



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

BUILDING SCIENCE N3

30 JULY 2019

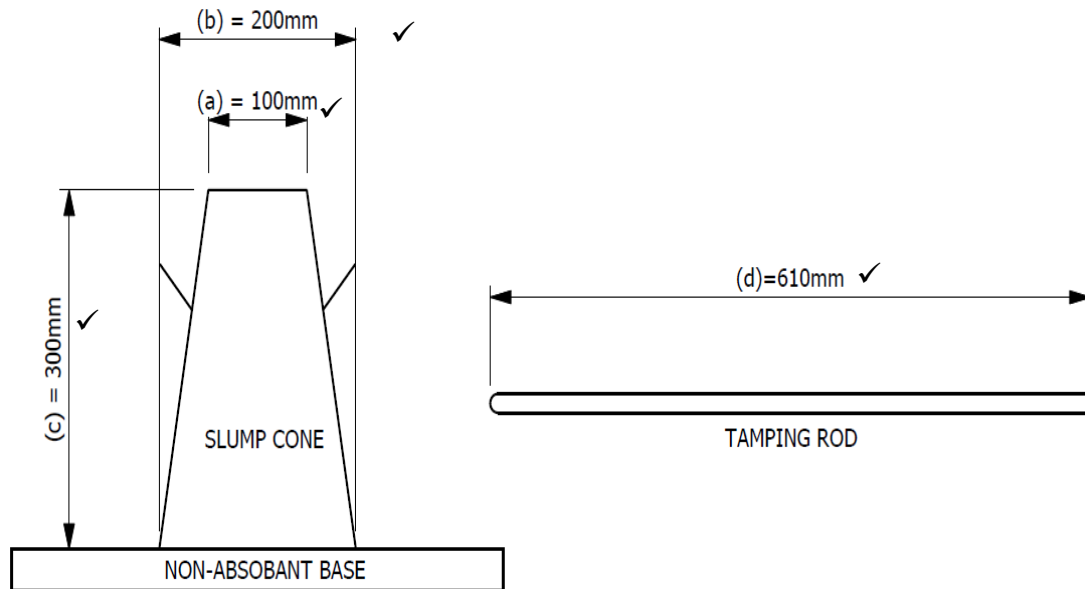
This marking guideline consists of 8 pages.

QUESTION 1

- 1.1 A – Curtaining, crinkling or sagging
 B – Cissing
 C – Blistering
 D – Flaking or peeling

(4)

1.2



(4)

- 1.3 Initial drying shrinkage is the largest amount of shrinkage that takes place during the setting and hardening process.
- 1.4 To determine the workability of a fresh concrete mix

(1)

(1)
[10]**QUESTION 2**

- 2.1 2.1.1 Coefficient of friction, $\mu = \text{Frictional force/Normal force}$
 $= 500/2\,000$
 $= 0,25$

- 2.1.2 Angle of friction, $\theta = \tan^{-1} \mu$
 $= \tan^{-1} (0,25)$
 $= 14,04^\circ$

(2 × 3) (6)

- 2.2 2.2.1 Velocity Ratio = Total number of pulleys
 $= 3 + 2$
 $= 5$

- 2.2.2 Mechanical advantage (MA) = Weight/Effort
 $= (25 \times 9,81)/85$
 $= 2,89$

$$\begin{aligned}
 2.2.3 \quad \text{Efficiency, } \eta &= 100\checkmark \times MA/VR \\
 &= 2.89/5\checkmark \\
 &= 57,8\%\checkmark
 \end{aligned}$$

(3 × 3) (9)
[15]

QUESTION 3

3.1 Taking moment about RR

$$\begin{aligned}
 \Sigma M_{RR} &= 0 \\
 10RL &= (11.5 \times 5) + (4 \times 5 \times 7,5) + (25\sin 45^\circ \times 3.5) + (40\sin 60^\circ \times 2)\checkmark \\
 &= 338,65\checkmark \\
 RL &= 338,65/10\checkmark \\
 &= 33,87 \text{ kN}\checkmark
 \end{aligned}$$

