higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NASIENRIGLYN

NASIONALE SERTIFIKAAT

BOU- EN STRUKTUURKONSTRUKSIE N5

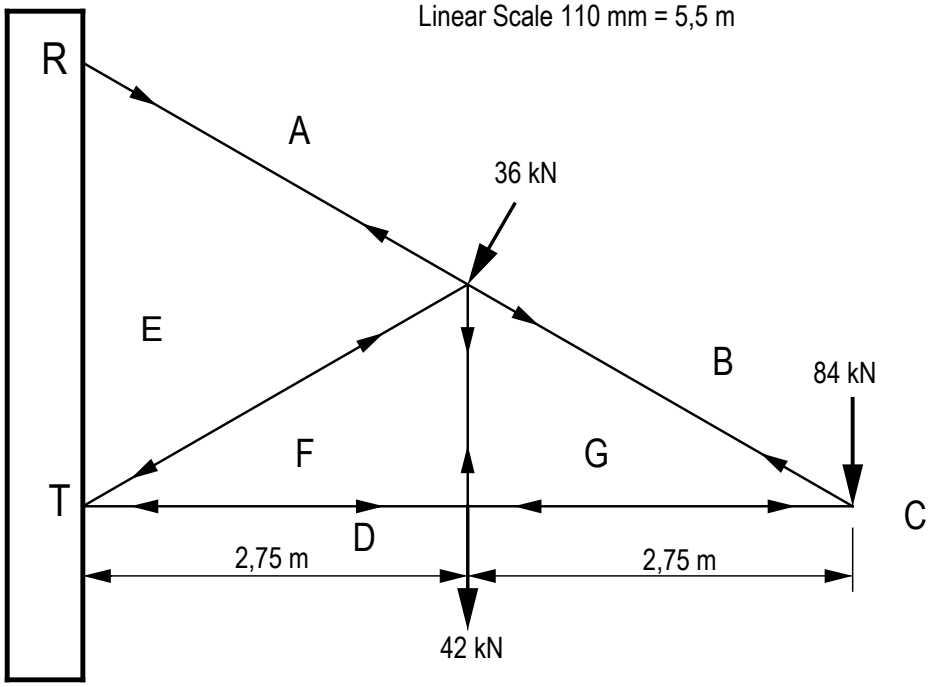
22 April 2021

Hierdie nasienriglyn bestaan uit 9 bladsye.

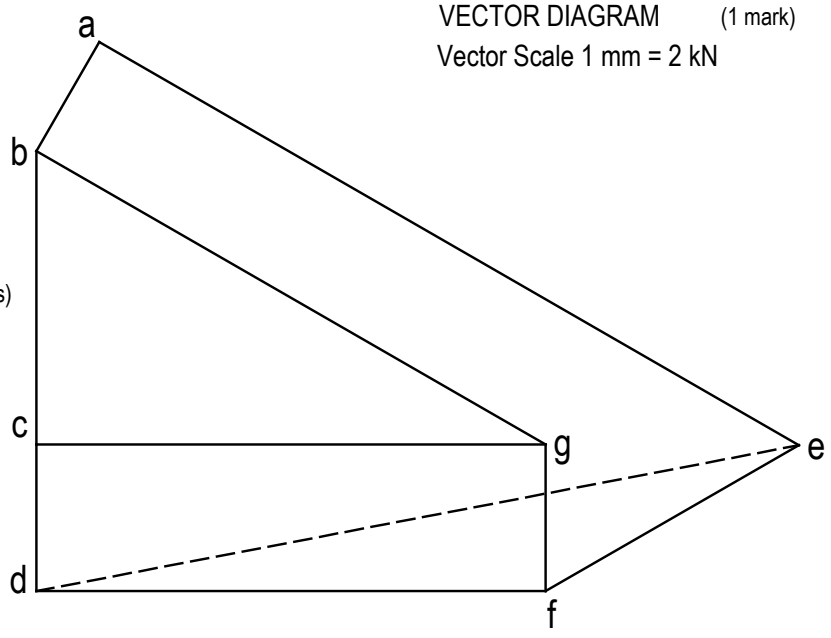
Kopiereg voorbehou

VRAAG 1

SPACE DIAGRAM (1 mark)
Linear Scale 110 mm = 5,5 m



VECTOR DIAGRAM (1 mark)
Vector Scale 1 mm = 2 kN



(3 marks)

