



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

BUILDING SCIENCE N3

20 April 2024

This marking guideline consists of 6 pages.

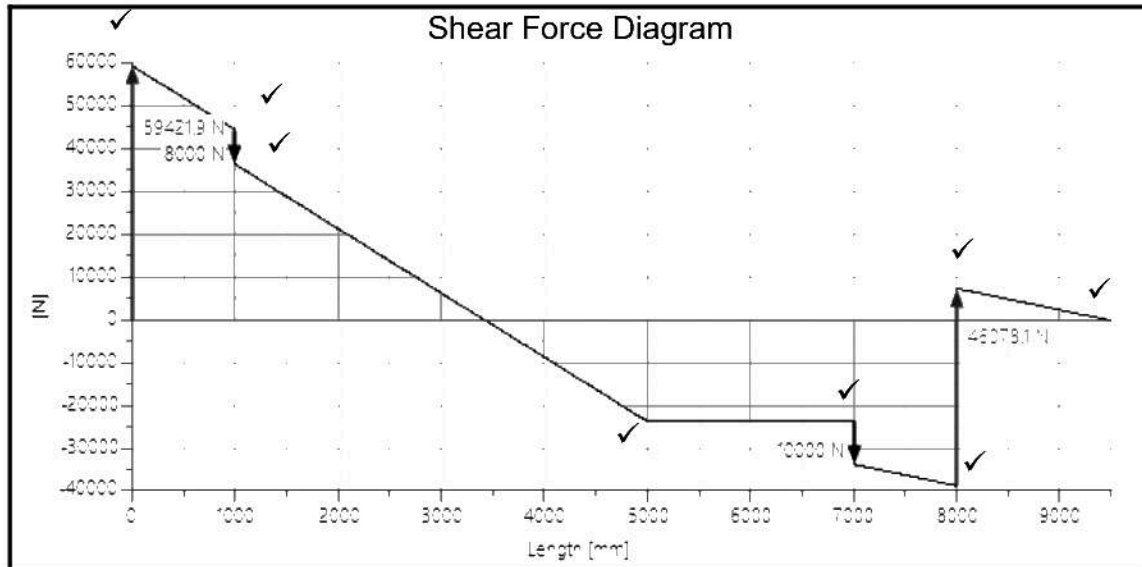
QUESTION 1

- 1.1 It is used to determine the compressive strength of concrete.✓✓ (2)
- 1.2
- Intermittent spraying of water
 - Covering with damp sacking
 - Covering with plastic sheeting
 - Covering with sawdust
 - Submerging with water (flooding) (Any 3 × 1) (3)
- 1.3
- Forms a protective layer around the material, e.g. wood and steel to protect against decay and rust.
 - Aesthetic purposes (decorative/beauty).
 - Surfaces are easier to clean.
 - Protect structures from effects from water and sun.
- (Any relevant answer is acceptable) (Any 2 × 1) (2)
- 1.4 Thermoplastics can be softened by heat✓ while thermosetting plastics cannot be softened by heat.✓ (2)
- 1.5
- 1.5.1 No effect OR no deposit of chemicals in pipes.
- 1.5.2 Corrodes the lead in pipes and holds it in suspension (plumbo-solvency)
- 1.5.3 No effect
- 1.5.4 Scaling, which reduces the pipe bore diameter (4 × 1) (4)
- [13]

