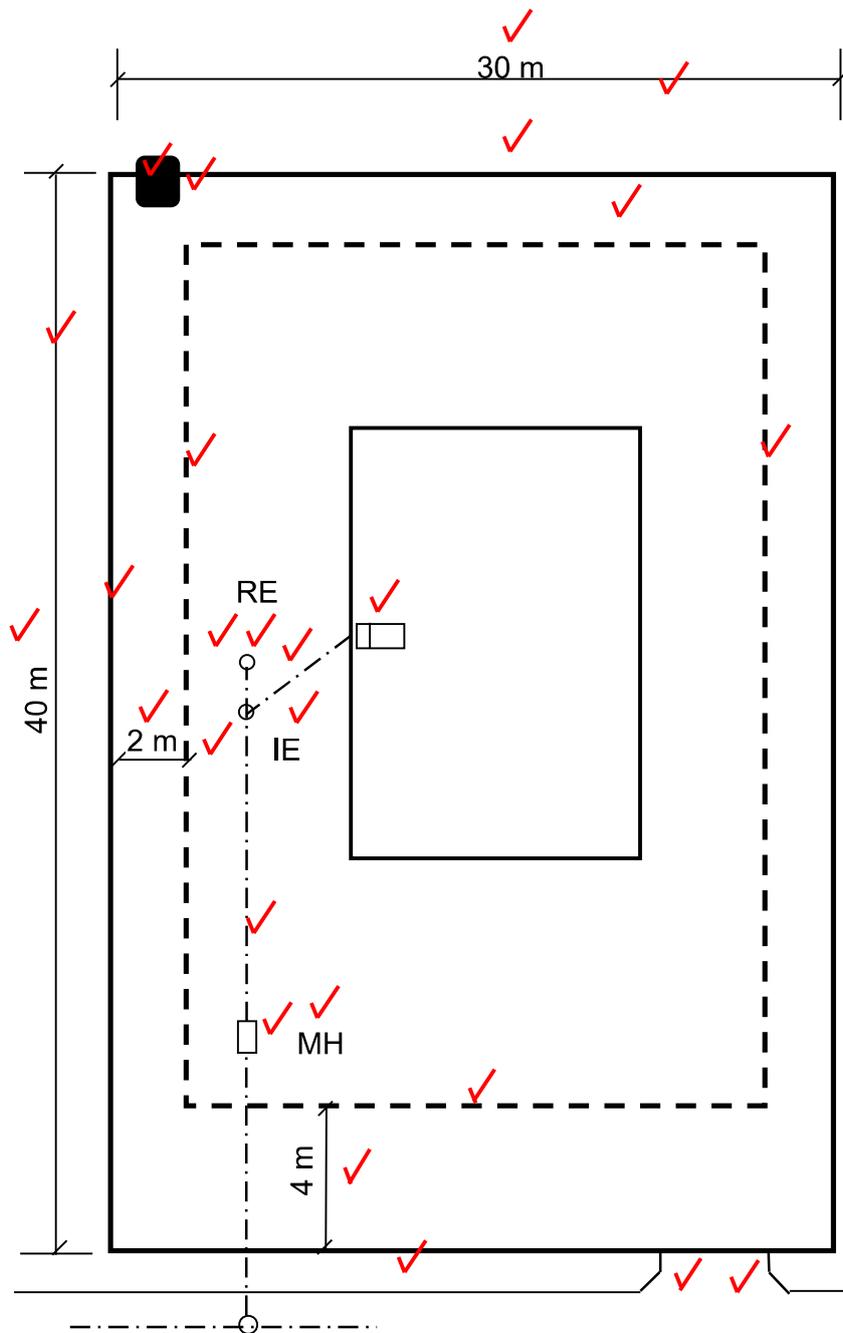
$$= 14,7 \text{ m} \checkmark \times 0,7 \text{ m} \checkmark \times 0,25 \text{ m} \checkmark$$

$$= 2,573 \text{ m}^3 \checkmark \quad \text{of } 2,57 \text{ m}^3 \quad (4 \times 1) \quad (4)$$

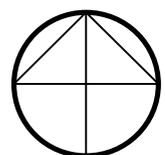
[30]**TOTAL: 200**

ANSWER SHEET A	CIVIL TECHNOLOGY GENERIC	NAME: _____
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2.1 FIGURE 2.1 on ANSWER SHEET A shows the outer lines of a structure that must be built on a site. Draw the site plan on scale 1 : 200 on ANSWER SHEET A so that the structure is in the middle of the site. (28)



Plot size	2
Pavement + street	3
Building boundaries	4
Entrance	2
Datum level	2
Water closet	1
Sewer connection	2
Inspection eye + abbr.	2
Rodding eye +abbr.	2
Manhole + abbr.	2
Measurements	6
TOTAL:	28



ANSWER SHEET B	CIVIL TECHNOLOGY CONSTRUCTION	NAME: _____
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5.2 Draw in the damp-proof course (DPC).

(5)