(4)

$$\begin{aligned}
 3.2 \quad \Sigma M_{RL} &= 0 \\
 10RR_V &= (4 \times 5 \times 2.5) + (25\sin 45^\circ \times 6,5) + (40\sin 60^\circ \times 8) - (1.5 \times 5)\checkmark \\
 &= 434,53\checkmark \\
 RR_V &= 434,53/10\checkmark \\
 &= 43,45 \text{ kN}\checkmark
 \end{aligned}$$

(4)

$$\begin{aligned}
 3.3 \quad \Sigma F_H &= 0 \\
 RR_H &= 25\cos 45^\circ - 40\cos 60^\circ\checkmark \\
 &= -2,32 \text{ kN}\checkmark
 \end{aligned}$$

(2)

$$\begin{aligned}
 3.4 \quad RR &= (RR_V^2 + RR_H^2)^{1/2} \\
 &= (2,32^2 + 43,45^2)^{1/2}\checkmark \\
 &= (1893,29)^{1/2}\checkmark \\
 &= 43,51 \text{ kN}\checkmark
 \end{aligned}$$

(3)

3.5 Calculate the direction of the reaction RR

$$\begin{aligned}
 \tan \theta &= (RR_H/RR_V) \\
 &= (2,32/43,45)\checkmark \\
 \theta &= \tan^{-1} (2.32/43.45)\checkmark \\
 &= 3,06^\circ \text{ NW}\checkmark
 \end{aligned}$$

(3)
[16]

AREA (mm ²) for X _{bar}	AREA (mm ²) for Y _{bar}
ab = 600 √	wx = 600 √
bc = 250 √	wy = 1250 √
cd = 900 √	yz = 250 √
de = 450 √	

ox	✓
oy	✓
oz	✓
ow	✓

ob	$\sqrt{\quad}$
oc	$\sqrt{\quad}$
od	$\sqrt{\quad}$
oe	$\sqrt{\quad}$
oa	$\sqrt{\quad}$

[16]

OR**ANALYTICAL METHOD**

SHAPE	AREA	X	Y	AX	AY	
1	30 × 20 = 600 ✓	10 ✓	55 ✓	6000 ✓	33 000 ✓	(2½)
2	10 × 25 = 250 ✓	25 ✓	12.5 ✓	6 250 ✓	3 125 ✓	(2½)
3	20 × 45 = 900 ✓	30 ✓	47,5 ✓	27 000 ✓	42 750 ✓	(2½)
4	0,5 × 45 × 20 = 450 ✓	46,67 ✓	47.5 ✓	21 001.5 ✓	21 375 ✓	(2½)
TOTALS	2 200 ✓			60 251,5 ✓	100 250 ✓	(3)

(13)

$$\bar{x} = \Sigma AX / \Sigma A \checkmark$$

$$= (60\,251,5 / 2\,200) \checkmark$$

$$= 27,39 \checkmark$$

$$\bar{y} = \Sigma AY / \Sigma A \checkmark$$

$$= (100\,250 / 2\,200) \checkmark$$

$$= 45,57 \checkmark$$

(3)
[16]

QUESTION 5

5.1 Calculate the Magnitude of force Y

$$\Sigma M_x = 0$$

$$2RL + 2Y = 4RR$$

$$Y = (4RR - 2RL)/2 \checkmark$$

Substituting values

$$= ((4 \times 35) - (2 \times 20))/2 \checkmark$$

$$= 50 \text{ kN} \checkmark$$

(2)