QUESTION 2

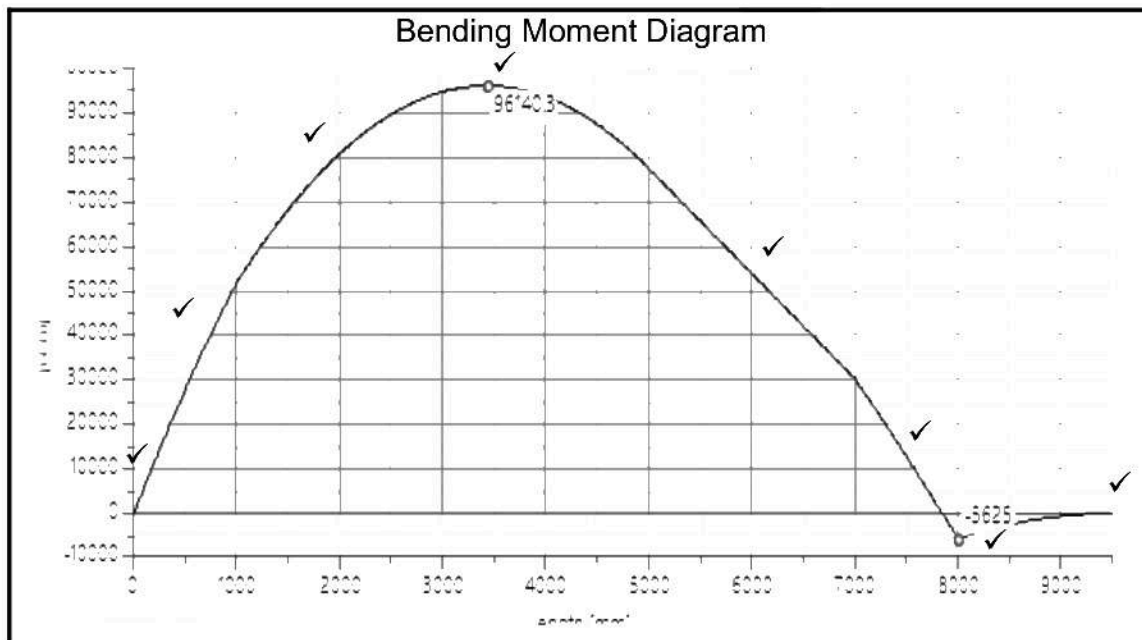
- 2.1 Taking moments about RL
- $$8RR = 5 \times 2.5 \times 8.25 + 10 \times 7 + 15 \times 5 \times 2.5 + 8 \times 1 \checkmark \text{ OR}$$
- $$8RR = (8 \times 1) + (75 \times 2.5) + (10 \times 7) + (12.5 \times 8.5)$$
- $$RR = 46.08 \text{ kN} \checkmark$$
- Taking moments about RR
- $$8RL = 8 \times 7 + 15 \times 5 \times 5.5 + 10 \times 1 + 5 \times 0.5 - 5 \times 1.5 \times 0.75 \checkmark \text{ OR}$$
- $$8RL = (12.5 \times 0.5) + (10 \times 1) + (75 \times 5.5) + (8 \times 7)$$
- $$RL = 59.42 \text{ kN} \checkmark (2 \times 2) (4)$$

2.2



(8)

2.3



(8)

[20]

QUESTION 3

3.1

$$+\uparrow \Sigma M_{RR} = -\downarrow \Sigma M_{RR}$$

$$5RL = 6 \times 5 + 8 \times 4 + 8 \times 3 + 6 \times 2 + 12 \times 1 \quad \frac{1}{2} \checkmark$$

$$RL = 110/5 \quad \frac{1}{2} \checkmark$$

$$= \underline{22 \text{ kN}} \quad \checkmark$$

$$(\frac{1}{2} \times 2 + 1)$$

(2)