MEMBER	MAGNITUDE	TYPE
EA	231 kN	Tie
BG	168 kN	Tie
GC	145 kN	Strut
DF	145 kN	Strut
FG	42 kN	Tie
EF	83 kN	Strut

(6 marks)

T = de = 221,8 kN at 30º
R = ea = 231kN at 10,86º

(4 marks)

[15]

VRAAG 2

2.1 <u>Weerstand van die boute weens skuiwing:</u>

$$\text{Spanning} = \frac{\text{las}}{\text{oppervlakte}}$$

$$\text{Krag} = \text{oppervlakte} \times \text{spanning} \times \text{ŋ}$$

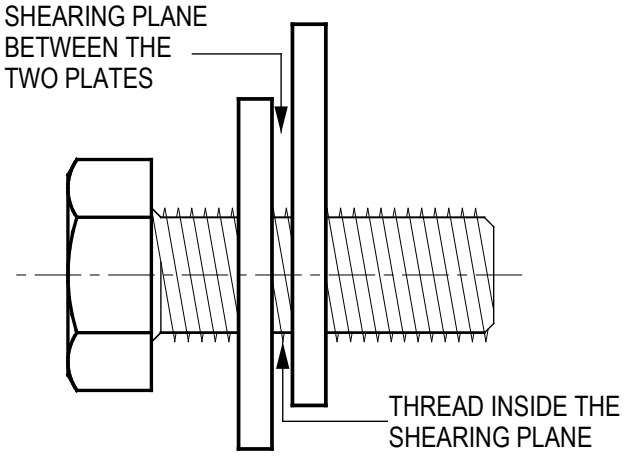
$$= \frac{\pi(\text{D}-0{,}9382\text{P})^2}{4} \times 101 \times 6\checkmark$$

$$= \frac{\pi(12-0{,}9382 \times 2)^2}{4} \times 101 \times 6\checkmark$$

$$= 80{,}5 \times 101 \times 6$$

$$= 48{,}8 \text{ kN}\checkmark$$ (3)

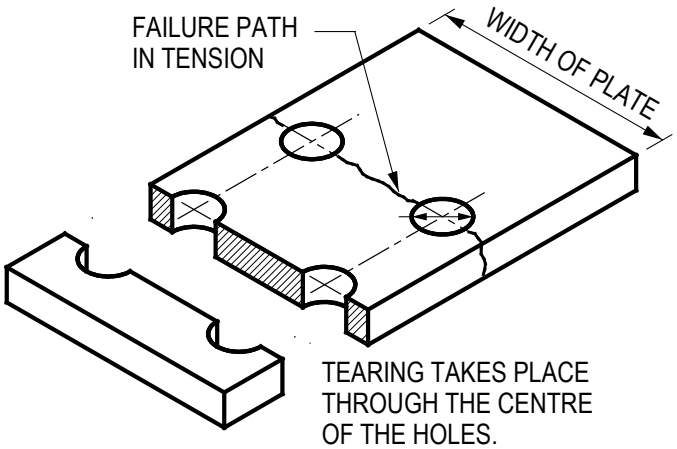
2.2



MARK ALLOCATION	
Drawing corr	1
shear plane indicated	2
Total	3

(3)