5.2 Calculate the Magnitude of force X

$$\Sigma M_y = 0$$

$$4RL = 2RR + 2X$$

$$X = (4RL - 2RR)/2 \checkmark$$

Substituting values

$$= ((4 \times 20) - (2 \times 35))/2 \checkmark$$

$$= 5 \text{ kN} \checkmark$$

$$\Sigma F_v = 0$$

$$X + Y = RL + RR$$

$$\text{But } Y = 50 \text{ kN}$$

OR Substituting values

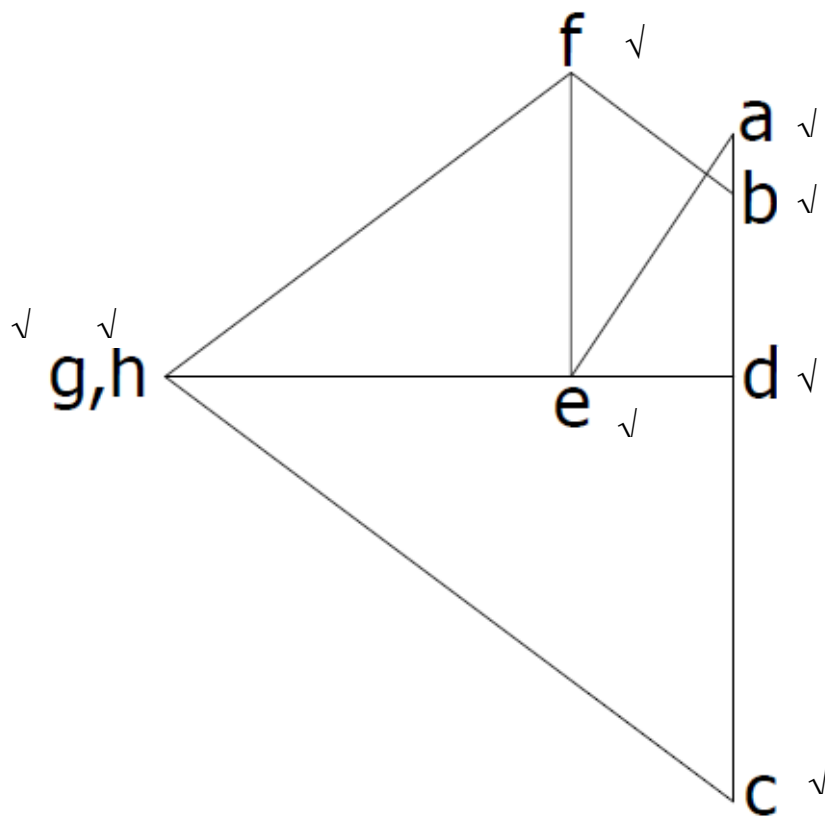
$$X = RL + RR - Y \checkmark$$

$$= 20 + 35 - 50 \checkmark$$

$$= 5 \text{ kN} \checkmark$$

(2)

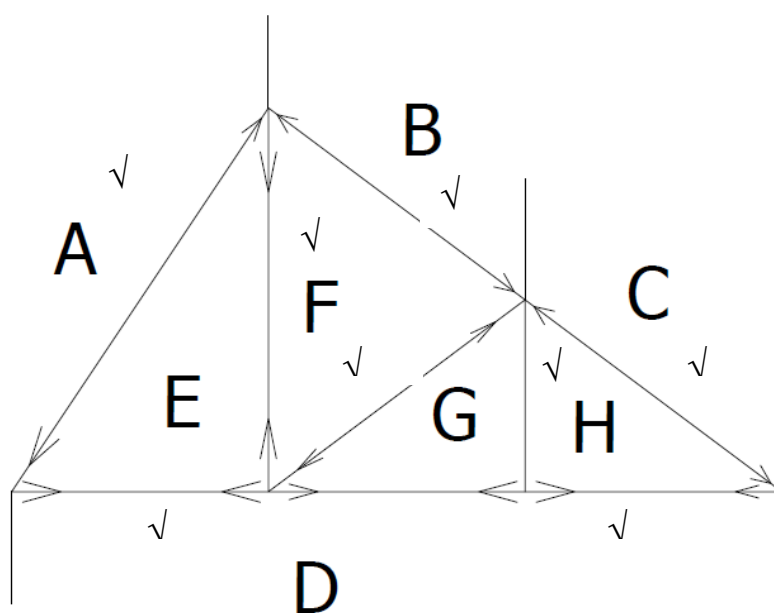
5.3



(4)

MEMBER	MAGNITUDE (kN)	NATURE
AE	24,0✓	STRUT✓
DE	13,3✓	TIE✓
EF	25,0✓	TIE✓
FG	41,7✓	STRUT✓
GH	0✓	REDUNDANT✓
DG	46,7✓	TIE✓
DH	46,7✓	TIE✓
CH	58,3✓	STRUT✓
BF	16,7✓	STRUT✓