3.2

$$+\uparrow \Sigma M_{RL} = -\downarrow \Sigma M_{RL}$$

$$5RR = 8 \times 1 + 8 \times 2 + 6 \times 3 + 12 \times 4$$

$$\frac{1}{2} \checkmark$$

$$RR = 90/5 \quad \frac{1}{2} \checkmark$$

$$= \underline{\underline{18. \text{ kN} \checkmark}}$$

OR

$$+\uparrow \Sigma F = -\downarrow \Sigma F$$

$$RR - RL = 6 + 8 + 8 + 6 + 12$$

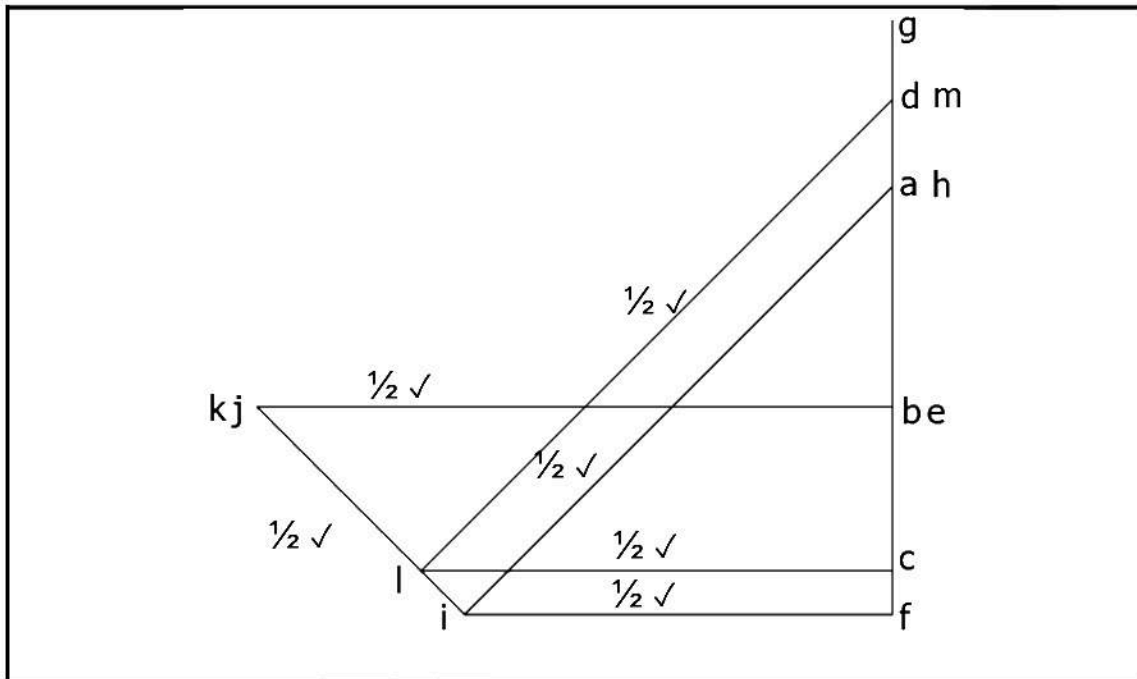
$$RR = 42.2 - RL$$

$$\text{But } RL = 22.88 \text{ kN}$$

$$\therefore RR = 40 - 22$$

$$= \underline{\underline{18 \text{ kN}}}$$

$(\frac{1}{2} \times 2 + 1)$ (2)



$(\frac{1}{2} \times 6)$ (3)

MEMBER	MAGNITUDE (kN)	NATURE
GH	6 $\frac{1}{2} \checkmark$	Strut $\frac{1}{2} \checkmark$
AH	0 $\frac{1}{2} \checkmark$	Redundant $\frac{1}{2} \checkmark$
HI	23.3 $\frac{1}{2} \checkmark$	Strut $\frac{1}{2} \checkmark$
FI	16.5 $\frac{1}{2} \checkmark$	Tie $\frac{1}{2} \checkmark$
IJ	12.4 $\frac{1}{2} \checkmark$	Tie $\frac{1}{2} \checkmark$
BJ	25.4 $\frac{1}{2} \checkmark$	Strut $\frac{1}{2} \checkmark$
JK	0 $\frac{1}{2} \checkmark$	Redundant $\frac{1}{2} \checkmark$
EK	25.4 $\frac{1}{2} \checkmark$	Tie $\frac{1}{2} \checkmark$
KL	9.4 $\frac{1}{2} \checkmark$	Strut $\frac{1}{2} \checkmark$
CL	18 $\frac{1}{2} \checkmark$	Strut $\frac{1}{2} \checkmark$
LM	25.7 $\frac{1}{2} \checkmark$	Tie $\frac{1}{2} \checkmark$
DM	0 $\frac{1}{2} \checkmark$	Redundant $\frac{1}{2} \checkmark$
CM	18 $\frac{1}{2} \checkmark$	Strut $\frac{1}{2} \checkmark$

$(\frac{1}{2} \times 26)$ (4)

QUESTION 4

SHAPE	AREA (mm ²)	Y (mm)	AY (mm ³)
A	$0.5 \times \pi \times 50^2$ $= 3\,926.99 \text{ mm}^2 \checkmark$	21.22 mm $\checkmark$	83\,323.73 mm ³ $\checkmark$
B	-20×5 $= 100 \text{ mm}^2$	7,5 mm $\checkmark$	-6\,774.66 mm ³ $\checkmark$
C	$-0.5 \times 15 \times 15$ $= -112.5 \text{ mm}^2 \checkmark$	30 mm $\checkmark$	-6\,774.66 mm ³ $\checkmark$
D	$-0.5 \times \pi \times 13^2$ $= -265.46 \text{ mm}^2 \checkmark$	25,52 mm $\checkmark$	-1\,350.00 mm ³ $\checkmark$
E	$-0.5 \times \pi \times 13^2$ $= -265.46 \text{ mm}^2 \checkmark$	25,52 mm $\checkmark$	-4\,249.50 mm ³ $\checkmark$
TOTAL	3\,183.57 mm² $\checkmark$		65\,649.41 mm³ $\checkmark$

$$\begin{aligned}\bar{Y} &= \Sigma Ay / \Sigma A \checkmark \\ &= 65\,649.41 \text{ mm}^3 / 3\,183.57 \text{ mm}^2 \checkmark \\ &= 20.62 \text{ mm} \checkmark\end{aligned}$$

[20]

QUESTION 5

- 5.1 5.1.1 Velocity ratio = Total number of pulleys $\checkmark$
 $= 3 + 2 \checkmark$
 $= 5 \checkmark$
- 5.1.2 Mechanical advantage, M.A = Weight / Effort
 $= (30 \times 9.81 \checkmark) / 95 \checkmark$
 $= 3.10 \checkmark$
- 5.1.3 Efficiency, $\eta = \text{M.A} / \text{V.R} \times 100 \checkmark$
 $= 3.10 / 5 \checkmark$
 $= 62\% \checkmark$