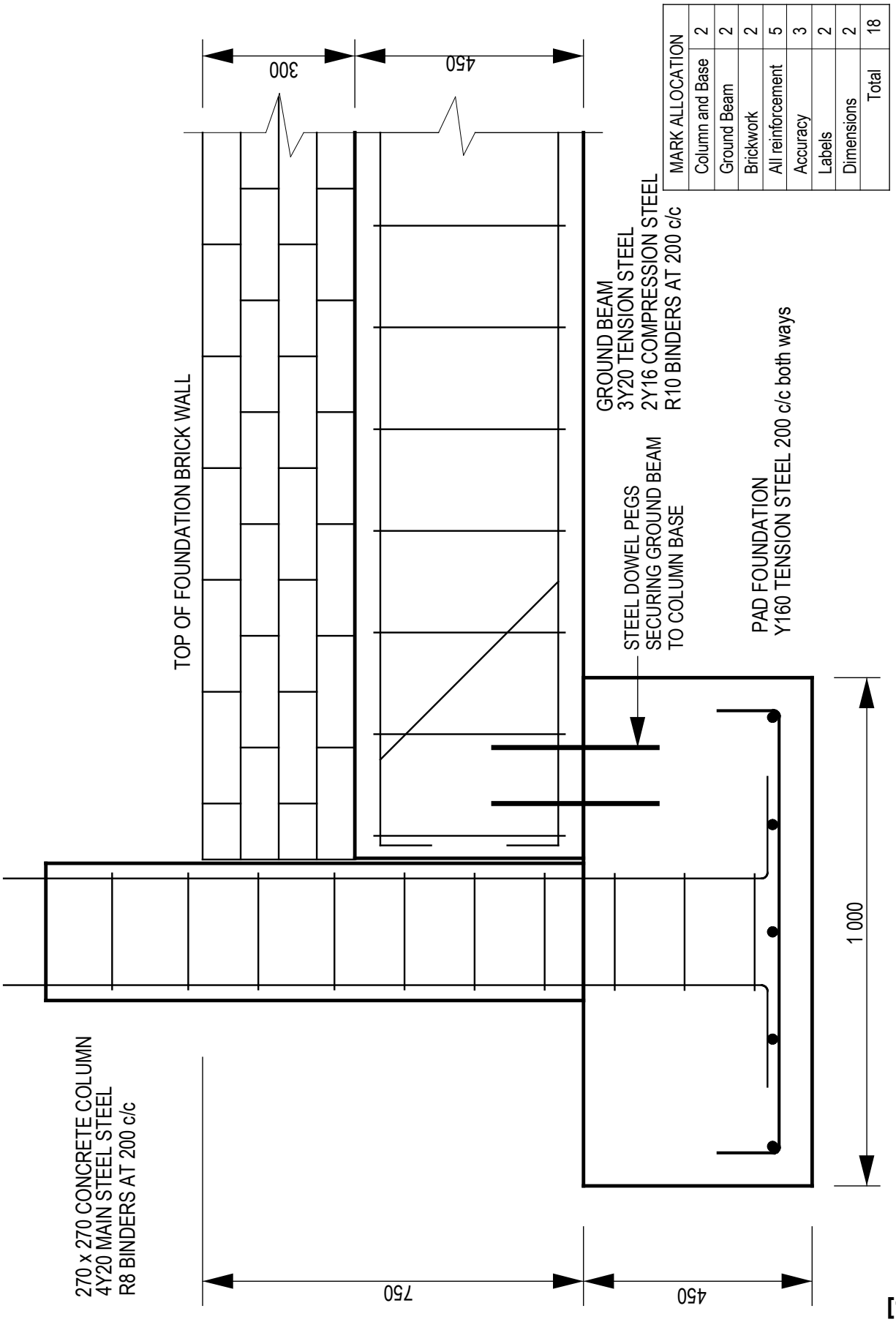
2.3



MARK ALLOCATION	
Drawing corr	1
Tearing plane indicated	2
Total	3

(3)
[9]

VRAAG 3


MARK ALLOCATION
Column and Base 2
Ground Beam 2
Brickwork 2
All reinforcement 5
Accuracy 3
Labels 2
Dimensions 2
Total 18
300
450
TOP OF FOUNDATION BRICK WALL
GROUND BEAM
3Y20 TENSION STEEL
2Y16 COMPRESSION STEEL
R10 BINDERS AT 200 c/c
STEEL DOWEL PEGS
SECURING GROUND BEAM
TO COLUMN BASE
PAD FOUNDATION
Y160 TENSION STEEL 200 c/c both ways
1 000
270 x 270 CONCRETE COLUMN
4Y20 MAIN STEEL STEEL
R8 BINDERS AT 200 c/c
750
450

[18]

VRAAG 4

4.1 Oppervlaktes:

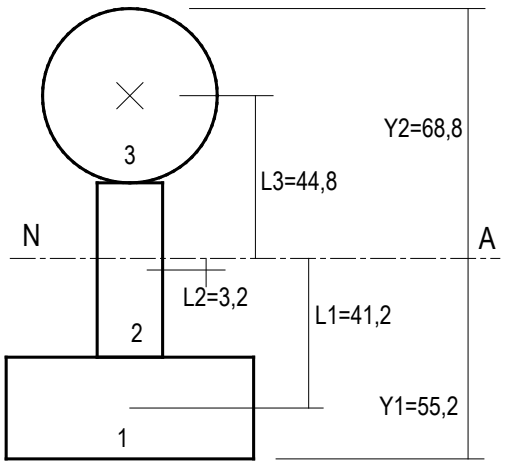
Oppervlakte 1: $68 \times 28 = 1\,905$
Oppervlakte 2: $48 \times 18 = 864$
Oppervlakte 3: $\frac{\pi\, 48^2}{4} = 1\,809{,}6$
Totale oppervlakte $= 4\,577{,}6$✓