(9)

(4)
[21]**QUESTION 6**

6.1 $P = VI$
 $I = P/V$
 $= 1\,500/220✓$
 $= 6,82\text{ A}✓$

(2)

6.2 $V = IR$
 $R = V/I$
 $= 220/6,82✓$
 $= 32,26\ \Omega✓$

OR $P = I^2R$
 $R = P/I^2$
 $= 1\,500/6,82^2✓$
 $= 32,25\ \Omega✓$

OR $P = V^2/R$
 $R = V^2/P$
 $= 220^2/1\,500✓$
 $= 32,27\ \Omega✓$

(2)

6.3 The energy used in 2 hours

$$E = Pt \checkmark$$

$$= 1,5 \times 2 \checkmark$$

$$= 3,0 \text{ kWhr} \checkmark$$

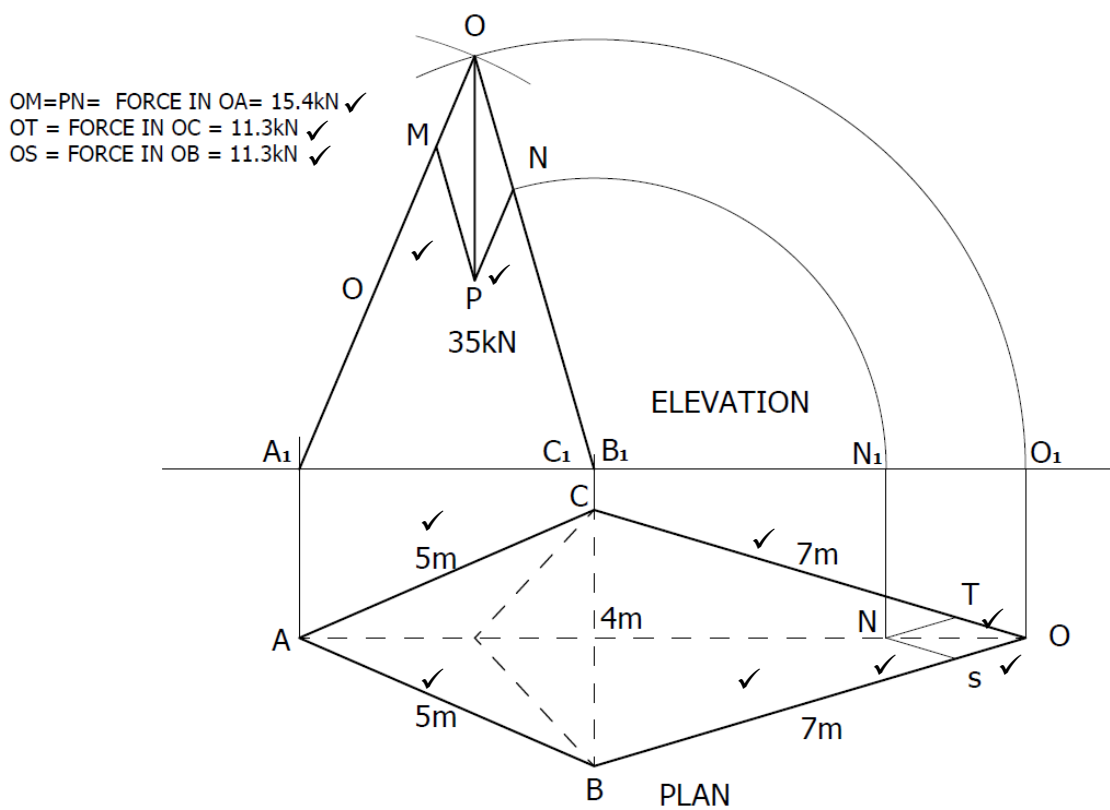
(3)

6.4 Cost = Daily energy consumption \times tariff \times number of days \checkmark

$$= 1,5 \times 2 \times 2 \times 30 \checkmark$$

$$= \text{R}180,00 \checkmark$$

(3)

[10]**QUESTION 7****[12]****TOTAL: 100**