(3 × 3) (9)

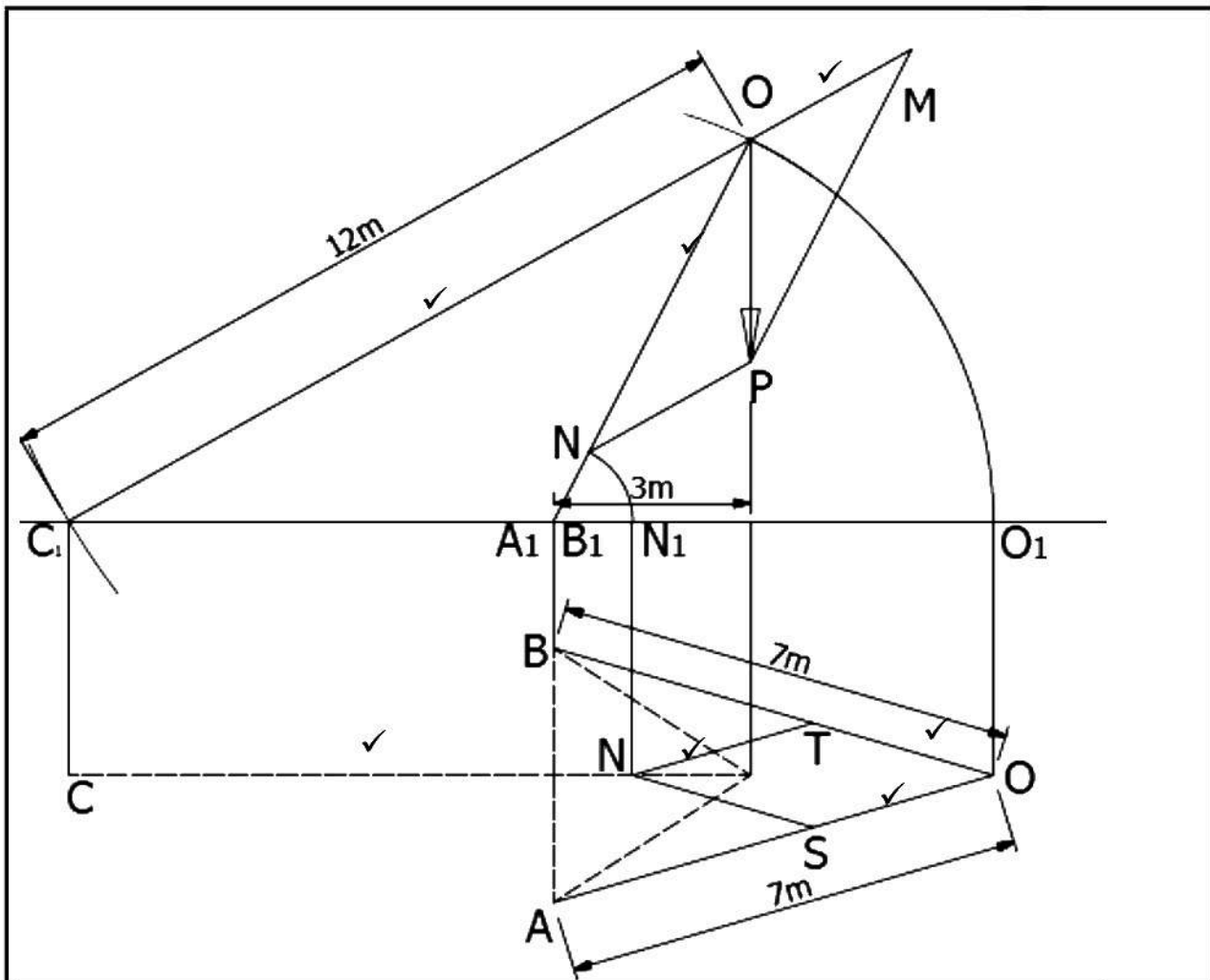
5.2 5.2.1 Coefficient of friction, $\mu = \text{Frictional force/Normal force} \checkmark$
 $= 600/3\ 000 \checkmark$
 $= 0.2 \checkmark \checkmark$

5.2.2 Angle of friction, $\theta = \tan^{-1} \mu \checkmark$
 $= \tan^{-1} (0.2) \checkmark$
 $= 11.31^\circ \checkmark \checkmark$

(2 × 4)

(8)
[17]

QUESTION 6



OM is the force in backstay OC = 28.4 kN ✓
 OS is the force in leg OA = 28.7 kN ✓
 OT is the force in leg OB = 28.7 kN ✓

[10]

TOTAL: 100