Neutrale as van A-B:

$4\,577 \times Y_1 = (1\,904 \times 14) + (864 \times 52) + (1\,809 \times 100)$✓✓

$$Y_1 = \frac{26\,656 + 44\,928 + 180\,960}{4\,577{,}6}$$

$Y_1 = 55{,}2$✓



(4)

4.2 Tweede moment van oppervlakte:

$$I_{xx\,Total} = \left(\frac{bd^3}{12} + AL^2\right) + \left(\frac{bd^3}{12} + AL^2\right) + \left(\frac{\pi\, D^4}{64} + AL^2\right)$$

$$I_{xx\,1} = \left(\frac{68 \times 28^3}{12} + 68 \times 28 \times 41{,}2^2\right)$$
$$= (124\,394{,}7 + 3\,231\,925{,}8) = 3\,356\,320{,}4 \text{ mm}^4$$✓✓

$$I_{xx\,2} = \left(\frac{18 \times 48^3}{12} + 18 \times 48 \times 3{,}2^2\right)$$
$$= (165\,888 + 8\,847{,}4) = 174\,735{,}4 \text{ mm}^4$$✓✓

$$I_{xx\,3} = \left(\frac{\pi \times 48^4}{64} + \frac{\pi\, 48^2}{4} \times 44{,}8^2\right)$$
$$= (260\,576{,}3 + 3\,631\,854{,}0) = 3\,892\,430{,}3 \text{ mm}^4$$✓✓

I_{xx} TOTAAL $= 7\,423\,486{,}1 \text{ mm}^4$ ✓

(7)

4.3 Profielmodulus (Z) om die x-x-as:

$Z = \frac{I}{Y}$

$Z = \frac{7\ 423\ 486{,}1\ mm4}{55{,}2\ mm}$ ✓

$Z = 134\ 483{,}44\ mm^3$ ✓

$Z = 134{,}5 \times 10^{-6}\ m^3$ (2)

4.4 Buigmoment (buigspanning = 154 MPa)

$\frac{m}{I} = \frac{f}{Y}$

$M = \frac{7\ 423\ 486{,}1 \times 154}{55{,}2\ mm}$ ✓

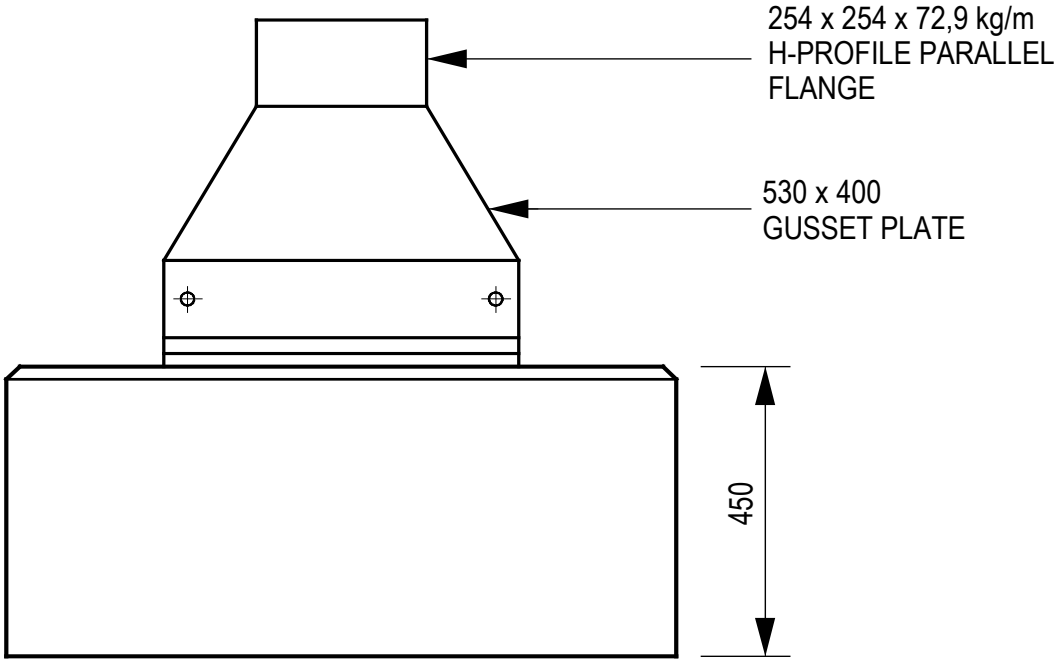
$M = 20\ 710\ 450{,}4\ N.mm$

$M = 20{,}7\ kN.m$ ✓ (2)

[15]

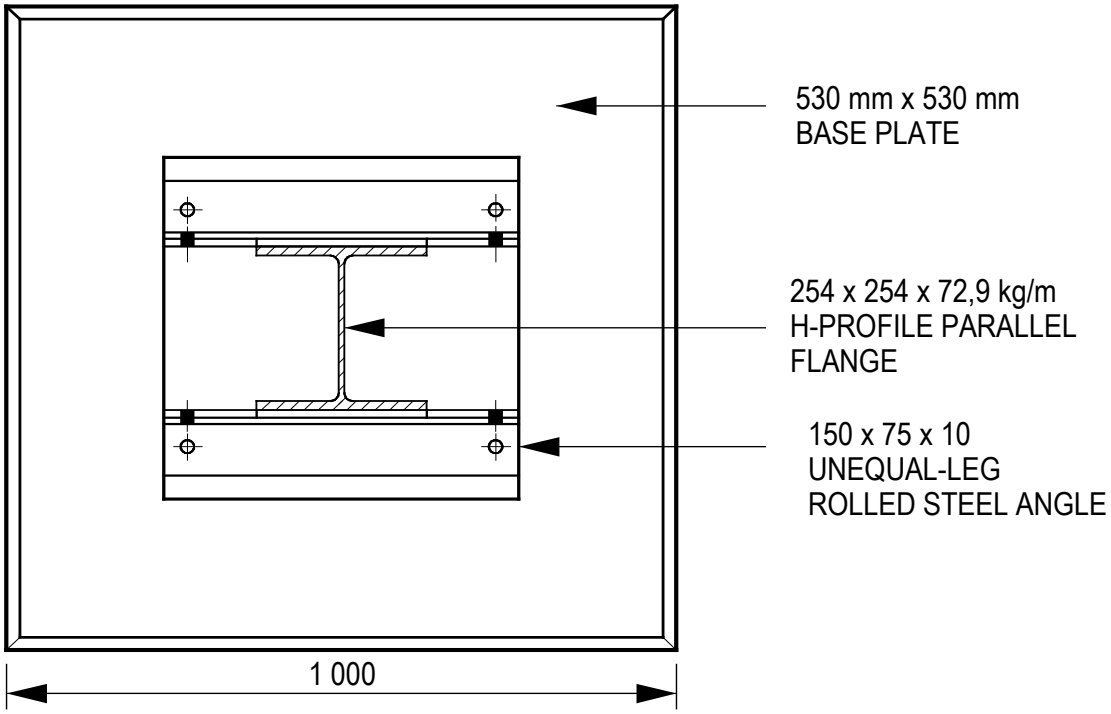
VRAAG 5

5.1



FRONT VIEW

5.2



FRONT VIEW

MARK ALLOCATION

Front view	
Concrete base	2
Column	1
Flange plate	1
Angle	1
Total	5

Top view	
Concrete base	2
Column	1
Flange plate	1
Angle	1
Total	5

Accuracy	2
Labels	2
Dimensions	1
Total	5

TOTAL = 15 marks

[15]

VRAAG 6

6.1 Neem momente om RL:

$(RR \times 7) = (37 \times 9,5) + (5 \times 6 \times 6,5) + (42 \times 3,5) + (3 \times 1,5 \times 2,75)$✓

$$RR = \frac{(351,5 + 195 + 147 + 12,375)}{7}$$
$$= (\frac{705,875}{7})$$
$$= 100,84 \text{ kN}$$✓

Neem momente om RR:

$(RL \times 7) + (37 \times 2,5) + (5 \times 2,5 \times 1,25)$
$= (3 \times 1,5 \times 4,25) + (42 \times 3,5) + (5 \times 3,5 \times 1,75)$✓

$$RL = \frac{(91,25 + 147 + 30,625) - (92,5+15,625)}{7}$$
$$= (\frac{196,75 - 108,125}{7})$$
$$= 12,66 \text{ kN}$$✓ (4)

6.2

SF A: 12,66 kN	12,66 kN✓	
SF C: 12,66 kN	12,66 kN	
SF D: $12,66 - (3 \times 1,5)$	8,16 kN✓	
SF D: $12,66 - (3 \times 1,5) - 42$	-33,84 kN	
SF E: $12,66 - (3 \times 1,5) - 42 - (5 \times 3,5)$	-51,34 kN (maks)✓	
SF E: $12,66 - (3 \times 1,5) - 42 - (5 \times 3,5) + 100,84$	49,50 kN✓	
SF B: $12,66 - (3 \times 1,5) - 42 - (5 \times 2,5) + 100,84 - 37$	37,00 kN✓	(5)

6.3

BM C: $(12,66 \times 2)$	25,32 kN.m✓	
BM D: $(12,66 \times 3,5) - (3 \times 1,5 \times 0,75)$	40,94 kN.m✓	
BM D: $(12,66 \times 7) - (3 \times 1,5 \times 4,25) - (42 \times 3,5)$ $- (5 \times 3,5 \times 1,75)$ (max)	-108,13 kN.m✓	
OF		
BM D: $-(37 \times 2,5) - (5 \times 2,5 \times 1,25)$	-108,13 kN.m	(3)

6.4 $Ze = \frac{\text{B M maks}}{\text{spanning}} = \frac{108,13 \times 10^6}{162} = 667\,469,14 \text{ mm}^3$✓

$Ze = 667,5 \times 10^{-6} \text{ m}^3$✓

Kies: $254 \times 152 \times 59,2 = 5$ kg/m I-tapse flens ($Ze = 669,2 \times 10^{-6}$)✓ (3)

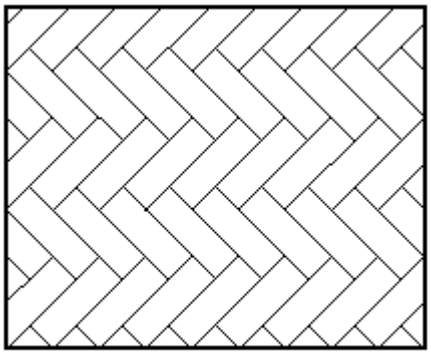
6.5 $\text{Skuifspanning} = \frac{\text{S F maks}}{\text{D x } t_1} = \frac{51,34 \times 10^3}{254 \times 9,1} = 22,21 \text{ MPa}$✓✓

$Ze = 22,21 < 100 \text{ MPa}$✓ (3)

[18]

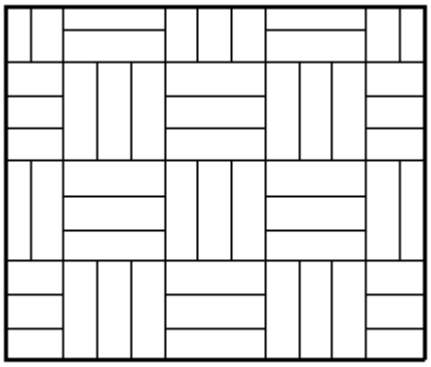
VRAAG 7

7.1 7.1.1



HERRINGBONE PATTERN

7.1.2

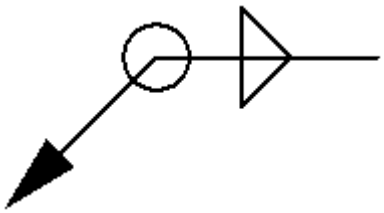


BASKET WEAVE PATTERN

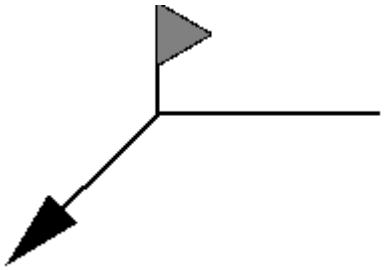
MARK ALLOCATION	
150 mm Square corr	1
Pattern corr	2
Total	3
2 x 3 = 6 marks	

(2 × 3) (6)

7.2 7.2.1



7.2.2



MARK ALLOCATION	
Symbol corr	1
Arrow indicated	1
Total	2
2 x 2 = 4 marks	

(2 × 2) (4)

[10]

TOTAAL: 100

Kopiereg voorbehou